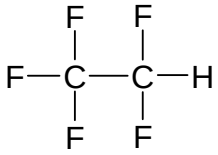
SIDS INITIAL ASSESSMENT PROFILE

CAS No.	354-33-6
Chemical Name	1,1,1,2,2-pentafluoroethane (HFC-125)
Structural Formula	

SUMMARY CONCLUSIONS OF THE SIAR

Analog Rationale

HCFC-141b (1,1-dichloro-1-fluoroethane; CAS No. 1717-00-6) and HCFC-142b (1-chloro-1,1-difluoroethane; CAS No. 75-68-3) are used to supplement the data for pentafluoroethane for the aquatic toxicity endpoints. These substances are justified as analogs because they have molecular weights, functional groups, and Log Kow values that are similar to pentafluoroethane (HFC-125).

Human Health

In an inhalation toxicokinetics study, exposure by rats to concentrations of 1,000, 5,000, and 50,000 ppm (4,909, 24,544, and 245,440 mg/m^3) for 6 hours did not result in significant absorption or distribution in the body. In an acute inhalation toxicity test, HFC-125 administered to rats at a concentration of 800,000 ppm (3,927,000 mg/m^3) did not result in death. However, ataxic gait and abnormal respiration were observed during exposure and ceased one hour after exposure ended. No signs of dermal or ocular irritation were observed during acute exposure (up to 800,000 ppm) or repeated whole-body exposure (up to 50,000 ppm, 245,440 mg/m^3). Skin sensitization was not observed during repeated-dose studies.

In a 28-day inhalation study, rats were administered doses up to 50,000 ppm (245,440 mg/m^3) 6 hours per day, 5 days per week. Ten rats per sex per dose were used in the study. No clear treatment-related effects were observed and the highest tested concentration was considered to be the NOAEC. In a 90-day inhalation study, groups of ten males and ten females were also administered HFC-125 at doses of 5,000, 15,000, and 50,000 ppm (24,544, 73,630, and 245,440 mg/m^3) by inhalation for 6 hours/day for 5 days/week. Gross pathological effects observed at the highest dose included a cyst in the kidney of one animal, a cyst in the ovary of another, enlarged lymph nodes of a third animal, and white patches in the liver of a fourth animal. Due to the limited number of animals and different organs affected as well as the lack of statistical significance, these effects were considered incidental. Therefore, the highest dose (50,000 ppm) was considered the NOAEC for the 90-day study.

In vitro genotoxicity studies (a bacterial reverse mutation test and two mammalian chromosomal aberration tests) and an *in vivo* study (a mammalian erythrocyte micronucleus test) showed negative results at non-cytotoxic concentrations.

Fertility studies are not available. Results of organ weight and tissue analyses of male and female reproductive organs in both the 28-day and 90-day studies did not reveal any treatment-related effects.

In a developmental study in rats, groups of 40 females were exposed to concentrations up to 50,000 ppm (245,440 mg/m^3) HFC-125 during days 6 to 15 of pregnancy for 6 hrs/day. Twenty-four rabbits per exposure group were also dosed with concentrations up to 50,000 ppm during days 6 to 18 of pregnancy for 6 hours/day. No changes in embryo-foetal viability, incidence of malformations, anomalies or variants were observed. Therefore 50,000 ppm (245,440 mg/m^3) can be considered as both the maternal and the foetal NOAEC in the developmental studies.

A study on cardiac sensitisation was carried out in dogs exposed to HFC-125 and concurrently injected with adrenaline. Cardiac sensitisation was observed in animals exposed to an atmosphere containing 100,000 ppm (490,880 mg/m^3) HFC-125 and above. The NOAEC for this study was 75,000 ppm (368,160 mg/m^3).

Environment

HFC-125 is a gas with a melting point of -103 °C, a boiling point of -48 °C, a vapor pressure of 1.4 x 10^4 hPa at 25°C an estimated water solubility range of 432-1071 mg/l at atmospheric pressure and a Log K_{ow} of 1.48.

According to the Level III Fugacity-based Multimedia Environmental Model, HFC-125 will partition almost exclusively into the atmosphere in an exposure scenario using 100 percent release into the air. No experimental data on abiotic degradation are available. However, calculated half-lives for hydrolysis are 1166 days at pH7 and 117 days at pH 8. Due to its vapor pressure and Henry's Law constant (28.2 KPa m^3/mol), the estimated volatilization half life 1 hour for a river and 105 hours for a lake. HFC-125 was not readily biodegradable in a closed-bottle test. Hydroxyl radical-mediated photodegradation in the troposphere results in a calculated global atmospheric lifetime of 29 years. Because of the low atmospheric degradation rate, HFC-125's potential to form ozone in the troposphere is considered negligible. Based on the ozone depletion potential value of 3 x 10^{-5} compared to CFC-11 (ODP = 1), HFC-125 does not contribute to atmospheric ozone depletion. Its global warming potential relative to CO_2 is 3,400 for a time horizon of 100 years and thus it has the potential to contribute to global warming upon release. Using the Log K_{ow} value, the estimated BCF is 2.75. Therefore, HFC-125 is not expected to bioaccumulate in aquatic organisms to any appreciable extent.

No ecotoxicity experimental data are available for HFC-125. ECOSAR calculations predicted the hazard potentials shown in the following table. This estimation is supported by the low aquatic toxicity of HFC-125 structural analogs. The analogs are likely to be more biologically reactive because of the presence of chlorine atoms in the chemical structures as well as the higher water solubilities.

	HFC-125	HCFC-141b	HCFC-142b
Fish (mg/L)	96-hr LC_{50} 274 (QSAR calculation)	96-hr LC_{50} 126 (experimental)	96-hr EC_{50} 220 (experimental)
Daphnia (mg/L)	48-hr LC_{50} 283 (QSAR calculation)	48-hr LC_{50} 31.2 (experimental)	48-hr LC_{50} 160 (experimental)
Algae (mg/L)	96-hr LC_{50} 172 (QSAR calculation)	72-hr EC_{50} >44 (experimental)	No data

Exposure

Greater than 99 percent of HFC-125 is used as a blend component for commercial refrigeration and air conditioning systems, while the rest is used as a fire extinguishing agent, as minor applications in plastic foam blowing, and as a solvent in special applications. The production of HFC-125 from three producers was approximately 16,000 tonnes in 2002. Occupational exposure to HFC-125 may occur during production and mainly during repair/maintenance operation in refrigeration systems. Since refrigeration units and fire extinguishing systems are hermetically sealed, consumer exposure would occur most likely from slow leaks. However, when used to extinguish fires, there may be

some short term exposure to HFC-125 as well as thermal degradation products such as hydrogen fluoride. Environmental monitoring data performed between 1998 and 2000 detected a maximum mixing ratio of 1.4 ppt HFC-125 in the atmosphere. The use and disposal of equipment containing HFC-125 is regulated in the USA under the Clean Air Act (FR V68, 162, 2003).

RECOMMENDATION AND RATIONALE FOR THE RECOMMENDATION AND NATURE OF FURTHER WORK RECOMMENDED

The chemical is currently of low priority for further work due to its low hazard profile for human health and the environment (fish, invertebrates, and algae). Its global warming potential is acknowledged and being addressed by other programs.