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Proposed amendments to the Montreal Protocol

Frequently asked questions on the North American amendment proposal to phase down the use of hydrofluorocarbons under the Montreal Protocol on Substances that Deplete the Ozone Layer

Note by the Secretariat

The annex to the present note contains a list of frequently asked questions and responses thereto relating to the North American amendment proposal to phase down the use of hydrofluorocarbons under the Montreal Protocol on Substances that Deplete the Ozone Layer. The list was submitted by Canada, Mexico and the United States of America in November 2012. It is presented as received by the Secretariat, without formal editing.

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Annex

Frequently Asked Questions on the North American HFC Amendment Proposal Submitted by the Governments of Canada, Mexico, and the United States of America November, 2012

1. Is there any reliable scientific study which provides the effect of HFCs vis-à-vis other greenhouse gases on the climate system, taking into account measures already taken by various treaties, including the Montreal Protocol and other measures like the mobile air-conditioning (MAC) directive, in various countries and regions?

These published scientific reports and articles are among the numerous papers that provide information about the effect of HFCs on the climate system vis-à-vis other greenhouse gases:

a) WMO (World Meteorological Organization), Science Assessment of Ozone Depletion: 2010, Global Ozone Research and Monitoring Project - Report No. 52, Geneva, Switzerland, 2011

b) Velders, G. J. M., Fahey, D. W., Daniel, J. S., McFarland, M., and Andersen, S. O. : The large contribution of projected HFC emissions to future climate forcing, Proc. Natl. Acad. Sci. USA 2009, 106, 10949–10954, doi:10.1073/pnas.0902817106, 2009. 2091, 2092, 2098, 2108 Accessible at: http://www.pnas.org/content/early/2009/06/19/0902817106.full.pdf+html

c) IPCC (1990): Climate Change: The IPCC Scientific Assessment (1990). Cambridge University Press, Cambridge

d) IPCC (2009) Meeting report of the expert meeting on the science of alternative metrics. IPCC Working Group I Technical Support Unit, University of Bern, Bern, Switzerland.

e) Jackson SC (2009) Parallel pursuit of near-term and long-term climate mitigation. Science 326:526–527

f) Gschrey B., Shwartz W., Elsner C. and Engelhardt R: High increase of global F-gas emissions until 2050. Greenhouse Gas Measurement & Management, 2011 Earthscan ISSN: 2043-0779

g) Lashof DA, Ahuja DR (1990) Relative contributions of greenhouse gas emissions to global warming. Nature 344:529–531

h) Fuglestvedt JS, Berntsen TK, Godal O, Skodvin T (2000) Climate implications of GWP-based reductions in greenhouse gas emissions. Geophys Res Lett 27(3):409–412

i) Velders, G.J.M., Ravishankara, A.R. , Miller M.K., Molina, M.J., Alcamo J., Daniel, J.S., Fahey, D.W., Montzka, S.A., Reimann, S., Preserving Montreal Protocol Climate Benefits by Limiting HFCs, Science 24 February 2012: 335 (6071), 922-923. [DOI:10.1126/science.1216414]

j) United Nations Environment Programme (UNEP), HFCs: A Critical Link in Protecting Climate and the Ozone Layer, 2011. 36pp.

k) Montzka SA, Dlugokencky EJ, Butler JH., Non-CO2 greenhouse gases and climate change. Nature. 2011 Aug 3;476(7358):43-50. doi: 10.1038/nature10322.

l) National Research Council, Climate Stabilization Targets: Emissions, Concentrations, and Impacts Over Decades to Millennia, 2010. 298pp.

m) Molina M.J., Zaelke D., Sarma K.M., Andersen, S.O., Ramanathan, V.R., Kaniaru, D., Reducing abrupt climate change risk using the Montreal Protocol and other regulatory actions to complement cuts in CO2 emissions, Proc. Natl. Acad. Sci. USA 2009, 106, no. 49, 20616-20621, doi: 10.1073/pnas.0902568106.

In addition to these studies, U.S. EPA studies can be found at: http://www.epa.gov/ozone/downloads/Benefits%20of%20Addressing%20HFCs%20Under%20the%20Montreal%20Protocol,%20June%202012.pdf

2. How does the North American amendment proposal relate to the recent outcome agreed to by governments at the United Nations Conference on Sustainable Development held in Brazil in June 2012 (Rio+20)?

