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**REPORT PURSUANT TO DECISION 93/104 ON LIFE-CYCLE REFRIGERANT
MANAGEMENT WITH A VIEW TO CONSIDERING THE ESTABLISHMENT
OF A FUNDING WINDOW IN LINE WITH DECISION XXXV/11
OF THE THIRTY-FIFTH MEETING OF THE PARTIES**

Introduction

1. At the Thirty-Sixth Meeting of the Parties, noting the 2024 assessment report of the Technology and Economic Assessment Panel (TEAP), the parties decided to inter alia request the Executive Committee to consider providing a window of funding for countries that had completed their national inventories of banks of used or unwanted controlled substances and a plan for the collection, transport and disposal of such substances, in accordance with decision 91/66, to support the implementation of the plans, as well as request the Ozone Secretariat to organize a one-day workshop on the matter (decision XXXV/11(2) and (4)). In line with that decision, at its 93rd meeting, the Executive Committee decided to request the Secretariat to prepare, for consideration by the Committee at its 97th meeting, a report providing an overview of the TEAP report and the outcomes of the workshop, and of the status of implementation and preliminary outcomes of the projects submitted under decision 91/66 with a view to considering the establishment of a funding window in line with decision XXXV/11 (decision 93/104).

2. The Secretariat has prepared the present paper in line with that decision.

Technology and Economic Assessment Panel 2024 report on life-cycle refrigerant management

3. The Technology and Economic Assessment Panel (TEAP) report considered life-cycle refrigerant management (LRM) to be a comprehensive set of strategies to reduce emissions from the installed refrigerant bank that starts with leak prevention in the design, manufacturing and assembly, installation, servicing and use of refrigeration, air-conditioning and heat pump (RACHP) equipment. Recovery is pivotal

¹ UNEP/OzL.Pro/ExCom/97/1

prior to reuse, recycling, reclamation or destruction as appropriate. The overall conclusions of the report and a summary of the key findings are presented in annex I to the present document.

Outcomes of the Ozone Secretariat's workshop on life-cycle refrigerant management

4. The objective of the workshop on LRM convened pursuant to decision XXXV/11² was to share information, experiences and lessons learned in relation to the issue and to assess challenges related to ways of strengthening LRM, including, among other things, existing and potential policies, best practices, standards and opportunities. The workshop was structured into four sessions: introduction to LRM, country experiences, technical deep dives, and financing mechanisms. The key takeaways from each session are presented in annex II to the present document.

Status of implementation and preliminary outcomes of the projects submitted under decision 91/66

5. To date, the Executive Committee has approved under decision 91/66 a total of US \$8,406,800, plus agency support costs of US \$943,950, to prepare a national inventory of banks of waste controlled substances and to develop a national plan for the management of those substances in 100 Article 5 countries. As originally approved, projects in 33 countries had an expected date of completion by December 2025; 25 by May 2026; 30 by December 2026; and 12 by May 2027, with a final report and copy of the resulting national inventories and action plans to be submitted within six months of completion.

6. In line with decision 93/104, the Secretariat requested an update on the status of implementation of the projects submitted under decision 91/66. Information requested, contained in annex III to the present document, included estimated quantities of identified used and unwanted controlled substances that have been collected and/or stockpiled; the existence of an operating reclamation centre in the country and mechanisms/testing facilities in place to check the identity of refrigerants and their quality/purity; whether the country has facilities to collect and dismantle end-of-life appliances and/or e-waste for material (including refrigerant) recycling and disposal; whether there is a facility capable of destroying controlled substances in the country; whether the country has ever exported used and unwanted controlled substances for destruction to another country; and whether the country has ever imported used and unwanted controlled substances for destruction from another country. While the bilateral and implementing agencies provided the best information available at the time of preparation of the present document, only limited information was available given delays due to inter alia challenges faced by the bilateral and implementing agencies in identifying and recruiting consultants and difficulties faced in estimating quantities of controlled substances that could be recovered.

7. In line with decision 82/50, the Secretariat invited the agencies to identify those projects for which an extension to the date of completion was required. Of the 33 projects expected to be completed by December 2025, 12 would be completed by the planned date, 20 were requesting an extension, and the project in one country was being proposed for cancellation at the present meeting.³ Of the 25 projects expected to be completed by May 2026, 8 would be completed by the planned date and 17 were requesting an extension. Requests for extension are further discussed in document UNEP/OzL.Pro/ExCom/97/11.

Activities related to life-cycle refrigerant management that are supported, partly supported, or not supported by the Multilateral Fund

8. LRM is critical to minimizing consumption and emissions of controlled substances in a cost-effective and comprehensive manner and contributing to Article 5 countries' compliance with the Montreal Protocol control targets. The Multilateral Fund has long funded activities in Article 5 countries

² Held on 27 October 2024 in Bangkok, Thailand, preceding the 36th Meeting of the Parties, with the participation of over 400 participants and 34 expert speakers from governments, industry, and international organizations.

³ As further discussed in document UNEP/OzL.Pro/ExCom/97/18, the Government of Nicaragua requested cancellation of the project at the present meeting.

that support elements of LRM, including promoting good servicing practices (training and certification of technicians; support to training institutes and refrigeration and air-conditioning (RAC) technician associations; and training on the safe handling of low-GWP alternatives); supporting the infrastructure for refrigerant containment (refrigerant recovery, recycling, and reclamation infrastructure; tools and equipment to RAC technicians; and refrigerant leakage prevention projects); and strengthening policy and regulatory frameworks (development of policies, regulatory measures, and standards for refrigerant management; licensing of workshops and introduction of labelling and record-keeping requirements; and training of officers related to enforcement of regulations). The activities supported by the Multilateral Fund thus mostly relate to the collection, transport and storage of refrigerants while still being used, and the assistance has been provided mostly in the context of the refrigeration servicing sector activities included in multi-year agreements to phase out CFCs and HCFCs or phase down HFCs.

