Supplement of Atmos. Chem. Phys., 25, 17761–17778, 2025
https://doi.org/10.5194/acp-25-17761-2025-supplement

Atmospheric Chemistry and Physics
Open Access
EGU

Supplement of

Impact of leakage during HFC-125 production on the increase in HCFC-123 and HCFC-124 emissions

Luke M. Western et al.

Correspondence to: Luke M. Western (lwestern@mit.edu)

S1 Contamination of HCFC-124 in air conditioning unit leaks

To determine the magnitude of HCFC-124 impurity in HFC-125 refrigerant in a case-study frame, events of air conditioner leakages at six AGAGE measurement sites (i.e. Trinidad Head, Ragged Point, Mace Head, Cape Matatula, Cape Grim, and Tacolneston), and at an additional, urban site (Aspendale), were evaluated for the years 2008-2024. Events of air conditioner leakage were identified by excess mole fractions of HFC-125 and HFC-32 (components of the R-410A refrigerant blend, HFC-125/HFC-32 ratio of 50%/50% by mass) in laboratory air measurements, as compared to ambient atmospheric mole fractions. Leakage events were additionally subdivided based on documented air conditioner servicing (including refrigerant refilling) and air conditioner replacements. HCFC-124/HFC-125 ratios and correlations varied across leakage events. Six events at a total of three sites (i.e. Trinidad Head, Ragged Point, and Mace Head), showed strong correlation ($r > 0.7$, $R2 > 0.5$), and positive regression slopes. The range of these six events indicate HCFC-124 impurities of 5.5×10^{-4} (to be considered zero) to $4.6 \times 10^{-2}\%$ by mass. For the other 70% of investigated events an HCFC-124 impurity was not demonstrable (with $r < 0.6$, $R2 < 0.4$). For these events, the lowest HCFC-124/HFC-125 ratio was $2.3 \times 10^{-5}\%$ (to be considered zero) by mass.

S2 Supplmentary Table

Measurement site	Latitude	Longitude	Network	Gas	Region
Alert, Nunavut, Canada	82.5° N	62.5° W	NOAA	HCFC-123, HCFC-124	Global
Zeppelin, Svalbard, Norway	78.9° N	11.9° E	AGAGE	HCFC-124	Europe
Summit, Greenland	72.6° N	38.4° W	NOAA	HCFC-123, HCFC-124	Global
Barrow, Alaska, USA	71.3° N	156.6° W	NOAA	HCFC-123, HCFC-124	Global
Mace Head, Ireland	53.3° N	9.9° W	AGAGE, NOAA	HCFC-124	Global, Europe
Tacolneston, UK	52.5° N	1.1° E	AGAGE	HCFC-124	Europe
Taunus, Germany	50.2° N	8.4° E	AGAGE	HCFC-124	Europe
Jungfraujoch, Switzerland	46.5° N	8.0° E	AGAGE	HCFC-124	Europe
Monte Cimone, Italy	44.2° N	10.7° E	AGAGE	HCFC-124	Europe
Niwot Ridge, Colorado, USA	40.1° N	105.6° W	NOAA	HCFC-123, HCFC-124	Global
Trinidad Head, California, USA	41.0° N	124.1° W	AGAGE, NOAA	HCFC-124	Global
Gosan, South Korea	33.3° N	126.2° E	AGAGE	HCFC-124	East Asia
Mauna Loa, Hawaii, USA	19.5° N	155.6° W	NOAA	HCFC-123, HCFC-124	Global
Cape Matatula, American Samoa	14.2° S	170.6° W	AGAGE, NOAA	HCFC-123, HCFC-124	Global
Kennaook / Cape Grim, Tasmania, Australia	40.7° S	144.7° E	AGAGE, NOAA	HCFC-123, HCFC-124	Global
Palmer Station, Antarctica	64.8° S	64.1° W	NOAA	HCFC-123, HCFC-124	Global
South Pole, Antarctica	90.0° S		NOAA	HCFC-123, HCFC-124	Global

Table S1. The location from which air was measured in this study using regular sampling. The column detailing the 'region of emissions quantification' shows for which region the measurements were used to derive emissions. Additional measurements of archived air were measured from Kennaook / Cape Grim, Niwot Ridge, Trinidad Head and Scripps Institution of Oceanography, California USA (32.9° N, 117.3° W) (see main text).