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EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Eighty-ninth Meeting
Montreal, 7-11 March 2022
Postponed to 16, 18 and 20 May 2022 (part I) and
16-18 June 2022 (part II)[1]

SYNTHESIS REPORT DESCRIBING BEST PRACTICES AND WAYS FOR THE EXECUTIVE COMMITTEE TO CONSIDER OPERATIONALIZING PARAGRAPH 24 OF DECISION XXVIII/2 (DECISION 84/87(b))

Background

1. Discussions on the issue of the disposal of unwanted controlled substances under the Montreal Protocol have been taken up by the Executive Committee since its 78th meeting in the context of the development of the cost guidelines for the phase-down of HFCs. At its 81st meeting, the Executive Committee decided to consider, at its 82nd meeting, issues related to funding the cost-effective management of stockpiles of used or unwanted controlled substances, including through destruction, in light of the synthesis report on ODS disposal being prepared by the Secretariat in response to decision 79/18(e) (decision 81/67(d)).

2. In response to decision 81/67(d), the Secretariat submitted to the 82nd meeting document UNEP/OzL.Pro/ExCom/82/21, presenting a synthesis report on the implementation of 11 projects, including issues related to project design, synergy with other projects, opportunities for resource mobilization, cost-effectiveness and lessons learned. During the discussions, some members, while cognizant that disposal was important and mandated by decision XXVIII/2, were of the view that, as disposal was not required for compliance and was not an incremental cost, it should not be discussed as part of the HFC phase-down cost guidelines. Other members considered disposal to be of fundamental importance, particularly for low-volume consuming (LVC) countries, and saw it as an integral part of the cost guidelines. Members also raised other matters, such as the relevance of the ODS disposal synthesis report; interim guidelines for the pilot projects approved at the 58th meeting; and policies on refrigerant

[1] Due to coronavirus disease (COVID-19), part I of the 89th meeting will be held online while part II will be held in-person.

management to minimize unwanted refrigerants. Further discussion of this issue was deferred to the 83rd meeting.

3. At its 83rd meeting, the Executive Committee agreed to reconstitute the contact group on the development of the cost guidelines for the phase-down of HFCs, where *inter alia* the issue on ODS disposal was discussed. Following the report by the convener of the contact group, the Executive Committee decided that the matter of disposal of controlled substances would be considered at the 84th meeting, in light of the final report on the evaluation of pilot demonstration projects on ODS disposal and destruction to be submitted by the Senior Monitoring and Evaluation Officer (SMEO) (decision 83/65(c)).

4. At its 84th meeting, under agenda item 6 on Evaluation, the Executive Committee considered the final report on the evaluation of the pilot demonstration projects on ODS disposal and destruction[2] submitted by the SMEO. In the ensuing discussion, there was general appreciation of the outcomes of the evaluation, which highlighted the various legal, logistical and policy challenges related to ODS disposal and destruction and provided replicable lessons that would assist countries in developing plans in that area. Comments made by members included remarks on the complexity of ODS management; that the choices countries made in the management of ODS stockpiles and the selection of disposal strategies depended on the economies of scale available; that prioritization of prevention of waste was the most cost-effective option for waste management; whether the lessons learned might be widely applicable to other ODS disposal projects given the small sample of projects; whether further information on cost effectiveness would be useful, in the light of the discrepancy in the projects reviewed between the amounts of ODS targeted for destruction and the actual amounts destroyed; and that greater attention should be given to quantifying the level of financing needed to develop inventories, with particular consideration given to the needs of LVC countries.

5. Further to the discussion, the Committee noted the final report on the evaluation of the pilot demonstration projects on ODS disposal and destruction,[3] and invited bilateral and implementing agencies to apply, when appropriate, the lessons learned on the basis of the key findings (decision 84/9).

6. Also, at its 84th meeting, under agenda item 13(a) on the Development of the cost guidelines for the phase-down of HFCs in Article 5 countries: Draft criteria for funding,[4] the Executive Committee reconvened the contact group where the issue of disposal of unwanted controlled substances in line with paragraph 24 of decision XXVIII/2[5] was discussed. Following the report of the convener of the contact group, the Executive Committee decided, *inter alia*, to request the Secretariat to prepare for the 85th meeting a synthesis report describing best practices and ways for the Executive Committee to consider operationalizing paragraph 24 of decision XXVIII/2, taking into account:

(a) The final report on the evaluation of the pilot demonstration projects on ODS disposal and destruction contained in document UNEP/OzL.Pro/ExCom/84/11, and the synthesis report on pilot ODS disposal projects contained in document UNEP/OzL.Pro/ExCom/82/21;

(b) Other relevant projects implemented in HCFC phase-out management plans (HPMPs);

(c) Lessons learned from existing infrastructure and policies that could be used to establish the cost-effective management of stockpiles of used or unwanted controlled substances; and

[2] UNEP/OzL.Pro/ExCom/84/11
[3] UNEP/OzL.Pro/ExCom/84/11 and Corr.1
[4] UNEP/OzL.Pro/ExCom/84/66
[5] To request the Executive Committee to consider funding the cost-effective management of stockpiles of used or unwanted controlled substances, including destruction.

(d) External funding opportunities and existing disposal programmes and partnerships (decision 84/87(b)).

Structure of the document

7. In response to decision 84/87(b) the Secretariat has prepared the present document and submitted it to the 86th meeting.[6]

8. The objective of the document is to provide guidance for the cost-effective management of stockpiles of used or unwanted ODS and other controlled substances,[7] taking into account policies and regulatory best practices, issues related to synergy with other projects, opportunities for resource mobilization, and funding modalities.

9. During its preparation, the Secretariat took into account the information (including the analysis and lessons learnt) contained in the report of the evaluation of the pilot demonstration projects on ODS disposal and destruction, and the synthesis report on pilot ODS disposal projects that would be applicable for all controlled substances taking particular note of the related opportunities for the disposal of controlled substances under the management and disposal of electronic and electrical waste; and reviewed those HCFC phase-out management plans (HPMPs) that had included some elements of disposal of controlled substances in their overall strategy.

