Ozone Governance and Nitrous Oxide: A Brief Historical Overview

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We are in a climate emergency that requires that we consider all the governance tools at our disposal

- We are on track to cross 1.5 °C of climate warming within 5 or so years.
- Carbon dioxide (CO_2) is only half of the warming story.
- Nitrous oxide (N_2O) and other climate super pollutants are the other half.
- While we are making some progress on CO_2 (although not fast enough), trends for N_2O in the atmosphere appear to exceed even the most dire projections, with serious implications for climate and the stratospheric ozone layer.
- This is an "all hands using all governance tools" moment.

N_2O is an ozone-depleting substance and a climate super pollutant

N_2O is not controlled under the Montreal Protocol

N_2O has an ozone-depleting potential (ODP) of 0.017.

- This ODP is comparable to ODPs for Montreal Protocol-controlled substances that include hydro-chlorofluorocarbon (HCFC)-31 (0.019), HCFC-123 (0.02)

N_2O has a 100-year global warming potential (GWP) of 273 (i.e., contributing 273 times the warming as the same amount of CO_2).

- This 100-year GWP is higher than the GWPs of Montreal Protocol-controlled substances such as hydrofluorocarbon (HFC)-152a (124)

N_2O is not currently a Montreal Protocol-controlled substance.

The implications of unabated N_2O emissions on the ozone layer were evident even in the early 1980s, in reports from organizations established for the negotiation of the Vienna Convention

Ad Hoc Working Group of Legal and Technical Experts for the Elaboration of a Global Framework Convention for the Protection of the Ozone Layer

Towards an Ozone Convention: A Look at Some Issues, 20-29 January 1982

- "Other contributions to change in total ozone include the cooling effect in the upper atmosphere due to increased carbon dioxide in the atmosphere (increase), N_2O from fertilizers and changes in land use (decrease), and planned supersonic fleets of aircraft at high altitudes (decrease)" (para 29).

Aspects of the International Transfer of Technology Information Related to Activities Which May Affect the Ozone Layer, 10 August 1982

- In the introductory paragraph regarding the recommended scope of a paper regarding technology transfer between countries, the Working Group states the need to include "(a) [a]ctivities which may indirectly affect the ozone layer such as the production and application of nitrogenous fertilizers, from which nitrous oxide emissions may ensue due to biological action on the soil" (para. 1).

Vienna Convention and Montreal Protocol N2O governance is an effective and economic way forward that we should consider

The Vienna Convention requires that Parties take appropriate measures to protect human health and the environment from adverse effects that result from human activities that modify the ozone layer

The 1985 Vienna Convention for the Protection of the Ozone Layer requires that Parties take appropriate measures to protect human health and the environment from adverse effects resulting or likely to result from human activities that modify or are likely to modify the ozone layer.

See Vienna Convention, Article 2(1): General obligations

Annex I of the 1985 Vienna Convention mentions that human-contributed N_2O emissions are becoming increasingly important

(b) Nitrogen substances

(i) Nitrous oxide (N_2O)

The dominant sources of N_2O are natural, but anthropogenic contributions are becoming increasingly important. Nitrous oxide is the primary source of stratospheric NO_x, which play[s] a vital role in controlling the abundance of stratospheric ozone.

Excerpt from Vienna Convention, Annex I: Research and systematic observations. See also Vienna Convention, Article 3 (1) and (2) concerning Annex I.

Article 2(10) of the Montreal Protocol contemplates the addition of new substances to Montreal Protocol control measures

Article 2(10) of the Montreal Protocol indicates that Parties may decide:

(a) whether any substances, and if so which, should be added to or removed from any annex to this Protocol, and

(b) the mechanism, scope and timing of the control measures that should apply to those substances;

(Excerpt. The above text was included in the 1987 adopted text of the Montreal Protocol and remains in the current version.)