9. More recently, the Executive Committee also approved the preparation of national inventories of banks of waste controlled substances and the development of national plans for management of those substances under decision 91/66.

10. However, the Multilateral Fund has so far provided only limited or no support for other elements of LRM. To date, it has provided only limited funding (in the form of pilot projects)⁴ for the disposal of controlled substances, for the design of equipment to maximize refrigerant containment and minimize leaks, and for tools for predictive maintenance; and no funding for the disposal of end-of-life equipment that contains controlled substances or for activities to establish extended producer responsibility (EPR) schemes. In part to address those limitations, the Executive Committee decided to provide flexibility for Article 5 countries to include, in HCFC phase-out management plans (HPMPs) or Kigali HFC implementation plans (KIPs), activities related to the environmentally sound management of used or unwanted controlled substances (decision 90/49(b)). While activities related to the environmentally sound management of used or unwanted controlled substances are thus eligible under HPMPs and KIPs, their funding could be provided only within the agreed cost guidelines.

Opportunities for strengthened engagement on life-cycle refrigerant management by the Multilateral Fund

11. Information collected from the TEAP's report on LRM, the workshop on LRM and consultations with experts highlight that to ensure effective and self-sustained LRM, a national strategy enabled by a robust regulatory framework tailored to each country's context should be established, including clearly determined roles and responsibilities of all involved stakeholders (regulators, industry, equipment and refrigerant importers and distributors, and service providers), ensuring private sector participation in the design and implementation, determining infrastructure required based on the country's context, ensuring an understanding of the economics and logistical requirements of the different aspects of LRM operation, identifying and securing sources of funding, and ensuring stakeholder feedback for policy refinement. The plans for the collection, transport and disposal of used or unwanted controlled substances being formulated by Article 5 countries in line with decision 91/66 would need to include such considerations.

12. While plans being formulated by Article 5 countries would identify funding needs for the collection, transport and disposal of used or unwanted controlled substances, based on the TEAP's 2024 report on LRM, the workshop on LRM, the preliminary outcomes of the projects approved under decision 91/66, and consultations with experts, the Secretariat has identified potential opportunities for strengthened support by the Multilateral Fund for the implementation of LRM in Article 5 countries. These opportunities intend to help address some of the gaps and issues identified for LRM, and they are presented below classified into three main blocks: (a) leakage prevention; (b) refrigerant recovery, recycling and reclamation; and (c) disposal of unwanted refrigerant. Activities in these blocks may already be funded to some extent, may be proposed for funding under the plans for handling used or unwanted controlled

⁴ A synthesis report on the pilot ODS disposal projects is contained in document UNEP/OzL.Pro/ExCom/82/21.

substances being prepared by Article 5 countries in line with decision 91/66, or may fall outside of these options. They also do not constitute all possible activities that could be included in these plans, as there may be additional ones identified by Article 5 countries in the preparation of their plans.

A. Enhancing leakage prevention

13. Some of the ideas discussed in the 2024 TEAP report and the LRM workshop related to reducing refrigerant leaks from equipment included ensuring proper equipment design and installation, enhancing technician training and certification, updating standards, promoting consumer and end-user education on preventive maintenance and periodic checks for large equipment, implementing predictive leak detection systems, adopting maintenance logbooks for certain equipment, adopting early leak detection tools, developing and enforcing codes of practice and associated regulations, and ensuring the proper disposal of equipment at end-of-life including refrigerant recovery.

14. Several of these activities have been initiated or are already included in refrigeration servicing activities being implemented under the HPMPs and KIPs, while others, such as improving the design and installation of equipment, may be partially included under the investment projects for conversion to low-GWP technologies and, in a limited number of cases, under technical assistance provided to enterprises assembling, installing, and charging in-situ large RAC equipment.

15. Other activities may be inadequately addressed or appear to be lacking entirely (e.g., ensuring proper disposal of equipment at end-of-life including refrigerant recovery). Moreover, challenges can vary by sector and refrigerant, and a holistic strategy would address that variability. For example, recovery and recycling of HCFC-123 is fundamentally different from that of HCFC-22 given the lower pressure of the refrigerant. Similarly, leakage rates in the fishery sector can be very high and low-GWP retrofit options may be unavailable or difficult.

16. Plans being prepared under decision 91/66 are expected to determine whether there are gaps in the activities already being implemented under the HPMPs and KIPs to ensure effective LRM, as well as the regulatory framework required to enable the implementation of these activities in a coordinated manner.

B. Optimizing refrigerant recovery, recycling and reclamation

17. Refrigerant recovery, recycling and reclamation activities and infrastructure are included in many HPMPs and KIPs. However, several countries report that the amounts of refrigerant received for reclamation has been lower than initially envisaged, with costly logistics and a lack of adequate and enforced regulations hampering their implementation. In the review of proposals, the Secretariat and the agencies discuss the business models designed for each country that would sustain the recycling or the reclamation operations, as well as the necessary policy and regulatory measures needed to ensure sustainability. In many countries, business models are difficult to design and implement, and have unresolved issues, such as the disposal of unusable refrigerants and the associated cost. In general, the limited volume of refrigerants and equipment containing controlled substances in low-volume-consuming (LVC) countries hinders the financial viability of business models for reclamation, making the development of sustainable reclamation programmes in those countries more challenging than in non-LVC countries.

