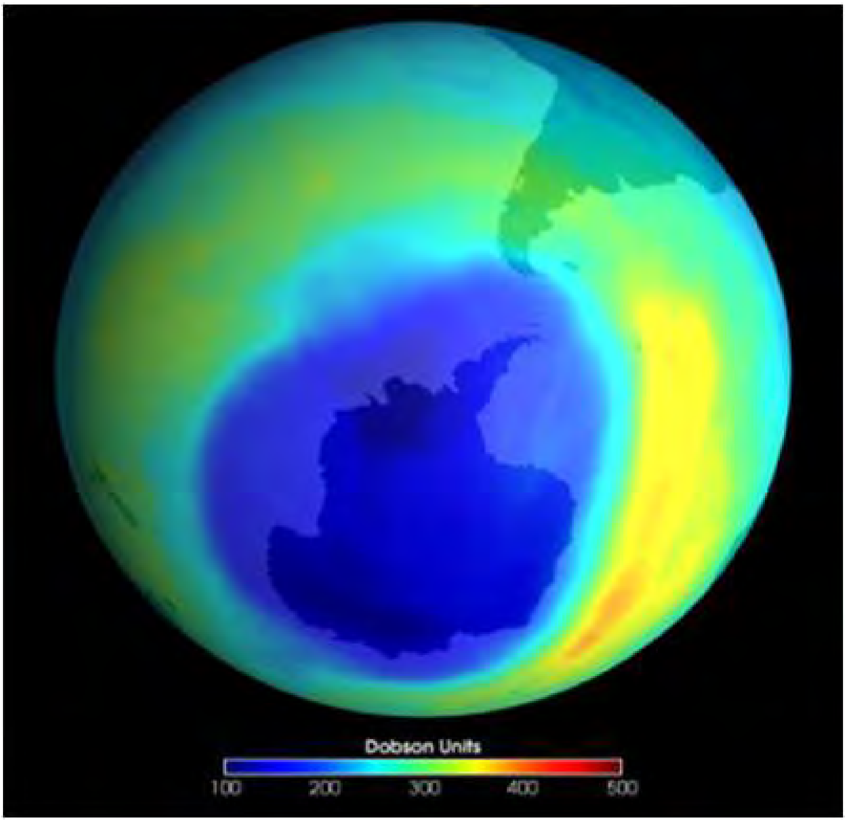
GLOBAL ENVIRONMENT FACILITY
EVALUATION OFFICE

OPS4 Technical Document # 2: Future Needs in Ozone Layer Protection

Touchdown Consulting

August 2009

Future Needs in Ozone Layer Protection



An overview of the remaining challenges in ozone layer protection, and their relevance to Countries with Economies in Transition

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Cover picture by NASA: The dark blue area (low Dobson units) shows the hole in the ozone layer over the Antarctic region and the tip of South America. Dobson Units indicate the quantity of ozone, measured vertically from earth to sky

Citation format :

Miller, M.K. and Batchelor, T.A. 2009. *Future Needs in Ozone Layer Protection: An overview of the remaining challenges in ozone layer protection, and their relevance to Countries with Economies in Transition*. Touchdown Consulting. Report for the Global Environment Facility Evaluation Office. Updated in August 2009. 54pp.

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List of acronyms and terms

A2	Article 2 Party of the Montreal Protocol, non-Article 5 Party, industrialised country
A5	Article 5 Party of the Montreal Protocol, developing country
BCM	Bromochloromethane (ODS controlled by the Montreal Protocol)
CEIT	Country with Economy in Transition
CFCs	Chlorofluorocarbons (ODS controlled by the Montreal Protocol)
CIS	Commonwealth of Independent States, a regional organization whose participating countries are former Soviet Republics.
Consumption	As defined under the Montreal Protocol, ODS consumption = production + imports – exports
CTC	Carbon tetrachloride (ODS controlled by the Montreal Protocol)
CUEs	Critical use exemptions for methyl bromide
EU	European Union, comprising 27 countries
EUEs	Essential use exemptions, mainly relating to CFCs
F-gases	Fluorinated gases: HFCs, PFCs, SF_6 (greenhouse gases controlled by the Kyoto Protocol)
GEF	Global Environment Facility
GHG	Greenhouse gas
Gt	Giga tonnes = thousand million tonnes = billion tonnes
GWP	Global Warming Potential
HBFC	Hydrobromofluorocarbons (ODS controlled by the Montreal Protocol)
HFCs	Hydrofluorocarbons (F-gases, greenhouse gases controlled by the Kyoto Protocol)
HCFCs	Hydrochlorofluorocarbons (ODS controlled by the Montreal Protocol)
IPCC	Intergovernmental Panel on Climate Change of WMO and UNEP (UNFCCC)
KP	Kyoto Protocol of the United Nations Framework Convention on Climate Change
MB	Methyl bromide (ODS controlled by the Montreal Protocol)
MCF	Methyl chloroform, also known as 1,1,1-trichloroethane or TCE (ODS controlled by the Montreal Protocol)
MDI	Metered-dose inhaler, a pharmaceutical product for treating asthma
MLF	Multilateral Fund of the Montreal Protocol
MP	Montreal Protocol
Mt	Million tonnes
Mt CO_2eq	Million tonnes carbon dioxide equivalent
n.d.	No data
Non-A5	Non-Article 5 Party of the Montreal Protocol, Article 2 Party, industrialised country
ODP	Ozone Depletion Potential, index of a molecule's impact on ozone in the ozone layer
ODP-tonnes	Tonnes weighted by a chemical's ozone depletion potential
ODS	Ozone depleting substance
PFCs	Perfluorocarbons (F-gases, greenhouse gases controlled by the Kyoto Protocol)
QPS	Quarantine and pre-shipment uses of methyl bromide
RAC	Refrigeration and air-conditioning equipment
RILO	Regional Intelligence Liaison Office of the World Customs Organisation
SF_6	Sulphur hexafluoride (F-gas, a greenhouse gas controlled by the Kyoto Protocol)
SME	Small and medium enterprises
t	Tonnes
t.b.d.	To be decided
t CO_2eq	Tonnes carbon dioxide equivalent
TEAP	Technology and Economic Assessment Panel of the Montreal Protocol
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WMO	World Meteorological Organization

Contents

1 Executive Summary

1. This summary presents the main results of a desk study on the remaining challenges posed by ozone-depleting chemicals, and their relevance to Countries with Economies in Transition (CEITs)[1].