Montreal Protocol Parties have already adopted decisions on the process and other considerations for adding new substances

Decision IX/24: Control of new substances with ozone-depleting potential (Ninth Meeting of the Parties, 1997).

Decision X/8: New substances with ozone-depleting potential (Tenth Meeting of the Parties, 1998)

Decision XI/19: Assessment of new substances (Eleventh Meeting of the Parties, 1999)

Decision XI/20: Procedure for new substances (Eleventh Meeting of the Parties, 1999)

Decision XIII/5: Procedures for assessing the ozone-depleting potential of new substances that may be damaging to the ozone layer (Thirteenth Meeting of the Parties, 2001)

These Decisions indicate:

Parties have the right to alert the Secretariat to new substances for control

The Secretariat is requested to share this information with the Scientific (SAP) and Technology and Economic Assessment (TEAP) Panels

Parties have the right to alert the Secretariat to the existence of new substances which they believe have ozone-depleting potential and likelihood of substantial production but which are not listed as Montreal Protocol controlled substances. **(Decision IX/24)**

The Secretariat is requested to forward such information to the Scientific and Technology and Economic Assessment Panels to further evaluate, report, and make recommendations on actions. **(Decision IX/24)**

Parties are discouraged from promoting, developing, and using new substances with significant ODP

Parties are discouraged from promoting and developing new substances with a significant potential to deplete the ozone layer, technologies to use such substances, and using such substances in various applications. **(Decision IX/24)**

Parties should fully consider ways to expedite the process for controlling new substances

Parties are requested to continue to give full consideration to ways to expedite the procedure for adding new substances and their associated control measures to the Protocol, and for removing them therefrom. **(Decision XI/20)**

And:

The Secretariat is requested to keep a list of new substances that Parties submit on the United Nations Environment Programme (UNEP) website

A request that the Secretariat keep the list of new substances that Parties submit per Decision IX/24 on the UNEP Website up to date and to distribute the current version of the list to all Parties about six weeks in advance of the meeting of the Open-ended Working Group and the Meeting of the Parties. **(Decision XIII/5)**

Keep in mind:

The Ozone Secretariat already received a request to include and has included N2O on the 2012 UNEP new substance list

N_2O is on the list of "New ozone-depleting substances that have been reported by the Parties: Decisions XIII/5, X/8 and IX/24 (updated May 2012)" on the Ozone Secretariat/ UNEP website.

The Montreal Protocol SAP, TEAP, and Environmental Effects Assessment Panel (EEAP) have been tasked with alerting Parties to ozone-layer developments and threats

Decisions IV/13 (1992), XIX/20 (2007), XXIII/13 (2011), and XXVII/6 (2015), among other things, ask the Assessment Panels to bring to the Parties' notice any significant/important developments and threats to the ozone layer.

The Quadrennial Scientific Assessments of Ozone Depletion continue to raise alarm on increases in N2O emissions. (Indeed, for more than 3 decades).

- World Meteorological Organization (WMO) Scientific Assessments of Ozone Depletion have been issued in 1985, 1988, 1991, 1994, 1998, 2002, 2006, 2010, 2014, 2018, and 2022.
- These Quadrennial Assessments cover N2O. Findings are presented to Montreal Protocol Parties, including recommendations to mitigate N2O emissions. See, for example:

Quadrennial Assessment 1988: "Atmospheric nitrous oxide (N2O) concentrations have continued to increase" (Chapter 8, Section 8.5, Nitrous Oxide, p. 559).

Quadrennial Assessment 2022: "Heightened concerns about influences on 21st century ozone include impacts of: further increases in nitrous oxide (N2O)… " (Executive Summary, Highlights, p. 3).

Decision XXXV/3(h) (2023) provides that the SAP 2026 quadrennial report should include N2O

Montreal Protocol Decision XXXV/3(h) (2023): provides that the 2026 report of the SAP should include "[e]arly identification and quantification of any substances that could be of concern for the ozone layer and relevant for the implementation of the Montreal Protocol and the objectives of the Vienna Convention for the Protection of the Ozone Layer, including other halogenated gases, in particular those with high global warming potential, breakdown products of controlled substances and their alternatives that are very persistent, such as perfluoro- and polyfluoroalkyl substances, including trifluoroacetic acid, **N2O** and very short-lived substances such as dichloromethane, and their main sources of emissions."

