environmental investigation agency

Maximising the Montreal Protocol's Potential for Urgent Global Climate Action

EIA briefing to the 46th meeting of the Open-Ended Working Group of the Parties to the Montreal Protocol, 8-12 July 2024

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The success of the Montreal Protocol demonstrates the progress it is possible for governments to make when working collaboratively within a strong governance framework.

This is evidenced by the avoidance of an estimated 2.5°C warming by the end of the century through actions of the Montreal Protocol,[1] as well as recent reports on the decrease of hydrochlorofluorocarbons (HCFCs) five years ahead of projections.[2]

However, early, deep and sustained emissions reductions of all greenhouse gases (GHGs) are needed to avoid escalating the harsh impacts of climate change. During the past year, the warmest ever, the effects of anthropogenic, accelerated warming have been inflicted on communities worldwide in record-breaking heatwaves, mass flooding and other catastrophic weather events.[3]

The 46th Open-Ended Working Group of the Montreal Protocol (OEWG46) presents significant opportunities for the Parties to the Montreal Protocol to demonstrate strong leadership in living up to its reputation as the "most successful environmental treaty". The pace of climate change demands urgent action to cut GHG emissions in the near-term and for Parties to take progressive action to protect the Protocol's legacy and ensure it can address present and future challenges.

By improving monitoring, reporting, verification and enforcement as well as limiting feedstock exemptions, Parties can begin to address the estimated 870 million tonnes of annual carbon dioxide-equivalent ($MtCO_2e$) emissions linked to fluorochemical production and illegal production and use of controlled substances.[4]

Meanwhile, the Technology and Economic Assessment Panel (TEAP) estimates that full implementation of effective lifecycle refrigerant management practices across all Parties can reduce cumulative hydrofluorocarbon (HFC) and HCFC emissions by 39 $GtCO_2e$ between 2025-50.[5]

This briefing outlines the analysis and recommendations of the Environmental Investigation Agency (EIA) on the key agenda items to be discussed at OEWG46.

Agenda Item 3: Presentations by the Technology and Economic Assessment Panel and the Scientific Assessment Panel

Decisions XXXV/6, XXXV/8, and XXXV/9 requested the TEAP to provide the Parties at OEWG46 with updated information on, respectively, very short-lived substances (VSLS), feedstock uses of controlled substances and emissions of carbon tetrachloride (CTC). In each of these areas, there is significant opportunity to strengthen the Montreal Protocol to maximise its climate and ozone benefits and avoid undermining the progress made so far. EIA therefore urges Parties to consider carefully the information provided by the TEAP and to press ahead in turning discussion into action in the same spirit of bold ambition that has historically defined the Montreal Protocol.

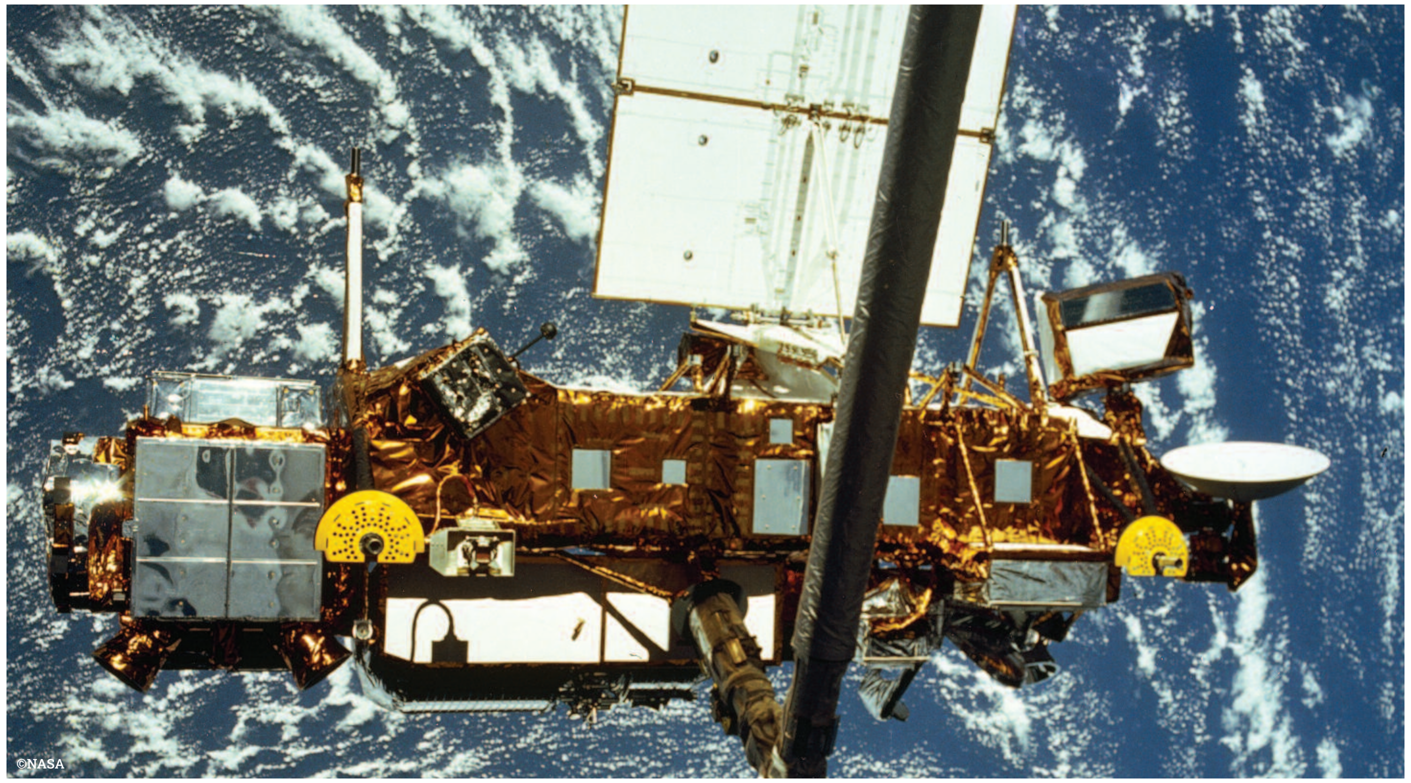
Agenda Item 3(a):

Very short-lived substances (decision XXXV/6)

Very short-lived substances (VSLS), currently not controlled under the Montreal Protocol, are compounds with atmospheric lifetimes typically less than six months. Due to their short lifetimes, a smaller fraction of VSLS emissions reach the stratosphere compared with emissions of the long-lived substances. Despite this, the impact of VSLS on stratospheric ozone can be significant and, in the context of their increasing emissions, Parties should consider how best to neutralise this growing threat to the ozone layer.

