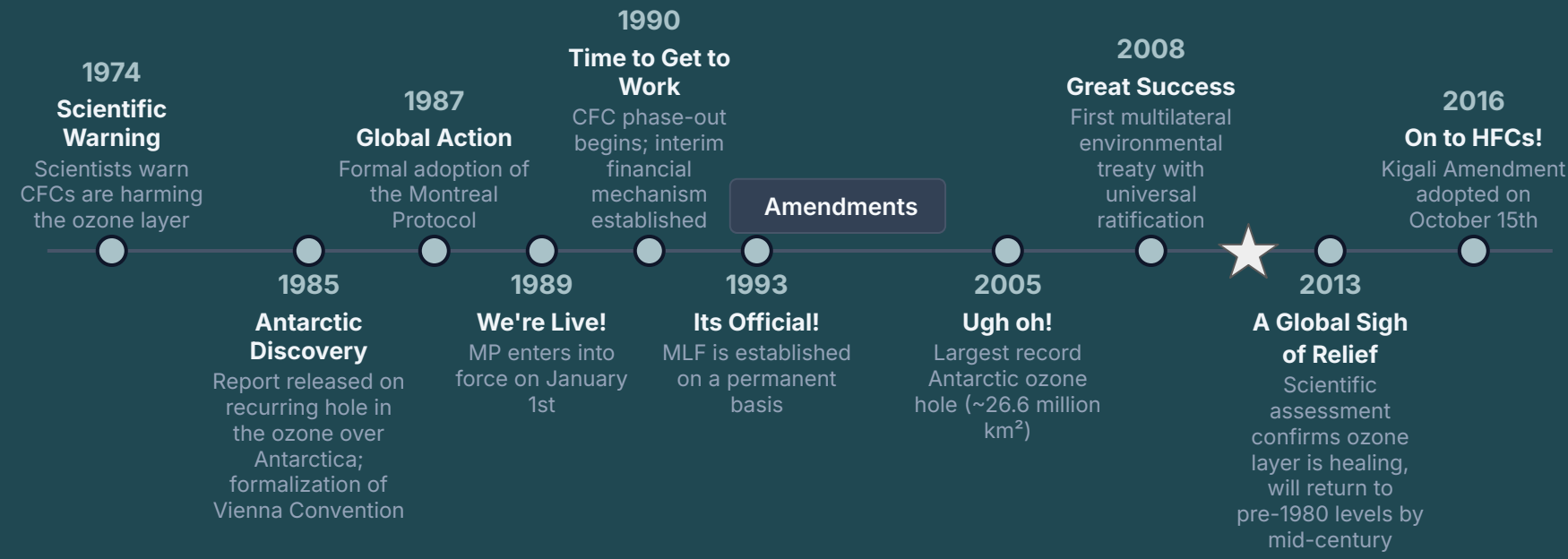
Montreal Protocol Overview

REEF
REFRIGERANT EMISSIONS ELIMINATION FORUM

Timeline of the Montreal Protocol



★ ***All parties complete the phase out of consumption/production of CFCs, halons, carbon tetrachloride, and other fully hydrogenated ODS (2010)***

Major Amendments Pre-Kigali

London Amendment (entered into force in 1992)

Mandated complete phase-out of CFCs and other major ODS by 2000 and established the financing mechanism to assist developing nations that would eventually become the Multilateral Fund

Copenhagen Amendment (entered into force in 1994)

Introduced strict control measures for HCFCs and methyl bromide, and moved up the phase-out deadlines for CFCs and halons.

Montreal Amendment (entered into force in 1999)

Introduced global licensing system to help reduce illegal trade and phased out use of methyl bromide

Beijing Amendment (entered into force in 2002)

Added new controls on production and trade of HCFCs and moved to more strictly regulate bromochloremethane (Halon 1011)

By 2014, all four amendments achieved universal ratification

Kigali: From Ozone to Climate Treaty

Emission Growth

While HFCs account for ~2% of global GHG emissions, they are growing at >10% per year without controls.

Climate Protection Shift

Adding HFCs to the Montreal Protocol shifted focus from ozone-depleting substances to broad climate protection.

Global Reductions

Developing nations froze HFC use in 2024; global use is expected to fall by 80-85% by 2047.

Kigali Impact

Could prevent up to 0.5C warming by 2100. 173 countries have formally ratified/accepted the treaty.

Success but not without a scandal or two...

Rogue emissions of CFC-11

The Montreal Protocol faced a significant challenge when unexpected spikes in CFC-11 emissions were detected, after the global phase-out was complete.

- Production phased out in developed (1996) and developing (2010) nations.
- Alarming increase detected around 2012, with ~13,000 extra tonnes/year from 2014-2016.

CFC-11 has a GWP of 4750 and is the baseline chemical used to measure the ozone depleting potential of all other substance.