2. Ozone-depleting substances (ODS) cause negative impacts in two main areas: (1) They damage the ozone layer, making it thinner. As a result more of the sun's UV radiation reaches the earth, harming human health, fish production, and ecosystems. A global phase-out of ODS will repair the ozone layer, and is expected to prevent about 20 million cases of skin cancer and about 130 million cases of eye cataracts in the period 1987-2060, as well as other benefits. (2) Most of the ODS are also potent greenhouse gases, contributing to the problem of global warming.

3. During the 1980s and 1990s the Montreal Protocol established timetables for phasing out (gradually eliminating) the production and consumption* of ODS, such as CFCs, HCFCs, halons, methyl bromide and others. However, some groups of ODS are exempted or not covered by the Protocol's phase-out programme, and many tonnes of ODS continue to be emitted each year, damaging ozone and adding to global warming. The remaining ozone challenges fall into three main categories, summarised in Table 1, and described in turn below:

    - *Challenge 1*: Chemicals that are required to be phased out by the Montreal Protocol,
    - *Challenge 2*: Chemicals that are not covered by phase-out requirements, and
    - *Challenge 3*: Links with other environmental issues.

1.1 CHALLENGE 1: CHEMICALS THAT ARE REQUIRED TO BE PHASED OUT BY THE MONTREAL PROTOCOL

4. ***Achievements to date*.** The Montreal Protocol requires specific groups of ODS to be phased out, and large volumes have been eliminated to date. Global consumption of these ODS was about 1,662,000 ODP-tonnes* in 1989, falling 96% overall to 68,700 ODP-tonnes in 2007. Global production of these ODS has fallen in parallel with consumption. In the last 20 years, developing countries have eliminated 81% of the ODS consumption that the Protocol requires to be phased-out, while industrialised countries have eliminated 99%. CEIT countries have also eliminated 99%: CEIT consumption fell from 275,253 to 1,665 ODP-tonnes in 1989-2007, while ODS production fell from 248,673 to 436 ODP-tonnes. When CEITs experienced difficulties in meeting the Montreal Protocol's ODS phase-out deadlines in the mid-1990s, the GEF assisted CEITs in eliminating about 19,260 ODP-tonnes of ODS consumption and about 33,148 ODP-tonnes of ODS production.

5. Global ODS consumption in 1989 was equivalent to about 9,200 million tonnes (9 Gt) CO_2eq/year, and was reduced to about 1,870 million tonnes (1.8 Gt) CO_2eq/year in 2007, as a result of ODS phase-out activities under the Montreal Protocol. This reduction of 7 Gt CO_2eq/year was at least three times greater than the Kyoto Protocol's reduction target (about 1-2 Gt CO_2eq/year in 2008-2012), demonstrating that the global ODS reductions achieved so far have already yielded a larger climate benefit than the current Kyoto Protocol target.

6. ***Remaining ODS that are due to be phased out under the Montreal Protocol.*** In 2007, the latest year for which global statistics are available, the ODS remaining and required to be phased out under the

* Terms used in this report: ODS 'consumption' is defined by the Montreal Protocol as follows
Annual ODS consumption = production + imports – exports – feedstock.
ODP-tonnes = tonnes that are weighted according to an ODS's potency and ability to damage ozone.

[1] The following 19 CEITs were included in this study on *Future Needs in Ozone Protection*: Armenia, Azerbaijan, Belarus, Bulgaria, Czech Republic, Estonia, Hungary, Kazakhstan, Latvia, Lithuania, Poland, Romania, Russian Federation, Slovakia, Slovenia, Tajikistan, Turkmenistan, Ukraine and Uzbekistan. Eighteen CEITs were funded by GEF for ODS phase out. Seventeen are currently classified as industrialised countries by the Montreal Protocol and are potentially eligible for GEF assistance.

Montreal Protocol totalled about 54,990 ODP-tonnes in developing countries and 13,710 ODP-tonnes in industrialised countries, including 1,665 ODP-tonnes in CEITs. In 2007 the ODS production remaining to be phased out under the Protocol amounted to about 45,000 ODP tonnes in 6 developing countries and 22,310 ODP-tonnes in 11 industrialised countries, including about 436 ODP-tonnes in 2 CEITs (Romania and the Russian Federation). The groups of ODS that are due to be phased out are summarised below.

7. ***HCFC phase-out to be accelerated.*** Recently the Montreal Protocol's timetable for phasing out HCFCs was accelerated to protect both ozone and climate. So countries need to reduce their consumption of HCFCs earlier than expected. More than 42,000 ODP-tonnes of HCFC were consumed in 2007, and almost all of this consumption is due to be eliminated by 2020 and 2030 in industrialised and developing countries, respectively. Statistics are not available for all CEITs, however 9 CEITs consumed 1,195 ODP-tonnes HCFC in 2007 (about 39 million tonnes CO_2eq/year). Most of this is due to be eliminated by 2020, with interim reduction steps to be achieved in 2010 and 2015. One CEIT country (the Russian Federation) will also need to eliminate its production of HCFC (281 ODP-tonnes in 2007). Alternatives need to be adopted for a substantial volume of products, because 1,195 ODP-tonnes of HCFC amounts to about 21,700 normal tonnes (because HCFCs have relatively low ODP values).

8. ***CFC and methyl bromide exemptions in several industrialised countries.*** CFC and methyl bromide consumption was due to be phased out in all industrialised countries by 1996 and 2005 respectively. However, a few countries still request the Montreal Protocol for exemptions for sectors where they believe that alternatives are not feasible. Many other countries have adopted alternatives for these sectors. The total authorised exemptions amounted to 3,629 ODP-tonnes of CFC and methyl bromide in 2009 (about 5.6 million tonnes CO_2eq/year, mainly arising from CFC). Of this total, one CEIT country (the Russian Federation) accounted for 352 ODP-tonnes of CFC (about 3.1 million tonnes CO_2eq/year) for medical and aerospace sectors, and recently requested a new exemption of 81 ODP-tonnes of methyl bromide (about 675 - 2,295 tonnes CO_2eq/year) for grain storage[2]. Another CEIT (Kazakhstan) made a commitment to phase-out methyl bromide by 2004; however consumption started again recently in 2006 and rose to 60 ODP-tonnes in 2007. In order to meet the phase-out commitments, alternatives would need to be adopted in these ODS sectors.