Mostafa K. Tolba, Executive Director of the United Nations Environment Programme (in 1992, when the Copenhagen Amendment was adopted, adding methyl bromide to the list of Montreal Protocol controlled substances):

"The measures you have passed here make the Montreal Protocol one of – if not the strongest package of global environmental law ever enacted.

The question which remains is this: Is it enough?

We are in the hands of scientists. From them – and we have sought advice from the best in the world – we know that the answer is 'No'. This package is not enough. The process of protecting the ozone layer is not at an end."

BACKUP SLIDES

Montreal Protocol Parties have previously acted to control a super climate pollutant and production byproduct – HFC-23

And…

HFC-23 (trifluoromethane/CHF_3)

HFC-23 has limited commercial uses, for example, as ultra-low temperature refrigerant for specialized storage and manufacturing**; it is predominantly unintentionally created, for example, as a byproduct during production of certain fluorinated compounds and certain chemical feedstocks, including HCFC-22** (chlorodifluoromethane). Listed as a Montreal Protocol controlled substance in Annex F, Group II, via the Montreal Protocol's Kigali Amendment (2016).

Per the Montreal Protocol: 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 [HFC-23**] 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.

(Montreal Protocol, Article 2J(6), emphasis added; via Kigali Amendment).

Montreal Protocol Parties have previously acted to control an ozone depleting substance in the agriculture sector—methyl bromide—and train farmers on alternatives

METHYL BROMIDE (CH_3Br)

Methyl bromide is primarily used for agricultural, shipping, and structural pest control. Listed as a Montreal Protocol controlled substance in Annex E, Controlled Substances, Group 1, via the Montreal Protocol's Copenhagen Amendment (1992).

The Multilateral Fund for Implementation of the Montreal Protocol (MLF) has supported farmer training activities in the agricultural sector related to methyl bromide alternatives.

See, e.g., Report on Food and Agriculture Organization (FAO) project, sponsored by UNEP under the MLF, on Training of Trainers for Alternatives to the Use of Methyl Bromide for Soil Fumigation in Brazil and Kenya (2001), https://www.fao.org/fileadmin/templates/agphome/documents/Methyl_Bromide/report1.pdf

The Montreal Protocol is a rare example of a treaty that averted environmental disaster

- Since the Montreal Protocol was agreed in 1987, it has phased out 99% of the production and consumption of nearly 100 harmful chemicals with its mandatory controls, putting the ozone layer on the path to recovery and preventing more than two million skin cancer deaths per year.
- Because many of the chemicals that destroy ozone are also climate super pollutants, the Protocol is also a powerful tool for combatting climate change. Indeed, the Montreal Protocol is on course to avoid 2.5 °C of warming by end of century.

The Montreal Protocol is also a powerful model for governance

It builds upon international legal principles including:

- **The precautionary principle** enabling decision-makers to take action before irreversible damage occurs
- **State responsibility for activities under State jurisdiction or control that cause damage to another State or areas beyond national control**
- **The principle of common but differentiated responsibilities**, which translates into earlier phaseout control schedules for developed countries, with developed countries contributing to a fund to support qualifying developing countries to meet their obligations.

And incorporates many other attributes that support successful governance, including:

- **Universal ratification**
- **SAP, TEAP, and EEAP experts that independently monitor, analyze, and report to the Parties**
- **A "start and strengthen" approach, that enables Parties to learn and increase ambition over time.** The Protocol started with the aim of reducing a small number of ozone depleting substances, and strengthened to phase out nearly 100, then broadened to protect the climate by phasing down HFC super pollutants and address energy efficiency