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CDM: Form for submission of requests for revisions of approved methodologies to the Methodologies Panel (version 01) ***(To be used by project participants, through the DOE/AE, for requesting revisions of approved methodologies)***	
Name of the entity (DOE) submitting this form	-
***Reference number** and **title** of the approved methodologies*	AM0001 – Incineration of HFC23 waste streams
Title/Subject (give a short title or specify the subject of your submission, maximum 200 characters):	Revision to AM0001 to ensure that recent agreements under the Montreal Protocol do not create perverse incentives to produce HCFC-22 beyond levels that would occur in the absence of the project activity
*Attach proposed **revised approved methodology** (with revisions in track change mode):*	☒ Yes, is attached.
*Attach **draft CDM-PDD** example of project activity:*	☐ Yes, is attached.
Date and signature for the DOE	-

Submitted request for revisions

Please use the space below to substantiate the reason for the request for revisions of the approval methodology. If the request for revision is related to a project activity under development or implementation, please describe the context in which they arose. If you are proposing amendments to existing methodologies, please specify the text you want to change or introduce. If necessary, attach files or refer to sources of relevant information.

If you propose an amendment to an approved methodology, please provide reasons.

Not applicable

If you have a request for revision, please specify and provide reference to the exact methodology to which it applies.

This revision request applies to version 5.1 of baseline and monitoring methodology AM0001. It aims at avoiding perverse incentives for operators of HCFC-22 plants to continue producing HCFC-22 at historical levels (as defined in AM0001), whereas production would decrease in the absence of the project activity. This revision request builds on the recent agreement under the Montreal Protocol to accelerate the phase-out of HCFCs as well as other considerations. The detailed rationale of the revision request is provided in the Annex of this document (because it is difficult to put longer text and figures in this table). A draft AM is attached as well.

In case you propose the amendment to the approved methodologies, please provide your draft below, if not included in an annex:

Revisions are illustrated in the draft revised methodology attached to this request.

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Information to be completed by the secretariat	
Date when the form was received at UNFCCC secretariat	
Date of transmission to the Meth Panel and Executive Board	

Detailed explanation of the revision request

Implications of the new agreement under the Montreal Protocol

In September 2007, Parties under the Montreal Protocol agreed to accelerate the phase-out of HCFCs in both developed and developing countries. This decision may impact the HCFC-22 production in registered and not yet registered CDM project activities that can use the approved baseline and monitoring methodology AM0001.

The new phase-out schedule for developing countries is illustrated in the Table below. For developing countries, the base year is now the average between 2009 and 2010, whereas previously the base year was 2015. A freeze is already envisaged by 2013 and 10% decrease below the base year level is required by 2015. By 2025, the production for emissive uses will have been reduced by about two thirds below 2009 / 2010 levels.

Table 1: Time schedule for phasing out HCFCs in developing countries under the Montreal Protocol

	Current agreement	Previous agreement
Base year	2009 / 2010	2015
Freeze	2013	2016
10% reduction	2015	-
35% reduction	2020	-
67.5% reduction	2025	-
97.5% reduction	2030	-
100% reduction	2040	2040

In the following it is explained that this new agreement under the Montreal Protocol can result in a situation where the current way of crediting of HFC-23 destruction in AM0001 can – despite the cap on credits based on historical HCFC-22 production levels – create perverse incentives for operators to continuing the production of HCFC-22 at historical levels, whereas they would reduce their HCFC-22 production in the absence of the CDM. Thus, it is possible that as a result of the CDM more HCFC-22 is produced under the project than would have been produced in the absence of the registered CDM project activity. To show that this situation can occur, two scenarios for HCFC-22 demand are developed and compared to the quantity that is eligible for crediting under AM0001.

Quantity of HCFC-22 production eligible for crediting

A recent TEAP report estimates the historical amount of HCFC-22 production from approved CDM projects that is eligible for crediting under AM0001 with about 205 kt in China and another 60 kt in Argentina, India, Mexico and South Korea, totalling to 265 kt (TEAP 2007, page 54). However, a number of plants, including one in Venezuela and possibly some production lines in China, have not yet applied for crediting under the CDM. Moreover, two plants have been registered with version 2 of methodology AM0001 which did not yet include a cap for the amount of HCFC-22 production that can be credited. These two projects have issued significantly more CERs (132% and 111%) than projected in the CDM-PDD (UNEP/RISOE 2007). The amount of HCFC-22 production that is eligible for crediting will therefore

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be higher than from the currently approved CDM projects. We estimate that it will be somewhere between 265 kt and 330 kt.