9. ***CFC, halon and carbon tetrachloride deadline approaching in developing countries.*** The phase-out date of 1 January 2010 is rapidly approaching for the production and consumption of CFC, halon and carbon tetrachloride in developing countries. In 2007 the remaining consumption was about 18,600 ODP-tonnes. Most developing countries are expected to meet the phase-out deadline because they have adopted diverse alternatives and implemented phase-out projects funded by the Montreal Protocol's Multilateral Fund (MLF). However, 8 developing countries are late in converting to CFC-free production of medical products, and have requested consumption of 2,060 ODP-tonnes of CFC in 2010. The relevant countries are due to draw up action plans to address this sector.

10. ***Illegal ODS trade.*** Prohibited ODS chemicals and equipment are sometimes smuggled across national borders. Customs officers at border posts face a complex task in differentiating between legal and illegal shipments of ODS, and they often lack the necessary training and detection equipment. Illegal trade was estimated to be roughly 10-20% of the volume of the legitimate ODS trade, indicating about 6,900-13,700 ODP-tonnes of illegal trade in 2007, with a value of US$28-56 million. The level of illegal trade is expected to increase from 2010, following the phase-out date for several major groups of ODS in developing countries. In CEITs, more than 76 cases of illegal ODS trade and infringements have been reported since 2002, but this is likely to be a small fraction of the total because the majority of contraband is not detected. A recent study carried out by the GEF Evaluation Office found that the risk of illegal ODS trade still remains high in most Central Asian CEITs today[3].

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[2] It appears that part of this methyl bromide might fall within the Montreal Protocol's general exemption for the quarantine sector (see paragraph 14 below). This question is due to be clarified by national authorities during 2009.

[3] GEF Evaluation Office. *Impact Evaluation of the Phase Out of Ozone-Depleting Substances in Countries with Economies in Transition*. August 2009. Volume 1: Theory of Change (177 pp). Volume 2: Country Reports (247 pp).

1.2 CHALLENGE 2: CHEMICALS THAT ARE NOT COVERED BY PHASE-OUT REQUIREMENTS

11. ***ODS that are exempted or not covered by phase-out requirements.*** Several groups of ODS are exempted from the phase-out programmes of the Montreal Protocol. For these groups of ODS there are no phase-out requirements, so ODS production, consumption and emission continues. In addition, the ODS that have been installed in equipment and products during the past decades still continue to release large emissions of ODS, damaging the ozone layer and contributing to the problem of global warming. These groups of ODS are summarised below.

12. ***Accumulated ODS installed in equipment and the need for safe disposal (destruction).*** Society's heavy dependence on ODS in past years has resulted in large quantities of ODS installed in equipment and products such as refrigerators, air-conditioning units, fire extinguishers and foam insulation. Unless preventive measures are taken, all of these ODS are eventually emitted to the atmosphere, damaging the ozone layer and contributing to global warming. The Montreal Protocol's technical panel has estimated that these ODS are being emitted at the level of more than 1,000 million tonnes (1 Gt) CO_2eq each year during this decade, and this would erase all of the reductions made under the Kyoto Protocol in 2008-2012. Although it is difficult to quantify the total, estimates indicate that there may be approximately 2,900,000 ODP-tonnes of ODS installed in equipment/products at present worldwide, totalling about 16,700 million tonnes (16.7 Gt) CO_2eq. In CEITs, there may be up to 500,500 ODP-tonnes installed, or about 2,850 million tonnes (2.8 Gt) CO_2eq. However, these are preliminary estimates extrapolated from the global total; to gain a reliable picture in CEITs it would be necessary to conduct inventory surveys. A recent GEF Evaluation Office study also noted that enterprises in some CEITs are storing stocks of unwanted ODS, but they lack access to environmentally-safe disposal methods.

13. It is not feasible to capture all of the ODS installed in equipment/products. However Japan, Brazil, the EU, Australia and others have demonstrated that it is feasible to collect and destroy a significant portion of the ODS, especially when the work is carried out as part of wider waste recycling programmes or producer responsibility programmes. The Montreal Protocol has requested its Multilateral Fund to conduct pilot projects in several developing countries. A Montreal Protocol meeting in July 2009 discussed potential action steps to collect and destroy ODS installed in equipment, identified areas where more information needs to be collected, and noted the importance of cooperation with the GEF. Discussions are scheduled to continue at the Protocol meeting in November 2009.

14. ***ODS exempted for use as feedstock agents in chemical processing.*** CFCs, carbon tetrachloride and many other ODS are used in chemical processing and as feedstock for the production of other substances. The Montreal Protocol assumed that these ODS were almost entirely converted to non-ODS chemicals and that emissions were very low, so this sector was exempted from the Montreal Protocol's phase-out requirements. Global consumption of ODS for feedstock and chemical processing was more than 400,000 ODP-tonnes in 2007. Emissions have been estimated at about 2,600-16,600 ODP-tonnes/year, but a recent study has indicated that emissions may be considerably higher. ODS for feedstock are produced in several CEITs, at the level of 3,274 ODP-tonnes in 2007, and it is likely that many CEITs consume ODS for feedstock and chemical processing. Although alternatives exist for some of these ODS uses, there are no requirements or incentives to adopt alternatives in this sector at present. Moreover, the continued production of ODS provides opportunities for illegal trade and consumption in other sectors where ODS were required to be phased out.