18. Some of the ideas that could help resolve gaps in refrigerant recovery, recycling, and reclamation include their consideration as part of a broader LRM strategy rather than as an individual activity, the development and enforcement of an appropriate regulatory framework to support such activities, the development of business models tailored to the size, consumption level and other characteristics of each country in cooperation with the local private sector, the development of reverse supply chains⁵ to facilitate refrigerant circulation, and improved capacity to test refrigerant quality. Plans being prepared under

⁵ The logistic process of returning recovered refrigerant for the purpose of recycling, reclamation or destruction.

decision 91/66 should be able to determine whether these gaps can be addressed through their ongoing projects (i.e., KIPs and HPMPs) or whether additional activities and different approaches are needed.

19. In addition to this, to address specific issues identified in the 2024 TEAP report and the LRM workshop, and after discussions with experts, the following ideas are considered. Article 5 countries may wish to consider including these initiatives in the plans being prepared in line with decision 91/66, wherever relevant based on national circumstances.

Enhancing refrigerant recovery and reclamation by addressing equipment end-of-life through replacement and end-user incentive programmes

20. Article 5 countries may from time-to-time implement equipment replacement programmes and end-user incentive projects. The implementation of such programmes and projects present opportunities for recovery of controlled substances and end-of-life management of equipment containing controlled substances. For example, based on similar experiences with CFC-based equipment in the past, programmes for the collection of end-of-life HCFC- and HFC-based commercial standalone refrigeration equipment or HFC-based domestic refrigerators could present opportunities for introducing equipment with improved energy efficiency in the market and recovery of HCFC and HFCs. Such programmes could be partly financed through the scrap value of equipment being replaced (e.g., copper heat exchangers, etc.) and they provide an opportunity to recover HCFCs and HFCs, which could be supported under HPMPs and KIPs within existing guidelines, where relevant. Additional Multilateral Fund support might also be provided in some projects where equipment replacement and end-user incentive programmes are undertaken to enable the introduction of equipment with improved energy efficiency in the market. Moreover, the implementation of EPR policies can provide additional incentives to ensure proper handling of equipment and its refrigerant at end-of-life, as further developed in the next section.

Enabling the implementation of extended producer responsibility schemes

21. EPR and product stewardship are policy models that assign the technical and/or financial responsibility for end-of-life equipment handling to fluorocarbon suppliers or equipment manufacturers. Typically, these programmes generate revenues to support downstream handling of refrigerants by attracting voluntary assumption of certain LRM costs by industry stakeholders individually or collectively, or mandatory schemes imposed by authorities that charge fees upon equipment purchase or apply levies to imported fluorocarbons.⁶ EPR has had some success in increasing recovery in some countries.⁷ For those Article 5 countries that do not have EPR programmes, it may be easier to implement such EPR programmes on a pilot basis with larger equipment manufacturers, importers and distributors that are more likely to have the technical, financial, and management capability to implement EPR, such as multinational and non-Article 5-owned enterprises. These programmes could be extended over time to larger locally owned enterprises and based on emerging needs and opportunities.⁸ It is also noted that the adoption of EPR programmes may be beyond the scope of the national ozone units (NOUs) in some countries, which would require additional institutional awareness-raising, consultation and coordination with relevant authorities.

⁶ TEAP 2024 Task Force Report on Life cycle Refrigerant Management, page 101.

⁷ Ibid, page 91.

⁸ For example, Article 5 countries with EPR programmes focused on equipment, and that have been unable to implement a ban on disposable cylinders, could consider extending such EPR programmes to also address disposable cylinders, where such an additional EPR programme would target the importers of refrigerants in disposable cylinders and would enable both the recovery of the scrap metal derived from the punctured disposable cylinders and recovery of the refrigerant “heel” (i.e., residual refrigerant left in disposable cylinders, which amounts on average to 5 per cent of the cylinder’s total charge size).

Exploring feasibility of enabling regional approaches to reclamation of controlled substances

22. In addition or alternatively to ongoing efforts on refrigerant containment at national level under the HPMPs and KIPs, noting that volumes of recovered refrigerant are not sufficient to justify large-scale or dedicated investment in reclamation facilities in all countries, significant benefits could arise from Article 5 countries working together to set up or take advantage of existing reclamation infrastructure in some regions or subregions.⁹ Such regional cooperation would require:

- (a) A central reclamation facility with sufficient capacity to reclaim recovered refrigerant from countries in the region/subregion; where such a facility did not exist, it would need to be established, which would require a careful assessment of the business model for the establishment and operation of the facility, including ensuring that there was sufficient and consistent volume of recovered refrigerant to justify the required capital costs for the establishment and sustained operation of the facility. The facility would need a laboratory to test the purity of recovered refrigerant to be reclaimed and to ensure that reclaimed refrigerant met the AHRI 700 standard. It is noted that in some regions there are already refrigerant management enterprises sending refrigerants to larger regionally accessible reclamation facilities. An example is Article 5 countries in Southeast Asia sending refrigerants to Australia;¹⁰
- (b) Effective implementation of recovery of refrigerant by countries in the region, ideally by certified RAC technicians. This, in turn, requires the availability of a fleet of cylinders in countries in the region, storage capacity to ensure sufficient recovered refrigerant can be consolidated for transportation, and capability to undertake composition analysis¹¹ of the recovered refrigerant prior to export to ensure reclamation is feasible; and
- (c) A mechanism to ensure the appropriate circulation of refrigerant cylinders and ISO tanks, where relevant, between countries in the region to the country where the reclamation facility is located, and vice versa.

23. Further, the practicality and cost-effectiveness of such regional cooperation depends inter alia on whether the countries consider the recovered refrigerant destined for reclamation to be a product and not waste and whether participating countries have a common definition of substances considered hazardous and not hazardous in a regionally consistent manner to facilitate transboundary movement under the Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal (hereafter Basel Convention)¹² (for more information, see paragraphs 38 to 41).

