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**Open-ended Working Group of the Parties to
the Montreal Protocol on Substances that
Deplete the Ozone Layer
Thirtieth meeting
Geneva, 15–18 June 2010
Items 4–11 of the provisional agenda***

**Issues for discussion by and information for the attention of the
Open-ended Working Group of the Parties to the Montreal Protocol
at its thirtieth meeting**

Note by the Secretariat

Addendum

Introduction

1. The present addendum provides, in chapter I, updated information on a number of the items on the agenda of the thirtieth meeting of the Open-ended Working Group (UNEP/OzL.Pro.WG.1/30/1/Rev.1) that were originally introduced in the note by the Secretariat set out in document UNEP/OzL.Pro.WG.1/30/2. They include agenda items 4 (a) and (b), on issues related to the financial mechanism; agenda item 6, on a proposal for an amendment to the Montreal Protocol; and agenda items 7 (a), 7 (b) and 8 (a)–(d), relating to issues discussed in the now completed 2010 progress report of the Technology and Economic Assessment Panel. The addendum also includes, in chapter II, additional information that the Secretariat would like to bring to the parties' attention.

**I. Summary of issues for discussion by the Open-ended
Working Group at its thirtieth meeting**

**Agenda item 4: Issues related to the financial mechanism under Article 10 of the
Montreal Protocol**

**Item 4 (a): Report of the Executive Committee of the Multilateral Fund for the Implementation of
the Montreal Protocol on a special facility under the Multilateral Fund (decision XXI/2)**

2. As noted in document UNEP/OzL.Pro.WG.1/30/2, by decision XXI/2 the parties to the Montreal Protocol requested the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol to continue its deliberations on the possible development of a special facility

* UNEP/OzL.Pro.WG.1/30/1/Rev.1.

and to report on its deliberations, including on possible options for such a facility, to the Working Group at its thirtieth meeting.

3. At its sixtieth meeting, the Executive Committee considered a paper prepared by the Multilateral Fund secretariat on issues related to the development of the special facility and agreed to make annex V to that paper available to the Open-ended Working Group at its thirtieth meeting. The annex, which is reproduced in document UNEP/OzL.Pro.WG.1/30/3, outlines issues related to the special facility raised by the World Bank, the United Nations Development Programme (UNDP), the United Nations Industrial Development Organization (UNIDO), the Government of Sweden and the Treasurer of the Multilateral Fund during the fifty-ninth meeting of the Executive Committee. Those issues are summarized in the following paragraphs.

4. The Treasurer of the Multilateral Fund, after assessing the extent to which it could accommodate carbon credits, had concluded that it would probably have to encash any credits upon receipt.

5. The World Bank presented the Committee with three proposals aimed at making money for project funding available relatively rapidly to accelerate early ozone-depleting substance and climate benefits. First, the Bank put forward a model based on scaling up donor contributions in the short and medium term, under which the Bank would seek long-term commitments from donors and, with those in hand, begin funding projects immediately. Under the second proposal the Bank would seek the same long-term funding commitments from donors and issue bonds based on those commitments that would be sold to private investors. That mechanism would free up large sums of money in the short term. The third option would, in addition to using bonds as in the second proposal, seek to address the fact that funds related to carbon credits are generally only available when a project is completed and emissions reductions are verified. That would be accomplished by advancing to a project developer a percentage of expected carbon credit earnings early in the life of the project to enable such earnings to be used to finance the project's construction. Under the second and third options, the bonds, backed by the commitment of donors to make future contributions, would be managed by one of the financial agents with whom the Bank regularly works. The Multilateral Fund would not assume any risk on either the bonds or other Bank financing because the risk would be absorbed through the proposed mechanism. The Bank reported that a similar mechanism used previously had been successful and that the bonds that had been issued had earned the highest possible credit rating. The Bank noted that its proposals would entail no changes in the operations of the Executive Committee or project documentation.

6. The UNDP proposal focused on a potential carbon facility that would have short-term, medium-term and long-term goals. In the short term, commencing with appropriate newly submitted projects, it was suggested that participation in the voluntary carbon markets provided an immediate opportunity for "learning by doing" while plans were laid for gaining access to the compliance-related market. A medium-term option, as soon as it could be established, would involve the development of an ozone-depleting substance climate-benefit facility consisting of a donor-led fund and an accompanying oversight framework. The facility could be structured in various ways, some of which would give the Montreal Protocol bodies a significant role in the oversight framework, with the Ozone Secretariat possibly acting as a registry or aggregator of various registry inputs. UNDP suggested that initially the proposed climate facility would cover costs of a defined number of high-quality, diverse demonstration projects funded on the basis of incremental costs with an accounting for carbon credits. If the facility was successful then over the next decade steps would be taken to gain access to the compliance carbon markets as a source of regular funding for ozone-depleting substance projects yielding climate benefits.

7. UNIDO reported that it was seeking to develop concepts and methods for identifying and quantifying the additional environmental benefits of hydrochlorofluorocarbon (HCFC) phase-out and ozone-depleting substance destruction activities. It was also working to identify sources of financing for additional climate benefits, including the most effective combination of such sources. UNIDO was considering a variety of financial options for maximizing the benefits of destroying banks of ozone-depleting substances and was developing concepts and methodologies in two pilot projects, on HCFC phase-out and the management and destruction of ozone-depleting substance banks. It also reported that in 2010 it would convene a conference on carbon financing focusing on the Montreal Protocol.

8. At its sixtieth meeting the Committee also considered a presentation on the main findings from a study commissioned by the Multilateral Fund on financing the destruction of unwanted ozone-depleting substances through the voluntary carbon market (UNEP/OzL.Pro/ExCom/59/Inf.2).

9. The study had concluded that there were significant opportunities for financing destruction projects through the voluntary market. Factors affecting those opportunities included the attractiveness of ozone-depleting substance offsets, the growth of the voluntary market, rates of ozone-depleting substance recovery (the study had assumed a recovery and destruction rate of 10 per cent) and the building of capacity in project monitoring and verification. The authors of the study had determined that ozone-depleting substance destruction credits were unlikely to flood the market or have a negative impact on compliance markets. It was expected that by early 2010 a global market platform would be created based on three standards that would enable carbon credits to be provided for ozone-depleting-substance destruction, including one allowing destruction to take place in parties operating under paragraph 1 of Article 5 of the Protocol. Along with the credits already available under the Chicago Carbon Exchange and the Climate Action Reserve, there would be a number of options for financing ozone-depleting substance destruction projects.

10. The study cautioned, however, that while the voluntary carbon market could be one source of financing for ozone-depleting substance destruction it was not a panacea. Some ozone-depleting substance banks would be very difficult and costly to extract and a voluntary carbon market incentive would probably not be sufficient to provide the financing necessary to do so. Given that and other challenges, the study suggested possible roles that parties operating under paragraph 1 of Article 5, the Ozone and Multilateral Fund secretariats, the Technology and Economic Assessment Panel and the Multilateral Fund's implementing agencies might play to create an enabling environment. The study also discussed rules and procedures for the three standards mentioned above, a guide to developing ozone-depleting substance destruction offset projects and steps that parties operating under paragraph 1 of Article 5 could take to address such standards.

11. Lastly, the Executive Committee considered a paper by Sweden entitled "Montreal Protocol Multilateral Fund special funding facility ('SFF')". In Sweden's view, a special facility should be a time-limited instrument that gives priority to abating the threat to stratospheric ozone and mitigating climate threats. The paper described Sweden's views on administration, modalities of operation, reporting requirements and other provisions in respect of such a facility.

12. In the discussions that followed the presentation of the above papers, one representative said that any facility established should have a clear scope; should provide a means of facilitating access to capital; could be initially capitalized by voluntary contributions from parties and other sources; should absorb the risks posed by gaining access to the climate markets; should provide an opportunity to address environmental benefits beyond those required by Article 10 of the Protocol; and should serve as a means of producing a return on investment with some premium. Another member suggested that under decision XXI/2 the Committee could not on its own take a decision to create a special financing facility and that any proposals for such a facility would have to be considered together with the question of what the Multilateral Fund should be doing under decision XIX/6. Other members urged caution, expressing the view that use of the carbon market would fundamentally change the work of the Multilateral Fund and that the work of the facility should be distinct from that of the Fund. The Fund had a clear mandate to provide stable and sufficient funding in respect of HCFC phase-out and he suggested that participation in the carbon market would pose considerable risk and uncertainty and might have a negative impact on the Fund's achievements. Further, he said, the Fund should not evolve from a funding mechanism into a banking institution geared to profit and if national ozone units were to take the lead his own country lacked the capacity and resources to do so. Further study of risks, benefits and policy and legal issues was therefore needed. Expressing anxiety regarding the scaling up of available funding, another member said that the carbon markets were highly volatile and therefore a hazardous place for the Multilateral Fund's resources and that great care should be taken not to send false signals to the markets.

Item 4 (b): Terms of reference for an evaluation of the financial mechanism (decision XXI/28)

13. To assist the parties in their consideration of the terms of reference for an evaluation of the financial mechanism called for in decision XXI/8, the Secretariat has reproduced in the annex to the present note the terms of reference developed by the parties to guide the last evaluation of the Multilateral Fund.