It is important to note that the HCFC-22 amount that is eligible for crediting is higher than the actual HCFC-22 production in 2004, for two reasons: Firstly, the highest annual HCFC-22 production among a series of historical years is used to establish the amount that is eligible for crediting (this includes for some installations other years than 2004). And secondly, the methodology allows swing plants to include an equivalent CFC production in the calculation of historical annual HCFC-22 production.

Current levels of HCFC-22 production

There is no precise information available on the total HCFC-22 production in developing countries. UNFCCC (2005) has estimated the total HCFC-22 production in developing countries with 211 kt in 2004. However, the recent TEAP report appears to assume significantly higher production levels: The TEAP indicates that the above-mentioned 265 kt of "existing production" correspond to "67-68% of the estimated total developing country production in 2006". Accordingly, 2006 HCFC-22 production in developing countries could be estimated with about 390 kt (=265 kt / 67%). Hence, the available information on actual HCFC-22 seems not fully consistent. The difference may partly be explained in the definition of "existing HCFC-22 production" which, as explained above, is actually higher than historical production level in 2004. This uncertainty in the actual HCFC-22 production is reflected in the two scenarios. For the low demand scenario, we assume a 2006 production of 255 kt which is derived from the UNFCCC figure for 2004 and a growth rate of 10% per year. For the high demand scenario, we assume a 2006 production of 390 kt which is derived from information in the TEAP report.

Projection of future HCFC-22 production and demand

Prior to the new agreement under the Montreal Protocol, the growth of HCFC-22 production for emissive uses has been estimated in the literature (TEAP 2007, page 25) with a factor between 1.78 and 2.81 for the period 2005-2015, corresponding to an annual growth rate between 6% and 11%. Emissions have grown rapidly in the past due to various factors, including high economic growth in China and production shifts from Annex I to non-Annex I countries. With the new agreement under the Montreal Protocol, these growth rates are expected to slow down and can continue only for a limited time frame. Parties to the Montreal Protocol may start early to implement policies and measures to facilitate the implementation of the earlier phase out. To achieve stabilization by 2013 on the 2009/2010 level, HCFC-22 demand for emissive uses is likely to peak in about 2011. In addition, production shifts from Annex I to non-Annex I countries have already occurred to a large extent and the accelerated phase-out in Annex I countries may free up production capacities that can supply growing demand in developing countries.

The Montreal Protocol only addresses HCFC-22 production for emissive uses and not production for feedstock purposes. Production for feedstock can continue to grow without any limitation. The production for feedstock purposes is reported to be relatively small in developing countries. The TEAP states that "only a small proportion of the HCFC-22 produced is used for feedstock applications (mainly in India)". We estimate that it ranges between 10% and 25% of total demand.

As mentioned above, two scenarios are developed to reflect the range of plausible assumptions for future HCFC-22 consumption and production. The following assumptions are used for the two scenarios:

- In the low demand scenario, it is assumed that total HCFC-22 demand in 2006 was 255 kt. It is assumed that 10% of the 2006 demand in developing countries is for feedstock purposes. The demand for emissive uses grows at 3% per year until 2010 and declines afterwards according to the schedule envisaged under the new agreement of the Montreal Protocol. HCFC-22 demand for feedstock purposes is estimated to grow at the same rate of 3%.
- In the high demand scenario, it is assumed that total HCFC-22 demand in 2006 was 390 kt. It is assumed that 25% of the 2006 demand in developing countries is for feedstock purposes. The demand for emissive uses grows at 8% per year until 2011 and declines afterwards according to the schedule envisaged under the new agreement of the Montreal Protocol. HCFC-22 demand for feedstock purposes is estimated to grow at a rate of 6% per year.

