FORMAMIDE

CAS number:	75-12-7
Synonyms:	Carbamaldehyde, formic acid amide, methanamide, methanoic acid amide
Chemical formula:	CH_3NO
Structural formula:	—

Workplace exposure standard (retained)

TWA:	**10 ppm (18 mg/m^3)**
STEL:	**—**
Peak limitation:	**—**
Notations:	**Sk.**
IDLH:	**—**

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

Recommendation and basis for workplace exposure standard

A TWA of 10 ppm (18 mg/m^3) is recommended to protect for eye and skin irritation and potential systemic effects in exposed workers.

Discussion and conclusions

Formamide is commonly used as an intermediate in the manufacture of esters, hydrocyanic acid, pharmaceuticals and pesticides, as a softener for glues, paper and water-soluble gums and a solvent for the production of plastics (ACGIH, 2018; HCOTN, 2011).

Critical effects of exposure include eye and skin irritation and possible kidney and liver damage. There are no human data available in the primary sources. Reports from animal studies suggest formamide may be a liver toxin and affect the kidneys at high doses (ACGIH, 2018). Considered to have low toxicity by inhalation in rats. A NOAEC of 100 ppm is reported in rats for effects on blood cells including a significant increase in atypical lymphocytes (white blood cells; DFG, 2013).

The current TWA of 10 ppm (18 mg/m^3) is retained based on ACGIH recommendation (2018) and supported by evidence from HCOTN (2011) and DFG (2013) and is considered protective for localised irritation and potential systemic effects on the liver, kidneys and blood cells.

Recommendation for notations

Not classified as a 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.

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APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	***1991***	***TWA: 10 ppm (18 mg/m^3)***
ACGIH	***2001***	***TLV-TWA: 10 ppm (18 mg/m^3)***
TLV-TWA recommended to protect against eye and skin irritation and kidney and liver damage. Skin notation warranted based on reported systemic toxicity following 3 mo dermal exposure in rats. Insufficient data to recommend sensitisation or carcinogenic notations. Summary of data: Human data: • No human data presented. Animal data: • LD_{50}: 6 g/kg (rats, oral) • LD_{50}: 6 g/kg (rabbits, dermal) relatively non-toxic by skin absorption (lethal dose >17g/kg) • Inhalation: low toxicity based on single exposure to 3,900 ppm (rats, 6 h) • 2 wk sub-chronic feeding test (rats) resulted in 4 fatalities before the 10th treatment of 1.5 g/kg bw, and 2 animals died within 2 d after 10th treatment indicating cumulative effects: o weight loss and characteristics of gastritis and malnutrition reported • Cumulative effects following skin absorption (rats exposed to 30–3,000 mg/kg, 6 h/d, 5 d/wk for 3 mo): o reported organ weight changes at 3,000 mg/kg o polycythaemia in animals treated with 300 or 1,000 mg/kg, and o no changes in those treated with 30 or 100 mg/kg • Low potential to cause dermatitis in guinea pigs, although producing slight temporary skin irritation with no allergic skin sensitisation • No signs of toxicity in rats exposed to 100 ppm (6 h/d, 10 d) or in acute single exposures up to 3,900 ppm mist o decreased rate of body weight gain and compound-related microscopic lesions in kidney (necrosis of tubular epithelium) observed in those exposed to 1,500 ppm o suppressed platelet and lymphocyte counts in those exposed at 500 or 1,500 ppm • Reproductive effects following dermal exposures to elevated concentrations include inhibition of foetal growth and foetal malformations in mice o effects are considered relatively weak as observed following exposures to elevated concentrations o reproductive NOEL of 22 mg/kg (rabbit, oral) • Not genotoxic; recommended as a solvent used in mutagenic assays.		
DFG	***2013***	***Not assigned***
No human data available for deriving a MAK. NOAEC OF 100 ppm (180 mg/m^3) derived from a 2 wk inhalation study for haematological and clinic-chemical parameters in rats including significant increase in atypical lymphocytes.		

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Source	Year set	Standard
Summary of additional data: • Inhalation study: 338–7,058 mg/m^3 (rats, acute 6 h) resulted in no observed toxicity • Reproductive NOAEL: 62 mg/kg/d (male rats), 98 mg/kg/d (female rats) • Foetotoxicity and teratogenic effect including cleft palates, phocomelia (disturbances in development of extremities), reduced bw in dams, possible liver damage following single dermal applications of 100 µL on day 11 and 2,500 µL /kg on GD 8 • Blockage of cell membranes of mammalian cells leading to paralysis and damage to various muscles demonstrated in *in vitro* studies.		
SCOEL	***NA***	***NA***
No report.		
OARS/AIHA	***NA***	***NA***
No report.		
HCOTN	***2011***	***Not assigned***
Summary of additional data: • Negative genotoxic test score in *in vivo* and *in vitro* assays.		

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	Skin
HCIS	—
NICNAS	—
EU Annex	NA
ECHA	—
ACGIH	Skin
DFG	—
SCOEL	NA
HCOTN	Carcinogenicity – category 2
IARC	NA

Source	Notations
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	
Conclusion:	
Adverse effects in human case study:	
Dermal LD_{50} ≤1000 mg/kg:	no
Dermal repeat-dose NOAEL ≤200 mg/kg:	yes
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:	45.04
Conversion factors at 25°C and 101.3 kPa:	1 ppm = 1.84 mg/m^3; 1 mg/m^3 = 0.543 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) (2013) Formamide – MAK value documentation.

Health Council of the Netherlands (HCOTN) (2011) Formamide. Evaluation of the carcinogenicity and genotoxicity. The Hague: Health Council of the Netherlands; publication no. 2011/01OSH.

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National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2013) Formamide: Human health tier II assessment – IMAP report.

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