At Rio+20, governments adopted an outcomes document known as the "The Future We Want." Paragraph 222 reads:

"We recognize that the phase-out of ozone depleting substances (ODS) is resulting in a rapid increase in the use and release of high global warming potential hydrofluorocarbons (HFCs) to the environment. We support a gradual phase-down in the consumption and production of HFCs."

Paragraph 222 specifically refers to consumption and production, which is the language used in the Montreal Protocol. It does not reference reductions in emissions, which is language of the Kyoto Protocol. The North American amendment proposal would fulfill the agreed language of paragraph 222 from Rio + 20.

3. How would UN Framework Convention on Climate Change (UNFCCC) obligations be impacted if this amendment were adopted? Would it remove HFCs from the UNFCCC? Would it undermine the UNFCCC?

The proposed amendment would have no effect on the UNFCCC's coverage of HFCs. Rather, the amendment is in addition to the UNFCCC's efforts to address climate change.

Article III of the proposed amendment makes this structure explicit. In accordance with Article 31(3)(a) of the Vienna Convention on the Law of Treaties, the North American Amendment Proposal states that the amendment would not exclude HFCs from the coverage of the relevant provisions of the UNFCCC and the Kyoto Protocol, and further states that Parties would continue to apply those provisions for as long as they remain in force. Thus, the amendment does not alter obligations under those agreements. It also does not undermine the UNFCCC, but rather supports, complements and enhances it.

4. Can the Vienna Convention and the Montreal Protocol be amended to include a phase-down of HFCs?

- **Can HFCs fit within the scope of the Montreal Protocol?**
- **What is the procedure for an amendment?**
- **Is authorization from the Kyoto Protocol needed to bring HFCs into the Montreal Protocol?**
- **How does the proposal reconcile the UNFCCC and the Montreal Protocol?**

Yes, either treaty can be amended to include a phase-down in HFCs. Article 2(2)(b) of the Vienna Convention includes language that applies to the Vienna Convention and the Montreal Protocol, and states that "Parties shall . . . co-operate in harmonizing appropriate policies" associated with controlling ozone-depleting substances. One way the Parties may cooperate in "harmonizing their policies" with regard to phasing out CFCs and HCFCs is to specify how that transition should be accomplished -- for example, by specifying which CFC and HCFC alternatives the Parties will, or will not, move to. Since HFCs are the primary alternative to CFCs and HCFCs, the Parties may agree to "harmonize their policies" in moving away from CFCs and HCFCs, past HFCs, and into other alternatives.

Amendment of the Montreal Protocol does not require any action by the UN Framework Convention on Climate Change (UNFCCC) or its Kyoto Protocol. The North American Proposal reconciles the relationship between the climate regime and the Montreal Protocol by keeping in place all of the obligations of the climate regime, as set out in Article III of the proposal. The new Montreal Protocol obligations with regard to HFCs would be in addition to the requirements of the climate conventions.

The procedure for amending the Montreal Protocol calls for a Party to present a proposed amendment at least six months before a Meeting of the Parties. The Meeting of the Parties can adopt an amendment that has been proposed, and which may include specific provisions related to its entry into force. The North American HFC Amendment Proposal includes provisions in Article IV of the proposal that set out entry into force requirements for countries that have deposited an instrument of ratification, approval, or acceptance.

5. Do these proposals deviate from the basic objective of the Montreal Protocol and the Vienna Convention?

No. First, it should be noted that the Montreal Protocol has a long history of concerning itself with HFCs and their growth as alternatives to ozone-depleting substances, as is evident by the following decisions:

- MOP Decision X/16 (1998): convened a workshop, in collaboration with UNFCCC, with view to assisting establishment of and providing information on HFCs and PFCs and potential ways to limit their emissions,
- MOP Decision XIV/10 (2002): called on TEAP to collaborate with IPCC to develop report: Safeguarding the Ozone Layer and the Global Climate System; Issues Related to HFCs and PFCs,
- MOP Decision XIX/6 (2007): called on the Executive Committee to give priority to substitutes and alternatives that minimize other impacts to the environment, including on the climate, taking into account global warming potential (GWP) and other factors.
- MOP Decision XX/8 (2008): called for a report and workshop on high-GWP alternatives, principally HFCs, to ODS, and
- Executive Committee Decision 60/44 (2010): allowed for up to a 25% funding increment, above cost-effectiveness thresholds, when needed for climate benefits, mainly to avoid selection of high-GWP HFCs.

