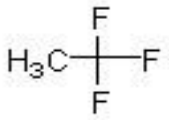
SIDS INITIAL ASSESSMENT PROFILE

CAS No.	420-46-2
Chemical Name	1,1,1-Trifluoroethane (HFC-143a)
Structural Formula	

SUMMARY CONCLUSIONS OF THE SIAR

Supporting Chemical Justification

For environment, an analog, 1,1-dichloro-1-fluoroethane (HCFC 141b; CAS No. 1717-00-6) was used as a surrogate for the algal toxicity and bidegradation endpoints. This approach is acceptable because HCFC 141b is also a halocarbon structurally similar to HFC 143a. HCFC 141b is more water soluble and less volatile than HFC-143a. HCFC 141b has been previously assessed in the OECD HPV Chemicals Program (documents are available at http://www.inchem.org/documents/sids/sids/1717006.pdf).

Physical-chemical properties

1,1,1-trifluoroethane (HFC-143a) is a colorless and odorless gas at room temperature with a melting point of -111.3 °C, a boiling point of -47.4 °C at 1013hPa and a measured vapour pressure of 1262-1272 kPa at 25 °C. The calculated octanol-water partition coefficient (log K_{ow}) is 1.74 and the measured water solubility is 761 mg/L at 25 °C. The flammability limits of HFC-143a at 20 – 25^{o}C are 7.4 – 18.8%.

Human Health

Data on toxicokinetics of 1,1,1-trifluoroethane are available from studies in rats and human volunteers. Studies in male rats (conducted via inhalation) indicate that the major metabolite found in urine after inhalation exposure to a concentration of 40,000 ppm 1,1,1-trifluoroethane for 4 hours (at saturation) is trifluoroethanol. Minor metabolites included the glucuronide conjugate of trifluoroethanol, trifluoroacetic acid, trifluoroacetaldehyde and the urea conjugate of trifluoroacetaldehyde. No metabolites were identified following exposure to air concentrations of 4800 ppm or lower. In another study, a significant decrease in liver glutathione was seen in rats exposed to concentrations greater than 10,000 ppm for 4 hours. In vitro studies using microsomes from rats or humans confirm low levels of metabolism. Less than 2.6 % of parent compound was metabolized when microsomes were exposured to 20000 or 60000 ppm; no metabolism was detected at 200 ppm. The major metabolite was trifluoroethanol and the minor metabolites were not identified.

Nine (occupationally exposed) male human volunteers were exposed to 500 ppm of 1,1,1-trifluoroethane for two hours during light physical exercise in an exposure chanber. A plateau blood concentration of 4.8 ±2.0 µM 1,1,1-trifluorethane was reached within 30 minutes of exposure. The concentration in plasma and inhaled air decreased quickly and in parallel when exposure was stopped. The urinary excretion of 1,1,1-trifluoroethane after exposure was 0.0007% of the inhaled amount. The half-time in urine was 53 minutes. The kinetic behaviour is in agreement with a very low blood:air partition coefficient and zero metabolism.

Acute inhalation exposure of rats (male and female) to concentrations up to 591,000 ppm (approximately 2030 mg/L) 1,1,1-trifluoroethane for four hours (nose only) did not cause lethality [OECD 403]. Body weight loss was the only clinical sign of toxicity. The LC_{50} was greater than 591,000 ppm. 1,1,1-Trifluoroethane induced cardiac sensitization in dogs at concentrations of 300,000 ppm. No effects of exposure at 500 ppm for 2 hours were seen

in humans either in the electrocadiographic monitoring or as rating for irritation and CNS symptoms. No reliable data on irritation are available for 1,1,1-trifluoroethane.

The repeated-dose toxicity of 1,1,1-trifluoroethane has been investigated in two studies. In a 4-week repeated-exposure inhalation toxicity study in male rats, the substance was administered via inhalation (whole body) at 0, 2000, 10,000 or 40,000 ppm (0, approximately 6.9, 34.4, 137.5 mg/L respectively) for 6 h/day, 5 days/week. The high exposure level was chosen as it approximated 50% of the lower flammability limit (7.0 to 7.5%). No treatment-related mortality, clinical signs, body weight changes or macroscopic or microscopic changes in the testes or epididymides were observed. The NOAEC was 40,000 ppm. In a second study [OECD TG 413], rats (20/sex/concentration) were similarly exposed via inhalation (whole body) for 13 weeks. The recovery groups of 10 animals/sex/concentration were included in the study which continued for four additional weeks without the test substance exposure. No mortality or treatment-related changes were observed. In addition to the guideline histopathological evaluations, liver samples were collected from 5 rats/group for determination of B-oxidation activity as a measure of peroxisomes proliferation. There was no proliferation of hepatic peroxisomes. The NOAEC was 40,000 ppm.

