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GDCh-Advisory Committee
on Existing Chemicals of
Environmental Relevance (BUA)

# Chloroethane
(Ethylchloride)

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S. Hirzel
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on Existing Chemicals of Environmental Relevance (BUA)

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Beratergremium für Umweltrelevante Altstoffe (BUA)

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## Foreword

The German Chemicals Act (Chemikaliengesetz - ChemG) of 1980 stipulates that certain existing chemicals must be reported to the competent authority, if they exhibit properties which indicate that they may be hazardous, either alone or in combination with other substances.
In the summer of 1982, an Advisory Committee on Existing Chemicals of Environmental Relevance (BUA) was set up by the German Chemical Society (Gesellschaft Deutscher Chemiker - GDCh). It brings together representatives from the scientific community, the chemical industry and the governmental authorities. This Advisory Committee is responsible for elaborating appropriate solutions for substances of relevance for health and the environment on the basis of voluntary measures. It selects and examines existing chemicals from the aforementioned angles. The testing and evaluation are based on scientific criteria alone.
It was, therefore, necessary to develop priority setting procedures. In a first phase reports were only prepared for priority chemicals. Within the framework of a first priority setting procedure, chemicals were compiled from several priority lists and 135 chemicals were selected for detailed substance reports.
In a second priority setting procedure the survey of the German Chemical Industry Association (VCI) on all substances with a production volume of more than 10 tons per year was used as a starting list. Since this survey covered 4,600 chemicals, BUA decided to process the corresponding list in several stages. The first stage included approx. 1,050 substances with a production volume of more than 1,000 tons per year.
Detailed reports are drawn up on chemicals suspected of having a hazard potential and abridged reports on those presenting only a minor hazard potential, according to the current state of knowledge.
The detailed BUA reports take in both the published literature and data from industry. If data for the evaluation of the chemicals are not available, additional studies are recommended and the results are published as updates to the reports. The reports serve as a basis for the instigation of administrative measures, when there are indications of risks to health or the environment.

Tübingen, May 1993

Ernst Bayer
Chairman of the Advisory Committee
on Existing Chemicals
of Environmental Relevance

**Contents**

## BUA Report on Chloroethane (Ethylchloride)

### Summary and conclusions


### Ecological aspects

In the Federal Republic of Germany (territory as in September 1990) approximately 12,000 t of chloroethane were manufactured in 1990 by the addition of hydrogen chloride to ethene. With an export volume of about 10,400 t and an import volume of about 4600 t, an annual consumption of about 6200 t results. With the decreasing consumption of tetraethylplumbane containing ("leaded) fuel the demand of chloroethane has declined during the last years.

In the former GDR approximately 5000 t chloroethane for the manufacture of tetraethylplumbane were produced annually until 1990.

About 75 % of the chloroethane used in the old territory of the Federal Republic are chemically transformed, about 5 % are in most cases directly released to the environment as spray components or by various other uses, and about 20 % escape from foamed polystyrene, for which they are used as a blowing agent, in the course of few years.

Approximately 120 t release to the environment in 1990 are obtained for the territory of the former GDR; in the old territory of the Federal Republic, the release amounts to about 1600 t with 1 t during the production, 56 t during processing, and 1550 t from application. Release occurs mainly into the atmosphere with the major part being emitted directly to this medium and a minor part being stripped from waste waters in sewage treatment plants.

Because of its physical properties, chloroethane is not expected to accumulate in the hydrosphere, in the geosphere, or in the biosphere. In single surface water samples of the River Rhine concentrations from 0.2 µg/l near Cologne to 2.5 µg/l near Basel were found (determined in 1978). For the Potomac River a value of < 2 µg/l was reported. In single samples from the effluent of a sewage treatment plant in Los Angeles chloroethane concentrations of 1.5 ± 1.1 µg/l were determined.

Chloroethane may appear under anaerobic conditions as a biodegradation product of trichloro- and dichloroethane in drainage waters beneath landfills. Concentration values reported here are between “not detectable” and maximally 170 µg/l. The latter value represents a single observation from 1 out of 5 landfill drainage water samples.

Studies on water samples taken below landfills also show considerable scattering in the frequency of positive identifications as well as in the concentrations. For the drainage waters of a combined domestic / industrial waste disposal site, values between not detectable and 160 µg/l were reported. For groundwater samples from beneath the area of a barrel recycling plant, values range from “not detectable” to maximally 136 µg/l.

