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Issues arising from the implementation of potential project activities under the clean development mechanism: the case of incineration of HFC-23 waste streams from HCFC-22 production

Technical paper [*]

Summary

This technical paper was prepared by the secretariat to facilitate the consideration by Parties of agenda item 5 (b) of the twenty-second session of the Subsidiary Body for Scientific and Technological Advice. It presents major issues that are being raised by experts in connection with potential clean development mechanism project activities that seek to earn certified emission reductions (CERs) by incinerating hydrofluorocarbon 23 waste streams from hydrochlorofluorocarbon 22 (HCFC-22) production. Such issues include the potential impact of the revenue stream from CERs on the level and location of HCFC-22 production and implications for the achievement of objectives under the Montreal Protocol on Substances that Deplete the Ozone Layer, notably relating to the eventual phasing out of such production in developing countries, and under the UNFCCC.

[*] This document was prepared by the secretariat on the basis of inputs by Mr. Erik Haites (consultant).

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I. Introduction

A. Mandate

1. The Executive Board of the clean development mechanism (CDM), at its fifteenth meeting, in September 2004, taking into consideration information that had emerged since the approval of the methodology "Incineration of hydrofluorocarbon (HFC) 23 waste streams from hydrochlorofluorocarbon (HCFC) 22 production" (methodology AM0001),[1] requested its Methodologies Panel to undertake a review of this methodology. The Executive Board, at its seventeenth meeting, in December 2004, considered the recommendations by the Methodologies Panel and agreed to revise the methodology.

2. The methodology is now limited to *existing* HCFC-22 production capacity.

3. The Executive Board indicated that the establishment of *new* HCFC-22 facilities by project participants who seek to obtain certified emission reductions (CERs) for the destruction of HFC-23 may have implications for the achievement of objectives of other conventions and protocols, such as the Montreal Protocol on Substances that Deplete the Ozone Layer. The Executive Board therefore brought this issue to the attention of the Conference of the Parties (COP), at its tenth session, and sought guidance on how to proceed in such cases.

4. The COP, at its tenth session, requested the Subsidiary Body for Scientific and Technological Advice (SBSTA), in collaboration with the Executive Board, "to develop a recommendation to the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol at its first session relating to implications of the implementation of clean development mechanism project activities for the achievement of objectives of other environmental conventions and protocols, in particular the Montreal Protocol, and which imply the establishment of new hydrochlorofluorocarbon 22 facilities which seek to obtain certified emissions reductions for the destruction of hydrofluorocarbon 23, taking into account the principles established in Article 3, paragraph 1, and the definitions in Article 1, paragraph 5, of the Convention".[2]

B. Scope

5. This technical paper was prepared by the secretariat to facilitate the consideration by Parties of agenda item 5 (b) of the twenty-second session of the SBSTA, on "Implications of the implementation of project activities under the clean development mechanism, referred to in decision 12/CP.10, for the achievement of objectives of other environmental conventions and protocols".

6. The paper is based on information used by the Executive Board in the process of revising methodology AM0001, in particular on inputs made by the public in response to a call for inputs as well as reports of the Methodologies Panel of the Executive Board and other internal background papers prepared for the Methodologies Panel.[3]

7. The paper summarizes issues raised by public comments and discussions by the Executive Board and its Methodologies Panel relating to HCFC-22 facilities which seek to obtain CERs for the destruction of HFC-23. In particular, it analyses potential impacts of awarding CERs for HFC-23 destruction project

[1] For the full text of the approved methodology AM0001 please refer to the section on "Methodologies" on the UNFCCC CDM web site: <http://cdm.unfccc.int/methodologies>.
[2] Decision 12/CP.10, paragraph 14.
[3] Public inputs can be reviewed in the section "What is New" on the UNFCCC CDM web site: <http://cdm.unfccc.int>. For the reports of the Methodologies Panel, go to the section "Panels/Working Groups" on the UNFCCC CDM website: <http://cdm.unfccc.int/Panels>.

activities at new facilities in Parties not included in Annex I to the Convention (non-Annex I Parties), but also touches upon aspects regarding existing facilities.

