

**Montreal Protocol
on Substances that
Deplete the Ozone Layer**

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**Open-ended Working Group of the Parties
to the Montreal Protocol on Substances
that Deplete the Ozone Layer
Forty-sixth meeting
Montreal, Canada, 8–12 July 2024**

**Report of the forty-sixth meeting of the Open-ended Working
Group of the Parties to the Montreal Protocol on Substances
that Deplete the Ozone Layer****I. Opening of the meeting**

1. The forty-sixth meeting of the Open-ended Working Group of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer was held at the International Civil Aviation Organization, Montreal, Canada, from 8 to 12 July 2024. The meeting was co-chaired by Miruza Mohamed (Maldives) and Ralph Brieskorn (Kingdom of the Netherlands).
2. Ms. Mohamed opened the meeting at 10 a.m. on Monday, 8 July 2024. An opening statement was delivered by Megumi Seki, Executive Secretary, Ozone Secretariat.
3. Welcoming participants, Ms. Seki invited participants to observe a minute of silence in memory of Patrick McInerney (Australia) and Jacques Monlollamon Glai (Côte d'Ivoire), both of whom had died in recent months. Ms. Seki said that Mr. McInerney had been an experienced negotiator, always calm and reliable, and full of warmth and wit. He had always built consensus and drawn up constructive solutions. His personality and leadership had been instrumental in securing the adoption of the Kigali Amendment in 2016. Mr. Glai, who had headed the national ozone office in his country, had been responsible for organizing the recent regional meeting of the network of national ozone officers from African countries and had been due to travel to attend the current meeting. She described him as humble, discreet and hardworking, and a friend to many.
4. Turning to the work of the Montreal Protocol, Ms. Seki said that the Secretariat was increasing its efforts to raise the profile of the Protocol and seek synergies with relevant organizations. At the twenty-eighth meeting of the Conference of the Parties to the United Nations Framework Convention on Climate Change, the Secretariat had showcased the impact of the Protocol on climate mitigation efforts, including at the “Advancing Climate Action” pavilion, which had been run by the Secretariat in collaboration with 15 partners. The pavilion had hosted a variety of side events, including a high-level ministerial dialogue, and had demonstrated the use of R-290-powered freezers. The Secretariat had also developed a website and an application entitled “Avoided CO₂e”.
5. Synergies between the Montreal Protocol and other multilateral environmental agreements, along with the achievements of the Protocol, had also been highlighted at the sixth session of the United Nations Environment Assembly. Experts from the assessment panels were providing expertise for ongoing multilateral processes such as the negotiations on a future plastics treaty and discussions on biodiversity. The Secretariat had been active in preparations for negotiations on creating a science-policy panel on chemicals, waste and pollution, had shared experiences of relevance to the Kunming-Montreal Global Biodiversity Framework and had collaborated further with Secretariat of the Basel, Rotterdam and Stockholm conventions on the topics of illegal trade, the transboundary movement of waste and the disposal of refrigerants and equipment.

6. Ms. Seki highlighted a number of key issues to be addressed at the current meeting in response to decisions taken by the Thirty-Fifth Meeting of the Parties, including life-cycle refrigerant management and a report thereon prepared by the Technology and Economic Assessment Panel. She drew attention to a workshop on fluorocarbon banks inventories, held the previous day by the Climate and Clean Air Coalition, describing the issue as of particular importance given that the management of banks was integral to life-cycle refrigerant management. She expressed the desire to build on the outcomes of the inventory workshop at a workshop on life-cycle refrigerant management to be convened by the Secretariat in October 2024. With regard to the atmospheric monitoring of controlled substances, the Working Group would consider a report on the costs of establishing monitoring stations and sustainable funding options for such monitoring stations. Other issues on the agenda resulting from the Thirty-Fifth Meeting of the Parties included very short-lived substances, feedstock uses of controlled substances, carbon tetrachloride emissions, energy efficiency, funding support for countries affected by the coronavirus disease (COVID-19) pandemic and options for amending form 3 to support reporting on HFC-23.

7. Ms. Seki welcomed Pablo Moscoso de la Cuba to the post of Senior Legal Officer within the Secretariat.

II. Organizational matters

A. Attendance

8. The following parties to the Montreal Protocol were represented: Albania, Algeria, Antigua and Barbuda, Argentina, Armenia, Australia, Austria, Azerbaijan, Bahamas, Bahrain, Barbados, Belgium, Benin, Bhutan, Bosnia and Herzegovina, Brazil, Brunei Darussalam, Burkina Faso, Cambodia, Cameroon, Canada, Chad, Chile, China, Colombia, Comoros, Congo (Republic of the), Cook Islands, Costa Rica, Cuba, Czechia, Denmark, Dominica, Dominican Republic, Ecuador, Egypt, Eritrea, Estonia, Eswatini, European Union, Fiji, Finland, France, Georgia, Germany, Ghana, Grenada, Guinea, Honduras, Hungary, India, Indonesia, Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kenya, Kuwait, Kyrgyzstan, Lao People's Democratic Republic, Lebanon, Lesotho, Malawi, Malaysia, Maldives, Mauritania, Mauritius, Mexico, Micronesia (Federated States of), Montenegro, Morocco, Mozambique, Myanmar, Namibia, Netherlands (Kingdom of the), Niger, Nigeria, Norway, Oman, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Republic of Moldova, Russian Federation, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Saudi Arabia, Senegal, Serbia, Solomon Islands, South Africa, Spain, Sri Lanka, State of Palestine, Sweden, Switzerland, Thailand, Togo, Trinidad and Tobago, Tunisia, Türkiye, Turkmenistan, Ukraine, United Kingdom of Great Britain and Northern Ireland, United Republic of Tanzania, United States of America, Uruguay, Vanuatu, Venezuela (Bolivarian Republic of), Viet Nam, Yemen, Zambia and Zimbabwe.

9. The following United Nations entities, organizations and specialized agencies were represented: secretariat of the Multilateral Fund for the Implementation of the Montreal Protocol, United Nations Development Programme, United Nations Environment Programme, United Nations Industrial Development Organization and World Bank. The Montreal Protocol assessment panels were also represented.

10. The following intergovernmental, non-governmental, industry, academic and other bodies were represented as observers: A-Gas (Australia) Pty Ltd.; A-Gas International, AGC Chemicals; Alliance for Responsible Atmospheric Policy; Association des Distributeurs, Conditionneurs, Récupérateurs et Retraiteurs de Réfrigérants; ATMosphere; California Citrus Quality Council; Canadian Space Agency; Carbon Containment Lab; Carrier Corporation; Centre for Environment Justice and Development; Chemours LLC; Chiesi Group; Clean Cooling Collaborative; Climate and Clean Air Coalition Secretariat; Daikin; Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH; Environmental Investigation Agency; Environmental Law Institute; European Association of Refrigeration and Air Conditioning Installers; European Partnership for Energy and the Environment; Glencoe Strategies LLC; Global Policy Associates; Guidehouse Germany GmbH; Gujarat Fluorochemicals Limited; Gulf Cooperation Council; ICF International; iFOREST; Institute for Energy and Climate Strategies; Institute for Governance and Sustainable Development; International Institute of Refrigeration; International Pharmaceutical Aerosol Consortium; Japan Fluorocarbon Manufacturers Association; Lanxess; Lennox International; MAHLE Behr Troy Inc.; Manitoba Ozone Protection Industry Association; Mebrom Corporation; Mexichem UK Ltd.; Mobile Air Conditioning Society; Natural Resources Defense Council; NYBRA Consulting; Overseas Environmental Cooperation Center; Refrigerant Gas Manufacturers Association; Refrigerant Reclaim Australia; Refrigerants Australia; SilverLining; SRF Limited; Sustainable Energy for All; The

Chemours Company; The Japan Refrigeration and Air Conditioning Industry Association; Tradewater; Union of Associations of African Actors in Refrigeration and Air-Conditioning.

B. Adoption of the agenda

11. The Working Group adopted the following agenda on the basis of the provisional agenda set out in document UNEP/OzL.Pro.WG.1/46/1/Rev.1:

1. Opening of the meeting.
2. Organizational matters:
 - (a) Adoption of the agenda;
 - (b) Organization of work.
3. Presentations by the Technology and Economic Assessment Panel and the Scientific Assessment Panel and discussions on:
 - (a) Very short-lived substances (decision XXXV/6);
 - (b) Feedstock uses of controlled substances (decision XXXV/8);
 - (c) Emissions of carbon tetrachloride (decision XXXV/9).
4. Life-cycle refrigerant management (decision XXXV/11).
5. Enhancing the global and regional atmospheric monitoring of substances controlled by the Montreal Protocol (decision XXXV/14).
6. Presentation of the Technology and Economic Assessment Panel 2024 progress report and discussions on:
 - (a) Nominations for critical-use exemptions for methyl bromide for 2025;
 - (b) Energy efficiency (decision XXXV/10);
 - (c) Panel membership changes;
 - (d) Any other issues.
7. Climate-friendly alternatives for metered-dose inhalers (UNEP/OzL.Pro.35/12, para. 251).
8. Future availability of halons and their alternatives (UNEP/OzL.Pro.35/12, para. 159).
9. Possible compliance deferral for Article 5, group 2 parties: technology review by the Technology and Economic Assessment Panel pursuant to paragraph 5 of decision XXVIII/2.
10. Strengthening Montreal Protocol institutions, including combating illegal trade (decision XXXV/12 and UNEP/OzL.Pro.35/12, para. 188).
11. Emissions of HFC-23: potential changes to reporting form 3 for reporting on HFC-23 (decision XXXV/7, para. 3).
12. Proposal by Cuba on additional funding to support countries seriously affected by the coronavirus disease (COVID-19) pandemic and listed in decision XXXV/16.
13. Other matters.
14. Adoption of the report of the meeting.
15. Closure of the meeting.

12. Under agenda item 13, "Other matters", the Working Group agreed to consider the illegal and unwanted import of energy-inefficient products and equipment.

C. Organization of work

13. The Working Group agreed to the organization of work proposed by the Co-Chair, namely to establish contact and informal groups as necessary and to avoid, to the extent possible, the holding of contact or informal group meetings in parallel with each other or with plenary meetings. Morning plenary sessions would run from 10 a.m. to 1 p.m. and afternoon sessions from 3 to 6 p.m.

III. Presentations by the Technology and Economic Assessment Panel and the Scientific Assessment Panel and discussions on:

- A. Very short-lived substances (decision XXXV/6)**
- B. Feedstock uses of controlled substances (decision XXXV/8)**
- C. Emissions of carbon tetrachloride (decision XXXV/9)**

1. Presentation

14. Introducing the sub-items, the Co-Chair drew attention to the note by the Secretariat on issues for discussion by and information for the attention of the Open-ended Working Group at its forty-sixth meeting (UNEP/OzL.Pro.WG.1/46/2), the addendum thereto (UNEP/OzL.Pro.WG.1/46/2/Add.1) and the report of the Technology and Economic Assessment Panel, May 2024, volume 1.

15. The information on very short-lived substances was set out in paragraphs 7 and 8 of document UNEP/OzL.Pro.WG.1/46/2, paragraphs 5–18 of document UNEP/OzL.Pro.WG.1/46/2/Add.1 and section 5.2 of the Panel's report. The information on feedstock uses of controlled substances was set out in paragraphs 9 and 10 of document UNEP/OzL.Pro.WG.1/46/2, paragraphs 19–30 of document UNEP/OzL.Pro.WG.1/46/2/Add.1 and section 5.3 of the Panel's report. The information on emission of carbon tetrachloride was set out in paragraphs 11 and 12 of document UNEP/OzL.Pro.WG.1/46/2, paragraphs 31–37 of document UNEP/OzL.Pro.WG.1/46/2/Add.1 and section 5.4 of the Panel's report.

16. The Working Group then heard presentations on the responses of the Technology and Economic Assessment Panel and the Scientific Assessment Panel to decisions XXXV/6, XXXV/8 and XXXV/9. The presentations were given by Helen Tope, co-chair of the Medical and Chemicals Technical Options Committee of the Technology and Economic Assessment Panel, and Stephen Montzka of the Scientific Assessment Panel. Summaries of the presentations, as prepared by the presenters, are set out in section A of annex II to the present report, without formal editing.

2. Question-and-answer session

17. In the ensuing question-and-answer session, many representatives had specific questions on the presentation and the relevant sections of chapter 5 of volume 1 of the Panel's May 2024 report, which Ms. Tope, Mr. Montzka and Nick Campbell, member of the Medical and Chemicals Technical Options Committee, proceeded to answer.

18. All the representatives who spoke thanked the Technology and Economic Assessment Panel and the Scientific Assessment Panel for their work.

19. In response to a question about the reasons for the focus, in the Panel's report, on only five very short-lived substances and about whether there might be other very short-lived substances that needed attention, Ms. Tope said that the five substances that had been included because they were produced in large volumes and because one substance in particular, dichloromethane, had a major impact on ozone depletion. In addition, given that information on very short-lived substances was not systematically reported by parties, the Panel had to use information that was publicly available or obtain information through industry experts. In that regard, and in response to other questions, Ms. Tope said that the Panel would welcome any information from parties on the quantities of very short-lived substances being produced so that it could be included the Panel's 2026 quadrennial assessment report. One representative expressed concern at the lack of information available on other very short-lived substances and advocated more in-depth study of the subject. Mr. Montzka underscored that the Scientific Assessment Panel was reliant on the observational community to supply information about other short-lived chlorinated and brominated gases in the atmosphere and their distribution. The Panel would nevertheless continue to update the scientific information as more details became available. Mr. Campbell, noting a lack of expertise in the Medical and Chemicals Technical Options Committee on the uses of very short-lived substances given that they were not controlled under the Montreal Protocol, said that, if parties had experts on those uses and on alternatives to chlorinated very short-lived substances, the Committee would welcome interaction with them, which would help in building its knowledge and providing the parties with a more thorough 2026 quadrennial assessment report.

20. Following a proposal by one representative, Ms. Tope said that information on alternatives to very short-lived substances would also be important. One representative, speaking on behalf of a group of parties, asked whether solvent use of dichloromethane was on the decline because of available alternatives.
21. In response to a question about rationalization in feedstock manufacture and the use of best practices in the handling of feedstocks, Mr. Campbell said that manufacturing facilities were tending to be larger in size and were handling considerably larger tonnages of feedstock. As such, best practice was in any case being implemented in the facilities for the sake of efficiency, not least for economic reasons to minimize product loss.
22. One representative sought clarification about the 66 per cent increase in the use of feedstocks that had been witnessed over the previous 10 years and any reason for the increase. In addition, he asked whether any study had predicted potential further increases in the future. In response to a question by another representative, Ms. Tope agreed that more information about the measures adopted by parties regarding feedstocks would be welcomed.
23. In response to questions about feedstock emission factors, Ms. Tope confirmed that, in addition to use, the matters of production, transport, distribution and the supply chain were included in the emissions estimates. She noted that feedstocks had different properties and were used in different ways in different facilities of different ages and in varying condition across the world. When establishing the most likely emission factors, the Technology and Economic Assessment Panel had taken into account the range of possibilities, using an average. The methodology employed was set out in the 2022 assessment report of the Panel and its May 2024 report. When dealing with specific substances, such as carbon tetrachloride, however, the Panel had used published reports containing industry information to refine the emission factors.
24. One representative speaking on behalf of a group of parties asked for more information on emissions from one-way cylinders. Mr. Campbell said that he had no knowledge of one-way cylinders being used to transport products for feedstock, but would very much appreciate receiving any information on the matter.
25. In response to a question about the changes in the fluorinated industry emission factors, Mr. Campbell explained that the Technology and Economic Assessment Panel had incorporated the guidelines of the Intergovernmental Panel on Climate Change for reporting factors and emissions from fluorinated production. The Technology and Economic Assessment Panel had been influenced by a major report produced by the United States Environmental Protection Agency just before the latest version of the guidelines. Those guidelines for the basic tier of reporting were 4 per cent emissions from production and did not include incineration. Ms. Tope explained that the best estimate of emissions by the Medical and Chemicals Technical Options Committee was 3.6 per cent. There was not much difference in the two values, but a range of emission factors was provided because what might apply in one country might not apply in another.
26. Mr. Campbell drew attention to a recent study conducted in the Kingdom of the Netherlands that had considered the actual emissions from an HCFC-22 unit. The study was due to be published shortly and any relevant information would be incorporated into future panel reports.
27. One representative speaking on behalf of a group of parties, expressed the view that carbon tetrachloride emissions would continue to be an issue in the future because of the use of the substance in the production of hydrofluoroolefins (HFOs) as alternatives to HFCs and the lack of other options. He asked whether the Technology and Economic Assessment Panel was able to predict future trends in the use of HFOs, the consequences for carbon tetrachloride feedstock production and thus related emissions. In response, Ms. Tope said that prediction of the future volumes of carbon tetrachloride required for HFOs was a very difficult exercise. Mr. Montzka underscored that the Scientific Assessment Panel did not make such market predictions, but in chapter 7 of the report entitled “Scientific Assessment of Ozone Depletion: 2022”, there were scenarios that considered various ranges of the future use of substances, including feedstocks, and their influence on ozone depletion and ozone recovery.

3. Discussion

(a) Very short-lived substances (decision XXXV/6)

28. In the ensuing discussion, several representatives recalled that very short-lived substances were not controlled under the Montreal Protocol. One representative noted that the information on the matter presented in the reports of the Technology and Economic Assessment Panel and the Scientific Assessment Panel had been based on hypothetical possibilities and, as such substances reacted

differently to various meteorological and other conditions, any consideration of their emissions and lifespan in the context of the Montreal Protocol should be based solely on proven scientific fact rather than hypothesis. One representative further recalled that parties were not required to submit data on very short-lived substances and requested additional information on the sources of the information presented in the report of the Technology and Economic Assessment Panel on the matter. Another representative expressed the view that there should be no further consideration of very short-lived substances, as only substances that affected the ozone layer or produced greenhouse gases could be considered for control under the Montreal Protocol. He added that it was stated in the report of the Technology and Economic Assessment Panel that over 90 per cent of very short-lived substances were used as feedstock, under which circumstances they would produce no emissions, and noted that such substances by their very nature did not enter the stratosphere and could therefore not affect the ozone layer. Moreover, even if such substances could be considered for control under the Montreal Protocol, the sheer number of them would make regulation extremely challenging.

29. Several representatives, including one speaking on behalf of a group of parties, however, drew attention to the harmful effects of very short-lived substances on health and the environment, and noted that they were a substantial source of chlorine-related ozone depletion. They therefore requested that the Technology and Economic Assessment Panel and the Scientific Assessment Panel provide parties with information regarding the possible future impact of those substances, with one representative requesting recommendations from the panels regarding ways of managing very short-lived substances and their opinion as to whether or not such substances should be controlled under the Montreal Protocol in the future, although another representative recalled that policy measures could only be undertaken through proposals put forward by the parties themselves. Noting that there was a reference in the report of the Technology and Economic Assessment Panel to the considerable emissive solvent use of certain very short-lived substances, one representative requested further information on the emissive uses of very short-lived substances, including the quantities involved. Some representatives also requested that the Medical and Chemicals Technical Options Committee provide additional information regarding the impact in quantitative terms on the stratospheric ozone layer of each of the very short-lived substances referred to in table 5.2 of the report of the Technology and Economic Assessment Panel.

30. Some representatives, including one speaking on behalf of a group of parties, noted the concerning upward trend in very short-lived substances with emissive uses, in particular dichloromethane, emphasizing that emissive uses of very short-lived substances that reached the stratosphere needed to be monitored. The representative speaking on behalf of a group of parties noted that those countries were currently monitoring their levels of dichloromethane and perchloroethylene. He recalled that, under the Vienna Convention for the Protection of the Ozone Layer, parties had an obligation to take appropriate measures against adverse effects resulting or likely to result from human activities which modified or were likely to modify the ozone layer, and said that it was important to investigate alternatives to such substances. One representative, however, sought clarification regarding dichloromethane. He noted that the chemical reactivity and physical solubility of dichloromethane shortened the lifetime of the substance in the lower atmosphere and that, once the substance reached the stratosphere, it was broken down by photolysis of sunlight. Accurate determination of the ozone-depleting potential of dichloromethane relied on the quantification of the amount of chlorine delivered by the substance to the stratosphere, which posed difficulties, as transport to the stratosphere could take a year, which was almost double the lifetime of the substance in the atmosphere.

31. One representative requested that, given the significant interest among parties regarding very short-lived substances, additional information be provided before the quadrennial assessment due to be presented in 2026. Another representative, however, recalling that the impact of very short-lived substances on the ozone layer and stratosphere was small and noting that it was more important to focus on the core work under the Montreal Protocol, said that it was appropriate to wait until the quadrennial report in 2026 for more information to be provided on the topic.

32. One representative requested that detailed mapping of alternatives be provided for each very short-lived substance in the progress report of the Technology and Economic Assessment Panel for 2025, and that information be included on the availability, technical feasibility, economic viability, safety and sustainability of those alternatives. Another representative underscored that any controls introduced on ethylene dichloride, which was used almost exclusively as a feedstock in the production of vinyl chloride monomer, a precursor to polyvinyl chloride, could have a significant negative economic impact. It was therefore vital to obtain more information on the feasibility and viability of alternatives for that substance in particular. One representative, noting that much information had been provided on alternatives to controlled substances in the reports of the Solvents, Coatings and Adhesives Technical Options Committee of 1998 and 2002, proposed that information relevant to alternatives to very short-lived substances could be extracted from those reports and that parties should

discuss how best to extract and structure such information, as well as submit any information they had obtained at the national level on very short-lived substances. A number of representatives also suggested that, in order to make such a task manageable, the Technology and Economic Assessment Panel should be instructed to focus only on those very short-lived substances with major emissive uses over a set threshold and on identifying any very short-lived substances which could become a cause for concern in the future.

33. One representative requested that, in the future, information provided on the impact on the ozone layer of chlorinated very short-lived substances be disaggregated and that a table be produced listing all the very short-lived substances of potential concern to the ozone layer, on the basis of an agreed emissions threshold, and providing information such as recent production, consumption and emission levels of those substances, as well as their ozone-depleting potential or an agreed alternative metric in cases where an agreed ozone-depleting potential value was not available. He expressed an interest in discussing the issue further with interested parties with a view to presenting a draft decision.

34. One representative noted that increasing attention had recently been paid to very short-lived substances in scientific literature. He asked for the opinion of the Scientific Assessment Panel regarding the conclusions drawn in an article entitled “Very short-lived halogens amplify ozone depletion trends in the tropical lower stratosphere” by Villamayor et al. that had been published in the journal *Nature Climate Change* in 2023, in which scientists had described their use of a community earth system model, including consideration of bromine and iodine as well as controlled substances, and also noted that future scenarios suggested that 25 per cent of tropical lower stratosphere ozone depletion could be prevented by the end of the twenty-first century by controlling emissions of anthropogenic very short-lived substances.

35. Subsequently, the representative of Canada, speaking also on behalf of Australia, the European Union and Switzerland, introduced a draft decision, set out in a conference room paper, on additional information on very short-lived substances. In the draft decision, the Technology and Economic Assessment Panel was requested, in its 2025 progress report, to identify very short-lived substances not mentioned in its 2024 progress report; provide additional information on alternatives to emissive uses of very short-lived substances in the main applications for which they were currently used, focusing on those with estimated emissive uses of at least 100,000 tonnes; and include a table providing, to the extent possible, the estimated annual production and consumption and estimated annual emissions for each very-short-lived substance identified in its 2024 and 2025 progress reports, and, subject to further discussion with the Scientific Assessment Panel, the range of ozone-depleting potential for each of those substances and their contribution to effective equivalent stratospheric chlorine. In addition, parties with production data on very short-lived substances or information on alternatives to emissive uses were invited to provide such information to the Ozone Secretariat. Finally, parties with national measures related to very short-lived substances were invited to provide such measures to the Secretariat by 1 February 2025, and the Secretariat was requested to make them available to parties in a compendium.

36. The Working Group agreed to establish a contact group, co-chaired by Bruna Veríssimo Lima Santos (Brazil) and Heidi Stockhaus (Germany), to discuss the matter further, taking into account the submission by Australia, Canada, the European Union and Switzerland.