Source Investigation

Research and atmospheric data traced these rogue emissions back to specific factories in **Eastern China**.

Resolution

By 2019, the continued spotlight on this issue at the Protocol-level and more and more research from TEAP/SAP helped drive CFC-11 emissions in the region back down to **pre-2012 levels**.

HFC-23: A Repeat of the CFC-11?

Unexpected Rise in HFC-23

While not an ozone-depleting substance, HFC-23 has a staggering Global Warming Potential (GWP) of 14,800 - highest GWP and longest atmospheric lifetime of HFCs.

- **By-product:** Primarily emitted during HCFC-22 production, which was phased out for refrigerant use.
- **Feedstock Loophole:** Production is only allowed for feedstock use, provided that by-product emissions are destroyed and reported.

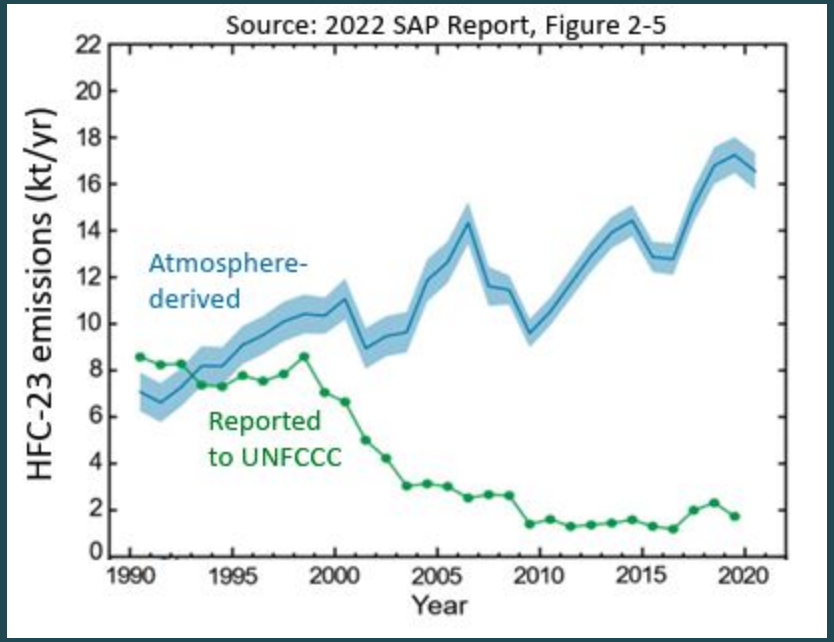
Atmospheric Discrepancy

By 2019, the gap between reported destruction and detected levels reached **~15,000 metric tons** (approx. 222 million metric tons of CO2).

Source Attribution

Data from NASA's Gosan station in South Korea suggests **Eastern China** may be responsible for up to **50%** of the global emissions gap.

Bottom-up v. Top-down HFC-23 Emissions (2008 - 2023)



See also: *Emissions of HFC-23 Do Not Reflect Commitments Made Under the Kigali Amendment, Adam et al (2024)*

The Need for More Protocol-Backed Monitoring

Emission Detection Successes

- Rogue CFC-11 emissions detected by Mauna Loa Observatory (NOAA)
- HFC-23 increases detected in Gosan, South Korea (NASA AGAGE)

Global Monitoring Gaps

Multiple 'blind' regions exist where no monitoring occurs, preventing verification of reported data.

Network largely propped up by US-backed projects and funding.

Strategic Path Forward

Multi-meeting effort focused on securing funding for pilot projects to enhance regional monitoring efforts globally.

Last Year's Decision on Atmospheric Monitoring

Decision XXXVII/1: Enhancing regional atmospheric monitoring of substances controlled by the Montreal Protocol on Substances that Deplete the Ozone Layer

The Thirty-Seventh Meeting of the Parties decides:

1. To request the Ozone Secretariat, in consultation with the Advisory Committee of the General Trust Fund for Financing Activities on Research and Systematic Observations Relevant to the Vienna Convention for the Protection of the Ozone Layer, to continue the evaluation of the suitability of potential sites for monitoring emissions of controlled substances situated within the regions and locations identified in the information provided by the Advisory Committee to the Thirty-Seventh Meeting of the Parties to the Montreal Protocol on Substances the Deplete the Ozone Layer, and with the voluntary participation of and in consultation with the concerned parties;

2. To also request the Ozone Secretariat to prepare, in consultation with the concerned parties that have expressed interest, for possible next steps towards establishing monitoring activities at those sites, taking into account the prioritization presented by the Advisory Committee at the Thirty-Seventh Meeting of the Parties and the phased approach presented in document UNEP/OzL.Pro.37/2/Add.1;

3. To further request the Ozone Secretariat to carry out these activities with a 2026 budget line item of 100,000 United States dollars from the cash balance of the Trust Fund for the Montreal Protocol, on an exceptional basis;

4. To request the Ozone Secretariat to report to the Open-ended Working Group of the Parties to the Montreal Protocol at its forty-eighth meeting and to the Thirty-Eighth Meeting of the Parties to the Montreal Protocol on progress in and any outcomes of those activities, for consideration by the parties;

5. To request the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol to take into consideration the information, including on the phased approach and the estimated costs, related to establishing and operating atmospheric monitoring stations as outlined in the above-mentioned document[1] when developing guidelines and considering a funding window to support pilot projects, and to provide an update to the parties on the progress made ahead of the Thirty-Eighth Meeting of the Parties.