10. Noting that in most Article 5 countries consideration of waste controlled substances has been closely linked with the refrigeration servicing sector, particularly the recovery and recycling programmes under the Multilateral Fund, the Secretariat also took into account information contained in the Preliminary document on all aspects related to the refrigeration servicing sector that support the HFC phase-down (decision 80/76(c)),[8] and in the Analysis of the level and modalities of funding for the HFC phase-down in the refrigeration servicing sector requested by decisions 83/65(b), 84/86(b)(ii) and 88/76.[9]

11. This document consists of the following sections:

(a) Analysis of lessons learned from the pilot ODS disposal projects;

(b) Elements to be considered for operationalizing paragraph 24 of decision XXVIII/2;

(c) Options to consider when funding the environmentally sound management of waste of ODS and other controlled substances; and

(d) Recommendations.

12. The document also contains an Annex providing a country-by-country overview of the completed pilot ODS disposal projects.

[6] In light of the COVID-19 pandemic, the Executive Committee deferred consideration of the present document in accordance with the agreed procedures for conducting each Executive Committee meeting since the 85th meeting. The present document is being reissued without any modifications to that submitted to the 86th, 87th, and 88th meetings, except for reference to document numbers.

[7] Under the Montreal Protocol, ozone-depleting substances (ODSs) are controlled substances except for HFCs that became controlled substances once the Kigali Amendment entered into force. Accordingly, the term "controlled substances" in the present document includes ODSs and HFCs.

[8] UNEP/OzL.Pro/ExCom/82/64

[9] UNEP/OzL.Pro/ExCom/89/8

Analysis of the results and lessons learned from the pilot ODS disposal projects

13. The key lessons learned from the implementation of the ODS disposal projects, as summarized below, should be considered when developing a strategy for the environmentally sound management of waste controlled substances:

(a) The discrepancies between estimated stocks of unwanted controlled substances, obtained through the national inventories, and the actual amounts destroyed highlighted a lack of waste collection capabilities in the recipient Article 5 countries, especially LVC countries, and demonstrated that activities related to recovery and recycling included in approved national plans for the servicing sector require further guidance;

(b) Systematic collection of ODS waste results from coordinated and synchronized efforts between appliance/equipment replacement and recovery-and-recycling programmes, including incentives to encourage collection require regulatory support to be successful;

(c) Awareness of the importance of developing concrete procedures for the management and disposal of ODS waste needs to be raised among waste management operators in the country, whether they are government operated or privately owned;

(d) The establishment of a sustainable business model entails complex coordination arrangements with various stakeholders and private sector commitment and involvement is necessary in order for these initiatives to be successful. The application of extended producer responsibility in support of the development and implementation of a sustainable business case is important; extended producer responsibility policies worked best with equipment that was manufactured in the country as compared to those that were imported;

(e) The long-term sustainability of ODS waste management remains a challenge without further involvement and cooperation from collection centres; institutional support including policies for destruction; and integration with hazardous waste management. A strategy for the environmentally sound management of waste controlled substances, within a comprehensive phase-out plan, should be included from inception rather than considering it only at the end; and

(f) The potential for co-financing was higher in those countries where the environmental management of waste was institutionalized and supported by regulatory and policy measures. However, the low price of carbon credits and the downturn in the carbon markets made it difficult to search for co-financing options that would support the sustainable disposal of waste controlled substances during the implementation of the pilot ODS disposal projects between 2012-2016.

14. Environmentally-sound management of waste controlled substances supported through policies that included the role of waste prevention was particularly important in Article 5 countries generating small quantities of waste refrigerants. For example, having an operational and well-established recovery and recycling[10] (reclamation where possible) scheme, in conjunction with disposal and destruction activities of controlled substances led to better outcomes.

[10] Recycling refers to the re-use of a recovered controlled substance following a basic cleaning process such as filtering and drying. For refrigerants, recycling normally involves recharge back into equipment which it often occurs "on-site".

Elements needed to operationalise paragraph 24 of decision XXVIII/2

15. The analysis of the ODS disposal pilot projects, the findings of the synthesis report on pilot ODS disposal projects, and the final report on the evaluation of the pilot demonstration projects on ODS disposal and destruction, demonstrated that in many Article 5 countries the management of used/unwanted controlled substances is still in an early stage of development, despite the assistance provided from the Multilateral Fund. While recovery/recycling (and reclamation in a few countries) practices are being implemented under the refrigeration servicing sector in some counties, approaches for institutionalized collection, reclamation, storage and final disposal (including destruction) of unwanted controlled substances remain to be established.

16. The majority of activities being implemented in the refrigeration servicing sector as part of the HPMPs for Article 5 countries, provide opportunities to consider integrating cost-effective management of waste controlled substances into the national hazardous waste strategies. It is relevant that under refrigeration servicing sector plans, Article 5 countries:

(a) Develop an approach that would ensure that refrigerant recovery, recycling and reclamation (where possible) programmes are an entry point in designing collection sites to support a waste management strategy;

(b) Establish a regulatory framework which *inter alia* prohibits the venting of controlled substances during installation, operation, servicing, and decommissioning of refrigeration and air-conditioning equipment and encourages the reuse of the controlled substances collected, when technically feasible and economically viable; considers economic incentives for the return of waste controlled substances; and takes into consideration international conventions on the movement of such hazardous waste;[11]

(c) Identify the equipment and logistics needed for the management of unwanted controlled substances, and include these needs in the overall approach; and

(d) Develop business plans for the establishment of recovery, recycling and reclamation schemes for controlled substances, and for the final disposal, including destruction,[12] of waste controlled substances, identifying who will bear financial responsibility and what will be the possible options.

17. The integrated approach for activities in the refrigeration servicing sector is discussed in the document on Potential strategies, policy measures and commitments, as well as projects and activities that could be integrated within stage I of HFC phase-down plans for Article 5 countries (decisions 84/54(b) and 88/75).[13] Including a strategy for the environmentally sound management of waste controlled substances supports this proposal and will ensure that all aspects of the management of refrigerants until their disposal, are fully considered.

