

# Study on the Collection and Treatment of Unwanted Ozone-Depleting Substances in Article 5 and Non-Article 5 Countries



**Final Report**

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## **Executive Summary**

Over 190 countries have signed the Montreal Protocol, adopting phase-out schedules for the production and consumption of ozone-depleting substances (ODS). However, many stocks of ODS exist worldwide, such as those held by industrial and commercial users, stored in containers, and installed in old refrigeration and air-conditioning equipment. Indeed, the Intergovernmental Panel on Climate Change in collaboration with the Technology and Economic Assessment Panel (IPCC/TEAP 2005) estimates that there were approximately 5.2 million metric tons of ODS in global banks in 2002. Of these banks, the Montreal Protocol's Technology and Economics Assessment Panel (TEAP) estimates that 1 million metric tons were available in Article 5 and non-Article 5 countries for recovery and destruction, although a sizeable portion of those would require significant effort for collection (TEAP 2002a). To prevent harmful emissions of ODS, which are also potent greenhouse gases, it is critical that unwanted ODS be properly recovered and ultimately destroyed. However, in managing stocks of unwanted ODS, countries faces many challenges, including informational, economic, logistical, and legal barriers. This is especially true in Article 5 countries, where resources are more limited.

The overall objective of this study is to obtain comprehensive knowledge from non-Article 5 countries to be used as a guide by Article 5 countries in establishing appropriate management systems for the treatment of unwanted ODS. The report aims to provide insight into the relevant framework conditions (cultural, legal and economic) under which different approaches have been established in non-Article 5 countries, and how these conditions and lessons learned may apply to Article 5 countries that may decide to adopt similar practices. In addition, the report aims to provide comprehensive understanding of the challenges faced by Article 5 countries vis-à-vis the destruction of ODS (both in bulk and in equipment), and how such challenges may influence the successful application of non-Article 5 ODS destruction strategies in Article 5 countries.

To do so, this study assesses ODS management programs and procedures in place in the following nine countries: Australia, Canada, the Czech Republic, Colombia, Germany, India, Japan, the United Kingdom, and the United States. The findings presented in this report are based on a desk study, questionnaires, and field visits that were conducted in November through December of 2007.

### **Program Approaches**

In the two Article 5 countries reviewed in this report—Colombia and India—the management of used/unwanted ODS is still in its nascent stage, with initial programs for training technicians and disbursing ODS recovery equipment underway, but procedures for the collection, reclamation, and destruction of ODS are not yet established. In the non-Article 5 countries whose practices were reviewed for this report, ODS management strategies have been developed and are being carried out with varying levels of success. All have passed a ban on the venting of ODS and have required the licensing of technicians that work with ODS (at least those in the refrigeration/AC sector). Additionally, some countries have established standards for the recovery of refrigerant and foam from appliances at disposal and/or implemented special requirements to address the commercial refrigeration/AC sector. The legislative approaches of the non-Article 5 case study countries are summarized in Exhibit ES-1.

**Exhibit ES-1: Comparison of Legislative Approaches in Non-Article 5 Case Study Countries**

Country	Ban on Venting ODS Refrigerants	License/ Certification Required for Refrigeration/ AC Technicians	Commercial Refrigeration/ AC Equipment	Domestic Refrigerated Appliances		
			Reporting Requirements for Refrigerant Recovery Operators in the Commercial Sector	Foam Recovery Required at Appliance Disposal	Standard for Refrigerant Recovery at Appliance Servicing and/or Disposal	Standard for Foam Recovery at Appliances Disposal
Australia	✓	✓			✓	
Canada	✓	✓				
Czech Rep.	✓	✓		✓		
Germany	✓	✓		✓	✓	✓
Japan	✓	✓	✓	✓ <sup>a</sup>	✓ <sup>b</sup>	
UK	✓	✓		✓	✓	✓
US	✓	✓			✓	

<sup>a</sup> Japan requires the recovery of all fluorocarbons, not just ODS, during the disposal of appliances.

<sup>b</sup> Industry (not regulatory) standards apply to the recovery of refrigerant in Japan.

In addition to the regulatory approaches noted above, many of the non-Article 5 case study countries have implemented a range of other approaches to collect and dispose of unwanted ODS. In particular:

*Domestic Appliance Disposal* –The three European Community countries and Japan have passed laws requiring producer responsibility programs, mandating the recovery of both refrigerant and foam ODS. The US has launched a voluntary partnership program to properly recycle refrigerators and recover ODS refrigerant and foam.

*Bulk ODS Disposal* –Australia and Canada have implemented producer responsibility programs in which rebates are provided for the return of used refrigerant; the collected refrigerant is destroyed.

