



EPICHLOROHYDRIN

CAS number: 106-89-8

Synonyms: 1-Chloro-2,3-epoxypropane, ECH, Oxirane

Chemical formula: C_3H_5OCl

Workplace exposure standard (amended)

TWA: 0.5 ppm (1.9 mg/m³)

STEL: —

Peak limitation: —

Notations: Carc. 1B, Sk., DSEN

IDLH: 75 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 0.5 ppm (1.9 mg/m³) is recommended to protect for reproductive effects and nasal irritation and in exposed workers. This TWA is also considered to minimise the potential for respiratory tract cancer as reported in animals.

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

Epichlorohydrin is used as a raw material for the manufacture of epoxy resins. It is used in various industrial applications (insecticides, adhesives, resins, solvents and glycidyl esters), glycerol production and in the manufacturing process for pharmaceuticals.

The critical effects of exposure include reproductive effects and nasal irritation. Evidence in animal studies suggest that epichlorohydrin is a carcinogen manifesting predominantly in respiratory tract tissues after inhalation. However, human epidemiology studies indicate that it is not likely to cause cancer in humans except under rare exposure conditions (ACGIH, 2018; DFG, 2015; US EPA, 2015).

A NOAEC of 5 ppm based on decreased male fertility was reported in a 10 week study in rats. A NOEC of 9 ppm in rabbits and rats for nasal irritation, lethargy and reduced body weights is also reported (ACGIH, 2018). Reproductive effects in humans have not been established in worker studies (NICNAS, 2013).

A TWA of 0.5 ppm is recommended as assigned by ACGIH (2018) based on the NOAEC of 5 ppm and NOEC of 9 ppm. This TWA is expected to be protective of reproductive effects and nasal irritation. A priority evaluation of the available data is recommended to better understand the carcinogenic potential.

Recommendation for notations

Classified as a category 1B carcinogen according to the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

Classified as a skin sensitiser and not a respiratory sensitiser according to the GHS.

A skin notation is recommended based on evidence suggesting potential dermal absorption and adverse systemic effects in humans and animals.

DRAFT

APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	1991	TWA: 2 ppm (7.6 mg/m³)
ACGIH	2001	TLV-TWA: 0.5 ppm (1.9 mg/m³)
<p>TLV-TWA recommended to minimise potential for reproductive effects and nasal irritation.</p> <p>Derivation of TWA not provided; cited as based on a NOAEL of 5 ppm (decreased male fertility in rats); NOEL of 9 ppm in rabbits and rats (nasal irritation, lethargy and reduced body weight).</p> <p>Summary of data:</p> <p>Human data:</p> <ul style="list-style-type: none"> • Evidence of systemic effects following skin exposures • Epidemiological studies provide no clear evidence for causal relationship between exposures and lung cancer in mortality studies. • Suggestions of sensitisation potential, however insufficient data to recommend a SEN notation. <p>Animal data:</p> <ul style="list-style-type: none"> • NOAEL: 5 ppm for male fertility (rats, inhalation, 10 wk) • NOEL: 9 ppm (rats, rabbits, inhalation, 18–20 d); at 17 ppm nasal irritation, lethargy, reduced bw; at highest dose of 120 ppm, increased urinary protein excretion; lung, liver, and kidney discoloration; congestion, oedema and leucocyte reaction in the kidneys • LD₅₀: 755 mg/kg (rabbit, dermal) • Squamous cell carcinomas and one papilloma reported in the nasal cavity of rats exposed 6 h/d, 5 d/wk for 6 wk at 100 ppm • Increased mortality, renal damage and respiratory effects that included lung congestion, pneumonia, and bronchiectasis reported in rats exposed 6 h/d, 5 d/wk lifetime exposure duration of 10 or 30 ppm • Nasal irritation, lung, liver and kidney discolouration at elevated levels (>120 ppm) in multiple rats and rabbits studies at various inhalation concentrations • Mutagenic activity in strains of <i>S. typhimurium</i> and <i>E. coli</i> (no other information) • Positive and negative genotoxic results observed in <i>in vivo</i> studies. 		
DFG	2015	Not assigned
<p>Summary of additional data:</p> <p>Human data:</p> <ul style="list-style-type: none"> • Data not sufficient to derive a conclusive evaluation of the carcinogenicity for humans • Corrosion of eyes and nasal mucosa at 20 ppm >1 h • Numerous studies reported dermal sensitisation in epoxy resin workers, noting quality documented evidence is limited. <p>Animal data:</p> <ul style="list-style-type: none"> • Reported as a genotoxic carcinogen; predominantly local effect in respiratory tract tissues following inhalation based on evidence in animals • Corrosive effect on skin, eyes and mucous membranes of the respiratory tract 		