15. ***Methyl bromide exempted for quarantine.*** When the Montreal Protocol first adopted controls on the ODS methyl bromide in 1992, the use of this pesticide in the quarantine sector was exempted from restrictions because governments believed there were no alternatives. The global consumption of methyl bromide for quarantine was about 6,452 ODP-tonnes in 2007, while production was 7,790 ODP-tonnes (about 64,920-220,730 tonnes CO_2eq/year). Consumption in CEITs was estimated to be about 24 ODP-tonnes in 2007, however this figure may be incomplete and further clarification is needed. The Russian Federation recently asked the Montreal Protocol for an exemption to consume 81 ODP-tonnes of methyl bromide (as mentioned in paragraph 8 above), and part or all of this may possibly be for quarantine. Since 1992, alternatives have

been identified for some quarantine uses, and several countries have entirely ceased using methyl bromide. The European Union has banned methyl bromide for quarantine treatments from March 2010. Recently the Montreal Protocol adopted Decision XX/6 which encouraged governments to put in place a national strategy to reduce methyl bromide use and emissions in the quarantine sector. A Montreal Protocol meeting in November 2009 is due to consider a technical report on the topic, to examine the potential for future action.

16. ***New ODS*.** In the last decade, scientists have identified several chemicals that are known or suspected to be ozone-depleting. A recent scientific report for the Montreal Protocol, *The Scientific Assessment of Ozone Depletion of 2006*, noted that the role of several new ODS in ozone depletion is of greater importance than previously estimated. However, it is difficult to obtain data on production and consumption because monitoring and reporting requirements have not been established. The procedure for adding new substances to the Montreal Protocol's list of controlled ODS, and implementing the controls at national level, is protracted and has typically taken 12-15 years. During this period enterprises can freely produce new ODS, even in areas where alternatives exist, because production and consumption are not monitored or limited.

1.3 CHALLENGE 3: LINKS WITH ENVIRONMENTAL ISSUES ADDRESSED BY OTHER M.E.A.s

17. The infrastructure and activities required for addressing ODS are similar to the infrastructure and activities needed to address some of the chemicals controlled by other multilateral environmental agreements (MEAs). This offers opportunities for joint work and improved cost efficiency. Issues linked to ODS include HFCs (potent industrial greenhouse gases), energy efficiency, the collection and disposal of POPs and other hazardous waste, and chemicals management. The GEF-4 Strategy for the ozone focal area also noted the strong linkages between these areas[4].

18. ***Use of HFC greenhouse gases***. HFCs are not ODS, but many are potent greenhouse gases (GHG), contributing to global warming. HFC emissions are controlled under the Framework Convention on Climate Change and Kyoto Protocol. HFCs have been widely adopted as substitutes for ODS in some regions, because they were often cheaper or more convenient than environmentally-sustainable alternatives. Global production of HFCs has risen rapidly from a low level in 1990 to about 240,000 tonnes in 2006 (about 500 million tonnes CO_2eq/year). Since many HFCs have been used as ODS-substitutes, the Montreal Protocol is currently considering a proposal to restrict HFC production and consumption, and/or to use the institutions of the Multilateral Fund to assist developing countries to adopt more environmentally-sustainable substitutes. The GEF-4 Strategy for ozone recognised the risk of moving from ODS to HFCs, and specifically aims to give preference to low-GHG technologies when selecting ODS alternatives. Statistics on HFC consumption are not readily available for CEITs, although a number of enterprises in CEITs are using HFCs. Emissions of HFCs reported by the Russian Federation, for example, increased from a low level in 1995 to 1.9 million tonnes CO_2eq in 2006. Since more environmentally-friendly alternatives exist for some applications, there is an opportunity to reduce HFC emissions.

19. ***Destruction of hazardous waste*.** ODS and HFCs are used in similar types of equipment such as refrigeration, air-conditioning, fire systems and foam insulation. There is an opportunity to collect and destroy some of the HFCs that have already been installed in equipment, using the same infrastructure and networks that can be used for the ODS contained in existing equipment. Destruction facilities that are suitable for destroying ODS are often also suitable for destroying HFC, PCB and other hazardous wastes that are controlled by MEAs. The GEF-4 strategy on ozone recognized strong linkages with the implementation of the Stockholm Convention on POPs.

20. ***Energy efficiency***. The International Energy Agency has estimated that feasible and cost-effective energy efficiency measures could save around 8,200 million tonnes CO_2/year by 2030 if implemented globally

4 GEF (2007) *Ozone Layer Depletion Focal Area Strategy and Strategic Programming for GEF-4 (2007-2010)*, approved by the GEF Council in September 2007.

without delay[5]. When adopting alternatives to CFC, HCFC and HFC, there are many opportunities to adopt energy efficient equipment or processes at the same time. The GEF-4 Strategy for ozone recognized this opportunity for ozone-climate synergies by seeking to integrate ODS projects with energy efficiency work supported by the climate focal area in participating countries. For example, the replacement of old refrigerators that use CFC or HCFC with energy efficient refrigerators can bring benefits for both ozone and climate.

1.4 CEIT NEEDS AND THE POTENTIAL ROLE OF GEF ASSISTANCE

21. There are several areas where the GEF could provide funding and/or investments for CEITs to address the remaining ODS challenges and problems described above. They include:

- Carrying out surveys and compiling inventories of the ODS and HFCs in existing equipment, and quantities still used in specific sectors;
- Identifying and adopting alternatives that are environmentally-sustainable and also meet the practical needs of enterprises and other users;
- Preparing reports required by the Montreal Protocol or other MEAs, such as sector action plans and accurate annual data reports;
- Technical and legal support to strengthen existing legislation and policies to tackle the remaining ODS and related problems; and training to prevent illegal trade in ODS.

22. GEF assistance can also build synergies between ODS phase-out activities and other environmental and development activities at the national or regional level, as appropriate. Examples include:

- Adopting more energy-efficient equipment and processes when eliminating HCFC and other ODS;
- Assisting enterprises to create 'green jobs' by making environmentally-sustainable ODS alternatives;
- Collecting ODS and HFCs from old equipment and products, as part of urban waste reduction/recycling programmes and producer responsibility programmes;
- Providing environmentally-safe methods for the destruction of unwanted ODS, HFCs, POPs and other hazardous waste; and
- Carrying out training programmes with customs officers on the full range of products that are subject to international import/export restrictions, such as ODS, POPs, PIC, CITES and others.

