HFC-23 and China Policy Brief

22 October 2024

Introduction

Hydrofluorocarbon-23 (HFC-23), also known as trifluoromethane (CHF_3), is a very potent greenhouse gas largely unintentionally created, for instance, as a byproduct during the production of fluorinated compounds and chemical feedstocks, including hydrochlorofluorocarbon (HCFC)-22.[1] HFC-23 also has limited commercial uses, such as an ultra-low temperature refrigerant for specialized storage and manufacturing. HFC-23 has a 20-year global warming potential (GWP) of 12,400 and a 100-year GWP of 14,700, meaning that one kilogram of HFC-23 released into the atmosphere will trap 14,700 times more heat over a 100-year period compared to one kilogram of carbon dioxide.[2]

HFC-23 is a controlled substance under the Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol) via the Kigali Amendment thereto. Rather than providing a phasedown or phaseout schedule, the Montreal Protocol requires Parties to ensure that their emissions of HFC-23 are destroyed to the extent practicable, using technologies that the Parties approve,[3] and to comply with certain HFC-23 reporting obligations.[4] Hydrofluorocarbons (HFCs) are now being phased down under the Montreal Protocol's Kigali Amendment, with the potential to avoid up to 0.5 °C of warming by 2100.[5] Cutting HFC-23 emissions will provide additional mitigation not included in the 0.5 °C calculation.[6]

Because efforts to reduce HFC-23 emissions are critical in the global climate emergency and recent reports include references to China's HFC-23 emissions, this briefing highlights scientific findings and provides a timeline recounting China's policy developments relevant to HFC-23 emissions control.

1. Recent Scientific Report Highlights HFC-23 Emissions from China:

The September 2024 Report of the Scientific Assessment Panel (SAP) of the Montreal Protocol alerts the 198 Montreal Protocol Parties to the gaps between global atmospheric monitoring-derived and reporting-derived HFC-23 emissions. Notably, the SAP calculated that unreported HFC-23 emissions from China account for 18 to 55% of the global emissions gap from 2015 to 2022.[7]

2. Timeline of China Policy Developments Relevant to HFC-23 Emissions Control:

To facilitate international understanding of China's regulatory and policy measures relevant to HFC-23 emissions control, the following is a chronological summary of China's regulatory and policy developments on HFC-23 emissions control. The summary reveals how China's approaches to the climate-harmful HFC-23 emissions are evolving from voluntary incentive mechanisms to mandatory measures.

2014: In May 2014, China's State Council announced the strengthening of HFC emissions management and acceleration of the destruction and replacement of HFCs as part of the action plan to implement China's 12th Five-Year Plan's energy conservation and emission reduction targets.[8]

2014-2019: From 2014 to 2019, the Chinese government provided subsidies to HCFC-22 manufacturers to incentivize the operation of HFC-23 destruction facilities.[9] The subsidy amount was calculated on a yearly basis at a rate of 4 RMB for 2014, 3.5 RMB for 2015, 3 RMB for 2016, 2.5 RMB for 2017, 2 RMB for 2018, and 1 RMB for 2019 per ton CO_2-eq of destroyed HFC-23 (GWP=11,700).[10] The subsidy was discontinued as of 2020.

2015: In April 2015, the Chinese government mandated that the construction and operation of "harmless treatment facilities" for HFC-23 byproducts must accompany newly constructed HCFC-22 production facilities.[11] All HFC-23 generated as a byproduct must undergo harmless disposal and not be directly emitted.

2021: In June 2021, China submitted its document ratifying the Kigali Amendment to the Montreal Protocol. China's ratification entered into effect on 15 September 2021. With this ratification, China is subjected to HFC-23 compliance obligations. As mentioned in the Introduction to this briefing, each Montreal Protocol Party must "destroy" their HFC-23 emissions "to the extent practicable using technology approved by the Parties" and calculate and provide to the Secretariat specific statistical data on HFC-23 emissions per facility.[12]

In September 2021, China's Ministry of Ecology and Environment (MEE) issued a new policy document prohibiting, as of 15 September 2021, direct emissions of HFC-23 from production processes for HCFC-22 and HFCs.[13] This policy document draws directly from the Montreal Protocol and its Kigali Amendment, providing that, except for feedstocks and essential uses, HFC-23 shall be destroyed to the extent practicable using technology approved by the Parties to the Montreal Protocol. Additionally, MEE specifies in the policy document that companies must install HFC-23 storage facilities or take other measures to avoid emergent HFC-23 emissions. In cases when the HFC-23 destruction and storage facilities are inoperative, the policy document specifies that HCFC-22 or HFC production processes must be paused to avoid HFC-23 emissions. The policy document also encourages technology innovation to reduce the rate of HFC-23 generation as a by-product and promotes resource utilization of HFC-23 as a feedstock. Additionally, the policy document underscores MEE's authority to conduct company inspections to identify potential HFC-23 leaks or emissions.

