

EIA Briefing to the 90th Meeting of the Executive Committee of the Multilateral Fund (MLF)

June 2022

This briefing outlines EIA's views and recommendations on proposed HCFC phase-out management plans (HPMPs) and the updated reports provided by China on issues relevant to unexplained emissions of CFC-11 and other controlled substances under discussion at the 90th ExCom.

I. HCFC phase-out Management Plans

Stage II HPMPs in the Servicing Sector (Docs 90/19, 21, 27ri, 29, 30ri, 31, 34)

The Bahamas, Benin, Chad, Grenada, Liberia, Libya, Madagascar and the Niger have submitted Stage II HPMPs, which are focused on reducing HCFC-22 consumption in the servicing sector.

Leakage

EIA is concerned at the high leakage rates reported in the documents, including more than 30% in room AC and up to 65% in large AC and commercial refrigeration (see Table 1). Two countries are losing on average more than half the charge of their commercial refrigeration systems each year.

	Bahamas	Benin	Chad	Grenada	Liberia	Libya	Madagascar	Niger
Estimated bank refilled during servicing (%)								
Room AC (unitary, split, portable)	25	35	33	15	2	16	30	27
Central/Commercial AC (roofop, multi-split, chillers)	11	65	33	30	10	15		29
Commercial Refrigeration		65	20	20		10	54	18
Industrial refrigeration			20			10	55	15
Transport refrigeration					30	10	35	27
Equipment Inventory	47,770	608,963	271,011	5,970	323,606	1,264,410	63,435	431,268
Servicing demand (tonnes)	36	272	183	2	29	872	255	165

Table 1: Leakage rates reported in HPMP proposals submitted to the 90th meeting (summarised).

With respect to the Niger, the high refrigerant leakage rates (15-29%) are reported to be due to aging equipment used beyond its normal lifespan, imports of second-hand HCFC-based equipment at a much lower price than new non-HCFC units, insufficient technical knowledge about equipment based on low-GWP alternatives, deficient servicing due to the high level of informality of the sector, lack of regulations to support refrigerant containment, and insufficient infrastructure for refrigerant R&R.

More effective containment measures are clearly required. Libya is proposing a number of elements contained in the EU F-Gas Regulation, including ensuring the maintenance of logbooks by servicing workshops; mandatory leak checking for equipment with initial charge of more than 3 kg; mandatory certification of technicians and registration of servicing workshops.

Recommendations

EIA notes the following comments and recommendations, applicable to all servicing sector HPMPs:

- As all the countries have significant market penetration of HFCs (46-90% according to data submitted), as far as possible all servicing sector activities should be immediately applied or easily extended to include HFCs and should incentivise the uptake of sustainable low-GWP technologies, i.e. natural refrigerants. For example, certification schemes for RAC technicians should be mandatory and should include HFCs and all alternatives to HFCs.
- Containment, labelling and reporting measures should cover HFC refrigerants and all levels of the supply chain, including provisions for storage, transport, processing, disposal, resale, recovery, recycling and reuse; reclamation of HFC blends may require more sophisticated fractional distillation than for reclaiming only HCFCs, and investments in such new reclamation facilities and recovery equipment should be designed to handle both where feasible.
- Policies, regulations and incentives to discourage the uptake of HFC-based technologies and the development of national standards for the safe installation, transportation, storage, operation, and maintenance of energy-efficient, low-GWP RAC equipment are critical. EIA commends Grenada's Stage II proposal, which plans to establish a differentiated tax scheme to promote RAC equipment that runs on renewable energy, is energy efficient, and uses refrigerants with GWP under 150, as well as including a green procurement component in its Public Procurement Act;
- Bans on import of HCFC-containing equipment should be in place by 2025 at the latest, and preferably earlier, given the average lifetime of equipment.
- Actions to enforce the HCFC phase-out can help prepare countries for challenges likely to occur with respect to the illegal trade in HFCs. EIA commends Liberia and Libya which plan to conduct three border dialogues with neighbouring countries. This type of coordination is critical for effective enforcement.

Doc 90/35: Pakistan Stage III and Change of Technology

Pakistan's Stage II HPMP, approved in 2016, included the conversion of one enterprise, Dawlance, manufacturing domestic AC equipment from HCFC-22 to R-290 technology. The Government of Pakistan and Dawlance are now requesting to change the alternative technology to HFC-32 over concerns of market acceptance of R-290-based room AC units.