23. Similar needs exist in many developing countries. The Montreal Protocol's MLF provides funds to developing countries for addressing ODS groups that are required to be phased out by the Protocol, but does not normally address other ODS groups and issues such as energy efficiency or the destruction of POPs. The GEF could provide assistance to enable developing countries to leverage their MLF projects on ODS by, for example, adding energy efficiency improvements; setting up networks for collecting and recycling waste equipment in urban areas; destroying unwanted ODS, HFCs and POPs; strengthening environmental policies and regulations; improving customs' enforcement of international environmental restrictions, and addressing other areas where synergies exist.

[5] IEA (2008) *Energy Efficiency Policy Recommendations In support of the G8 Plan of Action*. IEA, Paris, p.7.

Table 1: Summary of remaining ODS challenges, with estimated Consumption or use worldwide and in CEIT-19 in 2007 (ODP-tonnes)

Status under the Montreal Protocol	Remaining groups that need to be addressed	Global Consumption or use in 2007 (ODP-tonnes)			CEIT-19 in 2007 (ODP-tonnes)
		Industrialised countries (Article 2 Parties)	Developing countries (Article 5 Parties)	Global total	
Challenge 1: ODS groups that are required to be phased out by the Montreal Protocol (Section 5)	HCFCs	10,069	32,102	42,171	> 1,195
	CFCs	64	15,287	15,350	394
	Methyl bromide (MB)	3,575	3,741	7,316	76
	Halons	0	2,145	2,145	0
	Carbon tetrachloride (CTC)	0	1,174	1,174	0
	Methyl chloroform (MCF)	0	541	541	0
	HBFCs	3	0	3	0
	Total reported consumption in 2007	13,709	54,990	68,699	> 1,665
	MB exemptions authorised after the phase-out date ('critical uses')	4,537 (<2,116 in 2010)	Not applicable until 2015 (0 in 2010)	4,537 (<2,116 in 2010)	0 (~ 81 in 2010)
	CFC exemptions authorised after the phase-out date ('essential uses')	1,898 (400 in 2010)	Not applicable until 2010 (~ 2000 In 2010)	1,898 (~2400 in 2010)	363 (~ 308 in 2010)
	Laboratory and analytical exemptions	> 27	> 13	> 40	~ 10
	Total authorised exemptions in 2007	> 6,463 (~2,543 in 2010)	> 13 (~2013 in 2010)	> 6,515 (~4,556 in 2010)	~ 373 (~ 399 in 2010)
	Illegal trade in ODS	insufficient data	insufficient data	~ 7,000 - 14,000	insufficient data
Challenge 2: ODS groups that are not covered by phase out requirements (Section 6)	CFC & HCFC installed in equipment	~ 1,535,000	~ 593,000	~ 2,130,000	< 362,010
	Halon installed in equipment	~ 504,000	~ 311,000	~ 815,000	< 138,550
	ODS feedstock and process agents	~ 334,527	~ 71,034	~ 405,560	3,274
	MB quarantine and pre-shipment	> 2,970	> 3,482	> 6,450	~ 100
	Unwanted stockpiles of ODS	insufficient data	insufficient data	insufficient data	insufficient data
	New ODS	insufficient data	insufficient data	insufficient data	insufficient data
	Total in 2007	> 2,376,497	> 933,516	> 3,312,000	> 503,934
	Total of above groups of ODS in 2007	> 2,390,200	> 988,500	> 3,380,700	> 505,600
Challenge 3: Issues linked to ODS (Section 7)	HFC consumption	insufficient data	insufficient data	~ 240,000 tonnes	insufficient data
	Others: HFCs installed in equipment, energy efficiency, hazardous waste	insufficient data	insufficient data	insufficient data	insufficient data

Table 1 was compiled from the data presented in Sections 4 - 7 of this report

2 Introduction

24. This report provides an overview of the remaining challenges in ozone layer protection, and their relevance to CEITs. The report objectives are as follows:

- Summarise the phase-out of the production and consumption of ozone-depleting substances (ODS) achieved to date, globally and in CEITs.
- Estimate the remaining ODS production and consumption, indicating relevant information gaps.
- Briefly describe the problems arising from each remaining category of ODS.
- For each category, summarise the available quantitative data on production, consumption and estimated emissions, globally and in CEITs, indicating information gaps.
- Provide a table which summarises the remaining ODS and main activities where GEF would be able to assist in meeting the needs of CEITs in addressing ozone layer protection in future.

25. This report covers 19 CEITs, collectively called 'CEIT-19'. This group comprises the 17 CEITs that are currently classified as Article 2 (industrialised) Parties under the Montreal Protocol, and the 18 countries that have received GEF assistance to date, namely Armenia, Azerbaijan, Belarus, Bulgaria, Czech Republic, Estonia, Hungary, Kazakhstan, Latvia, Lithuania, Poland, Romania, Russian Federation, Slovakia, Slovenia, Tajikistan, Turkmenistan, Ukraine and Uzbekistan[6]. In the past, these 19 CEITs consumed 17% of the global baseline of ODS consumption (details in Table 3).

26. In this report the term 'Consumption' is used as defined in the Montreal Protocol: *ODS Consumption = ODS production + imports – exports – feedstock*[7]. 'ODP-tonnes' are tonnes that are weighted according to an ODS's potency and ability to damage ozone.

Why does the ozone layer need to be protected?

The earth is surrounded by a delicate layer of ozone gas, which plays an essential role in protecting life on earth. The ozone layer acts like an umbrella or shield around the earth, blocking large amounts of harmful radiation emitted by the sun.

In the 1970s and 1980s, scientists discovered that some man-made chemicals containing chlorine and bromine can attack the ozone layer, making it thinner. This process is called ozone layer depletion. When the ozone layer is thinner, more UV-B radiation reaches the earth. More UV-B radiation increases the number of eye cataracts and skin cancers, weakens immune systems, disrupts the growth of crops and forests, reduces fish production, and inflicts other negative effects (UNEP 2008). To prevent these problems, the Montreal Protocol placed international restrictions on substances that deplete the ozone layer.

