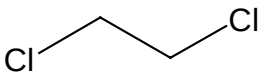
SIDS INITIAL ASSESSMENT PROFILE

CAS No.	107-06-2
Chemical Name	1,2-Dichloroethane
Structural Formula	

SUMMARY CONCLUSIONS OF THE SIAR

Human Health

1,2-Dichloroethane has to be considered as harmful after inhalation and oral application and as uncritical after dermal exposure, based on the GHS system. LD_{50} values ranging from about 400 – 1000 mg/kg bw (oral), > 4000 mg/kg bw (dermal) and from approx. 4000 mg/m^3 (7 h) to >49,000 mg/m^3 (0.5 h). A respiratory 4-h NOAEL is approximately 1400 mg/m^3 in rats. However, a steep concentration-response relationship associated with sudden, often unexpected mortality is characteristic of 1,2-dichloroethane. Death is thought to occur through CNS (Central Nervous System) and cardiovascular depression.

Studies on primary irritation of the substance demonstrated a low irritation potential both to the skin and eyes. In contrast to other species tested, specifically dogs experienced corneal turbidity and oedema after single and repeated atmospheric exposure to systemically toxic concentrations (about 4000 mg/m^3), but not when exposed to lower ones.

No studies on contact allergy were located.

Several repeated dose toxicity studies following oral and inhalation exposure in rats and mice showed mild histopathological effects after inhalation in lung, liver and in the kidneys of rats and mice at high doses or, after gavage dosing, minimal local lesions of the kidney and the forestomach. A subchronic drinking-water study does not allow to derive a NOAEL because of the highly reduced water consumption by the test animals. The lowest NOAEL for subchronic oral exposure by gavage is assumed to be 120 and 150 mg/kg bw/d for male and female rats, respectively, based on treatment-related effects in the forestomach and clinical symptoms, while the chronic oral NOAEL of about 25 mg/kg bw is equivalent to the highest dose administered to rats for two years in the diet. For inhalation, studies are conducted on a broad spectrum of species. A two-year-study shows a NOAEL of 50 ppm in rats. At subchronic to chronic exposure to 200 ppm variable responses from unremarkable to toxic and lethal were observed even within the same species. Based on the GHS-system, 1,2-dichloroethane should be regarded as harmful following repeated inhalation exposure.

1,2-Dichloroethane is mutagenic and genotoxic in bacterial and mammalian *in vitro* test systems, but gave no evidence of *in vivo* mutagenic activity (mouse micronucleus and DL assay), while some *in vivo* genotoxic potential was demonstrated in mice. However, evidence of DNA damaging *in vivo* activity/genotoxicity is presented by positive results in SCE assay and single DNA strand-break analysis. The cytochrome-P450 and glutathione-dependent pathways are assumed to be responsible for the generation of intermediates capable of binding to and damaging DNA.

1,2-Dichloroethane was shown to produce carcinogenic effects at multiple sites in rats and mice of both sexes after oral gavage administration for 78 weeks (up to 195 and 300 mg/kg/d, respectively), but not after inhalation in both species exposed to a reasonably high concentration of 150 ppm (about 600 mg/m^3) for the same period of time. Based on the GHS-system, 1,2-dichloroethane has to be regarded as suspected human carcinogen. The route of application-specific expression of tumorigenesis may be explained by the difference in pharmacokinetics and

dominance of metabolic pathways under either dosing mode: Systemically toxic inhalation concentrations result in significantly lower blood and organ levels than toxic gavage doses and, therefore, are expected to be (hypothetically) less likely to form oncogenic intermediates.

There was no evidence of 1,2-dichloroethane-induced impairment of reproductive performance in rats and mice including fertility of either sex and fetal viability parameters after repeated oral doses of 50 mg/kg bw/d (feed and drinking water) and after inhalation exposure to up to 150 ppm in several one-and two-generation studies. Furthermore, no histopathological adverse effects on the gonads were reported in two oral long-term studies in rats and mice.

In Several investigations on developmental toxicity, no significant toxicity was noted in the offspring of rats receiving up to maternally toxic oral (gavage) and inhalation doses during pregnancy. The NOAELs for developmental effects were the highest doses employed, 240 mg/kg bw/d and 300 ppm, respectively.

