UNITED NATIONS

EP

United Nations Environment Programme

Distr.
GENERAL

UNEP/OzL.Pro/ExCom/99/85
21 November 2026

ORIGINAL: ENGLISH

EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Ninety-ninth Meeting
Montreal, 7–11 December 2026
Item 16 of the provisional agenda[1]

UPDATED REPORT ON LIFE-CYCLE REFRIGERANT MANAGEMENT IN LIGHT OF COMPLETED INVENTORY PROJECTS AND NATIONAL PLANS AND OTHER RELEVANT INFORMATION, INCLUDING ON THE MOVEMENT OF CONTROLLED SUBSTANCES FOR DESTRUCTION OR RECLAMATION (DECISION 97/89(c))

Introduction

1. At the Thirty-Fifth Meeting of the Parties to the Montreal Protocol, 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 matters related to life-cycle refrigerant management (LRM) (decision XXXV/11(2) and (4)). In line with that decision, at its 93rd meeting, the Executive Committee requested the Secretariat to prepare, for consideration by the Committee at its 97th meeting, a report providing an overview of the 2024 Technology and Economic Assessment Panel's (TEAP's) report on LRM[2] and the outcomes of the workshop organized by the Ozone Secretariat, 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. At its 97th meeting, the Executive Committee considered the report on LRM prepared pursuant to decision 93/104.[3] The report provided an overview of the TEAP's 2024 report and the outcomes of the workshop, and identified potential opportunities for strengthened support to Article 5 countries for LRM by the Multilateral Fund, grouped under three broad areas: leakage prevention; recovery, recycling and reclamation; and disposal of unwanted refrigerants. It further noted that the national plans being prepared pursuant to decision 91/66 could identify additional approaches based on national circumstances. Following its consideration of the report, the Executive Committee encouraged the bilateral and implementing agencies

[1] UNEP/OzL.Pro/ExCom/99/1
[2] United Nations Environment Programme, *Report of the Technology and Economic Assessment Panel: Decision XXXV/11 Task Force Report on Life-cycle Refrigerant Management*, May 2024 (Nairobi, 2024)
[3] UNEP/OzL.Pro/ExCom/97/87

to intensify their efforts to assist Article 5 countries in finalizing projects under decision 91/66 as soon as feasible and in submitting the final reports and a copy of the resulting national inventories and national action plans, and requested the Secretariat to update the report for the 99th meeting in light of completed inventory projects and national plans and other relevant information, including on the movement of controlled substances for destruction or reclamation, and to prepare, for the 100th meeting, a document on funding modalities, including elements for draft cost guidelines, with a view to considering the establishment of a funding window in line with decision XXXV/11, taking into consideration inter alia the views expressed by the Executive Committee (decision 97/89).

3. The Secretariat has prepared the present report in line with that decision.

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

4. The Executive Committee has approved under the funding window established in decision 91/66 a total of US $10.95 million, plus agency support costs of US $1,128,120, for the preparation of national inventories of banks of waste-controlled substances and the development of national plans for the management of those substances in 128 Article 5 countries and in one region. Following the cancellation of projects in two countries, reports are expected from 126 countries and one region. As originally approved, projects in 33 countries were expected to be completed by December 2025, 25 by May 2026, 30 by December 2026, 12 by May 2027 and 28 by December 2027, with final reports (containing the national inventories and action plans) to be submitted within six months of project completion. Following extensions granted by the Executive Committee, six countries had a completion date of December 2025 and 12 had a completion date of May 2026. In explaining the main difficulties in preparing the inventories and plans, the bilateral and implementing agencies pointed consistently to human-resource capacity constraints at the national and regional levels, rather than to data collection or analysis methods.[4]

5. At the time of finalization of the present document, inventories and national action plans were available for six countries: Ecuador, Kenya, Mexico, Namibia, North Macedonia and Turkmenistan.

National inventories

6. The six inventories were prepared using different methodologies, data sources, sectoral boundaries and assumptions. Some estimated substances contained in installed equipment and products, while others focused more closely on end-of-life equipment or estimated the quantities of controlled substances potentially available for recovery and management. Different approaches included equipment-based bottom-up assessments, consumption or import-based estimates, waste collection records, surveys and combinations of top-down and bottom-up information. For example, Kenya used equipment stock, refrigerant distribution, charge-size and leakage data, while Turkmenistan combined enterprise-level information with national customs and import data; North Macedonia based its assessment primarily on collected waste temperature-exchange equipment that had reached end-of-life.[5] These differences reflect national circumstances and data availability. Detailed information on the scope, substances covered, methodology and quantities estimated is presented in annex I.