37. Subsequently, the co-chair of the contact group reported that, owing to time constraints, it had not been possible for the group to conclude its work. The Working Group therefore agreed to resume discussions on very short-lived substances at the Thirty-Sixth Meeting of the Parties, on the basis of the draft decision set out in section A of annex I to the present report.

(b) Feedstock uses of controlled substances (decision XXXV/8)

38. In the ensuing discussion, several representatives, including one speaking on behalf of a group of parties, noting that feedstock use of controlled substances had increased by 66 per cent in the last 10 years and by 41 per cent in the last 5 years, said that they supported the view of the Scientific Assessment Panel expressed in 2023 that a significant threat was posed by the emissions from such uses to the recovery of the ozone layer. By applying the average emission factor of around 3.6 per cent, around 70,000 tons of controlled substances had been emitted from feedstock in 2022 and the amount in tons of carbon dioxide equivalent would be considerably higher. Such figures challenged the long-held assumption of parties that feedstock uses of ozone-depleting substances should be excluded from consumption accounting as they were negligible.

39. One representative requested information from the Medical and Chemicals Technical Options Committee regarding the fugitive leakage or losses, if any, of ozone-depleting substances used as feedstock, and the impact of emissions in terms of a percentage of the total production of controlled

substances for feedstock uses. He also asked for feasible and viable alternatives to feedstock production of controlled substances. Furthermore, he requested details of the methodology used for estimating annual global emissions of controlled substances, in particular where noticeable differences had been observed on a global scale, as well as the emission factors used for the production, distribution and use of feedstocks in table 5.20, on the technical feasibility, economic viability and safety risk rating of various feedstocks, of the report of the Technology and Economic Assessment Panel. He requested details of the methodology used and the data sources for the detailed analysis in the report on various products that used controlled substances as feedstocks. Finally, he requested information from the Medical and Chemicals Technical Options Committee on strengthening the existing processes and mechanisms in place for the management of feedstock uses for controlled substances.

40. One representative called for attention to be drawn in particular to the use of ozone-depleting substances and hydrofluorocarbons (HFCs) as feedstock for plastic production, and for further information to be provided in future reports in that regard, in particular regarding the associated pollution which affected land, freshwater and delicate marine environments, most commonly in countries and communities that were not responsible for producing, exporting or using such products. Work to reduce feedstock emissions could therefore complement the work under way to develop an international legally binding instrument on plastic pollution, including in the marine environment. Another representative stressed the importance of not prejudging negotiations taking place in other forums.

41. A number of representatives, including one speaking on behalf of a group of parties, drew attention to the quick wins that could be achieved in relation to the aim of reducing feedstock emissions, namely the application of best practices during the distribution, storage, transport, handling and repackaging of controlled substances for feedstock use, as well as monitoring and reporting and the training of personnel in that regard. The use of abatement technologies in new plants, alternatives, and regulatory incentives to avoid emissions could reduce emissions still further. One representative, speaking on behalf of a group of parties, noted with concern the reference in the report of the Technology and Economic Assessment Panel to the use of non-refillable cylinders for feedstock and requested additional information on the issue. Another representative suggested that one or two projects within the production sector on the issue of feedstock uses of controlled substances could be considered under the Multilateral Fund for the Implementation of the Montreal Protocol in order to support best practices and technologies to minimize emissions of controlled substances used as feedstock, or that activities on the issue could be included in production projects related to the phase-down or phase-out of specific substances. He also suggested that the consideration of emissions of carbon tetrachloride could be included in a decision on feedstock, given the close relationship between the two issues.

42. Some representatives, recalling that feedstock uses were not controlled under the Montreal Protocol, asked the Technology and Economic Assessment Panel to focus on technologies that could reduce emissions from leakages and transportation of controlled substances and on suggesting alternatives, and to consider the whole life cycle of products rather than focusing on feedstock. Another representative noted that, although amounts of controlled substances used entirely as feedstock were subtracted from the amount considered as production, the production of controlled substances for feedstock uses were reported under the Montreal Protocol. He also noted that it was important to ensure that systems were in place to confirm that amounts of controlled substance produced with the intention of being used for feedstock were in fact used as such and not diverted into consumptive uses.

43. Subsequently, the representative of Australia introduced a conference room paper, also on behalf of Canada, Norway and Switzerland, containing a draft decision on feedstock uses of controlled substances. The draft decision was intended to reflect concerns regarding the increasing use of controlled substances as feedstock and the associated increase in emissions, as identified by the atmospheric measurements of such substances. In the draft decision, parties were urged to take steps to minimize their emissions of controlled substances and encouraged to promote the use of best practices and technologies to reduce such emissions. Parties should also report intentional production where such production was measurable. In addition, parties were invited to share information regarding their national procedures and frameworks for the management of such production and use with the Secretariat so that the Secretariat could then summarize such information for the benefit of all the parties. Finally, the draft decision contained a request for the Executive Committee to consider establishing a funding envelope to support up to two production-sector-related projects to demonstrate best practices and technologies for minimizing emissions of control substances used as feedstock, potentially providing useful quantitative information for parties in order to assist them in reducing emissions and developing and sharing that information with others.

44. Some representatives expressed the view that, as the issue of feedstock uses had already been discussed many times at previous meetings and would continue to be covered in the progress reports of the Medical and Chemicals Technical Options Committee, there was no need for further discussion of the issue. One representative recalled that, as controlled substances used as feedstock were then present in the final product, it was appropriate to consider the entire life cycle of those products rather than focusing solely on feedstocks. Another representative noted that it would only be appropriate to discuss possible action by parties on the issue if additional funding was secured through the Multilateral Fund to support national ozone units in carrying out additional tasks.

45. Other representatives, including one speaking on behalf of a group of parties, expressed their support for discussing the matter further in a contact group. Several representatives, including one speaking on behalf of a group of parties, noted that the Technology and Economic Assessment Panel 2024 progress report contained a significant amount of new information on feedstocks, including in relation to emission factors, and that an increase in associated emissions had been identified confirming that the issue merited further consideration. A number of representatives expressed the view that sufficient information had now been obtained from the Panel and that it would be timely to discuss what action should be taken by parties on the matter. Several representatives also drew attention to the call in the draft decision to the Executive Committee to consider funding for projects related to reducing emissions from feedstock, which was a direct response to previous requests from some parties for support, including in terms of capacity-building, in tackling the issue, and they therefore encouraged those parties to engage in the discussions, providing more information on the type of support that would be most beneficial. One representative also noted that the fact that the draft decision invited, rather than required, parties to submit information on best practices and technology meant that no additional burden would be placed on those parties that did not wish, or were not in a position, to submit such information.

46. The Open-ended Working Group agreed to establish an informal group, to be co-facilitated by Michel Gauvin (Canada) and Leslie Smith (Grenada), to discuss the matter further, taking into account the draft decision submitted by Australia, Canada, Norway and Switzerland.

47. Subsequently, the co-chair of the contact group reported that, owing to time constraints, it had not been possible for the group to conclude its work. The Working Group therefore agreed to resume discussions on feedstock uses of controlled substances at the Thirty-Sixth Meeting of the Parties, on the basis of the draft decision set out in section B of annex I to the present report.

(c) Emissions of carbon tetrachloride (decision XXXV/9)

48. Several representatives, including one speaking on behalf of a group of parties, thanked the Medical and Chemicals Technical Options Committee for its work, particularly for the progress made in resolving the discrepancy between top-down and bottom-up estimates, which one representative said had essentially addressed the issue.

49. Several representatives, including one speaking on behalf of a group of parties, said that the concern raised under item 3 (b) regarding increasing emissions from feedstock use was particularly applicable to carbon tetrachloride. All those who spoke expressed an interest in holding further discussions on the matter, including on alternatives to carbon tetrachloride and ways to assist parties in minimizing carbon tetrachloride emissions. Several representatives, including one speaking on behalf of a group of parties, suggested incorporating carbon tetrachloride into the general feedstock discussion under agenda item 3 (b).

50. One representative asked the Medical and Chemicals Technical Options Committee to provide additional information on fugitive leaks and losses of carbon tetrachloride used as feedstock; feasible and viable alternatives other than those indicated in previous reports; the methodology used to estimate annual global carbon tetrachloride emissions, in the light of the information provided in the 2024 progress report regarding recent scientific studies relating to chloromethanes and carbon tetrachloride; and non-fluorinated low-global-warming-potential (GWP) products, including their market penetration, especially in parties operating under paragraph 1 of Article 5 (Article 5 parties).

51. The Working Group agreed to address the issue of carbon tetrachloride emissions as part of the discussions to be held in the contact group on feedstocks established under agenda item 3 (b), and to record the outcome of those discussions under that agenda item.

IV. Life-cycle refrigerant management (decision XXXV/11)

52. Introducing the item, the Co-Chair recalled that, in response to the request contained in paragraph 1 of decision XXXV/11 on life-cycle refrigerant management, the Technology and

Economic Assessment Panel had established a task force to prepare a report. A summary of the report could be found in document UNEP/OzL.Pro.WG.1/46/2/Add.1, and the full report was available on the meeting website.

53. The co-chairs of the task force, Hilde Dhont and Roberto Peixoto, gave a presentation on the content and conclusions of the report. A summary of the presentation, as prepared by the presenters, is set out in section C of annex II to the present report, without formal editing. In answering questions and responding to comments, they were joined by members of the task force, Bassam Elassaad, Pallav Purohit and Helen Walter-Terrinoni. Ashley Woodcock, co-chair of the Technology and Economic Assessment Panel, observed that the report, which had been prepared within a limited period of time, was the first time the Panel had considered the issue; it was a first effort, and any subsequent reports would be more comprehensive.

54. All the representatives who spoke complimented the task force on the report, describing it as comprehensive, clear and detailed, and containing many good examples of policies and measures that could be followed by parties, together with the challenges they were likely to encounter. Representatives said that they looked forward to discussing the issue in more detail at the workshop to be held back to back with the Thirty-Sixth Meeting of the Parties in October. The issue of life-cycle refrigerant management was a critical one for achieving the objectives of the Montreal Protocol and combating climate change. In the face of the increasing devastation caused by the impacts of climate change, the question was not whether the Montreal Protocol should fully support the incorporation of life-cycle refrigerant management, but how quickly and fully it could do so.

55. One representative pointed out that leaking cooling equipment was more expensive to operate, and its inefficiency contributed to other negative impacts, including food waste and energy insecurity. Two foundational measures to optimize action on life-cycle refrigerant management were already underway in Article 5 parties, namely the preparation of inventories and national plans. By themselves, however, those did not guarantee the ability of parties to formulate optimal plans or to deliver the benefits available throughout the life cycle. All countries could benefit from information and capacity-building, but not all countries had the same capacity to implement life-cycle refrigerant management strategies.

56. Responding to questions, Ms. Walter-Terrinoni observed that the reclamation of blends posed greater challenges than single component refrigerants. Some companies blended additional refrigerant into the reclaimed substances to ensure that they maintained the right composition. Others used distillation columns to separate the components and then re-blended them. Responding to a question on possible impacts of the breakdown products from destruction on air and water quality, she commented that local and regional requirements relating to emissions to both water and air would be important to consider. On the question of why substances in foams had not been covered in the report, she recalled that the topic had not been included in decision XXXV/11.

57. Responding to a question on how technicians could determine whether to reuse, or recycle or reclaim, recovered refrigerants, Ms. Dhont said that ISO standard 5149, referred to in the report, provided the steps to be followed. If there was no contamination, the refrigerants could be directly reused in the same system, for example if the equipment was moved to a different location, whereas in other cases, recycling or reclamation might be needed. Responding to a question on direct and indirect leak detection methodologies, she said that the report did not provide a mapping of the situation in different countries, but did include a reference to indirect methods typically being used in complex installations or where equipment was located outdoors.

58. Responding to questions about which elements of life-cycle refrigerant management strategies had the most impact, Ms. Dhont drew attention to chapter 8 of the report, in which it was stated that, based on theoretical modelling, the task force had concluded that leak prevention accounted for about 40 per cent of the contribution, and recovery, recycling, reclaiming and destruction about 60 per cent. That would, however, depend on local circumstances, including the size of the bank and the types of refrigerants. Responding to a question on why the issue of preventive maintenance had not been included in the report, she agreed that it deserved fuller consideration. One representative highlighted the need for continued training of technicians in best practices for servicing and maintenance to prevent leaks and ensure that equipment could be operated efficiently, as this was a key aspect of good refrigerant management.

59. Responding to a question on the cost of refrigerant identifiers, Mr. Elassaad noted that the task force understood that there was currently a global shortage of identifiers, and also that the technology was changing.

60. Some representatives raised the issue of particular challenges faced by high-ambient-temperature countries, and expressed their desire to see the topic explored in more detail. One pointed out that ambient temperatures in his country were sometimes higher than the operating temperature for some refrigerants, such as R410A. Temperatures on roofs regularly exceeded safe temperatures for technicians to work in, making maintenance and servicing of roof-mounted equipment impossible and adding to leakage rates.

61. Members of the task force observed that their analysis of challenges categorized by countries' consumption patterns had not identified any difference in the technologies used in high-ambient-temperature countries. They recognized, however, the specific implementation challenges faced by those countries, and said that they would welcome further discussion of the issue.

62. Some representatives highlighted the particular challenges faced by low-volume-consuming countries, which only had very small volumes of substances to account for and manage, meaning that realizing the benefits of economies of scale was not generally possible. Equipment was very costly – potentially exceeding the funds made available for the preparation of Kigali implementation plans – and often was not available. They expressed the hope that the task force could further develop its recommendations for technology accessibility and economic assessment in relation to life-cycle refrigerant management in low-volume-consuming countries.

63. Members of the task force agreed that such countries faced significant challenges in realizing economies of scale, in particular with regard to reclamation and destruction, which highlighted the need for training and awareness-raising campaigns, and also the potential for regional cooperation. Another representative said that she would appreciate further discussion of the potential for regional cooperation.

64. Several representatives asked for more detail on the costs of equipment, and queried some of the estimated costs included in the report. One representative said that, in his experience, the cost of gas chromatography equipment was at least \$85,000 rather than the \$45,000 mentioned in the report. Mr. Peixoto stressed that the costs included in the report were estimates provided by experts; they had not been based on market surveys. The task force would welcome additional information from parties.

65. Several representatives drew attention to the need to provide adequate funding for capacity-building and institutional strengthening in Article 5 parties, including equipment and training for technicians, and called for greater consideration of funding options. One representative said that she was looking forward to the information and plans to be developed under the funding window open in the Multilateral Fund for the preparation of national inventories of banks and plans for their disposition and for identifying conditions and policy options for the effective implementation of life-cycle refrigerant management.

66. One representative highlighted some of the challenges his country had faced in implementing a life-cycle refrigerant management strategy, which had included regulatory restrictions affecting imports of some of the necessary equipment. Another representative drew attention to a policy successfully implemented in his country which required all importers and reclaimers of refrigerant for the stationary refrigeration and air-conditioning sector to develop and implement a refrigerant stewardship programme to collect used refrigerants for reclamation or destruction. He also highlighted the report's finding that, globally, 60 per cent of newly produced HFCs had been used for the servicing of refrigeration and air-conditioning equipment, while the remaining 40 per cent had been used for filling new equipment, which reinforced the need for effective life-cycle management.

67. One representative described how her Government was addressing the challenges of a large country with a relatively small and widely dispersed population. The Government had reached agreements with private companies operating reclamation centres, and had provided cylinders and other equipment and free transport to the centres and a share of recycled and reclaimed refrigerants, through an agreement with one of the biggest importers of refrigerants, which had its own transport network, thereby reducing costs and helping to increase the incentives to reclaim refrigerants.

68. One representative, speaking on behalf of a group of parties, described the legislation in place in her party, which included emission prevention, regular leak checks on refrigeration, air-conditioning and heat pump equipment containing controlled substances, recovery obligations, destruction, and detailed certification requirements for technicians and also for HFOs and alternatives to controlled substances. The unlawful release of controlled substances into the atmosphere was not only an infringement of climate regulations, but was also considered a crime, punishable by imprisonment. Good practices implemented by member States included central registration databases, including applications enabling the electronic recording of leak checks, as well as central reporting databases allowing clear monitoring of the movement of refrigerants. Another key driver for the careful

management of available refrigerants was the establishment of use bans for existing equipment, which incentivized the recovery and the use of controlled substances. She added that a smart option to avoid the build-up of HFC consumption was the use of environmentally friendly low-GWP replacements, including natural refrigerants, from the start of the refrigeration life cycle. Some member States also possessed a system which allowed equipment users to receive refunds if the refrigerants were returned for extraction or reclamation and recycling.

69. Closing the item, the Co-Chair observed that parties would be able to return to the topic in the workshop to be held before the Thirty-Sixth Meeting of the Parties in October. He encouraged parties to exchange views and consult with each other on the way forward.

V. Enhancing the global and regional atmospheric monitoring of substances controlled by the Montreal Protocol (decision XXXV/14)

70. Introducing the item, the Co-Chair recalled that, in decision XXXV/14, the Thirty-Fifth Meeting of the Parties had requested the Secretariat to provide the parties at the current meeting with information on cost estimates associated with enhancing atmospheric monitoring, and on options for sustainable funding to establish new monitoring capacities. The Secretariat's response was set out in paragraphs 41–76 of document UNEP/OzL.Pro.WG.1/46/2/Add.1 and in annexes V and VI thereto, with additional information provided in document UNEP/OzL.Pro.WG.1/46/INF/4. She also informed the Working Group that in preparing its response on the cost estimates, the Secretariat, in conjunction with the steering committee of the European Union-funded pilot project on regional quantification of emissions of substances controlled under the Montreal Protocol, had organized an online workshop to bring experts together to refine the cost estimates for establishing and operating monitoring stations.

71. Paul Newman, one of the members of the steering committee, presented the outcomes of the online workshop, as described in the background document entitled “Workshop on costs of atmospheric monitoring of gases controlled under the Montreal Protocol”, which was available on the meeting website.

72. The representative of the Secretariat presented the information pertaining to options for sustainable funding to establish new monitoring capacities, as set out in document UNEP/OzL.Pro.WG.1/46/2/Add.1.

73. All the representatives who spoke thanked Mr. Newman and Sophia Mylona for their presentations. Several representatives noted the progress that had been made in gathering the information required by the parties, saying that there was now sufficient information for a decision to be taken on the matter and for the process of enhancing atmospheric monitoring to get under way.

74. Cornelius Rhein, a member of the steering committee of the European Union-funded pilot project, thanked all those involved in the project, particularly the scientific members of the steering committee and other contributors including the secretariat of the Multilateral Fund, the Massachusetts Institute of Technology, the University of Bristol and the University of Dhaka. He requested more in-depth discussion of the possible involvement of the Multilateral Fund in the financing of the enhancement of the global network, stating that there were options additional to those included in the documents by the Secretariat that he would gladly explain.

75. In response to a question about the cost of running existing monitoring networks, Mr. Newman said that the cost of running the Advanced Global Atmospheric Gases Experiment network was about \$9 million annually in operational costs. More information about the cost of the network of the National Oceanic and Atmospheric Administration could be provided by Mr. Montzka. In response to a question about possible future stations, he said that 10 additional stations would be ideal, particularly in the regions where monitoring was lacking, but even 3 to 5 stations would be a significant improvement if they were located in the right regions. The cost of establishing a station was dependent on a number of factors, namely whether there was existing infrastructure or whether it had to be created, whether personnel were paid directly or by other organizations and whether laboratory and analysis facilities existed or services were offered in kind.

76. In response to a question about the wide range of the potential funding required to establish a new station, Ms. Mylona said that the funding estimates were rough estimates and the actual funding required would depend on the specific set-up chosen. The operating and capital costs could be as low as \$50,000 if existing facilities or an existing network were used and if personnel were on loan or provided services in kind, but the cost would be much higher if it was necessary to build infrastructure. One representative highlighted potential risks associated with currency fluctuations, inflation and other

economic factors, while another noted that costs were usually calculated on a commercial basis, but there might be increases when it was known that the client was the United Nations.

77. Questions were asked with regard to the process for taking decisions about new stations and the prioritization process. One representative expressed the view that the scientific considerations should come first, followed closely by a cost-benefit analysis. Mr. Newman said that his first priority would be the establishment of stations in regions where measurements were lacking, followed closely by host country authorization and cost. There would certainly be places in which it would be too expensive to establish a station and, if more than one station could be set up elsewhere for the same amount, then that would have to be given serious consideration. A steering committee could be established to help make such decisions.

78. Several representatives spoke in favour of the option of a step-by-step approach to establishing and maintaining a monitoring site set out in document UNEP/OzL.Pro.WG.1/46/2/Add.1. They also stressed the importance of agreeing on the level of ambition desired in the long term. One of the representatives said that she saw the benefit of both options – a step-by-step approach and a programmatic approach – depending on the speed of progress and the comprehensiveness of the programme desired. She said that the step-by-step approach would allow for a quicker start-up and a more iterative approach, whereas the programmatic approach offered potential economies of scale and greater visibility for donors. She considered a step-by-step approach better if the aim were to start work in 2024.

79. Several representatives said that they were in favour of transferring, to the General Trust Fund for Financing Activities on Research and Systematic Observations relevant to the Vienna Convention, a portion of the cash balances from either the Trust Fund for the Vienna Convention for the Protection of the Ozone Layer or the Trust Fund for the Montreal Protocol on Substances that Deplete the Ozone Layer, or perhaps a portion from each. One of them, however, expressed concern that the General Trust Fund worked on the basis of voluntary contributions and had faced the challenge over many years of ensuring that there was enough money in the Fund for its original purpose. She stressed the need to avoid undermining the existing activities of the Fund by transferring money for a new type of activity. She proposed that the available cash balances could support both the activities already mandated by the General Trust Fund and the new activities being discussed. Another representative, however, suggested that there be some kind of demarcation of the funding within the General Trust Fund so that funds provided for one purpose were not used for another. One representative drew attention to certain procedural issues that would need to be addressed. For instance, both the Vienna Convention Trust Fund and the General Trust Fund were under the responsibility of the Conference of the Parties to the Vienna Convention, which met only every three years. The mandate and the mode of operation of the General Trust Fund might also need to be examined.

80. Several representatives spoke of the desirability of cost effectiveness and optimizing limited financial resources. The proposals made were for cost-sharing mechanisms, the use of existing facilities and in-kind support. One representative proposed that the parties negotiate with the Global Atmosphere Watch of the World Meteorological Organization (WMO) on the use of stations in areas of interest to them. In response to a question about how the Secretariat was planning to engage with other organizations, Ms. Mylona said that an initial study had just been carried out to try to establish which other organizations might be approached. The list included WMO, the Global Environment Facility (GEF), the Comprehensive Nuclear-Test-Ban Treaty Organization and the Green Climate Fund. The idea was to conduct a mapping of the monitoring stations and associated facilities, such as laboratories, of such organizations and then assess whether certain stations were able to monitor controlled substances. Some representatives proposed the addition, to the network, of stations in their countries. One representative stressed the importance of considering the use of existing stations that were no longer in operation, such as one in his country, as a way of reducing costs. Another representative said that his country was geographically well placed to host a new station. One representative underscored the importance of stations being integrated within national frameworks and institutions to ensure their sustainability.

81. Some representatives expressed the view that it would be good, at least initially, to keep the financing process within the Montreal Protocol family, as it would probably be more efficient in the short term and provide parties with greater control. One representative said that, although he was of the view that there were a number of organizations, such as GEF, the Green Climate Fund and the Bezos Earth Fund, that could all deal with the financial side of enhancing the monitoring network, the parties had no institutional authority over any of those bodies. The parties would have to develop memorandums of understanding with the organizations and work out means of communicating or operating with them. Another representative also noted the many administrative considerations that related to the management of external funds and contributions. A third representative said that,

although he was interested to hear about other sources of funding, he was concerned about the sustainability of such funds.

82. One representative noted that mandating the Multilateral Fund would have to be done in a targeted way to ensure that its core function remained to support Article 5 parties in complying with their control obligations. Some representatives underscored the need to consider the additional workload for the Multilateral Fund secretariat, the additional administrative costs and the role of the Executive Committee and the implementing and bilateral agencies.

