The long-term impact of short-lived fluorinated pollutants

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The Montreal Protocol enforced a phase-out of the 1st and 2nd generation refrigerants (chlorofluorocarbons and hydrofluorocarbons, respectively) due to their disastrous ozone depletion potential. Much later, in 2016, the 3rd generation refrigerants (hydrofluorocarbons, HFCs) were banned by the same protocol due to their large global warming potentials. Some HFCs, when 1 kg is emitted today, will contribute more to surface heating over the next century than 10 000 kg of carbon dioxide. The emerging 4th generation are HFCs that incorporate a double bond to increase their lower atmosphere reactivity and are named hydrofluoroolefins (HFOs). We've recently discovered photochemical pathways, presently unconsidered, whereby some important HFOs could decompose into the most environmentally hazardous 3rd generation refrigerants (HFCs). Much of my research focuses on determining the environmental impact of this chemistry and developing a general model for photochemistry occurring in the decomposition networks on HFO refrigerants. This talk will present results from laboratory measurements performed on isolated molecules at zero pressure (mostly velocity-mapped ion imaging), including a new technique for measuring quantum yields in a molecular beam experiment, and on molecules in low-pressure reactors.