[11] The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal; Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary Movement of Hazardous Wastes within Africa; Waigani Convention: Convention to Ban the Importation into Forum Island Countries of Hazardous and Radioactive Wastes and to Control the Transboundary Movement and Management of Hazardous Wastes within the South Pacific Region.

[12] Article 5 countries that have cement kilns that may be used for the destruction of unwanted controlled substances, adjustments to the kiln may be required to achieve the destruction standards agreed by the Parties to the Montreal Protocol.

[13] UNEP/OzL.Pro/ExCom/89/7

Options to consider funding the environmentally sound management of waste controlled substances

18. This section intends to examine potential cost-effective approaches to funding sound management of waste controlled substances, based on the lessons learned from the funded ODS disposal demonstration projects.

Inventories of banks of controlled substances

19. The discrepancies in the estimated amounts of waste controlled substances in the project proposals and the actual amounts that were collected and destroyed, were due to a limited understanding on where the waste substances were stored and how they could be collected. To avoid similar situations, a priority activity would be to carry out an inventory of banks of controlled substances,[14] establishing their locations, estimating the amounts contained in the banks and identifying feasible actions required for their sound management. It is also important to assess the sectors where controlled substances are used to determine the scope of the problem (e.g., refrigerants charged and insulation foam in refrigeration equipment to be disposed off) and the sectors to be targeted in a cost-effective manner, as not all activities may be financially viable in all sectors.

20. Once the inventory of banks is completed, the activities and policy requirements needed to manage the waste controlled substances (i.e., domestically destroyed or exported for destruction) could be identified, designed and costed. Where export of waste controlled substances is economically viable, countries would need to consider national and international regulations on exporting these wastes.

Development of strategies for environmentally sound management of waste controlled substances

21. It is important for countries to consider prevailing circumstances and capacities prior to engaging in the management of waste controlled substances. Once the inventories of banks of controlled substances have been completed and assessed, it would be necessary to establish the supporting regulatory framework; the required recovery/recycling/reclamation facilities; a description of activities for decommissioning refrigeration equipment, including the collection of waste controlled substances (i.e., refrigerants and insulation foams) and recycled components (e.g., compressors, motors, electronics, metal scrap, oil); and a description of potential destruction facilities, if available, capable of destroying waste controlled substances with the destruction efficiencies established by the Parties to the Montreal Protocol.

Integration of waste controlled substances into national hazardous waste programmes

22. In most Article 5 countries, waste controlled substances should be considered under the overall hazardous waste programme of the country concerned. However, as controlled substances are regulated under the Montreal Protocol and phased out with financial support from the Multilateral Fund, in most countries the domestic policies on hazardous wastes do not regulate the substances under the Montreal Protocol.

23. The pilot ODS disposal projects that showed the potential for long-term sustainability were those implemented in conjunction with national hazardous waste management and energy efficiency programmes along with phase-out activities for controlled substances under the Montreal Protocol. Therefore, disposal of waste controlled substances should be considered comprehensively in relation to other relevant national programmes that may already be in place.

[14] The report on Safeguarding the Ozone Layer and the Global Climate System (Intergovernmental Panel on Climate Change (IPCC)/Technology and Economic Assessment Panel (TEAP) 2005, defines ODS banks as the total amount of substances contained in existing equipment, chemical stockpiles, foams and other products not yet released to the atmosphere.

Development of a business model and co-financing for the management of waste controlled substances

24. A key parameter to the sustainable management of waste controlled substances, is the development of a robust business model within the refrigeration servicing sector plan, and should consider, *inter alia*:

(a) Establishing the regulatory framework to ban intentional venting of controlled substance during operation, servicing and decommissioning of refrigeration and air-conditioning equipment; and to require mandatory leak checking for larger equipment (e.g., above 3 kg of refrigerant) and mandatory recovery of substances from containers and equipment at their end-of life;

(b) Establishing extended producer responsibility approaches within the national regulatory and policy frameworks for electronic waste management;

(c) Developing a financing scheme for example through refrigeration associations, fees for importers/users of refrigerants, tax incentives to encourage better maintenance practices of refrigeration equipment, fees for the disposal of refrigeration equipment at the end of their life, and special subsidies for the collection and disposal of waste controlled substances in line with domestic regulation for handling hazardous wastes;

(d) Identifying potential external funding opportunities for the management of waste controlled substances;

(e) Encouraging the participation of the private sector to manage the collection and disposal of discarded refrigeration equipment, including the cost-effective removal of waste controlled substances; and

(f) Identifying existing facilities (i.e., waste incinerators, cement kiln or waste aggregators) for the destruction of waste controlled substances, or assessing the establishment of mobile small-size facilities that could destroy small quantities of waste.

Recommendations

25. The Executive Committee may wish:

(a) To note the synthesis report describing best practices and ways for the Executive Committee to consider operationalizing paragraph 24 of decision XXVIII/2, contained in document UNEP/OzL.Pro/ExCom/89/9;

(b) To request bilateral and implementing agencies to assist those Article 5 countries that wish to develop a strategy for the environmentally sound management of waste controlled substances to incorporate it into their refrigeration servicing sector plans under current implementation; and

(c) To continue deliberations on operationalizing paragraph 24 of decision XXVIII/2 in the context of the discussion of the cost guidelines for the phase-down of HFCs in Article 5 countries in light of document UNEP/OzL.Pro/ExCom/89/6.

Annex I

OVERVIEW OF THE PILOT ODS DISPOSAL PROJECTS

1. At its 57th meeting, the Executive Committee decided to look at pilot ODS disposal projects that would respond to decision XX/7[15] of the Meeting of the Parties that specified that pilot projects could cover the collection, transportation, storage and destruction of ODS, with a focus on assembled stocks with high global warming potential (GWP) in a representative sample of regionally diverse Article 5 countries. The decision also postulated that ODS disposal demonstration projects should be feasible and include methods of leveraging co-funding (decision 57/6).