In its update to Parties, TEAP has focussed on five 'very high-volume' chlorinated VSLS: dichloromethane (DCM); trichloromethane (chloroform, CFM); 1,2-dichloroethane (ethylene dichloride, EDC); trichloroethylene (TCE); and perchloroethylene (PCE).[6] Emissions of these VSLS have significantly increased in recent years, by about 10 parts per trillion (ppt) between 2016-20.[7] The main sources of these VSLS emissions are industrial processes, with significant contributions from both feedstock and solvent uses.

The exact overall impact that increasing VSLS emissions have on the ozone layer is difficult to quantify as this varies depending on the specific VSLS and the conditions and location of their emission. Nonetheless, recent studies estimate that chlorinated VSLS reduced total column ozone by, on average, ~2-3 Dobson Units (DU) in the springtime high-latitudes between 2010-19 and by ~0.5-1 DU in the tropics.[8] Emissions of DCM – the dominant anthropogenic chlorinated VSLS – can be taken as emblematic of the issue, with its emissions forecast to deplete global annual average ozone by 1 DU every year.[9]



Satellite monitoring is detecting substantial and growing contributions of very short-lived substances to stratospheric ozone depletion.

Alternatives are already available in several feedstock and solvent applications and more are being researched and developed.[10] DCM, for example, has already been prohibited in some regions due to its associated risks to human health; several alternatives to DCM are highlighted by TEAP, many of which have been recognised since at least 2002 when the last report of the Solvents, Coatings and Adhesives Technical Options Committee was published.

Considering the update provided by TEAP, EIA urges Parties to begin discussing in earnest how best to take action to control VSLS under the Montreal Protocol. The growing emissions of VSLS present an increasing risk to ozone recovery efforts and by addressing these emissions and promoting safer alternatives, the Protocol can both protect and enhance its effectiveness in mitigating ozone depletion.

Agenda Item 3(b):

Feedstock uses of controlled substances (decision XXXV/8)

Although they are controlled substances, ODS and HFC use as feedstocks – the 'building blocks' in the manufacture of other chemicals – has been historically permitted under the Montreal Protocol.[11] This exemption from standard controls was based on the assumption that the ODS is entirely converted from its original composition and emissions were negligible. However, with ongoing and significant increases in unexpected emissions linked to fluorochemical production processes, this assumption is clearly incorrect.[12] EIA therefore welcomes the Montreal Protocol's recognition of the issue in Decision XXXV/8, and TEAP's updated information in its progress report.

The production of fluorochemicals for use as feedstocks and intermediates has increased rapidly in recent years. In 2022, total controlled ODS production and import for feedstock use was 1,943,14 metric tonnes (mt) based on reported data, representing a dramatic 66 per cent increase over the past 10 years.[13] This has been driven in large part by increasing HCFC-22 production for feedstock uses, which now accounts for 50 per cent of the total mass quantity of ODS produced for this purpose.[14] This is particularly concerning given that HCFC-22 production also results in the by-product emissions of HFC-23, a highly potent GHG with a GWP of 14,700.

Although known to be lower than ODS overall, an accurate estimate of the quantity of HFCs being produced for feedstock uses is less readily available. This is partially because of reporting logistics (a Party's obligation to report on HFC feedstock production only begins once it has ratified the Kigali Amendment and 2022 data is still incomplete due to reporting schedules), but also because TEAP has been required to approximate figures for some substances due to confidentiality requirements.

Parties must address this lack of transparency. TEAP notes that "the exact global capacity and production by chemical pathway are not accurately known and may be unavailable due to commercial-in-confidence reasons" and that "for most production facilities, actual emissions and locations across the globe are not reported by parties".[15] Although EIA understands the business rationale for some degree of confidentiality, when these requirements are preventing even the Protocol's own Assessment Panels from conducting their work effectively, Parties must consider whether the current rules are fit for purpose.

Recognising the challenges of relying on reported data to establish an estimate of feedstock and production-related emissions, EIA has – across a series of papers and reports, including the 2022 SAP Assessment report – synthesised recent scientific studies to calculate an estimate of annual fluorochemical GHG emissions from production processes.[16] In total, EIA estimates that these avoidable emissions could be as high as 491.94 million tonnes CO_2-eq emissions per year.[17] EIA investigations in the United States also recently confirmed emissions of chlorofluorocarbons (CFCs), HFCs and hydrofluoroolefins (HFOs) at the fenceline of two chemical production facilities.[18]

Production of controlled substances for feedstock and associated emissions will continue to increase until limitations on the feedstock exemption are established. EIA urges Parties to commit to following TEAP's guidance on best practices for minimising emissions and to consider future limitations on the feedstock exemption so that it applies only to those substances for which there are no emissions and no feasible alternatives.

The recently revised EU ODS Regulation allows the European Commission to establish a list of chemical production processes for which the use of ODS will be prohibited on the basis of technical assessments carried out under the Montreal Protocol or, failing that, on the basis of its own assessment by the end of 2027.[19] EIA also encourages Parties to consider how emissions from fluorochemical production processes as a whole can be better tackled and, ultimately, to accelerate the transition away from controlled ODS and HFCs in favour of non-fluorinated alternatives.