*Mobile Air Conditioners* –Japan has passed a law requiring the recovery and destruction of fluorocarbons from MACs, as well as the recycling of parts at vehicle end of life. In response, industry has implemented a recycling program under which end of life vehicles are sent to registered recovery operators, who recover ODS and are paid based on the number of MACs and quantity of refrigerant recovered.

*Halon Banking* – In the three European Community countries and Australia, the use of halons is banned in all non-critical uses, while the US and Japan allow its use in existing systems. Many countries have established central halon banks, where halon is purified and stored for critical use or destruction. Critical uses are generally closely monitored in order to prevent misuse. Specifically, Australia, Canada, the Czech Republic, Japan, the US, and the UK all have established halon banks of some form.

## Key Findings

The key findings derived based on the desk study, country visits, and country questionnaires reflect lessons learned in non-Article 5 countries that may be applicable for the management of unwanted ODS in Article 5 countries, as well as factors that may be important for Article 5 country governments to consider when creating a strategy for managing unwanted ODS. These factors include the country’s size, economy, regulatory frameworks, institutional capacity, geography, population, transportation infrastructure, and awareness of environmental issues. The major findings of the study are:

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- The experience of the countries assessed in this study shows that regulations are necessary for any ODS management scheme, but are not sufficient to ensure the proper disposition of ODS, be it wanted or unwanted. The success of regulations is closely tied to (a) industry outreach to build a strong base of support among stakeholders, (b) education/training to ensure that requirements are understood, and (c) enforcement structures (including incentives to recover and disincentives for not doing so) to ensure compliance.
- In developing a strategy for managing unwanted ODS, several scoping decisions must be made at the country level, including those related to: (1) whether to recover ODS refrigerant alone or to also recover ODS blowing agents in foam; (2) which sectors to include, since not all equipment types lend themselves equally to cost-effective ODS recovery; and (3) whether to develop capabilities for reclamation and/or destruction of collected non-recyclable ODS.
- The cost of unwanted ODS recovery and reclamation or destruction is a primary obstacle in achieving better ODS management in Article 5 countries. Thus, generating cash flow by creating economic incentives for recovery, reclamation, and destruction is vital to the success of a used/unwanted ODS management strategy.
- Country geography and infrastructure are key considerations in developing unwanted ODS management strategies, as much of the effort and cost of reclaiming or destroying ODS is a result of transportation needs. The establishment of bulk ODS or appliance collection programs beyond urban areas may not be economically viable or beneficial from an environmental (climate) perspective.
- Exporting ODS for destruction often can lead to delays, backlog issues, and administrative complications with international conventions (e.g., Basel). For countries with large annual quantities of unwanted ODS that do not have easy access to ODS destruction technologies (i.e., in-country or in nearby countries), the best option may be to pursue destruction options domestically. For cost efficiency, upgrading existing destruction facilities (i.e., cement kilns or hazardous waste facilities) can help reduce burden, although significant time and effort will still be required to plan, approve, and implement plant modifications. For countries with smaller quantities of unwanted ODS, new facilities will not be cost-effective to build or operate, and so export requirements need to be clarified and streamlined.

## **Recommendations**

Based on the experiences and lessons learned from the seven non-Article 5 countries and two Article 5 countries reviewed in this study, there are a number of approaches and program designs that can be adopted to achieve success. While the “recipe” for success will depend on unique country circumstances, overarching recommendations that apply to all countries are listed below. Ultimately, it must be recognized that the term “unwanted” ODS is relative; although “unwanted” ODS materials largely pose a burden to Article 5 countries in terms of their ultimate disposition, they can in fact have value. Realizing and extracting the value in “unwanted” ODS is critical for stimulating their recovery and cost-effective disposition.

### ***Scope of Unwanted ODS Management***

1. Article 5 countries may consider targeting specific end user sectors for ODS recovery/reclamation/destruction, since such activities may not be financially viable in all sectors. The best targets are those sectors where most ODS can be recovered with a relatively low-level of effort (i.e., refrigeration/AC, ODS stockpiles), and/or where most control can be exerted on stakeholders. Because of high global demand for halons and the nature of the fire protection sector (i.e., relatively few players, generally high industry standards for responsible use), the refrigeration/AC sector warrants the most attention in terms of developing ODS end-of-life management strategies in Article 5 countries. In particular, recovery from commercial refrigeration/AC applications, especially those where individual facilities comprise a large installed base, are likely to be some of the most cost effective opportunities.

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2. Any management scheme that targets refrigerant, foam, and/or fire extinguishing agents should address all halogenated substance types, including ODS and HFCs, to maximize environmental benefit and ensure long-term sustainability of any programs and markets that are developed on their basis. The facilities and procedures developed to handle ODS are largely applicable to the high-GWP HFCs.