In humans, incidental ingestion has been reported as cause of death; occupational dermal and inhalation exposure have produced marked systemic intoxication: primarily unspecific neurotoxic symptoms developed such as nausea, vomiting, headache, stupor, dysequilibrium, and - in fatal cases – coma followed by respiratory arrest. Severe cases also involved lesions of liver, kidney, and adrenal glands. High dermal and respiratory exposures caused skin and eye irritation. There have been no human case reports on skin sensitisation in the literature. In workers exposed to a mixture of vinyl chloride monomer (VCM) and 1,2-dichloroethane a statistically significant increase in SCE frequency of about 24 % in the higher exposed subgroup (20 individuals) was found. This increase was also obvious in non-smoking workers, and it was additionally shown that the SCE frequency was positively correlated with smoking but not with drinking habits and VCM exposure.

Environment

1,2-Dichloroethane has a water solubility of 8490 – 9000 mg/l, a vapor pressure of 81 hPa at 20°C and a log Kow of 1.45. According to a Mackay I model the atmosphere is the target compartment for the substance (~95 %), followed by water (~5 %). A Henry's law constant of 95.7 – 149 Pa $*$ m^3/mol was determined. Due to its chemical structure the substance will not undergo both hydrolysis in water and photodegradation by direct sun-light. A half-life of 42 to 73 days was calculated for indirect photodegradation by hydroxyl radicals in the atmosphere. Field measurements confirmed, that the photodegradation in the atmosphere prevents the global distribution and the atmospheric enrichment of emissions, released by industry mainly in the northern hemisphere.

1,2-Dichloroethane is not biodegradable under non-adapted test conditions but it could be demonstrated that appropriately adapted bacteria or enrichment with degradation promoting factors lead to acceptable and fast biodegradation rates. However, under environmental conditions biodegradation is not likely to occur. No potential for bioaccumulation (measured BCF = 2) or geoaccumulation (measured Koc = 33) could be identified. In acute and long-term ecotoxicity tests with aquatic organisms the following results were found:

LC_{50} (96 h)	= 66 mg/l (*Micropterus salmoides*)
LC_{50} (96 h)	= 115 mg/l (*Limanda limanda*)
EC_{50} (24 h)	= 36 mg/l (*Artemia salina*)
EC_{50} (24 h)	= 150 mg/l (*Daphnia magna*)
EC_{50} (72 h)	= 189 mg/l (*Scenedesmus subspicatus*)
NOEC (32 d)	= 29 mg/l (*Pimephales promelas*)
NOEC (28 d)	= 11 mg/l (*Daphnia magna*, Reproduction)

All effect values are based on measured concentrations or were performed in closed systems.

Taking into account the results of the different chronic toxicity studies conducted in aquatic organisms and considering the lowest valid NOEC of 11 mg/l obtained in a chronic aquatic toxicity reproduction test conducted in *Daphnia magna* a PNEC of 1100 µg/l is being derived applying a safety factor of 10.

Exposure

The worldwide production volume of 1,2-dichloroethane exceeds 1,000,000 tonnes/year. The main uses are as chemical intermediate in the vinylchloride monomer (VCM) manufacture with a contribution of about 95%. The remaining 5% of produced 1,2-dichloroethane enter applications such as raw materials for ethyleneamines, tri- and tetrachloroethylene, extraction and cleaning solvent as well as lead scavengers for gasoline. Due to the increasing use of unleaded fuel the latter application is assumed to subside gradually. 1,2-Dichloroethane emissions to the aquatic environment and to the atmosphere come nearly exclusively from manufacturing industrial locations and only to a minor extent from its use as extraction and cleaning solvent and as lead scavenger, respectively. It is not clear, however, whether 1,2-dichloroethane is still being used in aircraft gasoline.

Production and handling of 1,2-dichloroethane takes place in closed systems and it is directly transported via pipelines during filling processes, e.g. loading of tanker ships. In all countries with production plants occupational exposure limit values are established, during maintenance operations personal protection is mandatory.

In 1993 it was reported that 150 tonnes were emitted to the atmosphere during production and processing in Germany by 9 production and/or processing sites. Releases into the hydrosphere were estimated to be about 4.46 t for 7 producers/processors.

European Product Registers have several entries of paints and lacquers, adhesives and fertilizers containing 1,2-dichloroethane. But according to national laws these products are only available for professional use.

RECOMMENDATION

The chemical is currently of low priority for further work.

RATIONALE FOR THE RECOMMENDATION AND NATURE OF FURTHER WORK RECOMMENDED

Human Health: The substance is currently of low priority for further work. Although hazardous properties have been identified for this substance (possible genotoxic and carcinogenic effects), the overall exposure in humans is low, as it is mostly used as a chemical intermediate. In some countries, where products for professional use containing 1,2-dichloroethane may still be available, further exposure assessment and if necessary risk assessment is recommended.

Environment: The substance is currently of low priority for further work. This can be concluded from the main use as chemical intermediate, the very low bioaccumulation potential and the low toxicity to aquatic organisms.