83. In response to a question about past experience of dealing with atmospheric monitoring, Ms. Mylona mentioned that the monitoring of ozone and ultraviolet radiation had been funded since the inception of the General Trust Fund established in decision VI/2 of the Conference of the Parties to the Vienna Convention to provide complementary support for the continued maintenance and calibration of the existing ground-based stations of the WMO Global Atmosphere Watch for monitoring column ozone, ozone profiles and ultraviolet radiation to address balanced global coverage. The same decision stated that consideration might also be given to supporting other activities identified by the Ozone Research Managers and in consultation with the co-chairs of the Scientific Assessment Panel and the Environmental Effects Assessment Panel. In 2014, in decision X/3, the Conference of the Parties to the Vienna Convention had established a small advisory committee to develop a long-term strategy and short-term plan for the Trust Fund and evaluate project proposals, a task that had previously been carried out by the Ozone Secretariat in cooperation with WMO. Any action regarding the monitoring of controlled substances would therefore probably require decisions by both the Conference of the Parties to the Vienna Convention and the Meeting of the Parties to the Montreal Protocol.

84. In response to a question about flask sampling and high-frequency station measurements, Mr. Newman explained that a high-frequency station could take measurements every two hours because the instrument used to do so was located at the station. Flask measurements could be made at any desired frequency, such as on a monthly, weekly or daily basis, or even more frequently. Flask measurements, however, required more human involvement so there was a diminishing return if the measurements were taken very frequently as it became much more costly. The analysis of the flasks was done in analytic laboratories using similar technology as that used for the analysis of high-frequency measurements. Mr. Newman also mentioned a number of other measurement methods, including from aircrafts or satellites, stating that they were all less successful.

85. Several representatives asked for more information about the gaps in monitoring in Africa and about the fact that African stations had been largely absent from the map shown in the presentation. Mr. Newman explained that the reason that there were no data from the newly set-up station in Rwanda related to a problem with the measuring instrument. Regarding the station on Mount Kenya, Mr. Newman explained that the information gathered at the station was used quite extensively, but the station did not collect observations on ozone-depleting substances.

86. In response to a question about the impact of natural variations on emissions and observations of the surface, Mr Newman said that the scientific community was aware that climate change would lead to changes, for example, in monsoons or the transport of emitted air over stations. Fortunately, meteorological data was of very high quality, so it was possible to gauge the effect of natural variations and changes in those variations.

87. Some representatives highlighted the need for funding, technology transfer and capacity-building to enable Article 5 parties to contribute fully to the monitoring network. Another representative stressed the importance of data-related matters in new monitoring activities, including calibration, data-sharing, peer review, data management and data carving, as well as top-down inverse modelling to complement any expanded monitoring.

88. The Working Group agreed to establish a contact group, to be co-chaired by Liana Ghahramanyan (Armenia) and Alessandro Giuliano Peru (Italy), to discuss the matter further.

89. Subsequently, the representative of the United States, speaking also on behalf of Canada, introduced a draft decision on enhancing the regional atmospheric monitoring of substances controlled by the Montreal Protocol, as set out in a conference room paper. He began by noting that the draft decision was linked to a related decision that would need to be taken by the Conference of the Parties to the Vienna Convention. It provided for a staged approach, the first stage being to identify and evaluate potential monitoring sites and the second being to move forward with the establishment of a limited number of stations. For the first stage, the Secretariat would be requested to transfer the funds required to identify and evaluate potential monitoring sites to the General Trust Fund for Financing Activities on Research and Systematic Observations relevant to the Vienna Convention, and to

continue supporting the activities of the General Trust Fund by working to map possible sites for the monitoring of controlled substances. Parties to the Vienna Convention would be invited to request the Advisory Committee of the General Trust Fund, in evaluating potential sites, to take into consideration five criteria, namely the suitability of the sites for providing regionally representative data covering areas with substantial volumes of controlled substances; the potential for a dedicated implementing partner; existing infrastructure; the coordination of data calibration; and the sharing of data between scientific monitoring stations. The Advisory Committee would also be requested to modify the terms of reference of the General Trust Fund to specifically add atmospheric monitoring of controlled substances as a purpose of the fund; modify its own terms of reference to allow it to invite additional experts and establish a subcommittee on the monitoring of controlled substances; and report on progress and any results to the Thirty-Seventh Meeting of the Parties. For the second stage, the Executive Committee of the Multilateral Fund would be requested to consider a funding modality to support a limited number of pilot projects to enhance regional atmospheric monitoring of controlled substances, guided by the scientific advice of the Advisory Committee of the General Trust Fund, and to report to the Thirty-Seventh Meeting of the Parties on work undertaken to develop such a funding modality. The proponents were keen to hear other parties' thoughts on the proposal and to discuss it further in the contact group.

90. A number of representatives, including one speaking on behalf of a group of parties, thanked the delegations of the United States and Canada for formulating a text to serve as a basis for more specific discussion on the topic, and expressed support for discussing the proposal further in the contact group. Several noted that the views expressed during the earlier discussion on the topic were well reflected in the proposed text.

91. Later in the meeting, the co-chair of the contact group reported that the group had discussed the draft decision and made good progress but had not had time to review the entire text.

92. The Working Group agreed to forward the revised draft decision on enhancing the regional atmospheric monitoring of substances controlled by the Montreal Protocol, as set out in section C of annex I to the present report, to the Thirty-Sixth Meeting of the Parties for further consideration.

VI. Presentation of the Technology and Economic Assessment Panel 2024 progress report and discussions on:

93. The Co-Chair, introducing the agenda item, drew attention to the Technology and Economic Assessment Panel 2024 progress report (vol. 1) and to the summaries of the issues set out in a note by the Secretariat (UNEP/OzL.Pro.WG.1/46/2, paras. 20–27) and an addendum thereto (UNEP/OzL.Pro.WG.1/46/2/Add.1, paras. 77–115 and annex II). She also drew attention to the interim report of the Technology and Economic Assessment Panel on the evaluation of 2024 critical-use nominations for methyl bromide and related issues (vol. 2).

94. Following an introduction by Bella Maranion, co-chair of the Panel, members of the Panel and its technical options committees summarized the findings of the Panel's 2024 progress report and of its interim report on the evaluation of 2024 critical-use nominations for methyl bromide and related issues as follows: Paulo Altoé – Flexible and Rigid Foams Technical Options Committee; Adam Chattaway – Fire Suppression Technical Options Committee; Ian Porter – Methyl Bromide Technical Options Committee; Omar Abdelaziz – Refrigeration, Air Conditioning and Heat Pumps Technical Options Committee; Helen Tope – Medical and Chemicals Technical Options Committee; and Ashley Woodcock, co-chair of the Panel – organization and work of the Panel. A summary of the presentation is set out in section D of annex II to the present report, without formal editing.

95. During the ensuing discussion, many representatives took the floor, thanking the Panel for its work and presentation and posing a number of questions, to which members of the Panel subsequently responded.

96. Questions related to refrigeration were addressed by Mr. Abdelaziz, who began by clarifying that the wording “good technology options” in the progress report referred to available and accessible technology options. In addition, a reference in the progress report to a new energy-efficiency project had been included to highlight the significant remaining scope for financing of similar projects, as just over \$5.2 million of a funding window of \$20 million had so far been allocated, and parties were encouraged to submit additional energy efficiency projects for consideration before the ninety-sixth meeting of the Executive Committee.

97. Regarding how recently updated standards IEC 6335-2-89 and IEC 6335-2-41 for commercial refrigeration would affect the introduction of flammable refrigerants, Mr. Abdelaziz said that they allowed for larger flammable refrigerant charge and would expand the use of flammable refreshments

in refrigeration, air-conditioning and heat pump applications. The updated standards would enter into force in the near future and would be covered in the 2026 assessment report. He noted that hydrocarbons were generally widely adopted in residential refrigerators and self-contained commercial refrigeration in some parties, and the new standards could be expected to result in expansion towards smaller-size air-conditioning applications.

98. Responding to questions on energy efficiency, Mr. Abdelaziz referred representatives to previous task force and working group reports containing detailed information on the processes for improving energy efficiency when converting air conditioning and refrigeration. He noted that assessing the energy efficiency of air-conditioning and home refrigeration products would require a focus on the equipment itself, in particular equipment and component design, which had not been possible for the purposes of the May 2024 progress report. In terms of refrigerant performance related to the thermal performance and energy efficiency, Mr. Abdelaziz referred representatives to previous Energy Efficiency Task Force reports, as well as resources available on the public website of the Air Conditioning, Heating, and Refrigeration Institute public website and articles published by the United States Department of Energy. Regarding refrigerant blends, he drew attention to section 6.2.2 of the progress report, where all 18 new blends were listed, and to the 2022 assessment report, where all other refrigerant blends were listed, thus making all blend compositions available to parties, along with GWP, ozone-depleting potential and other pertinent information. He also noted that the same standards applied to both single component refrigerants and refrigerant blends.

99. With regard to electric vehicle cooling, Mr. Abdelaziz explained that battery electric vehicles were a challenge because cooling of the electric batteries had to be considered as well as cabin comfort. That called for a holistic view of the system that would provide cooling and heating and sometimes act as a heat pump, not just an air conditioner. Therefore, rather than just considering mobile air conditioning using HFO-1234yf, the Panel had considered all thermal management opportunities with a view to synergies, leading to the creation of the new concept of electric vehicle thermal management. With transport refrigeration, while the industry had moved to R-452a, which was still a relatively high-GWP alternative, additional work was being done on carbon dioxide (R-744) and hydrocarbon (R-290).

100. Answering a query regarding the processes that should be followed for decommissioned halons other than halon 1301, Mr. Chattaway said that the destruction of halon 1211 and 2402 should be avoided. There were numerous companies specializing in the recycling of halon and other fluorocarbons at the global level that could facilitate the collection of such materials and shipment to new users, thereby overcoming any issues associated with transboundary shipment.

101. Several representatives had questions regarding the 26 per cent emission factor used for halons. Mr. Chattaway began by clarifying that it reflected total emissions across the life cycle of the halon 1301 manufactured, transported and used as feedstock. The 26 per cent figure was not implausible but was not certain either, and the Panel would very much like to have more information to enable it to refine its estimate. The Panel would also welcome more historical data, to give it a better feel for how to look at and examine the data. Turning to the question of why the Fire Suppression Technical Options Committee felt that emissions over the last few years could not be attributed to emissions from banks, he said that the emissions were simply too large. Banks were finite, and a large emission representing a significant fraction of the banks would reduce the size of the banks and thus the new baseline. In addition, it would be physically impossible for the emissions curve to go up and down against the same baseline, meaning that the bulges seen in the curve had to be attributable to something other than emissions from a finite bank.

102. Regarding the 26 per cent emission factor, Ms. Tope, responding to a more general question of whether the Panel had ever seen known processes with such a high factor, began by recalling that emission factors now being applied by the Panel were for modern-day regulated manufacturing. In addition, the Panel relied on modelling to estimate emission factors for a broad range of substances and processes, intended to assist in policy decision-making. Nevertheless, the estimates were not exact, although they could be refined with new information. She also drew attention to the fact that, as mentioned in the Panel's 2024 report, the most likely emission factors would probably not be applicable for the use of halon 1301 and fipronil production, owing to the differences in how controlled substances were used as feedstocks and the processes used. For fipronil, the relevant process flow sheets and patents relating to the process routes to produce fipronil indicated differences in the use of halon 1301 feedstock; in small-tonnage production, halon 1301 was being fed in excess, generating excess halon 1301 that would need to be recovered, recycled or incinerated. It was plausible that the emission factor for such a process would be higher than the Panel's generic emission factor. The same could be said for any small production facility, semi-tech production facility, pre-commercial pilot manufacturing facility or open process. The Panel aimed to estimate the most

likely emission factors but there would always be circumstances, such as in the production of fipronil, where an emission factor did not apply.

103. Turning to the question of the derogation of 12 years plus 18 months for potentially critical applications like aviation fire suppression, Mr. Chattaway noted that fire protection on aircraft was challenging. Many of the potential candidate agents were not efficient enough to be used on aircraft, and the remaining candidates were largely included in the per- and polyfluoroalkyl substances (PFAS) group of chemicals. He said that, in his view, the derogation period, while welcome, might not be long enough. He agreed with a comment by one representative that the longevity of halon banks should be extended for as long as possible. Safety and security considerations, which the Panel referred to as performance factors, made halon very difficult to replace, particularly in aircraft applications.

104. Responding to the questions and comments related to foams, Mr. Altoé first addressed a request for information regarding suitable foam blowing agents for use in countries with high-ambient-temperature environments, saying that HCFC-141b was effective but required precautions, in particular when using it in remote areas, as it could sometimes boil off from the polyol mixture. A foam with similar levels of performance prepared with a polyol mixture containing HCFC-141b could be produced by combining HFOs with a larger amount of water and then could be used in environments with a high ambient temperature, as well as with methyl formate or methylal, which would ensure that the mixture remained cost-effective. Overall, the science of formulations had progressed considerably in the past two years, and there were new additives, meaning surfactants and catalysts, that could now be used to produce fairly stable formulations. Much progress had been made on water-blown formulations, which were very safe and could be competitive, and should be the first option considered when seeking new blowing agents or replacements for either CFCs or HFCs. He cautioned, however, that using hydrocarbon formulations as a spray could be a serious hazard and should be monitored.

105. Addressing comments regarding the limited availability of hydrochlorofluoro-olefins (HCFOs) and HFOs, Mr. Altoé observed that HCFO producers appeared to be keen to supply the market, had six plants up and running and claimed that their materials were available globally. Prices nevertheless reflected the limited availability of such materials.

106. Responding to a comment regarding the availability in one party of a process to recover old foams, destroy the ozone-depleting substances in them and reuse the foam matrix to make new foam, Mr. Altoé confirmed that the Panel was aware of such processes. The Flexible and Rigid Foams Technical Options Committee was monitoring a number of shredders installed globally, but there were unfortunately not many of them. Foams could also be recycled via chemolysis, to create a new polyol to be fed into the circular economy. The Committee was also monitoring how foams from end-of-life buildings could be put back into the circular economy, but they were only used in a few cases to produce new blocks, roofs and panels. Addressing a concern regarding the phase-down and eventual phase-out of HFC-152a, Mr. Altoé said that one alternative was to use carbon dioxide with an oxygenated blowing agent, although that approach required a significant investment, and a lower-cost approach was to use HFO-1234ze in combination with an oxygenated blowing agent to reduce the cost of the extruded polystyrene.

107. Addressing methyl-bromide-related questions and comments, Mr. Porter first responded to a query regarding a gap between methyl bromide production and consumption for quarantine and pre-shipment uses. He noted that the Panel, which merely used the data recorded by the Secretariat, was not well placed to evaluate the gap. That said, consumption was basically production plus imports minus exports, and production should be easy to measure, although it was difficult to monitor imports and exports. Addressing the gap would require the parties to have processes in place to record imports and exports and improve their reporting.

108. Addressing a comment regarding the use of hydrogen cyanide (HCN), a highly toxic product, as an alternative for pre-shipment uses, Mr. Porter said that it was used at very low levels and that companies registering such products ensured that they were used safely. HCN was generally used for empty structures, with people kept well away, as was the case for most fumigants. In general, the health and safety and environmental agencies of the various countries, not the Panel, assessed product applicability: if a product was registered and effective, the Panel considered it to be a valid alternative.

109. Ms. Pizano, addressing comments on pre-shipment uses of methyl bromide, affirmed that the Methyl Bromide Technical Options Committee considered regional availability, logistics and technical and economic feasibility to be key issues in its assessment of alternatives. The Committee welcomed any relevant information from parties in that respect. Speaking about the Committee's suggestion that parties consider removing the exemption for pre-shipment uses of methyl bromide, she said that the Committee was aware of instances where the use of methyl bromide did not fit the definition of

quarantine and pre-shipment, in which case the use would be considered non-compliant. The concern was that there was sometimes confusion or insufficient understanding regarding the use of methyl bromide. In suggesting that the parties consider removing the exemption for pre-shipment uses, the Committee merely wished to underscore that it had identified readily available, technically and economically feasible alternatives for pre-shipment uses of methyl bromide.

110. Ms. Pizano also responded to a question regarding the handling of empty cylinders of methyl bromide, which she said was an ongoing issue. She agreed that finding a way to destroy leftover methyl bromide in an economically feasible manner was likely to be difficult, and suggested that interested parties meet with the Methyl Bromide Technical Options Committee in the margins of the current meeting to discuss the matter, with a view to finding a more general solution.

111. On the topic of metered-dose inhalers (MDIs), one representative stressed the need to maintain their availability until safe alternatives that were economically feasible for all those who needed them became available. Addressing the issue of the availability of alternatives, Ms. Tope informed the Working Group that three companies had indicated that their clinical studies for inhalers using alternative propellants would be completed in 2025. Based on that information, the Panel's best estimate, given regulatory processes, was that alternative inhalers would not reach the market before 2026. Even then, they would enter the market slowly because of the need to ramp up production, and transitioning all inhalers to lower-GWP alternatives could be expected to take a long time.

112. Many representatives posed questions related to PFAS, including trifluoroacetic acid (TFA). Ms. Tope said that the Panel continued to report on PFAS regulations being developed at the national level but was currently unable to provide information on their potential impact, as many such regulations were still under development. She confirmed that the Panel was aware of the recent proposal in the European Union to regulate TFA due to reproductive toxicity effects as well as the underlying studies for that, and was monitoring developments. She drew the parties' attention to the fact that, owing to the uncertainties in the regulatory environment, a number of companies had indicated that they were delaying decision-making pending the outcome of policy developments. Such delays were in turn delaying the phase-out of ozone depleting substances and could also affect the phase-out of high-GWP products. The Panel was monitoring the situation and would update parties as needed.

113. One representative, speaking on behalf of a group of parties, spoke about the regulatory process under way for PFAS in his jurisdiction, which applied the precautionary principle as the basis of environmental law. The same principle had also been applied to the Vienna Convention. He took issue with the mention in the Panel's report of the fact that the legislation was creating uncertainty, saying that the regulatory approach was intended to create clarity for industry and certainty for the public, who were concerned about the forever chemicals and their health effects. With respect to the status of the regulatory process in his jurisdiction, an extensive stakeholder consultation had taken place and committees on risk assessment and socioeconomic analysis were currently assessing the proposals at the sectoral level. The process was a comprehensive assessment of where PFAS would remain essential for society. Exemptions were already foreseen for fire suppressing agents for aviation, industrial precision cleaning fluids for some aerosols and spray foams, and more exemptions could still be added. That said, he took issue with the Panel's assertion that the HFC phase-down could be delayed because of the PFAS issue, saying that sufficient suitable alternatives, many of which were not PFAS, were already available to ensure the phase-out. Similarly, in his view it was incorrect to say that the PFAS issue would slow the roll-out of heat pumps, as alternative equipment was coming into the market, and the restrictions placed on heat pumps with regard to high-GWP refrigerants was actually spurring development innovation, such as the small monoblocks with propane that had only recently come on the market but were now widely available in his party.

114. Janet Bornman, co-chair of the Environmental Effects Assessment Panel, addressed a question regarding the health risks of PFAS and TFA in relation to HFOs. She explained that the many studies done in animals on a laboratory scale had not found toxicity at the levels of TFA found in the environment, and it did not currently seem that the amount of TFA in the environment caused a toxic response; however, because TFA was very persistent in the environment, the potential for increased toxicity to animals, including humans, continued to be assessed. There was a lot of uncertainty about measurements, source and fate, including transport from the atmosphere to water bodies. Part of the uncertainty for characterizing amounts of TFA stemmed from the fact that it was not only from the breakdown of CFC replacements but also potentially from natural sources, which were very difficult to measure. At the same time, there were point sources of high TFA levels, namely factories producing trifluoromethyl group (CF₃) moiety compounds for different uses, such as the production of pharmaceuticals, pesticides and plastics. CF₃ moiety was used because it gave stability to many compounds, and at such factories it was a large point source of TFA, which was of concern to people

working in or living near such factories and perhaps drinking the local water or eating plants, which also absorbed TFA. At the same time, TFA taken up by organisms was passed out and did not accumulate in the organism; however, research had not yet determined whether damage might be done during transport through the body.

115. One representative spoke about the need for qualified experts for the technical options committees, suggesting that more effort be made to reach out to experts in developing countries, either through existing committee members, who might be aware of experts in developing countries, or by soliciting nominations from developing country parties. Mr. Woodcock welcomed the comments and encouraged representatives to look at the Panel's matrix of needed expertise and enter into bilateral discussions with that Panel about potential candidates. He also pointed out that the experts worked on an entirely volunteer basis but that the travel of experts from Article 5 parties was funded. Travel for experts from parties not operating under paragraph 1 of Article 5 (non-Article 5 parties) was not currently funded, but with the new difficult funding environment, the Panel was now requesting that travel funding be provided for all experts.

A. Nominations for critical-use exemptions for methyl bromide for 2025

116. Introducing the sub-item, the Co-Chair recalled that the Technology and Economic Assessment Panel had reported only one nomination for a critical-use exemption, which had been submitted by Canada for 2025. The Methyl Bromide Technical Options Committee's evaluation of the nomination was provided in volume 2 of the Panel's 2024 report and summarized in paragraphs 80 to 85 of document UNEP/OzL.Pro.WG.1/46/2/Add.1.

117. The representative of Canada thanked the Panel and the Methyl Bromide Technical Options Committee for their work in reviewing the Canadian nomination for a critical-use exemption in relation to the production of strawberry runners by a single grower on Prince Edward Island, where chemical alternative fumigants remained unavailable. The nomination of 2.85 tons of methyl bromide for 2025 was 26 per cent lower than the approved amount for 2024 and significantly less than the 5.3 tons that would be required to fumigate the entire acreage under a business-as-usual scenario. The reduction was based on the use of indoor soilless production for a significant portion of the operation on the way to a full transition to soilless production in 2026. In 2023, after four seasons of positive research trials, Canada had implemented a policy-based approach to the phase-out of methyl bromide that would phase out the last remaining critical-use exemption by 2026, and considered indoor soilless production to be a suitable non-chemical technical alternative to fumigation with methyl bromide for the grower's operation, despite the high capital investment required. Consequently, the nomination for 2025 would be the final one for that application. He said that he looked forward to the final recommendation on the nomination and expressed his willingness to engage in the margins of the current meeting with any parties that might have questions regarding the nomination.

118. Several other representatives, including one speaking on behalf of a group of parties, thanked the Methyl Bromide Technical Options Committee for its report and presentation. Two of them, including one speaking on behalf of a group of parties, expressed appreciation for the progress made by Canada in phasing out its use of methyl bromide for strawberry runners, with one recognizing the transition as a difficult one that entailed considerable costs for the grower. She also indicated in the case of her country, the registration of a methyl iodide mixture by the registration authority in December 2023 had enabled its use for soil fumigation for strawberry runners in 2024 and more information on its success would be available later in the year. The representative speaking on behalf of a group of parties also welcomed the commitment by Canada not to submit any further nominations.

119. Some representatives took the opportunity to speak about their national situations with regard to methyl bromide. The representative speaking on behalf of a group of parties expressed concern regarding the fact that, despite the Panel's clear indication that alternatives existed for most pre-shipment uses, methyl bromide continued to be used in significant quantities for quarantine and pre-shipment purposes and for other uses. She stressed that continued action was critical, especially as any reduction of methyl bromide very quickly had an impact in the atmosphere, and said that her delegation intended to raise the point again in upcoming meetings.

120. One representative questioned the need for separate reports by the Methyl Bromide Technical Options Committee and suggested that its future updates be provided in the Panel's regular progress report.

B. Energy efficiency (decision XXXV/10)

121. Representatives thanked the Technology and Economic Assessment Panel for its comprehensive update on energy efficiency in the progress report. All the representatives who took the floor stressed the importance of policies and measures to enhance energy efficiency in the phase-down of HFCs. Access to efficient low-GWP cooling equipment was becoming more and more important in a rapidly warming world. One representative observed that around 30 per cent of the global population was exposed to deadly heat for at least 20 days a year, yet less than 10 per cent of people living in the hottest parts of the world had air conditioners, while millions of people lacked safe, reliable refrigeration for health supplies and food storage.

122. One representative suggested that the Technology and Economic Assessment Panel report should not focus on initiatives taken under other platforms, such as the Global Cooling Pledge, but should focus on energy efficiency opportunities during the HFC phase-down.