[6] Armenia and Turkmenistan have recently been re-classified as Article 5 Parties under the Montreal Protocol. They are included in this report because they are among the 18 CEITs that have received GEF assistance to date.

[7] Article 1 of the Montreal Protocol legal text (Ozone Secretariat, 2006, p. 4).

3 Summary of ODS phase-out achieved to date

27. The Montreal Protocol (MP) is an international agreement which aims to protect the ozone layer by controlling substances that can damage the ozone layer. The MP has established schedules (timetables) for phasing out (gradually eliminating) the production and Consumption of many groups of ODS, such as CFCs, HCFCs, halons, methyl bromide, carbon tetrachloride. Annex 1 provides a list of the phase-out dates of the main groups of ODS. Action taken under the MP has achieved large reductions, phasing out 96% of the global production and Consumption of these ODS in the last 20 years, as illustrated in Figure 1. By 2007, industrialised countries eliminated 99% of their past Consumption and developing countries eliminated 81%. Global Consumption of ODS fell from about 1,661,982 to 68,699 ODP-tonnes between 1989 and 2007, as shown in Table 2 (Ozone Secretariat, 2009). These reductions cover only the groups of ODS that the MP requires to be phased out (refer to Annex 1).

28. The global production of these ODS fell from about 1,760,281 to 63,416 ODP-tonnes in 1989-2007, as shown in Table 2. The number of industrialised countries producing ODS has fallen from 18 in past years to 11 countries in 2007. Similarly, the number of developing countries producing ODS has fallen from 9 to 6 countries in 2007 (Ozone Secretariat, 2009). Industrialised countries have ceased production of CFCs, except for medical grade CFCs and other uses that are exempted from phase out. China and India have also ceased CFC production recently, except for exempted uses.

29. Similar progress has occurred in the 19 CEIT countries examined in this report. The CEIT-19 eliminated 99% of their ODS Consumption in 20 years, as shown in Figure 2 and Table 3. ODS Consumption fell from 275,253 to about 1,665 ODP-tonnes in the period from 1989 to 2007, while ODS production fell from 248,673 to about 436 ODP-tonnes in the same timeframe (Table 3).

30. The global reductions in ODS will prevent an estimated doubling of the UV-B radiation reaching the earth in the populated northern mid-latitudes, and prevent a quadrupling in the southern latitudes, by the year 2050 (Ozone Secretariat, 2008, p. 4). This has averted many millions of cases of cancer deaths and cataracts (Gonzalez, 2007, pp. 3, 6). A Canadian government study estimated that the Protocol will prevent 19.1 million cases of non-melanoma skin cancer, 1.5 million cases of melanoma skin cancer, and 129 million cases of cataracts, as well as averting $459 billion in costs resulting from UV damage to fisheries, agriculture and industrial materials in the period 1987-2060 (Environment Canada, 1997, p. 2).

31. Since most ODS are also greenhouse gases (GHG) the reductions in ODS have also reduced global warming, bringing substantial benefits for the climate. ODS reductions achieved by the MP will reduce GHG in 2010 by about 5-6 times the reduction target of the first Kyoto Protocol commitment period of 2008-2012 (SAP, 2008, p. 9). In 1989 global ODS Consumption was equivalent to more than 10,000 million tonnes CO_2eq; this fell to approximately 1,000 million tonnes CO_2eq in 2006, as illustrated in Figure 3 (Gonzalez, 2007, p. 9). In CEIT-19 these values fell from ~ 1,319 million tonnes CO_2eq in 1989 to ~ 42 million tonnes CO_2eq in 2007 (Figure 4).

Table 2: Trend in the global production and Consumption of ODS groups that are required to be phased out under the Montreal Protocol, 1986-2007 (ODP-tonnes)

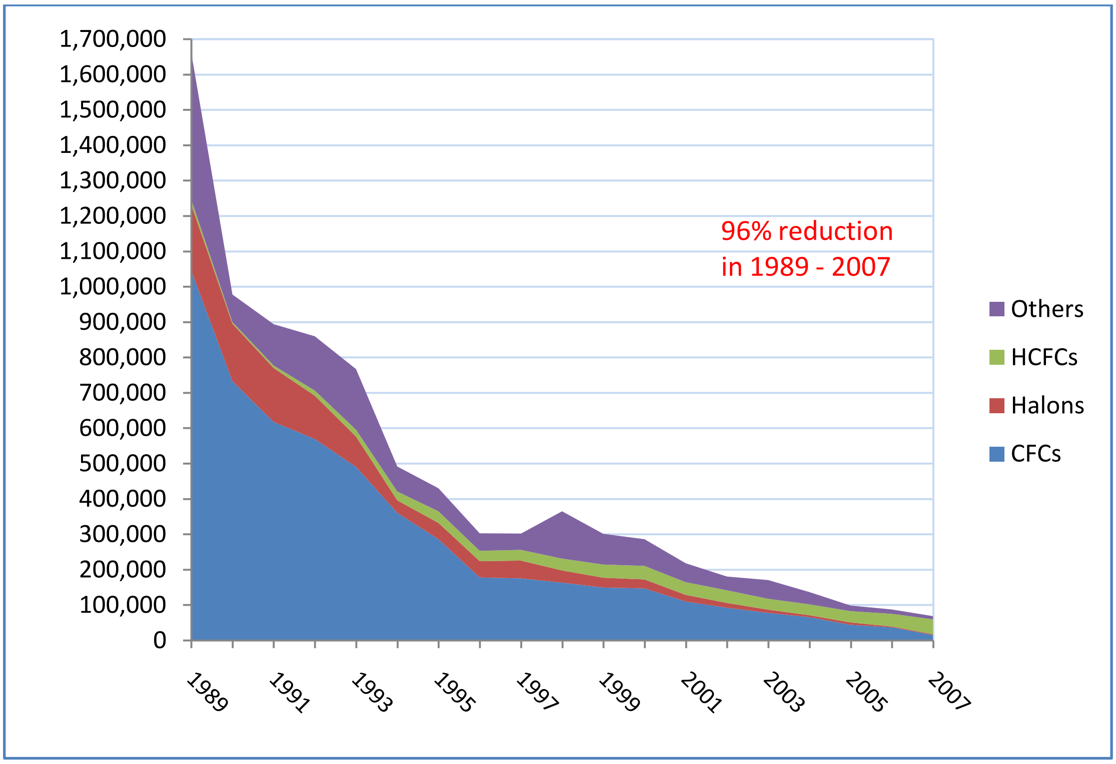
Production	Baseline	1986	1989	1991	1995	1999	2003	2004	2005	2006	2007
CFCs	1,128,113	1,016,228	1,049,316	666,145	253,867	146,823	82,876	69,955	49,578	31,781	10,592
Halons	197,458	197,458	185,252	150,289	42,241	25,192	7,913	4,832	6,331	2,465	2,092
HCFCs	41,168	no data	14,512	4,354	33,457	36,516	30,724	31,769	32,406	35,023	41,460
Others	503,593	no data	511,201	111,579	84,244	93,216	53,137	31,731	14,217	14,375	9,271
Total	1,860,224	1,269,754	1,760,281	932,367	413,808	301,748	174,649	138,287	102,532	83,644	63,416
Consumption											
CFCs	1,108,858	1,084,404	1,045,476	617,804	286,197	149,560	77,841	65,817	44,194	37,175	15,350
Halons	219,255	217,755	186,794	152,481	46,062	27,807	9,241	5,580	6,667	2,333	2,145
HCFCs	36,848	no data	14,330	6,968	32,883	37,233	30,692	30,758	31,898	35,785	42,171
Others	426,693	no data	415,382	116,999	65,199	86,884	52,980	34,738	15,982	12,379	9,034
Total	1,791,654	1,302,252	1,661,982	894,252	430,341	301,483	170,754	136,893	98,741	87,673	68,699