EIA is concerned at the request to change the technology to HFC-32 instead of R-290, given the high GWP of HFC-32 (2,690 over a 20-year period) and the clear transitional nature of the refrigerant which cannot meet the requirements of the Kigali Amendment. EIA does not agree that HFC-32 based units have higher energy efficiency; as noted in the Desk Study for the Evaluation of demonstration projects for low-GWP alternatives to HCFCs (Doc 90/06), the energy efficiency of R-290 based systems tested was 5-12% higher than HCFC-22 units. Moreover, regulations and standards equally apply to R-32 since it is also flammable.

Given the recent adoption of the new IEC-60335-2-40 standard which will allow higher charge limits of hydrocarbons in split AC and heat pump equipment in R290, which can be applied immediately using a risk assessment process, there is no justification for the MLF to fund transitions to high-GWP technologies that are not sustainable. Pakistan has already converted domestic and commercial AC manufacturing enterprises to R-410A equipment and is increasing the production and import of these units. Additional manufacturing of R-32 units will increase its HFC baseline further as Pakistan is in Group 2. EIA recommends that Pakistan is requested to develop a plan with UNIDO to overcome market acceptance, regulatory and other perceived challenges.

Pakistan is also submitting a Stage III HPMP proposal, which includes the conversion of six remaining foam enterprises to cyclopentane and water-blown technology and servicing sector activities. The project intends to phase out remaining HCFC consumption by 2030. Servicing sector activities include a review and development of policy and regulations, development and implementation of an e-licensing system for imports, training of customs officers, RAC technician training workshops, establishment of four national RR&R centres and four training centres and the promotion of alternatives. EIA supports the Stage III proposal and recommends that more attention is given over time to specific policies and fiscal / practical measures to incentivise the adoption of natural refrigerant alternatives to HCFCs.

Growing Consumption of HFCs

A review of the Stage II and III projects submitted to the meeting indicates high levels of HFCs already being used in developing countries. EIA has expressed concern previously about the number of self-funded conversions to high-GWP HFCs, particularly in the air-conditioning sector, which is creating a newly installed bank of HFC equipment that the MLF will have to fund future conversions away from. Additionally, some of the HFC technologies selected are not only high-GWP refrigerants but are also inefficient, further exacerbating climate mitigation challenges faced by developing countries.

Although these conversions are not necessarily funded by the MLF, the MLF is funding various activities, including technical assistance and awareness raising, in the country at the same time as these conversions. Given the urgent need to implement the Kigali Amendment, these activities should be linked to stronger commitments to avoid the uptake of HFCs. Implementing agencies should collect additional data on alternatives being adopted, regardless of MLF funding, in order to understand if awareness raising and technical assistance are successfully persuading companies to choose clean climate-friendly technologies instead of HFCs.

II. [China's Updated Reports Regarding CFC-11, CFC-12 and CTC – Doc 90/9/Add.1](#)

Overview

Three reports submitted by China to be discussed at the 90th meeting deal with follow up actions and updates regarding issues relevant to the unexpected increase in emissions of CFC-11, and associated issues regarding CFC-12 and CTC.

EIA is encouraged by China's reports on implementing a number of monitoring, regulatory and enforcement actions, however serious questions still remain as to whether underlying issues

that led to the unexpected emissions have been fully resolved, notwithstanding the scientifically observed decline in regional CFC-11 and CTC emissions beginning in 2018.

As further detailed below, neither the independent consultant's study dealing with circumstances that might have led to illegal production and use of CFC-11 and CFC-12, nor China's report on the production of CTC and its feedstock uses, provide consistent and comprehensive answers as to the origins or nature of the unexplained emissions.

New scientific observations of rising global emissions of HCFC-141b between 2017-2021 ([Western et al., 2022](#)) add to these questions. While Western *et al.* do not pinpoint the regional origin of increasing global HCFC-141b emissions, nor conclusively rule out the possibility that banks are contributing to this rise, the timely coincidence of this increase with the rapid decline in CFC-11 emissions raises a possible connection between these atmospheric trends due to replacement of illegal CFC-11 with unreported illegal production and use of HCFC-141b as an alternative blowing agent.

China's Report on Monitoring and Law Enforcement Progress

EIA notes the additional details regarding significant sampling and testing efforts undertaken in 2019 and continued efforts toward expanding local capacity for rapid detection. According to the Study on Supervision and Law Enforcement, CFC-11 was contained in products from 37 enterprises (6 combined polyether and 31 foam product enterprises) based on rapid portable testing of samples from 322 enterprises between June and August 2019. Laboratory retest confirmed illegal use of CFC-11 in 16 enterprises.