2. At its 58th meeting, the Executive Committee adopted interim guidelines for the funding of demonstration projects for the disposal of ODS (decision 58/19). Funding for the preparation of ODS destruction pilot project proposals had been approved since the 54th meeting. Subsequently, at its 63rd meeting, the Executive Committee decided to set a window for ODS destruction for low-volume-consuming (LVC) countries, pursuant to decision XXI/2 (decision 63/5(c)[16]).

3. Between the 54th to the 73rd meetings, the Executive Committee approved 16 project preparation funding that resulted in fully developed pilot demonstration projects for ODS waste management and disposal in 11 countries, two regional projects and one for technical assistance with a total funding of US $11,528,052. These included two regional ODS disposal demonstration projects, for Asia and the Pacific (ASP), and for Europe and Central Asia (ECA). The preparation funding provided for one country and one region did not result in complete projects and were cancelled.[17] In addition, the Executive Committee approved three technical assistance programmes (i.e., Nepal, regional strategy for Africa[18] and a global project[19]), resulting in a total of 12 projects approved, as shown in Table 1. These projects were approved in line with decision 58/19, interim guidelines for ODS waste disposal projects.

Table 1. Pilot ODS disposal projects approved

Country	Region	Agency	Meeting	Funds (US $)
Approvals for project preparation for ODS disposal demonstration projects				
Algeria	Africa	UNIDO	59	85,000
Region: ASP	Asia and the Pacific	Japan	54	30,000
Brazil	Latin America	UNDP	57	40,000
Colombia	Latin America	UNDP	59	40,000
China	South Asia	UNIDO	59	85,000

[15] To request the Executive Committee to consider as a matter of urgency commencing pilot projects that may cover the collection, transport, storage and destruction of ozone-depleting substances. As an initial priority, the Committee might consider projects with a focus on assembled stocks of ODS with high net GWP, in a representative sample of regionally diverse Article 5 countries. This initial priority would not preclude the initiation of other types of pilot projects, including on halons and CTC, should these have an important demonstration value. In addition to protecting the ozone layer, these projects will seek to generate practical data and experience on management and financing modalities, achieve climate benefits, and would explore opportunities to leverage co-financing; and to note that any project implemented pursuant to the present decision when applicable should be done in conformity with national, regional, and/or international requirements, such as those mandated by the Basel Convention and Rotterdam Convention.

[16] To set a window for ODS destruction for low-volume-consuming countries, pursuant to decision XXI/2 of the Twenty-first Meeting of the Parties, amounting to US $3 million;

[17] India, and the regional project for Asia and the Pacific submitted by Japan.

[18] The strategy for disposal and destruction of ODS for five countries (Central African countries (Burundi, Cameroon, Central African Republic, Congo and Guinea) was submitted without project preparation funding. It proposed to develop a regional strategy for LVC countries to address unwanted ODS stockpiles. However, due to difficulties in implementation, the project was cancelled.

[19] The global project for the World Bank was a study designed to explore opportunities for financing ODS destruction; it was approved outside the guidelines for ODS disposal projects and was not included in the synthesis report.

Country	Region	Agency	Meeting	Funds (US $)
Cuba	Caribbean	UNDP	59	40,000
Region: EUR	Europe	Czech Republic	65	35,000
		UNIDO	65	35,000
Georgia	Europe	UNDP	65	30,000
Ghana	Africa	UNDP	65	30,000
Indonesia	South East Asia	IBRD	64	50,000
India	South Asia	UNDP	57	80,000
Lebanon	West Asia	UNIDO	57	85,000
Mexico	Latin America	UNIDO	61	50,000
		IBRD	61	50,000
Nigeria	Africa	UNIDO	57	60,000
Philippines (the)	South East Asia	IBRD	58	50,000
Turkey	Europe	UNIDO	60	60,000
Approvals for ODS disposal demonstration project implementation				
Region: AFR*	Africa	France	68	80,000
Algeria	Africa	France	72	250,000
		UNIDO	72	375,059
Brazil	Latin America	UNDP	72	1,490,600
Colombia	Latin America	UNDP	66	1,195,000
China	South Asia	UNIDO	67	1,227,885
		Japan	67	900,000
Cuba	Caribbean	UNDP	62	525,200
Region: EUR	Europe	UNEP	69	75,000
		UNIDO	69	274,480
Georgia	Europe	UNDP	69	55,264
Ghana	Africa	UNDP	63	198,000
Global*	Global	IBRD	55	250,000
Lebanon	West Asia	UNIDO	73	123,475
Mexico	Latin America	UNIDO	63	927,915
		France	63	500,000
Nepal*	South Asia	UNEP	59	157,200
Nigeria	Africa	UNIDO	67	911,724
Turkey	Europe	UNIDO	66	1,076,250
Total				**11,528,052**

*Technical assistance

4. A final report was expected for each project that should cover the amounts of the different ODS collected, transported, stored and destroyed, as well as financial, managerial and co-funding arrangements, and any other issues relevant to the project implementation. Based on the draft guidelines, the Secretariat reviewed the projects, and reported to the Executive Committee at its 64th meeting[20] and 70th meeting.[21]

5. The following challenges on project implementation were observed:

(a) For project preparation, on average, it took between nine to 40 months before the final projects were submitted for consideration of the Executive Committee, and between five to 72 months for the projects to be completed and final reports submitted;

(b) The information that needed to be included in the proposals was not easy to obtain;

[20] UNEP/OzL.Pro/ExCom/64/49 Report on the experience gained in the implementation of the disposal projects (decision 58/10)

[21] UNEP/OzL.Pro/ExCom/70/54 Report on progress and experiences gained in demonstration projects for the disposal of ODS (decision 64/50)

frequently, it was cited as the reason for the delays in submitting the project for funding. Specifically:

(i) Difficulties were encountered in examining the national policy and regulatory infrastructure in place, and to link the potential project with existing similar initiatives for chemical waste management to develop synergies for the projects;

(ii) Identifying sources of co-financing the project and developing the business model, and in some cases, the downturn in the carbon markets made this an unsustainable source of co-financing;

(c) Delays were experienced in getting agreement with the country with respect to the approach for ODS disposal;

(d) The survey and aggregation of already collected ODS took longer than expected; and

(e) Some countries gave priority to completing HPMPs both during project preparation and implementation of the ODS disposal projects.