123. Another representative noted the Panel's conclusion that with improved energy efficiency and a faster phase-down of HFCs, up to 60 per cent of predicted emissions from the cooling sector could be avoided by 2050. With such a large potential benefit, it was crucial to seize the opportunity. He said that he was pleased to see the topic attracting growing political attention, for example through the Global Cooling Pledge adopted at the twenty-eighth session of the Conference of the Parties to the United Nations Framework Convention on Climate Change, in 2023, which at the time of the report had 70 signatories. He also welcomed the decision of the Executive Committee of the Multilateral Fund to make \$100 million available over the next three years for the operational framework of energy efficiency in the refrigeration and air-conditioning manufacturing sector, with the possibility of augmenting it. He encouraged countries with such manufacturing to include energy efficiency projects in their current and future Kigali implementation plans.

124. Another representative informed the Working Group that as part of her country's commitment to reaching net zero greenhouse gas emissions by 2050, its Kigali implementation plan included strategies for phasing down HFCs, including improved energy efficiency in key industrial sectors such as refrigeration, air conditioning and heat pumps. She recognized that different regions had adopted various approaches, policies, action plans and regulatory frameworks to achieve the common objective of increasing access to sustainable cooling, and urged the Technology and Economic Assessment Panel to continue updating its information in this regard.

125. A number of representatives of low-volume-consuming island countries drew attention to the life-threatening situation faced in those countries. Despite their efforts to provide access to cooling and strengthen cold chains, they lacked resources and technical capacity to keep up with the pace of global warming, while at the same time the increased demand for cooling was crippling their energy systems.

126. One representative expressed concern that under the pilot window for energy efficiency in the Multilateral Fund, only \$6 million of the total of \$20 million had so far been allocated, mostly for relatively small, non-investment projects. Stressing that it was now time to explore ways to enhance the quality and scope of project proposals and future support under the operational framework, she proposed a number of initiatives: considering ways to support regional centres of excellence, on the model of the Africa Centre of Excellence for Sustainable Cooling and Cold-Chain Systems; increasing synergies between HFC phase-down and energy efficiency by encouraging the inclusion of more energy efficiency strategies in Kigali implementation plans; preparing a practical manual on energy efficiency measures for use by national ozone units and implementing agencies to help guide the formulation of projects and national plans; and strengthening the institutions of the Montreal Protocol, including the Secretariat, the implementing agencies and national ozone units, with energy efficiency expertise.

127. Another representative informed the Working Group that in his country 46 per cent of electricity was used in unitary air-conditioning systems and up to 60 per cent for refrigeration and air-conditioning together; furthermore, no less than 95 per cent of the electricity generated came from petroleum-based sources such as diesel. That fact demonstrated the huge mitigation potential of the refrigeration and air-conditioning sector, especially from addressing indirect emissions, which were estimated to account for 80 per cent of the gains from energy efficiency measures. His country had already implemented a number of policies, including minimum energy performance standards for that sector. He also noted that the Technology and Economic Assessment Panel report had omitted the approach adopted by the Caribbean Community (CARICOM) through the Caribbean Regional Organization for Standards and Quality, which had developed regional standards, including minimum energy performance standards for refrigeration and air-conditioning appliances.

128. While he welcomed the new funding window in the Multilateral Fund, he regarded the sums available as grossly insufficient; furthermore, the window only addressed one sector, which was not relevant to countries like his. He expressed the hope that further decisions would be taken to allow additional funding to be made available for low-volume-consuming countries. Another representative agreed, calling for the provision of more technical and financial support for the development and implementation of energy efficiency activities.

129. One representative noted the Panel's advice that refrigeration and air-conditioning and heat pump equipment using low- and medium-GWP refrigerants with enhanced energy efficiency was now available in all sectors but not necessarily in all countries. She called for the establishment of increasingly ambitious minimum energy performance standards and other energy efficiency policies by countries to help drive the penetration of new energy-efficient technologies. Identifying the life-cycle benefits of energy efficiency to consumers and the broader economy, as well as well-directed regulation, would also act as drivers. She observed that many ideas discussed in the reports of the Technology and Economic Assessment Panel and the 2023 workshop on energy efficiency had been acted upon. The Executive Committee now enabled low-volume-consuming countries to augment their management plans by training technicians to integrate servicing for energy efficiency. The funding window for pilot energy efficiency projects would help countries and implementing agencies to learn by doing in relation to developing, assessing, implementing and reporting on HFC phase-down projects with energy efficiency elements; she encouraged countries to submit projects under that window. She looked forward to the Executive Committee carrying out more work on the assembly sector and on non-investment elements in relation to those funding modalities.

130. One representative from a high-ambient-temperature country said that more and more countries would fall into that category as global temperatures rose; in his country the temperature had reached 54 degrees Celsius in the previous week. The situation posed particular challenges from the very high demand for cooling and from degraded performance of appliances. He noted that the Gulf Cooperation Council countries were cooperating on the issue by developing unified regulation for energy consumption and a unified energy labelling system. Other initiatives included developing seasonal minimum energy performance standards and introducing building codes with very high insulation parameters and indicators, including for glass. He called on the Technology and Economic Assessment Panel to examine the question of engagement with end users as well as consult with equipment manufacturers and suppliers to understand demand and supply.

131. Another representative drew attention to the findings of the Technology and Economic Assessment Panel report that leak prevention was of importance to maintaining energy efficiency. He said that he looked forward to receiving further information from the Panel, and pointed out that it could continue to report on the matter in its progress reports.

132. Subsequently, the representative of Grenada introduced a draft decision on strengthening the enabling environments to enhance energy efficiency in the cooling sector while implementing the Kigali Amendment, explaining that it essentially reflected views and concerns expressed during the discussion in plenary session. Thus, the proposal included requests to the Executive Committee aimed at strengthening the capacity of national ozone units and implementing agencies and providing additional support on energy efficiency, taking into consideration the unique circumstances and challenges of low-volume and very low-volume-consuming countries. It also provided for the additional support provided to be specifically used for project preparation and implementation in relation to energy efficiency in the HFC phase-down. Finally, the Technology and Economic Assessment Panel was requested to continue updating parties on energy efficiency issues, also ensuring that the unique circumstances and challenges of low-volume- and very low-volume-consuming countries were taken into consideration. Acknowledging that the late submission of the proposal precluded a detailed review of the text at the current meeting, he expressed the hope that the draft decision could be forwarded for consideration at the Thirty-Sixth Meeting of the Parties.

133. The representative of the Federated States of Micronesia, speaking as the co-sponsor of the draft decision, added that while good progress had been made over the past years on building greater understanding of and capacity to address energy efficiency in the context of the HFC phase-down, more work remained to be done. The draft decision was intended as a step forward in overcoming the challenges and making the most of opportunities to address climate change while also supporting energy security, food security and access to cooling. The co-sponsors looked forward to working collaboratively with other parties to refine the ideas outlined in the submission.

134. During the ensuing discussion, a number of representatives, one of whom spoke on behalf of a group of parties, welcomed the draft decision, with several of them, including the one speaking on behalf of a group of parties, underscoring the importance of paying attention to energy efficiency in

the context of the HFC phase-down. While a few, including the representative speaking on behalf of a group of parties, noted the late submission of the text, all indicated their willingness to discuss it at the Thirty-Sixth Meeting of the Parties. Individual representatives expressed particular appreciation for the mention of the development of a robust pipeline of high-quality project proposals, which would be key to maximizing climate benefits, and the special attention paid to low-volume and very low-volume consuming countries, which could be subject to heightened risk and additional challenges.

135. One representative recalled that there were ongoing discussions on the matter in the Executive Committee, which, at its ninety-fourth meeting, had agreed to a \$100 million funding window for energy efficiency projects, with a focus on the manufacturing sector, and intended to hold further discussions at its ninety-fifth meeting, including on a revolving fund potentially relating to end-user projects and on non-investment issues, some of which were reflected in the current submission. It would be important, he said, to maintain a focus on achieving additional progress at the level of the Executive Committee. Another representative echoed those comments, noting the importance of ensuring that the draft decision was aligned with the guidelines for the \$100 million funding window under the Multilateral Fund.

136. The Working Group agreed to forward the draft decision on strengthening the enabling environment to enhance energy efficiency in the cooling sector while implementing the Kigali Amendment, as set out in section D of annex I to the present report, to the Thirty-Sixth Meeting of the Parties for its consideration.

C. Panel membership changes

137. Introducing the sub-item, the Co-Chair drew attention to table 5 of document UNEP/OzL.Pro.WG.1/4/26/Add.1, which listed the Panel members whose terms of office would expire at the end of 2024 and whose reappointment required a decision by the Meeting of the Parties. The members of the technical options committees whose terms would expire at the end of 2024 but whose reappointment did not require a decision by the Meeting of the Parties were listed in annex III to the same document. As nominations to the technical options committees could be made at any time to the Panel and technical options committee co-chairs, the question of such nominations would not be considered by either the Working Group or the Meeting of the Parties.

138. The Co-Chair reported that no nominations for the Panel, including for the co-chairs of the technical options committees, had been received to date, but allowed that nominating parties usually waited until the Meeting of the Parties to submit their nominations, and said that the Secretariat would post the nominations on the meeting website as they were received. He encouraged interested parties to consult with each other informally and with Panel members in the margins of the current meeting, with a view to deciding on nominations at the Thirty-Sixth Meeting of the Parties.

D. Any other issues

139. No other issues were raised.

VII. Climate-friendly alternatives for metered-dose inhalers (UNEP/OzL.Pro.35/12, para. 251)

140. Introducing the item, the Co-Chair recalled that, at the Thirty-Fifth Meeting of the Parties, during the presentation by the assessment panels on their synthesis report of the 2022 quadrennial assessment, one representative had requested that the issue of the use of alternative substances in MDIs be added to the agenda of the current meeting of the Open-ended Working Group. Section 5.9 of the 2024 Technology and Economic Assessment Panel progress report provided updates on MDIs and other aerosols, and the key messages of the report of the Medical and Chemicals Technical Options Committee were reproduced in annex II to document UNEP/OzL.Pro.WG.1/46/2/Add.1.

141. One representative, speaking on behalf of a group of parties, expressed gratitude for the inclusion of the item on the agenda. He explained that several manufacturers in his party had announced that they would start introducing new low-GWP propellants in 2025 and would convert their entire production by 2030. The first applications to the European Medicines Agency were expected before the end of 2024. The report of the Technology and Economic Assessment Panel had indicated that low-GWP propellants were also starting to be produced in other countries, including some Article 5 parties, and the Panel had made clear, in its presentation, that at least 10 companies globally were considering or introducing the new propellants, with availability from 2026 in Article 5 parties.

142. Accordingly, the medical approval processes needed to be well prepared by the relevant authorities and companies, which was a long process, requiring coordination between the stakeholders, as well as environmental authorities, and it should be possible to facilitate the process, for example by sharing application data between countries. Some medical agencies had already started to discuss the matter, including with industry, and he stressed that it would also be important to raise awareness among policymakers on the new options. While countries were in different positions – some were manufacturers, some exporters, many only importers – patients in all countries would benefit from a smooth transition. His delegation had prepared a proposal for a draft decision that he wished to introduce it when it became available on the meeting website.

143. All the representatives who spoke agreed that it was an important and complex topic needing careful consideration. They cited the many issues that needed to be considered, with the aim of maintaining the availability of MDIs for patients and ensuring a smooth transition to alternatives, including not just developments by industry but also environmental regulation, the security of supply and cost of pharmaceutical-grade HFCs and the acceptability to patients of alternatives. Lessons could be learned from the transition away from chlorofluorocarbon (CFC) MDIs in the early years of the Montreal Protocol. They welcomed the extensive information contained in the reports of the Technology and Economic Assessment Panel and said that they would welcome further updates.

144. One representative of an Article 5 party observed that 10 per cent of his country's population suffered from asthma and needed to use MDIs. His country was currently conducting studies on possible alternative propellants, but he expected the costs of converting production lines to be significant, and he said that he would appreciate assistance from the Multilateral Fund.

145. Other representatives, however, said that the Kigali Amendment had not been prescriptive about the uses of HFCs that parties should phase down first. Given that, in most countries, the consumption of HFCs for MDIs was a very small proportion of total consumption, and also that the transition to low-GWP propellants was only in its early stages – companies were mainly considering carrying out research and development, while only a few were conducting trials – it was not clear whether the Meeting of the Parties needed to reach any particular decision at this stage, although further information on the issue would certainly be welcome. Nevertheless, they declared themselves ready to discuss the proposed draft decision when it became available.

146. Subsequently, the representative of the European Union presented a conference room paper containing a proposed draft decision prepared by his delegation. It was designed to support the introduction of low-GWP MDIs, ensure that the relevant approval processes were well prepared and encourage global coordination between environmental and medical authorities and industry to make the transition as smooth as possible.

147. In the draft decision, the work done by the Technology and Economic Assessment Panel and its Medical and Chemicals Technical Options Committee was noted with appreciation. The fact that suitable propellant-free alternatives to MDIs were already available for many patients, and that MDIs with low-GWP propellants had been developed and were expected to enter the market in some countries from 2025 onwards was also noted. Parties were encouraged to promote coordination between their national environmental and health authorities, to liaise with companies producing MDIs in their countries with a view to encouraging them to seek approval for MDIs with low-GWP propellants, and to engage with their medical agencies to reach out to their counterparts in other countries to facilitate approval processes. He concluded by stating that he would welcome the establishment of a contact group to discuss the proposal in more detail.

148. A number of representatives expressed their willingness to join such a contact group, although some wondered whether the discussion might be premature. One expressed the hope that the group could take into account other issues that had been mentioned in the Technology and Economic Assessment Panel progress report and the quadrennial assessment from the Medical and Chemicals Technical Options Committee and raised in the earlier discussion.

149. Other representatives voiced doubts about the need for a decision or a contact group. In the light of the challenges faced by Article 5 parties, in particular, in terms of the technical feasibility and economic viability of alternative propellants for MDIs, given that alternatives were only in a very early stage of development and that many parties had other priorities for phasing down HFCs, they said that a discussion on the matter at the current meeting would not be useful.

150. The Working Group agreed to establish a contact group, to be co-chaired by Idris Abdullahi Ishaka (Nigeria) and Henry Wöhrschimmel (Switzerland), to discuss the matter further.

151. Subsequently, reporting back on the work of the contact group, the co-chair of the contact group said that while brackets remained in the draft decision, good progress had been made and the co-chairs recommended that parties pursue the discussion.

152. The Working Group agreed to forward the revised draft decision on measures to facilitate the transition to metered-dose inhalers with low-global-warming-potential propellants or other alternative products, as set out in section E of annex I to the present report, to the Thirty-Sixth Meeting of the Parties for further consideration.

VIII. Future availability of halons and their alternatives (UNEP/OzL.Pro.35/12, para. 159)

153. Introducing the item, the Co-Chair recalled that, in 2023, during both the forty-fifth meeting of the Open-ended Working Group and the Thirty-Fifth Meeting of the Parties, a number of representatives had expressed concern about the information provided in the 2022 quadrennial assessment report and the 2022 progress report of the Fire Suppression Technical Options Committee on the long-term availability of halons and the revisions to the predicted timelines for running out of halons. Several representatives expressed the view that those issues deserved careful consideration. Owing to time constraints at the meetings, however, parties had agreed to include the item on the agenda of the current meeting. She also reminded representatives of the updates on the topic included in the 2024 progress report of the Technology and Economic Assessment Panel.

154. The representative of Canada, speaking also on behalf of Australia and the United States of America, introduced a proposal for a draft decision, set out in a conference room paper. He explained that it was clear that parties viewed the issue as an important topic in the light of the considerable uncertainty over the long-term availability of halons, as well as some new questions regarding potential sources of unknown emissions of halon-1301. Other concerns included the loss of institutional memory related to halon management, the destruction of halon banks as part of carbon credit programmes, and the linkages between feedstock uses of halon-1301 and emissions.

155. Accordingly, the proposed draft decision urged parties to refrain from any deliberate destruction of recovered and recycled halons unless they could not be returned to an acceptable purity for subsequent reuse, and to retain recovered and recycled halon for anticipated future needs. It also urged parties that restricted imports or exports of recovered halons to review their regulations with a view to facilitating the transboundary movement of recovered halons, and urged parties to raise awareness of the importance of sustainable management of halons. Finally, it requested the Secretariat to liaise with relevant international organizations about the importance of sustainable management of halons, invited parties to submit information on feedstock production, use and, if available, related emissions of halon-1301 to the Secretariat, and requested the Technology and Economic Assessment Panel to assess the information submitted. He looked forward to discussing the proposal with all interested parties.

156. The Working Group agreed to establish a contact group, to be co-chaired by Ali Tumayhi (Saudi Arabia) and Andrew Clark (United States of America), to discuss the matter further.

157. Subsequently, the co-chair of the contact group reported that, owing to time constraints, it had not been possible for the group to conclude its work. The Working Group therefore agreed to resume discussions on the future availability of halons and their alternatives at the Thirty-Sixth Meeting of the Parties, on the basis of the draft decision set out in section F of annex I to the present report.

IX. Possible compliance deferral for Article 5, group 2 parties: technology review by the Technology and Economic Assessment Panel pursuant to paragraph 5 of decision XXVIII/2

158. Introducing the item, the Co-Chair recalled that, in paragraph 5 of decision XXVIII/2 related to the amendment phasing down HFCs, the Technology and Economic Assessment Panel had been requested to conduct a technology review four or five years before 2028 to consider a compliance deferral of two years from the freeze date of 2028 for Article 5, group 2, parties to address growth above a certain threshold in relevant sectors. He drew attention to the response of the Panel to that request, which was set out in chapter 8 of the Panel's 2024 progress report, and the summary of that response, set out in the note by the Secretariat on issues for discussion by and information for the attention of the Open-ended Working Group of the Parties to the Montreal Protocol at its forty-sixth meeting (UNEP/OzL.Pro.WG.1/46/2/Add.1).

159. The Open-ended Working Group heard a presentation on the response of the Technology and Economic Assessment Panel to the request in paragraph 5 of decision XXVIII/2. The presentation was delivered by Ms. Maranion and Suely Carvalho, co-chairs of the Panel's working group on decision XXVIII/2, paragraph 5, and by Mr. Abdelaziz, co-chair of the Refrigeration, Air Conditioning and Heat Pumps Technical Options Committee. The presentation is set out in section C of annex II to the present report.

160. Responding to queries regarding the sources of information for the report, including regarding the statement that some Article 5 parties had limited accessibility to alternatives, Mr. Abdelaziz said that, as there had been limited time and commercial information available to the Panel, the Panel had applied a methodology of contacting experts in the respective parties and obtaining information directly from industry at the local level, where possible. In that regard, Ms. Maranion added that, since 2016, Article 5, group 2, parties had been proactive, including in terms of minimum energy performance standards and equipment adoption.

161. Regarding a query on the low rates of adoption of alternatives in the air-conditioning sector in some Article 5 parties, Mr. Abdelaziz noted that the Panel had included information on the topic in previous reports but said that it had not been in the remit of the Panel for the 2024 report to consider adoption limitations. The Panel had instead focused on reporting on technology that was technically feasible and available in all markets, such as propane in mini split air-conditioning units or HFC-32 in larger applications. Furthermore, he noted that, as the transport refrigeration industry was global, it had been important to ensure that the alternatives listed for Article 5, group 2, parties were those most commonly used globally, such as R-452A, although other lower-GWP alternatives were being developed.

162. Mr. Elassaad, responding to queries as to why the specific challenges facing Article 5, group 2, parties with high ambient temperatures had not been covered in the report, such as the energy efficiency of products using alternatives, said that the Panel had in fact found that the same challenges were also faced by Article 5, group 1, parties with high ambient temperatures and so the topic did not fall within the remit of the report.

163. In response to a request for clarification of some of the terms used in the report, Mr. Elassaad said that, as the Panel had not had access to comprehensive market data, it had used the broad term "growing use" to reflect the fact that there was a high level of dynamism in the market and that the Article 5, group 2, parties were all at different stages of acceptance of the technologies. With regard to the difference between the terms "availability" and "accessibility", the former referred to the situation at the global level and the latter to the situation at the national level. Mr. Abdelaziz added that the wording "technologically proven" signified that the technology existed and could work in Article 5, group 2, parties, including in countries with high ambient temperatures. He noted that equipment with a capacity of less than 5 tons that used alternative refrigerants, including those with lower GWP, was already on the market in Article 5, group 2, parties. Turning to the larger capacity systems needed in residential units in some Article 5, group 2, parties, Mr. Abdelaziz said that, while he acknowledged that there were challenges in that regard, under the new international standards IEC 6335-2-40 and ISO 5149, the use of larger charges of refrigerants categorized as A2L (mildly flammable), which previously had been considered unsuitable for countries with high ambient temperatures, were now possible, thanks to better knowledge as to how to handle such refrigerants safely, including through the design of systems ensuring safe containment and sound operation.

164. Mr. Abdelaziz responded to a query on concerns raised by implementing agencies, in the context of reviewing Kigali implementation plans, regarding the lack of suitable alternatives identified for Article 5, group 2, parties and difficulties in building capacity in training and regulation when alternatives were not already present in the marketplace. He noted that implementing agencies tended to use the opportunities provided for under those plans to investigate non-mainstream options. The technology to convert from the use of HFCs to lower-GWP alternatives did exist and could be applied within a short time frame. Responding to the explanation, one representative said that he was concerned that there seemed to be inconsistency in the way in which information related to the Kigali implementation plans was handled in the Panel's reporting.

165. In response to a request for clarification regarding the rationale behind the choice of alternatives listed, Mr. Abdelaziz confirmed that, as a comprehensive list of alternatives had already been provided by the Panel in its 2022 progress report, the focus in the 2024 report had been on listing, where applicable, the alternatives that were most commonly used in a given sector, such as propane as the refrigerant for small self-contained air-conditioning equipment, and that were also appropriate for use in Article 5, group 2, parties. Consideration had also been given to factors such as energy efficiency and he noted that, although R-410A was being adopted in many high-ambient-temperature

countries, alternative refrigerants with lower GWP, such as HFC-32 or R-454B, would provide suitable energy efficiency. One representative requested more details regarding the development of technology for use with the alternatives mentioned in countries with high ambient temperatures, as he had been informed by suppliers that the maximum capacity of equipment using such alternatives would be six tons, making them unsuitable for many applications in countries with high ambient temperatures. Another representative also raised concerns that reporting was being based on a desk analysis rather than on practical experience.

166. Answering a question regarding PFAS, Mr. Abdelaziz noted that PFAS issues had not been included in the 2024 report, as the issue applied equally to Article 5, group 1, and Article 5, group 2, parties and therefore was not within the remit of the report.

167. In response to the safety concerns raised, including potential danger to life, regarding the use of flammable refrigerants for mobile air-conditioning units, Mary Koban, a member of the Refrigeration, Air Conditioning and Heat Pumps Technical Options Committee, said that category A2L low-GWP refrigerant had been introduced at the global level in 2012 by some manufacturers and, by 2017, had been adopted by all manufacturers. No issues had been detected with its use in light-duty vehicles and there was no technical reason to question the suitability of its use at the global level.

168. Regarding queries about the future provision of information in relation to paragraph 5 of decision XXVIII/2, Ms. Maranion recalled that, under the decision, parties had requested updates on alternatives to HFCs, including reporting on emerging issues every five years, and the Panel's annual progress reports would also continue to include consideration of the challenges that parties continued to face during the phase-down process.

169. In the ensuing discussion, one representative, speaking on behalf of group of parties, congratulated the two Article 5, group 2, parties that had ratified the Kigali Amendment in 2024: the United Arab Emirates and Bahrain.

170. With regard to the report by the Technology and Economic Assessment Panel on decision XXVIII/2, several representatives expressed the view that the report did not address the issues that the Article 5, group 2, parties had been expecting, and needed to be reworked. One representative stressed that air conditioning in high ambient-temperature countries was not a luxury, but of vital importance. Another representative said that, although low- or lower-GWP technologies were evolving, given the rise in global temperatures, countries faced challenges in adopting appropriate technologies, particularly in larger capacity air-conditioning systems, including for household uses. High-ambient-temperature conditions placed an excessive burden on the operation of air-conditioning systems. Given climate changes, he proposed a review of the definition of high ambient temperatures that had been decided on during the negotiation of the Kigali Amendment.

171. One representative recalled that there had been clear reasons for splitting Article 5 parties into group 1 and group 2 at the time of adoption of the Kigali Amendment. Article 5, group 2, parties had not been able to adopt the alternative technologies that other countries had adopted as those technologies had not been suitable for use in their countries. Article 5, group 2, parties were still willing and ready to adopt alternative technologies, as long as they were efficient and technically proven.