24. It would be desirable for the Article 5 country in which the central reclamation facility was located to also have a destruction facility to address those exceptional cases where shipments of recovered refrigerant from countries in the region were too contaminated to be reclaimed. Regional approaches to reclamation would need to carefully consider both how to minimize the likelihood that shipments of recovered refrigerant that could not be reclaimed but instead needed to be destroyed; and a mechanism to finance such destruction. In addition, mechanisms are needed to ensure that refrigerant that is transported across national boundaries is as declared; in other words, that recovered and reclaimed refrigerant is not virgin refrigerant, to minimize the risk of enabling illegal trade.

⁹ Ibid, page 4.

¹⁰ Ibid, page 36.

¹¹ In the exporting country, such composition analysis could be undertaken during the recovery of refrigerant by technicians using rapid handheld portable analyzers. In contrast, the reclamation facility in the importing country would require a laboratory to inter alia test the recovered and reclaimed refrigerant.

¹² And any other relevant conventions, e.g., Bamako Convention.

25. Such a regional approach would need to carefully consider logistics and costs of implementation. Collection, storage and transportation can be significant. If recovery and recycling have faced challenges at the national level in the exporting countries, international transport will likely add further challenges. Regional approaches should therefore include a robust feasibility assessment.

26. The TEAP noted that in the future, the anticipated development of effective and efficient LRM may drive the commercial development of destruction facilities regionally.¹³ In particular, there may be opportunities for regional cooperation in developing an economically sustainable regional market for such destruction capacity that could serve several parties in reasonable proximity that were willing to cooperate efficiently on Basel Convention approvals. This approach may ease the challenges of end-of-life refrigerant management for LVC countries, regions with limited destruction capability, and remote, albeit small stockpiles of refrigerants.¹⁴

27. Although decision 91/66 referred to national inventories and plans of action, the Secretariat recognizes the potential relevance of regional approaches to reclamation and disposal. It may be the case that Article 5 countries had considered the need for such a regional approach in their national plans.

Strengthening reclamation of HFCs in Article 5 countries with HFC-based RAC manufacturing

28. The greatest impact on effective LRM is the ease of availability and price of newly produced (virgin) refrigerant.¹⁵ Mechanisms exist to directly affect the price of virgin refrigerant imported into a country, some of which may be under the control of the NOU (e.g., restricting imports through the country's licensing and quota system) and some of which are generally not under the control of the NOU but the relevant ministry of trade or finance. However, increasing the price of refrigerant can increase the risk of illegal refrigerant production and trade. Article 5 countries with a reclamation facility and HFC-based RAC manufacturing that wish to incentivize the use of reclaimed rather than virgin HFCs could consider a mechanism other than the relative price of reclaimed and virgin HFC as an incentive: to require RAC manufacturers to use a minimum percentage of reclaimed HFC in their manufacturing, and to progressively increase that percentage as the HFC phase-down in the country proceeds.

C. Addressing disposal of unwanted refrigerants

29. Destruction is a critical component of LRM because it permanently eliminates potential emissions of recovered ODS or HFCs that can no longer be reused. Across the world, volumes of recovered waste refrigerant have not been of sufficient quantity to justify large-scale or dedicated investment in destruction facilities closer to source, resulting in high destruction costs relative to the volume of refrigerants being destroyed. In general, the most significant portion of these costs comes from actual destruction, with transportation and transaction costs accounting for 10 per cent of total costs for in-country destruction, and 20 per cent of total costs when export of refrigerants is required. Generally, in those instances where destruction has taken place, industry and the value chain (e.g., end users, contractors and distributors) have paid for such destruction.¹⁶

30. The availability of destruction facilities, and opportunities to sustainably operate those facilities, vary across Article 5 countries. Most LVC countries do not have destruction facilities and are unlikely to generate a consistent and sufficient stream of waste controlled substances to justify the capital expenditures necessary to establish such facilities. In addition, an important prerequisite for cost-effective management of unwanted or waste controlled substances is to accumulate enough controlled substances to be reclaimed or destroyed to make land and/or sea transport viable and justify the individual shipment transaction costs. This requires collection, consolidation in appropriately sized and qualified tankage, and secure storage until

¹³ Ibid, page 37.

¹⁴ Ibid, page 78.

¹⁵ Ibid, page 4.

¹⁶ Ibid., page 83.

such a viable quantity is available for shipping (this would typically be an amount that might fill a standard shipping container), all of which incur costs.¹⁷ It may take time for LVC countries to accumulate sufficient volume of unwanted or waste controlled substances to make shipping such stocks to another country with destruction facilities and/or the capability to reclaim such stocks. Smaller non-LVC countries may face similar challenges, while larger non-LVC countries are more likely to either have destruction facilities or to generate a consistent and sufficient stream of waste controlled substances to justify the capital expenditures necessary to establish such facilities; those streams of waste controlled substances, when coupled with appropriately implemented and enforced policies and regulations, can facilitate the development of sustainable business models to destroy waste controlled substances.

31. Plans being prepared under decision 91/66 should be able to determine the specific needs related to disposal for each country and the activities and approaches required to address them. In addition to this, to address specific issues associated with disposal identified in the 2024 TEAP report and the LRM workshop, and after discussions with experts, the following preliminary ideas are considered, on the understanding that the plans may provide different and additional approaches.

Exploring the feasibility of using flexible mobile destruction units

32. An alternative to fixed destruction facilities is the use of mobile destruction units. Such units are commercially available, including those based on technologies approved by the parties, and can provide a cost-effective destruction option for small stockpiles of waste controlled substances. The use of mobile destruction units could be an alternative to a regional approach to destruction, where rather than transporting the waste controlled substances to a country with a destruction facility, Article 5 countries in one, or even more than one, region share a mobile destruction unit. Such an approach could be an attractive option in those cases where the transboundary movement of waste controlled substances is precluded or exceedingly difficult. Article 5 countries wishing to consider the use of mobile destruction units would need to carefully consider any permitting or regulatory requirements necessary for the use of such units given national or local regulations.