The proposed amendment would build on the historical experience of the Montreal Protocol with respect to HFCs and complement the current activities of the Protocol. The Vienna Convention explicitly requires Parties to "co-operate in harmonizing appropriate policies" related to the phaseout of ozone-depleting substances. The amendment would help manage the phaseout of ozone-depleting substances in a more environmentally friendly fashion.

6. Should Parties pay attention at this juncture only to the phaseout of HCFCs?

Parties should maintain a focus on meeting HCFC phaseout objectives and obligations under the Protocol, and as they do so, every Party faces a decision regarding what alternatives they will rely on and the climate impacts of those alternatives. For Article 5 Parties, the 2013 freeze and 2015 10% reduction step are fast approaching, and planning needs to take place to ensure compliance is achieved. The Multilateral Fund's Executive Committee (ExCom) has already approved Stage I HCFC Phaseout Management Plans (HPMP) for 126 countries as of July 2012, and 13 additional plans are being considered at the 68th meeting of the ExCom shortly after the 24th MOP. The amendment is structured to be compatible and implementable with the HCFC phase out.

In undertaking Stage I of HPMPs, countries are already making important choices on the alternatives that will be phased in, and whether they will seek to maximize climate benefits. Some countries have focused their Stage I HPMP *only* on sectors that have a relatively wide range of climate-friendly alternatives or technology options, such as the foam and servicing sectors. Other countries have addressed more challenging sectors like industrial and commercial refrigeration and air-conditioning by pursuing relatively newer technologies such as lower GWP fluorinated and non-fluorinated refrigerants in certain applications.

In view of these developments, establishing a long-term framework for controlling HFC consumption and production would be consistent with those choices and assist Parties in taking decisions on the sectors and alternatives they should consider to phaseout HCFCs, by removing the current uncertainty over the future of HFCs. Currently, Article 5 Parties do not know the extent to which they should or should not transition to HFCs because the future of HFCs is unknown, despite the fact that their emissions are included in the basket of gases controlled under the UNFCCC and its Kyoto Protocol. This uncertainty is increasingly becoming problematic, both for Article 5 Parties and the ExCom, as decisions need to be taken on how to best meet upcoming HCFC targets. By adopting a gradual phase-down schedule for HFCs, which is sufficiently flexible to permit some transition to HFCs when alternatives are not available, Parties would be able to plan their HCFC phase-out in a more informed and integrated manner, because they would know the total quantity of HFCs they will be able to consume for many years ahead. Therefore, adopting an HFC phase-down would actually support and facilitate the HCFC phaseout, and provide certainty on the future applicability of such substances.

Last, there is a considerable volume of an installed base of HFCs already in place unrelated to the HCFC phase out, and it is growing every day. Just to name a couple examples: (1) HFC-134a has been used in all major automotive platforms on a global basis, and (2) R-410A (an HFC blend)

systems are already being produced and sold in Article 5 countries *before* those countries had taken any steps to phase out HCFCs. This HFC base is already significant, is growing rapidly, and currently lies outside the control of the Montreal Protocol. Activities in these sectors, currently outside the purview of the Protocol, may hinder the success of HCFC transitions in achieving climate-friendly transitions.

7. Why is there limited adoption of low-GWP refrigerants like hydrocarbons, ammonia and carbon-dioxide? Is this mainly because of their flammable and toxic properties, which limit application to only certain sectors and locations?

The current penetration of non-fluorinated compounds and low-GWP fluorinated compounds varies by sector and location. In many cases, the speed of deployment is increasing recently. There are applications where the development and adoption of standards for the use of flammable substances has slowed their adoption. However, the 2010 TEAP Assessment Report and TEAP's response to Decision XXIII/9 included in the 2012 Progress Report make the following comments specifically concerning the air-conditioning and refrigeration sectors:

