# Allyl chloride

| CAS number: | 107-05-1 |
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| Synonyms: | 3-Chloroprop-1-ene, 3-chloropropene |
| Chemical formula: | C3H5Cl |

Workplace exposure standard (interim)

| TWA: | **0.01 ppm (0.03 mg/m3)** |
| --- | --- |
| STEL: | **—** |
| Peak limitation: | **—** |
| Notations: | **Carc. 2, Sk.** |
| IDLH: | **—** |
| Sampling and analysis: | There is uncertainty regarding quantification of the recommended value with currently available sampling and/or analysis techniques. |

## Recommendation and basis for workplace exposure standard

An interim TWA of 0.01 ppm (0.03 mg/m3) is recommended to minimise the risk of cancer and to protect for neurological, hepatic and renal effects in exposed workers.

Investigation of additional data in the next scheduled review is recommended, particularly related to carcinogenicity data.

## Discussion and conclusions

Allyl chloride is used in manufacturing of polymers, resins, plastics and pharmaceutics. It has shown to be mutagenic and has demonstrated carcinogenic effects in animals. The chemical has demonstrated hepatic and renal effects in animals and has been reported to be readily absorbed through the skin and produce adverse systemic effects (ACGIH, 2018; DFG, 2002; NICNAS, 2013).

According to DFG (2002), genotoxic mechanisms involved in the carcinogenic process cannot be excluded. Allyl chloride is characterised as a non-threshold genotoxic carcinogen (DFG, 2002). However, there are no positive carcinogenicity data nor suitable exposure-response functions available to estimate a TWA. Therefore, an interim TWA is recommended.

The historic TWA of 1 ppm was considered by several agencies to protect for systemic effects including those on the CNS, liver and kidneys. Using this value as a point of departure, and applying an uncertainty factor of 10 to account for non-threshold effects and another uncertainty factor of 10 to account for the incomplete data in humans. The resulting TWA of 0.01 ppm is considered appropriate to minimise the risk of cancers in exposed workers.

A STEL is not recommended based on allyl chloride’s characterisation as a non-threshold based genotoxic carcinogen.

## Recommendation for notations

Classified as a category 2 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 as evidence indicates absorption through the skin producing adverse systemic effects.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA 1991 TWA: 1 ppm (3 mg/m3); STEL: 2 ppm (6 mg/m3) | |
|  |
| ACGIH 2011 TLV-TWA: 1 ppm (3 mg/m3); TLV-STEL: 2 ppm (6 mg/m3) |
| TLV-TWA and TLV-STEL recommended to minimise the potential for hepatic and possible renal effects in exposed workers and minimise the potential for respiratory and eye irritation.  Summary of data:  Human data:   * Reports of eye irritation, corneal injury and neurological effects (weakness, paraesthesia and numbness in the extremities) * A study of 1,064 male workers showed no significantly elevated SMR for all malignant neoplasms, lung cancer, circulatory system disease or arteriosclerotic heart disease in comparison to un-exposed external or internal populations. * Industry reports of dermal exposure in workers (no further details).   Animal data:   * Average of 8 ppm produced significant effects in liver and kidneys (guinea pigs, rats, rabbits; 28 x 7 h exposures over 35 d) * Average of 3 ppm produced slight lobular degeneration in female rat livers (guinea pigs, rats, rabbits, dog; 7 h/d, 5 d/wk; 127–134 exposures in 180–194 d) * NOAEL: 5.4 ppm (17 mg/m3) neurological effects (rabbits, 6 h/d, 6 d/wk, 5 mo) * LD50: 2,066 mg/kg (rabbit, dermal) * LC50: 2,000 ppm (rat, 4 h) * Acts as a skin tumour initiator in presence of promoter in mice and produces neoplastic lesions of the forestomach (adequately conducted carcinogenicity study).   Genotoxicity:   * Mutagenic in *Salmonella typhimurium* and NBP tests * DNA damage in bacteria, mutagenic to bacteria and fungi and induced gene conversion in yeast * Induced chromosomal aberrations in cultured Chinese hamster lung cells * Binds to isolated DNA.   Not considered to pose a significant developmental hazard; but some damage to sperm reported. |
| DFG 2002 NA |
| Suspected carcinogenic effects with potential genotoxic mechanisms, therefore previous MAK of 1 ppm withdrawn.  Summary of additional data:   * Considered a weak alkylating/mutagenic substance in studies considered suitable * Genotoxic mechanisms involved in the carcinogenic effects cannot be excluded. * Evidence of simultaneous dermal exposure increasing excretion of the metabolite *S-allyl mercapturic acid* in the urine of workers (no other details). |
| 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 |  | 2013 | * Reported to cause polyneuropathy, adverse effects on the central nervous system and reversible liver and kidney damage after occupational exposure * Respiratory irritation noted in acute inhalation studies * Reported eye irritation, often with orbital pain along with nose, throat and respiratory irritation, and with eye and respiratory tract irritation reported at 75 mg/m³ * NOAEC: 0.29 mg/m3 (rats, sub chronic exposure; reversible neurological effects and effects on male reproduction) * The critical effects are systemic, long-term effects (carcinogenicity, mutagenicity, repeat dose toxicity and reproductive toxicity). |
| IARC |  | 1987 | * Non-significant increase the incidence of squamous cell papillomas and carcinomas of the forestomach of mice in an oral study * No skin tumours in mice following repeated skin applications * Increased incidence of tumour-bearing mice (compared to controls) after a single application and treatment with 12‑O‑tetradecanoylphorbol 13-acetate * A marginal increase in the multiplicity of lung adenomas in mice following intraperitoneal injection * Concluded not to be classifiable as carcinogenic in humans based on inadequate evidence in experimental animals and humans. |