Agenda Item 3(c):

Emissions of carbon tetrachloride (decision XXXV/9)

Carbon tetrachloride (CTC) is a chlorinated hydrocarbon used primarily as a feedstock in the production of various chemicals, including HFCs, HFOs, perchloroethylene (PCE), and divinyl acid chloride (DVAC). CTC is both a potent ODS (ODP 0.87) and a powerful GHG (GWP100 2,150).[20] In 2022, CTC production rose to 358 kilotonnes (kt), reflecting an 11.9 per cent increase from 2021. This growth was primarily driven by increased HFC and HFO/HFCO (hydrochlorofluoro-olefins) consumption, driven by the HFC phase-down in non-A5 parties and regions where these substances are regulated.[21]

Fugitive emissions from feedstock and process agent uses of CTC accounted for about eight kt of emissions in 2022.[22] However, other significant sources of CTC emissions also exist, including: legacy emissions from historic production and contaminated waste (7.5 kt); fugitive emissions from non-feedstock use in chloromethane and PCE plants (seven kt); and fugitive emissions arising from other chlorination processes (five kt).[23] An additional source of CTC emissions (estimated at two kt in 2022) came from 'unknown' industry emissions that appear to be linked to machinery manufacture, based on a recent study cited by TEAP.[24]

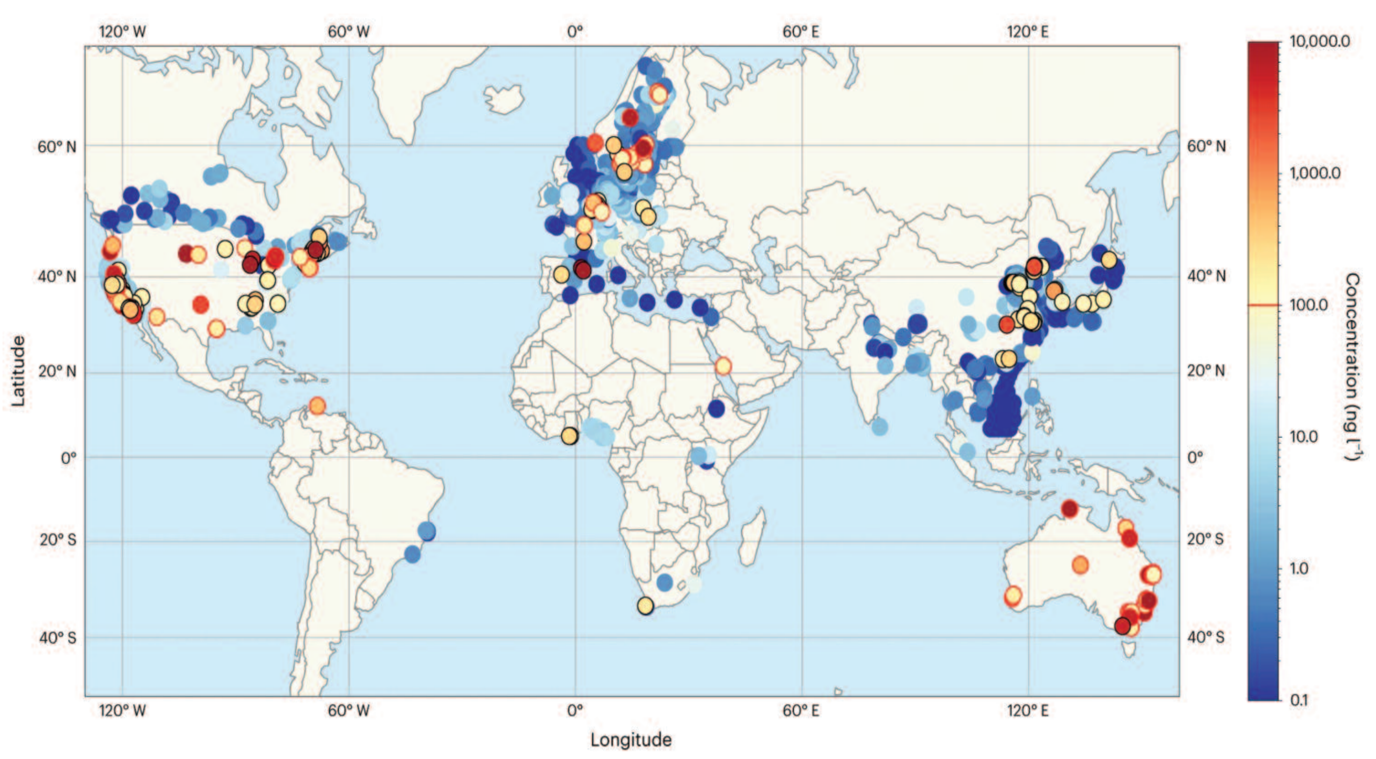
EIA calls on Parties to take action that will ensure fugitive emissions from non-feedstock sources are being mitigated and minimised to the greatest extent possible and for more research to be carried out to fully understand the currently 'unknown' industry sources of CTC emissions. Parties should accelerate the transition away from HFCs in favour of hydrocarbon and non-fluorinated alternatives, noting that production of natural refrigerant solutions, unlike HFOs, does not lead to fugitive emissions of controlled substances.

Alternative substances:

Per- and poly-fluoroalkyl substances (PFAS)

The planetary boundary for novel entities (anthropogenic chemicals) has already been exceeded, with per- and polyfluoroalkyl substances (PFAS) playing a key role due to their persistence.[25] Beyond this, some scientists even argue that environmental contamination by PFAS is so significant that it should define its own separate planetary boundary, one which would already have been exceeded.[26]

The growth in CTC feedstock production is driven primarily by its use in the production of HFCs and HFOs.



Source: Ackerman Grunfeld, D., Gilbert, D., Hou, J. *et al.* Underestimated burden of per- and polyfluoroalkyl substances in global surface waters and groundwaters. Nat. Geosci. 17, 340–346 (2024). https://doi.org/10.1038/s41561-024-01402-8

Global map of PFAS concentration in water. The map shows the sum of concentration of 20 PFAS subject to EU guidance in surface water, groundwater and drinking water samples. Those above the EU drinking water limit of 100 ng/l (marked red on scale bar) are circled in red (for known contamination sources) or black (unknown sources).

Despite this, in its assessment of the issue of PFAS and the impacts of potential PFAS restrictions, TEAP does not pay sufficient attention to the serious risks and socio-economic challenges with which PFAS pollution is associated. Rather, the report appears to pit ozone and climate protection against environmental protection from PFAS, neglecting the opportunity to develop an holistic strategy that respects the importance of both.