Agenda item 5: Proposed adjustments to the Montreal Protocol

14. Pursuant to paragraph 9 of Article 2 of the Montreal Protocol any proposal to adjust the Montreal Protocol must be submitted to the Ozone Secretariat at least six months before the meeting of the parties at which such proposal would be considered. While no proposals calling explicitly to adjust the Montreal Protocol had been submitted to the Secretariat by the date six months before the Twenty-Second Meeting of the Parties, it is possible that the parties may decide that some components of the proposed amendments to the Protocol are actually in the nature of an adjustment.

Agenda item 6: Proposed amendment to the Montreal Protocol

15. On 29 April 2010 the Ozone Secretariat received a proposal to amend the Montreal Protocol from the Government of the Federated States of Micronesia. On the same day it also received a proposal to amend the Montreal Protocol from the Governments of Canada, Mexico and the United States of America. The proposals, which were submitted pursuant to Article 9 of the Vienna Convention for the Protection of the Ozone Layer and paragraph 10 of Article 2 of the Protocol, may be found in documents UNEP/OzL.Pro.WG.1/30/4 and UNEP/OzL.Pro.WG.1/30/5, respectively.

16. While the proposal submitted by the Federated States of Micronesia is similar to the proposal submitted by that party and Mauritius in 2009, it differs in a number of ways with regard to timing and coverage. The proposal would add a new Article 2J to the Protocol that would require the control of the production and consumption of hydrofluorocarbons (HFCs) and two low global-warming potential hydrofluorocarbons (also called hydrofluoroolefins (HFOs)). Specifically, the proposal calls for parties not operating under paragraph 1 of Article 5 to reduce their production and consumption of those substances by 15 per cent of their average 2004–2006 levels of production and consumption of HCFCs and HFCs in the 12 month period commencing on 1 January 2013. Reductions of 30 per cent would follow in the 12-month period commencing on 1 January 2016, 45 per cent in 2019, 55 per cent in 2022, 70 per cent in 2025, 75 per cent in 2027, 85 per cent in 2028 and 90 per cent in 2030. In the proposed text, all these reduction rates and years are enclosed in square brackets to indicate that they are negotiable, and all the production limitations noted above are subject to the allowance of an additional 10 per cent to meet the basic domestic needs of parties operating under paragraph 1 of Article 5.

17. For parties operating under paragraph 1 of Article 5, the proposal calls for a six-year grace period from the deadlines noted in the preceding paragraph. In addition, the baselines for such parties would be different, in that they would be based solely on 2007–2009 HCFC production and consumption. The proposal includes a provision that would extend the mandate of the Multilateral Fund to cover agreed incremental costs of activities to enable parties operating under paragraph 1 of Article 5 to comply with the agreed HFC controls. That would include controls related to the destruction of HFC-23 unless such destruction has already been funded through the Clean Development Mechanism.

18. The proposal would require all parties to meet efficiency standards in the production of HCFC-22 and to destroy all remaining by-product HFCs. The latter provision would not apply to cases where destruction was undertaken pursuant to a project approved by the Clean Development Mechanism prior to 1 January 2010. Lastly, the proposal makes it clear that it would operate without prejudice to the treatment of HFCs under the United Nations Framework Convention on Climate Change and its Kyoto Protocol.

19. The proposal of Canada, Mexico and the United States is very similar to the proposal submitted by those parties in 2009 to the Twenty-First Meeting of the Parties in that it aims to list 20 specific HFCs, including two low-global-warming potential HFCs, in a new annex F to the Protocol. Recognizing that alternatives are not currently available for all HFC applications, the proposal calls for a phase-down rather than a phase-out of the listed chemicals. Specifically, for developed countries (those parties not operating under paragraph 1 of Article 5), they propose an initial phase-down of production and consumption of 10 per cent of the baseline amount by the end of 2014. That would be followed by a series of further reductions leading, by the end of 2033, to the elimination of 85 per cent of baseline production and consumption. Production and consumption equal to 15 per cent of the baseline would be permitted from that point forward. For parties operating under paragraph 1 of Article 5 the proposal calls for an initial phase-down of production and consumption of 10 per cent of the baseline amount by the end of 2017. That would be followed by a series of further reductions leading, by the end of 2043, to the elimination of 85 per cent of baseline production and consumption. Production and consumption equal to 15 per cent of the baseline would be permitted from that point forward. The baseline for both parties operating under paragraph 1 of Article and parties not so

operating would be the average of 2004–2006 annual production and consumption of HCFCs and HFCs.

20. In addition, the proposal calls for the measurement of production and consumption of HFCs in terms of global-warming potential instead of ozone-depletion potential; strict limitations on the emission of HFC-23 as a by-product of HCFC production (e.g., HCFC-22); licensing of HFC imports and exports; bans on imports and exports of HFCs to non-parties to the amendment; and reporting on the production and consumption of HFCs and the emission of HFC-23 produced as a by-product.

21. The proposal would not affect the provisions of the Framework Convention on Climate Change and its Kyoto Protocol governing HFCs. The Montreal Protocol obligations would therefore be additional obligations and parties could follow those as a way of meeting some of their HFC obligations under the Convention. The proposal envisions an amendment to the Montreal Protocol and a related decision by the parties to the Convention confirming the proposed Montreal Protocol approach.

Agenda item 7: Issues related to hydrochlorofluorocarbons

Item 7 (a): Response by the Technology and Economic Assessment Panel to the hydrochlorofluorocarbon issues highlighted in decision XXI/9

22. As noted in document UNEP/OzL.Pro.WG.1/30/2, by decision XXI/9 the parties requested the Technical and Economic Assessment Panel to undertake an extensive technical and economic assessment of available and emerging alternatives and substitutes to HCFCs, focusing in particular on alternatives with low global-warming potential (low-GWP). The Panel has now completed that assessment. A summary overview of the key issues in that report follows.

23. The co-chairs decided to address the numerous HCFC-related requests made by the parties in decision XXI/9, including updating of the 2009 report called for in decision XX/8 and focusing on, among other things, available and emerging low-GWP technologies. The report presents a table in each of its chapters describing the use of low-GWP alternatives to HCFCs in a given sector, including where possible a comparison of the alternatives and chemical-based technologies with high global-warming potential (high-GWP).

24. As neither the Meeting of the Parties nor the Panel has adopted clear definitions for the terms “low-GWP” and “high-GWP” the Panel had to devise its own working definitions for the purposes of its assessment. The assessment report thus proposes the following nomenclature for 100-year global-warming potentials for purposes of the Montreal Protocol, with the understanding that revisions over time would be expected:

| | | |
|---------|-----------------|---|
| 0.1 | < GWP < ~30 | “very low-GWP” ¹ (“ultra-low” ²) |
| ~30 | < GWP < ~100 | “very low-GWP” |
| ~100 | < GWP < ~300 | “low-GWP” |
| ~300 | < GWP < ~1000 | “moderate-GWP” |
| ~1000 | < GWP < ~3,000 | “high-GWP” |
| ~3,000 | < GWP < ~10,000 | “very high GWP” |
| ~10,000 | < GWP | “ultra-high GWP” |

25. These definitions allow alternatives to be referred to in terms of their global-warming potential. The report stresses, however, that other key characteristics such as toxicity and flammability must be taken into consideration; thus the best alternative to a given product might not be the one with the lowest global-warming potential. It also stresses the need to consider indirect greenhouse-gas emissions from product manufacturing and product energy use, which often dominate the life-cycle carbon footprint of products. Life-cycle climate performance (LCCP) calculations are the most comprehensive method for determining direct and indirect greenhouse-gas emissions at the product level. LCCP models, however, need further development to make them more transparent and adaptable to local climate and electricity carbon intensity situations. When LCCP models are inappropriate or the necessary data are unavailable, other metrics can be useful. Examples include product energy efficiency, electricity carbon footprint, carbon footprint offset, total equivalent warming impact, the functional unit

1 The value of 0.1 has been chosen to also cover substances with a global warming potential lower than 1.

2 Although one could use the term “ultra-low”, it is proposed to use the term “very low” for substances with global warming potential lower than 30. This is done because this range also includes carbon dioxide (although it has a global-warming potential of 1), which is the largest contributor to human-induced global warming.

approach, the Multilateral Fund climate impact indicator and life-cycle assessment. The Panel presents those and other single-factor and multiple-factor environmental performance metrics in the report.

26. The Panel makes a number of interesting observations on the consideration of climate impacts, including the following:

(a) In applications such as solvent use and fire protection, the climate impact of substitutes and alternatives to HCFCs is typically only a consequence of direct emissions of greenhouse-gas chemicals because such applications use very little energy. The climate impact of refrigerants and thermal insulating foam, however, arises from both direct emissions of greenhouse-gas refrigerants and foam blowing agents and from the indirect emissions of fuel used to power air-conditioning and refrigeration equipment or to heat or cool insulated spaces;

(b) Highly emissive uses of high-GWP refrigerants can account for a third or more of total HFC greenhouse-gas emissions while highly contained low-GWP refrigerants account for an insignificant portion of HFC greenhouse-gas energy emissions. For example, operation of vehicle air-conditioning equipment in the United States consumes 6 per cent of motor fuel, while associated greenhouse-gas refrigerant emissions have the carbon equivalence of 2 per cent of motor fuel use, making the total contribution from vehicle air-conditioning equipment equivalent to 8 per cent of greenhouse-gas emissions from motor fuel use. By contrast, in countries with hot climates and heavy traffic such as India, the proportion of fuel consumption from operating vehicle air-conditioning equipment can be as high as 20 per cent.