Lessons learned from pilot ODS disposal projects

6. The synthesis report presented in document 82/21 gave a detailed analysis of only nine out of the 13 approved pilot projects on ODS disposal, and two studies for the establishment of a private-public financing system for disposal of ODS, for which final reports were received by the Secretariat as listed in table 2.

Table 2. Completed ODS disposal demonstration projects

Country	Project
China	Pilot demonstration project on ODS waste management and disposal
Colombia	Demonstration project on end of life ODS management and destruction
Georgia	Pilot demonstration project on ODS waste management and disposal
Ghana	Pilot demonstration project on ODS waste management and disposal
Indonesia*	Project preparation for a pilot demonstration project for ODS waste management and disposal
Mexico	Demonstration project for disposal of unwanted ODS
Nepal	Demonstration project for disposal of unwanted ODS
Nigeria	Demonstration project for disposal of unwanted ODS
Turkey	Demonstration project for disposal of unwanted ODS
Philippines (the)*	Project preparation for a pilot demonstration project for ODS waste management and disposal
Region: EUR	Demonstration of a regional strategy for ODS waste management and disposal in Europe and Central Asia

*Report of a study only.

7. The report summarized the information presented in each report according to the different categories of activities associated with ODS disposal, the approaches used for ODS waste collection, the options used for transport, the destruction methods considered and applied in each project, related policies and regulations, synergies with other projects, and the business models for financial set up of the various approaches used.

8. The report also observed that the cost of destroying ODS waste in Article 5 countries appeared to be substantially higher than in non-Article 5 countries (as shown in Table 3). Based on the differences in destruction costs, and notwithstanding the additional transportation costs required for exporting ODS waste, it appears that in many instances a more cost-effective option for the destruction of ODS waste from Article 5 countries without their own destruction facilities would be to export such waste to non-Article 5 countries for destruction.

Table 3. Cost of destruction reported for the pilot projects

Country	Destruction method	Cost of destruction (US $)
China	Domestic - rotary kiln incineration	8.00 – 12.50
Colombia	Domestic - high temperature incineration (HTI)	5.20 (for CFC-11 foam)[a]
		5.98 (for liquid CFC-11)[a]
		6.20 (for gas CFC-12)[a]
Georgia	Exported to France – HTI	5.99[b]
Ghana	Exported to Poland – HTI	No cost for destruction provided
Mexico[c]	Domestic – argon plasma arc	7.50
	Domestic – cement kiln incineration	6.00
Nigeria	Domestic – rotary kiln incineration	29.82[d]
Region: ECA	Exported to Germany and Poland – rotary kiln incineration	1.87 to 2.45[e]
Turkey	Exported to Poland – rotary kiln incineration	1.87 to 2.45[e]

[a] Indicative commercial pricing from TECNIAMSA based on test burn results, based on solid foam.
[b] Based on 1.5 mt ODS destroyed, includes transportation abroad and actual destruction including inland and maritime transportation.
[c] Mexico identified the cost of US $1.4/kg for transport and consolidation of ODS waste within Mexico.
[d] Based on 1.66 mt ODS destroyed, includes transportation costs.
[e] Destruction cost in Euros is 1.64-2.15/kg.

9. The projects also offered a view of the activities necessary for environmentally sound management of ODS waste. The observations from the reports include factors that determine the sustainability of destruction, which are summarized below:

(a) For LVC countries:

(i) More efficient collection, dismantling and recovery of the ODS waste refrigerant lowers transaction and operational costs considerably;

(ii) Aggregating waste from nearby countries or regions may be an option to ensure that sufficient quantity is aggregated for cost-effective transportation and destruction, given due consideration to national/regional regulations on hazardous waste movement;

(iii) Close coordination among the different stakeholders responsible for all stages of the management of ODS waste, is essential to ensure that all activities are implemented efficiently; and

(iv) Public awareness is an important aspect, particularly in cases where it is important for the public to be made aware of the appliance replacement programme to encourage more owners to participate;

(b) Project design and sustainable business model:

(i) Due to the long implementation period of the demonstration projects and the focus on CFCs, additional qualification testing of incineration facilities with other wasted refrigerants (i.e., HCFCs and HFCs) may be necessary to ensure that these can be used for these relevant EOL substances;

(ii) Aligning the design of ODS destruction projects to procedures of the voluntary carbon markets could provide an opportunity for sustaining funding for such activities; and

(iii) Putting in place a cost-effective and sustainable EPR system based on an industry-administered partnership is necessary to ensure a waste stream that will make

destruction efforts profitable and sustainable;

(c) With regard to synergies with other destruction activities for hazardous chemicals:

(i) Co-disposal of ODS waste and other hazardous waste (e.g., POP waste) provides opportunities for economies of scale leading to cost-effective disposal options, especially for those countries with very small ODS waste streams;

(ii) Exploring synergies with other multilateral environmental agreements, in particular with those that relate to climate change and chemical management, could be considered;

(iii) The requirements of the Basel Convention do not preclude countries from exporting ODS waste for destruction in line with the requirements of that Convention; and

(iv) Integrating ODS disposal issues within the national strategy of waste management linked with other aspects, such as energy efficiency, offers prospects for a sustainable ODS waste stream from replaced EOL equipment.

Summary of country reports for completed ODS disposal projects.

10. A summary of the information presented in the 11 reports received are presented in detail below.

China: Final report on the pilot demonstration project on ODS waste management and disposal (Government of Japan and UNIDO)

11. The objective of the pilot demonstration project is to explore treatment to the collected ODS wastes, set up a sustainable model for ODS wastes destruction, and the disposal of 192.0 metric tonnes (mt) of ODS wastes, particularly CFC banks.

12. The Regulation on ODS Management, which became effective in June 2010, is the basis for ODS recycling. It stipulates *inter alia* that enterprises specialized in the servicing and scrapping of refrigeration equipment, refrigeration and fire-extinguishing systems that contain ODS, shall be recorded under the local environmental protection bureaus (EPBs) and shall collect, recycle the ODS or transfer them to enterprises specialized in their collection, recycling and destruction to give proper treatment to ODS.