- In commercial refrigeration stand-alone equipment, hydrocarbons (HCs) and R-744 (CO_2) are gaining market shares in Europe and in Japan; they are replacing HFC-134a, which is the dominant choice in most countries.
- In many developed countries, R-404A and R-507A have been the main replacements for HCFC-22 in supermarkets; however, because of their high GWP a number of other options are now being introduced. Indirect systems are the most effective option for emissions reductions in new centralised systems for supermarkets. In two stage systems in Europe, R-744 is used at the low-temperature level and HFC-134a, R-744 and HCs at the medium temperature level.
- In industrial refrigeration, R-717 (ammonia) and HCFC-22 are still the most common refrigerants; R-744 is gaining in low-temperature, cascaded systems though the market volume is small.
- In unitary (air-to-air) air-conditioning, HFC blends, primarily R-410A, but to a limited degree also R-407C, are still the dominant near-term replacements for HCFC-22 in air cooled systems. HC-290 is also being used to replace HCFC-22 in low charge split system, window and portable air-conditioners in some countries. Most Article 5 countries are continuing to utilise HCFC-22 as the predominant refrigerant in air-conditioning applications.
- Car manufacturers and suppliers have evaluated several refrigerant options for new car (and truck) air-conditioning systems including R-744, HFC-152a and HFC-1234yf, all with GWPs below the EU regulatory threshold of 150. These options can achieve fuel efficiency comparable to the existing HFC-134a systems with appropriate hardware and control development. The use of hydrocarbons or blends of hydrocarbons has also been considered but so far has not yet received support from vehicle manufacturers due in part to safety concerns. The eventual decision of which refrigerant to select for vehicle air-conditioning will be made based on the GWPs of the available options along with additional considerations including regulatory approval, costs, system reliability, efficiency, safety, heat pump capability, and servicing.

Supermarket centralized systems is a subsector where significant focus has been on a combination of changing refrigerant fluids, improving designs, and improving servicing practices. Secondary loop systems that chill glycol, brine or R-744, and systems cascaded with direct expansion R-744 systems, are available globally and reduce the use of HFCs significantly. The secondary glycol, brine and R-744 systems are made by most major manufacturers. The cascade R-744 system has many installations in Europe and several in the United States and is made by multiple manufactures in both these locations. Supermarkets in Australia are incorporating R-744 cascade and transcritical refrigeration systems to meet their target reductions in CO2eq emissions. Shifting from HFCs to R-744 has reduced their carbon footprint by 25%. In Europe many transcritical R-744 systems and ammonia/R-744 cascade systems have been installed with many more being prepared for installation. The United States has recently seen R-744 cascade systems and ammonia/R-744 systems installed as well as a few transcritical systems, while in Canada several supermarkets have converted to R-744 cascade and there's a greater focus on transcritical systems.

Non-fluorinated options are increasingly being considered for both small charge and larger charge applications. Safety standards have evolved in many places allowing for increased use of non-fluorinated options.

In addition, since MOP-23, the U.S. EPA's SNAP program listed as acceptable various alternatives that could result in increased market penetration in North America and elsewhere. These include:

- hydrocarbons for use in stand-alone commercial freezers and domestic refrigeration;
- CO2 for motor vehicle air conditioning;
- CO2 for vending machines;
- Solstice 1233zd for various foam blowing applications; and
- additional alternatives for fire suppression.

One interesting example in 2012 for commercial refrigeration is the opening of a supermarket in the United States that deploys 100% non-fluorinated alternatives. This store opened in May 2012 and uses non-fluorinated compounds in all refrigeration applications – including centralized equipment, stand-alone cases, and vending machines.

8. How far have the non-Article 5 Parties used non-HFC alternatives to HCFCs in refrigeration and air-conditioning sector in meeting the 75% reduction in 2010? Some countries have suggested it may be worthwhile to carry out a study on this topic to take well informed decisions.

Based on national circumstances, countries have designed their HCFC phaseout plans differently. In the United States, the approach is based on 'worst first' or higher ozone depleting potential (ODPs) first approach. This resulted in early transitions in foam sectors, starting with flexible foams in 1993-1994 and rigid foams in 2003-2004. Roughly half of the foam blowing sectors in the United States moved entirely to non-fluorinated compounds, at a time when the availability of low-GWP alternatives was much more limited as compared to today. The United States also similarly focused on the non-medical aerosol sector first in the early 1990s and also saw a majority of the transition to non-fluorinated options.

For the refrigeration and air-conditioning sector, most of the transition was initially to HFCs. In some sectors, most notably with smaller charge sizes, a number of refrigeration subsectors transitioned to hydrocarbons and there is the beginning of a second transition to either lower GWP fluorinated options or non-fluorinated options. For unitary air-conditioning and larger charge sizes the majority of the transition has been and continues to be to high-GWP HFCs. However, there are several options now under either development or investigation that will likely be able to replace a portion of that end use in the near future.