27. The Panel emphasizes that the ultimate choice of technology for phasing out HCFCs would not be based on climate impact alone, but would also take into account ozone depletion, health, safety and affordability and availability of alternatives.

28. In summary the Panel states that overall the global market penetration of low-GWP substances is low in many refrigeration and air-conditioning subsectors; it is no more than several per cent in the commercial and transport refrigeration, unitary air-conditioning and chiller subsectors and there is no commercialization yet in the vehicle air-conditioning subsector. Penetration is much higher in those subsectors that have dealt with low-GWP substances for a long time (such as the industrial subsector in respect of ammonia). It is also much higher in the domestic refrigeration subsector, where the hydrocarbon isobutane was introduced in Europe in the 1992–1993 period and now has more than one third of the market globally.

29. With the above considerations noted, the tables reviewing low-GWP and high-GWP greenhouse-gas alternatives to sector-specific HCFC applications may be found for the following sectors in the following chapters and pages of volume 1 of the Panel's 2010 progress report: domestic refrigeration – chapter 4 (pages 37–39); commercial refrigeration – chapter 5 (pages 41–50); industrial refrigeration – chapter 6 (pages 51–53); transport refrigeration – chapter 7 (pages 55–59); unitary air conditioning – chapter 8 (pages 61–65); chiller air conditioning – chapter 9 (pages 67–72); vehicle air conditioning – chapter 10 (pages 73–83); foams – chapter 11 (pages 85–90); fire protection – chapter 12 (pages 91–93); solvents – chapter 13 (pages 95–99); inhaled therapies – chapter 14 (pages 101–104).

Item 7 (b): Scoping study by the Technology and Economic Assessment Panel on alternatives to hydrochlorofluorocarbons in the refrigeration and air-conditioning sectors in parties operating under paragraph 1 of Article 5 with high ambient temperature conditions (decision XIX/8)

30. The Technology and Economic Assessment Panel's work relating to an assessment of alternatives to HCFCs in high-ambient-temperature climates and other unique operating conditions such as those in non-open-pit mines is discussed in its 2010 progress report (second part, volume 1).

31. A trip to South Africa was made in the second part of 2009 for the purpose of studying alternatives for use in non-open-pit mines. Leading mining companies, the engineering firms supporting them, researchers and government representatives were consulted. Based on that trip the 2010 progress report indicates that in deep mines ambient heat rejection (refrigerant condensing) temperatures generally are less extreme, humidity is lower and water cooling towers are typically employed rather than air-cooled condensers. In contrast, heat absorption temperatures often are lower for chillers for deep mines, to minimize pumping burdens since equipment generally is installed at the surface. Extra cold water, ice slurries and less commonly brines or other heat transfer fluids are used for heat transport to depths currently as low as 4 km (2.5 miles), with expected extension to depths approaching 5 km (3.1 miles) in coming years. Virgin rock temperatures approach 55 °C–70 °C, demanding continuous cooling on a year-round basis to enable miners to survive. The equipment required is quite large, resulting in significant energy requirements and heightened concern with energy-related greenhouse gas

emissions. Most mine chillers in the last decade have used HFC-134a or ammonia (R-717). Some older and small mines, however, have used HCFC-22 and some newer installations have used HCFC-123 to attain high efficiencies. Some recent systems have used water (R-718) as a refrigerant in a vacuum, vapour-compression flash cycle to produce ice slurries directly. Owing to its continuous use, equipment in the sector tends to be retired more quickly than are systems for comfort conditioning, which are typically used intermittently.

32. The Panel concludes that deep mine systems are not as vulnerable to high-ambient climatic conditions as are other applications discussed in the report. The replacement of limited use of chlorofluorocarbons (CFCs) is progressing and HCFC and especially HCFC-22 dependence is comparatively low and is being addressed. As nearly all deep mines are run by multinational firms and are capital-intensive and skill-intensive, the transition to new and better technologies is not a prohibitive problem. Rather than developing countries being at a technological disadvantage in mining, some parties operating under paragraph 1 of Article 5 – including South Africa in particular – are world leaders in the technologies involved and are able to export the requisite technologies.

33. In addition to its renewed consideration of the deep mines issue, in its 2010 progress report the Panel reviews its earlier findings on air-conditioning and refrigerant uses in the light of comments made by parties at the Twenty-First Meeting of the Parties. Those parties expressed concern about, among other things, the lack of satisfactory alternatives to HCFCs in high-ambient-temperature applications; the resulting difficulties encountered by some parties in meeting their HCFC targets; concerns about the accessibility, affordability and maintenance requirements of related new technologies; the need for capacity-building; and the need for an in-depth study of alternative technologies and their possible negative effects.

34. In respect of air-conditioning, the Panel assesses the impact of high ambient conditions (above 40 °C) on the performance of current HCFC-22 replacements and concludes that, in the near term, regions with hot climates should be able to rely on the refrigerants and technologies that are currently commercially available to replace HCFC-22 (R-407C, R-410A and HC-290). The Panel suggests that in most cases equipment using R-410A or R-407C would only need to be 5–10 per cent larger than HCFC-22 equipment to compensate for the lower capacity of these replacements at ambient temperatures up to 50 °C. The increased cost of such larger equipment would be about 3 per cent for a 10 per cent increase in capacity. HC-290 might also be considered when replacing HCFC-22 in low-charge applications (small window and portable room air conditioners) if appropriate design changes are made to comply with all applicable codes and standards. The Panel stresses that HC-290 should not be used as a retrofit solution, since appropriate safety considerations would need to be addressed in the fundamental design of products that used it.

35. The Panel notes that HFC-32 is likely to become a longer-term replacement for R-410A, as it has a global-warming potential approximately 32 per cent that of R-410A and exhibits much better high ambient performance than R-410A. In addition, the design changes required to convert from R-410A to HFC-32 should be minor. The Panel also notes that, while HFC-134a and HC-600a would seem attractive because their performance at high ambient temperatures is similar to that of HCFC-22, the use of these low-pressure refrigerants would require an extensive redesign of base system components to achieve the capacity and efficiency of the HCFC-22 system. HFC-134a and HC-600a are therefore not considered to be cost-effective alternatives to replace HCFC-22 in unitary air-conditioning applications.

36. A number of low-GWP alternatives to HFC refrigerants are currently in the early stages of development, but it was thought to be premature to list them as options in the report. The Panel believes, however, that as non-ozone-depleting and low-GWP technologies are developed to replace current HCFC-22, R-407C and R-410A technologies, equipment designed to operate with acceptable efficiency and capacities in extreme environments should become widely available.

37. In terms of commercial refrigeration, for stand-alone equipment in high-ambient-temperature conditions, the Panel found that four possible refrigerants could easily be used with current refrigeration technologies: HFC-134a, HC-600a, HC-290 and HFC-1234yf. Considering centralized systems, the use of indirect systems is possible in high-ambient-temperature conditions because evaporation temperature does not vary significantly. Possible refrigerants to replace HCFC-22 in large commercial refrigeration systems are HFC blends with high global-warming potential, such as R-404A or even R-422D or R-427A; for the latter two, however, refrigerating capacity could be about 5 per cent lower and efficiency also 5–10 per cent lower. R-407C is used in centralized systems in Japan and exhibits the lowest global-warming potential (1800) of all HFC blends. Hydrocarbons such as HC-290 and HC-1270 can be used in hot climates and exhibit relatively low discharge temperatures compared to HCFC-22. Nevertheless, safety precautions, including charge reductions, would have to be taken, and the circuits

in direct expansion systems would have to be almost completely welded to limit refrigerant leaks. Owing to the development of HFC-1234yf, new blends with very low global-warming potential can be expected in the next three years. To address environmental impact, safety and energy efficiency, those new blends may be used in indirect systems or cascading systems with carbon dioxide at the low temperature level used as a refrigerant or as a heat transfer fluid.

Agenda item 8: Issues related to exemptions from Article 2 of the Montreal Protocol

Item 8 (a): Nominations for essential-use exemptions for 2011

38. Table 1 shows parties' requests for essential-use exemptions for 2011 for CFCs and the initial recommendations of the Technology and Economic Assessment Panel. A brief explanation is given where the Panel's recommendation differs from a given request. Full details of the Panel's findings related to requests for exemptions for CFCs for metered-dose inhalers can be found in chapter 1 of its 2010 progress report, volume 2, while details of the Panel's findings related to the exemption for Russian Federation aerospace uses can be found in chapter 4, section 4.5.

39. Table 2 shows in further detail the amounts of CFCs for use in metered-dose inhalers being recommended for exemption for each party, together with information on the specific ingredients and intended market for those amounts.