Supporting disposal campaigns of phased out controlled substances except for halons, HCFCs, and HFCs

33. One lesson from the implementation of the pilot ODS disposal projects funded by the Multilateral Fund was that the quantity of waste ODS was smaller than originally planned.¹⁸ It is likely that in any given LVC and smaller non-LVC country, such disposal of unwanted or waste previously phased out controlled substances would be undertaken periodically, e.g., only once every several years, as time would be needed for sufficient volume of unwanted or waste controlled substances to make shipping feasible.¹⁹

34. Enterprises exist that provide a service to collect stocks of such unwanted or waste controlled substances for destruction or reclamation.²⁰ For those cases where such enterprises are unable or unwilling to provide this service, LVC countries and smaller non-LVC countries without local destruction capacity could consider including in their plans being prepared under decision 91/66 support for the disposal of unwanted or waste controlled substances identified in their inventories that have been phased out except for halons, which are still used, and HCFCs and HFCs to maximize recovery and recycling and/or reclamation. However, several considerations would need to be taken for the provision of such assistance. For example, to avoid inadvertently incentivizing that recovered halons, HCFCs and HFCs were mixed

¹⁷ Ibid., page 78.

¹⁸ UNEP/OzL.Pro/ExCom/82/21.

¹⁹ Such periodic destruction could be coupled with equipment end-of-life replacement campaigns and implementation of end-user incentive programmes. Cylinders of refrigerant that were confiscated by customs could also contribute to accumulation of stocks of waste controlled substances if consistent with national regulations, noting that storage of such confiscated cylinders would also need to be considered.

²⁰ For example, see <https://ozone.unep.org/system/files/documents/A-GasBusinessModel.pdf> and https://ozone.unep.org/system/files/documents/Tradewater%20side%20event%20slides_MOP36.pdf.

with stocks of waste or unwanted phased out controlled substances, a maximum percentage (e.g., less than 5 per cent) of halons, HCFCs and HFCs contained in cylinders and ISO tanks of unwanted or waste controlled substances, should be defined. Support could be provided on the understanding that the Government concerned committed to ensuring that there would be no additional funding from other sources, including carbon credits²¹ or offsets, during or after completion of the project. Where not covered under ongoing projects, additional support could be considered for the consolidation and storage of the unwanted or waste controlled substances (except for halons, HCFCs, and HFCs) to be destroyed.

35. While Article 5 countries may already be considering including such disposal in their plan for the collection, transport and disposal of used or unwanted controlled substances being developed under decision 91/66, it is important to note the special case of LVC countries and smaller non-LVC countries²² interested in undertaking a project to dispose of unwanted or waste controlled substances (except for halons, HCFCs, and HFCs). The approximate quantity of unwanted or waste controlled substances (except for halons, HCFCs, and HFCs) that had been collected for disposal, whether a national or regional approach will be used, whether an existing destruction facility had been identified or if mobile destruction units were planned, and other characteristics of the project, would be important to identify when considering whether these cases could be considered under a possible funding window as a priority.

36. Larger non-LVC countries are more likely to have destruction facilities and to be able to generate a consistent and sufficient stream of waste controlled substances to enable the development of business models for LRM, including related to EPR and disposal, which may allow for continuous disposal rather than in campaigns. For those countries, funding disposal of unwanted or waste controlled substances (except for halons, HCFC and HFCs) could be considered on a case-by-case basis based on their proposals to implement the national plans for the collection, transport and disposal of used or unwanted controlled substances developed under decision 91/66.

37. Based on the successful implementation of such disposal projects, the Executive Committee could then consider also funding the disposal of waste HCFCs once those have been phased out. In such case, the Executive Committee may need to consider whether safeguards would be needed to ensure that the possible funding of disposal of HCFCs by the Multilateral Fund does not negatively affect the recovery, recycling and, if appropriate, reclamation of HCFCs in the 2030-2040 period.

Facilitating appropriate transboundary movement of controlled substances for destruction or reclamation

38. The ability to manage the transboundary movement of unwanted or waste controlled substances is necessary to achieve global access to reclamation and destruction technologies. In many parties, unwanted or waste controlled substances are considered as hazardous wastes, given their ozone and climate impacts, potential for unsuitable disposal, and association to dumping of used and scrap RAC equipment from developed to developing countries. As such, their transboundary movement could be subject to the requirements of the Basel Convention as well as other related international shipping standards.²³

39. Barriers to transboundary movement of refrigerants is a challenge for Article 5 countries that lack national capability for reclamation or destruction or the resources to undertake export transactions of relatively small quantities of unwanted or waste refrigerants.²⁴ As part of their national action plans developed under decision 91/66, such Article 5 countries could consider requesting technical assistance to enable the classification in their national regulations of recovered refrigerants intended for recycling or reclamation as a product and not “waste.” Countries wishing to do so, however, would also need to carefully

²¹ Romm et al., 2025. Annual Review of Environment and Resources, 50:649-680 <https://doi.org/10.1146/annurev-environ-112823-064813>.

²² This would correspond to brackets D and E described in paragraph 47 below.

²³ TEAP 2024 Task Force Report on Life cycle Refrigerant Management, page 71.

²⁴ Ibid, page 72.

consider mechanisms to ensure that recovered refrigerants are recovered and not virgin refrigerant and of sufficient quality that the recovered refrigerant can be recycled or reclaimed rather than destroyed.

