

Title of Chapter in Book: Hydrofluorocarbons

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Abstract: Hydrofluorocarbons (HFCs) are a group of organic compounds that contain carbon, fluorine, and hydrogen. They are by-products of industrial manufacturing and were introduced as a replacement for chlorofluorocarbons and other ozone depleting substances. However, though HFCs have zero ozone depletion potential (ODP), they have intrinsic and significant global warming potential (GWP), typically in the range of 1,000 to 3,000 times that of CO₂. Thus, they are among the six key greenhouse gases listed in the Kyoto Protocol for emission reduction. Other greenhouse gases listed by the protocol are CO₂, CH₄, N₂O, PFCs, SF₆, and HFCs. Industry and government are collaborating on research and development, communication, and other activities to find new technologies, designs, and processes to manage these emissions. The emissions management is occurring through non-regulatory means, voluntary measures, and industry-government collaborations. The air-conditioning and commercial refrigeration industry has particularly contributed to the success of the management process. HFCs are generally colourless and odourless gases at environmental temperatures and are mostly chemically unreactive. They are non-flammable, having very low toxicity; they are recyclable, and highly energy efficient. There has been a significant growth in the market for HFCs because they have been identified as important alternative fluids for many end users. They find applications in refrigeration and air-conditioning, foam-blowing, general aerosols, solvent cleaning, firefighting, and metered-dose inhaling. They are preferred due to certain physical and chemical characteristics, especially their low toxicity and low flammability. The main sources of atmospheric HFCs are traceable to their sources of application. Two other major emitters are chemical plants making HCFC 22 (where HFC-23 is emitted as a by-product) and HFCs. There are several points in the lifecycle of HFC-using products at which emissions can occur. A computer model uses four emission factors to characterize the HFC emissions, namely fluid manufacturing, product manufacturing, product life, and disposal loss factors. Examples of HFCs include trifluoromethane (HFC-23), difluoromethane (HFC-32), fluoromethane (HFC-41), hydrofluorocarbons (HFC-41), 2-chloro-1,1,1,2-tetrafluoroethane (HFC-124), 1,1,2,2,2-pentafluoroethane (HFC-125), 1,1,2,2-tetrafluoroethane (HFC-134), 1,1,1,2-tetrafluoroethane (HFC-134a), 1,1-difluoroethane (HFC-152a), 1,1,1,2,3,3,3-heptafluoropropane (HFC-227ea).