Australia and the European Union have also undertaken efforts to control HFCs. Australia recently implemented the Clean Energy Future Plan, which includes the application of a carbon price on HFCs and other synthetic greenhouse gases. It applies an equivalent carbon price and is intended to increase recycling, improve servicing and reduce leakage, and promote technology innovation and conversion to low-GWP equipment. The carbon price applies to imports of HFCs in bulk and in pre-charged equipment, with a refund provided for exports and exempts foams and metered dose inhalers (MDIs).

The European Union's regulations on fluorinated greenhouse gases have been in place since 2006 and cover stationary equipment with a specific directive on mobile air conditioners. The regulation for stationary equipment includes containment measures and a few use and market bans on HFCs and other F-gases. The MAC Directive bans refrigerants above a GWP of 150 in new motor vehicle models and in all new cars from 2017. The European Commission is considering options to further reduce F-gas emissions. Policy options that include an EU-wide HFC phasedown, end use bans, and thresholds, are currently being reviewed, with proposed legislation expected shortly.

Consistent with approach suggested in the North American Proposal to amend the Protocol to address HFCs, Parties can continue to use national approaches to determine the best way to meet the GWP-based obligations. It is not necessary to transition all sectors at the same time, and it may be advisable to wait for the development and commercialization of additional alternatives in some sectors. Approaches used by many non-Article 5 Parties to meet the HCFC freeze, the 35% reduction, and more recently the 75% reduction, have not required addressing all subsectors at the same time. Parties could therefore, (1) address sectors and subsectors where non-fluorinated and low-GWP fluorinated options exist first, (2) incorporate the use of technology to reduce charge sizes, and (3) improve maintenance and servicing practices to ensure the overall reduction in HFC consumption.

9. Would HFC-23 control under the amendment produce a perverse incentive for excessive HCFC-22 production and HFC-23 byproduct? How would Clean Development Mechanism (CDM) HFC-23 credits be affected if there is an HFC phase-down under the Montreal Protocol?

The North American Amendment Proposal includes a compliance obligation to control HFC-23 byproduct emissions from certain chemical production facilities, and at the same time makes implementation of this compliance obligation eligible for financial support from the Multilateral Fund. The Protocol's incremental cost model pays only the agreed incremental costs for compliance, and therefore would not provide an incentive for over-production of HCFC-22 since it would only pay the

agreed incremental costs for mitigating or destroying any byproduct that is generated. This stands in contrast to the model under the CDM that provides a market value for HFC-23 credits. Because the market value of HFC-23 credits dramatically exceeds the cost of mitigation, the question of perverse incentive is directly relevant to the issuance and value of CDM credits. One advantage of the use of the Multilateral Fund model, since it relates back to actual mitigation costs, is that it avoids concerns over perverse incentives.

The HFC-23 control obligation does not apply to emissions from production lines that have an approved project under the CDM so long as those emissions are covered by and continue to generate emissions reduction credits under a CDM project. There are a number of production facilities that do not currently have CDM projects that would be eligible for Multilateral Fund financing under the North American Amendment Proposal.

10. How would technical and financial support be provided for the North American Amendment Proposal? How much would the amendment cost, and could the TEAP make an estimate of its costs? What action can be taken by the Party itself, without Multilateral Fund support? Are some actions cheap enough that they shouldn't require Multilateral Fund support?

The North American Amendment Proposal would rely on the same successful financial and technical support model that has been used to implement the Montreal Protocol to date. Financial support is provided to meet the agreed incremental cost of implementation in accordance with Article 10 of the Montreal Protocol. We would anticipate that assistance would continue to be provided to build and maintain national-level capacity through institutional strengthening and regional capacity assistance networking.

The cost of the amendment itself will depend on the cost of implementation and incremental costs over the next three decades as the amendment itself would be implemented. Cost estimates would be made under normal procedures under the Protocol, meaning that the TEAP would be requested to provide estimates of agreed incremental costs for Article 5 Parties to comply with their HFC targets in the context of three-year replenishment periods. Should Parties be interested, they could also request the TEAP to provide an overall estimate of the total incremental costs associated with various phase-down options. However, any such global estimate would be subject to significant uncertainty, given that it is impossible to know the cost of alternative technologies over the next 30 years, particularly in view of the fact that new technologies are continuously being developed.