National action plans

7. The analysis of the six reports received focuses on the findings of the national inventories and the measures proposed in the corresponding national plans for the management of used or unwanted controlled substances. The document presented at the 97th meeting identified a number of possible approaches for LRM

[4] MLF/IACM.2026/2/2

[5] Including refrigerators, refrigerated display cases, ice machines, air conditioners, including split systems and heat pumps, and other equipment.

under leakage prevention, recovery, recycling and reclamation, and disposal of unwanted refrigerants. The six completed reports contain different combinations of these approaches, as described below.

A. Enhancing leakage prevention

8. Refrigerant leakage is identified as an issue in most of the reports, and countries have included measures to address leakage in their action plans. Some reports identify sectors with relatively high estimated leakage, persistent leakage from particular equipment, or technical barriers to effective servicing. To address those issues, the plans have proposed measures like tighter maintenance and leak checks, appropriate recovery equipment, technician training, regulatory requirements, and retirement of equipment with chronic leakage.

9. Leakage prevention is covered differently across the six reports. Some countries address it directly. Ecuador proposes expanding its "Zero Leaks" initiative, including keeping records of leaks and maintenance, while North Macedonia includes low-loss recovery practices, maintenance scheduling and systematic leak checks. Other countries address leakage more indirectly through good servicing practices, technician training and certification, controls on venting and refrigerant recovery. Namibia and Turkmenistan include proposed regulatory and capacity-building measures that could help reduce refrigerant emissions.

10. The plans also consider the need for additional regulatory measures for leak prevention. Turkmenistan, for example, proposes additional regulatory measures addressing venting, refrigerant recovery during servicing, technician requirements, reporting and technical standards, while Kenya includes technician certification, safe refrigerant handling, and recovery requirements. Across the six plans, the identified measures therefore cover both activities that are already undertaken under HCFC phase-out management plans (HPMPs), Kigali HFC implementation plans (KIPs) or existing national regulations, and additional measures proposed under the action plans, including regulatory requirements, reporting, monitoring and enforcement arrangements needed to coordinate leakage-prevention activities with the recovery and subsequent management of refrigerants.

B. Optimizing refrigerant recovery, recycling and reclamation

11. The reports show that recovery and recycling have been part of ongoing activities under the phase-out/phase-down plans, with different intensities and success rates. Several plans distinguish between large commercial and industrial systems, where equipment owners and larger refrigerant charges can be identified and recovery can be planned directly, and smaller or dispersed sources, particularly household appliances and material handled through informal channels, where small individual charges and dependence on equipment collection or take-back systems make recovery more difficult.

12. Mexico and Turkmenistan therefore prioritize identifiable large users while proposing different aggregation or waste-management arrangements for smaller sources, while Kenya and Ecuador link recovery from household and other small equipment more closely with waste electrical and electronic equipment (WEEE), take-back or extended producer responsibility (EPR) systems. North Macedonia additionally identifies differences arising from the refrigerant itself: mildly or highly flammable refrigerants, ammonia and high-pressure CO_2 require different recovery equipment, handling and safety procedures, and its plan therefore proposes refrigerant-specific technician training and tools. Overall, the plans suggest that a single recovery approach may not be suitable for all sectors and refrigerants, and that recovery strategies may need to differentiate between concentrated and dispersed sources and, where relevant, the safety and handling characteristics of the refrigerant.

13. The six reports show that reclamation depends on more than the availability of reclamation equipment. In some cases, reclamation infrastructure already exists but remains underused because of insufficient or uncertain flows of recovered refrigerant, varying facility readiness, weak collection and transport arrangements, and the need for improved traceability and quality control. In other cases, domestic

reclamation capacity is absent and new facilities are proposed; however, uncertainties remain regarding the quantities that can be collected and whether these would be sufficient to support sustainable operation of a reclamation facility. For countries with relatively small and dispersed refrigerant volumes, establishing a dedicated national reclamation facility may not be economically viable, leading to consideration of regional reclamation arrangements. The reports also identify upstream constraints, including limited recovery and collection systems, transport and storage costs, availability of suitable cylinders, refrigerant identification and quality requirements, and limited financial incentives for recovery. Overall, the reports suggest that sustainable reclamation requires sufficient and predictable quantities of recovered refrigerant, effective collection and transport arrangements, refrigerant identification and quality control, traceability, appropriate regulatory requirements, and a viable financing or business model, in addition to the necessary technical infrastructure.