F-gases account for the greatest PFAS usage in tonnage and the greatest quantity of PFAS emissions, some 59 and 63 per cent, respectively.[27] The specific environmental issue with regards to F-gases is that they degrade into trifluoroacetate (TFA), a chemical pollutant that is both extremely persistent and highly mobile.[28] TFA's potential reprotoxic properties, and non-retrievability through common and economically feasible water treatment, underscores the urgent need to minimise TFA precursors including F-gases.

TFA is currently set to be re-classified under the EU Regulation (EC) No 1272/2008 on the classification, labelling and packaging of substances and mixtures (CLP regulation) as a persistent, mobile and toxic (PMT) substance, a move that will have far-reaching consequences for the restriction of TFA precursors such as F-gases.[29]

Sustainable, climate-friendly alternatives to F-gases, based on natural origin gases, are feasible, efficient and available. With this in mind, the present report should be re-evaluated to appropriately consider the environmental risks and socio-economic liabilities which evidence shows are associated with PFAS.[30]

Furthermore, the report should also consider recent studies that demonstrate potential atmospheric formation of HFC-23 from HFOs which, alongside feedstock and other intermediate or by-product emissions associated with HFO production, would significantly increase the climate impact of HFO adoption and entirely undermine these substances' supposedly low GWPs.[31]

Parties must take action now in order to prevent another regrettable F-gas substitution, which will further delay the crucial global adoption of sustainable fluorine-free alternatives that are non-ozone depleting, climate-friendly and non-persistent.

Agenda Item 4: Life-cycle refrigerant management (decision XXXV/11)

Lifecycle refrigerant management (LRM) offers substantial potential climate benefits of avoided emissions through leak and venting prevention, maximised refrigerant recovery and responsible reclamation and destruction of controlled substances.

TEAP Task Force report on LRM, per decision XXXV/11 analyses available technologies, approaches and challenges for implementation, costs for the necessary infrastructure and the climate and ozone benefits.

Based on the GAINS model framework,[32] with "effective implementation of policies, measures and regulations for leakage prevention by both A5 and non-A5 parties," the report estimates potential cumulative HFC/HCFC emissions reductions of 15.6 $GtCO_2e$ from 2025-50, relative to a pre-Kigali baseline.[33] This assumes "good practices," in which average leak rates are reduced by 20-50 per cent, depending on equipment type.

A further potential cumulative emissions reduction of 23.4 $GtCO_2e$ HFC/HCFCs is available through effective refrigerant management at EOL of RACHP equipment, in which removal efficiency is 70-90 per cent.[34]

While these estimates are based on full implementation of the activities in all A5 and non-A5 Parties and, further, do not consider cost constraints, it is clear that LRM offers substantial mitigation opportunities that should be explored by the Parties. Furthermore, TEAP reports substantial employment opportunities across non-A5 and A5 parties, citing an estimate that investing in LRM could create 500,000 new jobs in the US alone.[35]

Given the significant emissions reduction potential and economic benefits, EIA supports the continued discussion by the Parties to address the barriers to effective LRM for A5 and non-A5 Parties, particularly around funding mechanisms. TEAP identifies carbon markets as a possible funding pathway, but the high risks associated with a credit-based offsetting approach are not sufficiently addressed and other potential funding mechanisms are insufficiently explored.

Refrigerant leakage prevention

By retaining refrigerant charge, leak prevention from RAC equipment offers benefits in terms of both emission reductions, equipment efficiency with climate benefits from reduced energy use and economic savings. High-standard manufacturing, professional installation and leak detection supported by regular maintenance are all necessary for leak prevention. This requires design standards, technician training and technology to monitor and repair leaks promptly.[36] As such, it is crucial to consider leak prevention throughout the entire lifecycle of RAC equipment, beginning with the design stage. EIA recommends the Parties consider existing standards, such as ISO 14903 on component selection and tightness, in developing any policy requirements for manufacturing design.[37]

EIA supports best practices for manufacturing, including tightness tests before charging and refrigerant leak tests, as well as during installation. There may also be value in mechanisms to report faulty installation from the field when called to service equipment. We support the implementation of leak detection technology and emphasise the value of minimum standards to ensure the successful use of these approaches. For example, EIA investigations into commercial refrigeration leaks in US supermarkets have shown concentrations detected above two ppm are an indicator of a potentially significant leak.[38] These details are important in exploring policies to require direct leak detection.

Recovery, recycling, reclamation and destruction

A major cornerstone of LRM is the proper handling of refrigerant and equipment to prevent emissions at end-of-life. Infrastructure needs exist in varying degrees of development across the Parties, from cylinders designed for recovery and inventory management to the availability of facilities for refrigerant reclamation or destruction.

Reclaimed refrigerant can be used in servicing the installed base and eventually be destroyed once substances are too contaminated for reuse or are no longer needed. Although TEAP states that the processes of recycling or reclaiming refrigerant are less emissive than destroying the refrigerant,[39] EIA underscores the need for integrating the scaling up of destruction as the market for HFCs declines and alternative safe refrigerants gain market share.

Refillable cylinders, optimally designed for reuse and to prevent damage over time, enable tracking of controlled substances to deter illegal trade. Disposable cylinders are a common vehicle for transporting illegal refrigerant and EIA urges the Parties to explore bans and other controls on non-refillable containers.[40] EIA supports the use of labelling for traceability of the cylinders to track current location and the refrigerant types contained in the cylinder.

Chemical testing can provide important details on quality levels for reclaimed refrigerants. A challenge facing reclaim use is the perception of lower quality compared to virgin refrigerants. This is an area where successful examples from regions with higher reclaimed refrigerant use could be valuable, as well as funding and government mandates for refrigerant testing within the recovery infrastructure to ensure quality standards are met.

Some Parties, especially low volume consuming (LVC) Parties, may have insufficient quantities of refrigerant to justify investment in reclaim and destruction facilities, resulting in stockpiles until enough substances are accumulated. Regional cooperation to develop a local market could support neighbouring Parties and help mediate the refrigerant management challenges for LVCs and regions with limited destruction and reclamation infrastructure.[41] TEAP concludes that LVCs "can potentially maintain or even surpass compliance with the Kigali Amendment through effective LRM, at the same time as reducing refrigerant emissions and climate impact."[42]

Policies, regulations and projects related to LRM

The most successful LRM policies implemented by Parties have strong economic drivers, with high awareness and consensus across stakeholders. There is also a need for greater refrigerant recycling and reclamation data, which is generally not collected by most Parties or sub-national governments, to analyse the gaps in the system. Even in Parties with extensive end-of-life programmes, the quantities returned for reclaim or destruction, especially of R-410A, are often lower than initially expected.

