

# METHYL ISOCYANATE

**CAS number:** 624-83-9

**Synonyms:** Isocyanic acid, methyl ester, MIC

**Chemical formula:**  $C_2H_3NO$

## Workplace exposure standard (amended)

**TWA:** 0.02 ppm (0.047 mg/m<sup>3</sup>)

**STEL:** 0.06 ppm (0.14 mg/m<sup>3</sup>)

**Peak limitation:** —

**Notations:** Sk., DSEN, RSEN

**IDLH:** 0.12 ppm (0.28 mg/m<sup>3</sup>)

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

## Recommendation and basis for workplace exposure standard

A TWA of 0.02 ppm (0.047 mg/m<sup>3</sup>) is recommended to protect for irritation of the eyes and mucous membranes in exposed workers.

A STEL of 0.06 ppm (0.14 mg/m<sup>3</sup>) is recommended to protect for acute irritation of the eyes and mucous membranes in exposed workers.

## Discussion and conclusions

Methyl isocyanate is used as a chemical intermediate in the production of a wide variety of insecticides and herbicides and in the production of polyurethane foams and plastics.

The critical effects of exposure are irritation of the eyes and mucous membranes. In one study, volunteers exposed for one to five minutes reported no irritation at 0.4 ppm. Irritation of the mucous membranes is evident at 2 ppm with eye irritation beginning at 4 ppm. Exposure to 21 ppm was immediately intolerable. Another study reported irritation of the eyes after one to two minutes and tearing after three to five minutes at 0.5 ppm (ACGIH, 2018; SCOEL, 2006). A  $RD_{50}$  of 1.3 ppm is reported in mice. No effects are seen in rats exposed at approximately 0.6 ppm (NOAEC) for six hours a day for eight days (ACGIH, 2018). Mice exposed at 1 ppm for six hours per day for four days demonstrated unspecified damage to respiratory epithelium (SCOEL, 2006).

The TWA of 0.02 ppm (0.047 mg/m<sup>3</sup>) is recommended be retained and ACGIH (2018) STEL of 0.06 ppm (0.14 mg/m<sup>3</sup>) is recommended be adopted. Based on the weight of evidence presented, these values are considered protective for irritation effects reported in humans and animals.

## Recommendation for notations

Not classified as a carcinogen according to the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

Classified as a skin sensitizer and respiratory sensitizer according to the GHS.

A skin notation is recommended based on the available data in animals.

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## APPENDIX

### Primary sources with reports

Source	Year set	Standard
<b>SWA</b>	<b>1995</b>	<b>TWA: 0.02 mg/m<sup>3</sup> (as-NCO); STEL: 0.07 mg/m<sup>3</sup> (as-NCO)</b>
<b>ACGIH</b>	<b>2014</b>	<b>TLV-TWA: 0.02 ppm (0.047 mg/m<sup>3</sup>); TLV-STEL: 0.06 ppm (0.14 mg/m<sup>3</sup>)</b>
<p>TLV-TWA and TLV-STEL recommended to minimise the potential for mucous membrane and eye irritation.</p> <p>Summary of data:</p> <p>Human data:</p> <ul style="list-style-type: none"> <li>Acute irritation responses in 4 volunteers exposed for 5 min: <ul style="list-style-type: none"> <li>0.4 ppm no irritation</li> <li>2 ppm minor mucous membrane irritation at 2 ppm</li> <li>4 ppm ocular irritation</li> <li>21 ppm intolerable</li> </ul> </li> <li>Eye and nose irritation at 0.5 ppm for 1 min</li> <li>30 ppm for 1 h; risk of permanent injury.</li> </ul> <p>Animal data:</p> <ul style="list-style-type: none"> <li>LC<sub>50</sub>: 6.1 ppm (rats, 6 h)</li> <li>RD<sub>50</sub> of 1.3 and 2.9 ppm in mice</li> <li>LD<sub>50</sub>: 210 mg/kg (rabbits, dermal)</li> <li>Positive dermal sensitisation in guinea pigs</li> <li>Rats exposed to 0.15, 0.58 or 3.07 ppm for 6 h/d for 8 d: <ul style="list-style-type: none"> <li>0.15 or 0.58 ppm; no effects</li> <li>3.07 ppm: organ weight changes involving the kidney, liver, testes, and lungs; histopathologic evidence of inflammation and squamous metaplasia in the nasal cavity, trachea, and bronchi.</li> </ul> </li> </ul>		
<b>DFG</b>	<b>2014</b>	<b>MAK: 0.01 ppm (0.024 mg/m<sup>3</sup>)</b>
<p>Evaluated as part of diisocyanates group.</p> <p>No data for methyl isocyanate as an individual chemical.</p>		
<b>SCOEL</b>	<b>2006</b>	<b>STEL (15 mins): 0.02 ppm</b>
<p>STEL recommended to protect for irritation of the eyes and mucous membranes.</p> <p>Summary of additional data:</p> <ul style="list-style-type: none"> <li>No additional data in humans</li> <li>Mice exposed 6 h/d for 4 d at 1 ppm unspecified damage to respiratory epithelium accompanied by bone marrow depression; bone marrow effects secondary to lung effects; with pronounced bronchial fibrosis at 3 ppm</li> <li>NOAEL of 0.6 ppm (study cited by ACGIH, 2018)</li> <li>Considered evidence insufficient to derive an 8 h TWA</li> </ul>		