14. Some experience with operational reclamation systems was reported. Mexico has a network of seven recovery, recycling and reclamation centres in operation, although their utilization, readiness and throughput vary, while Ecuador has two centres with operational reclamation experience, but relatively limited quantities processed to date. Plans included measures to strengthen recovery and collection systems to ensure sufficient and regular flows of refrigerant; identification and segregation to avoid contamination; appropriate cylinders, storage and transport; quality testing and traceability; and regulatory measures requiring recovery and restricting venting. Overall, the plans approach reclamation as an integrated chain from recovery and collection through reclamation and reuse, with refrigerant unsuitable for reclamation directed to destruction.

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

15. The six plans reflect several elements of the approach identified at the 97th meeting, although the level of detail varies. Some plans propose old-for-new rebates, equipment-return pilots, retail or municipal take-back arrangements, and incentives for delivering intact end-of-life appliances to authorized collection centres, thereby creating opportunities to recover refrigerant before dismantling. Others recognize equipment replacement and take-back as useful recovery channels but focus their proposed support on collection, recovery and treatment rather than financing the replacement equipment itself. EPR is considered in several plans as a mechanism for assigning responsibility and financing the collection and treatment of end-of-life equipment, while energy-efficiency standards or the introduction of more efficient low-global-warming-potential equipment are also mentioned in some cases. However, none of the plans reviewed clearly develops the use of the scrap value of replaced equipment as a financing source, and the direct integration of equipment replacement, improved energy efficiency and refrigerant recovery is more developed in some plans than in others.

Enabling the implementation of extended producer responsibility schemes

16. The reports indicate varying levels of development of EPR approaches. In some countries, EPR frameworks already assign responsibility for end-of-life electrical and electronic equipment to manufacturers and importers, thereby providing a means of financing the collection and subsequent treatment of such equipment. For example, North Macedonia has producer responsibility arrangements under which producers may transfer their obligations to licensed Producer Responsibility Organizations, which have established collection points for electrical and electronic equipment, including equipment containing controlled substances. Kenya similarly has an EPR framework for electrical and electronic equipment and a licensed Producer Responsibility Organization for e-waste.

17. Some plans propose incorporating or further developing EPR as part of their action plan. Ecuador, for example, assigns manufacturers and importers a role in financing and organizing EPR or equivalent systems, including arrangements for take-back and collection of end-of-life equipment. Namibia proposes an import levy/EPR scheme as a longer-term financing mechanism for refrigerant management, with responsibilities for collection and treatment shared between Government and the private sector.

Turkmenistan identifies EPR among the mechanisms to be further explored for financing and managing used or unwanted controlled substances.

Exploring feasibility of enabling regional approaches to reclamation of controlled substances

18. The six plans show that regional reclamation received limited consideration compared with national reclamation. Namibia considered a regional approach because the quantities expected to be available for reclamation nationally were considered insufficient to support a dedicated domestic reclamation facility; the report refers to the possibility of accessing reclamation capacity in the region, including facilities in South Africa, and identifies collection, aggregation, refrigerant analysis, storage and quality requirements as prerequisites. North Macedonia proposes establishing national reclamation capacity but also identifies the possibility of developing the facility's regional-hub capability at a later stage; however, the plan does not identify participating countries or detail the arrangements necessary to enable the transboundary movement of recovered refrigerants to the reclamation centre.

19. The other four plans do not develop a regional reclamation approach. Ecuador focuses on strengthening its two existing national reclamation centres and assessing additional national capacity; Turkmenistan proposes establishing a national reclamation system; and Mexico proposes using and strengthening its existing network of national recovery, recycling and reclamation centres. Kenya also focuses on developing reclamation capacity nationally. Thus, among the first six plans, Namibia expressly considered accessing regional reclamation capacity and North Macedonia envisaged possible future regional use of national capacity, while the remaining four plans focused on national arrangements. The reports provide little information so far on the more detailed elements of a regional reclamation model identified in document UNEP/OzL.Pro/ExCom/97/87, such as participating countries, a shared business model, cross-border circulation of cylinders, or arrangements governing the movement of recovered refrigerant between countries.