II. Background

8. In accordance with Article 12 of the Kyoto Protocol, CDM project activities are to result in CERs for reductions of greenhouse gas (GHG) emissions achieved in non-Annex I Parties that are Parties to the Kyoto Protocol.[4] Such CERs can be used by Parties included in Annex I to the Convention (Annex I Parties) that are Parties to the Kyoto Protocol to help meet their quantified emission limitation and reduction commitments under Article 3 of the Kyoto Protocol.

9. HFC-23, a potent GHG regulated by the Kyoto Protocol,[5] is generated as a by-product during the manufacture of HCFC-22, a GHG[6] and an ozone-depleting substance controlled by the Montreal Protocol.[7] Most of the HFC-23 generated during HCFC-22 production is vented to the atmosphere because there is only a small, declining market for HFC-23 and discharges are not regulated because this gas is not toxic.

10. Project participants are interested in undertaking CDM project activities in non-Annex I Parties to earn CERs for the destruction of HFC-23 generated during HCFC-22 production and which otherwise would be vented to the atmosphere.

11. It has been argued by some that the value of the CERs awarded for HFC-23 destruction could create an incentive to delay the phase out of production and consumption of HCFC-22 by developing countries under the Montreal Protocol.

12. A methodology for determining the quantity of CERs to be issued for HFC-23 destruction (AM0001) was approved by the Executive Board at its tenth meeting (July 2003). Two HFC-23 destruction project activities[8] that plan to use methodology AM0001 were submitted for registration, on 28 August 2004 (Gujarat) and 7 September 2004 (Ulsan). The Executive Board registered these projects at its eighteenth meeting on 23–25 February 2005.

13. Taking into consideration information that emerged since the approval of methodology AM0001, the Executive Board put this methodology on hold in September 2004 and requested the Methodologies Panel to make a recommendation on a possible revision to address, inter alia, potential leakage. A call for inputs was posted on the UNFCCC CDM web site with a comment period from 22 September to 7 October 2004. Twenty-two submissions were received.[9]

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[4] In the context of this document, "Party" refers to a Party to the Kyoto Protocol.

[5] The 100-year global warming potential of HFC-23 is 11,700, which means that the cumulative radiative effect of 1 kg of HFC-23 is 11,700 times that of 1 kg of CO_2 over 100 years.

[6] The Intergovernmental Panel on Climate Change (IPCC) in chapter 4 of its Third Assessment Report (The Scientific Basis) refers to HCFC-22 as a GHG controlled by the Montreal Protocol. IPCC, *Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change*, J.T. Houghton, Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell, and C.A. Johnson (eds.), (Cambridge University Press, Cambridge, United Kingdom and New York, United States of America).

[7] The term Montreal Protocol is used to cover subsequent amendments to that Protocol as well.

[8] "Project for GHG emission reduction by thermal oxidation of HFC-23 in Gujarat, India (0001)" and "HFC Decomposition Project in Ulsan, Republic of Korea (0003)". Detailed information on the two CDM project activities is available in the section on "Project activities: registered" on the UNFCCC CDM web site: <http://cdm.unfccc.int/Projects/registered.html>.

[9] Public inputs are available in section "What is New" of the UNFCCC CDM web site: <http://cdm.unfccc.int>.

14. In November 2004, the Methodologies Panel proposed revisions to AM0001 to limit its application to *existing* HCFC-22 production capacity. The proposed revisions to AM0001 limit the generation of CERs to the destruction of HFC-23 corresponding to no more than the highest historic HCFC-22 annual output multiplied by the lowest historic HFC-23 generation rate, not to exceed 3 per cent.[10] A final formatted revised version of AM0001 is expected to be approved by the Executive Board at its nineteenth meeting (May 2005).

15. In the report of its thirteenth meeting, the Methodologies Panel also identified several issues that should be addressed by any proposed new methodology for the destruction of HFC-23 generated by *new* HCFC-22 production capacity.[11]

16. The Executive Board at its seventeenth meeting requested guidance from the COP on how to handle proposed CDM project activities that may have implications for the achievement of objectives of other conventions and protocols, such as the Montreal Protocol in the case of projects which imply the establishment of new HCFC-22 facilities which seek to obtain CERs for the destruction of HFC-23.