In two bacterial reverse mutation assays/Ames tests with multiple strains of *Salmonella typhimurium* [OECD TG 471], 1,1,1-trifluoroethane was negative both with and without metabolic activation.. An *in vitro* chromosomal aberration test [OECD TG 473] was negative with and without metabolic activation when human lymphocytes were exposed to 5000, 15,000, 25,0000 or 35,000 ppm 1,1,1-trifluoroethane for 3 hours at 37 ^{o}C. An *in vivo* micronucleus assay [OECD TG 474] was negative, in which mice were exposed whole body for 6 hours/day for two consecutive days to 2000, 10,000 or 40,000 ppm 1,1,1-trifluoroethane. Based on these results, 1,1,1-trifluoroethane is considered to be non genotoxic *in vitro* and *in vivo*.

In a limited oral carcinogenicity study, HFC143a was administered in corn oil, by gavage to male and female rats at a dose of 300 mg/kg, 5 days/week for 52 weeks. The rats were then observed for an additional 72 weeks. No compound related carcinogenic or chronic toxic effects were seen.

A reproductive toxicity study is not available for 1,1,1-trifluoroethane. No treatment-related effects were seen following histological examination of the reproductive organs (testes, epidydimides, prostate, ovaries and uterus) in the 13-week whole body inhalation repeated-dose toxicity study when animals were exposed (whole body) to 1,1,1-trifluorethane up to 40,000 ppm. The developmental toxicity of 1,1,1-trifluoroethane has been investigated in rats and rabbits in studies conducted according to OECD TG 414. The pregnant rats were exposed (whole body) from day 7 through day 16 of gestation and the pregnant rabbits were exposed from day 6 through day 18 of gestation. In both studies the exposure levels were 0 (control), 2000, 10,000 or 40,000 ppm. No evidence of developmental toxicity was observed in rats or rabbits. The NOAEC for maternal and developmental toxicity in both studies was 40,000ppm.

This chemical does not present hazard for human health based on its low hazard profile. Adequate screening-level data are available to characterize the hazard for the environment for the purposes of the OECD HPV Chemicals Programme.

Environment

1,1,1-Trifluoroethane does not contain any hydrolizable groups and will not undergo hydrolysis. For the photodegration, indirect photo-oxidation by reaction with hydroxyl radicals is predicted to occur with a half-life of 9,600 days. The 100-year global warming potential has been estimated as 3800 (compared with 1 for CO_2) and the atmospheric lifetime has been estimated as 48.3 years. These estimations are based on information presented by the Intergovernmental Panel on Climate Change (IPCC). The global warming potential of this chemical is acknowledged and being addressed by other programs. Based on the analog data for HCFC-141b, 1,1,1-trifluoroethane is considered to be not readily biodegradable. In general, low molecular weight halocarbons are not readily degradable. A level III fugacity model calculation with equal and continuous distributions to air, water and soil compartments suggests that 1,1,1-trifluoroethane will distribute mainly to the air (52.1 %) and water (47.2 %) compartments with minor distribution to the soil (0.47 %) and sediment (0.19%) compartment. If released only to the air compartment, this chemical stays in the air compartment (> 99.9 %) with negligible amounts in other compartments. As this chemical is a gas, it will be released almost exclusively into the air.

The estimated Henry's Law constant of 11.2 kPa-m^3/mole suggests that volatilization of 1,1,1-trifluoroethane from the water phase is expected to be high. The bioaccumulation potential is expected to be low based on the

estimate log K_{ow} of 1.74 and estimated BCF value of 0.81.

The following acute toxicity test results have been determined for aquatic species:

Fish [*Oncorhyncus mykiss*]:	96 h LC_{50} > 40 mg/L (measured, highest concentration tested); 109 mg/l (modelled)
Invertebrate [*Daphnia magna*]	48 h EC_{50} = 300 mg/L (measured)
Aquatic plants:.	96-h EC_{50} = 71 mg/L mg/L.(modelled)
Aquatic plants (analog HCFC-141b)	72 h NOEC > 44 mg/L (measured; highest concentration tested)

This chemical does not present hazard for the environment based on its low hazard profile. This chemical is considered not readily biodegradable and the bioaccumulation potential is expected to be low. Adequate screening-level data are available to characterize the hazard for the environment for the purposes of the OECD HPV Chemicals Programme.

Exposure

Annual global production for 2006 is estimated to be between 10,000 and 50,000 tons. There are two identified production sites, one in the U.S. and one in France. It is produced at a purity of >99.9% and sold as a liquified gas. It is flammable. It is used in stationary air conditioning systems and commercial refrigeration.

Since 1,1,1-trifluoroethane is a gas with a low boiling point (-47.4˚C), it is produced in sealed systems. There is no monitoring data for 1,1,1-trifluoroethane (from effluents, surface water in occupational settings) available from the production and processing sites in the US or France. However, the American Industrial Hygiene Association's Workplace Environmental Exposure Level committee recommends an OEL (occupational exposure limit) of 1000 ppm as an 8-hr TWA.

It is a gas with a boiling point of -47.4°C and therefore must be used in sealed systems. During the past 6 years a total of 19 samples were collected at Honeywell's production site. Most samples were below the limit of detection (approximately 0.1 ppm) and the highest level reported was 0.65 ppm.

Occupational exposure through inhalation is possible. Consumer exposure is considered to be negligible Environmental exposure throughair is possible but will be very low/considered negligible.