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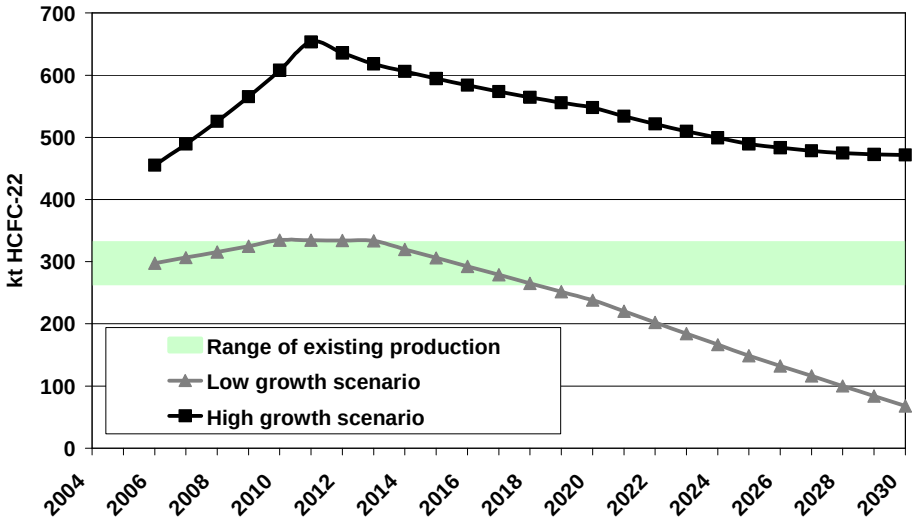
These two scenarios are illustrated in the following figure. The figure shows the following: in the case of the high demand scenario, the demand for HCFC-22 in developing countries will always exceed the quantity of HCFC-22 that is eligible for crediting. In contrast, in the low demand scenario, the demand drops well below the quantity of HCFC-22 that is eligible for crediting.

In considering these scenarios, one should also bear in mind that the situation may differ by country or region.



As soon as the HCFC-22 demand drops below the quantity of HCFC-22 that is eligible for crediting, the current cap in AM0001 does not fulfil anymore its function of avoiding perverse incentives: operators would have strong economic incentives to continue HCFC-22 production even if the market demand drops. Data from UNFCCC (2005), the TEAP (2007) and other publications (Schneider et al. 2005) suggest that the economic incentives are considerable. The TEAP (2007, page 57) concludes that "the net revenue per year for HFC-23 destruction could easily exceed the revenue from HCFC-22 sales". Schneider et al. (2005) have estimated the impact of CER revenues on HCFC-22 production costs for a range of possible assumptions (see figure below). In a "high impact" scenario, the revenues from CERs exceed the HCFC-22 production costs by a factor of 4-5. In the worst case, this could result in that HCFC-22 is produced which is not consumed but released to the atmosphere. In other cases, it could delay or exacerbate the achievements of the accelerated phase-out of HCFCs under the Montreal Protocol, with severe consequences for emissions of both greenhouse gases and ozone depleting substances.

Scenario		Low Impact	Reference	High Impact
Assumptions				
HFC-23 / HCFC-22 ratio	-	1,5%	2,2%	3,0%
HFC-23 abatement costs	US$/$CO_2$e	1,0	0,6	0,2
Market price for CERs	US$/CER	5	10	15
Share of CERs allocated to plant operator	-	50%	75%	98%
Market price for HCFC-22	US$/kg HCFC22	2,4	1,7	1,1
Economic effects of CER revenues				
Net profit from CER revenues	US$/kg HCFC22	0,3	1,8	5,0
Potential reduction of HCFC-22 production costs	-	**11%**	**103%**	**458%**

Source: Schneider et al. (2005)

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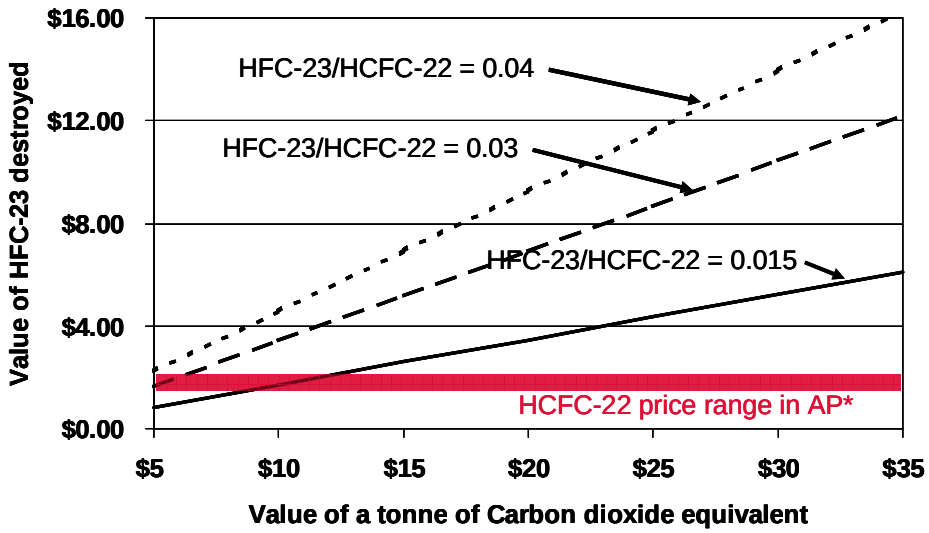
Similar conclusions have been confirmed by the TEAP. The figure below (TEAP 2007, page 6) illustrates the relation of CER revenues to HCFC-22 production costs for different CER prices and HFC-23/HCFC-22 ratios. The figure illustrates that CER revenues can easily exceed HCFC-22 production costs.