It is noteworthy that China reports that none of the 16 entities conclusively found to be using illegal CFC-11 were registered with the China Plastic Processing Industry Association (CPPIA) or had received funding from the Multilateral Fund. This seems to reinforce [EIA's findings](#) that the illegal production and use may have been mostly occurring in the domain of underground and unregistered enterprises, outside the scope of the Government's primary means of policy engagement with industry. The extent of this unregistered and less-understood segment of the foam market in China is highly pertinent to the question of widespread illegal production and use of CFC-11.

Of the 16 enterprises, convictions and/or dismantling of enterprise operations appears to have been limited to the one major producer, the Minghe company, and two smaller enterprises, while the majority of small foam enterprises are presumed to be still operating. Additional information regarding any follow up inspections or verifications with compliance at these entities would be beneficial to ensuring these enterprises have transitioned to legally procured blowing agents.

EIA notes that following distribution of 50 portable detection devices to local environmental enforcement bureaus across 30 provinces in 2019, information is yet to be shared on ongoing detection, sampling, and testing efforts by local authorities. It would be helpful to see additional updates on the scope of ongoing sampling and testing conducted after 2019, following dissemination of detection devices to local environmental enforcement.

As per the report, MEE launched a new round of special ODS law enforcement inspection nationwide at the end of July 2020, mainly targeted at HCFC-141b and HCFC-22 production enterprises as well as illegal production and use of CFC-11. Sharing information and findings from this new round of inspections will be helpful globally.

Finally, the report also states that MEE will start the construction of ODS monitoring stations in 2021 and conduct ODS monitoring in 2022 as planned. EIA and other stakeholders look forward to additional updates in this regard and transparent sharing of resulting data and analysis.

Study to determine regulatory, enforcement, policy or market circumstances that might have led to illegal production and use of CFC-11 and CFC-12

The study prepared by consultant ESD China Limited does not conclusively determine the circumstances that might have led to widespread illegal production and use of CFC-11 in the polyurethane foam sector. The study utilised on-site visits and interviews as well as an ODS market survey and a mass-balance analysis to determine the degree to which previously phased out substances have been produced and used after being prohibited.

Mass balance analysis

EIA believes additional clarifications regarding certain inputs and assumptions to the mass-balance analysis in particular may be helpful to determining the utility of its findings. The results of the mass-balance analysis of raw materials linked to rigid PU foam manufacturing are central to the study's conclusion that "widespread production and consumption of CFC-11 in the PU foam sector during 2008-2018 is highly unlikely in China". The analysis bases its assumptions regarding the quantities of CFC-11 that could have potentially been used and emitted in the sector on a ratio to the consumption of isocyanates (polymeric MDI), the other component of foam mixed with pre-blended polyols containing CFC-11 or another blowing agent. This is due to a higher level of confidence in the MDI data from a smaller number of producers and importers compared with the numerous and varied polyol suppliers. This seems to leave the study open to a number of potential issues regarding assumed ratios and mixtures in various types of foams, particularly given the range of practices that may exist in various less well understood polyol entities. The analysis also does not seem to take into account the potential emissions factors or conversion rate of such polyol entities using a given quantity of CFC-11 in production of spray foams.

Additionally, the report indicates the mass balance analysis is based on data from the China Plastic Processing Industry Association (CPPIA), whereas information on monitoring and enforcement actions indicates that illegal CFC-11 was detected at enterprises that are not members of CPPIA. It is not immediately clear if the MDI consumption data would account for consumption by non-CPPIA enterprises. This calls into question the completeness of the analysis, if it fails to account for consumption by an uncertain market segment outside of the CPPIA's membership. Additional clarification in this regard would be helpful to assess the validity of the mass-balance analysis outputs and conclusions.

Market trends in foam blowing agents

EIA notes that the study does acknowledge that there appears to have been a shortfall of CFC-alternatives for foam blowing during the 2008-2010 period immediately after the CFC-11 phase-out that may have been filled by illegal trade or stockpiles. It also outlines trends in market consumption and prices of alternative blowing agents during 2008-2018, with EIA noting key observations including:

- A tightening market and steeply rising prices for HCFC-141b were seen after introduction of the production quota system in 2013, with prices rising more than 100% from 10,000 RMB/ton in 2013 to 21,800 RMB/ton in 2018;

- Market prices of hydrocarbon blowing agents remained much lower but were not widely used in the small foam enterprises due to safety concerns or in spray foams due to flammability;
- HFC-245fa blowing agents were available at significantly higher prices ranging from a low point of 29,400 in 2014 increasing to 60,000 RMB/ton in 2018. This limited the overall amount of HFC blowing agent uptake despite increasing demand under the HCFC-141b phase-out.