13. The project had provided for local EPBs to undertake verification activities such as on-site visits, and collect information on ODS recycling enterprises, destruction procedures applied and related cost; and record ODS recycling equipment and its operational status. The verification of some large refrigeration servicing facilities found that this sector only uses HCFCs (i.e., there are no CFCs for disposal).

14. The total amount of CFCs destroyed amounted to 194.793 mt, consisting of 11.788 mt of CFC refrigerants, 172.005 mt CFC in foam wastes and 11 mt of CFC-11 used as a blowing agent. All the collected wastes were incinerated using rotary kilns. The disposal cost for ODS-related foam wastes and refrigerants comprised direct and indirect costs. Direct costs included those related to energy including electricity and gas, water and other materials for flue gas treatment and testing. Indirect costs included shared investment of fixed asset, overheads, management and others (e.g., taxes). Although the costs vary among provinces, the average cost of destruction ranged from US $8.00/kg to US $12.50/kg.

15. The demonstration project has validated that the rotary kiln technology is efficient for the destruction of CFC-12, CFC-11 and CFC-11-based foams although the cost of operation is relatively high. Optimization of the destruction process is recommended in order to improve efficiency and reduce cost. While there are hazardous wastes disposal facilities available in some provinces, these are operating at full

capacity dealing with other solid wastes. Considering the potential ODS waste coming from HCFCs and HFC-based products in the coming years, additional disposal facilities may need to be established in future.

Colombia: Final report on the demonstration project on end-of-life ODS management and destruction (UNDP)

16. The objective of the pilot project is to demonstrate a sustainable approach for ODS waste management from collection to destruction, by strengthening destruction capabilities of domestic facilities integrating them into broader hazardous waste, and energy efficiency initiatives. It proposed to address the disposal of 114 mt of ODS wastes for destruction; put in place measures to support the sustainability of the project taking into account ODS wastes that will be collected through the refrigeration servicing sector, and supported by policy initiatives now being implemented.

17. The ODS waste disposal project was implemented within a broader national policy framework of an integrated approach to hazardous waste management, energy efficiency, management of greenhouse gas emissions and the commitment to meeting the obligations under the Montreal Protocol. This included a priority attached to the environmentally sound management of end-of-life ODS as a result of national policy initiatives in the areas of refrigeration and air-conditioning. It was also supported by a sustainable Extended Producer Responsibility Programme that started in 2013, which progressed from a voluntary pilot phase to a mandatory system.

18. The demonstration test burn work showed that a domestic capability is qualified in principle, for the destruction of ODS, specifically CFC-11 and HCFC-141b-based foam and CFC-11 and CFC-12 chemicals up to established limits of chlorine feed content. While the destruction facility met the destruction efficiency requirements, there were limitations related to air emissions, particularly acid gases (hydrochloric acid (HCl) and hydrogen fluoride (HF)) that limit chlorine and fluorine content of the feed, impacting the productivity and cost-effectiveness of the destruction tests. The cost-effectiveness for destruction of CFC-11 and CFC-12 chemicals was estimated at half the cost-effectiveness specified by the Multilateral Fund (i.e., US $13.20/kg). However, for the destruction of foam, the cost-effectiveness was estimated at approximately four times the threshold and, therefore, not affordable. Based on this, the current option is either the use of an electric arc furnace steelmaking plant processing intact refrigerator cabinet and doors, or a commercial cement kiln to destroy foam and potentially ODS refrigerant. Depending on the option selected, overall cost estimates range from US $6.40 to US $12.30 per refrigerator.

Georgia: Pilot demonstration project for ODS waste management and disposal (UNDP)

19. The objective of the pilot project for Georgia was to demonstrate how barriers to destruction and management of unwanted ODS can be overcome through synergies between ODS waste and persistent organic pollutants (POPs) stockpiles, and the disposal of 2.13 tonnes of unwanted ODS wastes that had already been collected and were temporarily stored in facilities in the country.

20. The final report focused on the activities done jointly by the focal areas, where both waste streams were co-disposed in a cost-effective manner. Terms of reference and a tender document were prepared for the co-disposal process to identify a waste sub-contractor that could collect, aggregate, pack and transport the obsolete POPs and the ODS waste to a destruction facility in France. The policy framework on hazardous waste management was reviewed to consider both ODS and POPs wastes in a comprehensive manner.

21. One key factor to the project's success was the close coordination between two separately funded activities, with the support of the Government. Joint project management through one consolidated tender, one sub-contractor and one process followed for waste export permitting procedures resulted in overall savings. In addition, having smaller waste streams, ODS waste disposal will in future continue to benefit from joint export with POPs waste, where under the Stockholm Convention it is a national obligation to

destroy such hazardous waste. Experience showed that implementation of such joint projects takes longer time for preparation and identification of companies with expertise of both wastes. This project allowed for such a system to be put in place.

22. The project resulted in the disposal of 1.2 mt of waste ODS, an amount lower than what had been originally targeted. This was due to deterioration of the tanks where CFCs were stored which may have resulted in gas leakage. The project identified all sources of ODS waste in the country; supported by legislation, such collection would continue in future.

23. With regard to the sustainability of the project, Georgia is currently in the process of establishing a National Environmental Fund to include funds collected from penalties associated with illegal ODS trade. This fund may thus be used for additional exports of ODS waste in the future.

Ghana: Pilot demonstration project for ODS waste management and disposal (UNDP)

24. The project for Ghana proposed to dispose 8.8 tonnes of CFC-12 that had already been collected and were ready for destruction, and to put in place measures to support the sustainability of the project by considering other potential ODS waste that could be collected nationally under a project on energy efficiency (EE) funded by the Global Environment Facility (GEF).

25. The final report provided details on project implementation, the set-up of the operations in particular the synergy between the pilot demonstration project and the GEF-funded project, procurement of equipment (e.g., portable recovery machines from Germany, laboratory equipment, refrigerant identifiers, refrigerant cylinders), and the results of the destruction process. It indicated that a total of 1.2 mt of CFCs and 5.2 mt of methyl bromide were destroyed through a facility in Poland (Veolia), and an additional 1 mt of CFC was exported for destruction at a facility in the United States of America (Tradewater). Thus, the total ODS waste destroyed amounted to 7.4 mt.

