
o-Chlorostyrene

(CAS reg no: 2039-87-4)

Health-based Reassessment of Administrative
Occupational Exposure Limits

Committee on Updating of Occupational Exposure Limits,
a committee of the Health Council of the Netherlands

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
1 Introduction

The present document contains the assessment of the health hazard of *o*-chlorostyrene by the Committee on Updating of Occupational Exposure Limits, a committee of the Health Council of the Netherlands. The first draft of this document was prepared by MA Maclaine Pont, M.Sc. (Wageningen University, Wageningen, the Netherlands).

The evaluation of the toxicity of *o*-chlorostyrene has been based on the review by the American Conference of Governmental Industrial Hygienists (ACG99). Where relevant, the original publications were reviewed and evaluated as will be indicated in the text. In addition, literature was retrieved from the data bases Toxline, Medline, and Chemical Abstracts covering the period of 1981 until October 1999, 1966 until December 1999, and 1937 until September 1999, respectively, and using the key words: *o*-chlorostyrene, 2-chlorostyrene, and benzene, 1-chloro-2-ethenyl- and styrene, *o*-chloro- 2039-87-4. The final literature search has been carried out in December 1999.

In April 2001, the President of the Health Council released a draft of the document for public review. The committee received no comments.

2 Identity

name	:	<i>o</i> -chlorostyrene
synonyms	:	1-chloro-2-ethenylbenzene; 2-chlorostyrene
molecular formula	:	C ₈ H ₇ Cl
structural formula	:	
CAS reg no	:	2039-87-4

Data from How92.

3 Physical and chemical properties

molecular weight	:	138.6
boiling point	:	188.7°C
melting point	:	-63.1°C
flash point	:	58°C
vapour pressure	:	at 25°C: 0.13 kPa
solubility in water	:	at 20°C: <1 mg/mL
odour threshold	:	approximately 5.8 mg/m ³
log P _{octanol/water}	:	3.54 (estimated)
conversion factors (20°C, 101.3 kPa)	:	1 ppm = 5.76 mg/m ³ 1 mg/m ³ = 0.174 ppm

Data from Dow47, Dow72, Kei87, Lid96, <http://esc.syrres.com>.

o-Chlorostyrene has a disagreeable odour at relatively low vapour concentrations (Dow72).

4 Uses

o-Chlorostyrene is used in organic synthesis and in the preparation of speciality polymers (ACG99).

5 Biotransformation and kinetics

There is no indication, from the skin irritation tests conducted, that this material is absorbed through the skin in toxic amounts (Dow61). No further data are available.

6 Effects and mechanism of action

Human data

No data have been found.

Animal data

o-Chlorostyrene is moderately irritating to the skin of rabbits. Single applications to the ears caused only very slight irritation, while repeated applications caused a slight to moderate irritation characterised by hyperaemia, exfoliation, hair loss, and mild blistering. A marked reaction characterised by hyperaemia, oedema, and necrosis resulted from bandaging the material onto the shaven bellies of rabbits (Dow46). There are no quantitative data. From another source, quantitative data are available: 10 mg irritates the skin of rabbits, and 500 mg is irritating to the eyes of rabbits (Lew92).

The following acute toxicity data were found (Lew92):

- LD₅₀ oral rat: 5200 mg/kg body weight
- LD₅₀ dermal rabbit: 20,000 mg/kg body weight.

Rats (n=2) survived exposure by inhalation to a saturated atmosphere*, for 7 hours. Some kidney injury was observed at autopsy. The animals were drowsy and unsteady upon removal from the chamber. The eyes and nose were slightly wet (Dow61).