Regions which do not have recovery infrastructure, or have not yet started the HFC phase-down, often have higher prices for reclaimed refrigerant, which means they are not competitive with virgin refrigerants. The generally low price of virgin HFCs is therefore a primary barrier to reclamation in A5 Parties.[43] Policy interventions may be needed to increase competitiveness of reclaimed substances and develop end markets, particularly as the 'full cost' of the virgin substance is not taken into the pricing from a climate perspective.

TEAP provides an overview of major financing mechanisms to address the costs of LRM infrastructure across Parties. The Multilateral Fund (MLF) has funded training in A5 Parties on leak prevention, recovery, recycling and safe handling for flammable refrigerants. Challenges to these programmes include access to training facilities and costs to attend, as well as sufficient tools for technicians after they receive training. Additionally, monitoring for best practices and secondary training are not funded. TEAP provides examples of how India is working to overcome training challenges by improving access to and mobility of training programmes and having industry contribute with its own training facilities and foundations under corporate social responsibility commitments.

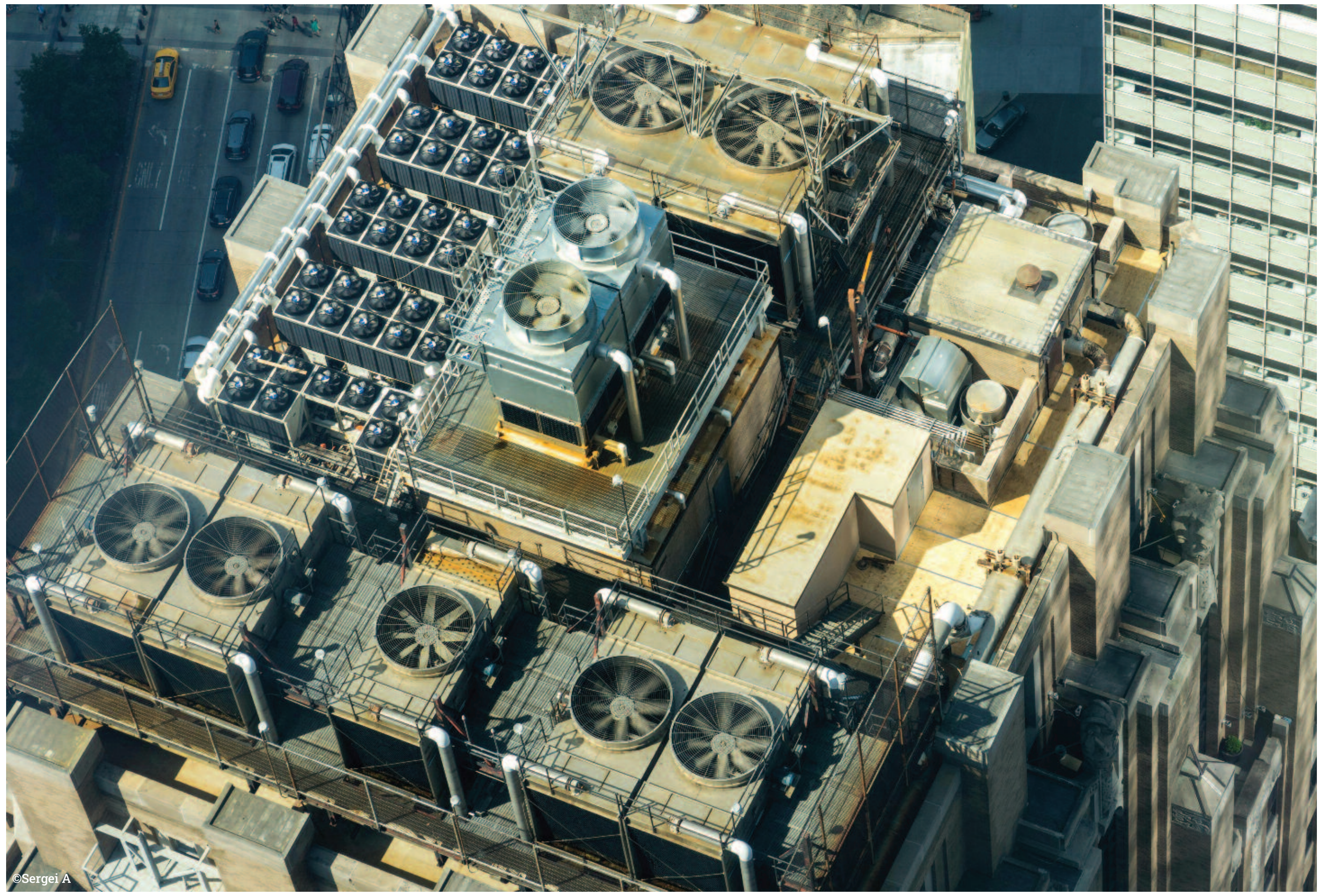
The MLF has also recently opened a funding window to fund inventories of controlled substances with plans for collection and disposal. Scaling up LRM activities will need to be part of future replenishment discussions as the demand for reclaimed refrigerant increases with the phase-down and to maximise GHG reduction opportunities.

Extended Producer Responsibility (EPR) can also provide an incentive for refrigerant recovery, spreading the cost of managing these substances up the supply chain and addressing low refrigerant return rates for reclaim despite mandates or venting prohibitions. By charging a fee to producers and distributors of refrigerants, EPR generates a financial incentive for technicians to take time for recovery and return of refrigerant to a distributor or designated collection site. A key aspect to EPR includes oversight by a government agency to ensure the programme meets recovery targets.