40. Should Article 5 countries define recovered refrigerants intended for destruction as hazardous waste, they could consider requesting technical assistance to enable the export of such waste. The Basel Convention foresees for parties, taking the appropriate measures, to allow the transboundary movement of hazardous wastes if the transboundary movement in question is in accordance with “other criteria” to be decided by the parties, provided those criteria do not differ from the objectives of the Basel Convention. Thus, at a regional level, countries could agree that hazardous movement will be allowed for reclamation or destruction at a specific regional facility that uses a technology approved by the parties. For example, regional agreements such as the Bamako Convention²⁵ could provide a framework under which such regional cooperation could be undertaken.

41. In general, the requirements of the Basel Convention are triggered when waste refrigerants are defined as hazardous waste by the exporting country, the importing country, or any of the countries through which the waste refrigerants are shipped. In such cases, countries through which such waste refrigerants are shipped may require a guarantee or collateral that the waste refrigerants will be destroyed in order to provide the prior informed consent required under the Basel Convention.²⁶ If so requested, the Secretariat could explore whether funding with a different modality (such as a revolving fund modality), could be established with the purpose of providing a guarantee that waste controlled substances (except for halons, HCFCs, and HFCs) were destroyed at a facility using a technology approved by the parties. In such a scenario, Article 5 countries wishing to export waste controlled substances (except for halons, HCFCs, and HFCs) would effectively be taking out a loan to provide the required collateral for shipment of the waste controlled substances; that collateral would be returned to the revolving fund upon verification that the waste controlled substances were destroyed at a facility using a technology approved by the parties.

Consideration of a funding window for countries that had completed their national inventories of banks of used or unwanted controlled substances and a plan for the collection, transport and disposal of such substances

42. The sections above describe the activities and the approach for an overall national or regional strategy for LRM and a plan for the collection, transport, and disposal of used or unwanted controlled substances.

43. To consider a dedicated funding window to support the implementation of national plans for the collection, transport, and disposal of used or unwanted controlled substances, in line with decision 91/66, a cost analysis would be required. This analysis should estimate the additional resources needed to ensure that ongoing activities under the HPMPs and KIPs are effectively integrated into a LRM strategy without duplicating funding, as well as additional funding that may be required for complementary activities not currently covered.

44. The cost analysis would encompass the development of robust regulatory frameworks tailored to each country’s context, coordination with relevant institutions and the private sector, and the infrastructure and activities needed to prevent refrigerant leakage throughout the equipment lifecycle, recovery, recycling, and reclamation, transportation, storage and final disposal where applicable.

45. The analysis should also account for the fact that countries, in preparing their plans, will identify and leverage various sources of funding. These will depend on factors such as the size of the RAC sector, the volume of refrigerants to be managed, the existing infrastructure for the collection and handling of

²⁵ The Bamako Convention urges member states to effectively manage and restrict the cross-border transport of hazardous wastes across Africa. See <https://www.bamakoconvention.org/>.

²⁶ Article 6 of the Basel Convention establishes that transboundary movement of hazardous wastes shall be covered by insurance, bond or other guarantee as may be required by the State of import or any State of transit that is a party.

waste, existing or potential regulatory incentives, and institutional capacity, among others. Having completed the cost analysis, given the challenges of assessing each plan individually, grouping countries with similar characteristics has proven to be an effective approach for determining costs and delivering assistance under different funding windows of the Multilateral Fund.

Initial consideration of categories of Article 5 countries

46. Article 5 countries' capacity to implement LRM varies. Funding needs would depend on national circumstances, including inter alia the effective implementation and enforcement of a policy and regulatory framework that minimizes leakage, maximizes recovery, and reuse or reclamation, as appropriate, and minimizes emissions of refrigerants throughout the lifecycle of RACHP equipment; the availability of infrastructure to implement LRM; the quantity of controlled substances that have been or could be recovered; and other characteristics.

47. The TEAP 2024 Task Force Report on Life cycle Refrigerant Management used five brackets to describe accessibility to LRM:

- (a) Bracket A is based on baseline HCFC consumption over 25,000 metric tonnes (mt);
- (b) Bracket B is based on baseline HCFC consumption from 10,001 to 25,000 mt;
- (c) Bracket C is based on baseline HCFC consumption from 2,001 to 10,000 mt;
- (d) Bracket D is based on baseline HCFC consumption from 360 to 2,000 mt; and
- (e) Bracket E is based on the list of HCFC LVC countries.

48. These brackets are an imperfect proxy to determine funding needs of individual Article 5 countries to implement LRM. However, in view of the limited information on the national plans for the collection, transport and disposal of used or unwanted controlled substances being developed under decision 91/66, they may provide an initial categorization the Secretariat could use to develop a document containing information on expected costs to enable the Executive Committee to consider the establishment of a funding window in line with decision XXXV/11.

Recommendation

49. The Executive Committee may wish to consider:

- (a) Noting the report pursuant to decision 93/104 on life-cycle refrigerant management with a view to considering the establishment of a funding window in line with decision XXXV/11 of the Thirty-Fifth Meeting of the Parties contained in document UNEP/OzL.Pro/ExCom/97/87;
- (b) Encouraging the bilateral and implementing agencies to intensify their efforts to assist Article 5 countries in finalizing projects under decision 91/66 as soon as feasible and submitting the final report and a copy of the resulting national inventories and the national action plans in line with decision 91/66(e)(iii); and
- (c) Requesting the Secretariat, taking into account discussions on the matter during the 97th meeting and information on the inventories and national plans prepared under decision 91/66, to prepare a document for the 99th meeting including draft cost guidelines and funding modalities to implement national or regional plans for the collection, transport and disposal of used or unwanted controlled substances, with a view to considering the establishment of a funding window in line with decision XXXV/11 (decision 93/104).