Source	Year set	Standard
<ul style="list-style-type: none"> Maximisation test in 15 guinea pigs (20 in control group) using intradermal and dermal inductions (5% epichlorohydrin in ethanol, 1% epichlorohydrin in ethanol) observed positive skin sensitisation reaction in 9/15 animals Concluded animal studies provided sufficient evidence of skin sensitisation. <p>Limited, but justifiable evidence for a skin sensitisation notation.</p>		
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
ECHA	✓ 2006	<ul style="list-style-type: none"> LD₅₀: 515 mg/kg (rabbits, dermal) LC₅₀: 3,617 ppm (rats, 1 h).
NICNAS	✓ 2013	<ul style="list-style-type: none"> Critical health effects include systemic long-term reproductivity effects, acute mucosal effects and corrosive local effects Reproductive effects in humans have not been established in worker studies Genotoxic mode of action for carcinogenicity cannot be precluded.
US EPA	✓ 2015	<ul style="list-style-type: none"> IUR based on non-significant increase in incidence of nasal cavity tumours in rats (15/140); strong dose rate effect, as evidenced by the tumour response with a high-exposure, short duration group NOAEL for respiratory effects at 5 ppm (inhalation, 90 days) NOAEL for kidney effects 30 ppm (inhalation, 90 days) LOAEC 25 ppm for respiratory effects (inhalation, 90 days).

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:Sen
HCIS	Carcinogenicity – category 1B, Skin sensitisation – category 1
NICNAS	Skin, Skin sensitisation, Carc. Cat 2
EU Annex	NA
ECHA	Carc. 1B, Skin Sens. 1
ACGIH	Carcinogenicity – A3, Skin
DFG	Carcinogenicity – 2, H (skin), Sh (dermal sensitiser)
SCOEL	NA
HCOTN	NA
IARC	Carcinogenicity – Group 2A
US NIOSH	SK:SYS, SK:SEN
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:	yes
Dermal LD ₅₀ ≤ 1000 mg/kg:	yes
Dermal repeat-dose NOAEL ≤ 200 mg/kg:	
Dermal LD ₅₀ /Inhalation LD ₅₀ < 10:	
<i>In vivo</i> dermal absorption rate > 10%:	
Estimated dermal exposure at WES > 10%:	
a skin notation is warranted	

IDLH

Is there a suitable IDLH value available?	Yes
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Additional information

Molecular weight:	92.52
Conversion factors at 25°C and 101.3 kPa:	1 ppm = 3.78 mg/m ³ ; 1 mg/m ³ = 0.26 ppm
This chemical is used as a pesticide:	<input checked="" 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 checked="" 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 7th Edition Documentation, CD-ROM, Single User Version. Copyright 2018. Reprinted with permission. See the [TLVs® and BEIs® Guidelines section](#) on the ACGIH website.

European Chemicals Agency (ECHA) (2006) Epichlorohydrin – REACH assessment.

Deutsche Forschungsgemeinschaft (DFG) (2015) 1-Chloro-2,3-epoxypropane (Epichlorohydrin) – MAK value documentation.

International Agency for Research on Cancer (IARC) (1999) Epichlorohydrin. IARC Monographs on the evaluation of the carcinogenic risk to humans.

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

US Environmental Protection Authority (US EPA) (2015) Integrated Risk Information System (IRIS) Chemical Assessment Summary – Epichlorohydrin; CASRN 106-89-8.

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

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