There may be some actions that do not require MLF support; for example, if operating the low-GWP technology is less expensive than operating the HFC technology being replaced, there would not be any incremental operating costs, although there may still be incremental capital costs. This would be determined when considering the estimated incremental costs of complying with the obligations in the various HFC-consuming sectors, based on the Parties' list of categories of incremental costs (adopted at the 4th Meeting of the Parties) and specific cost guidelines developed by the ExCom, as per usual practice.

11. How can we adopt this proposal if there are not alternatives available in all sectors? Where is there more information on alternatives?

Our amendment proposal recognizes that there may not be commercially available alternatives today for all HFC applications and therefore utilizes a gradual phase-down mechanism with a plateau. Options for replacing HFCs with either lower GWP HFCs or non-HFCs today are similar in many ways to the situation for CFC replacements in 1987 and also similar to when the Parties agreed to phase out HCFCs. In those cases and now, alternatives were known for many, but not for all end-use applications. We do see a number of sectors and applications where alternatives are already available, or have been commercialized and are being implemented now and in the next few years.

It is clear, even today, that HFC use can be reduced or avoided for a number of end uses. The TEAP notes in its 2010 Assessment Report and the 2012 Progress Report that technically and economically feasible substitutes are available for ODS and that the suite of known alternatives includes many low-GWP options. Increasingly, information on alternatives is available from a range of other sources. If further information is desired, Parties could request that the TEAP provide additional information on a number of issues, including: (1) more specificity on low-GWP fluorinated and non-fluorinated options, (2) performance under various climatic conditions such as high ambient temperatures, and (3) a focused description of specific subsectors.

U.S. EPA has analyzed technically- and economically-viable mitigation options for HFCs in several key sectors. Similar to the TEAP's findings, the most promising options to reduce HFC consumption include:

- Transition to low-GWP or no-GWP substances in many applications;
- Implementing new technologies with lower HFC charge size; and,
- Changing various processes and handling procedures to reduce consumption during the manufacture, use, servicing, and disposal of products that contain or use HFCs.

Information on substitutes reviewed by EPA can be found at: http://www.epa.gov/ozone/snap/index.html

U.S. EPA has developed six factsheets about alternatives in the following sectors: 1) motor vehicles, 2) domestic refrigeration, 3) transport refrigeration, 4) construction foams, 5) commercial refrigeration, and 6) unitary air-conditioning. These can be found at: http://www.epa.gov/ozone/intpol/mpagreement.html

Moreover, a technology conference held July 21-22, 2012, prior to the 32nd Open-Ended Working Group, explored available and emerging ozone and climate protection technologies. The conference was sponsored by United Nations Environment Programme, the United States Government, the European Commission, the United Nations Development Programme, the Climate and Clean Air Coalition on Short-Lived Climate Pollutants and the Alliance for Responsible Atmospheric Policy. The conference and concurrent technology exhibition attracted over 400 participants including industry, policymakers, environmental organizations, and academia. The conference objective was to share information and expertise on alternatives and approaches to ensure that the phase-out of CFCs and HCFCs is done in such as way as to limit the climate contribution of high-GWP HFCs. Forty-two speakers gave presentations that explored both fluorinated and non-fluorinated alternatives, including potential timelines and challenges for application of alternatives, covering the foam, refrigeration, and air conditioning sectors. Presenters identified and described existing and emerging low-GWP and energy-efficient technologies that can be deployed in those sectors. This information is particularly relevant to Article 5 Parties, as they prepare their Stage II HPMPs. A summary of that meeting is available at: http://www.unep.org/ccac/Portals/24183/docs/Bangkok%20Technology%20Conference%20-%20Report%20and%20Cover%20-%20FINAL.pdf

Taken together, alternative chemicals, new technologies, and better process and handling practices can reduce HFC consumption in both the near and long term in a way that will allow countries to implement an orderly HFC phase-down.

12. How does the proposal work in terms of a weighted phase-down, is this ODP based or GWP based? Parties need better information concerning how the amendment allows for some continued use of HFCs. Can an explanation of a GWP-based cap be provided? Also, how much R-410A would be permitted compared to HFO-1234yf or other similar examples would be useful.

