

Yields of TFA from HFCs, HFOs and HCFOs EFCTC
Sep-23
All data on degradation products and TFA yield is from 2022 Assessment Report of the Environmental Effects Assessment Panel

TFA yield error limits in the chart represent both experimental uncertainties and upper and lower yield ranges due to competing reaction channels that depend on environmental conditions. The TFA yield from processing of CF₃CHO is estimated at 2% with an upper theoretical limit of ~ 30%. CF₃CHO is an intermediate for HFC-143a, HFC-365mfc, HFO-1234ze(E), HFO-1336mzz isomers and HCFO-1233zd(E).

Designation	Complete Name	Formula	Atmospheric lifetime AR6	TFA CF ₃ COOH Yield	TFA Yield Error Limits		Intermediate Fluorinated Degradation Products	Final Degradation Products
					Low	High		
HFCs								
			Years					
HFC-125	pentafluoroethane	CHF ₂ CF ₃	30	1%	1%	10%	minor intermediate CF ₃ CF ₂ OH yields TFA main route CF ₃ CF ₂ O → CF ₃ + COF ₂	CO ₂ , HF
HFC-134a	1,1,1,2-tetrafluoroethane	CH ₂ FCF ₃	14	14%	7%	20%	CF ₃ CFO (7-20%) + CF ₃ + HCOF	HCOOH, CO ₂ , HF, CF ₃ COOH
HFC-143a	1,1,1-trifluoroethane	CH ₃ CF ₃	51	2%	2%	30%	CF ₃ CHO (100%)	CO ₂ , HF, CF ₃ COOH
HFC-227ea	1,1,1,2,3,3,3-heptafluoropropane	CF ₃ CHFCF ₃	36	100%			COF ₂ , CF ₃ OH, CF ₃ COF	CO ₂ , HF, CF ₃ COOH
HFC-236fa	1,1,1,3,3,3-hexafluoropropane	CF ₃ CH ₂ CF ₃	213	20%	10%	30%	CF ₃ COCF ₃ → CF ₃ CO + CF ₃	CO ₂ , HF, CF ₃ COOH
HFC-245fa	1,1,1,3,3-pentafluoropropane	CHF ₂ CH ₂ CF ₃	7.9	1%	1%	17%	COF ₂ , CF ₃ CHO, CF ₃ OH	CO ₂ , HF, CF ₃ COOH
HFC-365mfc	1,1,1,3,3-pentafluorobutane	CF ₃ CH ₂ CF ₂ CH ₃	8.9	2%	2%	30%	CF ₃ CH ₂ CF ₂ CHO → CF ₃ CHO, CF ₃ CO and COF ₂	CO ₂ , HF, CF ₃ COOH
HFOs and HCFOs								
HFO-1234yf	2,3,3,3-tetrafluoroprop-1-ene	CF ₃ CF=CH ₂	12	100%			CF ₃ CFO (100%)	CF ₃ COOH, CO ₂ , HF
HFO-1234ze(E)	Trans-1,3,3,3-tetrafluoroprop-1-ene	Trans- CF ₃ CH=CFH	19	2%	2%	30%	CF ₃ CHO (100%)	CO ₂ , HF, HCOOH, CF ₃ COOH
HFO-1336mzz(Z)	Cis-1,1,1,4,4,4-hexafluorobut-2-ene	Cis-CF ₃ CH=CHCF ₃	27	4%	4%	60%	CF ₃ CHO up to 2 moles per mole of HFO-1336	CO ₂ , HF, CF ₃ COOH
HFO-1336mzz(E)	Trans-1,1,1,4,4,4-hexafluorobut-2-ene	Trans-CF ₃ CH=CHCF ₃	122	4%	4%	60%	CF ₃ CHO up to 2 moles per mole of HFO-1336	CO ₂ , HF, CF ₃ COOH
HCFO-1233zd(E)	Trans 1-Chloro-3,3,3-trifluoroprop-1-ene	Trans-CHCl=CHCF ₃	42	2%	2%	30%	CF ₃ CHO	CO ₂ , HF, HCl, HCOOH, CF ₃ COOH