Table 3: Trend in CEIT-19 production and Consumption of ODS groups that are required to be phased out under the Montreal Protocol, 1986-2007 (ODP-tonnes)

Production	Baseline	1986	1989	1991	1995	1999	2003	2004	2005	2006	2007
CFCs	107,574	107,274	107,468	84,539	39,697	18,444	-	-	-	-	120
Halons	27,800	27,800	15,240	11,450	1,086	554	-	-	-	-	-
HCFCs	4,203	-	1,194	426	184	146	327	257	222	268	281
Others	124,771	-	124,771	310	8,473	372	352	181	31	109	35
Total	264,348	135,074	248,673	96,725	49,440	19,516	679	438	253	377	436
Consumption											
CFCs	147,704	149,684	144,102	56,756	29,022	17,652	1,087	766	706	471	394
Halons	39,940	39,960	18,120	13,072	1,134	456	-	2	-	-	-
HCFCs *(a)*	5,339	1	1,348	395	287	403	943	899	671	1,032	1,195
Others	111,969	2	111,684	4,649	2,317	173	456	183	61	81	76
Total	304,953	189,646	275,253	74,871	32,760	18,684	2,486	1,849	1,438	1,584	1,665

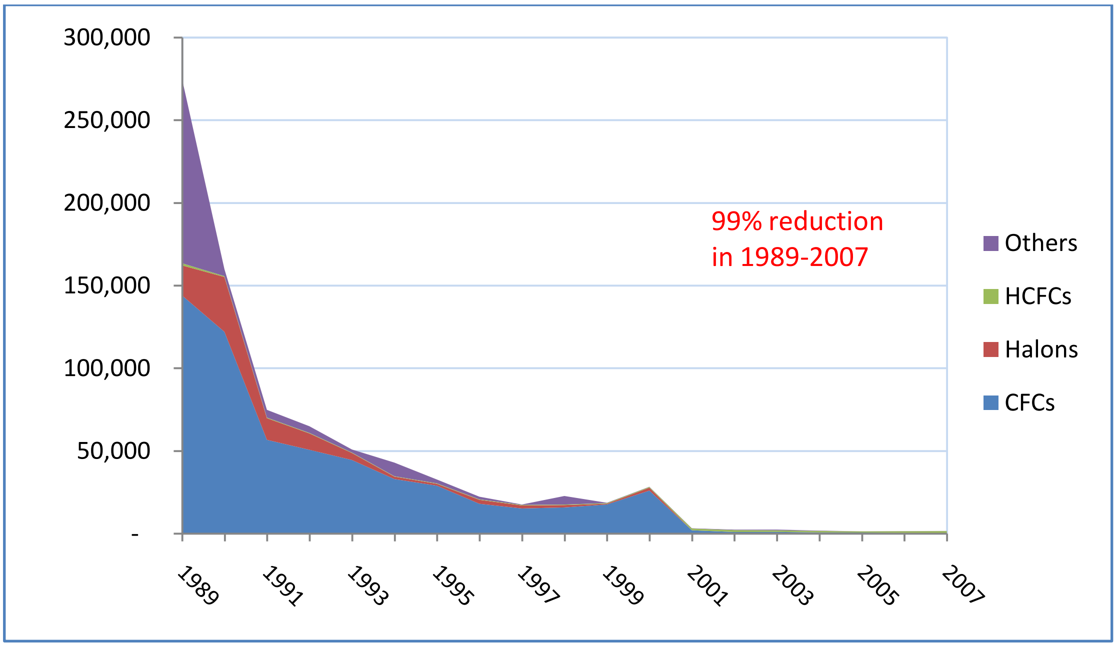
Compiled from (Ozone Secretariat, 2009). *(a) HCFC Consumption data are not included in 2004-2007 for CEITs that became EU members, because national data are not available.*

Figure 1: Trend in global Consumption of ODS groups that are required to be phased out under the Montreal Protocol, 1989-2007 (ODP-tonnes)



