# 1,1-Dimethylhydrazine

| CAS number: | 57-14-7 |
| --- | --- |
| Synonyms: | N,N-Dimethylhydrazine, unsymmetrical-dimethylhydrazine, UDMH |
| Chemical formula: | C2H8N2 |
| Structural formula: | — |

Workplace exposure standard (interim)

| TWA: | **0.01 ppm (0.025 mg/m3)** |
| --- | --- |
| STEL: | **—** |
| Peak limitation: | **—** |
| Notations: | **Carc. 1B, Sk.** |
| IDLH: | **15 ppm** |
| **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 0.01 ppm (0.025 mg/m3) is recommended to protect for irritation and minimise the potential for nasal cancer in exposed workers.

Given the limited data available from the primary sources, it is recommended that a review of additional sources be conducted at the next scheduled review.

## Discussion and conclusions

1,1-Dimethylhydrazine (UDMH) is used as a component of jet and rocket fuels, an absorbent for acid gases, in photography and in chemical synthesis.

Non-carcinogenic critical effects are respiratory tract irritation and neurological effects. Based on evidence in animals UDMH is considered to be carcinogenic. *In vitro* evidence demonstrates mutagenicity (ACGIH, 2018; DFG, 1973; NICNAS 2014). However, the cancers reported in animals are not relevant for humans. Additionally, there is a lack of data available in the primary sources to confirm this effect in humans from inhalational exposure. Therefore, it is unclear if a non-threshold mechanism for cancer is a critical effect in recommending a TWA.

A TWA of 0.01 ppm is recommended to be retained in the interim based on the weight of evidence presented and it is considered protective for irritation effects reported in animals. A review of additional data sources is recommended at the next scheduled review.

## 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 of dermal uptake and systemic effects in animals, in addition to the severity of carcinogenic effects.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA 1991 TWA: 0.01 ppm (0.025 mg/m3) | |
|  |
| ACGIH 2001 TLV-TWA: 0.01 ppm (0.025 mg/m3) |
| TLV-TWA recommended to minimise the potential for respiratory tract irritation and possible cancer.  TLV-TWA based on slightly elevated incidence of nasal tumours seen in rats at 0.05 ppm (inhalation) and by analogy to methyl hydrazine.  Summary of data:  Human data:   * Case incidents of human exposure with no concentration data; respiratory effects, pulmonary oedema, nausea, vomiting, neurological effects and increased serum glutamic-pyruvic transaminase (SGPT).   Animal data:   * Elevated incidence of nasal tumours observed in rats at 0.05 ppm; 6 h/d, 5 d/wk for 6 mo (no further information) * Mice, rats, and hamsters administered UDMH in drinking water: * mice – a significant increase in tumours of the blood vessels, lungs, kidneys and liver. * rats developed liver carcinomas * hamsters developed vascular and caecal tumours * Analogous to other hydrazines; methyl hydrazine causes nasal irritation at 0.02 ppm in rats and mice * LD50:156 mg/kg (rabbits, dermal); occlusion of the dermal test site * LD50:1,200 mg/kg (dogs dermal) * LD50:1,060 mg/kg (rabbits, dermal) * Absorbed rapidly through the skin of dogs; detectable in the blood within 30 sec following application; produced opacity of the cornea.   Genotoxicity and mutagenicity:   * Positive mutagenicity in *Salmonella typhimurium* * Mutations produced in L5178Y mouse lymphoma cells and V-79 liver cells * Unscheduled DNA synthesis was increased in hepatocytes. |
| DFG 1973 MAK: 0.1 ppm (0.25 mg/m3) |
| Summary of additional data:   * Weak carcinogenic effect as demonstrated in drinking water study in rats; liver carcinomas with metastases in the lungs. |
| 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 |  | 2014 | * Hamsters dosed weekly via subcutaneous injections (37.3 and 32.5 mg/kg/wk for males and females, respectively) for life developed peripheral nerve sheath tumours (neurofibrosarcoma, melanotic and unpigmented schwannoma) * 6 mo study in dogs, rats, mice and hamsters inhaling 5 ppm induced liver tumours in rats and mice * Unscheduled DNA synthesis in mouse hepatocytes * Gene mutations in Chinese hamster lung V79 cells and in mouse lymphoma L5178Y cells. |

### Carcinogenicity — non-threshold based genotoxic carcinogens

| Is the chemical mutagenic? | Yes |
| --- | --- |
| 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 | Carc. 1B, Skin |
| HCIS | Carcinogenicity – category 1B |
| NICNAS | Carc. Cat 2 |
| EU Annex | NA |
| ECHA | Carc. 1B |
| ACGIH | Skin, Carcinogenicity – A3 |
| DFG | H (skin) |
| SCOEL | NA |
| HCOTN | NA |
| IARC | Carcinogenicity – Group 2B |
| 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 LD50 ≤1000 mg/kg: | yes | 3.00 |  | | Dermal repeat-dose NOAEL ≤200 mg/kg: |  |  |  | | Dermal LD50/Inhalation LD50 <10: |  |  |  | | *In vivo* dermal absorption rate >10%: |  |  |  | | Estimated dermal exposure at WES >10%: |  |  |  | |  |  | 3 | **consider assigning a skin notation** | |

### IDLH

| Is there a suitable IDLH value available? | Yes |
| --- | --- |

## Additional information

| Molecular weight: | 60.1 |
| --- | --- |
| Conversion factors at 25°C and 101.3 kPa: | 1 ppm = 2.6 mg/m3; 1 mg/m3 = 0.41 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*](http://www.acgih.org/tlv-bei-guidelines/policies-procedures-presentations) on the ACGIH website.

Deutsche Forschungsgemeinschaft (DFG) (1973) 1,1-Dimethylhydrazine – MAK value documentation.

European Chemicals Agency (ECHA) (2019) 1,1-Dimethylhydrazine – REACH assessment.

International Agency for Research on Cancer (IARC) (1999) 1,1-Dimethylhydrazine. IARC Monographs on the evaluation of the carcinogenic risk to humans.

National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2014) Hydrazine, 1,1-dimethyl-: Human health tier II assessment – IMAP report.

US National Institute for Occupational Safety and Health (NIOSH) (1994) Immediately dangerous to life or health concentrations –1,1-Dimethylhydrazine.