The baselines in the North American Proposal and the compliance steps for the phase-down are weighted based on GWPs. In both cases, a formula is used to calculate a baseline from which reductions would be made. For Article 5 Parties, the baseline is calculated based on production and consumption of HCFCs respectively, averaged over 2005-2008. This baseline was proposed recognizing that there would be difficulties in obtaining HFC data for many Article 5 countries. For non-Article 5 Parties, the baseline is calculated from a combination of HFC plus 85% of HCFC consumption and production respectively averaged over 2005-2008. Based on analysis to date, it appears likely that on a global basis the baseline will be greater than the actual installed consumption of HFCs for Article 5 Parties for the first year when an obligation would apply for those Parties. This would allow Article 5 Parties to transition some of their HCFC consumption to HFC consumption, while still complying with initial control measures.

In response to the question on providing specific examples, what follows is a baseline calculation for an Article 5 Party, in the simplified case where HCFC consumption comprises only HCFC-22:

1) Average 2005-2008 ODS Consumption = 10 ODP tonnes
2) Divide by ODP to convert to actual metric tonnes = 10 ODP tonnes/0.055 = 181.82mt
3) Multiply by GWP = 181.82 mt * 1,810 = 329,091 mt of CO2 equivalent (Note – 1,810 is the 100-year GWP for HCFC-22)
4) Cap Amount for Each Substance - In response to the question of how this would convert to caps for other substances, the table below provides equivalent tonnes of other substances related to this baseline of 329,091 mt of CO2-equivalent. This amount is calculated by dividing the CO2-equivalent tonnes by the GWP of each substance.

GWP Weighted Cap Amount			Cap Equivalent Amount (metric tonnes)				
			GWP = 1,810	GWP = 1,430	GWP = 2,022	GWP = 675	GWP = 4
Year	% of Baseline	metric tonnes CO_2eq	HCFC-22	HFC-134a	R-410A	HFC- 32	HFC-1234yf
2018	100%	329,091	182	230	163	488	82,273
2024	80%	263,273	145	184	130	390	65,818
2029	60%	197,455	109	138	98	293	49,364
2034	40%	131,636	73	92	65	195	32,909
2043	15%	49,364	27	35	24	73	12,341
*GWPs from IPCC AR4							

The table above illustrates the differences in the equivalent amounts of various substances when weighting by GWP. In this particular example, a low-volume consuming country with a 2005-2008 average consumption of **181.8 mt (10 ODP tonnes of HCFC-22) of HCFCs** would still be allowed to consume **49,364 mt CO_2eq** of HFO-1234yf after 2043, corresponding to **12,341 mt of that material**, assuming it does not consume any other HFCs.

13. Can the baseline methodology be reconsidered? Could the amendment provide an option for Article 5 Parties to use a methodology that includes HFC consumption data if they have it available?

The North American amendment proposal categorized countries, consistent with past practice, according to whether they are currently Article 5 or non-Article 5 parties. One key aspect in developing the formula for the Article 5 baseline was the potential lack of availability for many Article 5 countries of historical HFC consumption data. We are willing to consider various options on how to calculate baselines for Article 5 and non-Article 5 Parties, so long as they provide accurate estimates to establish a baseline at a reasonable level. We would be willing to further discuss options with countries if they believe it would be appropriate to their circumstances and they have reliable data on HFC consumption available.

14. How do countries calculate a baseline? How is the Article 5 baseline affected by transition to HFCs as part of a country's HPMP? For example, transition from HCFC-22 to HFC-32 – would HFC-32 fit within the baseline?

Article 5 Parties: The baseline is calculated on a GWP-weighted basis, based on production and consumption of HCFCs respectively averaged over 2005-2008. An HCFC-only formula was used recognizing that there may be difficulties in obtaining HFC data for many Article 5 countries. Since HCFC production and consumption is reported to the Ozone Secretariat on an annual basis, Article 5 countries can use this same information for the years 2005-2008 and develop the average for both consumption and production respectively. This would involve converting ODP tonnes for consumption or production of each substance to metric tonnes and then to GWP-weighted tonnes. The GWP-weighted tonnes would then be added together for each country to establish an overall baseline.

The baseline for Article 5 Parties is calculated based on historical HCFC production and consumption respectively. In many cases, this baseline will be larger than the installed base of HFCs at the time of a first HFC control measure. Given that many applications have not yet transitioned out of HCFCs, it is envisioned that a certain amount of HFCs will be phased in and will likely be less than the calculated baseline for the Article 5 Parties. In other words, consumption of HFCs is likely to be lower than the established baseline even accounting for growth.