EIA is concerned that the TEAP report appears to support voluntary or compliance carbon markets as a viable financing option for LRM, which we strongly oppose. The sale of climate pollution permits to fund activities related to ODS and HFC management and destruction would allow needless damage to the climate system, prevent the adoption of effective national policies such as EPR and pose serious problems in terms of accounting, verification and additionality.[44]

EIA reiterates concerns with carbon credits' effect on Parties adhering to the Vienna Convention on the Protection of the Ozone Layer, undermining the climate protection legacy of the Montreal Protocol, subverting national efforts to address emissions from banks and allowing private rent-seeking over public benefits.[45]

Furthermore, carbon markets are ill-suited for HFCs due to their continued production. Premature incentives for destruction can also negatively affect supply of reclaimed refrigerant.



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Agenda Item 5: Enhancing the global and regional atmospheric monitoring of substances controlled by the Montreal Protocol (decision XXXV/14)

Decision XXXV/14 requested information on enhancing global and regional atmospheric monitoring for OEWG46, including refining the cost estimates associated with enhancing atmospheric monitoring previously presented in the TEAP's report in response to Decision XXXIII/4.

After the discovery of unexpected CFC-11 emissions, Parties recognised the current observing stations were inadequate for regional monitoring of controlled substances and the need to expand the network globally.[46] In 2021, a pilot project was set up to understand the costs of installing and operating monitoring sites.[47] In February 2024, an online workshop was held to consider the information obtained during the pilot project.[48] The goals included developing cost estimates for the major components of establishing a monitoring station, specifically understanding cost differentials associated with two sampling strategies (high-frequency on-site, versus low-frequency flask collection).

Both collection methods require a 30-100m tower and careful selection of sampling sites. Site location considerations include climatological wind patterns and distance from the emission regions, such that plumes from emissions regions reach the site before gases of interest are completely mixed with the background air.

For high-frequency on-site measurements, air samples are collected and analysed using a gas chromatograph (GC) to separate the constituents and a mass spectrometer (MS) to quantify the analytes (GC/MS system). Measurements can be made every two hours and capture variations in mole fraction of the compounds of interest from up to roughly a thousand miles. Low-frequency flask collection involves regular (daily to weekly) collection of samples in a canister which are shipped to specialised central laboratories for analysis.

The outcomes of the workshop also note that a telescoping portable mast or a drone may be used for flask sample collection at sites without a permanent tower. EIA supports more research to establish the feasibility of these collection methods, noting that similar techniques using a portable FTIR (Fourier Transform Infrared Spectroscopy) gas analyser have successfully captured fluorochemical production emissions at much closer distances.[49]

The workshop estimated initial and operational costs for both sampling strategies, noting that the flask sample costs are highly dependent on whether constructing additional central laboratories is required. Costs are highly variable depending on the need to acquire land and what, if any, existing facilities can be utilised. Highly variable costs for flask sampling include frequency of collection, staff time and location of the site.

Overall cost estimates for high-frequency on-site sampling range from approximately $456,000-$1,245,000, while flask sampling cost estimates are between $195,000-1,300,000.

EIA highlights the need for significant investment to establish, ideally, a combination of the two sampling strategies to close the existing monitoring gaps. While the Vienna Convention Trust Fund for Research and Systematic Observation is designed to support global research and monitoring activities, funding must be expanded to provide early warning when unexplained emissions are threatening the ozone layer's recovery.

EIA also recommends additional research into the feasibility of using portable flask sample collection at locations where permanent facilities are impractical. Pilot projects similar to the one carried out in the EU in 2021 could confirm where these lower-cost monitoring options are viable for closing gaps in certain regions or specific use cases.

Agenda Item 9: Strengthening Montreal Protocol institutions, including for combatting illegal trade

After large-scale illegal production and use of CFC-11 was identified in 2018, Parties to the Montreal Protocol initiated a variety of discussions and studies to examine the Protocol's institutions and mechanisms to better understand how to avoid similar situations in the future.[50]

One such report, prepared by the Ozone Secretariat on *"Possible ways of dealing with illegal production of and illegal trade in controlled substances under the Montreal Protocol, identifying potential gaps in the non-compliance procedure, challenges, tools, ideas and suggestions for improvement"*, was discussed at the Implementation Committee's 63rd meeting in 2019.[51]

The Ozone Secretariat's report, along with other studies,[52] highlighted a broad set of shortcomings to be addressed. Recognising this, Parties at the 31st MOP in Rome (2019) agreed to expand the mandate of the CFC-11 contact group to identify institutional processes to be enhanced or strengthened.

Multiple discussions have since taken place and, through contact groups and informal discussions, the Parties have produced a list of "issues of interest" at OEWG44[53] (e.g. including illegal trade and production, licensing systems, capacity-building and the Implementation Committee) and, most recently at OEWG45, a list of suggested elements to be included in draft decisions:[54]

- preventing illegal trade, including defining, controlling, monitoring and reporting
- licensing and quota systems, addressing both the international and national levels, capacity strengthening and ensuring compliance
- implementation and enforcement systems, addressing both the international – institutions, mechanisms, recommendations and the role of the Implementation Committee, and national levels – practices for implementation, domestic measures, capacity strengthening, ensuring compliance
- reporting systems and practices under Article 7 and information needed outside the scope of Article 7 – international and national level issues
- assessment of opportunities to strengthen the Montreal Protocol.

The intention was for informal discussions to continue during the intersessional period with a view to one or several draft decisions being submitted to MoP35 for consideration.[55] However, no draft decisions were submitted and discussion at MoP35 was again limited to the issues of illegal trade and atmospheric monitoring.[56] It is now six years since the unexpected CFC-11 emissions were exposed and the Parties to the Montreal Protocol are yet to undertake the promised examination of the Protocol's institutions and processes.

Shortcomings in reporting, monitoring and verification
The Ozone Secretariat's note identified a number of gaps and challenges in the current monitoring, reporting and verification (MRV) process of the Montreal Protocol.

For example, the following issues have not been defined or treated as compliance issues:

- illegal production (the Implementation Committee only considers reported production that exceeds control limits)
- illegal trade (other than contravening the ban on trade with non-Parties)
- illegal consumption (including the potential diversion of controlled substances from the uses for which they were licensed or permitted e.g. feedstocks and other exemptions)
- polyols (there is no agreed definition or consistent approach to dealing with them).

