

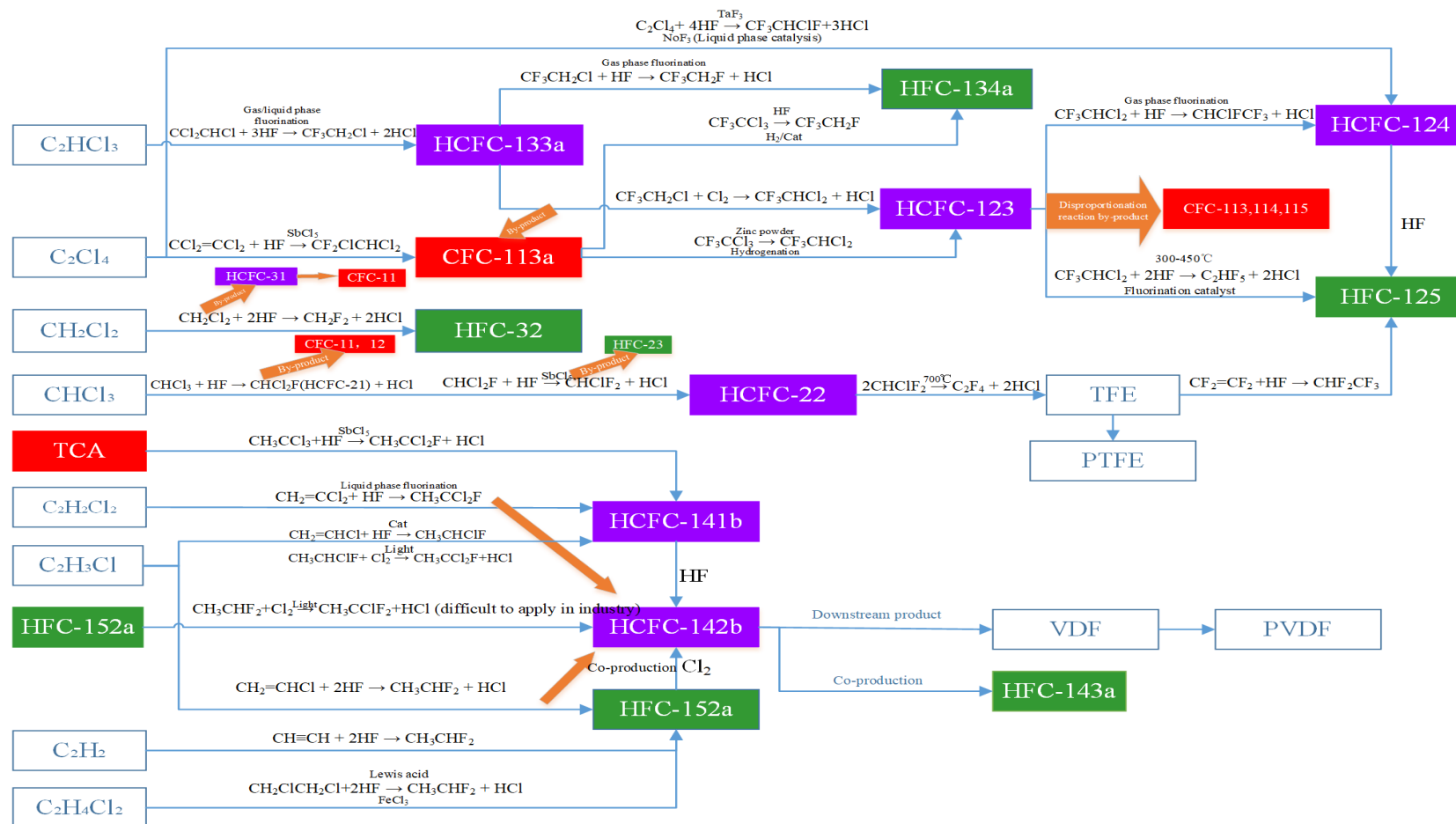
WORKSHOP
2 JULY 2023
BANGKOK

Do emissions from fluorochemical production processes matter?

Jianxin HU, Peking University
July 2, 2023

Chemical synthesis processes for some fluorinated gases

-Simple primary chemical process, but a wide variety of by-products may be present (secondary chemical and impurity chemical reactions)



Vollmer, M.K. *et al.* Unexpected nascent atmospheric emissions of three ozone-depleting hydrochlorofluorocarbons, PNAS Vol. 118 No 5 (2021).

Western, L.M. *et al.* Global increase of ozone-depleting chlorofluorocarbons from 2010 to 2020. *Nat. Geosci.* 16, 309–313 (2023).

2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (**much higher but very uncertain**)

TABLE 3.28A (NEW)
TIER 1 DEFAULT EMISSION FACTORS FOR FLUORO-CHEMICAL PRODUCTION

Fluorochemical Produced	Emission Factor for each Emitted GHG (kg fluorinated GHG emissions/kg fluorochemical produced)	Uncertainty for default emission factor for fluorochemical production
SF ₆	0.03 (SF ₆) ^a	±50% (0.015 to 0.045)
	0.08 (SF ₆) ^b	±50% (0.04 to 0.12)
NF ₃	0.02 (NF ₃) ^c	±50% (0.01 to 0.03)
	0.03 (N ₂ O) ^d	±50% (0.015 to 0.045)
	0.01 (CF ₄) ^d	±50% (0.005 to 0.015)
All other fluorochemicals	0.04 (see Table 3.28B for composition of emitted mass) ^e	-98% to +470% (0.001 to 0.2) ^f

Significant increase in emissions from the production sector if the new IPCC guidelines are used

- IPCC 2019 TFI: Proposes new fluorochemical emission factors significantly higher than the default values in the 2006 version (0.5% to 4%)
 - This emission is about 8.5 Mt CO₂-eq and 68 Mt CO₂-eq if estimated only using the Secretariat's HFCs production data (1.7 billion ton CO₂-eq) for 2021.
 - There are also HCFCs close to this production level, and not insignificant emissions of HFCs and HCFCs are expected from the HCFC production process.
 - The most important thing to tell us is that we only have emission factors for 2006, which may underestimate the emissions of ODS and HFCs from the production process.

However, the new IPCC emission factor is a composite factor and may not be applicable to emissions from specific production lines.

Need more material balance data for enterprise production processes.

More monitoring studies are needed for F-gas production line emissions.

TABLE 3.28B (NEW)
REPRESENTATIVE CHEMICAL COMPOSITION OF THE EMITTED MASS

Fluorinated GHG emitted	Percentage emitted (% of unweighted tonne) ^a
HFC-134a	18
PFC-14 (Perfluoromethane)	18
Perfluorocyclobutane	13
HFC-32	11
HFC-125	11
HFC-23	11
HFC-143a	7
PFC-116 (Perfluoroethane)	5
PFC-218 (Perfluoropropane)	4
PFC-5-1-14 (Perfluorohexane, FC 72)	3