17. In its guidance relating to the issues on the CDM, the COP requested the SBSTA, in collaboration with the Executive Board, to develop a recommendation to the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol, at its first session, relating to implications of the implementation of CDM project activities for the achievement of objectives of other environmental conventions and protocols.[12]

III. Uses, phase-out schedule, and projected production of HCFC-22

18. HCFC-22 is used as circulating fluid in refrigeration and air conditioning systems, as a blend component in foam blowing, and as a feedstock for manufacturing fluoropolymers such as polytetrafluoroethylene (PTFE).[13] The HCFC-22 used in non-feedstock applications is released in the atmosphere over time, hence these uses of HCFC-22 are being phased out under the Montreal Protocol.

19. Consumption of HCFCs for non-feedstock uses in industrialized countries was frozen in 1996 followed by a 35 per cent reduction by 1 January 2004. Further reductions are foreseen as follows; 65 per cent as of 1 January 2010, 90 per cent as of 1 January 2015, and 99.5 per cent as of 1 January 2020. Complete elimination is scheduled for 2030.[14] Developing countries are to freeze their HCFC consumption for non-feedstock uses at 2015 levels (maximum) as of 1 January 2016, and phase it out completely by 1 January 2040. The 2016–2040 phase-out schedule for developing countries has not yet been established.

[10] If actual data on the HFC-23 generation rate are not available, the default value to be used is 1.5 per cent.
[11] For the reports of the Methodologies Panel, refer to the section "Panels/Working Groups" on the UNFCCC CDM web site: <http://cdm.unfccc.int/Panels>.
[12] Decision 12/CP.10, paragraph 14.
[13] In its non-feedstock uses, HCFC-22 replaces chlorofluorocarbons (CFCs), which are much more potent ozone depleting substances and which are being phased out under the Montreal Protocol.
[14] Each developed country's 1996 HCFC cap is 2.8 per cent of its 1989 ozone depleting potential (ODP) weighted chlorofluorocarbon consumption plus 100 per cent of ODP-weighted HCFC consumption in 1989. The cap and phase-out schedule apply to HCFCs as a group, not to individual HCFCs, such as HCFC-22, so more rapid phase out of one compound allows a slower phase out of other HCFCs.

20. Currently, there are about 20 HCFC-22 plants in industrialized countries, with total production estimated at 313 kt HCFC-22 in 2004.[15] HCFC-22 output in industrialized countries is projected[16] to decline by 20–25 per cent from current levels by 2015. This is less than the percentage reduction specified by the Montreal Protocol because the Montreal Protocol applies only to emissive uses (i.e. refrigeration, air conditioning and foam blowing) and because producers in industrialized countries can supply markets in developing countries.

21. Currently there are also about 30 HCFC-22 plants in developing countries, with total production estimated at 211 kt HCFC-22 in 2004.[17] This includes "swing" plants that are capable of producing either CFCs or HCFC-22. Forecasts of HCFC-22 production in developing countries range from a low of 50 to a high of 500 kt HCFC-22 in 2015,[18] without considering the possible impacts of HFC-23 destruction on HCFC-22 production (described in subsequent sections).

22. Because of the current phase-out obligations of industrialized countries under the Montreal Protocol, both the demand and production of HCFC-22 in industrialized countries are decreasing. On the other hand, the demand and production of HCFC-22 in developing countries are increasing. It is argued that because of the current phase-out obligations of industrialized countries under the Montreal Protocol, the production of HCFC-22 may tend to shift to developing countries.

IV. Impact of the revenue from HFC-23 destruction on the economics of HCFC-22 production

23. Public inputs on methodology AM0001 indicate that the sale of CERs from HFC-23 destruction may have a substantial impact on the economics of HCFC-22 production. The quantity of HFC-23 generated is typically 2–3 per cent of the quantity of HCFC-22 produced.[19] At a rate of 2.9 per cent, HFC-23 destruction would reduce GHG by about 335 t CO_2 equivalent for each tonne of HCFC-22 produced.[20]

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[15] The United States is a substantial producer of HCFC-22, but is not a Party to the Kyoto Protocol. A. McCulloch, *Incineration of HFC-23 Waste Streams for Abatement of Emissions from HCFC-22 Production: A Review of Scientific, Technical and Economic Aspects*, (Internal background paper prepared for the United Nations Framework Convention on Climate Change secretariat, 4 November 2004) table 1, page 5. (For the full document go to: <http://cdm.unfccc.int/methodologies/inputam0001/Background.html>).

