

REACH PFAS Control Exemption Application for Refrigerants

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The refrigerant is known as fluorocarbons, which include Fluorochloroalkanes(CFCs), Hydrochlorofluorocarbons(HCFCs), Hydrofluorocarbons(HFCs), and Hydrofluoroolefins(CFOs). Due to the destruction of the ozone layer, global warming and climate protection, the Montreal Protocol, the Kyoto Protocol and the Kigali Amendment have come into force and implemented to control the production and use of such compounds and mixtures in a planned way. Therefore, the REACH PFAS regulation does not need to cover the use of these chemicals in gaseous state again.

The development of refrigerants originated in the 1930s, from the first generation of NH₃, CO₂ and other less safe natural working fluids to the second generation of Chlorofluorocarbons (CFCs) and Hydrochlorofluorocarbons (HCFCs), and then to The third-generation refrigerants of Hydrofluoroalkanes (HFCs) that are still widely used at present and the fourth-generation refrigerants of Hydrofluoroolefins (HFOs) that are being developed and promoted have gone through about 200 years.

These compounds can form Trifluoroacetic acid (TFA) through atmospheric degradation pathways. For example, HCFC-123 can form CF₃CClO, which further forms TFA; HFC-134a can form CF₃CFO, which further forms TFA; HFO-1234yf can form CF₃CFO, which further forms TFA; HCFO-1233zd(E) can form CF₃CHO, which further forms TFA. Please refer to Figures 10 and 11 in the attached article by S. Madronich et al., June 2023. In general, after use, fluorine-containing gas substances will enter the atmosphere, pass through intermediates, and finally degrade to generate TFA.

TFA is an acid when formed in the atmosphere, and forms salts with alkali metals (such as sodium, potassium, calcium, etc.) when it reaches the surface (soil or water). TFA salts lack reactivity and are relatively persistent in the environment with estimated half-lives ranging from hundreds to thousands of years. This persistence is not critical due to nonreactivity with biomolecules. TFA and its salts are easily excreted by animals and do not bioaccumulate in the food chain. TFA salts have low animal and phytotoxicity characteristics and therefore pose little danger. Please refer to section 3.8 in the attachment.

Regarding the PFAS restriction measures proposed by the EU, we sincerely put forward the above opinions and suggestions, all of which are based on the actual production conditions of the industry. We apply for the exemption of REACH PFAS control for refrigerants, and the relevant refrigerant information is as follows.

Classification	Refrigerant	Name	CAS No.	Chemical Formula
HFCs	HFC-134a	1,1,1,2-Tetrafluoroethane	811-97-2	CF ₃ CH ₂ F
	HFC-125	1,1,1,2,2-Pentafluoroethane	354-33-6	CF ₃ CHF ₂
	HFC-143a	1,1,1-Trifluoroethane	420-46-2	CF ₃ CH ₃
HFOs	HFO-1234yf	2,3,3,3-Tetrafluoropropene	754-12-1	CF ₃ CF=CH ₂
	HFO-1234ze	1,3,3,3-Tetrafluoropropene	29118-25-0	CF ₃ CH=CHF
	HCFO-1233zd	1-Chloro-3,3,3-Trifluoropropene	460-71-9	CF ₃ CH=CClH

Reference attachment:

S. Madronich and etc., Changes in tropospheric air quality related to the protection of stratospheric ozone in a changing climate, Photochemical & Photobiological Sciences, Published online: 13 June, 2023.