26. Some of the challenges faced during implementation included: difficulties in aggregating wastes in sufficient amount for a cost-effective destruction; instability of the carbon markets which was seen as a driver for the interest in export for destruction; internal process of getting clearances for exporting a mixture of waste to Poland and the United States of America (i.e., persistent organic pollutants (POPs), polychlorinated biphenyl (PCBs) and ODS); and addressing stocks of collected foam containing CFC-11 and its destruction.

27. One main lesson learned from the project was the importance of cooperation between projects of complementary nature, in this case the GEF-funded appliance replacement and rebate scheme and the pilot waste destruction project funded by the Multilateral Fund. While the approach was complex, combining these waste streams provided a cost-effective solution for destruction, saving on transport and destruction costs. This has also led to collaboration between Ghana's Energy Commission and Environmental Protection Agency, the two agencies responsible for the GEF and Multilateral Fund projects, respectively.

Mexico: Final report on the demonstration project for disposal of unwanted ODS (UNIDO)

28. The objective of the pilot demonstration project for Mexico was the disposal of the 166.7 metric tonnes (mt) of CFC-12 from old refrigerators and air-conditioners, and 7.0 mt from chillers. The demonstration project destroyed 113.0 mt of unwanted CFC-12.

29. In addition to ozone and climate benefits, the project encouraged the first Mexican facilities to obtain licenses to incinerate and co-process ODS waste, and proved the feasibility of ODS destruction using two different technologies: argon plasma arc and cement kiln. Mexico has two companies with the necessary authorizations from the Government, which were issued after satisfying relevant safety and environmental standards associated with ODS destruction.

30. The final report provides details on the phased implementation of the project. Preliminary activities consisted of training and recovery equipment endowment to home appliances replacement programme (HARP) centres, monitoring, reporting and verification (MRV) system design, awareness workshop, and implementation of ODS destruction pilot tests and licensing approval for two Mexican companies. Aggregation and consolidation of ODS banks were achieved and approximately 74.0 mt of unwanted CFC-12 banks were destroyed in the argon plasma; and an additional 39.0 mt were destroyed between 2016 and 2017. The cost-effectiveness based on implementation ranged from US $8.0/kg to US $9.20/kg.

31. The report states that the argon plasma arc is a cutting-edge destruction technology and is the cleanest; however, its limitation is the high cost. Cement kiln proved to be the most cost-effective ODS destruction technology, noting that the cement manufacturing industry in Mexico has a long experience in handling hazardous waste, other than ODS. Project lessons are provided in the final report.

Nepal: Pilot demonstration project for ODS waste management and disposal (UNEP)

32. The project for Nepal was approved by the Executive Committee at the 59th meeting to allow Nepal to explore two options for destroying a small amount of unwanted ODS that had been collected and stored through the national ozone unit. This ODS could not be sold in the market as it had been brought in above the country's allowable CFC consumption and was considered unwanted. As Nepal had a restriction for ODS re-export, the country had no option but to explore destruction possibilities.

33. The selected approach that the destruction project used was to export the ODS for destruction to the United States of America. This was done through a broker, EOS Climate, who organised the transfer to a licensed facility for destruction. UNEP reported that the shipment reached the United States of America in November 2012, and subsequently has been reported as destroyed as of February 2013. The amount of ODS handled in this project was 10 ODP tonnes (107,000 CO_2-equivalent tonnes).

34. In March 2013, the Nepal project was submitted to the Climate Action Reserve (CAR). This has subsequently been listed in CAR with a reserve project identification number of CAR955. Upon further verification with the CAR website, the Secretariat noted the project has now changed status with CAR as registered, as of 24 May 2013. It has met final verification requirements of the CAR, and Climate Reserve Tonne (CRTs) may now be issued.[22]

35. In summarizing the demonstration value of the Nepal project, this provided an opportunity to link ODS destruction to the carbon market and explore the possibility of other financial mechanisms to support ODS destruction activities. The project's registration with the CAR is a good example for other countries who are pursuing this track for their ODS disposal projects. It also reported that one of the challenges that was faced during project implementation was the lengthy process to get approval for the export of the ODS to the United States of America, because of the legal impediments that required Parliamentary clearance.

Nigeria: Final report on the pilot demonstration project for disposal of unwanted ODS (UNIDO)

36. The objective of the pilot project is to demonstrate a sustainable business model for ODS waste management from collection to disposal using Multilateral Fund assistance as seed money to destroy current

[22] Project developers submit a project by uploading the necessary forms and supporting documents to the Climate Action Reserve online software. The Reserve staff pre-screen projects for eligibility. Eligible projects are posted on the Reserve site with a status of "listed." The next step is verification by an independent, accredited verification body. Once completed, Reserve staff review the verification documentation, and if the project passes this final review process, it is labeled "registered" and CRTs are issued. Project developers submit a project by uploading the necessary forms and supporting documents to the Reserve online software. The Reserve staff pre-screen projects for eligibility. Eligible projects are posted on the Reserve site with a status of "listed." The next step is verification by an independent, accredited verification body. Once completed, Reserve staff review the verification documentation, and if the project passes this final review process, it is labeled "registered" and CRTs are issued.

stock of unwanted ODS and generate carbon credits. These credits would be used to establish an Appliance Replacement Programme (for the replacement of existing domestic refrigerators and air-conditioners with more energy efficient ones), to sustain the current recovery and collection system for ODS, with the view to incorporate other refrigerants in the future. The project intended to destroy future ODS wastes through local incineration facilities whose capacity would be developed through the revenues generated from these carbon credits. The expected output from this project was the destruction of 84.0 mt of CFC-12 which had been reported as already collected during the project preparation from industrial sources, particularly from oil refineries.