Table 1
Essential-use nominations submitted in 2010 for 2011 (in metric tonnes) and recommendations of the Technology and Economic Assessment Panel

| <i>Party</i> | <i>Approved for 2010</i> | <i>Nominated for 2011</i> | <i>Recommendation of the Technology and Economic Assessment Panel</i> |
|--|--------------------------|---------------------------|--|
| Parties not operating under paragraph 1 of Article 5 | | | |
| Russian Federation (metered-dose inhalers) | 212 | 248 | Recommended 212, unable to recommend 36 believing the difference can be supplied by CFC-free imports |
| Russian Federation (aerospace) | 120 | 100 | Recommended 100 |
| United States (metered-dose inhalers) | 92 | 0 | - |
| Subtotal: parties not operating under paragraph 1 of Article 5 | 424 | 348 | 312 |
| Parties operating under paragraph 1 of Article 5 | | | |
| Argentina (metered-dose inhalers) | 178 | 120.2 | Recommended 107.2; unable to recommend 13 for some export requests |
| Bangladesh (metered-dose inhalers) | 156.7 | 113.73 | Recommended 38.65; unable to recommend 75.08 owing to availability of CFC-free alternatives |
| China (metered-dose inhalers) | 972.2 | 809.91 | Recommended 741.15; unable to recommend 68.76 for some export requests |
| Egypt (metered-dose inhalers) | 227.4 | 0 | - |
| India (metered-dose inhalers) | 343.6 | 192.34 | Recommended 48.2; unable to recommend 144.14 for some domestic and export requests |
| Iran (Islamic Republic of) (metered-dose inhalers) | 105 | 105 | Recommended 105 |
| Pakistan (metered-dose inhalers) | 34.9 | 39.6 | Recommended 39.6 |
| Syrian Arab Republic (metered-dose inhalers) | 44.68 | 0 | - |
| Subtotal: parties operating under paragraph 1 of Article 5 | 2062.48 | 1 380.78 | 1 079.8 |
| Grand total: all nominations | 2486.48 | 1 728.78 | 1 391.8 |

Table 2
Technology and Economic Assessment Panel recommendations on 2010 nominations for 2011 essential-use exemptions for CFCs for metered-dose inhalers, with ingredients and intended markets

| <i>Party</i> | <i>Panel's recommended exemption amount for 2011 (in metric tonnes)</i> | <i>Active ingredients</i> | <i>Intended markets</i> |
|----------------------------|---|--|--|
| Argentina | 106.7 | Beclomethasone, budesonide, fenoterol, fluticasone, ipratropium, salbutamol, salbutamol/beclomethasone, salbutamol/ipratropium, salmeterol, salmeterol/fluticasone | Argentina |
| | 0.5 | Salbutamol/ipratropium | Chile, Paraguay, Peru |
| Bangladesh | 38.65 | Ciclesonide, fluticasone/salmeterol, ipratropium, ipratropium/salbutamol, salmeterol and tiotropium | Bangladesh |
| China | 741.15 | Beclomethasone, beclomethasone/clenbuterol/ipratropium, budesonide, datura metel extract/clenbuterol, dimethicone; ephedra, ginkgo, sophora flavescens and radix scutellariae; ipratropium, ipratropium/salbutamol, isoprenaline, isoprenaline/guaifenesin, procaterol, salbutamol, salmeterol, cromoglycate | China |
| India | 19.8 | Ipratropium, ipratropium/salbutamol, tiotropium and tiotropium/formoterol | India |
| | 28.4 | Ipratropium, ipratropium/salbutamol, tiotropium and tiotropium/formoterol | Colombia, Jamaica, Panama, Peru, Sri Lanka, Suriname, United Arab Emirates, Uganda, Venezuela (Bolivarian Republic of) |
| Iran (Islamic Republic of) | 105 | Beclomethasone, salbutamol, salmeterol, cromoglycate | Iran (Islamic Republic of) |
| Pakistan | 39.6 | Beclomethasone, beclomethasone/salbutamol, fluticasone/salmeterol, ipratropium, salbutamol, salmeterol, triamcinolone | Pakistan |
| Russian Federation | 212 | Salbutamol | Russian Federation |

Item 8 (b): Results of the mission by the Technology and Economic Assessment Panel and its Medical Technical Options Committee to the Russian Federation to review that country's transition to chlorofluorocarbon-free metered-dose inhalers (decision XXI/4)

40. As noted in document UNEP/OzL.Pro.WG.1/30/2, by decision XXI/4 the Twenty-First Meeting of the Parties requested the Technology and Economic Assessment Panel and its Medical Technical Options Committee to undertake a mission to the Russian Federation to examine the technical, economic and administrative issues affecting the Party's transition from CFC-based metered-dose inhalers to CFC-free alternatives. The decision was prompted by the Russian Federation, which reported to the Twenty-First Meeting of the Parties that it was experiencing difficulties in achieving the transition. The mission by the Panel and the Committee took place in February 2010, when the mission team met a number of experts. The mission is discussed in chapter 3 of the Panel's 2010 progress report, volume 2. Key findings of the mission team are outlined below.

41. The manufacture of CFC-based metered-dose inhalers began in the Russian Federation in 1984 and there are currently two domestic manufacturers of CFC-based salbutamol metered-dose inhalers, MosChimPharmPreparaty in Moscow and Altaivitaminy in Biysk. The two companies state that their objective is to manufacture affordable metered-dose inhalers for the market within the Russian Federation and that to that end they work "as colleagues and not as competitors". They have informal agreements on market split across the Russian Federation and on the price of products to make them competitive with imported products. The companies have good distribution channels and each produces about 50 per cent of the Russian-made CFC-based metered-dose inhalers using salbutamol as the active ingredient. Multinational companies also import a variety of HFC-based metered-dose inhalers and dry-powder inhalers and it appears that domestically produced and imported metered-dose inhaler products are currently sufficient to meet patient demand.

42. In 2004, the Ministry of Natural Resources and Environment of the Russian Federation submitted to the Ozone Secretariat a national plan of action for phasing out the use of CFCs in the manufacture of metered-dose inhalers in the country by 2008. The plan stated that CFC-free metered-dose inhalers would be developed and launched by the end of 2008 and that CFCs would not be required in 2008.

43. During 2006–2007 two investment projects, one for Altaivitaminy and one for MosChimPharmPreparaty, were prepared by the World Bank with the participation of a local bank to provide financing for the two companies' conversion from CFC-based metered-dose inhaler production to CFC-free metered-dose inhaler production. Neither company, however, accepted the loans offered by the local bank, saying that the terms of the loans were too short (1.5–2 years instead of 3–3.5 years as requested), that the interest demanded was too high (18–20 per cent) and that other terms were unacceptable (real estate required as security, which was not feasible for the State-owned MosChimPharmPreparaty). Consequently, the World Bank returned unspent funds to the Global Environment Facility (GEF) and the planned phase-out in the metered-dose inhaler sector stalled. Both companies continue to work on the development of CFC-free metered-dose inhalers.

44. In 2008, the Russian Ministry of Health and Social Development requested UNIDO to provide technical assistance in the development of a metered-dose inhaler project and on 20 September 2009 UNIDO received a formal request to that effect. UNIDO planned to submit a request to GEF in April 2010 under the fifth GEF replenishment; funding for the project has yet to be committed.

45. In addition to financial assistance, some technical assistance is also needed to complete the conversion from CFC-based metered-dose inhalers to HFC-based metered-dose inhalers. In particular, technical assistance in respect of equipment installation and commissioning and facilitation in respect of equipment procurement are required. Such assistance is likely to come from the manufacturer of the equipment. The overall total time for conversion of the two companies is estimated to be about 24 months once funding becomes available. The Panel states that if funding becomes available by the third quarter of 2010 then the phase-out of CFC-based metered-dose inhalers could be achieved by about mid-2012, assuming that product documentation, licensing approval and equipment procurement proceed smoothly. In response to questions regarding its essential use nomination for 2011, the Russian Federation stated that if GEF funds were available the phase-out would be achieved by the end of 2012.

46. According to accounting framework reports submitted by the Russian Federation in relation to its essential-use exemptions, CFC consumption for metered-dose inhaler manufacture ranged from 330 tonnes in 2003 to 396 tonnes in 2006, declining to and remaining stable at about 240 tonnes from 2007 to 2009. The Russian Federation was granted an essential use exemption of 212 tonnes for 2010 and has submitted a nomination for 248 tonnes of CFCs for metered-dose inhalers in 2011. For 2011, the Medical Technical Options Committee has again recommended an exemption for 212 tonnes of

CFCs, instead of the 248 tonnes requested, based on its view that imported HFC-based metered-dose inhalers could meet the expected demand in 2011 for metered-dose inhalers having salbutamol as the active ingredient. The recommended exemption would enable the party to achieve the transition to the manufacture of non-CFC-based metered-dose inhalers or, if the necessary funding for that is not forthcoming in 2010, would permit importers of CFC-free inhalers to increase their market share sufficiently (from 25 to 100 per cent of the market) to provide adequate CFC-free alternatives by the start of 2012. Without demonstrated progress in the manufacturing transition, the Panel may not be able to recommend any future essential-use nominations.

47. The Open-ended Working Group may wish to consider the Panel's report and to make any recommendations deemed appropriate.

Item 8 (c): Nominations for critical-use exemptions for 2011 and 2012

48. In 2010 the Technology and Economic Assessment Panel and its Methyl Bromide Technical Options Committee received 10 requests for critical-use exemptions for 2011 and 25 such requests for 2012. A further supplementary request was submitted by Australia for the strawberry runner sector for 2011. The Committee made interim recommendations in respect of all the requests, noting substantial reductions in the amounts requested by Israel and the United States and plans to phase out methyl bromide in Israel and Japan by the end of 2011 and 2012, respectively.

49. The outcome of the Committee's initial evaluation of critical use nominations for 2011 and 2012 is summarized below in table 3 and an explanation of why the Committee recommended exemptions for amounts less than those sought by the requesting parties is outlined immediately below the table. A detailed discussion of the Committee's critical-use recommendations may be found in chapter 10 of the Technology and Economic Assessment Panel's 2010 progress report, volume 2. As the final recommendations may be subject to the presentation of further information, the Open-ended Working Group is expected to ask the Panel any questions that it may find relevant to the nominations or the review process. As is customary, the nominating parties may wish to meet the Committee bilaterally to discuss issues relevant to the Committee's initial recommendations.