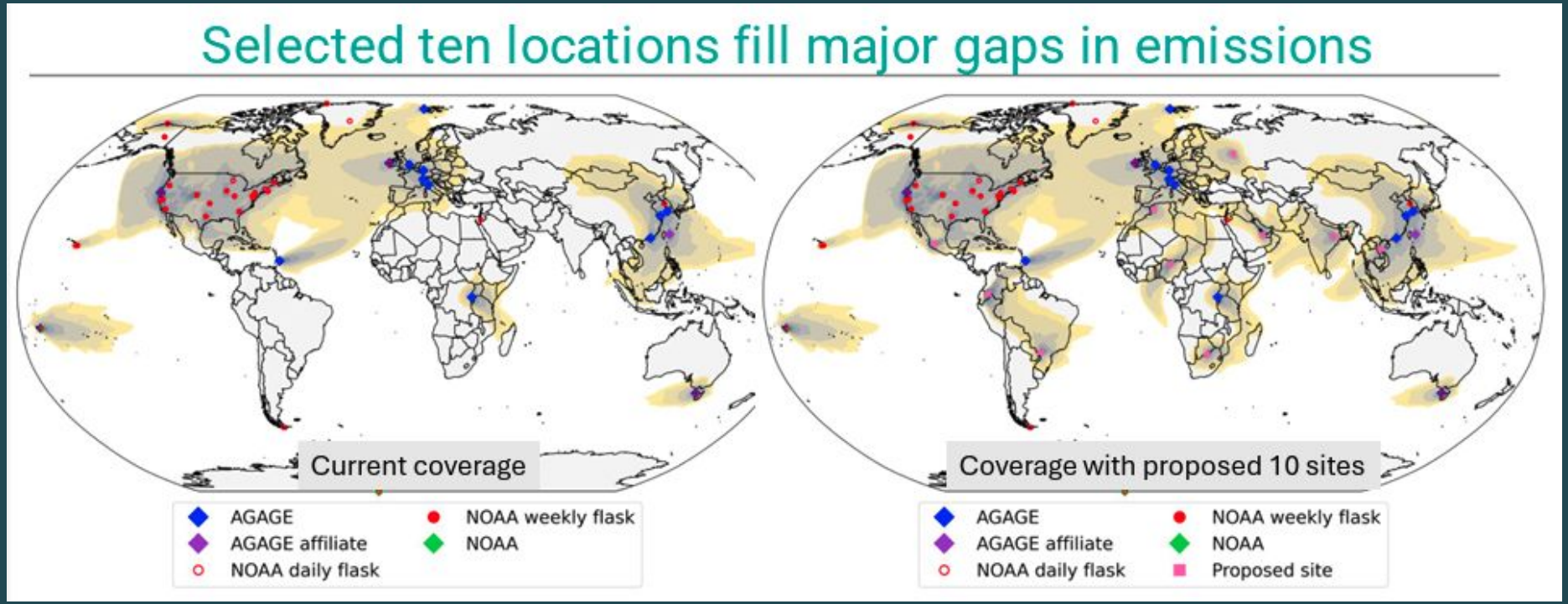
Site Evaluation: Continue suitability evaluation of sites with ***voluntary*** support from interested parties. Parties previously decided to pull $400,000 from MP's Trust Fund for these efforts.

Infrastructure: Prepare next steps for possibly establishing new monitoring sites once sites are evaluated.

Budget & Reporting: $100,000 for activities from the MP's Trust Fund and request to Ozone Secretariat for a progress report at next OEWG and MOP

Funding Window: Request for ExCom (MLF) to consider a funding window for pilot projects

Proposed Sites Based on Analysis Thus Far



Does a site have existing infrastructure? Correct tower height? Lab analysis capacity? Staffing capacity?

