Toxicity of HFC 134a

Today HFC 134a (1,1,1,2 tetrafluoroethane) is widely used, having been introduced as a replacement for CFC 12. CFC 12 had a proven, outstanding record of product safety over many years in various applications, such as domestic, commercial and industrial refrigeration and air conditioning, as well as in many consumer products, such as aerosols. Any replacement for CFC 12 should have at least the same high level of product safety.

HFC 134a was first synthesized in 1936 but was not extensively tested in applications until the 1980s. A group of international fluorocarbon manufacturers funded a study beginning in 1987 to evaluate the toxicity of leading alternatives to CFCs. This study, the Programme for Alternative Fluorocarbon Toxicity Testing (PAFT), included HFC 134a as one of the first alternatives evaluated.

PAFT evaluated a balanced package of short-term (acute), long-term (chronic), developmental and genetic toxicity testing. This in-depth program of testing was a first for an industrial chemical before full commercialization. HFC 134a showed an extremely low level of toxicity throughout the testing. The 8 hour average workplace exposure level has been set at 1,000 ppm which is the highest (i.e safest) value given to a chemical. Any recent information on the safety and toxicity of HFC 134a can be found in the Material Safety Data Sheet (MSDS).

Short-term toxicity testing showed HFC 134a to be "practically non-toxic". There was significant toxicity only at extremely high concentrations (over 50% in air). This level of concentration is extremely unlikely to occur during normal use. Accidental release of the entire 6 ounce HFC 134a charge from a refrigerator into a typical kitchen would not cause a toxicity problem.

There was no evidence of genetic toxicity (cancer-causing potential) and no effects of concern in developmental toxicity tests (birth defect potential). The sub-chronic (90 day) and chronic (1 year) testing showed no effects of any kind. At the very end of the 2 year toxicity lifetime study (rats normally live just over 2 years) the testing showed an increased number of benign (non-cancerous) tumors only visible under a microscope. These showed up only at the highest dose tested (50,000 ppm) and were considered to be extremely unlikely to occur in people. In fact, these tumors are found quite often in this type of rat at the end of its lifetime. At 10,000 ppm HFC 134a exposure there were no increases in these tumors. CFC 12 has been tested up to only 5,000 ppm where it showed no evidence of toxicity.

At very high exposure levels HFC 134a, along with other halogenated and non-halogenated hydrocarbons (such as propane), can sensitize the heart to adrenaline. This could cause irregular heartbeat and even death. The no-effect level (NOEL) for cardiac sensitization for HFC 134a is 50,000 ppm (5%) while for CFC 12 the NOEL is 25,000 ppm. HFC 134a is at least as safe as CFC 12. Intentionally concentrating and breathing the vapors of any refrigerant or aerosol propellant could be dangerous and even lead to death.

In summary, HFC 134a has been rigorously tested for toxicity, and all the testing has shown it to have extremely low toxicity. Its use for over 15 years suggests that HFC 134a is at least as safe as CFC 12 which had an outstanding record of safety.