These market trends, including the increasing prices of other blowing agent alternatives combined with the challenges to apply cheaper hydrocarbon-based blowing agents for smaller enterprises and the spray foam sector, reflect consistently with earlier [EIA hypotheses](#) on the drivers for significant illegal use of CFC-11.

Law enforcement and regulatory improvements

EIA concurs with several of the key findings of the study regarding proposed law enforcement and regulatory improvements. Several of the identified findings align closely with EIA's previous recommendations, including:

- Strengthen efforts and frequency of routine ODS law enforcement at local levels;
- Improved enforcement in remote areas where routine supervision and management capacity is weaker;
- Enhance capacity and training with rapid detection equipment;
- Necessity for a sustainable compliance mechanism after initial phase-out goals have been achieved is needed along with better delineation of compliance responsibilities at different levels of government;
- Punitive penal policies require strengthening, while incentive policies should be formulated to foster innovation in alternative technologies.

Updated report on the production of CTC and its feedstock uses in China (Decision 84/41(b) and (c))

At its 84th meeting ExCom requested an updated report on the production of CTC and its feedstock uses in the country including: (i) an update on the progress in monitoring perchloroethylene (PCE) plants that used the alkane chlorination process; (ii) any additional information relevant to the difference in emissions described in the report, and the estimated CTC emissions from China included in section 1.2.3 of the Scientific Assessment of Ozone Depletion: 2018; and to note that the Government of China was considering monitoring the PCE that used the alkane chlorination process, and to invite the Government to include in the updated report any actions taken on that matter (decision 84/41).

The updated report states that only one PCE plant uses the alkane chlorination process that produces CTC by-product and that CTC by-product from this plant is recycled directly to the reactor. The PCE plant does not have a CTC purification unit to separate CTC from the process streams that include a mixture of CTC, PCE, and other components. Accordingly, the Government considered the risk of diversion of CTC from the plant is low and therefore has not taken any additional actions to monitor the PCE plant.

As the Secretariat notes, China's updated report on CTC and its feedstock uses does not include information or analysis to address the difference in emissions reflected in the 2018 Scientific Assessment of Ozone Depletion and more recent scientific estimates by [Lunt et al. \(2018\)](#) and

[Park et al. \(2021\)](#). The emissions estimated by the model are orders of magnitude less than those estimated by Lunt *et al.* Park *et al.* (2021) reported a decline in emissions of CFC-11 and related chemicals, including CTC, from eastern China. Nevertheless, the decreased level CTC emissions estimated by Park *et al.* (2021) for 2018-2019 remain two and one order of magnitude higher than the estimated CTC emissions and maximum CTC emissions respectively, as presented in the updated report. Despite the science pointing to regional emissions attributable to eastern China, the Government of China continues to attribute this disparity to a global issue involving other regions and the gap in top-down vs. bottom-up estimates in global emissions. EIA recommends additional analysis of more recent atmospheric data from at least one site within China available from the Global Atmospheric Watch (GAW) at Shangdianzi as noted by the secretariat, in order to verify other recent findings.

While real-time monitoring is reported to be in place for chloromethane (CM) facilities, there are questions as to whether the monitoring of the growing number of registered feedstock users is adequate. As the Secretariat notes, reported material conversion rates for the same feedstock uses differed across years and facilities. Feedstock uses of CTC are reported to have grown considerably (by 70%) between 2015 and 2019. Manufacture of HCC-240fa, used to make HFOs and HFC-245fa, became the largest feedstock use in 2019, accounting for approximately 40% of the CTC used as feedstock. It is also noted that CM producers have not considered technology upgrades that could further reduce the concentration of CTC in chloroform, another potential source of emissions.

Recommendations

Given the remaining open questions regarding resolution of the underlying issues related to CFC-11 emissions, and the continued unexplained disparity in modelled versus observed regional emissions of CTC in China, EIA recommends continued reporting on these aspects, with particular attention to:

- Scope of ongoing rapid detection, sampling and testing efforts by local environmental bureaus;
- Expansion of the atmospheric monitoring network and real-time sharing of data from atmospheric monitoring as it becomes available;
- Analysis and sharing of available data on CFC-11, CFC-12, CTC and HCFC-141b production, use and consumption;
- Clarification of CTC feedstock use monitoring, given the inconsistent conversion rates across time and similar uses;
- Strengthening capacity building of local governments for sustained compliance.

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