Strengthening reclamation of HFCs in Article 5 countries with HFC-based refrigeration and air-conditioning (RAC) manufacturing

20. None of the six national plans proposed requiring RAC manufacturers to use a minimum percentage of reclaimed HFCs in manufacturing. However, only two out of the six countries that submitted plans have local RAC manufacturing; national action plans submitted by other Article 5 countries with manufacturing may consider this element.

C. Addressing disposal of unwanted refrigerants

21. Several of the six plans address the same issues identified in document UNEP/OzL.Pro/ExCom/97/87, particularly the relationship between available volumes, destruction capacity, transport/export costs and financing. Namibia and Turkmenistan, in particular, considered the quantities expected to require destruction in assessing whether dedicated national capacity would be justified, and examined aggregation and regional or international destruction as alternatives. The plans also identify different approaches to financing those activities, including producer responsibility arrangements, contributions by equipment owners, import levies or fees, public financing and international support. However, the plans do not consistently provide a breakdown of destruction, transportation and transaction costs.

22. The six national plans identify different disposal needs and approaches according to the quantities expected to require destruction and the availability of existing national infrastructure. The approaches considered include the use or qualification of existing national destruction facilities; temporary storage and consolidation until sufficient quantities are available; export to existing destruction facilities in other countries; and, in some cases, consideration of regional or smaller-scale destruction options. For example, Ecuador and Mexico have destruction facilities and identify existing or previously demonstrated national

destruction routes, while Namibia proposes arrangements with destruction facilities in South Africa and Turkmenistan envisages temporary storage followed primarily by export or a possible future regional route. The plans also address associated requirements to varying degrees, including segregation and storage of non-reclaimable substances, transport and consolidation, transboundary movement procedures, monitoring and verification, and financing of destruction.

Exploring the feasibility of using flexible mobile destruction units

23. Of the six national plans, only Namibia considered the use of portable destruction units. Its plan proposes evaluating portable units capable of serving multiple locations, together with other small-scale destruction technologies, followed by a demonstration of the most promising option to assess its performance, costs, environmental impacts and operational requirements. The other five plans did not propose mobile destruction units, instead considering existing or potential national destruction facilities, cement kilns, export for destruction or regional destruction arrangements, depending on their national circumstances.

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

24. The reports provide some examples of enterprises and other operators collecting or receiving recovered refrigerants for subsequent reclamation or destruction, although a fully integrated commercial service comparable to the model identified at the 97th meeting is not clearly reported.

25. Several of the plans identify a need for financial support for the destruction of refrigerants that cannot be reclaimed, although the scope and level of detail vary. Some plans provide estimated costs for destruction or for activities required to enable destruction, including temporary storage, testing, consolidation, packaging, transport, destruction trials and regional or international disposal. Others identify destruction as an area requiring additional financing without specifying a dedicated budget. The plans also consider a mix of financing sources, including Multilateral Fund and other international support, national resources, producer or end-user contributions and other sustainable financing mechanisms. This indicates that, particularly where quantities are small or domestic destruction capacity is unavailable, the funding requirement extends beyond the destruction process itself to the collection, consolidation, storage, transport and verification needed to deliver refrigerant to an environmentally sound destruction route.

26. The six national plans provide limited information to distinguish between disposal of controlled substances other than halons, HCFCs and HFCs and disposal of all controlled substances. The plans generally address disposal of mixed ODS and HFC streams and do not identify campaigns or funding requirements corresponding specifically to phased-out controlled substances.