172. Some representatives highlighted the imprecise language used in the Panel's report, such as "growing accessibility", and requested the Panel to use specific figures, statistics and percentages to illustrate the points that it was making.

173. One representative noted that the implications of the future European regulations on PFAS were missing from the report.

174. One representative said that it was important that the Technology and Economic Assessment Panel continue to provide updates on the low- or lower-GWP alternatives. He said that he intended to work with like-minded parties to propose a draft decision to enable the Panel to do so. Supported by other representatives, he proposed further discussion of the matter in a contact group.

175. In contrast, other representatives, including one speaking on behalf of a group of parties, noted that the Technology and Economic Assessment Panel, after looking at a broad set of criteria and analysing whether Article 5, group 2, parties were in a different position from other Article 5 parties when it came to the accessibility of alternatives to HFCs, had found that the only difference related to whether refrigerants were technically proven. As such, Article 5, group 2, parties seemed to face similar opportunities and challenges as other Article 5 parties in achieving HFC phase-down.

176. One representative expressed the view that the report provided a detailed technical review of the alternatives relevant for Article 5, group 2, parties. He said that, although the report indicated a

number of potential barriers related to technically proven alternatives, he understood that they could be addressed by specific policy initiatives. Another representative, highlighting the steps taken in her own country to meet its phase-down obligations, said that parties had to be cognizant of the fact that different countries would make different choices according to their specific transitions and time frames. She said that she did not consider the situation of Article 5, group 2, parties as an issue that required additional work by the Technology and Economic Assessment Panel in a separate report. She noted that other requests had been made for the Panel to provide information to the parties, in the annual progress reports and the quadrennial assessment reports for example, and there had been a separate request under decision XXVIII/2 for an assessment every five years on alternatives to HFCs. Although she was willing to consider a draft decision, she questioned the need to request another report from the Panel.

177. At a later stage in the meeting, the representative of India, supported by the representative of Bahrain, introduced a conference room paper containing a proposed draft decision prepared by Bahrain, India, Kuwait, Qatar and Saudi Arabia. He explained that it was designed to deal with the unique challenges facing high-ambient-temperature countries listed in Article 5, group 2, in adopting low-GWP technologies, particularly in large capacity air-conditioning systems, which he felt were not being adequately addressed. Several of those countries had recently been experiencing unprecedented heatwaves and significant rises in summer temperatures, resulting in excessive load on the operation of air-conditioning systems.

178. Accordingly, the proposed draft decision requested an update by sector, sub-sector and region on low-GWP and lower-GWP alternatives to HFCs, including challenges and barriers in terms of availability, accessibility and adoption in Article 5 parties, with a particular emphasis on Article 5, group 2, parties; standards for alternative refrigerants; market structure, including supply chain issues; pathways for promoting adoption in Article 5 parties, with a particular emphasis on Article 5, group 2, parties; and the Technology and Economic Assessment Panel to conduct assessments by region of the costs of adoption for Article 5 parties in its 2027 progress report. He said that he was aware of the pressures on the Panel, and so was not proposing a separate report on the situation in Article 5, group 2, parties, but rather a separate section within the progress report.

179. Several representatives thanked the proponents for putting forward the draft decision and expressed their willingness to discuss it in more detail. Some pointed out that all Article 5 parties faced similar challenges, not just those in group 2, and particularly applauded the proposal to conduct assessments by region of the costs of adoption, since those could differ significantly. Another representative queried the title of the proposed draft decision, noting that it was a request for more information rather than for compliance deferral.

180. Several representatives expressed the desire to discuss when the additional information requested in the draft decision could best be included in the various Technology and Economic Assessment Panel reports, including the next quadrennial assessment, in order to avoid overburdening the Panel, and in the light of the freeze date for Article 5, group 2, parties, which was not until 2028. One representative added that care should be taken not to request the Panel to provide information that they were already providing.

181. The Working Group agreed to establish a contact group, to be co-chaired by Cornelius Rhein (European Union) and Anna Maria Kleymeyer (Micronesia, Federated States of), to discuss the matter further.

182. The co-chair of the contact group later reported that the proponents of the draft decision had met with members of the Technology and Economic Assessment Panel to clarify the feasibility of the information requests in the draft decision, following which the contact group had begun working on the proposed text. The group's discussions had been productive but had not led to a final conclusion, and the participants had expressed the desire to continue the discussion.

183. The Working Group agreed to forward the revised draft decision on possible compliance deferral for Article 5, group 2 parties, as set out in section G of annex I to the present report, to the Thirty-Sixth Meeting of the Parties for further consideration.

X. Strengthening Montreal Protocol institutions, including combating illegal trade (decision XXXV/12 and UNEP/OzL.Pro.35/12, para. 188)

184. Introducing the item, the Co-Chair recalled that the Thirty-Fifth Meeting of the Parties had adopted decision XXXV/12, on further strengthening Montreal Protocol institutions, including for

combating illegal trade, following discussions that had begun at the forty-fifth meeting of the Open-ended Working Group on the outcomes of a workshop held on 2 July 2023 on strengthening the effective implementation and enforcement of the Montreal Protocol. In that decision, parties were encouraged to inform the Secretariat of practices used by entities attempting unauthorized imports of controlled substances and the Secretariat was requested to provide, before the forty-sixth meeting of the Open-ended Working Group, and on an annual basis thereafter, a compilation of that information and information provided pursuant to decision XXXIV/8, on strengthening Montreal Protocol institutions, including for combating illegal trade. The Thirty-Fifth Meeting of the Parties had also agreed to include the matter of strengthening Montreal Protocol institutions in the agenda of the current meeting. In accordance with the request in decision XXXV/12, the Secretariat had prepared a note containing a compilation of the information provided by parties on illegal trade practices and the approaches taken by national authorities to identify and address such cases (UNEP/OzL.Pro.WG.1/46/4). Relevant information was also set out in paragraphs 34 to 37 of the note by the secretariat on issues for discussion by and information for the attention of the Open-ended Working Group of the Parties to the Montreal Protocol at its forty-sixth meeting (UNEP/OzL.Pro.WG.1/46/2) and in the note by the Secretariat on information on illegal trade in and production and consumption of controlled substances reported by parties (UNEP/OzL.Pro.WG.1/46/INF/3).

185. A representative of the Secretariat gave a presentation on document UNEP/OzL.Pro.WG.1/46/4, providing information on the number of cases reported; parties that reported cases of illegal trade; the substances traded and the quantities involved; methods of illegal trade; common means of detection; enforcement actions and the penalties imposed; handling and disposal of detained substances; and information on the notable approaches to addressing and combating illegal trade reported by parties.

186. Following the presentation, the representative of the European Union introduced a draft decision on the next steps for further strengthening Montreal Protocol institutions, set out in a conference room paper. Stressing that it was important to pursue discussions on strengthening Montreal Protocol institutions, he said that the draft decision comprised three elements. First was a request to the Secretariat to prepare a guidance document on the establishment and operation of licensing systems, consolidating previous guidance documents and relevant decisions of the parties. Such guidance would be very useful for parties, in particular those preparing their Kigali HFC implementation plans. Second, the Secretariat was also requested to provide, before the forty-seventh meeting of the Open-ended Working Group, an analysis of the annual compilation of information pursuant to decision XXXV/12 and of other relevant sources, identifying options for addressing cases of illegal trade, for consideration by the Thirty-Seventh Meeting of the Parties. Third, the Secretariat was further requested to convene, before the forty-seventh meeting of the Open-ended Working Group, a meeting of experts from interested parties and other persons with relevant expertise to reflect on the functioning of the compliance mechanism of the Montreal Protocol and to identify issues for review by the parties. Since the inception of the Montreal Protocol, the compliance mechanism had not been reviewed, although decisions requesting such a review had been adopted.

187. In the ensuing discussion, several representatives thanked the Secretariat for its note, along with the parties that had submitted information on illegal trade, and thanked the European Union for its proposed draft decision. One representative said that she had found the information in the compilation helpful for her own country's domestic efforts to combat illegal trade. She noted some potential areas of common ground for moving forward towards a decision, in particular in relation to licensing systems.

188. Several representatives expressed their views on the draft decision. Some representatives questioned whether a collation of guidance prepared by the Secretariat would be the best way forward and proposed that other options also be explored. One representative expressed concern that the language in the draft decision predetermined a path forward and said that there were other elements that she wished to include in such a draft decision. Several representatives said that the nature of an expert meeting needed more clarification with regard to its purpose, length, timing, format, who would participate, the lack of definition of the term "expert" and the need to ensure regional representation. One representative said that another option could be that work was undertaken intersessionally, with online meeting sessions held to minimize the budgetary implications. Another representative said that the matter should be discussed further by the parties as opposed to by a group of experts.

189. Several representatives expressed the view that the matter of next steps on dealing with illegal trade merited further consideration in a smaller group.

190. The Working Group agreed to establish a contact group, to be co-chaired by Shontelle Wellington (Barbados) and Jana Mašíčková (Czechia), to discuss the matter further.

191. The co-chair of the contact group, reporting on the group's work, said that although the entire draft decision on the matter remained in brackets, the group had held focused and frank discussions and was amenable to continuing the discussion at the Thirty-Sixth Meeting of the Parties. She also reported that the proponents of the draft decision had acknowledged parties' concerns and feedback and indicated that they would submit a new version of the text for consideration by the Thirty-Sixth Meeting of the Parties.

192. The Working Group agreed to forward the revised draft decision on further strengthening Montreal Protocol institutions, as set out in section H of annex I to the present report, to the Thirty-Sixth Meeting of the Parties for further consideration.

XI. Emissions of HFC-23: potential changes to reporting form 3 for reporting on HFC-23 (decision XXXV/7, para. 3)

193. Introducing the item, the Co-Chair recalled that, in paragraph 3 of decision XXXV/7 on emissions of HFC-23, the Secretariat had been requested to provide options with respect to potential changes to reporting form 3, specifically concerning when HFC-23 was generated, destroyed or maintained as stocks. The options were set out in document UNEP/OzL.Pro.WG.1/46/3.

194. The representative of the Secretariat outlined the information in the document and presented the two options proposed by the Secretariat.

195. Thereafter, he responded to a number of questions regarding the ramifications of the changes for data reporting forms 3, 4 and 6, the options' similarities and differences with the reporting frameworks for accounting for essential- and critical-use exemptions, and the specific quantities of HFC-23 that parties would be expected to report. He confirmed that the Secretariat had considered the ramifications for data reporting forms 3, 4 and 6, adding that in the process it had also identified a number of potential issues that parties might wish to address, including possible errors in the instructions or guidance provided. With regard to similarities and differences with the reporting frameworks for essential- and critical-use exemptions, the Secretariat had indeed borrowed the concept from those two accounting frameworks, but they were different. All the newly proposed columns for HFC-23 reporting would be additional to the reporting required under Article 7, and would probably constitute optional reporting.

196. Turning to the question of the specific quantities to be reported, the representative of the Secretariat said that the proposed data represented the Secretariat's understanding of what parties might choose to report if they wanted to track stocks, as set out in the request to the Secretariat, by tracking quantities produced, used and remaining at year-end. He underscored that the only new data would be the quantities in the 5 new columns, as the quantity imported was already supposed to be reported in data form 1 and the quantities captured and produced were already supposed to be reported in data form 3. He cautioned that the quantity reported in data form 4 could include both new and recovered substances, whereas for the purposes of tracking stocks, the quantity destroyed should only reflect the destruction of newly produced or unused and not-recovered HFC-23, hence there would be a slight difference between the quantity destroyed reported in the new accounting process and the quantity reported in data form 4.

197. Several representatives, while thanking the Secretariat for its response to the parties' request in decision XXXV/7, observed that the issue was complex and indicated that they would be in favour of discussing the matter further in the margins of the meeting. One representative highlighted the fact that while the decision had only referred to potential changes in data form 3, the Secretariat had confirmed that there were implications for the three relevant forms and had even identified errors that parties might wish to correct.

198. One representative suggested that the request in the decision had not been completely clear, and said that it was reasonable to understand from the guidance in the decision that the parties would want a reporting framework that would allow stocks of HFC-23 to be tracked. From that perspective, the proposed options made sense; in his view, however, the added value of keeping track of HFC-23 stocks was not clear. In general, the quantity of HFC-23 used and emitted from year to year was small compared to the amount actually generated and then captured or destroyed. In addition, under the proposed reporting framework, information would only be received from the producing countries, yet information on emissions in countries that imported HFC-23 could also be useful. Nevertheless, his delegation was interested in further discussion, including on the links with data form 6.

199. The Working Group agreed to pursue the discussion in an informal group, to be co-facilitated by Martijn Hildebrand (Kingdom of the Netherlands) and Obed Meringo Baloyi (South Africa), open to all interested parties and including the representative of the Secretariat.

200. The co-facilitator of the informal group subsequently reported that, during the informal discussions, some parties had expressed an interest in also looking into the issue of HFC-23 destruction. In addition, a number of further challenges had been identified on reporting forms 3, 4 and 6. At the conclusion of the discussion, one representative had offered to prepare a text on the most appropriate options to serve as a basis for further discussion by the Thirty-Sixth Meeting of the Parties.

XII. Proposal by Cuba on additional funding to support countries seriously affected by the coronavirus disease (COVID-19) pandemic and listed in decision XXXV/16

201. Introducing the item, the Co-Chair recalled that the Thirty-Fifth Meeting of the Parties had adopted decision XXXV/16 on addressing the impacts of the coronavirus disease (COVID-19) pandemic on HFC baseline consumption for certain parties. On 25 March 2024, the Secretariat had received a proposal for a draft decision from Cuba, with a request that the draft be considered by the Open-ended Working Group at the current meeting. The text was set out in annex I to document UNEP/OzL.Pro.WG.1/46/2/Add.2, and would also be circulated as a conference room paper at the current meeting.

202. Introducing his proposal for a draft decision, the representative of Cuba drew attention to the consumption figures for HFCs for Cuba for the period 2018–2023, as set out in document UNEP/OzL.Pro.WG.1/46/INF/6. Owing to the pandemic, Cuba had experienced a sharp drop in imports of HFCs in 2020 and 2021, which had meant that its baseline level had been set unrealistically low, as had been recognized in decision XXXV/16. Given that imports had since recovered to their pre-pandemic level, the Kigali Amendment target of a 10 per cent reduction in consumption was equivalent in reality to a 42 per cent reduction from the 2023 consumption level. Accordingly, in the draft decision, the Executive Committee of the Multilateral Fund was requested to establish a new funding window to provide sufficient additional funds, on an expedited basis, to enable countries seriously affected by the COVID-19 pandemic to meet their HFC consumption reduction targets and fulfil their commitments under the Montreal Protocol.

203. Several representatives declared their support for the proposal, given the similar circumstances they faced, and expressed the hope that financial support and other measures could be explored. They recognized that the issue could be addressed through the Kigali implementation plans, as set out in decision XXXV/16, but they faced real challenges in the lack of accessibility to and affordability of low-GWP alternatives to HFCs.

204. One representative informed the Working Group that HFC consumption in his country had grown by 250 per cent from 2022 to 2023; increasing amounts of HFC-using equipment were being installed, creating future dependence on HFC refrigerants. It was crucial not to disrupt the cooling sector in countries such as his because of the implications for economic development and healthy lifestyles. He also expressed the belief that his country should be added to the list of countries that the Executive Committee had identified for further consideration with regard to the issue, and stated that he intended to take the matter up with the Committee.

205. Another representative expressed his support for the proposal, explaining that his country had seen a severe economic recession, accompanied by unsustainable debt and a balance of payments crisis. Imports of refrigerants had been significantly affected, posing serious challenges to both HCFC phase-out and preparations for HFC phase-down. Demand for cooling had remained high, however, and local manufacturing of refrigeration equipment and MDIs had expanded. The end result was that demand for HFCs in 2024 was expected to reach nearly five times the baseline consumption level, and further growth in demand could be expected as the economy recovered. He expressed the hope that it would be possible to collaborate with the Secretariat and parties to exchange knowledge, guidance, technology and best practices.

206. Other representatives, however, while expressing sympathy for the challenges faced by those parties, pointed out that there was no cause for concern in terms of compliance, because under decision XXXV/16 the determination of compliance would be deferred until 2026 data became available, which applied to the eight parties listed in the decision, including Cuba. That decision did not prevent a party from asking the Meeting of the Parties to consider the possibility of further deferring compliance if there continued to be a problem, or other parties from applying to be covered by the decision; they were prepared to discuss that possibility.

207. They pointed out, however, that the issue of additional funding had been considered in 2023, and it had not been agreed at that time. Furthermore, they expressed the view that reopening the agreements that had been negotiated by the Executive Committee would create a poor precedent. Levels of funding for the servicing sector had been agreed less than a year ago, after discussion of issues related to the impact of the COVID-19 pandemic, and they had included a much higher level of funding for low-volume-consuming countries than had been the case for HCFCs. Many countries were now including the servicing sector in their Kigali implementation plans as a result. Furthermore, other funding windows were available; for example, in addition to the approval of its Kigali implementation plan, Cuba would be allowed, on an exceptional basis, to submit investment projects for the refrigeration and air-conditioning sector to achieve additional HFC reductions.

208. The representatives highlighted paragraph 2 of decision XXXV/16, in which parties that had not already done so were urged to submit expeditiously their Kigali implementation plans for consideration by the Executive Committee. The solution to the problem was to move forward with HFC phase-down as fast as possible at the same time as deferring consideration of compliance. They recognized that of the eight countries listed in the decision, three had already had Kigali implementation plans approved, and four others had them in preparation. The implementation of appropriate policies, a key element of Kigali implementation plans, including import and export licensing systems, would help to constrain demand and reduce future servicing liability. Without such systems, it was not surprising that imports were increasing; the same outcome had been observed in non-Article 5 parties. Thus, while they would be happy to discuss the issues with Cuba and other parties, they did not want to reopen the agreements that had been reached over the previous year and a half to accommodate the concerns that had been raised.

209. Recognizing the different views that had been expressed, the Co-Chair encouraged parties to consult informally with each other in the margins of the meeting to try to identify a way forward. He invited Cuba to report back on those consultations in due course.

210. Subsequently, the representative of Cuba reiterated the issues facing his country with regard to meeting its HFC consumption reduction targets and fulfilling its commitments under the Montreal Protocol, and he expressed the hope that the proposed draft decision would be submitted for consideration by the Thirty-Sixth Meeting of the Parties.

211. In response to an observation from one representative that the proponent of the draft decision had not, as agreed, reported back on consultations that had taken place, the representative of Cuba said that no consultations had, in fact, taken place, as no other parties had engaged in discussions with Cuba on the matter. The other representative, recalling that, in a situation where no contact or informal group had been established, it was incumbent upon the proponent of a draft decision to approach other parties directly to garner support for that draft decision, said that his country did not support the submission of the draft decision for consideration by the Thirty-Sixth Meeting of the Parties.

212. Noting that there was insufficient support for the proposed draft decision among the parties, the Co-Chair said that the proposed draft decision would not be submitted for consideration by the Thirty-Sixth Meeting of the Parties.

XIII. Other matters

A. Unwanted import of energy-inefficient products and equipment

213. The representative of Kyrgyzstan introduced a draft decision on avoiding unwanted imports of energy-inefficient products and equipment, which he said had the support of other countries in his region. As background to the draft decision, he noted that his country had started implementing its Kigali HFC implementation plan and developing minimum energy performance standards in preparation for the introduction of energy-efficient technologies and equipment in the refrigeration sector. In addition, the European Union and the Eurasian Economic Union had recently adopted regulations setting more stringent energy-efficiency requirements, and his country had adopted a national standard prohibiting the use of products in the lower classes of energy efficiency. It was unclear, however, how parties were to inform the international community that they did not wish to import energy-inefficient products that did not meet the new technical requirements. He therefore proposed that the Secretariat establish a list of parties that did not wish to import energy-inefficient products and equipment, much like the list established pursuant to decision XXVII/8. The idea was that countries that had banned energy-inefficient products and equipment could use the list to inform exporting countries of such bans, and companies that produced or exported refrigerants could be certified as meeting the exporting country's requirements. Thus, in the draft decision, parties were invited to inform the Secretariat, on a voluntary basis, that they did not consent to the importation of

such products and equipment into their territories, and the Secretariat was in turn requested to maintain a list of parties that did not wish to receive energy-inefficient products and equipment, and to circulate it to all the parties and update it annually. He stressed that the draft decision was not intended to address dumping or illegal trade in HFCs or related products or to restrict trade, but was primarily aimed at controlling the introduction of energy-inefficient technologies into national economies. His delegation was open to any suggestion for changes or additions to the draft decision.

214. During the ensuing discussion, the representatives who took the floor, including one speaking on behalf of a group of parties, thanked the representative of Kyrgyzstan for putting forward the proposal and indicated their interest in pursuing the matter. One representative, noting that the Secretariat's information on her country's regulatory domestic bans was out of date, suggested that the existing list on the Secretariat's website might be adapted to serve the need expressed, and that parties could take advantage of the opportunity to update the Secretariat's information on their national import restrictions in general. Another representative, however, expressed a preference for a separate list, underscoring that there was no cost to establishing a list.

215. One representative, while open to further discussion and supportive of the suggestion to use an existing list, said that his delegation wished to better understand the rationale behind the proposal. He recalled decision XXXV/13, which provided for funding for the development and enforcement of policies and measures to control the importation of prohibited cooling equipment in Article 5 parties, with parties exporting such equipment urged to consider instituting measures prohibiting the export of cooling equipment relying on controlled substances that were no longer permitted to be placed on the market in the exporting parties. At the time, parties had discussed preparing a list but had not taken the idea forward.

216. One representative cautioned that energy inefficiency could mean different things to different countries, and that parties should therefore ensure that national limits for what was considered energy-efficient and energy-inefficient were clear.

217. The Working Group agreed to establish a contact group, to be co-chaired by Morane Godfrin (France) and Linda Kosgei (Kenya), to discuss the matter further.

218. The co-chair of the contact group later reported that the contact group had made good progress on reviewing the draft decision but had not had sufficient time to finalize the review.

219. The Working Group agreed to forward the revised draft decision related to avoiding unwanted imports of energy-inefficient products and equipment, as set out in section I of annex I to the present report, to the Thirty-Sixth Meeting of the Parties for further consideration.

B. Presentation by the Secretariat on the mobile and web application entitled "Avoided CO₂e"

220. The representative of the Secretariat delivered a short presentation on the mobile and web application entitled "Avoided CO₂e", noting that it had been developed by the Secretariat to highlight the contribution of the Montreal Protocol to combating climate change. The application, which used data reported by the parties on consumption and production, baselines and control limits, could present those data in a variety of graphical forms and levels of aggregation, including by party, substance, time frame or unit of measurement (ozone-depleting-potential tonnes, carbon dioxide-equivalent tonnes or metric tons).

C. Other matters

221. The Executive Secretary expressed her appreciation for the contributions to the Montreal Protocol made by Bernhard Siegele (Germany), who was moving on to a different position outside the ozone family. As head of the GIZ Proklima bilateral implementing agency for 12 years, he had made an invaluable contribution to the implementation of the Protocol. A representative agreed, expressing his sincere gratitude for Mr. Siegele's efforts on behalf of his party and many others.

XIV. Adoption of the report of the meeting

222. The parties adopted the present report on the basis of the draft report that had been circulated, as orally amended. The Ozone Secretariat was entrusted with the finalization of the report.

XV. Closure of the meeting

223. Following the customary exchange of courtesies, the forty-sixth meeting of the Open-ended Working Group of the Parties to the Montreal Protocol was declared closed at 6.30 p.m. on Friday, 12 July 2024.

Annex I

Draft decisions to be forwarded to the Thirty-Sixth Meeting of the Parties

The Working Group agreed to forward to the Thirty-Sixth Meeting of the Parties, the following draft decisions for further consideration, on the understanding that they did not constitute agreed text and were subject in their entirety to further negotiation.