Sediment samples from the coastal area of Los Angeles and from the North American Lake Pontchartrain, respectively, were analyzed for chloroethane. While in the first case < 0.5 µg/kg are reported, for the second area concentrations of “not detectable” and 0.2 µg/kg are given.

Chloroethane is not biodegradable under methanogenic conditions. In laboratory experiments, the bacterium *Nitrosomonas europaea* proved to be able to co-oxidize chloroethane. Further information on the bio degradation of chloroethane could not be found.

The abiotic degradation occurs in the atmosphere by reaction with OH radicals as the main route of elimination. Atmospheric half lives between 40 and 58 days were reported.

Hydrolysis as a degradation pathway is of minor importance in surface waters since volatilization from aqueous solutions occurs more rapidly than hydrolytic degradation. Under anaerobic conditions (in ground water and drainage waters), however, hydrolysis may be of importance in the elimination of chloroethane.

No experimental studies on the bioaccumulation of chloroethane are available. Monitoring values in 5 oysters showed a mean concentration of 7.6 µg/kg (wet weight). Due to other studies, however, in fish livers, mysidaceae, decapode crabs, and shrimps, however, chloroethane was not detected. With a log $P_{OW}$ of 1.52, accumulation in the biosphere is not probable.

Chloroethane was identified qualitatively in 2 out of 8 samples of mother‘s milk.

The soil sorption of chloroethane is to be classified as very low. Together with the high mobility geoaccumulation does not appear to be probable.

No studies on ecotoxic effects on algae, daphnia, or fish are available.

**Toxicological Aspects**

The substance is depressing the central nervous system, thus the narcotic effect is dominant. For inducing narcosis of humans, concentrations of 36,000 - 45000 ppm (96.5 - 120 $mg/l^{-1}$) are necessary.

Following prolonged exposure to narcotic concentrations chloroethane acts cardiotoxic, via a sensibilisation of the heart against adrenalin. Because of the cardiotoxicity chloroethane is no longer applied as an anaesthetic. Following chronic abuse (sniffing) reversible neurological changes like ataxia, nystagmus, stammering and dysbasia have been described.

Due to the low boiling point of the substance studies concerning skin and eye irritation were not conducted; the available inhalation studies showed no irritation of the mucous membranes of the respiratory tract.

The acute toxicity of chloroethane is considered to be low. The $LC_{50}$ (2 h) for rats has been described with 59,700 ppm (160 $mg/l^{-1}$).

Chloroethane is absorbed rapidly into the blood via the lung. After inhalation chloroethane is almost quantitatively exhaled unchanged. Data describing the metabolisms of chloroethane are rare, however a reaction with glutathion has been described in mice following inhalation.

After acute, subacute and subchronic exposure adverse effects on liver, kidney and heart have been reported (liver enlargement, accumulation of fat). In a subchronic study with rats and mice (13 weeks; 5 d/w; 6 h/day) a NOEL of 10,000 ppm (26.8 $mg/l^{-1}$) has been described.

Chloroethane was mutagenic in the Ames-Test in strains TA 100 and TA 1535 (± S 9), but did not show any DNA-damaging activity in an *in vitro* DNA-repair test in hepatocytes of mice. Chloroethane showed no transforming activity in a BALBI/c3T3 transformation assay.

In a long-term inhalation study with extremely high concentrations (15,000 ppm = 40.2 mg $l^{-1}$) an increase in the incidence of uterus tumours was observed in female mice. The mechanism of the tumour development remains unclear.

After inhalation of chloroethane (5000 ppm = 13.4 mg $l^{-1}$) slight foetotoxicity but no teratogenicity have been observed in mice.

## **<u>Recommendations</u>**

### Ecology

No studies on the biodegradation under aerobic conditions are available yet. They will be performed as a closed bottle test.

No data are available on the ecotoxic effects of chloroethane. Currently studies on the acute toxicity towards water flea (*Daphnia magna*) are being performed, those to determine the chronic effects on algae (*Scenedesmus subspicatus*) are in preparation. Recommendations on further tests regarding the effects of chloroethane on aquatic Organ isms will depend on the results of these studies.

The effects of gaseous chloroethane on higher plants should be tested (e.g. modified LIS test).

### Toxicology

First of all, studies in the area of metabolism should be conducted. The reaction of chloroethane via the oxidative pathway (cytochrome P-450) and the reaction with glutathione should be studied *in vitro* and if necessary *in vivo*. Furthermore the conflicting results of the available in vitro genotoxicity assays should be clarified.

Depending on the results of these studies, the mechanism of the development of uterus tumours in mice should be reconsidered.