Source: TEAP (2007, page 6)

In conclusion, the development of the future HCFC-22 demand in developing countries is uncertain but it is possible that the demand will drop below the levels that are eligible for crediting under the CDM within the next 10 years, as a result of the new agreement under the Montreal Protocol. Therefore, the methodology AM0001 should be revised in a manner to address the perverse incentives that may arise from such a situation. The revision will affect plants that are not yet registered as CDM projects and egistered CDM projects for second and third crediting periods.

Technological innovation

A key parameter for the calculation of emission reductions is the quantity of HFC-23 generated as by-product per quantity of HCFC-22 produced (the HFC-23/HCFC-22 ratio). AM0001 requires using the lower value between 3% and the lowest annual HFC-23/HCFC-22 ratio observed in the historical period between 2002 and 2004. In the absence of historical data, a default value of 1.5% shall be used.

The HFC-23/HCFC-22 ratio can vary significantly among plants. Modern plants in industrialized countries have managed to significantly reduce the HFC-23/HCFC-22 ratio. DuPont has reported that it managed to achieve a HFC-23/HCFC-22 ratio of 1.37%. The methodology AM0001 implicitly assumes that the historical level of HFC-23/HCFC-22 ratio would continue for 21 years, an assumption that may not be valid for some emerging economies which use advanced technologies in most sectors. It is very well possible that, without the CDM, plant operators in developing countries would seek ways to reduce the by-product generation of HFC-23 in order to achieve a higher HCFC-22 output and to reduce the costs for HFC-23/HCFC-22 separation.

In contrast, the methodology discourages the achievement of a low HFC-23/HCFC-22 ratio: An operator that has achieved a HFC-23/HCFC-22 ratio of 2.8% historically has an incentive to operate the plant in a manner that ensures that production always meets or exceeds this ratio. For example: if the HFC-23/HCFC-22 ratio in that plant typically varies between 2.6% and 3.0%, the operator of the plant has under the current methodology an economic incentives to operate the plant in a manner that the HFC-23 production in each monitored period does not drop below the threshold of 2.8%. This may, for example, result in an operation mode where the variation over time is between 2.8% and 3.2%.

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The methodology also implicitly assumes that the plants can continue to operate without any time limitation. However, industrial facilities have usually a limited technical lifetime and are replaced after some time. This has been acknowledged in general guidance by the EB (EB8 and EB22) but not in the current methodology. It is possible that a HCFC-22 production plant would have been shut down at a certain point in time but that its operation is prolonged due to the possibility of CDM crediting. Given that new plants can so far not be credited under the CDM, the operators would loose a significant amount of revenues if the operation of the plant would be stopped. This may result in continued operation of less efficient old plants with potentially higher HFC-23/HCFC-22 ratios, whereas these plants may, in the absence of the CDM, be replaced by new production facilities with potentially lower HFC-23/HCFC-22 ratios.

These examples illustrate the weakness of the current methodology AM0001 which does not take fully reflect how the sector would develop in the absence of the CDM over time.

How are these issues addressed in the proposed revision?

The above-mentioned concerns are addressed in the requested revision by a number of changes, the most important one being a cap on the HFC-23/HCFC-22 ratio.

To address the perverse incentive arising from the situation where HCFC-22 demand drops below the quantities eligible for crediting, the strong economic incentives for operators that arise from the revenues from CERs for the destruction of HFC-23 needs to be removed. The incentive arises from the fact that revenues from the sale of CERs may easily exceed the HCFC-22 production costs. As long as the revenues from HFC-23 destruction are lower than the HCFC-22 production costs, the worst incentives are avoided. This is achieved by introducing a cap on the HFC-23/HCFC-22 ratio.