Annex I

OVERALL CONCLUSIONS OF THE 2024 TEAP REPORT ON LIFE-CYCLE REFRIGERANT MANAGEMENT

Overall conclusions¹

1. Responsible refrigerant management is critical to minimize refrigerant emissions, alongside phasing out ODS and phasing down HFCs in increasingly energy efficient refrigeration, air-conditioning and heat pump (RACHP) equipment.
2. Life-cycle refrigerant management (LRM) can increase available refrigerant supply, especially for servicing-only parties that have less flexibility in their approach to phasing out or phasing down refrigerant consumption. Effective leakage prevention and refrigerant reuse provide additional tools to reduce the production and consumption, which can assist with Montreal Protocol compliance.
3. In the long term, the Kigali Amendment will facilitate a phase-down of high-GWP HFC refrigerants. However, in the near and medium term there may be a build-up of HFCs in banks in Article 5 parties (both in RACHP equipment and HFCs for servicing) due to the overall rise in cooling demand in advance of the technology transfer to lower-GWP alternatives. The phase-down regimes in some Article 5 parties will ensure a continued market for HFC refrigerants for new RACHP equipment and for servicing. As a result, inexpensive new HFCs may be available in Article 5 parties, and HFC banks will inevitably build up.
4. LRM strategies can help minimize refrigerant emissions and make refrigerant available through reuse, especially for Article 5 parties. LRM can include refrigerant venting prohibitions, leak prevention strategies, and establishing the reverse supply chain² and infrastructure to maximize refrigerant recovery, prior to recycling, reclamation and destruction as appropriate.
5. In many Article 5 parties, the HFC consumption and production phase-down schedules started from 2024, with some others starting in 2028. If phase-down of HFCs creates a shortage of refrigerant and leads to price increases, then refrigerant recovery may increase. However, if supply of newly produced refrigerant remains plentiful, other policy and economic measures may be required to incentivize effective recovery.

¹ Ibid., pages 5-6. The report's key findings are summarized in pages 2-5 of the report.

² The logistic process of returning recovered refrigerant for the purpose of recycling, reclamation or destruction.

Annex II

KEY TAKEAWAYS FROM THE WORKSHOP ON LIFE-CYCLE REFRIGERANT MANAGEMENT CONVENED PURSUANT TO DECISION XXXV/11

Introduction to life-cycle refrigerant management and country experiences

1. During the workshop, countries shared diverse approaches to implementing life-cycle refrigerant management (LRM) practices. Some emphasized strict documentation and compliance through tracking, monitoring, and reporting across the value chain, supported by stakeholder engagement and media coverage to foster a culture of accountability. Others highlighted collaboration between governments and industries to balance oversight with industry-driven initiatives. Several countries integrated LRM into broader environmental efforts, such as e-waste management via extended producer responsibility (EPR) schemes and nationally determined contributions. One approach focused on encouraging industry-led initiatives that go beyond regulatory compliance, promoting proactive environmental stewardship.

Technical aspects of life-cycle refrigerant management

Leak prevention

2. Key challenges in preventing refrigerant leaks include equipment degradation combined with limited access to appropriate alternative technologies, particularly in high-ambient-temperature countries; insufficient technician training and certification and servicing tools; and low consumer awareness on the importance of equipment maintenance. Proposed solutions to reduce leaks included enhancing technician training, updating standards, promoting consumer education on preventive maintenance, ensuring proper equipment installation, implementing predictive leak-detection systems, adopting electronic logbooks, and retrofitting older equipment with proper leak detection tools. Collaboration with manufacturers and international organizations was emphasized to improve training and infrastructure.

Recovery, recycling and reclamation

3. Key challenges in this area include the high costs and infrastructure challenges associated with refrigerant recovery, recycling, and reclamation, especially in low-volume-consuming countries, difficulties in maintaining refrigerant purity, the increasing use of refrigerant blends, and regulatory ambiguities between reused and waste refrigerants as defined under the Montreal Protocol and the Basel Convention. Proposed solutions included conducting inventories of refrigerant banks, establishing policy frameworks with incentives for recovery, and engaging stakeholders to develop tailored approaches. Building reverse supply chains,¹ regional laboratories, and public-private partnerships were proposed to enhance access to facilities and expertise.

Destruction of refrigerants

4. Challenges for environmentally sound destruction of refrigerants include financial constraints, inadequate infrastructure, limited access to advanced technologies, the need to upgrade existing facilities for refrigerant destruction, and regulatory hurdles, particularly those related to transboundary movement under the Basel Convention. Proposed solutions included regional collaboration to share resources and facilities, using cost-effective technologies like cement kilns, and exploring innovative small-scale destruction methods. Assessing current infrastructure, establishing clear transport guidelines, building institutional capacity, and creating financial mechanisms such as carbon credits and recovery levies were recommended to support sustainable refrigerant destruction.

¹ The logistic process of returning recovered refrigerant for the purpose of recycling, reclamation or destruction.

Dealing with equipment

5. Key challenges for the management of used and waste refrigerant-containing equipment in Article 5 countries include insufficient infrastructure, high costs, and inconsistent regulations regarding definitions of used versus waste equipment. Recycling chain sustainability is also hindered by difficulties reintegrating materials like plastics and foams. Solutions emphasized regional collaboration for shared recycling facilities and expertise, implementing EPR schemes tailored to national contexts, and improving data collection and reverse logistics chains. Inventory projects funded by the Multilateral Fund and global guidance documents, such as the one being prepared by the Basel Convention, were seen as valuable tools for aligning national efforts and improving end-of-life equipment management.