Transboundary movement of controlled substances for destruction or reclamation

27. Used, unwanted or contaminated controlled substances may constitute wastes under the Basel Convention and therefore become subject to its provisions on transboundary movements. This may also apply when controlled substances are contained in discarded refrigeration and air-conditioning equipment or other waste electrical and electronic equipment. The Basel Convention's prior informed consent procedure requires notification to, and consent from, the countries concerned before covered wastes are moved across borders and is intended to ensure that the wastes are ultimately managed in an environmentally sound manner. In practical terms, countries considering regional or overseas reclamation or destruction therefore need not only to identify suitable treatment facilities, but also to establish arrangements for the collection, safe storage and transport of recovered substances, classification and documentation of the waste, authorization of the shipment, and coordination among the exporting, importing and, where applicable, transit countries.[6]

[6] The Ozone Secretariat, together with OzonAction and the Basel Convention, prepared a practical guide on transboundary movements of Montreal Protocol controlled substances and related equipment considered waste under the Basel Convention, available at: https://ozone.unep.org/system/files/documents/UNEP%20Practical%20Guide.pdf.

28. The six plans show different levels of consideration and understanding of the arrangements necessary for the transboundary movement of recovered controlled substances and of used equipment containing controlled substances. The action plans for Namibia and Turkmenistan provide detailed arrangements. Namibia proposes exporting non-reclaimable refrigerants to destruction facilities in South Africa and identifies the supporting measures required, including standardized export documentation, pre-approval for regular shipments, staff training, digital shipment tracking, coordination with customs and compliance with the Basel Convention. It also proposes framework agreements, bulk shipment arrangements and joint monitoring and verification with the receiving facilities. Turkmenistan describes the Basel Convention prior informed consent procedure in detail, as summarized below. The plan notes that the procedure may take several months and proposes consolidating and storing non-reclaimable substances until an authorized regional or international destruction route becomes available.

29. The general procedure, as mentioned in the Turkmenistan action plan, includes the following:

(a) Determine the status of the waste under the applicable national legislation, including whether it is classified as hazardous waste;

(b) Consult the national competent authority for the Basel Convention to confirm applicable requirements, documentation and expected timelines;

(c) Identify an appropriate facility and carrier, including an overseas treatment facility and a carrier holding the necessary permits, and establish contractual arrangements for the environmentally sound management of the waste;

(d) Submit a notification to the competent authority of the exporting country, which transmits it to the competent authorities of the importing country and, where applicable, transit countries;

(e) Obtain the required written consent from the importing and transit countries and issue the Movement Document. Consent is for a specific consignment and is generally valid for a specified period;

(f) Undertake the shipment, with the Movement Document accompanying the waste throughout its transport and being completed or signed by the relevant parties along the chain;

(g) Confirm receipt and treatment of the waste. Upon arrival, the receiving facility confirms receipt of the shipment and subsequently provides confirmation of its treatment to the relevant competent authorities;

(h) Labelling, packaging and safety: Appropriate packaging, labelling and documentation are required for the transport of ODS and HFC waste, together with compliance with applicable dangerous-goods transport requirements. This may include the use of certified pressure vessels and compliance with applicable requirements (e.g., the International Maritime Dangerous Goods (IMDG) Code for maritime transport). These measures support safe handling and facilitate regulatory and customs controls during shipment and transit; and

(i) Selection of the destination country and facility: The receiving facility should be selected taking into account logistical feasibility, appropriate reclamation or destruction technology, relevant permits, and experience in handling transboundary waste movements under the Basel Convention. As national or regional requirements may be more stringent than the Basel Convention requirements, the applicable rules of the importing and transit countries also need to be verified in advance, including through consultation with the relevant competent authorities or national focal points.

30. The remaining plans address the issue in less detail or treat it as a contingency. Kenya proposes a regional workshop on transboundary movement of ODS and fluorinated gas waste, indicating a need for regional information exchange and capacity-building. Mexico identifies export for destruction as a legally available route subject to Mexican authorization and Basel Convention controls but notes that such exports would be a contingency in light of local capacity to destroy controlled substances, further noting no exports were undertaken under the demonstration project for the disposal of ODS funded under decision 58/19. North Macedonia has no domestic destruction capacity and envisages storage pending feasible international destruction arrangements, while Ecuador focuses mainly on domestic reclamation and destruction infrastructure, with traceability and logistics as the principal identified gaps.

31. Among the six reports, practical experience with exporting recovered controlled substances appears limited. Kenya documents recovered refrigerant being exported to South Africa for reclamation in one instance (as reported by a WEEE centre), while several other plans consider future export for reclamation or destruction where domestic capacity is unavailable or uneconomic. The latter plans focus mainly on the arrangements needed for such exports, including accumulation and storage, Basel Convention procedures, authorized transport and confirmation of final treatment, rather than reporting substantial previous export experience. The WEEE centre highlighted challenges faced in the willingness of consumers and contractors in handing over broken or faulty RAC appliances for recovery, recycling and reclamation despite having the capacity to recover and store the controlled substances. In addition, the Kenya report does not provide details on the transboundary movement and the application of the Basel Convention for this export.