Table 3

Critical-use requests in metric tonnes submitted in 2010 for 2011 and 2012

| <i>Party</i> | <i>Nominated for 2011</i> | <i>Nominated for 2012</i> | <i>Methyl Bromide Technical Options Committee interim recommendation</i> | |
|---------------|---------------------------|---------------------------|--|------------------|
| | | | <i>2011</i> | <i>2012</i> |
| Australia | - | 34.66 | - | 31.708 |
| Canada | 3.529 | 16.281 | 2.084 | 16.218 |
| Israel | 232.247 | - | 224.317 | - |
| Japan | - | 221.051 | - | 216.120 |
| United States | - | 1 181.779 | - | 993.706 |
| <i>Total</i> | <i>235.776</i> | <i>1 453.771</i> | <i>226.401</i> | <i>1 257.752</i> |

50. The Methyl Bromide Technical Options Committee recommended exemptions for less than the full amounts requested by Australia, Canada, Israel, Japan and the United States. The Committee recommended an exemption for 2.922 metric tonnes less than the amount requested by Australia for rice based on its understanding that several technically effective and registered alternatives were available in Australia. For Canada's nomination for pasta for 2011, the Committee recommended an exemption for 1.445 tonnes less than the requested amount, the reduction corresponding to the amount nominated for one facility reporting poor gas tightness. The Committee recommended an exemption for 0.625 metric tonnes less than the amount requested by Israel for the cut flowers industry, particularly for substrate, based on the availability of substrate protocols and internationally accepted carnation cultivars that were resistant to fusarium wilt; it also recommended 7.125 tonnes less than the party requested for strawberry production based on the availability and effectiveness of metam sodium followed by Telone. The Committee recommended an exemption for 1.495 metric tonnes less than the amount requested by Japan for fresh chestnuts based on the belief that the party could meet part of its needs with methyl iodide. For the United States, the Committee recommended an exemption for 84 metric tonnes less than the amount requested for field strawberries because it believed that the party could make greater use of 1-3d pic and metam sodium; an exemption of 2.852 tonnes less than the amount requested for commodities based on its belief that a number of alternatives existed; and an exemption of 60.789 tonnes less than the amount requested for mills and processors because of what it saw as inadequate

substantiation of the need for the exemption. Finally, the Committee was unable to recommend any exemption at all for the 17.365 tonnes for food processing facilities requested by the United States because of what it saw as inadequate substantiation of the need for the exemption.

Item 8 (d): Technology and Economic Assessment Panel-led report on quarantine and pre-shipment issues (decision XXI/10)

51. As noted in document UNEP/OzL.Pro.WG.1/30/2, by decision XXI/10 the Meeting of the Parties requested the Technology and Economic Assessment Panel and its Methyl Bromide Technical Options Committee to consult relevant experts and the secretariat of the International Plant Protection Convention and to provide a report to the Working Group at its thirtieth meeting on specific issues related to quarantine and pre-shipment uses of methyl bromide. The report was to include information on the availability, technical and economical feasibility and market penetration of alternatives to methyl bromide and the availability of alternatives for sawn timber and wood packaging material; grains and similar foodstuffs; pre-plant soils use; and logs. The Panel was also asked to include a draft methodology for determining the impact of implementing related alternatives to methyl bromide or restricting the use of methyl bromide for quarantine and pre-shipment uses.

52. The Panel and the Committee have now undertaken the consultations and prepared the report requested by the parties in decision XXI/10. The report is contained in chapter 8 of the Technology and Economic Assessment Panel's 2010 progress report, volume 2. As requested by the parties in decision XXI/10, the availability and market penetration of technically and economically feasible alternatives were estimated for the four largest-consuming categories of methyl bromide use for quarantine and pre-shipment: sawn timber and wood packaging material (in accordance with Standard 15 of the International Plant Protection Convention's International Standards on Phytosanitary Measures, on the regulation of wood packaging material in international trade (ISPM-15)); grains and similar foodstuffs; pre-plant soils; and logs. The Panel estimated that about 1,995–2,571 tonnes of methyl bromide used for quarantine and pre-shipment were immediately replaceable globally for the four main categories of quarantine and pre-shipment uses, which represents 32–42 per cent of total consumption for those categories.

53. For sawn timber and wood packaging material, heat is a technically and economically feasible alternative. Heat enjoys good market penetration in most countries, including many parties operating under paragraph 1 of Article 5. For at least 28 countries, methyl bromide is not an option and heat is the main alternative used to meet ISPM-15. In some countries, heat was reported to be less expensive than methyl bromide. Not-in-kind alternatives such as plastic pallets are used in some countries. Six additional treatments are being evaluated under the International Plant Protection Convention for possible inclusion as treatment options for wood packaging material under ISPM-15.

54. For grains and similar foodstuffs, many treatments target non-quarantine pests and are therefore considered to be pre-shipment treatments. Phosphine is the most commonly used alternative. Controlled atmospheres were in use where this technology was available. Where permitted, dichlorvos and sulfuryl fluoride were also used. Several countries specified methyl bromide as the only acceptable treatment. Heat disinfestation is technically but not economically feasible.

55. For pre-plant soils use, the United States is the only country that categorized the use of methyl bromide for this purpose as a quarantine and pre-shipment use. As a category within quarantine and pre-shipment, it was the second largest use of methyl bromide in 2007. Plants for propagation in the United States are not eligible for certification if nematodes are detected in a sample of the plant's propagation material and methyl bromide or an alternative (1,3-D) is applied to the soil in which the plants are grown to meet this nematode-free requirement. As the treatment targets nematodes that are not quarantine pests according to the definition used in the Montreal Protocol, the Technology and Economic Assessment Panel considers this use of methyl bromide in soil to be inconsistent with the definition. Technically and economically feasible alternatives (1,3-D/Pic and methyl iodide/Pic) are available for controlling pests in soils to meet the required standard, and the Panel estimates that about 50–95 per cent of this use is replaceable after consideration of the regulatory and other conditions that limit its use. The Panel notes that the United States has requested methyl bromide for the same end-uses under the critical-use exemption and the quarantine and pre-shipment exemption and that methyl bromide for this use can be replaced in both exemption categories by technically and economically feasible alternatives that have already been used by many parties.

56. Methyl bromide is the most widely-used fumigant for logs and logs constitute the largest single category of commodities treated with methyl bromide. In-transit fumigation with phosphine is a technically feasible alternative and can be less expensive than methyl bromide treatment but currently

has limited market penetration globally. The more widespread application of this alternative is limited by the terms of bilateral agreements, usually due to a lack of efficacy data on specific quarantine pests of concern. Other fumigants and mixtures are technically and economically feasible in some cases, but none have been implemented as quarantine treatments for use on logs. Heat applied to logs is technically and economically feasible where sawn timber is acceptable to the end-user. Debarking of logs is expensive and sometimes must be combined with another treatment for acceptance as a quarantine treatment.

57. The Panel estimates that in parties operating under paragraph 1 of Article 5 more than 60 per cent of the methyl bromide used in sawn timber and wood packaging could be replaced by heat or alternatives; that less than 10 per cent of the methyl bromide used for quarantine treatment for grains and similar foodstuffs could be replaced by alternative fumigants and controlled atmospheres, while 30-70 per cent for pre-shipment treatments in grains and similar foodstuffs could be replaced by fumigants, protectants, controlled atmospheres and integrated systems; and that 10–20 per cent of the methyl bromide used in logs could be replaced by alternative fumigants, conversion to sawn timber (lumber), immersion, debarking and heat. No methyl bromide is used on soil for quarantine and pre-shipment in parties operating under paragraph 1 of Article 5.

58. The Panel estimates that in parties not operating under paragraph 1 of Article 5 60–80 per cent or more of the methyl bromide used in sawn timber and wood packaging could be replaced by heat or non-wooden pallets; that less than 10 per cent of methyl bromide used as a quarantine treatment for grains and similar foodstuffs could be replaced by alternative fumigants and controlled atmospheres, while more than 80 per cent for pre-shipment treatments in grains and similar foodstuffs could be replaced by fumigants, protectants, controlled atmospheres and integrated systems; that about 50–95 per cent used in soil could be replaced by alternative fumigants, provided the alternatives met certification standards and methyl iodide/Pic was available; and that 10–20 per cent of methyl bromide used in logs could be replaced by alternative fumigants, conversion to sawn timber (lumber), immersion, debarking and heat.

59. The technical and economic feasibility of alternatives to methyl bromide used for quarantine and pre-shipment depends mainly on their efficacy against quarantine pests of concern, the infrastructural capacity of the country using them, customer requirements, phytosanitary agreements where relevant, and logistical requirements and approvals for their use.

60. In decision XXI/10 the parties also asked the Technology and Economic Assessment Panel to describe a methodology for assessing the impact of restricting methyl bromide production and consumption for quarantine and pre-shipment uses. The Panel suggests that the methodology should focus on the major categories of methyl bromide quarantine and pre-shipment use (by quantity), and in particular methyl bromide used for quarantine and pre-shipment on entry to facilitate trade by one party with many different countries. Countries that do not permit alternatives to methyl bromide may require methyl bromide fumigation en route, or on arrival, of products imported from countries that have banned the use of methyl bromide on exported products. The ability of Governments to detect such uses of methyl bromide depends on good fumigation records and the collection and analysis of the records to determine uses for which alternatives are available and could be used.