Last Year's Decision on HFC-23

Decision XXXVII/2: Emissions of HFC-23

The Thirty-Seventh Meeting of the Parties,

Noting with appreciation the updated information on HFC-23 emissions submitted by the Technology and Economic Assessment Panel and the Scientific Assessment Panel to the Thirty-Seventh Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer in response to decision XXXVI/3,[1]

Recognizing with appreciation the concerted efforts taken by parties since the entry into force of the Kigali Amendment to the Montreal Protocol,

Decides:

1. To request the Technology and Economic Assessment Panel and the Scientific Assessment Panel to provide an update on emissions of HFC-23 to the Thirty-Eighth Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer, taking into account the information submitted by parties in response to decision XXXVI/3 and pursuant to paragraph 2 below and including the following:

(a) Additional analysis of the discrepancy between reported emissions and those derived from atmospheric measurements, including the methodologies applied;

(b) A description of the information and data sources used, identifying any gaps or limitations;

(c) Additional information on methodologies adopted by parties for estimating and reporting HFC-23 emissions as well as best practices for improvements to minimize such emissions;

2. To invite parties that have HCFC-22 production facilities and did not submit information pursuant to decision XXXVI/3 to submit to the Ozone Secretariat, by 28 February 2026, on a voluntary basis, their current methodologies for estimating and reporting HFC-23 emissions from HCFC-22 production;

3. To invite relevant parties:

(a) To report 2025 data, consistent with form 6 of the data reporting forms, on the amounts of HFC-23 generated, captured, destroyed and stored;

(b) To examine, as appropriate, their HFC-23 emissions and the sources of those emissions and encourage scientific research institutions in their countries to undertake or collaborate internationally on research on their HFC-23 emissions and the sources of those emissions, and to report to the Ozone Secretariat new relevant information, if any.

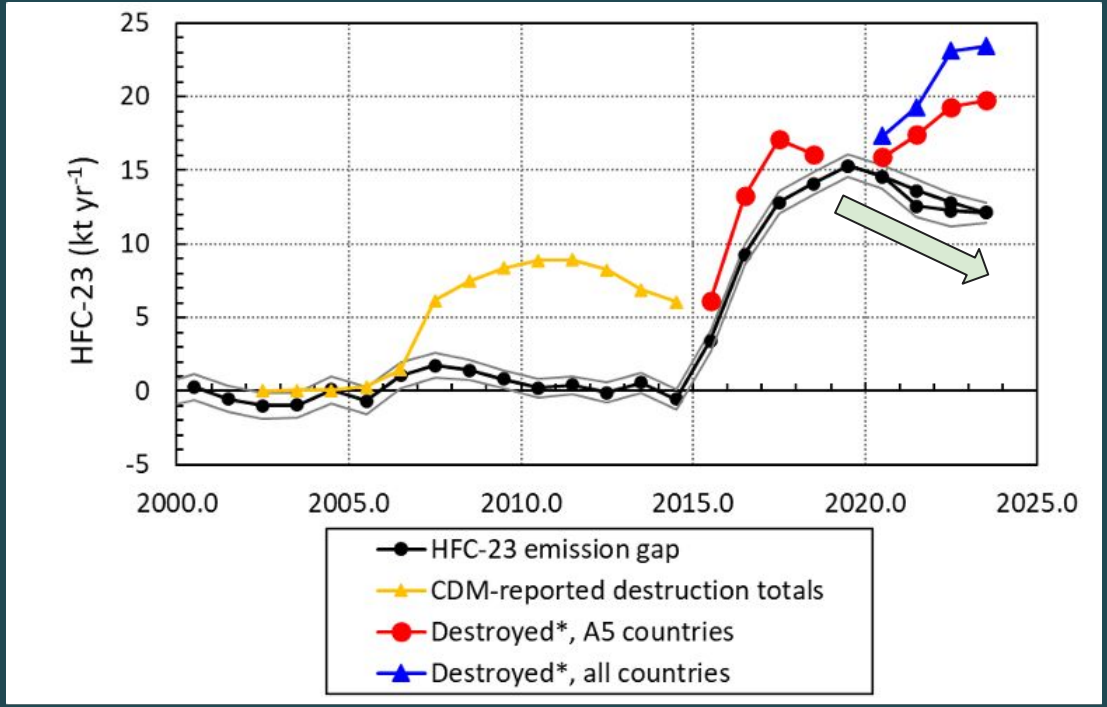
Preambular Platitudes: although the problem still persists, it is common to acknowledge previous progress to date of Parties.

SAP/TEAP Update: A formal request for an update on HFC-23 emissions for the next MOP, incorporating any new party data and atmospheric measurement discrepancies.

Party Invitations: *Invites* parties to share estimation methods for HFC-23 emissions from HCFC-22 production and collaborate with research institutes on emission source analysis.

*an invitation is not legally binding.

A Slight Decline, but the Gap Persists



Main Takeaways

Global Impact
Most successful multilateral treaty of all time.

Diplomatic Reality
Diplomacy is a process, and progress can be slow at times; decisions often result in incremental changes.

US Engagement Concerns
General concern regarding US engagement for the remainder of the Trump administration, including risks of pulling back MLF funding, blocking decisions, and disabling monitoring networks.