Source	Year set	Standard
<ul style="list-style-type: none"> <li>• STEL based on: <ul style="list-style-type: none"> <li>○ Irritation in humans exposed at 0.5 ppm for 1 min</li> <li>○ RD<sub>50</sub> of 1.3 and 2.9 ppm in mice</li> <li>○ NOAEL of 0.6 ppm in rats.</li> </ul> </li> </ul>		
<b>OARS/AIHA</b>	<b>NA</b>	<b>NA</b>
No report.		
<b>HCOTN</b>	<b>NA</b>	<b>NA</b>
No report.		

### Secondary source reports relied upon

Source	Year	Additional information
NTP	✓ 2015	<ul style="list-style-type: none"> <li>• Increased spontaneous abortions, stillbirths, pre-term babies born with birth defects and organ defects and decreased placental and foetal weights were observed following accidental exposure in the Bhopal disaster</li> <li>• Reproductive and developmental LOAEC of 1 ppm in mice based on statistically significant increase in the number of dead fetuses at birth</li> <li>• LOAEC of 2 ppm in mice based on developmental effects.</li> </ul>
US EPA	✓ 1991	<ul style="list-style-type: none"> <li>• No further information.</li> </ul>

### 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	—
HCIS	Skin sensitisation – category 1, Respiratory sensitisation – category 1
NICNAS	—
EU Annex	Skin sensitisation – category 1, Respiratory sensitisation – category 1
ECHA	NA
ACGIH	Skin, DSEN
DFG	NA
SCOEL	NA



Source	Notations
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 <sub>50</sub> ≤ 1000 mg/kg:	yes
Dermal repeat-dose NOAEL ≤ 200 mg/kg:	
Dermal LD <sub>50</sub> /Inhalation LD <sub>50</sub> < 10:	
<i>In vivo</i> 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:	57.05
Conversion factors at 25°C and 101.3 kPa:	1 ppm = Number mg/m <sup>3</sup> ; 1 mg/m <sup>3</sup> = Number ppm
This chemical is used as a pesticide:	<input type="checkbox"/>
This chemical is a biological product:	<input type="checkbox"/>
This chemical is a by-product of a process:	<input type="checkbox"/>
A biological exposure index has been recommended by these agencies:	<input type="checkbox"/> ACGIH <input type="checkbox"/> DFG <input type="checkbox"/> SCOEL

## Workplace exposure standard history

Year	Standard
Click here to enter year	

## References

American Conference of Industrial Hygienists (ACGIH®) (2018) TLVs® and BEIs® with 7<sup>th</sup> 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) (2018) List of MAK and BAT Values 2018 – MAK value documentation.

EU Scientific Committee on Occupational Exposure Limits (SCOEL) (2006) Recommendation from the Scientific Committee on Occupational Exposure Limits for methyl isocyanate. SCOEL/SUM/118.

National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2015) Methane, isocyanato: 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) (2016) Immediately dangerous to life or health value profile – methyl isocyanate.

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