32. The plans therefore consider transboundary movement mainly in terms of enabling export for destruction, with limited detail on export for reclamation.

Additional elements emerging from the six reports

33. In addition to elements identified in document UNEP/OzL.Pro/ExCom/97/87, the national plans submitted to date contain several operational approaches that were either not specifically addressed or were less developed in that document:

(a) Greater integration between refrigerant management and WEEE systems. This is relevant particularly for domestic and standalone equipment, where refrigerant collection depends on equipment entering an organized end-of-life channel. North Macedonia distinguishes bulk refrigerant recovery from collection of waste equipment and links the latter to municipal infrastructure, producer financing and household participation. Kenya similarly proposes equipment and training for WEEE centres as part of its collection arrangements;

(b) Traceability through the complete management chain. Ecuador proposes following substances from source to final destination using manifests, facility mass balances, quality certificates and destruction certificates. Mexico proposes batch identification, chain-of-custody arrangements and independent verification of quantities physically recovered and treated. These approaches add an operational monitoring dimension to the elements identified in document UNEP/OzL.Pro/ExCom/97/87;

(c) Related to traceability, another approach contained in the Mexico plan is to link project payments to quantities of refrigerant that have been physically recovered, weighed, identified and routed to reclamation or destruction, subject to verification. The approach is proposed specifically for that national plan and has not yet been demonstrated through implementation. It nevertheless provides an additional model that can be monitored as implementation experience becomes available;

(d) The action plan for North Macedonia proposed a national digital tracking platform, comprising an online database and mobile application, to enable technicians to record

refrigerant types and quantities and track servicing and maintenance activities. The system would link individual equipment records across their life cycle, including refrigerant recovery during servicing and subsequent collection at end of life, thereby allowing national inventories to be updated using operational data rather than relying mainly on periodic data collection, while also helping to avoid double counting between refrigerant recovered during servicing and refrigerant contained in equipment entering the waste stream;

(e) The North Macedonia action plan proposes circular economy approaches by promoting the reuse of reclaimed gas, including by establishing commercial rules that favour using certified reclaimed stocks for maintaining existing cooling systems and thereby decreasing the need for virgin imports. The plan also proposes partnering with manufacturers to introduce sustainable product designs that allow easier refrigerant recovery and modular recycling at end-of-life at a later stage; and

(f) Separate management of blowing agents contained in foams also emerges prominently in several plans. North Macedonia identifies mechanical extraction as necessary for blowing agents remaining in insulation foam rather than conventional refrigerant recovery. Ecuador establishes a separate component for foams, including characterization, controlled dismantling and treatment, while Mexico proposes a separate foam workstream to examine alternative treatment routes. The management of blowing agents contained in insulation material would require considerably different arrangements than those required for the management of refrigerants in equipment circuits.

34. Collection, storage and traceability, which are not commonly included in HPMPs or KIPs, are identified in the plans as important elements for ensuring that recovered refrigerant reaches recycling, reclamation or destruction facilities, an issue that was only briefly mentioned in the document UNEP/OzL.Pro/ExCom/97/87.

Linkage to destruction of persistent organic pollutants and other chemical wastes

35. The six plans provide limited evidence of linkages between the management or destruction of unwanted controlled substances and persistent organic pollutants (POPs), or Global Environment Facility (GEF)-funded chemicals and waste projects. One plan identifies the GEF as a potential source of co-financing for the implementation of LRM activities but does not link this to a specific POPs project. Other plans consider using existing hazardous waste infrastructure, including cement kilns and hazardous waste treatment facilities, which could offer opportunities for coordination with other hazardous waste streams. Relevant experience outside the six plans demonstrates that ODS and POPs have previously been managed together including the demonstration projects on ODS disposal in Georgia and a regional project in Bosnia and Herzegovina, Croatia and Montenegro approved under decision 58/18,[7] and under a GEF-supported regional project,[8] suggesting potential opportunities for economies of scale, particularly where quantities of unwanted controlled substances are too small to support dedicated destruction arrangements. However, such synergies are not yet systematically incorporated into the six national action plans.