[16] Projections described in this chapter do not consider possible impacts of HFC-23 destruction on HCFC-22 production.

[17] There are about 20 plants in China with a combined capacity of about 250 kt HCFC-22 per year, 4 plants in India with a combined capacity of about 50 kt HCFC-22 per year, and 1 plant each in Korea, Mexico, Taiwan and Venezuela with a combined capacity of about 40 kt HCFC-22 per year. A. McCulloch, *Incineration of HFC-23 Waste Streams for Abatement of Emissions from HCFC-22 Production: A Review of Scientific, Technical and Economic Aspects*, (Internal background paper prepared for the United Nations Framework Convention on Climate Change secretariat, 4 November 2004).

[18] A. McCulloch, *Incineration of HFC-23 Waste Streams for Abatement of Emissions from HCFC-22 Production: A Review of Scientific, Technical and Economic Aspects*, (Internal background paper prepared for the United Nations Framework Convention on Climate Change secretariat, 4 November 2004) table 3, page 21.

[19] The lowest annual value over the previous three years is 2.89 per cent for the Gujarat project and 2.90 per cent for the Ulsan project.

[20] One tonne of HCFC-22 yields 0.029 t HFC-23. With virtually complete (>99.999 per cent) destruction, this represents 0.029*11,700 = 339 t CO_2 equivalent. Destruction of 1 t of HFC-23 generates emissions of 3–4 t CO_2 equivalent from the destruction process, the use of fossil fuels and disposal of wastes. In accordance with the modalities and procedures for the CDM, one CER is equal to 1 t CO_2 equivalent. So destruction of 1 t HFC-23 would yield about 335 CERs.

24. Based on a scenario where the assumed price of a CER is USD 5/t CO_2 equivalent, the value of 335 CERs earned through HFC-23 destruction would be USD 1,675 per t of HCFC-22 produced. The cost of HFC-23 destruction is estimated at USD 4–6 per kg (USD 0.34–0.51/t CO_2 equivalent). At USD 6 per kg, the HFC-23 destruction cost is USD 175 per t of HCFC-22 produced.[21] Thus the net revenue from the destruction of HFC-23 would be (USD 1,675 – USD 175 =) USD 1,500 per t, or USD 1.50 per kg, of HCFC-22 produced. At an assumed price of USD 10/t CO_2 equivalent, the net revenue from the destruction of HFC-23 would thus be (USD 3,350 – USD 175 =) USD 3,175 per t or USD 3.17 per kg of HCFC-22 produced.

25. Bearing in mind that the net revenue is sensitive to the market price of CERs and the HFC-23 generation rate, the net revenue from the destruction of HFC-23 in the above scenario could be between USD 1.50 and USD 3.00 per kg of HCFC-22 produced. Because the market price of HCFC-22 is reported to range between USD 1 and USD 2 per kg, the net revenue from HFC-23 destruction could exceed the revenue from the sale of the HCFC-22 produced.

26. In the expert community, different views have been put forward regarding the impact of the net revenue from HFC-23 destruction CDM project activities. Some argue that this net revenue could lead to a lower price for HCFC-22 and/or additional revenue for HCFC-22 manufacturers in non-Annex I Parties. It is also suggested that the net revenue of HFC-23 destruction through the CDM may lead to a shifting, or accelerated shifting, of HCFC-22 production from industrialized countries to developing countries.

27. Under the Montreal Protocol, developing countries are expected to freeze their HCFC-22 production at their 2015 output level as of 2016. A phase-out schedule, yet to be negotiated, would take effect leading to complete phase out by 2040. Thus, developing country HCFC-22 output will fall below the 2004 level at some point in the future. The available forecasts suggest that this could occur at any time between 2008 and 2030.

28. Under one scenario, the business as usual production of HCFC-22 in developing countries rises to 496 kt in 2015.[22] To get back to the 2004 output of 211 kt would require a 42.5 per cent reduction from the 496 kt baseline. The phase-out schedule for industrialized countries suggests that it might be 10–15 years before a reduction of more than 42.5 per cent is required. Thus, it would take until 2025 or 2030 to get back to the 2004 output level again.