61. The Technology and Economic Assessment Panel could in the future examine opportunities for methyl bromide replacement in key categories, along with any possible constraints. The uses of methyl bromide for pre-shipment could also be quantified as much as possible, since it appears from the latest reports by parties that methyl bromide has been replaced by other substances for most pre-shipment uses. The methodology used to assess whether an alternative is economically feasible could include the requirement that its net returns be determined relative to those of a treatment using methyl bromide. An alternative should be implemented without significant market disruption and the sectors that benefit as a result of the adoption of the alternative should be identifiable.

62. The design of any quarantine and pre-shipment restriction could affect the feasibility of the transition from methyl bromide for quarantine and pre-shipment and the methodology for assessment of its impact. With regard to the design, the Technology and Economic Assessment Panel considers a number of factors to be important, including the time frame for compliance, flexibility of choice in how to maintain compliance, the usefulness of a feasible and expedient exemption pathway that takes account of trade flow decisions and whether pre-shipment or pre-plant soil uses should be included in the methodology. Feedback from the parties on these factors would assist the Panel in its efforts devise such a design.

Item 8 (e): Laboratory and analytical uses of ozone-depleting substances (decision XXI/6)

63. As noted in document UNEP/OzL.Pro.WG.1/30/2, by decision XXI/6 the Meeting of the Parties requested the Technology and Economic Assessment Panel and its Chemicals Technical Options Committee to finalize the report on laboratory and analytical uses of ozone-depleting substances that they had been requested to prepare by decision XIX/18. The response of the Committee and the Panel can be found in section 4.4, chapter 4, of the Panel's 2010 progress report, volume 2. It includes as an annex to the chapter detailed information on laboratory and analytical uses, including those uses for which no alternatives to ozone-depleting substances are known to exist. Based on its assessment of available alternatives the Panel recommends that the following procedures be eliminated from the global exemption for laboratory and analytical uses of ozone-depleting substances:

| <i>Ozone-depleting substance</i> | <i>Procedure</i> |
|---|--|
| Methyl bromide | Laboratory use as a methylating agent |
| Carbon tetrachloride | Reaction solvent, except reactions involving N-bromosuccinimide (see below) |
| Carbon tetrachloride | A solvent for infrared, Raman and nuclear magnetic resonance spectroscopy |
| Carbon tetrachloride | Grease removal and washing of nuclear magnetic resonance tubes |
| Carbon tetrachloride | Iodine partition and equilibrium experiments |
| Carbon tetrachloride | Analysis of hydrocarbon oils and greases in water, soil or oil mist in air |
| Carbon tetrachloride | Analysis of polydimethylsiloxane and medicinal products such as simethicone that contain carbon tetrachloride |
| Carbon tetrachloride | A solvent for assay of cyanocobalamin (vitamin B ₁₂) |
| 1,1,1-trichloroethane | Determination of bromine index |
| Carbon tetrachloride and other ozone-depleting substances | Analysis involving selective solubility, including analyses of cascarosides, thyroid extracts and polymers and the formation of picrates |
| Carbon tetrachloride | Preconcentration of analytes in liquid chromatography, gas chromatography, adsorption chromatography of organic substances, atomic absorption spectroscopy and X-ray fluorescence analysis |
| Carbon tetrachloride | Detection of the end point in titration involving iodine and thiosulphate (iodometry) for analysis of iodine, copper, arsenic, hypochlorite, chlorate, bromate or sulphur |
| Carbon tetrachloride | Determination of iodine index |
| Carbon tetrachloride | Determination of jellification point of agar, cement analysis and gas-mask cartridge breakthrough |
| Carbon tetrachloride | Determination of porosity of activated carbon |

64. The Panel recommends that the general exemption for laboratory and analytical uses of ozone-depleting substances should be retained for the following procedures:

| Ozone-depleting substance | Procedure |
|----------------------------------|---|
| Carbon tetrachloride | A solvent for reactions involving N-bromosuccineimide |
| Carbon tetrachloride | A chain transfer agent in free-radical polymerization reactions |
| Carbon tetrachloride | Biomedical research |

65. The Panel also discusses a newly identified laboratory use of carbon tetrachloride: its use in biomedical research to induce fibrosis. The amount of carbon tetrachloride used for this purpose is uncertain.

66. The Panel notes in its report that it remains engaged in work to respond to paragraphs 5 and 6 of decision XXI/6 and will endeavour to provide further information to the Twenty-Second Meeting of the Parties. With regard to paragraph 6 of the decision, in which the parties requested the Panel to evaluate the availability of alternatives to laboratory and analytical uses that had been removed from the global exemption for parties operating under paragraph 1 of Article 5, the Panel suggested that it would be helpful if parties so operating submitted information on any such uses that they might have that had already been made ineligible for the global exemption.

67. The Working Group may wish to consider the issues mentioned above and make recommendations as deemed appropriate. The Working Group may wish also to consider whether parties operating under paragraph 1 of Article 5 should provide the information on laboratory and analytical uses requested by the Panel, including the modalities and timing for the provision of such information.

Item 8 (f): Issues relating to the use of ozone-depleting substances as process agents (decision XXI/3)

68. The Panel's 2010 progress report includes an update on the status of process-agent uses and suggestions for changes to tables A and B of decision X/14, as amended by subsequent decisions. Those changes are being proposed pursuant to decision XVII/6, in which the Meeting of the Parties requested the Panel to review tables A and B and make recommendations on possible amendments of them every two years. Following that procedure, the Panel recommends the deletion from table A of the following process-agent uses, which have ceased in the European Community: carbon tetrachloride use in the manufacture of isobutyl acetophenone (item 5 in table A); carbon tetrachloride use for the production of radio-labelled cyanocobalamin (item 27 in table A); and CFC-113 use for the production of perfluoropolyetherpolyperoxide intermediate for the production of perfluoropolyether diesters (item 11 in table A). With regard to table B, the Panel reports that, while not all relevant data are available, the data reported by the United States are in line with table B of decision X/14. The make-up limit for the European Community was slightly exceeded in 2008, however, and countermeasures are being taken to bring the make-up quantities back into line with table B. As at 4 May 2010, Armenia, Australia, Austria, Canada, Cyprus, Hungary, Jamaica, Morocco, Panama, Poland, Sweden, Saint Lucia and the former Yugoslav Republic of Macedonia had reported that no process-agent applications were in use in those parties. Since not all the data are available, however, the Panel makes no recommendation on reductions of the make-up and maximum emissions in table B. Lastly, the Panel recommends that countries having no process-agent uses be removed from table B.

69. Decision XXI/3 on process agents clarifies that the annual reporting obligation in respect of process agent uses of ozone-depleting substances does not apply to parties once they have informed the Secretariat that they do not use ozone-depleting substances as process agents unless they subsequently begin to do so. Pursuant to the decision the Secretariat wrote to all parties to request them to submit information on process agent uses in their territories by 30 September 2010. As at 14 May, the Secretariat had received submissions from 15 parties.

70. Also by decision XXI/3 the Meeting of the Parties requested the Technology and Economic Assessment Panel and the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol to prepare a joint report on process agent applications for future meetings as called for in paragraph 6 of decision XVII/6. The Panel has indicated that that work was in progress but a report was not ready for the 2010 progress report. The Panel further informs the parties that the quadrennial assessment of the Chemicals Technical Options Committee, to be completed by the end of 2010, will contain some relevant information. The Panel and the Committee also report that the joint report of the Panel and the Executive Committee will be prepared for submission to the Open-ended Working Group at its meeting in 2011.

71. The Working Group may wish to consider the above issues and make recommendations, as appropriate, in the light of, among other things, the scheduled review of process-agent uses under decisions XVII/6 and XXI/3.

Agenda item 9: Environmentally sound management of banks of ozone-depleting substances

Item 9 (b): Review by the Technology and Economic Assessment Panel of technologies for the destruction of ozone-depleting substances (decision XXI/2)

72. As noted in document UNEP/OzL.Pro.WG.1/30/2, by decision XXI/2 the Meeting of the Parties requested the Technology and Economic Assessment Panel to review technologies for the destruction of ozone-depleting substances, including technologies that it had identified as having a high potential in the 2002 report of the task force on destruction technologies, and to report to the Open-ended Working Group at its thirtieth meeting on their “commercial and technical availability”.

73. The Panel has now completed its review of destruction technologies as requested in decision XXI/2. The Panel’s discussion of its review may be found in section 4.7, chapter 4, of the Panel’s 2010 progress report, volume 2. The panel reports that it has identified at least 176 destruction facilities that are being operated in 27 countries. The facilities employ a variety of technologies, far wider than those listed in the 2002 task force report, that fall into four categories: high temperature incineration; furnaces dedicated to manufacturing; plasma; and other non-incineration. Furnaces dedicated to manufacturing include cement kilns, lime rotary kilns, electric furnaces, sulphuric acid recovery furnaces and lightweight aggregate kilns. Other non-incineration technologies include catalytic destruction, chemical treatment and solid-phase alkaline reactors. As indicated in the 2002 task force report, the suggested minimum standards of technical performance are guidelines for selecting destruction technologies.