Linkage to Basel Convention and PACE II

36. The Basel Convention is considered in several of the plans, particularly where unwanted refrigerants or equipment may need to be exported for reclamation or destruction. However, explicit linkages with Partnership for Action on Challenges relating to E-waste (PACE) II under the Basel Convention are not evident in the six plans. PACE II is nevertheless relevant to LRM, as guidance being developed under the PACE II addresses the environmentally sound refurbishment, repair and end-of-life management of

[7] See paragraphs 13-17 and 42-46 of Annex II of document UNEP/OzL.Pro/ExCom/82/21.
[8] https://www.thegef.org/projects-operations/projects/5300

refrigerators and other cooling and heating equipment, providing an opportunity for greater coordination between implementation of the Basel Convention and the Montreal Protocol.

Principal cost components

37. The national plans provide information to varying degrees on the resources that could be required to implement LRM activities. The proposed cost estimates are not directly comparable, since they cover different implementation periods, quantities, existing infrastructure, accounting boundaries and combinations of activities. Some include substantial investment in physical infrastructure or payment for treatment of specified quantities, while others focus more strongly on establishing regulatory, collection, institutional or other system elements. Detailed information on the cost estimates and activities included is presented in annex II.

38. Notwithstanding those differences, the plans identify a number of recurring categories of cost involved in establishing and operating an LRM system: regulatory and institutional measures; recovery and collection; cylinders and storage; identification, analysis and segregation; transport and consolidation; recycling or reclamation; destruction; end-of-life equipment; information and traceability systems; training; and monitoring and verification.

39. The plans also provide different approaches to financing continued operation. Ecuador envisages progressively transferring recurring costs to service fees, producer and importer contributions, EPR arrangements and public oversight budgets. Turkmenistan identifies state budget resources, public-private partnerships, private investment and international financing among potential sources. Kenya identifies establishment of a sustainable financing mechanism as one of the four core processes of its strategy. Mexico presents a further financing model in which eligible support would be linked to verified net incremental costs after deducting revenues from reclaimed refrigerant, contributions from users or operators and costs already financed through the HPMP or KIP. Its national planning assumptions differentiate collection and consolidation, identification, reclamation, domestic destruction and treatment of small or dispersed quantities, while treating the resulting values as planning ceilings rather than automatic payment rates.

Approaches identified at the 97th meeting that are less evident in the six reports

40. A few approaches proposed in document UNEP/OzL.Pro/ExCom/97/87 were not, or only marginally, reflected in the six national plans. These include establishing regional reclamation facilities with detailed arrangements for participating countries; requiring RAC manufacturers to use a minimum percentage of reclaimed HFCs; shared use of mobile destruction units; and establishing guarantee/collateral or revolving-fund mechanisms to facilitate transboundary shipments of recovered controlled substances. Additional action plans submitted by Article 5 countries may include consideration of such approaches.

Recommendation

41. The Executive Committee may wish to note the updated report on life-cycle refrigerant management in light of completed inventory projects and national plans and other relevant information, including on the movement of controlled substances for destruction or reclamation (decision 97/89(c)) contained in document UNEP/OzL.Pro/ExCom/99/85.