Reporting relies on self-reporting and there is no provision for verification of the reported data under the Protocol. At the same time, while Parties are required to report on the establishment of a licensing system, there is no provision for confirmation or oversight in respect of the licensing systems, other than limited requirements for A5 Parties receiving MLF support.

A 2006 study commissioned by the Montreal Protocol under Decision XVII/16, undertaken by EIA and Chatham House, reviewed licensing systems in 20 countries, noting that little assessment of their effectiveness has been carried out, that the systems used vary widely and that there are many reasons why systems may fail to perform as intended.[57]

Shortcomings in the Montreal Protocol's compliance regime
The Secretariat's note contains a comparative review which examines implementation and compliance related mechanisms in the following multilateral legal regimes: CITES (1973), Aarhus Convention (1998), Basel Convention (1989), Cartagena Protocol (2000), Nagoya Protocol (2010), Trade Policy Review Mechanism (1994), Kyoto Protocol (1997), Rotterdam Convention (1998), Human Rights Council (2006), Minamata Convention (2013) and Paris Agreement (2015).[58]

The review reveals some obvious shortcomings in the approach of the Montreal Protocol. For example:

- participation in the Montreal Protocol's Implementation Committee does not require expertise, unlike many other multilateral legal regimes
- there is no provision for whistleblowers, observers or other stakeholders other than Parties to trigger the non-compliance mechanism (unlike CITES, Aarhus Convention, Human Rights Council)
- the Implementation Committee is not able to examine systemic issues relating to compliance
- decision-making authority rests with the MoP. In many other treaties, the compliance body can make decisions
- nearly all other mechanisms examined have meetings open to observers – only the Montreal Protocol and Basel Convention are closed
- reporting of illegal trade, production and use are voluntary. Basel Convention mandates reporting of confirmed cases of illegal trafficking, as does Cartagena Protocol
- reporting is not independently verified by third party technical experts, unlike the process in the Kyoto Protocol and Paris Agreement.

Overdue review of compliance procedure

The non-compliance regime was first adopted on an interim basis at the second MoP (June 1990, London) by Decision II/5, in accordance with Article 8,[59] and with Annex III outlining the procedure.[60]

At the fourth MoP in 1992 (Copenhagen), the non-compliance procedure was permanently established through Decision IV/5, including an indicative list of measures that might be taken in event of non-compliance. The measures consisted of appropriate assistances, issuing cautions and "suspension, in accordance with the applicable rules of international law concerning the suspension of the operation of a treaty, of specific rights and privileges under the Protocol, whether or not subject to time limits, including those concerned with industrial rationalisation, production, consumption, trade, transfer of technology, financial mechanism and institutional arrangements".[61]

In 1997, the Parties decided to review the non-compliance procedure, establishing an Ad Hoc Working Group of Legal and Technical Experts on Non-Compliance, composed of seven A5 and seven non-A5 Party representatives, to develop recommendations "on the need and modalities for the further elaboration and the strengthening" of the procedure.[62] Based on the review, the non-compliance procedure was amended at the 10th MoP in Cairo in 1998.[63] Decision X/10 required the Parties "To consider, unless the Parties decide otherwise, the operation of the non-compliance procedure again no later than the end of 2003."

In 2002, at the 14th MoP (Rome), a group of Parties introduced a conference room paper containing a draft decision to strengthen the non-compliance procedure. However, the proposal was withdrawn due to lack of consensus over the package of measures.[64] No further review has since taken place, thus the commitment under Decision X/10 to consider the operation of the non-compliance procedure is now more than 20 years overdue.

Combatting illegal trade

The Secretariat's compilation of information provided by the Parties on illegal trade demonstrates that the illegal trade of controlled substances remains a significant issue and that although reporting has improved in recent years, the majority of Parties continue to ignore voluntary reporting requests.

As a result of Decision XXXV/12, eight Parties reported an additional 154 cases in the past year, while 12 indicated they did not have any cases to report. In fact, since 2002, only 49 parties to the Montreal Protocol have reported cases of illegal trade.

The Secretariat note summarises 713 cases of illegal trade over the period 2002-24 (as of 30 April).[65] Just 10 Parties reported 80 per cent of the cases, with 70 per cent of those being EU member states. According to Table 3 in the report, which itemises the most common substances traded, 2,298 tonnes of seizures have been reported. Based on the GWP of the substances, these seizures represent 9.6 million tonnes of CO_2-equivalent refrigerant ($MtCO_2e$) (see Table 1).

In comparison, EIA's Global Environmental Crime Tracker database, populated primarily via media reports of seizures, details a similar number of cases over the period but a much higher tonnage. Since 2002, EIA's database contains 771 cases with 6,280 tonnes of refrigerant seized, representing approximately 19 $MtCO_2e$ (see Fig 1).[66]

Clearly, the data available to the Secretariat is not reflective of the reality of the global situation, which hinders the Parties' ability to accurately assess and respond to the situation.

Next steps to strengthen the Montreal Protocol

The Montreal Protocol is at the beginning of a new cycle of policymaking, which should be embraced as it approaches its 40th year, and Parties should be methodical in their consideration of the issues that have been raised. To this end, EIA recommends that a roadmap be agreed upon for future work to undertake the comprehensive review. This should include an intersessional process for soliciting input from Parties, observers and other stakeholders and experts on specific issues, summarised in a synthesis report prepared by the Secretariat, and timeframes for Parties to consider them in future years.

The outcome of the review could be a list of recommendations for future decisions and potential amendments or adjustments to strengthen the Protocol's institutions and mechanisms. In this way, Parties can ensure that the Protocol is fit for purpose to sustain the achievements so far and rise to the new challenges that must be addressed to align with our climate objective to limit global heating to 1.5°C.