74. The Panel evaluated the destruction technologies, other than 12 that it deems recommended technologies, against the performance criteria used by the countries employing the technologies and against the criteria set out in the 2002 task force report. In the United States, for instance, technologies must comply with what are termed “maximum achievable control technology standards” for destruction efficiency and atmospheric emissions. Countries in Europe employ the destruction technologies recommended in the 2002 task force report, along with a number of incinerators for the destruction of polychlorinated biphenyls and other persistent organic pollutants. Japan permits the use of destruction technologies in accordance with its law on fluorocarbon recovery and destruction.

75. The Panel observes that technology transfer to parties operating under paragraph 1 of Article 5 countries has begun. A destruction project in Indonesia using a cement kiln was supported by the Japanese Government and a private company. Such assistance to parties operating under paragraph 1 of Article 5 is likely to increase since ozone-depleting substance destruction can be expected to gain importance in such countries.

76. Owing to the existence of the above-mentioned facilities, since 1993 the European Union and the United States have destroyed 114,603 and 38,278 tonnes of ozone-depleting substances, respectively. Japan has destroyed 25,925 tonnes of CFCs, HCFCs and HFCs. Recently, Brazil, China, the Republic of Korea and some parties operating under paragraph 1 of Article 5 have begun to destroy ozone-depleting substances.

77. In terms of emerging destruction technologies, the Panel received information on four kinds of technologies for review and evaluation. Appropriate advice has been sent by the Panel to the developers of these technologies regarding their technical performance and suitable substances to be destroyed under destruction conditions. Since details of the technical information were not available in time for inclusion in the report, those technologies will be evaluated at a later stage.

78. One technology, known as the Newcastle process, is covered by a United States patent (number 0036719 (2009), in favour of Kennedy and others). Using this technology halons and CFCs have been processed on a pilot scale at a rate of 25 kg/hour with 99.8 per cent conversion and vinylidene fluoride as a major product. At higher temperatures, the conversion efficiency exceeds 99.99 per cent for halons and CFCs. No dioxins have been detected. One request for review by the Panel concerned the applicability of current destruction technologies to methyl bromide, which is the most difficult ozone-depleting substance to destroy by incineration. Commercial recapture systems for methyl bromide have been developed based on adsorption of methyl bromide from treatment containers and chambers using activated carbon. An emerging destruction technology involves contacting methyl bromide released from activated carbon with a thiosulphate solution in a liquid scrubber to yield methyl thiosulphate ions. The table below summarizes the emerging technologies discussed in the Panel’s report.

Proposed emerging destruction technologies evaluated by the Technology and Economic Assessment Panel

| <i>Organization</i> | <i>Country</i> | <i>Fluorocarbons destroyed</i> | <i>Evaluation</i> |
|---------------------------|----------------|---------------------------------|---|
| Lesni A/S | Denmark | CFCs, HFCs | Destruction of dilute fluorocarbons by catalytic cracking |
| Midwest Refrigerants, LLC | United States | CFCs, HCFCs, HFCs, PFCs, Halons | Transformation of fluorocarbons by pyrolytic conversion |
| SGL Carbon GmbH | Germany | HCFCs, HFCs, CCl ₄ | Destruction of concentrated sources by a porous reactor |
| University of Newcastle | Australia | Halons, CFCs | Transformation of fluorocarbons to fluorinated vinyl monomers |
| SRL Plasma Pty Ltd | Australia | Methyl bromide | Applicability of present destruction technologies to methyl bromide |

Agenda item 11: Additional issues arising from the 2010 progress report of the Technology and Economic Assessment Panel

A. Halons

79. By paragraph 2 of decision XXI/7 the Meeting of the Parties requested the Technology and Economic Assessment Panel and its Halons Technical Options Committee to continue to engage with the International Civil Aviation Organization (ICAO) and to report to the Twenty-Second Meeting of the Parties on progress in the replacement of halons in aircraft. In its 2010 progress report, the Panel reports that in December 2009 it participated in a working group discussion with ICAO and other stakeholders regarding ICAO General Assembly resolution A36-12, in which the ICAO General Assembly had requested the ICAO Council to consider requiring halon alternatives for lavatory and hand-held extinguishers and engine and auxiliary power unit fire protection systems. On the basis of those discussions the working group developed a draft resolution for consideration by the ICAO General Assembly at its thirty-seventh session, in September 2010. That draft resolution is as follows:

- *Requests* that the Council consider a mandate to be applicable in the:
 - 2011 time frame for the replacement of halon in lavatories for new production aircraft.
 - 2014 time frame for the replacement of halon in hand-held extinguishers for new production aircraft.
 - 2014 time frame for the replacement of halon in engines and auxiliary power units for aircraft for which a new application for type certification (sometimes referred to as new designs) has been submitted.
- *Urges* States to issue guidance material for halon alternatives and fire detection systems in cargo compartments for new production aircraft.
- *Encourages* States to promote aircraft and engine manufacturers' research on halon alternative fire suppression systems.
- *Urges* States to take note of its halon reserves and report back at the next regular assembly meeting.

80. It should be noted that some of the dates in the new draft resolution are three years later than those originally agreed upon in resolution A36-12. The reason for that is that the resolution would require the amendment of annex 8 to the International Convention on Civil Aviation, which sets forth minimum aircraft airworthiness standards. Under the annex, parties have three years to implement certain changes. As a consequence of that and the time required to negotiate the amendment of the annex, the use of halon alternatives could not be required in hand-held extinguishers and engines and auxiliary power units in new production aircraft or new designs until 2014 at the earliest.

81. Subsequent to the working group discussions several stakeholders requested that ICAO consider a two-year delay in the installation of halon alternatives for hand-held fire extinguishers for new production aircraft. The reason for the delay is to allow for the further development of a low-GWP

unsaturated hydrobromofluorocarbon, known as 2-bromo,1,1,1-trifluoropropene or 2-BTP. The Technology and Economic Assessment Panel, in the fire protection section of its response to decision XX/8, indicates that that substance could be commercialized in a short period of time, as a significant part of the required testing has already taken place. In their request to ICAO to consider the two-year delay, the International Coordinating Council of Aerospace Industries, Boeing and Airbus agreed that if 2-BTP proved unsuitable they would put in service non-halon hand-held extinguishers by 2016 using two already-approved high-GWP HFCs and an HCFC-123 blend that had also been approved but was subject to Montreal Protocol production and consumption phase-out. Because the Panel expressed concern at the prospect of a further two-year delay ICAO recommended a compromise: to accept the two-year delay in exchange for amending the phrase “consider a mandate” in the draft resolution to read “establish a mandate.” The ICAO stakeholders agreed to the compromise, and participants at the December meeting (mentioned under paragraph 79 above) are being consulted on the following proposed change to the draft resolution:

Requests that the Council establish a mandate to be applicable in the:

- 2011 time frame for the replacement of halon in lavatories for new production aircraft.
- 2016 time frame for the replacement of halon in hand-held extinguishers for new production aircraft.
- 2014 time frame for the replacement of halon in engines and auxiliary power units for aircraft for which a new application for type certification (sometimes referred to as new designs) has been submitted.

82. The Working Group may wish to consider what action, if any, it would like to recommend on this issue.

B. Selection of a successor to Mr. José Pons Pons as Co-Chair of the Technology and Economic Assessment Panel

83. As noted in the 2009 report to the parties, Mr. José Pons Pons will be stepping down from his position as a member of the Technology and Economic Assessment Panel at the end of 2010. While there will be other occasions to thank Mr. Pons for his service to the Montreal Protocol, the Secretariat would like to take this initial opportunity to express its heartfelt thanks for his tremendous work over the past 20 years.

84. Consistent with the Panel’s terms of reference, a replacement may be recommended by parties and the Panel. The Panel recommends that the parties consider Ms. Martha Pizano of Colombia as a successor to Mr. Pons. Ms. Pizano has served as a member of the Methyl Bromide Technical Options Committee since 1998 and as a valued co-chair of that Committee since 2005. The parties may wish to consider this issue with a view towards ensuring that the Twenty-Second Meeting of the Parties is in a position to take a final decision on it when it meets in November in Uganda.

II. Other issues that the Secretariat would like to bring to the attention of the parties

A. Discrepancies between reported exports and imports

85. In accordance with decision XVII/16, the Secretariat compiles and sends to parties information contained in data reports relating to reported exports. This information enables importing parties to verify whether their licensing systems are accounting for all substances imported into their territories. In this regard, many parties operating under paragraph 1 of Article 5 have noted differences, some significant, in the levels of HCFC imports reported through their licensing systems and the levels of HCFC exports reported by exporting parties. There may be a number of reasons for such differences, including differences in reporting of imports and exports of HCFCs and reporting of sales to cruise ships as exports to their flag States. It is particularly important for parties operating under paragraph 1 of Article 5 to understand these differences in the years before the establishment of their HCFC baselines so that those baselines are correctly calculated.

B. Observations related to reporting: decimal places

86. In 2006, the Secretariat brought to the attention of the Implementation Committee the issue of treatment of data in respect of very small (*de minimis*) quantities of ozone-depleting substances, relative to compliance with the Montreal Protocol. At that time and at the Committee's request, the Secretariat circulated a paper requesting guidance from the parties regarding the number of decimal points that should be used in respect of quantities of ozone-depleting substances in assessing compliance. The Eighteenth Meeting of the Parties rejected a proposal for further study of the issue and concluded that the Secretariat should revert to its method of rounding to one decimal place (see paragraph 147 of the report of the Eighteenth Meeting of the Parties (UNEP/OzL.Pro.18/10)).