***Regulations, Enforcement, and Education***

3. Countries should enact regulations that specifically prohibit venting of ODS and require the use of recovery equipment (at least in key sectors); a legal mandate is needed for any ODS management scheme to be successful. Even an industry-led product stewardship scheme will achieve greater participation and success if a government mandate supports it, creating a level-playing field by requiring all stakeholders to be involved. If regulation is selected as the primary means for managing end-of-life ODS, a strong enforcement regime is a precondition for success, particularly if cost dynamics may be a disincentive for compliance.
4. Technician certification in the refrigeration and air conditioning sector should be mandatory. Linking certification/licensing to refrigerant purchase has been highly successful means for ensuring the training of technicians in the servicing sector in non-Article 5 countries. While it may be difficult to reach all appropriate entities and individuals, it is important to provide training and conduct outreach efforts for those who deal with equipment at end of life. In many Article 5 countries, this type of training may be most needed for scrap metal collectors, and while such training should be addressed under Phase-out Management Plans or through HCFC Phase-out activities, it should be recognized that it may be difficult to implement and will achieve varying degrees of success.
5. In any unwanted ODS management approach, accountability is key; the program must balance the need for recordkeeping/reporting requirements with the administrative burden that these requirements will entail. At a minimum, reclamation companies, destruction facilities, and appliance demanufacturing facilities should record and report data to ensure best practices and allow for program success to be tracked and improved, as needed. Such reporting would provide significant benefit by allowing government and industry to assess national trends and implement policy or programmatic changes needed to increase recovery or plant efficiency.

***Consideration of Other Multilateral Environmental Agreements and Institutions***

6. The MLF Secretariat should work with the Basel Convention Secretariat to streamline and harmonize waste definitions and export requirements. Waste ODS falls under the jurisdiction of the Basel Convention as an organohalogen, and the Parties to the Basel Convention have already adopted an ISO standard to distinguish ODS destined for destruction from ODS destined for reclamation. Further work can be done, however, to ensure that unwanted ODS that needs to be destroyed is not illicitly shipped as non-waste ODS, outside the jurisdiction of Basel. In addition, the MLF and the Basel Secretariat should work together to ensure that the Prior Informed Consent shipping procedure is as clear and streamlined as possible for ODS shipment. Finally, further opportunities may exist for the MLF Secretariat to collaborate through other global chemicals management initiatives, as described under Recommendation 13.
7. The MLF Secretariat should coordinate with the Global Environmental Facility (GEF) Secretariat in assisting Article 5 countries to account for their chemical waste streams and to identify safe disposal strategies, particularly for halogenated wastes, including ODS and POPs. In addition, the GEF and MLF Secretariats should continue to look for other cross-focal area synergies, including those associated with containment and destruction of ODS and other high-GWP gases that result in climate and ozone co-benefits.

### ***Program Funding and Economic Incentives***

8. It is critical that recovery and reclamation/destruction not impose a cost burden on end-users. At the most basic level, end-users should not have to pay for reclamation/destruction. Creating economic incentives—or at the very least removing disincentives—is important for the success of an unwanted ODS management strategy. For example, countries could consider offering a rebate on the return of used ODS, but must have sufficient monitoring and enforcement to ensure that this does not lead to problems, such as illegal ODS imports or fraudulent return of non-ODS substances. In order to provide these incentives, however, funding will be needed.
9. Funding mechanisms currently used in non-Article 5 countries include ODS levies (e.g., tax per kg of refrigerant imports/production), municipal taxes, and taxes on new equipment. Possible options for A5 countries could include direct assistance from the MLF, and/or through appropriate carbon trading platforms (e.g., Clean Development Mechanism [CDM], Chicago Climate Exchange [CCX])—using an approved ODS destruction methodology. Currently, neither the MLF nor the CDM have specific mandates to conduct these activities,<sup>1</sup> but a joint review could identify opportunities for coordination and/or joint guidance. For example, in countries where an ODS-containing appliance decommissioning program is appropriate, e.g., in countries with more than 1 million refrigerators disposed per year, the MLF could consider funding incremental costs associated with the removal and destruction of ODS refrigerant and foam from appliances, with co-funding from local industry, government, and/or other multilateral organizations used to cover costs of metal recovery or waste disposal. Additionally, a combination of new and existing approaches could be used, including funding to cover agreed upon incremental costs of refrigerant/foam recovery, recycling fees added to new appliances at the time of purchase to fund annual recycling activities, and revenue from carbon credits (earned through ODS destruction) to finance the disposal of older appliances. Other innovative market-based mechanisms may also be possible, such as the allocation of new ODS “production credits” based on a certain ratio of ODS destruction, while allowing such production credits to be sold if they are not needed in-country. A working group could be established to pursue these and other innovative ideas.
10. Should the mandate of the CDM or other carbon trading platforms be extended to include ODS destruction, methodologies for ODS destruction for certified emission reductions (CERs) on a GWP-weighted basis should be developed and approved. At least one such methodology has been developed to date under the CCX. Coordination with the CDM Executive Board, as well as multilateral/bilateral institutions should be pursued to improve dialogue on these issues. Any such destruction projects should also establish the requirements that may be required for HFC destruction post-2012.