Financing life-cycle refrigerant management

6. The financial challenges and opportunities for scaling up LRM management identified included the high capital and operational costs of infrastructure and technologies, lack of expertise, and lack of scale in smaller countries. The absence of sustainable business models and long-term financing mechanisms further hinders progress, with existing support from the Multilateral Fund for foundational activities such as support for leak prevention and the servicing sector being insufficient for large-scale LRM implementation.

7. Experts emphasized the need for diverse financing strategies such as EPR, carbon credits, and public-private partnerships. Successful examples, such as tax and refund systems applied by some countries, were highlighted as potential models to incentivize the recovery and destruction of refrigerants. Effective financing requires robust data collection on refrigerants, operational costs and financial needs; strong regulatory frameworks that define stakeholders' roles and ensure transparency and accountability; private sector engagement; and circular business models adaptable to market changes and regulator shifts. It was stressed that LRM should be viewed as a strategic investment with the potential for transformative environmental and economic benefits.

Closing remarks and wrap-up

8. Key takeaways shared by participants in the final session of the workshop included the need for financial support, including from the Multilateral Fund, to initiate LRM, with incentives for recovery and reclamation seen as essential for sustainability; importance of conducting inventories and assessments to inform data-driven policy design; need for collaboration across national and international stakeholders; and need for technician training and certification and institutional capacity-building. There was also broad recognition that no one-size-fits-all solution exists; strategies must be tailored to national contexts. Participants' feedback reflected a sense of urgency, encouraging countries to begin implementing measures immediately, even if incrementally. Finally, the need for a holistic approach that integrates both ozone and climate considerations was acknowledged.

Annex III

REQUESTED INFORMATION ON THE STATUS OF IMPLEMENTATION OF PROJECTS UNDER DECISION 91/66

General

1. Project status: Confirmation that the projects will be completed by the date of completion specified in decision 91/66(c)(iv). Should on an exceptional basis an extension be required, please indicate the reasons for the delay and the proposed revised date of completion.
2. Preliminary inventory results: Approximate quantity of identified used and unwanted controlled substances that have been collected and/or stockpiled (in metric tonnes (mt)). Ideally provide this quantity by controlled substance.
3. Inventory maintenance mechanisms: Whether the country has a mechanism in place to maintain/update the inventory of used and unwanted controlled substances after the date of completion of the project (yes/no).
4. Supporting regulations for refrigerant management: Whether the country implements any of the measures listed in table A below to support effective refrigerant management. If so, please indicate such in the table.
5. Technicians' capability for refrigerant management: Existence of an operational competency-based refrigeration and air-conditioning (RAC) technician certification scheme (yes/no). If yes, kindly clarify if the scheme is mandatory.

Refrigerant management infrastructure

6. Whether the country implements a recovery and recycling scheme (yes/no). If yes:
 - (a) Please identify the controlled substances (e.g., CFC-12, HCFC-22, HFC-134a, R-410A, etc.) reused; and
 - (b) Please provide the approximate quantity of controlled substances reused (in mt), ideally by controlled substance (ideally, annually, but can be cumulative if that is not available).
7. Whether there is an operating reclamation centre in the country (yes/no). If yes, please provide:
 - (a) The number of reclamation centres;
 - (b) Controlled substances the centre(s) is(are) capable of reclaiming; and
 - (c) If available, the approximate quantity of controlled substances reclaimed (in mt), ideally by controlled substance (ideally, annually, but can be cumulative if that is not available).
8. Whether there are mechanisms/testing facilities in place to check the identity of refrigerants and, if so, also their quality/purity.
9. Whether the country has facilities to collect and dismantle end-of-life appliances and/or e-waste for material (including refrigerant) recycling and disposal (yes/no).
10. Whether there is a facility capable of destroying controlled substances in the country (yes/no). If yes:

- (a) Please clarify whether the facility/facilities use a technology approved by the parties for the destruction of the controlled substances identified in paragraph 2, preliminary inventory results;
 - (b) Please provide the number of facilities, and what type (e.g., cement kiln, rotary kiln, plasma arc, etc.);
 - (c) Whether the facility/facilities are operational and, if so, the quantity of controlled substances destroyed (in mt), ideally by controlled substance; and
 - (d) Whether the facility/facilities also destroy other substances (e.g., persistent organic pollutants, hazardous waste, etc.) and, if so, what.
11. Whether the country has ever exported used and unwanted controlled substances for destruction to another country (yes/no).
12. Whether the country has ever imported used and unwanted controlled substances for destruction from another country (yes/no).
13. Other relevant information, if available:
- (a) Any key lessons from the implementation of the project;
 - (b) Identified key challenges to the implementation of the plan for the collection, transport and disposal of used or unwanted controlled substances;
 - (c) Whether there are ongoing or planned initiatives (e.g., national plans, pilot projects, partnerships) related to refrigerant inventories or destruction; and
 - (d) Any other issues the agency would like to bring to the Secretariat's attention.

Table A. Possible measures to support effective refrigerant management

Measure	Yes/No	Comments
Regulation requiring recovery of controlled substances during the servicing of RAC equipment		
Prohibition on venting of controlled substances during installation, servicing and decommissioning of RAC equipment (including establishing penalties for contraventions to the prohibition)		
Regulation requiring leak checking for larger equipment (e.g., above 3 kg of refrigerant)		
Record-keeping practices (e.g., logbooks and equipment logbooks for systems above certain charge)		
Mandatory recovery of controlled substances from containers and equipment at their end-of life		
Regulations and procedures relating to import of recovered refrigerants (to ensure refrigerants declared as recovered are not virgin)		
Prohibition on disposable cylinders		
Extended producer/distributor responsibility or similar regulations ensuring proper collection, recycling and disposal of equipment and its components (including refrigerant) at end-of-life		
Any other relevant regulation (e.g., waste management requirements, hazardous waste classification, etc.)		