A. Additional information on very short-lived substances

Submission by Australia, Canada, the European Union and Switzerland

The Thirty-Sixth Meeting of the Parties,

[*Taking note with appreciation of the information on very short-lived substances in the 2022 quadrennial assessment report of the Scientific Assessment Panel, the 2022 assessment report of the Medical and Chemical Technical Options Committee of the Technology and Economic Assessment Panel, and the 2024 progress report of the Technology and Economic Assessment Panel,*

Noting that the 2022 quadrennial assessment report of the Scientific Assessment Panel indicates that chlorine emissions from very short-lived substances not controlled by the Montreal Protocol on Substances that Deplete the Ozone Layer, in particular from dichloromethane, continue to increase and are estimated to contribute about 4 per cent of total chlorine input to the stratosphere, and that future emissions of dichloromethane have the potential to lead to more ozone depletion than emissions from other sources in many of the other alternative scenarios explored in the report,

Concerned about the continued substantial increase of emissions of dichloromethane, which is the main component of the very short-lived substance chlorine, estimated to have averaged 13 per cent annually between 2011 and 2019, according to information contained in the 2022 assessment report of the Medical and Chemical Technical Options Committee, and that emissions continued to grow during the period 2020–2022,

Reminding parties that there are alternatives to halocarbons for many emissive uses of very short-lived substances, including for solvent uses, foam blowing and chromatography, as well as best practices for limiting the use of chlorinated solvents and reducing emissions,]

1. *Requests the Technology and Economic Assessment Panel, in cooperation with the Scientific Assessment Panel, to include in its [2025 progress report] [2026 assessment report], for consideration by the Open-ended Working Group at its [forty-seventh] meeting;*

(a) *[Updated information on dichloromethane, trichloromethane, dichloroethane, trichloroethylene and perchloroethylene including their emissive solvent and feedstock uses and growth trends for the past five years];*

(b) *Identification of [other high-volume] [anthropogenic] [halogenated] very short-lived substances not mentioned in the 2024 progress report of the Technology and Economic Assessment Panel with [quantifiable] emissions that could reach the lower stratosphere [along with methodology adopted for such assessment, growth trends for the past five years, their ozone-depleting potential and impact on the stratospheric ozone layer in quantifiable terms];*

(c) *Additional information on alternatives to the very short-lived substances in (a) and (b) in the emissive applications where they are currently used, including information on availability, technical feasibility [including solvent having low boiling point, better yield of the end-product][performance], economic viability, safety and sustainability and penetration in Article 5 parties, focusing on very short-lived substances with estimated emissive uses of at least 100,000 tonnes;*

(d) *A table providing, to the extent possible, for each very short-lived substance identified in (a) and (b) the following information: estimated annual production and consumption; estimated annual emissions; range of ozone-depleting potential that have been estimated by the Scientific Assessment Panel or peer-reviewed scientific literature; contribution to effective equivalent stratospheric chlorine; and their impact on the stratospheric ozone layer in quantifiable terms;*

2. *[Invites parties that have production data on very short-lived substances in paragraph 1(a) or information on alternatives to emissive uses of these very short-lived substances to provide*

such information on a voluntary basis to the Ozone Secretariat by 31 March 2025 in order to facilitate the preparation of the report referred to in paragraph 1 above];

3. *Invites* parties that have national measures concerning the use and/or emissions of very short-lived substances to provide the Ozone Secretariat with information [on a voluntary basis] on those measures by 31 March 2025;

4. *Requests* the Ozone Secretariat to provide a compendium of national measures based on the information provided in accordance with paragraph 3 above.

B. Feedstock uses of controlled substances

Submission by Australia, Canada, Norway and Switzerland

The Thirty-Sixth Meeting of the Parties,

Recalling paragraph 5 of Article 1 of the Montreal Protocol, which excludes the calculated level of controlled substances entirely used as feedstock in the manufacture of other chemicals from the definition of production of controlled substances,

Recalling also decision IV/12, in which Parties were urged to take steps to minimize emissions of such substances, including such steps as avoidance of the creation of such emissions, reduction of emissions using practicable control technologies or process changes, containment or destruction,

Recalling further decisions XXXV/8 and XXXV/9, in which, among other things, the Technology and Economic Assessment Panel, in cooperation with the Scientific Assessment Panel as appropriate, was requested to provide in its 2024 progress report updated information on feedstock in general and carbon tetrachloride in particular, considering emissions and emission sources, best practices and technologies for minimizing emissions, as well as available alternatives,

Noting that the 2022 assessment reports of the Technology and Economic Assessment Panel and the Scientific Assessment Panel and the 2023 and 2024 progress reports of the Technology and Economic Assessment Panel highlight the significant increases in the production of controlled substances used as feedstock and the unexplained abundance of ozone-depleting substances in the atmosphere, which may result from increased emissions of these substances from feedstock production or use, or from by-product emissions from other chemical processes,

Taking note of the information on and descriptions of isolated and non-isolated intermediates used as feedstock in section 2.2.2 of the 2022 quadrennial assessment of the Medical and Chemical Technical Options Committee of the Technology and Economic Assessment Panel,

Taking note with appreciation of information provided by the Technology and Economic Assessment Panel in its 2024 progress report on best practices and technologies to reduce emissions of controlled substances produced and used for feedstock in response to decisions XXXV/8 and XXXV/9,

Reminding Parties that controlled substances produced for feedstock applications may only be used as feedstock for the manufacture of other chemicals,

1. *[Urges][Encourages]* relevant Parties[, in accordance with decision IV/12,] to continue taking steps to minimize emissions of controlled [ozone-depleting] substances during their production, transportation, distribution, storage, handling, repackaging and use as feedstock, including such steps as avoidance of the creation of such emissions and reduction of emissions [using practicable control technologies or process changes], containment or destruction;

2. *Encourages* Parties to promote the use of [best practices and technologies] to reduce emissions of controlled substances during their production, transportation, distribution, storage, handling, repackaging and use as feedstock in the manufacture of other chemicals [, taking into account national circumstances];

3. *[Clarifies]* that Parties should include unintentional production of isolated and non-isolated intermediates [that are controlled substances] when they are reporting feedstock production, where such production is measurable;]

4. *Invites* Parties with production and/or use of controlled substances for feedstock to provide to the Ozone Secretariat, on a voluntary basis, by 1 May 2025 information on their established national procedures and frameworks for management of such production and use, including any controls on resulting emissions;

5. *Requests* the Ozone Secretariat to collate and summarize the information provided pursuant to paragraph 4 above for consideration by the Open-ended Working Group at its forty-seventh meeting;

6. [*Requests* the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol to consider establishing a funding envelope to support up to two production-sector-related projects to demonstrate best practices and technologies for minimizing emissions of controlled substances used as feedstock, with a view to achieving reductions in emissions and developing and sharing information on the costs and effects of such best practices and technologies.]

C. **Enhancing regional atmospheric monitoring of substances controlled by the Montreal Protocol on Substances that Deplete the Ozone Layer**

Submission by Canada and the United States of America

The Thirty-Sixth Meeting of the Parties,

Recalling decision XXXV/14 and taking note with appreciation of the information reported by the Secretariat at the forty-sixth meeting of the Open-ended Working Group and the recommendations¹ from the twelfth meeting of the Ozone Research Managers, in particular recommendation 2.2 – to enhance monitoring of ongoing emissions at the global and regional scales, especially in under-sampled regions – and those in section C, on gaps in the global coverage of atmospheric monitoring of controlled substances and options for enhancing such monitoring,

Noting that the selection of suitable locations for the establishment of monitoring of emissions of controlled substances on a regional basis is the first stage in developing a more comprehensive approach to understanding the sources of emissions,

[*Recalling* decision VI/2 of the Conference of the Parties ...]

1. *Requests* the Executive Secretary to transfer \$[-] from the Montreal Protocol Trust Fund to the General Trust Fund for Financing Activities on Research and Systematic Observations Relevant to the Vienna Convention for the Protection of the Ozone Layer for the specific purpose of funding projects to evaluate the suitability of potential sites for monitoring regional emissions of controlled substances;

2. *Requests* the Ozone Secretariat to continue supporting the work of the General Trust Fund in mapping possible locations for monitoring of controlled substances using existing facilities currently being used to monitor other substances and reaching out to other organizations to determine possible interest in coordinated monitoring or in sharing of monitoring facilities;

3. *Invites* the Parties to the Vienna Convention to:

(a) Request the Advisory Committee of the General Trust Fund, in undertaking projects to evaluate the suitability of potential sites for monitoring regional emissions of controlled substances, to take into consideration:

- (i) The suitability of potential sites for providing regionally representative data covering areas in which controlled substances are produced, used or emitted in substantial volumes at measurable concentration levels, while addressing existing gaps in atmospheric monitoring and avoiding duplication with the coverage of existing and planned monitoring sites;
- (ii) The potential for [scientific implementing partner[s]] [the potential for partnering with scientific institutions [having]] [that can provide personnel or] technical expertise for data collection, data management and data analysis [or [that can provide] [other] in-kind contributions];
- (iii) Potential cost savings and other benefits from relying on existing infrastructure and/or monitoring networks;
- (iv) The [need][capacity] to coordinate the [calibration][validation] of data with other [controlled substance] monitoring stations [and networks];

¹ An unedited advance version is available at https://ozone.unep.org/system/files/documents/ORM12_Recommendations.pdf.

- (v) The sharing of data between [scientific] [existing] monitoring stations and the potential to integrate new monitoring capability and newly obtained data into existing monitoring and data networks;
 - (b) Modify the terms of reference of the General Trust Fund to add the atmospheric monitoring of controlled substances as [an important] [a new] [an additional] [a specific] purpose of the Fund;
 - (c) [Modify the terms of reference of the Advisory Committee to allow it to invite additional experts and establish a subcommittee on the monitoring of controlled substances to assist in [the evaluations] [related activities], and to specify that the subcommittee, through the Advisory Committee, will report to and accept guidance from the Parties of the Montreal Protocol on all General Trust Fund activities related to the monitoring of controlled substances];
 - (d) [Receive additional funds.....];
 - (e) Request the Advisory Committee to report on progress in and any results of the evaluation[s] to the Thirty-Seventh Meeting [and following Meetings] of the Parties;
4. [Requests the Executive Committee to consider a funding modality to support a limited number of pilot projects to enhance regional atmospheric monitoring of substances controlled by the Montreal Protocol guided by the scientific advice of the General Trust Fund Advisory Committee in relation to the location and establishment of new monitoring facilities, and to report to the Thirty-Seventh Meeting of the Parties on work undertaken to develop such a funding modality];
5. [Requests the Ozone Secretariat to reach out to institutions active in emissions monitoring in order to explore options for long-term co-financing].

D. Strengthening the enabling environment to enhance energy efficiency in the cooling sector while Implementing the Kigali Amendment

Submission by Grenada and the Federated States of Micronesia

The Thirty-Sixth Meeting of the Parties,

Deeply concerned that global average temperatures have increased by 1.2°C, causing record high temperatures globally, which endanger human health, biodiversity, and food and water security, with particularly devastating impacts on the most vulnerable countries and communities,

Taking into consideration the recent global reports, including reports issued by the International Energy Agency and the United Nations Environment Programme, indicating that the demand for cooling equipment is predicted to triple by 2050, leading to increased demand on energy systems and further exacerbating the causes of climate change,

Recalling decisions XXVIII/3, XXIX/10, XXX/5, XXXI/7, XXXIII/5, XXXIV/3 and XXXV/10 relating to energy efficiency and the phase-down of hydrofluorocarbons,

Recalling also decisions 89/6, 91/65 and 94/60 of the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol relating [to certain aspects of and support for] energy efficiency under the Montreal Protocol and its Kigali Amendment,

Taking note with appreciation of the recent progress report of the Technology and Economic Assessment Panel updating the Parties on the information referred to in paragraph 1 (a) of decision XXXIV/3,

Aware that the effective implementation of the Kigali Amendment depends on the technical and financial capacity of its supporting institutions,

Recognizing the extraordinary challenges faced by Parties operating under paragraph 1 of Article 5 of the Montreal Protocol with respect to the limited resources and expertise available to apply energy efficiency measures in the implementation of hydrochlorofluorocarbon and hydrofluorocarbon project activities,

1. *Requests* the Executive Committee of the Multilateral Fund to strengthen the enabling environment for Montreal Protocol institutions to support Parties' efforts relating to decision XXVIII/2, including by:

- (a) Further enabling the national ozone units and implementing agencies to develop a robust pipeline of high-quality project proposals that address energy efficiency in the phasing down of hydrofluorocarbons, whether as standalone projects or as part of Kigali implementation plans;

(b) Supporting the creation of regional centres of excellence for energy efficiency to provide various forms of assistance on energy efficiency in the refrigeration, air conditioning and heat pump sector;

2. *Requests* the Executive Committee, in upcoming decisions relating to the provision of financing for non-investment projects under the operational framework on energy efficiency, to ensure support to address the unique challenges and special circumstances of low- and very-low-volume-consuming countries;

3. *Requests* the OzonAction programme of the United Nations Environment Programme to consider utilizing funding under Executive Committee decision 93/93 to support the provision of additional training, capacity-building and technical assistance by subject specialists in support of the preparation and implementation of energy efficiency projects in the phase-down of hydrofluorocarbons;

4. *Requests* the Technology and Economic Assessment Panel to continue updating the Parties on issues of relevance on energy efficiency and, in so doing, ensuring that the unique challenges and special circumstances of low- and very-low-volume-consuming countries are taken into consideration.

E. Measures to facilitate the transition to metered-dose inhalers with low-global-warming-potential propellants or other alternative products

Submission by the European Union

The Thirty-Sixth Meeting of the Parties,

Noting with appreciation the work done by the Technology and Economic Assessment Panel and its Medical and Chemical Technical Options Committee as reflected in the 2022 quadrennial report and the 2023 progress report,

Noting that dry powder inhalers and aqueous soft mist inhalers already provide suitable propellant-free alternatives to metered-dose inhalers for many patients, that metered-dose inhalers with propellants with low global warming potential have been developed and are expected to enter the market in some countries from 2025 onward, and that other treatments and devices not using controlled substances already provide a suitable alternative for many patients,

[

Encourages Parties:

(a) To promote coordination between their national environmental and health authorities on metered-dose inhaler propellants to raise awareness of their impact on climate and the environment with a view to promoting the use of dry powder inhalers and soft mist inhalers, as well as facilitating effective approval processes for new metered-dose inhaler propellants with low global warming potential;

(b) To liaise with companies producing metered-dose inhalers in their countries with a view to encouraging them to seek approval for metered-dose inhalers with propellants that have low global warming potential, including in export markets;

(c) To engage with their medical agencies to reach out to their counterparts in other countries to facilitate approval processes for such new metered-dose inhalers and relevant alternatives.

]

{ALT Text}

Encourages Parties:

1. To promote continued coordination between their national environmental and health authorities to raise awareness of the phase-down of HFCs underway and of the progress in development of new MDI products using lower GWP propellants [and availability of other alternatives] recognizing the need to ensure patient access to critical health remedies;

2. [To request the TEAP to continue monitoring and updating parties on developments with respect to HFC-based MDIs and their alternatives; and]

3. [To revisit this issue ~~in~~ no later than 2027 in light of updated information provided in the 2026 TEAP quadrennial assessment report;]

[placeholder: TEAP to obtain more information from parties regarding transitional plans]

F. Measures to support the sustainable management of recovered, recycled or reclaimed halons

Submission by Australia, Canada and the United States of America

The Thirty-Sixth Meeting of the Parties,

Recognizing that the global production and consumption of newly manufactured halons for controlled uses were eliminated in 2009, but that since 1994 some enduring uses have relied on stocks of recovered, recycled or reclaimed halons for fire safety, and that they will continue to do so for the foreseeable future,

Recalling that the import, export and use of recovered, recycled or reclaimed halons are not controlled under the Montreal Protocol,

Recalling paragraph 2 of decision XXIX/8, in which parties were invited, on a voluntary basis, to reassess any national import and export restrictions other than licensing requirements with a view to facilitating the import and export of recovered, recycled or reclaimed halons and the management of stocks of such halons with the aim of enabling all parties to meet remaining needs in accordance with national regulations even as they made the transition to alternatives to halons,

Noting with concern information provided by the Technology and Economic Assessment Panel suggesting that there could be a lack of available supply of recovered, recycled or reclaimed halons for enduring fire safety uses within the next decade, and that the deliberate destruction of halons has the potential to significantly reduce the available supply of recovered, recycled or reclaimed halons, thereby accelerating projected run-out dates,

Noting that the lack of development of and transition to alternatives to halons for all applications has the potential to prolong the global reliance on recovered, recycled or reclaimed halons for enduring uses and even result in some sectors' that have transitioned away from the use of halons reverting to their use,

Taking note of the information presented in the progress report of the Technology and Economic Assessment Panel provided to the parties before the forty-sixth meeting of the Open-ended Working Group, as well as in the 2022 assessment report of the Fire Suppression Technical Options Committee of the Panel,

1. *[[Urges][Encourages][Invites parties to encourage relevant stakeholders]* parties [and their stakeholders] to refrain from [and urges [the parties][them] to disallow] any deliberate destruction of recovered or recycled halons that can be reclaimed for re-use, and to ensure that sufficient stocks of recovered, recycled or reclaimed halons remain available for anticipated future needs;]

1(bis) *[[Urges][Encourages]* parties [and their stakeholders] to ensure that, during maintenance and service of equipment, or before the dismantling and disposal of equipment, halons be recovered for recycling and reclamation to ensure that [to retain] sufficient stocks of recovered, recycled or reclaimed halons [remain available] for anticipated future needs;]

2. *Urges* parties that restrict the import and/or export of recovered halons to [review their regulations with a view to] [facilitate] [facilitating] the transboundary movement of recovered halons for the purpose of recycling and reclamation [in other parties that have those capabilities and][to enable] [enabling all] parties to meet remaining needs while avoiding any new production of halons;

3. *Urges* parties to raise awareness of the importance of sustainable management of halons, [and avoid] [including by avoiding] the use of halons where other alternatives are available, and to inform their users of halons, including the aviation sector and the military, of the need to prepare for the risk of reduced availability of halons in the future;

4. *Requests* the Ozone Secretariat to continue to liaise with relevant international organizations about the importance of sustainable management of halons and related elements of the present decision and report back to the parties, as needed;

5. [Invites relevant parties to submit information on feedstock production and use and, if available, on related emissions of halon 1301 to the Ozone Secretariat by 15 March 2025, [going back to 1992, where data is available]];

5 (alt) [Invites relevant parties to submit any information they may have on emissions arising from [any] production [including production for feedstocks], use or storage of halon 1301 to the Ozone Secretariat by 15 March 2025, [going back to [1992][1997], where data is available]];

6. [Requests the Technology and Economic Assessment Panel to assess the information submitted in accordance with paragraph 5 above, including the effects, if any, on estimated run-out dates of stocks of recovered, recycled or reclaimed halon 1301 for remaining uses, and to report to the parties on the matter at the earliest opportunity, taking into account the overall workload, but no later than by the Thirty-Seventh Meeting of the Parties].

G. Possible compliance deferral for Article 5, group 2 parties

Submission by Bahrain, India, Kuwait, Qatar and Saudi Arabia

The Thirty-Sixth Meeting of the Parties,

Recalling paragraph 5 of decision XXVIII/2 relating to the amendment phasing down hydrofluorocarbons,

Noting with appreciation the report by the Technology and Economic Assessment Panel containing a technical review of alternatives to hydrofluorocarbons,

Noting that there could be considerable demand for refrigeration and air conditioning equipment in several group 2 parties,

1. *Requests* the Technology and Economic Assessment Panel to provide in its [2027] [annual progress] [2026 Quadrennial Assessment] report an update by sector[,] [and] subsector [and region] on low- and lower-global-warming-potential alternatives to hydrofluorocarbons [for use in Article 5, group 2 parties to [consider] [prepare for] HFC freeze], including the following:

(a) Challenges [, and] barriers [,] [and successful transitions] in terms of availability, accessibility and adoption in various parties operating under paragraph 1 of Article 5 of the Montreal Protocol (Article 5 parties), with a particular emphasis on Article 5, group 2 parties;

(b) Standards for alternative refrigerants as well as equipment, taking into consideration the capacity of equipment in different countries;

(c) Market structure, including supply chain issues;

(d) [Suggestive] [Options] [to address the challenges and barriers identified in paragraph 1(a).] [Pathways] [for promoting adoption in Article 5 parties, with a particular emphasis on Article 5, group 2 parties];

2. *Also requests* the Technology and Economic Assessment Panel to conduct assessments by region of the costs of adoption for Article 5 parties, considering paragraph 1 above, in its 2027 progress report.

H. [Further strengthening Montreal Protocol institutions: next steps

Submission by the European Union

[The Thirty-Sixth Meeting of the Parties,

Recalling decisions XIV/7, XXXI/3, XXXIV/8 and XXXV/12,

Taking note with appreciation of the summary of the workshop on strengthening the effective implementation and enforcement of the Montreal Protocol held in Bangkok on 2 July 2023, in response to decision XXXIV/8,²

Recalling the discussions at the forty-fifth meeting of the Open-ended Working Group on the outcomes of the workshop,³

² UNEP/OzL.Pro.WG.1/45/6.

³ See document UNEP/OzL.Pro.WG.1/45/8, paras. 165–175.

Taking note of the information 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 provided by the Secretariat to the Thirty-Fourth Meeting of the Parties,⁴

Considering that a number of issues raised in the discussions at the forty-fifth meeting of the Open-ended Working Group on the outcomes of the workshop have not yet been addressed by decisions of the Parties, and that the Thirty-Sixth Meeting of the Parties should identify further steps for doing so and for taking stock of the progress made,

1. *Requests* the Secretariat to [review] [extract common elements from] the licensing systems and provide a compilation [of common elements] [to be presented for the consideration of parties at OEWG47];

[2. *Also requests* the Secretariat to provide, before the forty-seventh meeting of the Open-ended Working Group, [an [update of the] analysis of] the annual compilation of information pursuant to decision XXXV/12 [and of other relevant sources], identifying options for addressing cases of illegal trade, for consideration at the Thirty-Seventh Meeting of the Parties;]

[3. *Further requests* the Secretariat to convene, before the forty-seventh meeting of the Open-ended Working Group, [a meeting of experts from interested parties and other persons with relevant expertise] to reflect on the functioning of [the compliance mechanism of] the Montreal Protocol and to identify issues for review by the parties.]]

[- invites parties to provide information of how they address disposition of detained substances;

- requests the Secretariat to maintain a list of parties that may be willing to receive detained substances as long as it is consistent with their national requirements and the Montreal Protocol.]]

I. Avoiding imports of equipment containing or relying on controlled substances [and] not [compliant] [[consistent] with [nationally] binding] MEPS] [and other [energy efficiency-] related regulations]

Submission by Kyrgyzstan

The Thirty-Sixth Meeting of the Parties,

Noting with appreciation the significant role of decision XXVII/8 establishing a list of countries that do not produce hydrochlorofluorocarbon-based products or equipment for domestic consumption and do not wish to import such products or equipment,

Bearing in mind that decision XXVII/8 applies only to ozone-depleting substances,

Considering that the implementation of the Kigali Implementation Plan may benefit from the positive experience of parties in implementing the main provisions of decision XXVII/8, especially in developing countries, by introducing bans or restrictions on imports of energy-inefficient products and equipment,

Taking into account that some parties have already imposed bans or restrictions on imports of energy-inefficient products and equipment and wish to inform exporting countries of that fact through the mechanisms available under the Montreal Protocol,

1. *Invites* those parties that [prohibit] [do not allow] [are not allowed] [to] [the] import [of equipment containing or relying on controlled substances [and other refrigerants] [and] not compliant with [nationally] binding MEPS [energy-inefficient products and equipment] [from any source] to inform the Secretariat, on a voluntary basis, that they [prohibit] [do not allow] [do not consent to the importation] of such [products and] equipment into their territories [, and to provide information on domestic regulations [implementing these restrictions] [, specifying the categories of the equipment concerned];

2. *Requests* the Secretariat to [publish] [maintain] a list of [the information received under paragraph 1 and update that information when new information is available.] [parties that do not wish to receive [equipment containing or relying on controlled substances not compliant with [their]

⁴ UNEP/OzL.Pro.34/8.

[nationally] binding MEPS [energy-inefficient products and equipment], to be circulated to all parties by the Secretariat and updated [annually] [regularly]].