Groups of 24 rats, 3 rabbits, 12 guinea pigs, and 1 dog of each sex were exposed 7 hours/day, 5 days/week, for 6 months to a concentration of 101 ppm (580 mg/m³). On the basis of appearance, growth, behaviour, mortality, haematology, blood urea nitrogen, alkaline phosphatase, serum glutamic pyruvic transaminase (alanine aminotransferase), blood serum protein, organ weights, and macroscopic examinations, there were no adverse effects in any species. Microscopic examination of rats, rabbits, guinea pigs, and dogs indicated no clear-cut compound-related effect, but there appeared to be a slightly higher incidence of those liver and kidney changes usually found in controls (no further details are presented) (Dow72).

o-Chlorostyrene was not mutagenic when tested in *S. typhimurium* strains TA97, TA98, TA100, and TA1535 with and without rat or hamster liver metabolic activation (Zei88).

* The (theoretic) concentration in saturated air can be calculated using the formula: (vapour pressure in Pa x 10⁶ ppm)/10⁵ Pa. Using a vapour pressure of 130 Pa (at 25°C), the committee estimates that these animals could have been exposed to, at most, 1300 ppm or (roughly) 7540 mg/m³.

The committee did not find data from genotoxicity tests in mammalian cell systems *in vitro* or in mammals *in vivo* or on the potential carcinogenicity or reproduction toxicity of *o*-chlorostyrene.

7 Existing guidelines

The current administrative occupational exposure limit (MAC) for *o*-chlorostyrene in the Netherlands is 285 mg/m³ (50 ppm), 8-hour TWA.

Existing occupational exposure limits for *o*-chlorostyrene in some European countries and in the USA are summarized in the annex.

8 Assessment of health hazard

o-Chlorostyrene was moderately irritating to the skin and eyes of rabbits; in skin, it induced hyperaemia, oedema, and necrosis (Dow46, Lew92).

Based on rat oral and rabbit dermal LD₅₀-values of 5200 and 20,000 mg/kg bw, *o*-chlorostyrene would not be classified regarding its acute toxicity.

After inhalation exposure to saturated atmospheres (estimated to be *ca.* 1700 ppm or 7540 mg/m³), for 7 hours, drowsiness and unsteadiness, as well as some kidney injury were observed.

In a 6-month inhalation study in which rats, rabbits, guinea pigs, and dogs were exposed to 101 ppm (580 mg/m³), 7 hours/day, 5 days/week, for 6 months, slightly higher incidences of kidney and liver changes were found in exposed animals when compared to controls (Dow72). Due to the absence of detailed data, the committee could not draw definite conclusions from this study.

o-Chlorostyrene did not induce mutations in an *in vitro* bacterial test system.

The committee did not find data from genotoxicity tests in mammalian cell systems *in vitro* or in mammals *in vivo* or on the potential carcinogenicity or reproduction toxicity of *o*-chlorostyrene.

The committee considers the toxicological data base on *o*-chlorostyrene too poor to justify recommendation of a health-based occupational exposure limit.

Based on a slightly higher incidence of microscopic kidney and liver changes in experimental animals exposed to 580 mg/m³, for 6 months, the committee concludes that the present MAC-value of 285 mg/m³ (50 ppm), as an 8-hour time-weighted average, for *o*-chlorostyrene may be too high.

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Annex

Occupational exposure limits for *o*-chlorostyrene in various countries.

country -organisation	occupational exposure limit		time-weighted average	type of exposure limit	note ^a	lit ref ^b
	ppm	mg/m ³				
the Netherlands - Ministry	50	285	8 h	administrative		SZW01
Germany - AGS	-	285			S	TRG00
- DFG MAK-Kom.	-	-				DFG01
Great Britain - HSE	-	-				HSE01
Sweden	-	-				Arb00b
Denmark	50	285	8 h			Arb00a
USA						
- ACGIH	50	-	8 h	TLV		ACG01
	75	-	15 min	STEL		
- OSHA	-	-				ACG00
- NIOSH	50	285	10 h	REL		ACG00
	75	430	15 min	STEL		
European Union - SCOEL	-	-				CEC00

^a S = skin notation, which means that skin absorption may contribute considerably to body burden; sens = substance can cause sensitisation

^b Reference to the most recent official publication of occupational exposure limits