29. Another scenario suggests that HCFC-22 production in developing countries could fall below the 2004 level as early as 2008[23] if developing countries rapidly adopt the non-HCFC-22 air-conditioning and refrigeration technologies of industrialized countries so their products can be exported to those markets.

30. Some public inputs claim that HFC-23 destruction would give developing country producers a strong financial incentive to meet demand for HCFC-22 by adding *new* capacity because the revenue from the sale of CERs is large relative to the price of HCFC-22. In addition, others claim that this revenue could even provide an incentive for maintaining output at the *existing* (2004) capacity once the

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[21] USD 6/kg HFC-23 * 1000 kg/t * 2.9 per cent = USD 175.

[22] A. McCulloch, *Incineration of HFC-23 Waste Streams for Abatement of Emissions from HCFC-22 Production: A Review of Scientific, Technical and Economic Aspects*, (Internal background paper prepared for the United Nations Framework Convention on Climate Change secretariat, 4 November 2004) table 3, page 21.

[23] The Reduced Emissions Case in Table 3 of A. McCulloch, *Incineration of HFC-23 Waste Streams for Abatement of Emissions from HCFC-22 Production: A Review of Scientific, Technical and Economic Aspects*, (Internal background paper prepared for the United Nations Framework Convention on Climate Change secretariat, 4 November 2004) shows that HFC-23 emissions in developing countries were 8.4 kt in 2004, would rise to 8.6 kt in 2005 and 2006, and begin to fall to reach 8.4 kt in 2007 and 8.1 kt in 2008.

HCFC-22 output in developing countries would otherwise fall below the 2004 level. The net revenue from HFC-23 destruction would give developing country producers a competitive advantage over producers in industrialized countries because they could afford to offer HCFC-22 at lower prices than their competitors in industrialized countries. This may lead to an increase in production of HCFC-22 in developing countries and could accelerate the existing shift in production of HCFC-22 from industrialized countries to developing countries.[24]

31. In accordance with some of the submissions, the shift of production from industrialized to developing countries may lead to a global increase of HFC-23 produced because the average HFC-23 generation rate in developing countries is on average approximately 3 per cent as opposed to 2 per cent in industrialized countries where there are often better operating practices and voluntary or mandatory destruction. Others argue, however, that a global decrease in HFC-23 emissions is just as likely as an increase because the capacity in industrialized countries that is under threat of closure (or that has already been closed) is generally from smaller, more expensive to run and often unabated plants. In addition, the average of 2 per cent in industrialized countries is a consequence of most of the large plants being at zero capacity utilization and most of the small plants being at substantially higher capacity utlilzation.

32. Assuming that a shift in production of HCFC-22 to developing countries would be accelerated through CDM project activities, some argue that global emissions would actually be increased because for the same amount of HCFC-22 produced more HFC-23 would be emitted and subsequently converted to CERs upon its destruction. Those CERs would be used by Annex I Parties to offset emissions of GHGs listed in Annex A to the Kyoto Protocol to meet commitments under the Protocol.

33. Limiting HFC-23 destruction to existing HCFC-22 output, as agreed by the Executive Board through the revised methodology AM0001, would largely eliminate the incentive to increase HCFC-22 production beyond the 2004 level.[25]

V. Possible impacts on the demand for HCFC-22

34. Several of the public submissions on AM0001 argue that a lower price for HCFC-22 will not materially change the global demand for HCFC-22 in its existing uses. The case is made that most of the HCFC-22 produced today is used in refrigeration and air-conditioning equipment. The demand for HCFC-22 therefore largely depends on the demand for new refrigeration and air-conditioning equipment and replacement HCFC-22 in existing refrigeration and air-conditioning equipment. The cost of HCFC-22 is less than 1 per cent of the price of new refrigeration and air-conditioning equipment, therefore a lower price for HCFC-22 would not materially increase the demand for refrigeration and air-conditioning equipment. The balance of the HCFC-22 produced goes into PTFE manufacture. PTFE, which is derived from HCFC-22, is the lowest priced fluoropolymer, so a lower price for HCFC-22 is not expected to have a substantial impact on the demand for PTFE, and, hence, the demand for HCFC-22.