2024: China's amended Regulation on the Administration of Ozone Depleting Substances took effect on 1 March 2024.[14] The amended Regulation establishes a comprehensive national regulatory framework for China's HFC phasedown. In pertinent part, the amended Regulation provides that entities that generate ozone-depleting substances (ODSs)/HFCs as production byproducts must undertake harmless disposal of the byproducts prior to discharge. Further, the amended Regulation requires that entities that produce or use large quantities of ODSs/HFCs, and entities that generate large quantities of production-process byproduct ODSs/HFCs, must install automatic monitoring equipment and connect such devices to the government monitoring system.

In January 2024, MEE released a draft standard for public comment setting forth technical specifications for monitoring, verification, and reporting of HFC-23 by-production from HCFC-22 production facilities.[15] As of 22 October 2024, this standard has not been formally released.

In June 2024, MEE released a draft-for-comment version of the National Plan on the Implementation of the Montreal Protocol on Substances that Deplete the Ozone Layer (2024-2030) ("draft Plan").[16] The draft Plan indicates that China will further strengthen the monitoring, reporting, and verification of HFC-23 by-production from HCFC-22 production facilities and encourage the adoption of HFC-23 re-utilization technologies.

In October 2024, the People's Bank of China, MEE, China's General Administration of Financial Supervision, and the Securities Regulatory Commission jointly released a document on advancing the role of green finance for constructing "a beautiful China."[17] This document identifies key prioritized green finance areas, including providing green financing support for research, development, demonstration, and market promotion of green and low-carbon alternatives to ODSs, HFCs, and related technologies.

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[1] Liang Q., Rigby M., Fang X., Godwin D., Mühle J., Saito T., Stanley K. M., Velders G. J. M., Bernath P., Derek N., Reimann S., Simpson I. J., & Western L. (2022) *Chapter 2: Hydrofluorocarbons (HFCs)*, in SCIENTIFIC ASSESSMENT OF OZONE DEPLETION: 2022, Global Ozone Research and Monitoring Project–Report No. 278, World Meteorological Organization, 129-131.

[2] Burkholder J. B., Hodnebrog Ø., McDonald B. C., Orkin V., Papadimitriou V. C., & Hoomissen D. V. (2022) *Annex: Summary of Abundances, Lifetimes, ODPs, REs, GWPs, and GTPs* in SCIENTIFIC ASSESSMENT OF OZONE DEPLETION: 2022, Global Ozone Research and Monitoring Project–Report No. 278, World Meteorological Organization, Table A-5.

[3] United Nations Treaty Collection (15 October 2016) Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer ("Each Party manufacturing Annex C, Group I, or Annex F substances shall ensure that for the twelve-month period commencing on 1 January 2020, and in each twelve-month period thereafter, its emissions of Annex F, Group II, substances generated in each production facility that manufactures Annex C, Group I, or Annex F substances are destroyed to the extent practicable using technology approved by the Parties in the same twelve-month period.").

[4] United Nations Treaty Collection (15 October 2016) Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer ("Each Party shall provide to the Secretariat statistical data on its annual emissions of Annex F, Group II, controlled substances per facility in accordance with paragraph 1 (d) of Article 3 of the Protocol.").

[5] World Meteorological Organization (2022) SCIENTIFIC ASSESSMENT OF OZONE DEPLETION: 2022, Global Ozone Research and Monitoring Project–Report No. 278, WMO, 3 ("Compliance with the 2016 Kigali Amendment to the Montreal Protocol, which requires phase down of production and consumption of some hydrofluorocarbons (HFCs), is estimated to avoid 0.3–0.5 °C of warming by 2100. This estimate does not include contributions from HFC-23 emissions.").

[6] World Meteorological Organization (2022) SCIENTIFIC ASSESSMENT OF OZONE DEPLETION: 2022, Global Ozone Research and Monitoring Project–Report No. 278, WMO, 3 ("Compliance with the 2016 Kigali Amendment to the Montreal Protocol, which requires phase down of production and consumption of some hydrofluorocarbons

(HFCs), is estimated to avoid 0.3–0.5 °C of warming by 2100. This estimate does not include contributions from HFC-23 emissions."). *See also* Liang Q., Rigby M., Fang X., Godwin D., Mühle J., Saito T., Stanley K. M., Velders G. J. M., 105 Bernath P., Derek N., Reimann S., Simpson I. J., & Western L. (2022) *Chapter 2: Hydrofluorocarbons (HFCs)*, in SCIENTIFIC ASSESSMENT OF OZONE DEPLETION: 2022, Global Ozone Research and Monitoring Project–Report No. 278, World Meteorological Organization, 143 ("Under the business-as-usual scenario, if the current fractional rate of HFC-23 destruction continues into the future, radiative forcing due to HFC-23 is expected to reach 0.015 W m^{-2} in 2050. Under the scenario in which there is widespread destruction of HFC-23 by-product, the contribution of HFC23 to overall HFC radiative forcing will be small (Section 7.2.2.1).").