Non-Article 5 Parties: The baseline is calculated from a combination of HFC plus 85% of HCFC consumption and production respectively, averaged over 2005-2008. Since HCFC production and consumption is reported to the Ozone Secretariat on an annual basis, non-Article 5 countries can use this information for the years 2005-2008. Since these countries are also Annex 1 countries under the UNFCCC, these countries report information concerning their HFC emissions each year. This information is generally derived from consumption and production, and these countries often have additional domestic requirements for reporting of production and consumption information. The non-Article 5 countries can combine the information on HCFCs and HFCs using the formula above for both consumption and production respectively.

With respect to the question on HFC-32, a couple of examples illustrate how the transition can take place under a GWP-weighted phase-down schedule. The GWP of HCFC-22 is 1,810, while blends, such as R-410A have a GWP of 2,022. So a transition from HCFC-22 to R-410A permits nearly 1-1

transition on a GWP-weighted basis because the GWPs are similar. In contrast, HFC-32 has a GWP of 675, so a transition from HCFC-22 to HFC-32 gives an intrinsic GWP-weighted reduction of roughly two-thirds relative to the HCFC baseline (additional benefits of reduced charge size are not accounted for here). This means that countries that are moving to HFC-32 (e.g. Indonesia) are likely to be significantly below their baseline cap calculated by the formula in the proposed amendment, even if there is significant growth.

15. Is 15% the correct plateau? What sectors and continued uses are within the 15%?

The North American Proposal to address HFCs under the Montreal Protocol sets a plateau of 15% of the calculated baseline. It does not specify for which uses HFCs can continue to be used, and instead leaves that decision to Parties based on national circumstances. The plateau level is proposed recognizing that for some subsectors (e.g., Metered Dose Inhalers) the continued use of HFCs (e.g., HFC-134a) may continue beyond the date when the plateau is reached for certain uses. Niche applications may continue to use higher GWP HFCs beyond those dates while a larger number of subsectors may continue to rely on low-GWP HFCs or no-GWP alternatives. A variety of HFCs will be necessary to service a legacy fleet including both low and high GWP HFCs; and the plateau allows for such servicing to occur uninterrupted. Parties could continue to use a mix HFCs with a greater focus on lower GWP HFCs within their mix. We believe 15% is reasonably representative of a limited number of applications for which there are currently no clear low-GWP alternatives.

Given the phase-down is GWP-based, no specific HFC or sector is targeted by the proposal. It would be up to each country to decide, based on their circumstances, what types of uses they may want to fit within the 15% plateau.

16. To what extent is energy efficiency considered in the amendment proposal?

Historically, with each of the transitions from ODS, we have seen improved energy efficiency. As manufacturers seek to redesign equipment, direct and indirect contributions to climate change can be considered together. In addition, several of the newer low-GWP alternatives (e.g., foam blowing agents) are being developed that will improve energy efficiency.

The TEAP reported in the 2010 Assessment Report and the 2012 Progress Report that lower GWP HFC non-fluorochemical options are increasingly used in most sectors, with emphasis on optimizing system efficiency (expressed as Coefficient of Performance - COP) and reducing emissions of high Global Warming Potential (GWP) refrigerants.

While energy efficiency is not directly included in the amendment proposal, the proponents consider increasing energy efficiency while transitioning away from high GWP HFCs as an important co-benefit of the proposal. There are a number of ways for countries to ensure energy efficiency is improved, including by adopting energy efficiency standards for appliances. UNEP, UNDP, the World Bank, UNIDO, and other institutions have been working with countries in recent years to ensure continued progress in efficiency is achieved even as we change out refrigerants in various sectors.

17. Is there a cut-off date for facilities eligible for funds under the proposal?

The amendment proposal itself does not set out any limitations on eligibility for facilities. Discussions of eligibility of funding would be expected to take place as Parties moved forward on the specific aspects of implementation. In the past, Parties have let the Executive Committee to determine specific eligibility parameters, such as the cut-off dates for the establishment of CFC and HCFC capacities. However, a decision could also be made by the Parties if they so desire. It would be important that any cut-off date takes into account the availability of alternative technologies and is not so far into the future as to provide an incentive for companies to further increase their HFC capacity.