### Carcinogenicity — non-threshold based genotoxic carcinogens

| Is the chemical mutagenic? | Yes |
| --- | --- |
| Is the chemical carcinogenic with a mutagenic mechanism of action? | Yes |
| **The chemical is a non-threshold based genotoxic carcinogen.** | |
| Is a cancer slope factor or inhalation unit risk value available? | No |
| Calculated TWA value (µg/m3) | NA |

## Notations

| Source | Notations |
| --- | --- |
| SWA | Carc. 2 |
| HCIS | Carcinogenicity – category 2 |
| NICNAS | Carc. Cat. 3 |
| EU Annex | Carcinogenicity – category 2 |
| ECHA | NA |
| ACGIH | Carcinogenicity – A3; Skin |
| DFG | Carcinogenicity – 3B; H (skin) |
| SCOEL | NA |
| HCOTN | NA |
| IARC | Carcinogenicity – Group 3 |
| 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: | yes | 4.00 |  |  | | Dermal LD50 ≤1000 mg/kg: |  |  |  |  | | Dermal repeat-dose NOAEL ≤200 mg/kg: |  |  |  |  | | Dermal LD50/Inhalation LD50 <10: |  |  |  |  | | *In vivo* dermal absorption rate >10%: |  |  |  |  | | Estimated dermal exposure at WES >10%: |  |  |  |  | |  |  |  | **a skin notation is warranted** | | |

### IDLH

| Is there a suitable IDLH value available? | No, the chemical is a genotoxic carcinogen |
| --- | --- |

## Additional information

| Molecular weight: | 76.52 |
| --- | --- |
| Conversion factors at 25°C and 101.3 kPa: | 1 ppm = Number mg/m3; 1 mg/m3 = 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*](http://www.acgih.org/tlv-bei-guidelines/policies-procedures-presentations) on the ACGIH website.

Deutsche Forschungsgemeinschaft (DFG) (2002) Allyl chloride – MAK value documentation.

International Agency for research on Cancer (IARC) (1999) Allyl Chloride. IARC Monographs on the evaluation of the carcinogenic risk to humans.

National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2013) Allyl chloride: 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).