[7] Montzka S. A., Burkholder J. B., Carpenter L. J., Fahey D. W., Jucks K. W., & Safari B. (September 2024) Report of the Scientific Assessment Panel in Response to Decision XXXV/7: Emissions of HFC-23, United Nations Environment Programme, 23 ("These three studies (Park et al., 2023; Huang et al., 2024; and Yi et al., 2023) suggest that emissions from eastern China accounted for between 30 and 50% of global emissions during 2015 - 2019, and during 2021 - 2022, and emissions from northern China accounted for approximately 20% of global emissions in 2021-2022. Furthermore, after subtracting China's emissions accounted for in the analysis of the global emission gap (related to HPPMP as reported to the MLF and in A7-reporting to the Ozone Secretariat (UNEP, 2024)) the results from these three studies indicate that unaccounted regional emissions from China have accounted for approximately 18 to 55% of the global emissions gap from 2015 to 2022.").

[8] China State Council (2014) 2014–2015 Energy Conservation, Emissions Reduction and Low Carbon Development Action Plan [2014-2015 年节能减排低碳发展行动方案] (hyperlink to original Chinese) ("为确保全面完成'十二五'节能减排降碳目标，制定本行动方案……加强对氢氟碳化物（HFCs）排放的 管理，加快氢氟碳化物销毁和替代，'十二五'期间累计减排 2.8 亿吨二氧化碳当量.") (English translation: "The action plan is made in order to meet all the energy conservation and emission reduction targets set for the twelfth five year period…. Strengthen the management of HFCs emission. Accelerate the destruction and replacement of HFCs. The total emission reduction of HFCs should reach 0.28 billion tonnes CO_2-eq during the twelfth five-year period.").

[9] General Office of China National Development and Reform Commission (2015) Circular on Carrying Out Related Work on HFCs Disposal [关于组织开展氢氟碳化物处置相关工作的通知] (hyperlink to original Chinese).

[10] General Office of China National Development and Reform Commission (2015) Circular on Carrying Out Related Work on HFCs Disposal [关于组织开展氢氟碳化物处置相关工作的通知] (hyperlink to original Chinese).

[11] General Office of China Ministry of Environmental Protection (now "China Ministry of Ecology and Environment") (2015) Supplementary Provisions on the Strict Control of New, Modified and Expanded HCFCs Production Projects [关于严格控制新建、改建、扩建含氢氯氟烃生产项目的补充通知] (hyperlink to original Chinese).

[12] China has an obligation to report on HFC-23 production and generation under the Kigali Amendment. This obligation is currently performed through annual data reports under Reporting Form 3. Data reporting instructions and guidelines of HFC-23 is provided in UNEP, Article 7 Data reporting instructions and guidelines: Appendix I to Decision XXX/10 (15 November 2018), UNEP/OzL.Pro.30/11, at 75 [7.1]-[7.4], 76 [8.3], 77 [10.1]-[10.3].

[13] General Office of China Ministry of Ecology and Environment (2021) Circular on Controlling the Emissions of HFC-23 By-products [控制副产三氟甲烷排放的通知] (hyperlink to original Chinese).

[14] China State Council (2024) Regulation on the Administration of Ozone Depleting Substances [消耗臭氧层物质管理条例] (hyperlink to original Chinese). IGSD's English reference translation of the amended Regulation on the Administration of Ozone Depleting Substances is available here.

[15] General Office of China Ministry of Ecology and Environment (2024) Technical Specification for Accounting Methods and Reporting of By-product HFC-23 emission from HCFC-22 Production Facility (Draft for Public Comment) [一氯二氟甲烷生产设施副产三氟甲烷排放核算方法与报告技术规范（征求意见稿）] (hyperlink to original Chinese).

[16] General Office of China Ministry of Ecology and Environment (2024) National Plan on the Implementation of the Montreal Protocol on Substances that Deplete the Ozone Layer (2024-2030) (Draft for Public Comment) [中国履行

〈关于消耗臭氧层物质的蒙特利尔议定书〉国家方案（2024-2030）（征求意见稿）] (hyperlink to original Chinese).

[17] People's Bank of China, MEE, China's General Administration of Financial Supervision, and the Securities Regulatory Commission (2024) Opinions on Advancing the Role of Green Finance for the Construction of a Beautiful China [关于发挥绿色金融作用 服务美丽中国建设的意见] (hyperlink to original Chinese).