[24] Global demand for HCFC-22 would be declining and be less than the production capacity so shifting production from industrialized to developing countries would not require any investment. HCFC-22 consumption for emissive uses may have been largely phased out in industrialized countries by the time output in non-Annex I Parties falls below the 2004 level. But industrialized countries could still produce HCFC-22 for feedstock use and for export to developing countries.

[25] There might be economies of scale in production or marketing relating to total output or market share. Then HCFC-22 producers might choose to use some of the revenue from HFC-23 destruction from existing output to subsidize additional production.

35. Other public submissions on AM0001 argue that revenue from HFC-23 destruction could lead to higher HCFC-22 production than would otherwise occur, in one or more of the following ways:

(a) By making HCFC-22 production more profitable it would cause manufacturers in developing countries to lobby their governments for a slower phase-out schedule between 2015 and 2040

(b) A lower price for HCFC-22 might make it attractive in new applications

(c) If the revenue from the sale of CERs generated through destruction of HFC-23 is high enough, it could be profitable for producers to increase HCFC-22 output and to release the extra HCFC-22 output to the atmosphere to generate more HFC-23.

VI. Possible leakage adjustment for higher HFC-23 and/or HCFC-22 emissions

36. To address the effects described in the previous sections of this paper, some expert inputs have proposed to treat as leakage the impacts of possible increased production of HCFC-22 due to the CDM project activities undertaken to destroy HFC-23.

37. Leakage is the net change of anthropogenic emissions by sources of GHGs which occurs outside the project boundary, and which is measurable and attributable to the CDM project activity. The modalities for the CDM require that reductions in anthropogenic emissions of GHGs achieved by a project activity must be adjusted for leakage.

38. The definition of baseline scenario for CDM project activities under paragraph 44 of the modalities and procedures for a CDM, contained in decision 17/CP.7 (hereinafter referred to as CDM modalities and procedures), is limited to Annex A gases. In accordance with paragraph 43 of the CDM modalities and procedures, emission reductions of a project activity are to be calculated in relation to the baseline scenario.[26]

39. The emission limitation and reduction commitments of Annex I Parties under Article 3 of the Kyoto Protocol are limited to the gases listed in its Annex A, which does not include HCFC-22.

40. In accordance with the definitions above, those experts arguing in favour of considering HCFC-22 as leakage would not consider HCFC 22 as part of the baseline scenario or of the project boundary, but would consider the gas as part of leakage and take it into consideration when calculating the emission reductions. This argument is based on the assumption that CDM is not limited to gases included in Annex A to the Kyoto Protocol.

[26] Paragraph 44 of the CDM modalities and procedures stipulates that: "The baseline for a CDM project activity is the scenario that reasonably represents the anthropogenic emissions by sources of greenhouse gases that would occur in the absence of the proposed project activity. A baseline shall cover emissions from all gases, sectors and source categories listed in Annex A within the project boundary. A baseline shall be deemed to reasonably represent the anthropogenic emissions by sources that would occur in the absence of the proposed project activity if it is derived using a baseline methodology referred to in paragraphs 37 and 38 of the CDM modalities and procedures". Paragraph 43 stipulates that: "A CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity".

41. Other experts consider it difficult to treat an increase in HFC-23 destruction and/or HCFC-22 production as "leakage" due of the following:

(a) HCFC-22 leakage would be difficult to measure because for the calculation of HCFC-22 the global increase in HFC-23 destruction and/or HCFC-22 output would need to be considered and then some or all of that increase, would need to be attributed to a specific HFC-23 destruction project

(b) Although HCFC-22 is a GHG,[27] its net global warming potential (GWP) values for ozone-depleting substances, such as HCFC-22, are not precisely defined because only ranges of values are identified for indirect effects[28]

(c) All CDM methodologies approved to date have limited the emission reductions and leakage to the GHGs listed in Annex A to the Kyoto Protocol. Considering the effects of CDM project activities on GHGs other than those listed in Annex A, such as HCFC-22, may therefore require a number of approved CDM methodologies to be reviewed and possibly revised

(d) Issues of consistency regarding the treatment of gases controlled by Annex I Parties under the Kyoto Protocol and GHGs accounted for under the CDM. Further consistency issues may arise regarding CDM methodologies and methodologies being developed for projects under Article 6 of the Kyoto Protocol (Joint Implementation).