Annex II*

Summaries of presentations by the members of the Technology and Economic Assessment Panel

A. Presentation on the responses to decision XXXV/6 on updated information on very short-lived substances, decision XXXV/8 on feedstock uses, and decision XXXV/9 on abating emissions of CTC

1. Presentation by the Technology and Economic Assessment Panel

1. On behalf of TEAP and its MCTOC, Ms. Helen Tope presented TEAP's responses to decision XXXV/6 on updated information on very short-lived substances, decision XXXV/8 on feedstock uses, and decision XXXV/9 on abating emissions of CTC. In preparing the response to these decisions, she said that TEAP and its MCTOC chemical experts developed the responses to these decisions in consultation and cooperation with the Scientific Assessment Panel (SAP), with SAP providing updated science information, as presented. She noted that the 2022 SAP Assessment Report was used as the main reference, with recent science papers included as agreed in consultation with SAP. She said that TEAP, MCTOC, and SAP reviewed the draft and final reports. For decision XXXV/6 on updated information on very short-lived substances, Ms. Tope noted that many chlorinated hydrocarbons with very low but non-zero ODPs are not controlled under the MP and are monitored by atmospheric scientists, and collectively known as very short-lived substances (VSLs, chlorinated VSLs or Cl-VSLs) because of their atmospheric lifetimes of less than 6 months. She explained that the report focused on 5 Cl-VSLs that are very high-volume chemical products: dichloromethane (DCM), trichloromethane (chloroform, CFM), 1,2-dichloroethane (ethylene dichloride, EDC), trichloroethylene (TCE), and perchloroethylene (PCE). She noted that parties are not required to submit data on production of very short-lived substances to the Ozone Secretariat, and that information in the report was obtained from industry experts, publicly available government and industry data, and SAP as described. She presented data for 2022 on estimated production of chlorinated very short-lived substances and SAP estimated top-down emissions for dichloromethane. For dichloromethane, she noted that 25% of dichloromethane production is for feedstock uses for HFC-32 and that production of dichloromethane for emissive uses is around 1,300 to 1450 ktonnes, consistent with SAP estimated top-down global dichloromethane emissions. She went on to explain that each of the 5 chemicals is used as feedstock and that some also have emissive uses as solvent or foam blowing agent. She stated that feedstock usage of ethylene dichloride is close to 100% and of chloroform is more than 90%, with ethylene dichloride's main feedstock application being the production of vinyl chloride monomer to polyvinyl chloride, the third largest of the global plastics production. She said that chloroform is also used as a process agent solvent in the pharmaceutical industry. She reported that dichloromethane is predominantly used in emissive uses, such as solvent and foam blowing, and that emissive dichloromethane uses have been banned in some regions due to health risks. She said that trichloroethylene and perchloroethylene are also partly used as solvents. She explained that alternatives for these very short-lived substances were reviewed and have been previously reported by MCTOC, FTOC, the former STOC, and MLF implementing agencies, for similar emissive halocarbon uses in these sectors. She noted that alternatives have generally not changed and remain relevant for very short-lived substances, and that selection of alternatives is on a case-by-case basis for specific applications. For solvents, she listed the available alternatives, in order of preference, which are aqueous and hydrocarbon-surfactant, or semi-aqueous, cleaning; hydrocarbon solvent cleaning, where the toxicity is lower than halogenated solvents, such as acetone; halogenated solvents such as HFEs, HFOs, HCFOs; hydrocarbon solvent cleaning, where the toxicity is higher than halogenated solvents, such as toluene and dimethylformamide. For foam blowing, she noted that dichloromethane use is increasingly banned due to human health risks and alternatives are well documented. She referred the meeting to the 2022 TOC Assessment Reports for latest solvent and foam blowing alternatives. She noted that the report provides examples of alternative feedstock routes. She explained that chlorinated hydrocarbons are chosen as feedstocks generally because the chlorine atom is readily replaced, and the chemical structure is amenable to the desired end-product. For decision XXXV/8 on feedstock uses, she reported that in 2022 15 parties reported feedstock use of ozone-depleting substances, and 10 of these parties also produced ODS for feedstock uses. In 2022, she reported that total reported ODS production and import for feedstock uses was 1,943,134 tonnes, which is a 66% increase over the

* The annex is presented without formal editing.

decade that has been mostly due to the increase in feedstock uses of HCFCs, particularly HCFC-22. HCFC-22 is mainly used to produce tetrafluoroethylene, which is polymerised to make fluoropolymers that have many applications. She explained that the increasing demand for HCFO, HFOs and perchloroethylene is driving the more recent increase in carbon tetrachloride feedstock use. She also noted an increase in reported feedstock use of HCFC-244 and HCFC-21, used as feedstocks for different routes to produce HFO-1234yf. She reported that HFC-152a is the largest HFC feedstock use, for example to produce vinyl fluoride that is used to produce polyvinylfluoride. She presented the trends in production and import for the main ODS feedstocks, and noted more information was tabulated in the Progress Report. Ms. Tope recalled that emissions of controlled substances during production, distribution, feedstock use contribute to overall global emissions. She noted that some controlled substances arising as feedstocks and by-products have non-feedstock uses or have emissions from banks of RACHP equipment or foams, which can prevent direct comparison of estimates of annual global emissions from feedstock production and use with estimates from atmospheric observations. She explained that comparison was made of estimates of annual global emissions of controlled substances based on bottom-up calculations, where these could reasonably be made with currently available data, and annual global emissions estimated by SAP based on atmospheric observations taken from the 2022 SAP Assessment Report and other agreed sources. She further explained that bottom-up calculations were made using emissions factors for feedstock production, supply chain, and feedstock use, developed by MCTOC in its 2022 Assessment Report, with the most likely emission factors applied to the amount of production for each substance. She explained that MCTOC selected a group of controlled substances for comparison with the available data. Ms. Tope went on to summarise the results of the comparisons of estimated annual global emissions. For several substances, such as 1,1,1-trichloroethane and CFC-113, she reported that there was reasonable agreement between bottom-up calculations and top-down estimates; although she noted that, according to SAP, top-down emission estimates for CFC-113 may have some small contribution from CFC-113a that is not yet well characterised. For some substances, such as CFC-114, HCFC-124, HCFC-133a, she noted that there were differences between bottom-up calculations and top-down emission estimates, and in some cases, possible reasons for these differences were proposed, for example, emissions of HCFC-124 intermediate from HFC-125 production appear to make a significant contribution to total HCFC-124 emissions, and more than 90% of reported HCFC-133a emissions are suggested to be due to emissions of intermediate HCFC-133a from the production of HFC-134a. However, she explained that for at least one substance, a representative bottom-up calculation was not considered possible with the data currently available to TEAP. She gave the example of the feedstock use of Halon 1301 in fireproof production, where the most likely emission factors were not considered applicable and adequate operational information was not available to better characterise the emission factor for this process. She referred the meeting to TEAP's Progress Report presentation where the Fire Suppression Technical Options Committee would discuss Halon 1301 emissions. Regarding alternatives to feedstock uses of controlled substances, she noted that MCTOC reviewed and updated the list of available alternatives to ODS feedstock, together with including alternatives to HFC feedstock use, and that the list of alternatives to ODS feedstock uses has not changed significantly. She referred to additional information on technical feasibility, economic viability, safety and sustainability, which is provided for large scale feedstock uses in the Progress Report. She reported the outcome of the review, which indicates that only a few technically and commercially possible alternatives to the controlled substance feedstocks currently used have been identified and these alternatives do not cover all of those controlled substances, and that those that are available are likely to require significant economic and/or technical hurdles to be overcome to be able to compete with, or replace, existing processes, equipment and supply chains that use controlled substance feedstocks. She indicated that the absence of switching production to alternative, non-controlled substance, feedstocks suggests that in many cases these hurdles do not make them attractive. She then reported that in response to the decision on carbon tetrachloride, MCTOC has updated its global carbon tetrachloride emissions estimations for 2022 from CTC production, handling, supply chain, and use, from non-chloromethanes production, legacy emissions from landfill, industrial and contaminated sites, and from new unknown industry sources that are not yet fully characterised, to be around 30 ktonnes, and between the range 17 to 48 ktonnes. She noted that SAP has estimated top-down global CTC emissions for 2022 from AGAGE data to be 43.6 ktonnes, with uncertainty plus or minus 14.1 ktonnes, and from NOAA data to be 33.8, with uncertainty plus or minus 14.2 ktonnes. She noted that within the range of uncertainties, the bottom-up and top-down global emissions estimates for CTC are now in general agreement and that SAP and MCTOC will continue to review the situation for carbon tetrachloride emissions for its 2026 Assessment Report. She explained that the methodology for estimating bottom-up emissions of CTC is based on SPARC (2016) and Sherry et al. (2018) using available updated information on CTC pathways, reported production and use, and estimated emission factors. She noted that examples of potential and existing alternatives to current CTC feedstock uses to make products were provided in the report in response to

decision XXXV/7 on feedstock uses. She explained that CTC usage is quite specific in its main feedstock applications, and that available alternatives are not as technically and/or economically feasible. She reported that best practices are available for minimizing emissions from feedstock production, by-production, and use, including for CTC. She recalled that best practices were detailed further in the 2022 MCTOC Assessment Report, the 2023 and 2024 TEAP Progress Reports, and that this information remains unchanged. In concluding remarks, Ms. Tope summed up that TEAP has reviewed all the available information on chlorinated very short-lived substances, feedstock uses, and CTC, and that for CTC and dichloromethane, bottom-up and top-down emissions estimates are generally in good agreement within uncertainties, and that for feedstock uses, where there are differences, these are explored and/or explained in the report. She concluded by saying that any further information provided by parties, or other information that becomes available, would be reviewed and included for the 2026 Assessment.

2. Presentation by the Scientific Assessment Panel

2. The SAP coordinated with the TEAP for the presentation on agenda item 3 in response to MOP 35 decisions XXXV/6, XXXV/8 and XXXV/9.

3. The SAP portion of the presentation reminded the parties of the challenges of determining emission estimates and ozone depletion potentials for VSLs. The information on ODPs for VSLs as collated in the Annex to the 2022 SAP assessment report remains unchanged. Based on observations, updated annual emission estimates for 2021 and 2022 were provided for dichloromethane (DCM) and carbon tetrachloride, which extends the records two years beyond the results included in the 2022 assessment. These updated data were used as input to the TEAP/SAP report on these same decisions. The SAP plans to update the Annex with new information about VSLs and associated ozone depletion in the 2026 SAP assessment report.

B. Life-cycle refrigerant management

4. Mr. Roberto Peixoto started his presentation on behalf of the decision XXXV/11 TEAP Task Force, saying that the presentation will be done with the other Task Force co-chair, Mrs. Hilde Dhont.

5. Mr. Peixoto initially mentioned that the report addresses the four main points requested by the parties, which are: (i) available technologies for the leakage prevention, recovery, recycling, reclamation and destruction of refrigerants, and their accessibility in parties; (ii) the obstacles and challenges associated with the effective leakage prevention, recovery, recycling, reclamation and destruction of refrigerants; (iii) the costs and climate and ozone benefits; and (iv) policies, incentive schemes, good practices and lessons learned.

6. In the sequence, Mr. Peixoto presented the TEAP Task Force membership, and the definition of Life-cycle Refrigerant Management, LRM, mentioning that it is a comprehensive approach to managing refrigerants throughout their entire lifecycle, involving: (i) prevention of refrigerant leakage of RACHP equipment; (ii) recovery of refrigerant during servicing and at end-of-life (EOL); (iii) reuse, either through recycling or reclaiming; and (iv) destruction.

7. Then Mr. Peixoto handed over to co-chair, Hilde Dhont, who described the four steps of LRM.

8. Mrs. Dhont explained that Life-cycle Refrigerant Management aims to minimize direct emissions of refrigerants in RACHP through four key measures: Leak prevention; Refrigerant recovery; Reuse (through recycling or reclamation); and Destruction.

9. On leak prevention she explained that this encompasses a variety of preventive actions during design, manufacturing, transport, storage, installation, use and end-of-life treatment. International standards and other guidelines provide recommendations in this regard, such as the selection of suitable materials, technicians training and regular tightness inspections. She further elaborated that tightness inspection requires the use of leak detection methods, which can be direct or indirect or a combination thereof. Various leak detection methods are available but not always accessible in Article 5 parties.

10. Mrs. Dhont explained that refrigerant recovery is essential before recycling, reclamation or destruction can take place, but that it remains low in many Article 5 and non-Article 5 parties. Effective refrigerant recovery requires a change in behavior to stop venting to the atmosphere through technician training, access to recovery machines, establishment of a reverse supply chain, sufficient technician time and financial mechanisms to support responsible recovery.

11. Refrigerant reuse does not count towards Montreal Protocol consumption targets and can contribute to compliance. Reuse can be done through recycling or reclamation, and Mrs. Dhont

explained the difference between both, following the definitions in the Montreal Protocol handbook. Whereas recycling often occurs “on-site” and is most suitable for single component refrigerants, the reclamation is often “off-site” and suitable for blends, although blends present particular challenges as in some cases composition changes can occur. Incentives for refrigerant reuse are highly sensitive to the size and accessibility of the refrigerant bank, the regulatory environment, the availability of alternative technologies and to virgin refrigerant prices. Mrs. Dhont explained that if a phase out or phase down regime creates a shortage of virgin refrigerant, then refrigerant reuse may increase. However if the supply of virgin refrigerant remains plentiful, then reused refrigerant may be non-competitive and other policy and economic measures may be required to incentivize LRM.

12. Finally Mrs. Dhont explained that some recovered refrigerants need to be destroyed, for example if they are highly contaminated or there is no market need. She pointed out that the Montreal Protocol established a list of approved destruction methodologies for the purpose of production data reporting. She explained that there is adequate global capacity for destruction but that it is unevenly distributed between non-Article 5 and Article 5 parties, and also between Article 5 parties. She mentioned it can be anticipated that destruction technology may improve in cost, scalability, mobility and efficiency.

13. After Mrs. Dhont’s initial exposition, Mr. Peixoto took over again to continue the LRM report presentation and mentioned the several aspects related to LRM costs. Mr. Peixoto said that LRM costs include capital, variable, and opportunity costs. He mentioned that LRM requires substantial investment for the acquisition and operation of equipment in both Article 5 and also non-Article 5 parties, and that LRM costs depend the type of refrigerant, the scale of the operation, regional regulations, the technology used, and the fate of the recovered refrigerant (reused or destroyed). Additionally, Mr. Peixoto said that recovery and recycling are not capital intensive, and requires large amount of equipment to be sustainable, and the equipment for reclamation is more sophisticated, capital intensive and centralized. Then Mr. Peixoto presented some average costs for LRM equipment and facilities.

14. Continuing, Mr. Peixoto presented the main points related to LRM policy framework discussed in the report, mentioning the importance of mandatory and voluntary LRM policies and programmes currently implemented in many parties, and that lessons have been learnt from those experiences.

15. Then Mr. Peixoto presented some issues identified by the Task Force regarding LRM infrastructure, such as the inadequacy of LRM infrastructure in Article 5 parties, particularly in low-volume consuming (LVC) parties, which lack equipment, analysis laboratories, facilities, and capacity building related to training of technicians.

16. Mr. Peixoto also presented that the Task Force report discusses challenges and barriers for LRM, and that some of them are low volumes in smaller Article 5 parties that may not achieve the economies of scale to be commercially viable; companies find it difficult to justify funding reverse supply chain infrastructure; and that there are challenges related to LRM funding and the expansion of existing and new innovative financing mechanisms.

17. In the last part of his presentation Mr. Peixoto highlighted that the Task Force assessed the LRM ozone and climate benefits, through preliminary modeling efforts.

18. Mr. Peixoto said that the Task Force considered two pre-Kigali Amendment scenarios, one without LRM practices, and one with LRM practices in all parties, and that assessing preliminary simulation the Task Force report mentions that the adoption of LRM presents an estimated HCFC emissions reduction up to 5 kilotons ODP between 2025 and 2040, and an estimated HFC and HCFC emissions reduction up to 39 gigatons CO₂ equivalent between 2025 and 2050.

19. And then Mr. Peixoto handed over again to Mrs. Dhont to close this presentation with some of the main conclusions of our report.

20. Mrs. Dhont concluded the presentation with following key messages:

- LRM technologies are available for leak prevention, recovery, recycling, reclamation and destruction but not accessible in all A5 parties;
- There are policy, economic and accessibility obstacles and challenges associated with effective LRM;
- If a phase out / phase down regime creates a shortage of refrigerant and leads to price increases, then refrigerant recovery may increase. However, if supply of newly produced refrigerant remains plentiful, other policy and economic measures may be required;

- Mandatory and voluntary LRM policies and programmes are currently implemented in many parties with varying levels of effectiveness;
- Establishing a data collection system by parties could inform their decision-making for optimal LRM strategies;
- The cost effectiveness of LRM could not be assessed;
- LRM practices can be a key component of refrigerant emissions reductions;
- LRM can achieve emissions reductions beyond those strictly from compliance with the Kigali Amendment;
- LRM may be the key tool for some parties to achieve Kigali compliance.

21. Mrs. Dhont mentioned that TEAP continues to follow these issues and its potential emission reduction opportunities and thanked the LRM Task Force for their contribution to the LRM Task Force Report.

C. Presentation by the Technology and Economic Assessment Panel working group on decision XXVIII/2, paragraph 5 on a technical review of alternatives relevant to group 2 Parties

22. Ms. Bella Maranion, Co-chair of the TEAP, began her presentation on behalf of her Working Group (WG) Co-chairs Suely Carvalho and Helen Walter-Terrinoni and the members of the WG. She noted that the response to this decision is Chapter 8 of the TEAP 2024 Progress Report. She noted that the decision taken 8 years ago, included in paragraph 4, a request to the TEAP to conduct periodic reviews of alternatives, in 2022 and every five years thereafter, using the criteria set out in paragraph 1 (a) of decision XXVI/9, in 2022 and every five years thereafter, and to provide technological and economic assessments of the latest available and emerging alternatives to HFCs. The criteria for review of alternatives as set out in Decision XXVI/9, paragraph 1(a) includes whether they are: commercially available; technically proven; environmentally sound; economically viable and cost-effective; safe to use in areas with high urban densities considering flammability and toxicity issues, including possible, risk characterization; easy to service and maintain. TEAP's first response to paragraph 4 of the decision is contained in its September 2022 Decision XXVIII/2 TEAP Working Group Report: Information on Alternatives to HFCs. This report was based on the 2022 TEAP and TOCs assessment reports being prepared during the same period.

23. Paragraph 5 of the decision requests the TEAP to conduct a technology review four or five years before 2028 to consider a compliance deferral of two years from the freeze date of 2028 for Article 5, group 2, (G2) parties to address growth above a certain threshold in relevant sectors. The decision established the G2 parties as Bahrain, India, the Islamic Republic of Iran, Iraq, Kuwait, Oman, Pakistan, Qatar, Saudi Arabia and the United Arab Emirates. To respond to paragraph 5 of the decision, TEAP established a working group composed of members from the TEAP and two contributing experts from the RTOC. TEAP conducted this one-time assessment responding to paragraph 5 based on its September 2022 report. While the 2022 review focused on alternatives for HFCs globally, this review focused on alternatives in sectors relevant to G2 parties. The same sectors as in the 2022 report are covered in this review, focusing on the refrigeration, air conditioning, and heat pumps (RACHP) sector. Sector information in the 2022 report remains relevant, so TEAP refers to that report for full details. TEAP also considered other relevant changes that have occurred since adoption of Decision XXVIII/2 in 2016 that are relevant to G2 parties including: standards for refrigerants and RACHP equipment; technology conversion investment and demonstration projects approved, implemented, or under implementation; and potential activities included in the 2024-2026 business plan under the MLF.

24. Ms. Maranion noted that TEAP's approach to paragraph 5 was to provide its technical review of alternatives relative to G2 parties. TEAP did not attempt to: assess individual national market dynamics and possible implementation plans; qualify whether alternatives will enable G2 parties to achieve certain reductions by a certain date, which requires consideration of factors beyond specified technical and economic criteria; assess relative ability of G2 parties to comply with control measures, which depends on their Kigali Implementation Plans (KIPs) and implementation approach. TEAP deferred to parties to consider, or not, any changes to phasedown schedules.

25. Mr. Omar Abdelaziz, RTOC co-chair, next presented information on alternatives in the RACHP sectors. He noted that the RACHP sector continues to dominate HFC consumption. In a TEAP 2016 report, it was estimated that RACHP contributes to approximately 80% of the global GWP-weighted HFC emissions. More recent 2022 Country Programme data reported to the MLF Secretariat by 117 out of 144 Article 5 parties show the same approximate percentage of HFC

consumption in the RACHP sector. So the WG approach in this current technical review was to focus mostly on the RACHP sector. He noted that the 2022 Report findings remain relevant for both G1 and G2 parties. Lower GWP alternatives to the popular high GWP HFCs are available for most RACHP applications, but there is limited accessibility to alternatives for some Article 5 parties. There is still ongoing development of new lower GWP refrigerants. There are a number of significant RACHP applications with widely available alternatives with GWP < 10 including hydrocarbons (HCs), CO₂ (R-744), ammonia (R-717) and hydrofluoro-olefins (HFOs). For some applications alternatives with GWP of up to 750 can quickly be adopted (e.g., HFC-32 and R-454B). Lower GWP refrigerants are available, and the technology is mature for many RACHP applications; however, there could still be minimal use of the popular high GWP HFCs in new equipment. Lower GWP alternatives adoption can be increased by: measures to discourage import of equipment with high GWP HFCs, awareness programs related to lower GWP alternatives, and training related to use of flammable refrigerants. Some applications are still reliant on high-GWP refrigerants. These are applications with small consumption of HFCs relative to other RACHP applications. One is transport refrigeration (vans, trucks, trailers, containers) which was a major user of R-404A (GWP 3922, HFC blend) and R-452A (GWP 2140, HFO-HFC blend) is now widely available with lower GWP options under development. Another application is ultra-low temperature systems (e.g., freezers for vaccines at -70°C) which rely on cascade refrigeration systems. These presently use high GWP gases, e.g., R-508B (GWP 13,396; HFC-PFC blend) with lower GWP options mainly in the development stage.

26. Mr. Abdelaziz said that the WG looked at some commonalities among G2 parties. Most G2 parties have manufacturing enterprises producing RACHP units, with local or mixed ownership, and with varying capabilities for research and development. At least one G2 party, India, also manufactures components that are used for building RACHP units like compressors or motors. Manufactured units are mostly sold locally, but some parties have significant output made for export and needs to respond to the importing parties' requirements. All the G2 parties are in a geographical region with similar climatic conditions although one party, India, is not defined as a high ambient temperature (HAT) country as per the definition set by Decision XXVIII/2, paragraph 29. All G2 parties have Minimum Energy Performance Standards (MEPS) in place; however, the MEPS are not harmonised and use different temperature settings for the efficiency ratings and use different minimum efficiency levels. G2 parties are at varying stages of HCFC phaseout with some more advanced than the Montreal Protocol control targets. Due to the HCFC phase-out, by 2024 the use of HCFC refrigerants in A5 parties has significantly decreased. All G2 parties import HFC-based units across most RACHP applications.

27. He reviewed the criteria under Decision XXVI/9, paragraph 1(a) relative to G2 parties. TEAP did not find a distinguishing factor for G2 parties in the criteria for commercial availability, environmentally sound, and economically viable and cost effective. He noted that with regard to the criterion on safe to use in areas with high urban densities, some A5 parties have still not adopted international standards, while in others even if the standard is accepted, it is not mandatory. With regard to the criterion on ease to maintain or service, all A5 parties may require training and mandatory certification procedures; G2 parties fall within three groups of higher consumption brackets and share common characteristics with the other parties in those brackets. With regard to the technically proven criterion, TEAP considers that it is possible to produce a system using certain refrigerants that are accessible and technically proven in non-A5 parties whilst the local industries or consumers in G2 parties might have reservations in accepting the product. Having taken all the above criteria into consideration for G2 parties, the only distinguishing criterion for accessibility in G2 parties is whether refrigerants are technically proven.

28. TEAP categorised the lower GWP alternatives in groups as follows: non-Montreal Protocol controlled substances (including multiple flammability and toxicity classes) which have very low to zero GWP and zero ODP and include ammonia (R-717), hydrocarbons (HCs), CO₂ (R-744), HFOs & HCFOs; A2L refrigerants which are Montreal-controlled substances that are mildly (or lower) flammable A2L (A2L refers to the safety class of refrigerants as ASHRAE-34 or ISO-817) and include HFC-32 and various HFC-HFO blends, with GWPs between 140 and 1,100; A1 refrigerant blends which are Montreal-controlled non-flammable (A1 safety class) HFC or HFC-HFO blends with GWP that can exceed 1,100; and refrigerants currently "under consideration" which TEAP uses to refer to refrigerants that are either under development, testing, or have not been commercialised yet globally; these refrigerants are consequently not accessible to G2 parties but are listed. He then reviewed some example tables on RACHP applications including appliances, food retail and service refrigeration, and air-to-air conditioners and heat pumps, noting that remaining tables are in the chapter and in back-up slides to the presentation.