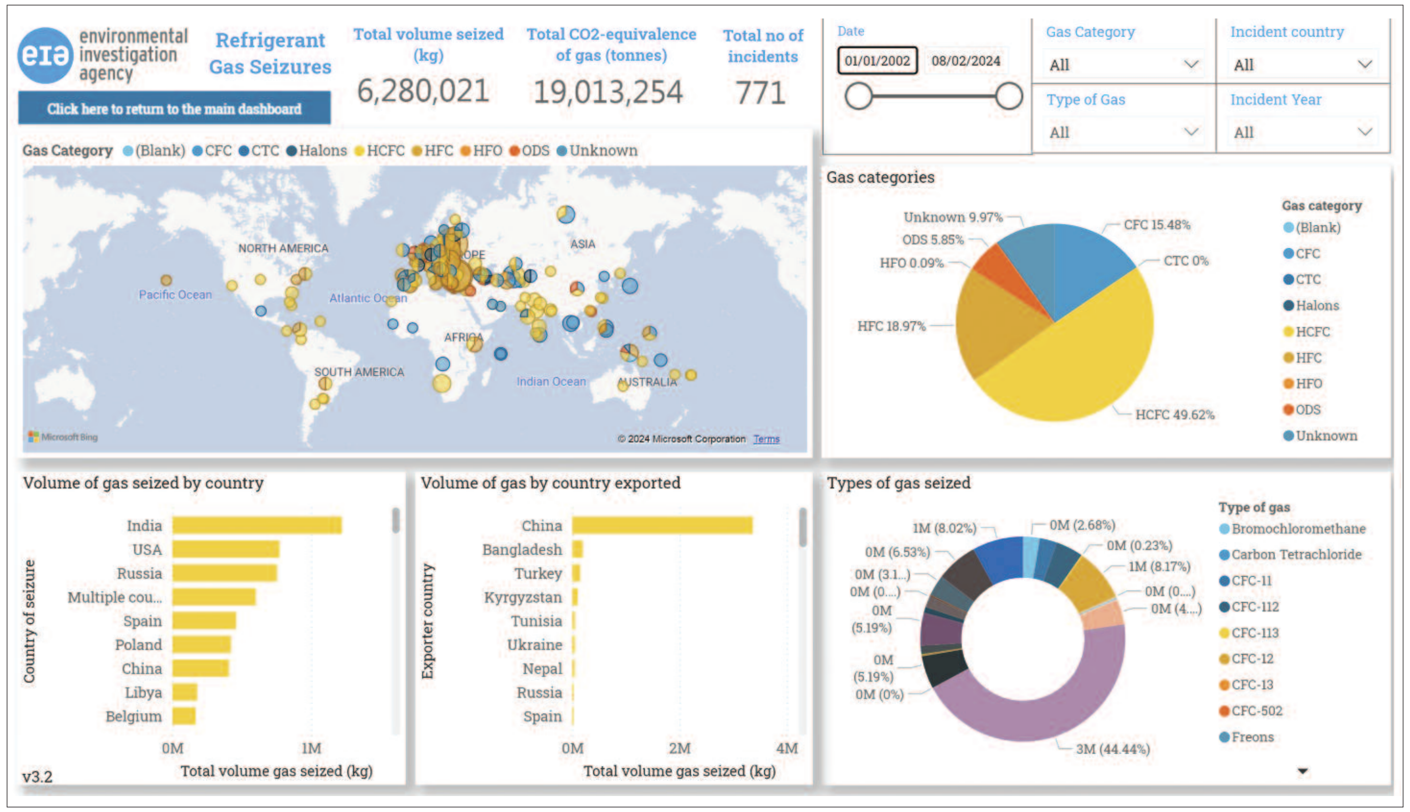
Seizure of 10 tonnes of HFC-404A by Dutch customs, September 2020.

Table 1: *CO_2-equivalence of most common substances traded illegally compiled by the Secretariat*[67]

Substance	Number of reported cases	Total weight of substances (kg)	Percentage of substance weight in total	GWP	Tonnes CO_2e
HFCs (not specified)*	21	369,423	16	2776	1,025,518
HFC-134a	266	375,491	16	1470	551,972
R-404A	167	203,571	9	4808	978,769
HCFC-22	102	383,639	17	1910	732,750
R-410A	100	301,908	13	2285	689,860
CFC-12	55	345,135	15	12500	4,314,188
R-407C	34	56,010	2	1892	105,971
HFC-32	22	32,446	1	749	24,302
R-507A	9	105,854	5	4860	514,450
HFC-125	9	56,593	2	3820	216,185
CFC-11	7	63,077	3	6410	404,324
HFC-23	7	5,123	0.22	14700	75,308
	799	**2,298,270**			**9,633,598**

* GWP of 'not specified' based on average GWP of all specified HFC cases

Figure 1: *EIA refrigerant gas seizure database showing volume and CO_2-equivalence of gases seized globally since 2002*



Conclusions

In addition to a robust implementation of the HFC phase-down under the Kigali Amendment, there is enormous potential for greater action on climate change under the Montreal Protocol.

The agenda at OEWG46 offer opportunities for substantially increasing action on climate and ozone and, if the Parties embrace these opportunities, will position the Protocol to build on its successful legacy.

EIA urges the Parties to address gaps in the Protocol, including the increasing threat of VSLS impacts and limitations on feedstock exemptions which currently permit the use and emissions of ODS from production. It is essential that the transition under the Kigali Amendment does not lead to another regrettable substitution, but instead focuses on substances that do not pose threats to the ozone, climate or human and environmental health. For the existing bank of refrigerants, robust lifecycle refrigerant management can provide significant emissions reductions through leak prevention and end of life recovery. However, in the pursuit of financial mechanisms to support this work globally, the Parties must avoid carbon markets, which undermine the goals of the Treaty itself.

To ensure global efforts to reduce ODS and HFC emissions are progressing, EIA supports further research and investment for expanded monitoring approaches under the Protocol to ensure timely and accurate pinpointing of existing and new emissions sources. This is key to addressing the millions of tonnes of CO_2e annual emissions linked to fluorochemical production, illegal production and use, or other unexplained sources.

Finally, it is six years since large-scale unexpected CFC-11 emissions were exposed and the Parties have not yet undertaken a thorough examination of the Protocol's institutions and processes.

The issues of interest and suggested elements discussed at OEWG44 and 45 include critical components of a comprehensive review — and eventual strengthening — of the institutions and processes of the Montreal Protocol to ensure continued success.

EIA urges the Parties to agree a roadmap to completing this work, which will complement issues currently being considered by the Parties, including unexplained HFC-23 and CTC emissions, feedstock uses, LRM and gaps in global coverage of atmospheric monitoring.

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