87. Since the Eighteenth Meeting of the Parties the parties have adopted an adjustment to the Protocol's HCFC control provisions. As the parties are aware, HCFCs have a significantly lower ozone-depleting potential than do CFCs. Since it is rounded to one decimal place, the HCFC consumption data provided by the Secretariat on the internet and to the Implementation Committee will show zero consumption for the many parties whose consumption is lower than 0.5 ODP-tonnes. Those parties may therefore be considered to be in compliance with the HCFC phase-out even though their consumption may be several metric tonnes. This situation contradicts the letter and spirit of Articles 2 and 5 of the Montreal Protocol, which establish zero production and consumption as the measure of full compliance with the Protocol. Furthermore, and given the mandate of the Multilateral Fund to enable compliance, a question may arise as to whether such parties are eligible for assistance from the Fund to eliminate this use of HCFCs.

88. As the issue concerns past decisions of the Meeting of the Parties related to compliance by individual countries, it is important to note that some of those decisions included agreements for reductions to fractions of a tonne expressed to as many as three decimal places. While the specificity in those decisions might appear to control, the fact that the parties' direction on the use of decimal places came later in time could lead to confusion.

89. Given the factors noted above, the Secretariat intends to raise this issue with the Implementation Committee and is taking this opportunity to notify the parties that it may be raised for their consideration at a meeting of the parties.

C. New papers on ozone issues

90. The Secretariat, in accordance with its regular practice of providing information to the parties about new scholarly work that touches on the Montreal Protocol and issues of interest to parties, has posted on the Secretariat website an article entitled "Recent increases in global HFC-23 emissions", which was published by S. A. Montzka, L. Kuijpers, M. O. Battle, M. Aydin, K. R. Verhulst, E. S. Saltzman and D. W. Fahey in the journal *Geophysical Research Letters*. The article, along with previous articles that the Secretariat has circulated to stakeholders, may be found on the Ozone Secretariat website at <http://www.unep.ch/ozone/Publications/index.shtml>.

Annex

Terms of reference for the study on the management of the financial mechanism of the Montreal Protocol (Annex V to the report of the Fifteenth Meeting of the Parties (UNEP/OzL.Pro.15/9))

Preamble

1. The financial mechanism was established by Article 10 of the Montreal Protocol to provide financial and technical cooperation to Parties operating under paragraph 1 of article 5 to enable their compliance with the control measures set out in articles 2A-2E and 2I, as well as any control measures contained in Articles 2F-2H, that are decided pursuant to paragraph 1 *bis* of Article 5. The mechanism includes a multilateral fund, financed by contributions from Parties not operating under paragraph 1 of Article 5. An executive committee was established by the Parties to develop and monitor the implementation of specific operational policies, guidelines and administrative arrangements, including the disbursement of resources for the purpose of achieving the objectives of the Multilateral Fund. A secretariat assists the Executive Committee in the discharge of its functions. The assistance activities requested by parties operating under paragraph 1 of Article 5 approved by the Executive Committee and funded by the Multilateral Fund are implemented by four multilateral implementing agencies (the United Nations Development Programme, the United Nations Environment Programme, the United Nations Industrial Development Organization and the World Bank) and also by bilateral agencies as agreed in decision II/8.

2. The Fourth Meeting of the Parties, which established the Multilateral Fund on a permanent basis, recognized the need to review periodically the operation of the financial mechanism in order to ensure maximum effectiveness in addressing the goals of the Montreal Protocol. Accordingly, in decision IV/18, the Parties requested an evaluation study, which was carried out in 1995. Based on the results of that study, the seventh Meeting of the Parties adopted decision VII/22, in which they decided:

(a) To request the Executive Committee to consider innovative mobilization of existing and additional resources in support of the objectives of the Protocol and any further action by the end of 1996 and to report thereon to the eighth Meeting of the Parties;

(b) That the actions set out in annex V to the report of the seventh Meeting of the Parties should be taken to improve the functioning of the financial mechanism.

Purpose

3. Recognizing that more than five years after that first study it was appropriate to evaluate and review the financial mechanism, the Thirteenth Meeting of the Parties decided in its decision XIII/3:

(a) To evaluate and review, by 2004, the financial mechanism established by Article 10 of the Montreal Protocol with a view to ensuring its consistent, effective functioning in meeting the needs of Article 5 Parties and in accordance with Article 10 of the Protocol and to launch a process for an external, independent study in that regard to be made available to the Sixteenth Meeting of the Parties;

(b) That the study should focus on the management of the financial mechanism of the Montreal Protocol;

(c) That the terms of reference and modalities of the study should be submitted to the fifteenth Meeting of the Parties;

(d) To consider the necessity to launch such an evaluation on a periodic basis;

(e) To request the existing evaluation mechanism in place within the United Nations system to provide the Meeting of the Parties, for its consideration, with any relevant findings on the management of the financial mechanism of the Montreal Protocol at any time such findings are available.

Scope

4. In carrying out the study, the consultant should consider the management of the financial mechanism of the Montreal Protocol as follows:

- (a) Executive Committee decision-making process:
 - (i) Review of the adequacy of planning and implementation process of activities to ensure compliance;
 - (ii) The adequacy of information presented to the Executive Committee to enable it to take decisions on projects and policies;
 - (iii) Coherence and effectiveness in project review process;
 - (iv) Cost effectiveness of approved ODS phase-out projects and programmes;
 - (v) Effectiveness and cost of the administrative organization of the Executive Committee, including the structure and functions of the Subcommittee for Project Review and the Subcommittee for Monitoring, Evaluation and Finance and their role in the Executive Committee. This should include analysis of options for management in the future, given implementation of the new country driven and compliance-focused programme;
 - (vi) Assessment of the necessary level of confidentiality of the Executive Committee meeting documentation, bearing in mind the interest of project proponents;
 - (vii) Use of performance indicators;

- (b) Multilateral Fund secretariat activities:
 - (i) Appraisal of the efficiency and effectiveness of the review process of ODS phase-out projects and programmes with respect to the goals of the Montreal Protocol and decisions of the Meetings of the Parties;
 - (ii) Monitoring the efficiency of the implementation of projects and programmes, in particular the monitoring and management of fund transfer and disbursement;
 - (iii) Adequacy and comprehensiveness of the information provided to the Executive Committee on the financial reports submitted for the Executive Committee's consideration;

- (c) Activities implemented by multilateral and bilateral implementing agencies:
 - (i) Review of the adequacy in identifying plans and projects to assist national compliance with the Montreal Protocol;
 - (ii) Evaluation of the fund management and disbursement policy of each implementing agency;
 - (iii) Investment strategy of cash advances;
 - (iv) Assessment of the use of the administrative costs, with special consideration to smaller versus larger projects;
 - (v) Cost effectiveness of each agency, taking separately into account the investment projects and other activities (institutional support, ODS officer network management, etc.);
 - (vi) Assessment of the proportion of approved funds between investment and non-investment projects in the different agencies;
 - (vii) Adequacy and effectiveness of fund disbursements, and fund disbursement management, including reporting to the Multilateral Fund secretariat;
 - (viii) Additional costs for the Multilateral Fund, if any, of overlapping activities between agencies;

- (d) Fund management:
 - (i) Assessment of past experience of fund management as performed by the Treasurer;
 - (ii) Comparison with management and financial practices of other funds (Global Environment Facility, development banks) as benchmarks;

- (e) Additional matters:
- (i) Adequacy of the interaction between the implementing agencies, the Multilateral Fund secretariat and relevant subsidiary bodies;
 - (ii) Analysis and reconciliation of financial data from different sources (Treasurer, implementing agencies, Multilateral Fund secretariat accounts and audited United Nations Environment Programme Fund accounts);
 - (iii) Performance of donor countries in fulfilling their obligation vis-à-vis the Multilateral Fund.

Conclusions and recommendations

5. In carrying out the study, the consultant(s) will identify the strengths, weaknesses, opportunities and threats and, where relevant, make recommendations suggesting possible improvements. The study will include a general overall review of the achievements of the Fund in phasing out controlled substances and in enabling the compliance of Article 5 Parties with the Montreal Protocol.

Source of information for the evaluation

6. The Ozone Secretariat, the Executive Committee, the Treasurer, the Multilateral Fund secretariat, the implementing agencies (multilateral and bilateral), ozone offices, recipient countries and companies and non-Article 5 Parties are invited to cooperate with the consultant(s) and to provide all necessary information. The report should take into account the relevant decisions of the Meetings of the Parties and the Executive Committee.

7. The consultant(s) should consult widely with relevant persons and institutions and other relevant sources of information deemed useful.

8. The following table presents tentative milestones for the study.

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| November 2003 | Approval of the terms of reference by the fifteenth Meeting of the Parties |
| | Selection of a panel |
| December 2003 | Finalization of the procedure for the selection of qualified external and independent consultant(s). |
| | Analysis of bids by the Ozone Secretariat and recommendation to the steering panel |
| | Independent consultant(s) selected by the panel |
| | Contract awarded. |
| January 2004 | Independent consultant(s) meet with the steering panel to discuss study modalities and details |
| May 2004 | Mid-term review/preliminary draft report review by the steering panel |
| Mid-June | First draft report submitted to the Open-ended Working Group at its twenty-fourth meeting |
| November 2004 | Submission to the Sixteenth Meeting of the Parties |