42. Some experts argue that the definitions in paragraphs 36–39 above imply that the CDM is limited to gases included in Annex A to the Kyoto Protocol, and hence HCFC-22 is not to be considered.

VII. Summary

43. This paper presents arguments made to date on how the high level of net revenue generated by the destruction of HFC-23 may impact on the level and location of HCFC-22 production. It also shows divergent arguments regarding threats to achieving goals under the UNFCCC and the Montreal Protocol (level, location and speed of global phasing out of HCFC-22 production).

44. HFC-23, a potent GHG, is generated during the production HCFC-22. Destruction of the waste HFC-23 yields a climate change benefit. A methodology to determine the CERs generated by the destruction of HFC-23 generated by *existing* HCFC-22 facilities has been approved and is currently being revised. It is argued that because of the current phase-out obligations of industrialized countries under the Montreal Protocol and the increasing demand in developing countries, the production of HCFC-22 may tend to increase in developing countries.

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[27] The IPCC in chapter 4 of its Third Assessment Report (The Scientific Basis) refers to HCFC-22 as a GHG controlled by the Montreal Protocol. In accordance with Article 1.5 of the UNFCCC, a GHG is a gaseous constituent of the atmosphere that absorbs and re-emits radiation. Article 1 of the Kyoto Protocol states that the definitions of Article 1 of the UNFCCC apply to the Protocol.

[28] Decision 2/CP.3 states that the GWP used by Parties should be those provided by the IPCC in its Second Assessment Report based on the effects of the GHGs over a 100-year time horizon. The IPCC Second Assessment Report provides specific GWP values for the GHGs listed in Annex A to the Protocol in table 4, p. 22 and table 2.9, p. 121. The GWP values for ozone-depleting substances, such as HCFC-22, are the sum of a direct (positive) component and an indirect (negative) component which depends strongly on its ozone destruction effectiveness. For HCFC-22, the IPCC reported the 100-year direct effect as 1500 and the indirect effect as 1300 to 1400, so the net GWP would be 100 to 200 (table 2.8, p. 119). IPCC, *Climate Change 1995: The Science of Climate Change. Contribution of Working Group I to the Second Assessment of the Intergovernmental Panel on Climate Change*, J.T. Houghton, L.G. Meira Filho, B.A Callender, N. Harris, A. Kattenberg and K. Maskell (eds.) (Cambridge University Press, United Kingdom).

45. The net revenue from HFC-23 destruction could exceed the revenue from the sale of the HCFC-22 produced. Different views exist over the impact of the net revenue from HFC-23 destruction CDM project activities. Although it is argued that a lower price for HCFC-22 will not materially change the global demand for HCFC-22 in its existing uses and therefore that production will be unaffected, the net revenue from HFC-23 destruction prompts a discussion on the potential of a shifting, or accelerated shifting, of HCFC-22 production from industrialized countries to developing countries and a corresponding raising of the baseline for developing country commitments under the Montreal Protocol, which will be determined based on the output production in 2015. Impacts of a possible increase in production of HCFC-22 due to destruction of HFC-23 could include higher global emissions of GHGs and possible delay in phasing out HCFC-22 under the Montreal Protocol.

46. In limiting HFC-23 destruction to existing HCFC-22 output, as proposed by revised methodology AM0001, the Executive Board largely eliminated the incentive to increase HCFC-22 production beyond the 2004 level. However, some argue that the HFC-23 revenue could provide an incentive for maintaining output at the *existing* (2004) capacity once the HCFC-22 output in developing countries would otherwise fall below the 2004 level.

47. The treatment under the CDM of HFC-23 destruction for *new* HCFC-22 production requires, however, particular attention as in some scenarios it could lead to higher HCFC-22 production in developing countries and so increase total HCFC-22 emissions and the quantity of HFC-23 destroyed. Treating these potential impacts as leakage is problematic due to the difficulty of measuring the global increase in HFC-23 destruction and/or HCFC-22 output and then attributing some or all of that increase to a specific HFC-23 destruction project. No methodology for earning CERs from destruction of HFC-23 from new HCFC-22 production has yet been submitted to the Executive Board.

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