37. An inception workshop took place in November 2013, with participation from government agencies, servicing companies, waste management companies and end-users. A local contractor was hired to aggregate ODS wastes in the country; a training workshop was provided to technicians on safe collection, transportation and storage of ODS wastes including testing, correct labelling and documentation procedures; and a capacity building workshop for ODS collection and aggregation was held in June 2014. Companies and end-users that were identified during the preparatory phase were contacted to enquire about their stocks of ODS. However, stocks of ODS reported in most cases were not found. The total ODS collected amounted to only 1.66 mt of CFC-12. The collection activities were halted as no new stocks of CFC-12 were found and new inquiries repeatedly turned out to be halons (which are stored in Government agencies).

38. The revised ODS Regulations (2016) makes provisions for mandatory destruction of wastes, guidelines for destruction facilities including emission limits, and extends responsibility of end-of-life waste equipment to producers/suppliers. Extended Producer Responsibility regulations are now in place for the electronic/electrical sectors; thus, for new refrigerators, future recovery of refrigerants at their end-of-life should be the responsibility of the private sector. Training sessions on e-waste collection and management were carried out.

39. Officials from the Ministry of Environment and UNIDO inspected four disposal facilities and invited two of them to bid for the disposal of CFCs. The company selected has a proven track record of hazardous waste management for multinational companies and experience of managing CFC wastes specifically from collection to recycling. The collected stocks of CFC waste were tested for purity at the storage facility before loading, and transported to the destruction facility in Port Harcourt, Nigeria. The destruction process employed by the contracted facility is a rotary kiln incineration.

40. Of the total funds approved of US $911,724, only US $253,965 has been disbursed. Based on these disbursement, the actual cost of destruction for this project was US $153/kg of ODS waste. The financial report will be updated once destruction is complete and all outstanding payments are made. The balance of funds will be returned to the 82nd meeting.

Indonesia and the Philippines: Final reports of ODS disposal projects (World Bank)

41. At the 57th meeting, the Executive Committee approved funds for the preparation of pilot demonstration projects for ODS waste management and disposal for Indonesia and the Philippines. At that meeting, the World Bank had indicated that these funds would be used to generate data and experience on management and financing modalities, and would examine opportunities to leverage co-financing.

42. The World Bank submitted final reports containing material describing the current ODS waste inventories for Indonesia and the Philippines, information on how to do inventories and data collection, guidance on the management of unwanted ODS, financing options for destroying unwanted ODS including information about available markets, cost considerations and market prices. The reports also contain specific options for each country, an evaluation of these options, and the next steps that would be needed for implementation.

Turkey: Final report on the demonstration project for disposal of unwanted ODS (UNIDO)

43. The objective of the project was to establish a sustainable and integrated business model for an efficient waste management system of ODSs, through institutional measures that will organize the existing recovery and collection systems in the country into an integrated and efficient collection validation and valuation system.

44. Turkey had already collected some ODS wastes through Government-authorized recovery and reclamation centres established in three cities, Ankara (TUHAB), Istanbul (ISISO) and Izmir (ESSIAD); the expected amount of ODS wastes to be destroyed was 103.72 mt of CFC-12. However, during implementation, it was found that the ODS wastes available were in many cases mixtures of all types of refrigerants and the actual amount available for destruction was 9.162 mt of CFC-12.

45. The project had envisaged exporting the ODS waste to the United States of America for destruction; however, the absence of expected revenue from carbon markets, and the very small amounts of ODS wastes to be destroyed led to a redesign of the disposal strategy. It was decided to destroy the collected waste in Europe through an international bidding process.

46. In order to be more cost-effective, the ODS wastes from Turkey was combined with that of ODS waste from Montenegro; the latter was part of the regional demonstration project for ODS waste disposal pilot project for the Europe and Central Asia (ECA) region also funded by the Multilateral Fund. Other activities such as sharing of lessons learned, awareness raising were also done in close cooperation with the ECA region.

47. The project resulted in the destruction of 9.162 mt of CFC-12, reported an expenditure of US $598,345 out of the approved US $1,076,250 (plus agency support costs), resulting in a cost-effectiveness of US $65/kg of ODS wastes destroyed.

ECA region: Demonstration of a regional strategy for ODS waste management and disposal (UNIDO)

48. The objective of the pilot demonstration project for three countries – Bosnia and Herzegovina, Croatia and Montenegro in the ECA – was to evaluate a regional approach for ODS waste disposal in terms of cost-effectiveness and sustainability, particularly in LVC countries that do not have their own ODS destruction facilities.

49. The project aimed at destroying 29.07 mt of ODS waste from the three countries. It collected mainly CFCs, HCFCs and small amounts of HFCs. A total of 41.37 mt of waste were destroyed, including 32.79 mt of ODS waste. It was not feasible to separate ODS waste from non-ODS waste, meaning that all collected quantities were destroyed under the project. The cost-effectiveness of the project was US $8.01/kg calculated based only on the portion of ODS waste destroyed, exceeding the expected cost-effectiveness of US $12.02/kg. Therefore, the overall cost estimate of the project is US $262,622, and any balances will be returned to the Multilateral Fund after financial completion of the project.

50. The final report highlights that both legislation and institutional arrangements of the beneficiary countries did not support the aggregation of ODS waste at the regional level, synchronization of the shipments from different countries, and synergies with persistent organic pollutants (POPs) destruction.

51. The project facilitated the establishment of the Regional Cooperation Forum (RCF) as a communication platform that provided, *inter alia*, a list of equipment and tools that are necessary for proper aggregation of waste; check list for laboratory analysis of ODS waste; list of eligible destruction facilities in the European Union (EU); and recommendations and lessons learned.

52. Some lessons include improved knowledge on legislation in the EU and project countries, which does not allow the aggregation of ODS waste at regional level because ODS waste is classified as hazardous waste; the need for national legislation of the country in which destruction is to take place to allow the import of waste mixtures containing ODS for destruction; a list of destruction facilities in EU countries that accept waste mixtures containing ODS for destruction would be useful to other countries in the ECA region; and environmental taxes on refrigerants contributing to ozone layer depletion and climate change might feed into environmental funds to finance the environmentally sound disposal of refrigerant waste in the long-term.