SODIUM HYDROXIDE

CAS number: 1310-73-2

Synonyms: Caustic soda, lye

Chemical formula: NaOH

Structural formula: —

Workplace exposure standard (retained)

TWA: —

STEL: —

Peak limitation: **2 mg/m^3**

Notations: —

IDLH: **10 mg/m^3**

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

Recommendation and basis for workplace exposure standard

A peak limitation of 2 mg/m^3 is recommended to protect for acute irritation of the eyes, skin and mucous membranes in exposed workers.

Discussion and conclusions

Sodium hydroxide is a soluble, strong base, used in numerous industries such as pulp and paper, soap and detergents, cellophane and textiles, etching and electroplating.

The critical effects are identified as irritation of the eyes, skin and mucous membranes (ACGIH, 2001).

Much of the data from humans generally relates to accidental or suicidal ingestion with effects include necrosis, principally of the mouth, oesophagus, gastric mucosa, hypersalivation, emesis, cardiovascular collapse, tracheal obstruction and dyspnoea, retching and severe pain (ACGIH, 2018). The main effects of exposure are local irritation and corrosion. Very limited inhalation data are available with irritant effects of caustic mists encountered at 1 to 40 mg/m^3, with 2 mg/m^3 considered 'noticeably but not excessively' irritating (ACGIH, 2018).

The peak limitation of 2 mg/m^3 as assigned by SWA, ACGIH (2018) and HCOTN (2000) is recommended to be retained and is generally protective of irritation to eyes, skin and mucous membranes in exposed workers.

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 not recommended based on the available evidence.

APPENDIX

Primary sources with reports

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

TLV-Ceiling recommended to minimise irritation to eyes, skin and mucous membranes in exposed workers. TLV is based on a concentration that produces a noticeable, but not excessive, ocular and upper respiratory tract irritation.

Summary of data:

Human data:

- Numerous cases of accidental and suicidal poisonings
- Ingestion causes necrosis, principally of the mouth, oesophagus and gastric mucosa, hypersalivation, emesis, cardiovascular collapse, tracheal obstruction and dyspnoea, retching and severe pain
- Death occurs due to shock, infection of corroded tissue, pulmonary necrosis or asphyxia
- Report of one oesophageal carcinoma due to localised stricture following ingestion
- 2 mg/m^3 considered 'a concentration that is noticeably, but not excessively, irritant':
  - irritant effects of caustic mists encountered at 1–40 mg/m^3, (no exposure or sampling times provided)
- Burning and redness of nose, throat or eyes reported in workers undertaking cleaning with airborne concentrations of 0.005–0.7 mg/m^3:
  - solvents also present up to 780 mg/m^3 (no exposure or sampling times provided)
- Severe eye injury reported in workers exposed to high concentrations (as dust or liquid); no further information
- Application of 1 g equivalent to forearms of volunteers (15–180 min) caused dissolution of cells in outer layer of epidermis, progressing to oedema and destruction of epidermis in 60 mins.

Animal data:

- Ingestion in dogs causes haemorrhagic gastritis and oesophageal strictures
- Oral intubation in rabbits:
  - 4% solution caused mucosal and submucosal necrosis
  - 12% solution eroded into muscle
  - 28% solution caused perforation
  - similar results in cats
- 5% aqueous solution applied to rabbit skin (4 h) caused severe necrosis
- Rats inhaling aerosols 30 min/d suffered pulmonary damage (concentrations not provided).

Insufficient data to recommend skin, SEN or carcinogenicity notations.

Source	Year set	Standard
DFG	***1999***	***Not assigned***
MAK withdrawn as cannot identify exposure concentration where irritation will certainly not occur from available data. Summary of additional data: • Corrosive to skin and eyes • Poorly documented reports of irritation to airways and eyes from exposure at 0.5 mg/m^3 • No increased mortality from malignant and non-malignant diseases amongst 265 workers at factory producing chlorine, employed up to 30 y • Negative in mutagenicity tests; clastogenic effects *in* vitro following increased pH of the culture medium with metabolic activation only • 'Few available tests' indicate not genotoxic at physiological pH: o local carcinogenic effects observed in humans following severe poisoning and animals after dermal application due to cell regeneration following tissue damage and scarring • 48 h patch test in volunteers: o no irritation from 1% aqueous solution but irritant skin reactions at ≥2%.		
SCOEL	***NA***	***NA***
No report		
OARS/AIHA	***NA***	***NA***
No report		
HCOTN	***2000***	***Ceiling limit: 2 mg/m^3***
Summary of additional data: • Most dominant effect is local irritation and corrosion • 10% solution corrosive in *in vitro* skin corrosion test • TWA exposure levels of 265 workers survey (cited in DFG, 1999) estimated to be 0.5–2.0 mg/m^3: o medical aid was sought most for skin contact and least for inhalation • 2 h exposure at 65 mg/m^3 (nose only) or 250–3,200 mg/m^3 (whole body) in young and adult rats: o larynx target organ o no effects on nasal turbinates, lungs, oesophagus or stomach o no effects at 65 mg/m^3 o 6/11 died at 3,200 mg/m^3 o aerosols mainly consisted of Na_2CO_3 • LD_{50}: 1,350 mg/kg (rabbits, dermal) • Committee concluded insufficient information to comment on OEL.		

Secondary source reports relied upon

Source		Year	Additional information
US NIOSH	✓	1994	• REL 2 mg/m^3 ceiling • IDLH 10 mg/m^3.

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	—
NICNAS	—
EU Annex	NA
ECHA	—
ACGIH	—
DFG	—
SCOEL	NA
HCOTN	—
IARC	NA
US NIOSH	—

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:	no
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%:	
	a skin notation is not warranted

IDLH

Is there a suitable IDLH value available?	Yes

Additional information

Molecular weight:	39.99
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) (1999) Sodium hydroxide – MAK value documentation.

Health Council of the Netherlands (HCOTN) (2000) Sodium hydroxide. Health-based calculated occupational cancer risk values. The Hague: Health Council of the Netherlands; publication no. 2000/15OSH/015.

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

US National Institute for Occupational Safety and Health (NIOSH) (2011) NIOSH Skin Notation Profiles: Sodium Hydroxide (NaOH).