29. Ms. Suely Carvalho, TEAP Senior Expert and WG co-chair, continued the presentation on information on alternatives for foam, fire suppression, and medical and chemical sectors. For these

sectors, the 2022 Report findings remain relevant for both G1 and G2 parties. An update in the foams sector is that HFC-365mfc has been reported as no longer commercially available as production ceased in September 2023, with no reports of any new manufacturing. In the fire suppression sector, both G1 and G2 parties face the same barriers to the use of lower GWP alternatives. An update for this sector is that the use of FK-5-1-12 may become affected by proposed PFAS regulations and definitions in the EU and other parties. Since the 2022 report, there have been no significant updates for aerosols, solvents, semiconductor/electronics manufacturing and magnesium production. For MDIs, global legislation and corporate policies of major pharmaceutical companies may accelerate the introduction of lower GWP pMDIs in Article 5 parties. This could potentially mean lower GWP pMDIs are available in Article 5 parties from 2026 onwards. The reduction in use of HFCs in Europe/United States may lead to security of supply and commercial pricing concerns for Article 5 parties, including India.

30. Ms. Carvalho presented information on standards, regulations, and building codes, noting that these have been regularly updated since 2016 incorporating learnings from company and industry sponsored research. As the industry moves from conventional high GWP products toward lower GWP refrigerants, the safety classification of refrigerants is changing; therefore, equipment and installation standards need to be updated to incorporate these changes. Some examples of equipment covered by standards include: compressors; commercial refrigerating appliances; heat pumps, air-conditioning units and dehumidifiers, including chillers; ice-cream appliances/ice makers; packaged AC systems; refrigerant recovery equipment. Several G2 parties participate in the Gulf Cooperation Council (GCC) Standards Organization (GSO) (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and UAE). Examples of International and Regional RACHP standards can be found in Annex 2.

31. Upon request by the WG co-chairs, the MLF Secretariat provided relevant information on projects completed, approved and/or under implementation on G2 parties. Annex 3 contains examples of relevant demonstration and investment projects for G2 parties since 2016 (India, Bahrain, Iran, Kuwait, Pakistan and Saudi Arabia). Planned activities included in the MLF Adjusted Consolidated Business Plan 2024-2026 for G2 parties (India, Iran, Iraq, Oman, Pakistan, and Qatar) are contained in Annex 4 of the TEAP 2024 Progress Report. Only India and UAE had ratified the Kigali Amendment as of 19 April 2024, with Bahrain recently ratifying on 1 July 2024; UAE does not receive MLF financial assistance. Table 8.9 in the chapter provides reporting of HFC consumption by some G2 parties.

32. Ms. Carvalho provided some conclusions for the presentation. In accordance with the TOR, TEAP provided technical review of alternatives relative to G2 parties based on the September 2022 report. She noted that TEAP did not attempt to qualify whether alternatives will enable G2 parties to achieve certain reductions by a certain date, which requires consideration of factors beyond specified technical and economic criteria. TEAP did not attempt to assess relative ability of G2 parties to comply with control measures, which depends on their implementation approach. TEAP defers to parties to consider, or not, any changes to phasedown schedules.

33. The current technical review reinforced key messages from 2022 report: the development of lower GWP alternatives for most applications in all sectors since 2016 supports HFC phasedown globally; alternatives in all sectors meeting technical criteria are in use by many parties, including G2 parties; some technically proven alternatives accessible to all parties including in G2 parties have some challenges identified which need to be addressed; and for most of the criteria investigated, the TEAP working group did not find any distinguishing factor between G1 and G2 parties.

D. Presentation of the Technology and Economic Assessment Panel 2024 progress report

1. Flexible and Rigid Foams Technical Options Committee

34. Mr. Altoé acknowledged his colleague co-chair Ms. Helen Walter Terrinoni in presenting the FTOC report.

35. Mr. Altoé described that the successful transitions from hydrofluorocarbons (HFCs) and hydrochlorofluorocarbons (HCFCs) continues for most foam types. He also mentioned that all previously used HFCs, except HFC-152a, are no longer allowed for use in foams in almost all non-Article 5 (A5) parties. Supply chain recovery continues for foam blowing agents (FBAs) and other raw materials. Hydrofluoroolefin (HFO) / hydrochlorofluoroolefin (HCFO) supply shortages have eased, in both A5 and non-A5 parties, due to capacity increases. High demand for pentanes has created shortages in some cases. He commented that plant closure of HFC-365mfc at the end of 2023 has

created issues in A5 parties that implemented this blowing agent to phase out HCFCs. HFC-245fa is still being used in A5 to mitigate costs of foams with HFO/HCFOs.

36. Mr. Altoé stated that enterprises in A5 and non-A5 parties transitioned away from fluorocarbons (FCs). He also commented that non-fluorocarbon components (e.g., hydrocarbon (HC), methylal, methyl formate, and methylene chloride) are reportedly blended with FCs to reduce costs.

37. In the last part of the presentation Mr. Altoé highlighted the risks of flammable FBAs and toxic FBAs which could lead to safety concerns for end-users and workers at system houses and foam manufacturers, especially small and medium enterprises (SMEs). For example, 1,2 dichloroethylene (1,2-DCE) toxicity and use in foam is currently being reviewed by at least one party. Field studies related to spray foam indoor air quality (IAQ) show concentrations of 1,2-DCE for months to years after installation. Mr. Altoé stated that FTOC is seeking additional information about safety measures to address exposure and safety risks in SMEs, for Hydrocarbons as blowing agent for spray foam in some A5 parties.

38. Mr Altoé then turned to Adam Chattaway to provide the FSTOC report.

2. Fire Suppression Technical Options Committee

39. Adam Chattaway acknowledged his co-chairs: Sergey Kopylov and Dan Verdonik.

40. He stated that the FSTOC is not aware of any new fire suppression alternatives to halons, HCFCs or high-GWP HFCs. Furthermore, development of a low-GWP agent blend has ceased, possibly owing to the uncertainty of PFAS regulations. The uncertainty over the proposed PFAS definitions and regulations could impact the transitions away from high-GWP HFCs, including Kigali Implementation Plans.

41. He noted that although R&D activities continue in the civil aviation sector, there are no certified alternatives to halon 1301 in aircraft cargo compartments and engines, either for newly-produced aircraft or for retrofit of existing aircraft. This has relevance to the EU end-dates of 2040, by which all halons need to be removed from all EU registered aircraft.

42. Mr. Chattaway observed that the destruction of halon 1301 for carbon credits is continuing; this could deplete the halon 1301 bank, bringing the run-out date closer to 2030.

43. He said that recently fire suppression standards / approvals have been updated to allow the use of reclaimed HFC-227ea for new systems as well as for refill. Reclaimed fire suppression agents have the same purity standard as newly-produced agents, so their fire suppression efficiency is identical. He noted that the FSTOC views this as a positive step, as it incentivizes banking of HFC-227ea for fire suppression applications.

44. In the wider fire protection industry, there appears to be confusion around the intent of the Montreal Protocol in relation to halon management; he regularly hears comments to the effect that “Halon is banned; Halons have been phased out”, etc.

45. He stated that parties may wish to consider the following:

(a) Clarifying and reinforcing the message that recovery, recycling, and reclamation of fire suppressants is encouraged under the Protocol. i.e., the production and consumption of newly manufactured halons is banned, not the use of halons; Facilitating the transboundary shipments of recovered halons for recycling/reclamation to another party that has those capabilities; Discouraging parties from destroying halons unless they cannot be reclaimed to an acceptable purity. He acknowledged that the European Union has added this language to the latest version of their Ozone Depleting Substance Regulations.

(b) He also explained that the Ozone Secretariat published data on production of halons for feedstock use. When the FSTOC plotted these data over time, they noticed the annual pattern of production closely matches peaks and troughs of emissions derived from atmospheric measurements. Trying to use the emission factors published by MCTOC to relate production for feedstock to emission, resulted in very low emissions. As detailed in the progress report, the FSTOC used successively higher emission factors. At 26% the match was remarkable, as shown in the graph presented. The purple line is the emissions modelled by the FSTOC. The orange line shows emissions derived from atmospheric measurements. The black line is emissions from feedstock with a 26% emission factor added to the FSTOC model. Mr. Chattaway emphasized the match is remarkable or even undeniable.

(c) He acknowledged that a 26% emission rate is high, but it is important to recall that there will be additional emissions when the halon 1301 is used as a feedstock. There are patents

describing the yield of Fipronil (that is how much of the halon is converted to Fipronil). While the FSTOC have limited information, they believe this yield is not inconsistent with the overall emission factor.

(d) Therefore, parties may wish to consider providing information on emissions from production for, and feedstock use of, Halon 1301 to the Ozone Secretariat for confidential use by the TEAP in its assessment. He concluded that clearly, more work is needed to understand this fully.

46. Mr. Chattaway handed over to Ian Porter of the MBTOC.

3. Methyl Bromide Technical Options Committee

47. On behalf of the MBTOC Co-chair, Marta Pizano, the Methyl Bromide Technical Options and TEAP, MBTOC Co-chair, Ian Porter, presented an overview of the Critical Use Nominations submitted in 2024. He stated that in this round, MBTOC received one application for critical use of MB of 2.850 tonnes in 2025 for preplant soil use in strawberry nurseries from Canada. This amount represented a 26% reduction from the amount approved last year at the 35th MOP. Canada reported no stocks at the end of 2023 and indicated a reduction plan to potentially phase out MB by 2026.

48. MBTOC accepted the progress made by Canada and an interim recommendation of the full amount of 2.850 tonnes of MB as nominated was made. No A5 party submitted a CUN for MB use in this round.

49. Mr. Porter then highlighted the great effort by the parties to reduce the critical use nominations requested for controlled use over the last two decades from 2005 to 2025, where the original number of applications of approximately 145 CUNs for 18,600 tonnes in 2005 had been reduced to 1 for 3 tonnes in 2025. He then followed with a highlight from the Progress Report with a significant milestone that over 62,300 t (99.9%) of the MB used for controlled (i.e. non-QPS) uses is now reportedly phased-out.

50. Alternatives for QPS MB uses for Quarantine and Pre-shipment (QPS) which uses between 8,000 to 10,500 t annually is now the focus. It was highlighted that technically and economically feasible alternatives are available for over 40% of current QPS uses, particularly for the PS uses. However, reports and websites identify that substantial MB is still being used for unreported controlled use and this questions non-compliance. One method to avoid this situation was for parties to reinforce policies which ensure that MB is only used for QPS. This means strictly only using MB within the defined guidelines, being: (i) MB use for Quarantine (Q) is only for quarantine pests; or (ii) MB use for Preshipment (PS) is only for 'officially endorsed' control of cosmopolitan pests, and only within 21 days before export, and that official documentation must have been in place before 1996.

51. A chart of the relative decline in the use of MB for non QPS verses QPS uses was highlighted. He then finalized the presentation by referring to key messages from the progress report on QPS use of MB. These included: 1. Key alternatives for QPS include: ethane dinitrile (EDN), hydrogen cyanide (HCN), and ethyl formate (eFume). He noted that EDN has potential to replace up to 50% of MB QPS use (e.g. for timber/wood product treatments) and is increasing registration globally; 2. New regulations in New Zealand have led to a sharp drop in use of MB for QPS of over 800t, with phosphine being taken up for logs. Australia has accepted controlled atmosphere treatments for Khapra beetle on grain. Japan is expanding registration of methyl iodide for some QPS uses; 3. However, India has increased QPS consumption due to regulations that favour MB as the primary treatment. For example, MB is required on imported timber and wood products from Uruguay and Argentina; 4. The US is unique in using MB for preplant treatments of nursery crops; 5. There is uncertainty over the future of MB alternatives e.g., sulfuryl fluoride (SF) in the EU, where it raises concerns that some QPS treatments may revert back to MB treatment.

52. Mr. Porter handed over to Mr. Abdelaziz from RTOC.

4. Refrigeration, Air Conditioning and Heat Pumps Technical Options Committee

53. Mr. Abdelaziz acknowledged his RTOC co-chairs: Roberto Peixoto, Fabio Polonara, Rajan Rajendran and the work of his RTOC colleagues.

54. Mr. Abdelaziz then mentioned that in RTOC, members met in-person in summer 2023 and spring 2024 to determine the structure of the assessment report and reached a consensus that it will be organized around Cold Chain, Comfort Cooling and Heating applications, and Equipment.

55. He said that in terms of membership, RTOC welcomed a fourth co-chair appointed from the US who was already an RTOC member. He also mentioned that all members' appointments end in

December 2024 and that reappointment will be scrutinized to ensure that they can successfully produce the 2026 Assessment Report and address future challenges while maintaining proper balance.

56. Mr. Abdelaziz then discussed the adoption of the lower GWP refrigerants. He indicated that the availability of lower GWP alternative refrigerants continues to grow for all RACHP sectors. He also mentioned that 18 new lower-GWP refrigerant blends received designations and classifications from ASHRAE Standard 34 and/or from ISO standard 817. In addition, Mr. Abdelaziz stated that globally, domestic refrigeration industry is accelerating the conversion from HFC-134a to HC-600a and that in food retail, food service and transport refrigeration the less than 150 GWP alternative refrigerants, including non-fluorinated refrigerants and HFO containing blends, are common in non-A5 parties, while in both non-A5 and A5 parties, lower GWP alternative refrigerants continue to replace high-GWP R-404A and HFC-134a. Also, on this topic, Mr. Abdelaziz said that the HFC/HFO blend R-452A is now used in road transport refrigeration while HFO-1234yf is used in marine container refrigeration.

57. He then cited that in US and Europe, regulatory GWP limits on small and large air-conditioning and heat pump systems are driving the growth and adoption of <700 and <150 GWP alternatives to high-GWP refrigerants. Furthermore, he suggested that vehicle electrification requires holistic vehicle thermal management (heating and cooling of the driver cabin along with battery cooling) and referred to a cooperative research program that is underway to investigate lower-GWP refrigerants suitable for electric vehicles.

58. In response to Decision XXXV/10, Mr. Abdelaziz stated that the RTOC reviewed the energy efficiency landscape and provided several updates on energy efficiency while phasing down HFCs in the RACHP sectors. He started by quoting the Global Cooling Stocktake Report 2023 that showed that passive cooling, higher energy efficiency standards, and faster phase down of climate warming refrigerants used in the cooling industry could avert up to 60% of the predicted direct and indirect CO₂eq emissions from the cooling sector by 2050. He also mentioned that many Article 5 parties are working on approving harmonized regional Minimum Energy Performance Standards (MEPS) for AC and residential refrigerators. Finally, he said that dumping of high-GWP and/or ODP refrigerant and low-efficiency cooling equipment is widespread, with additional evidence presented for Southeast Asia.

59. Mr. Abdelaziz finally provided updates on the funding related to energy efficiency within the Montreal Protocol's Multilateral Fund (MLF). He started by reiterating that the Executive Committee (ExCom) adopted decision 91/65 and created a funding window of US\$20M for EE projects. Then he said that at their 93rd meeting, the ExCom approved projects totaling over US\$4.5M, including 9 non-investment projects, 2 investment projects, and 4 preparation projects. He concluded his intervention by stating that since the publication of the report, the ExCom has approved 4 non-investment projects total funding of approximately US\$720 thousand including support costs under Decisions 94/54, 55, 56, and 57, respectively and that the ExCom agreed on a funding window of US\$100 million for projects developed and implemented under the operational framework elaborated during the meeting, subject to further augmentation by the ExCom (Decision 94/60).

5. Medical and Chemicals Technical Options Committee

60. On behalf of the Medical and Chemical Technical Options Committee and its co-chairs, Takeshi Eriguchi and Jianjun Zhang, co-chair, Ms. Tope, then provided an update on the development of lower GWP pressurised metered dose inhalers (pMDIs). She recalled that pMDIs, dry powder inhalers, aqueous soft mist inhalers, and other delivery systems, all play a role in the treatment of asthma and chronic obstructive pulmonary disease. She reported that the development of lower GWP pMDIs is progressing, though potential challenges could risk the consistent supply of affordable medicines, as discussed in previous reports. She indicated that at least 10 companies globally could have active programmes to develop pMDIs with lower GWP propellants HFC-152a and HFO-1234ze(E), and that generic pMDI manufacturers are also developing lower GWP pMDIs, including in A5 parties. She said that development is a complex process involving new ways of manufacturing, new clinical trials, and new regulatory approvals, and reported that three manufacturers have registered clinical studies for three inhalers, which are due to be completed in 2025. With subsequent regulatory submissions/approvals, she indicated that the first lower GWP pMDIs may not reach the market sooner than 2026. Ms. Tope said that the price of bulk HFC propellant currently used in pMDIs is likely to increase as HFC quotas for non-pharmaceutical uses tighten, making some pMDIs less commercially attractive to manufacture. She reported that the price of some new lower GWP pMDIs will be higher due to capital investment, research and development, and increased costs of propellants and valves. She suggested that the impact of global legislation and corporate policies may accelerate the introduction of lower GWP pMDIs in A5 parties well before their scheduled Kigali HFC

phase-down, meaning lower GWP pMDIs could be available in A5 parties from 2026 onwards. She reiterated that the reduction in HFCs use in Europe and United States may lead to uncertainty over security of supply and commercial pricing concerns in A5 and other parties for current HFC propellants and MDIs. For other aerosols, Ms. Tope reported that the non-pMDI aerosol market continues to evolve with improvements in aerosol valve technology allowing for effective use of some non-HFC propellants, such as nitrogen and compressed air, in more applications.

61. On behalf of the TEAP and its TOCs, Ms. Tope summarised information on per- and poly-fluoroalkyl substances (PFAS) on emerging policies and sector considerations. She explained that the definitions for PFAS incorporated into potential future policies varies between jurisdictions, and that they may include Montreal Protocol controlled substances, substitutes, and breakdown products, such as trifluoroacetic acid (TFA) and its salts. She stated that the OECD definition of PFAS encompasses a wide range of chemicals from gases to liquids to solid polymers, includes TFA and most commercial HFCs and HFOs and excludes several fluorinated gases such as halons 1301 and 1211, HFC-32, HFC-23, CF3I, HFC-152a, and HCFC-22. She stated that manufacturers and other stakeholders have reported that they are delaying decisions on the selection of alternatives and the associated investments, because some or all fluorinated alternatives might become unavailable, and which will be delaying the phase-out of ODS and phase-down of high GWP HFCs. She said that a proposal for the precautionary restriction of around 10,000 PFAS, submitted in January 2023 by 5 parties, was opened for public consultation by the European Chemicals Agency (ECHA) for the European Economic Area. She reported that ECHA has now completed its public consultation on consideration of restricting many, if not most, fluorinated refrigerants. She noted that the proposed ECHA definitions would lead to a restriction on manufacture, use, and placing on the market many currently used controlled substances and alternatives, for example, the ECHA definition includes currently used pMDI propellants and one future HFO substitute under development, and that under the current proposal, these restrictions would apply to pMDIs 18 months after entry into force. She stated that the US Environmental Protection Agency (U.S. EPA) has continued to implement their risk-based approach delineated in the “PFAS Strategic Roadmap: EPA’s Commitments to Action 2021-2024”, within which a narrower PFAS working definition than the EU REACH proposal is used. She noted that the U.S. EPA reporting programme excludes certain HFOs, TFA and certain HFCs from the working PFAS definition. She reported that some other jurisdictions, such as China and Japan, so far only restrict certain PFAS that are listed under the Stockholm Convention. She reported that in 2023, Canada accepted comments during public consultation considering the OECD PFAS definition of approximately 4700 chemicals. For state jurisdictions, she noted that two US states enacted legislation requiring reporting and bans on PFAS chemicals with a definition broad enough to include substances controlled under the Montreal Protocol.

6. Organization and work of the Technology and Economic Assessment Panel

62. Ashley Woodcock, TEAP Co-Chair, described Decision XXXI/8 which requests TEAP to “summarise annually how we have been working within terms of reference through clear and transparent procedures”.

63. He emphasized some specific points on the terms of reference. First, working in full consultation with national focal points regarding proposed nominations, using a standardized form and appointment decisions. Second, applying new rigour to the annual declaration of interest during 2024, with it being complete and fully transparent so that co-chairs of TEAP require it routinely at the start of all meetings. Fourth, the “Matrix of Needed Expertise” is updated annually. Finally, the Guidance on nominations and appointments is re-stated in the Progress Report for the benefit of parties.

64. Mr. Woodcock then described the TEAP plans for replenishment. He stated that parties’ replenishment of the MLF for the triennium 2024-2026 was at an historic level, representing a significant milestone in assistance to Article 5 parties. However, TEAP and especially its Replenishment Task Force had a very substantial workload to provide the estimated funding that underpinned that funding level, considering for the first time HCFC phaseout and HFC phasedown simultaneously. TEAP has been reviewing that experience, the lessons learned, and the improvements they will make for this standing request, which will include more continuous updating in intervening years, more regular updating of the database and modelling to reflect ExCom decisions and increasing their engagement with the MLF to understand better the future funding direction and Decisions.

65. Mr. Woodcock then addressed the changing scope and workload, with the overlap of the HCFC phaseout and HFC phasedown regimes, and reporting on new topics that flow from the Kigali Amendment such as HFC alternatives, Energy Efficiency, and this year, LRM.

66. He listed the three major new reports, plus responses to five separate Decisions requesting updates to information sometimes only recently provided in 2024. He asserted that the TEAP workload is only manageable because of the steady rhythm of standing decisions with their wide-ranging regular updates. These include regular reports such as the Annual Progress Report, Quadrennial Assessment, Quintennial HFC alternatives assessment, Replenishment Report, Periodic HAT exemption review. Also, TEAP reports on new nominations/new information in CUNs, EUNs, nPB, destruction, laboratory and analytical uses, process agents etc. TEAP also reports on emerging issues such as CFC-11, PFAS, VSLs, vaccine cold chain. He stated that this rolling programme can be reviewed at Annex 8 or the TEAP section on the Ozone Secretariat website with the new reports TEAP are expecting to provide until 2030. 2025 will be a busy year with their usual Progress Report but especially because the TOCs and TEAP will be working hard to develop their Assessment Reports. And 2026 will be an even busier year with all those reports been finalized, replenishment under way, the Progress Report, and developing the Synthesis Report.

67. He moved on to describe the important principles behind TEAP as a mutually supportive team. TEAP/TOCs need to both retain current expertise, and to recruit new volunteers. Experts serving on the TEAP/TOCs commit to providing independent expertise, working to consensus, and drafting and reviewing products under strict deadlines. TEAP/TOCs have lost some experienced members, some non A5 members because of lack of travel support for their participation. New members need time to gain experience in the rather unique TOR, TEAP and Montreal Protocol processes.

68. He stated that meeting face-to-face is an essential part of TEAP/TOC functioning, and to maintain the mutual respect and trust that underpins consensus, and suggested that parties may wish to consider funding travel expenses for TEAP/TOC where needed, irrespective of A5/non-A5 status.

69. Mr. Woodcock described some operational details. At the end of 2024, terms of appointment will end for one TEAP co-chair, three TOC co-chairs, and all Senior Experts (Annex 5, TEAP 2024 Progress Report). He emphasised the valuable role that Senior Experts fulfil in providing specific expertise not covered by TEAP or TOC co-chairs. Current Senior Experts have world-leading expertise in economics, in modelling, in Montreal Protocol processes and experience, and in Implementing Agencies. TEAP looks to the continuing support of parties to identify experts based on its matrix of needed expertise and when doing so, to ensure that those experts are able to fully participate in the activities and work of the TEAP and its TOCs for parties. He requested that parties considering nominations have informal discussions with TEAP/TOC Co-chairs as appropriate, prior to making a formal nomination.

70. He finished by observing that the TEAP is working to consider its response to Decision XXXV/20: Options for the organisation of TEAP and its TOCs which will be due for the 2025 Open-Ended Working Group.