This cap also addresses issues regarding the technological innovation that may occur in the absence of the CDM over time. With the new cap on the HFC-23/HCFC-22 ratio, the crediting under the CDM is independent on the actual HFC-23/HCFC-22 ratio observed, avoiding perverse incentives to continue operating plants at high HFC-23/HCFC-22 ratios.

A key challenge is the identification of the appropriate level of the cap. The cap should at least ensure that CER revenues do not exceed HCFC-22 production costs but should, at the same time, ensure that sufficient incentives are provided to undertake the CDM project activity. The most sensitive parameter is the CER price which may vary considerably over time. In the draft revised methodology, a cap on the HFC-23/HCFC-22 ratio of 0.5% is imposed. The figure below illustrates that this cap results for a wide range of CER prices (from US$ 3 to US$ 30) the worst situation of CER revenues exceeding HCFC-22 production costs. At the same time, the HFC-23 abatement is still economically attractive at the lower end of the CER price range.

Scenario		Low CER price	Reference	High CER price
Assumptions				
HFC-23 / HCFC-22 ratio	-	0.5%	0.5%	0.5%
HFC-23 abatement costs	US$/$CO_2$e	0.6	0.6	0.6
Market price for CERs	US$/CER	3	10	30
Share of CERs allocated to plant operator	-	90%	90%	90%
Market price for HCFC-22	US$/kg HCFC22	1.7	1.7	1.7
Economic effects of CER revenues				
Net profit from CER revenues	US$/kg HCFC22	0.1	0.5	1.5
Potential reduction of HCFC-22 production costs	**-**	**7%**	**29%**	**90%**

Other changes

The draft revised methodology contains also a number of other changes which are editorial, improve the presentation of the methodology and make the methodology consistent with methodologies that have been approved more recently:

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- The methodology was restructured. The previous emission reduction calculation had a section on "emission reduction" and "baseline", while a section on project emissions was lacking. The "baseline" section did not really provide the baseline emissions (as in the understanding of more recently approved methodologies) but included the potential emission reduction that would also occur in the baseline. The methodology was restructured in line with more recently approved methodologies in the following sections: "project emissions", "baseline emissions", "leakage" and "emissions reductions".
- To calculate project emissions from electricity and fossil fuel consumption, the respective methodological tools are used.
- Leakage emissions (emissions from transportation of sludge) are very small. Given that such minor emission sources are also neglected in other methodologies, they are not considered in the revised methodology for simplicity. Other leakage emissions (e.g., fossil fuel combustion for steam generation) are considered by introducing the tools.
- The monitoring section has been updated, according to the changes in the baseline methodology and using the type of tables that have been used in more recently approved methodologies.

Conclusions

The current methodology AM0001 can create perverse incentives which can seriously risk the objective of the CDM to achieving real and additional emission reductions and which can exacerbate the achievement of objectives pursued under the Montreal Protocol. These concerns can be addressed through the proposed revision to AM0001.

Apart from addressing the methodological issues raised in this request, the proposed revision will have positive benefits for other policy objectives pursued under the Kyoto Protocol and the UNFCCC: As the number of CERs issued is significantly lower compared with the actual GHG abatement, there is a significant climate benefit from crediting HFC-23 under the CDM. In addition, a reduced supply of CERs from this project type could positively affect the regional distribution of CERs, given that no such installations are in Least Developed Countries (LDCs) and in Africa. Finally, a lower CER supply from HFC-23 projects may indirectly result in more other projects being developed, including project types that have very large benefits for sustainable development.

References

- Technology and Economic Assessment Panel (TEAP) under the Montreal Protocol on Substances that Deplete the Ozone Layer (2007): Report of the task force on HCFC issues (with particular focus on the impact of the clean development mechanism) and emission reduction benefits arising from earlier HCFC phase-out and other practical measures. Response to decision XVIII/12, August 2007
- UNEP/RISOE (2007): CDM Project Pipeline, 1 October 2007
- Schneider, Graichen, Matz (2005): Implications of the Clean Development Mechanism under the Kyoto Protocol on other Conventions. The case of HFC-23 destruction. Elni Review, 2005, No. 1, pages 41-52