### ***Infrastructure, Equipment, and Geography***

11. Recovery equipment and logistics (e.g., identifying cylinders or tanks for storage, transporting ODS-containing equipment or cylinders once material is recovered, and securing climate-controlled storage space for recovered ODS) are fundamental to the success of an unwanted ODS management strategy. National collection sites are also needed, as well as access to reclamation and destruction facilities (either in-country, via export, or via mobile units). However, very few countries will need their own high-capacity ODS destruction facilities, and countries with existing cement kilns may be able to outfit them to handle ODS. Mobile units (operated by private companies) may represent a viable option for destroying locally unwanted ODS, especially for countries that border the sea, although a sustainable business model would be required to ensure the successful long-term management of such units.

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<sup>1</sup> The MLF is mandated to fund the phaseout of ODS consumption and production, not necessarily disposal; and the CDM is mandated to only accept projects that reduce emissions of chemicals listed in Kyoto’s “basket” of chemicals, which does not include ODS.

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12. The export of ODS for destruction will be the most feasible option for many Article 5 countries, and will require only assistance in rendering Article 5 country governments “Basel-capable.” A specific product that may be useful is an outreach communiqué or a newsletter provided through the MLF that covers specific interpretation to Article 5 country representatives on an on-going basis. In addition, workshops and/or other *fora* may be appropriate means for information dissemination and technical assistance for Article 5 countries.
13. An international “clearinghouse” function could be provided through the MLF to match supply with demand by connecting countries requiring ODS destruction to those having available capacity, focusing on efforts to minimize transport distances and maximize effectiveness. Comprehensive data would be needed to identify and monitor global destruction capacity, and a web-based platform may be helpful to allow users—be they private companies or country governments—to locate nearby destruction facilities able to accept their ODS waste, and provide the tools/resources to facilitate the transaction. By having a global clearinghouse, small quantities can be bulked up for maximum cost-effectiveness, or countries with unwanted stockpiles may be able to identify customers willing to purchase materials for on-going critical uses. In developing this clearinghouse, the MLF Secretariat should collaborate with the Stockholm Convention Secretariat to identify overlapping destruction capacities, since great effort has already been made to identify POPs destruction facilities and associated capacities worldwide.<sup>2</sup> Together, the Secretariats can update and expand upon existing knowledge to identify current and overlapping POPs/ODS destruction capacity. Such information collection and dissemination efforts should also be coordinated with other ongoing initiatives related to global chemicals management—such as UNEP’s Strategic Approach to International Chemicals Management (SAICM) and the Inter-Organization Programme for the Sound Management of Chemicals (IOMC).

### ***Producer Responsibility Approaches***

14. Producer responsibility schemes generally work well when there are few players involved (i.e., producers/importers) to allow for effective organization/management of the scheme. They also work best in countries where there is a strong public, a strong government, or both. Specifically, for voluntary producer responsibility schemes to succeed, there must be significant public pressure and/or a credible threat of regulatory action for programs to be successful. For producer responsibility schemes mandated by law, strong government is needed to ensure compliance through verification/enforcement activities and collaboration with industry. For government-mandated producer responsibility schemes, governments may collect fees and/or establish program criteria, but should allow industry to take the lead on setting up and administering programs, with third party auditing. Bottom-line-oriented companies that are familiar with the equipment/products are best suited to establish and run cost-effective programs for meeting the requirements set by national governments. Producer responsibility schemes are most effective when they are supported by a legal mandate, since this creates a level playing field, so that all producers must share the responsibilities and costs.
15. Producer schemes for bulk ODS or ODS-containing appliances should address both ODS and HFCs, for program longevity and maximum environmental benefit, and should require recordkeeping/reporting and routine audits, but avoid over-reporting to minimize burden. In addition, producer responsibility schemes for bulk ODS should ban disposable cylinders to ensure appropriate infrastructure for ODS collection. They should include an option for recycling/reclamation of phased out ODS that is (or will be) in high demand, for example, by building-in incentives for the recovery of unmixed, recyclable/reclaimable used refrigerant (e.g., by offering a rebate).

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<sup>2</sup> PCB destruction facilities and associated capacities have been identified in the December 1998 report, *Inventory of World-wide PCB Destruction Capacity*, prepared by UNEP Chemicals in co-operation with the Secretariat of the Basel Convention, available at <<http://www.chem.unep.ch/pops/pdf/pcbrpt.pdf>>.