Annex I

SUMMARY OF INVENTORIES

Country	Scope	Substances	Methodology	Estimated bank
Ecuador	Residential, commercial, and mobile air-conditioning; domestic, commercial, industrial and transport refrigeration; fire extinguishing equipment; closed-cell foam.	HCFCs and HFCs; HCFC-141b in foam.	Hybrid top-down substance-supply and bottom-up equipment-cohort model using imports, stock, charges, technology shares, lifetimes and retirements; separate cohort model for foam. Validated through records, surveys and consultations.	**9,542 mt** RAC: 6,895 mt HFCs; 805 mt HCFCs; Foam: 1,842 mt HCFC-141b.
Kenya	Residential, commercial and mobile air-conditioning; domestic, commercial, industrial and transport refrigeration; Foam limited to domestic and commercial stand-alone appliances.	ODS and HFCs	Tier 2 equipment-stock approach using sales/stock, refrigerant shares, charges and leakage assumptions; foam estimated from equipment numbers. Validated through survey and consultations.	**2,594 mt** 728 mt ODS; 1,866 mt HFCs
Mexico	Residential, commercial and mobile air-conditioning; domestic, commercial, industrial and transport refrigeration; closed-cell foam.	HCFCs and HFCs; HFC in closed-cell foam.	Bottom-up equipment model using stock, technology shares, charges, lifetimes and leakage; national statistics, customs and market data reconciled with consultations. Foam bank estimated through cohort-survival model.	**167,739 mt** RAC: 118,971 mt HFCs; 10,891 mt HCFCs; Foam: 37,877 mt HFCs
Namibia	Residential, commercial and mobile air-conditioning; domestic, commercial, industrial and transport refrigeration.	ODS and HFCs	Equipment approach using fieldwork, questionnaires, household/vehicle statistics and customs data; assumed charges, lifetimes and market shares. GDP growth used for some projections; refrigerant leakage not deducted.	**913 mt** 393 mt ODS; 520 mt HFCs
North Macedonia	Formally collected waste temperature-exchange equipment (TEE), 2020-2024; refrigerant circuits and insulation foam.	ODS and HFCs	Equipment approach using officially reported waste-equipment mass and assumptions on equipment composition, unit weight, refrigerant charge, leakage, residual charge, equipment vintage and foam content; supplemented by servicing-sector recovery records.	**89 mt** in collected end-of-life TEE (2020–2024) RAC- 46 mt Foam- 43 mt Inventory covers substances in formally collected waste equipment, not the national installed stock.
Turkmenistan	Residential, commercial and mobile air-conditioning; domestic, commercial,	ODS and HFCs	Bottom-up: enterprise questionnaires, and field surveys; Top-down: customs/import data, National Ozone Unit data.	**3,819 mt** 407 mt ODS; 3,412 mt - HFCs

	and industrial refrigeration; fire suppression; aerosols.		Validated using inventory software and expert assessment.	

Annex II

SUMMARY OF ACTION PLANS INCLUDING ESTIMATED COSTS

Country	Estimated costs	Implementation period	Coverage / main cost elements
Ecuador	US $2,500,000	Five years	US $300,000 regulation and governance; US $400,000 large users; US $450,000 small users; US $350,000 foams; and US $1,000,000 common measures covering reclamation centres, logistics, destruction, traceability, monitoring, and sustainability. Financial planning envisages initial project support followed by a gradual transition to national financing through tariffs, EPR, revenues from reclaimed refrigerants and public budgets, for recurrent costs, and possible complementary climate financing mechanisms for expansion or innovation.
Kenya	Not specified	Not specified	Activities identified include policy and regulatory measures; sustainable financing/EPR; collection; recovery and storage equipment; training; reclamation and destruction infrastructure; WEEE-centre support; and pilot incentives. Potential funding sources include project support, EPR, levies, fees, grants and other mechanisms, including possible complementary climate financing mechanisms.
Mexico	US $5,350,000	Six years	US $5,000,000 for the refrigerant-bank action plan and US $350,000 for a separate foam workstream. Financing envisages project support as the main source during implementation, followed by an increasing user/operator contribution and revenue generation, leading to post-project financing.
Namibia	Indicative range: approximately US $900,000–US $1,600,000	10 years	Indicative activities include regulation and coordination; technician and operator capacity; collection, storage and transport infrastructure; recovery/recycling/reclamation; export or regional destruction arrangements; monitoring; and possible domestic reclamation facility. Proposed funding sources include project support, EPR/levy, and possible complementary climate financing mechanisms.
North Macedonia	US $2,025,000	2027–2034	US $350,000 for system foundations; US $1,510,000 for infrastructure scaling; and US $165,000 for circular-economy integration, monitoring and related research and development. Proposed funding sources include project support and other external support for capital investment, with ongoing operations financed through EPR fees and potential regional cost recovery from reclamation services.
Turkmenistan	US $2,250,000	2026–2045	Activities include regulatory and enforcement measures; data collection and periodic inventories; regional recovery and recycling centres; reclamation infrastructure; collection, transport and storage; training and certification; digital tracking and reporting; destruction pathways; awareness-raising; technical standards and procedures; and coordination and monitoring. Financing is envisaged from project support, government resources, public-private partnerships, private-sector resources, the GEF, and other permitted sources.