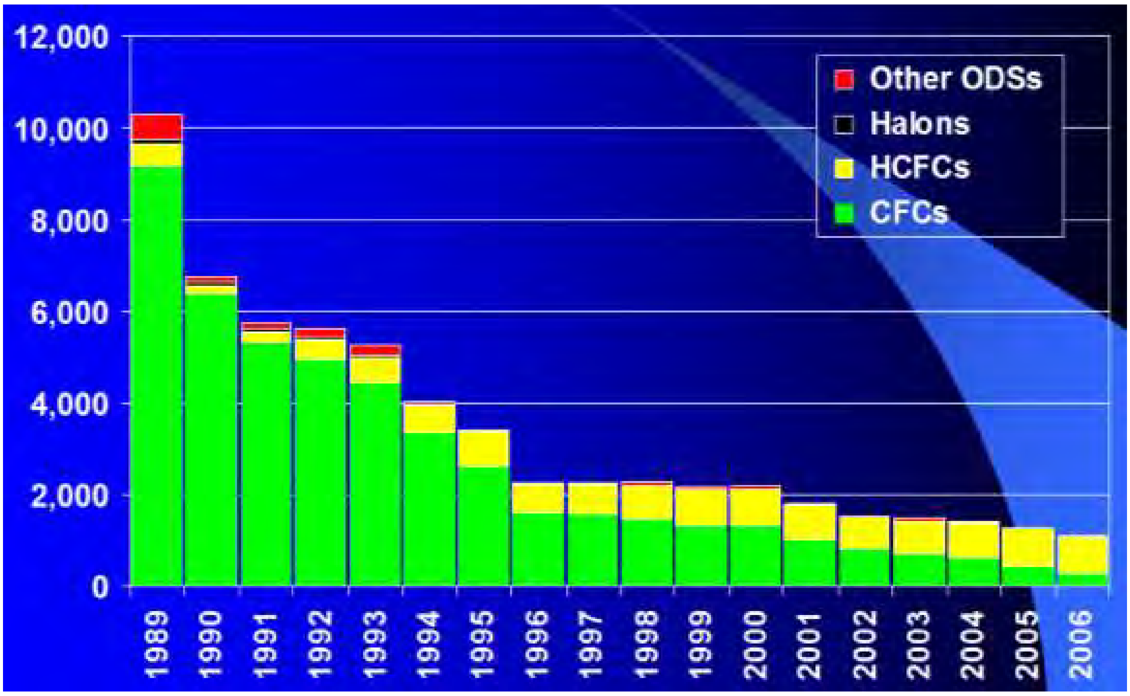
Data source: (Ozone Secretariat, 2009).

Figure 2: Trend in CEIT-19 Consumption of ODS groups that are required to be phased out under the Montreal Protocol, 1989-2007 (ODP-tonnes)



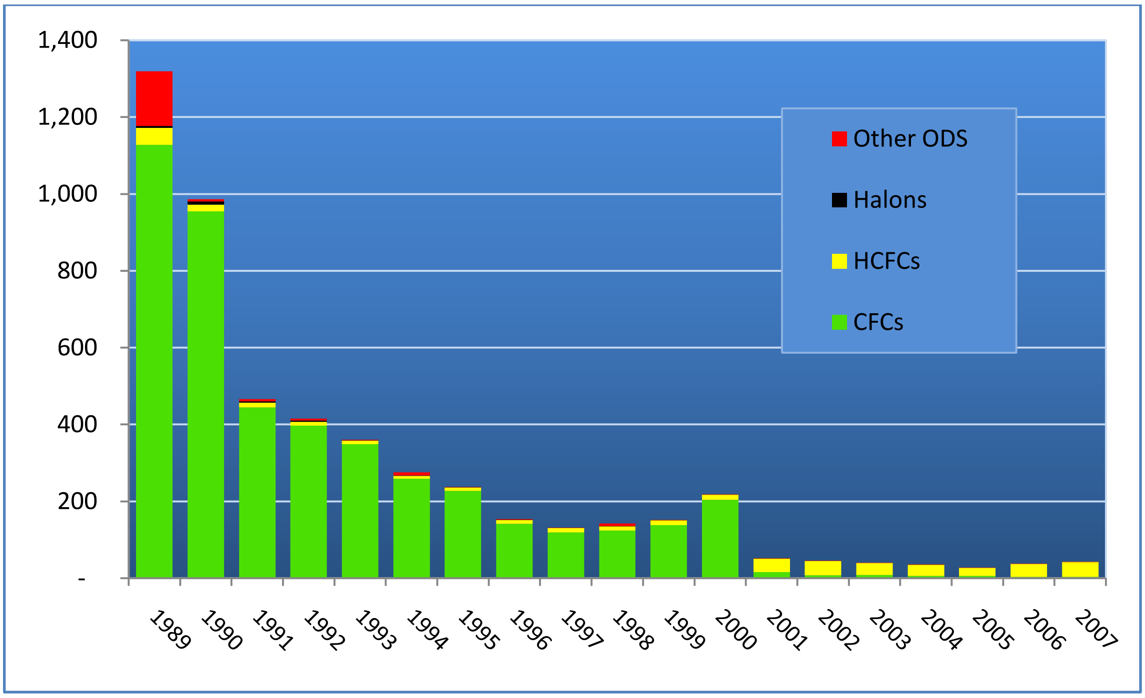
Data source: (Ozone Secretariat, 2009).

Figure 3: Trend in global Consumption of ODS groups that are required to be phased out under the Montreal Protocol, 1989-2006 (million tonnes CO_2eq)



Reproduced from (Gonzalez, 2007, p. 9). *Note the increasing importance of HCFCs.*

Figure 4: Trend in CEIT-19 Consumption of ODS groups that are required to be phased out under the Montreal Protocol, 1989-2006 (million tonnes CO_2eq)



Estimated by Touchdown from data in: (Ozone Secretariat, 2009).

4 Overview of the remaining ODS challenges

32. The *Scientific Assessment of Ozone Depletion* in 2006 reported that the total level of ODS in the atmosphere has started to decrease. However the recovery of the ozone layer is slower than expected; the Antarctic ozone hole, for example, is expected to continue until 2060-2075, roughly 10-25 years later than scientists estimated previously (WMO, 2007, p. xxiv). This is due to several factors, such as larger recent estimates of the ODS installed in equipment and larger HCFC production (WMO, 2007, pp. xxxv-xxxvi). Moreover, some groups of ODS are exempted from the MP's phase out requirements, and are not included in the official ODS production and Consumption figures cited in Section 3 above.

33. The ODS areas that remain to be addressed fall into three main categories, summarised in turn in the sections below:

- *Challenge 1:* ODS that are required to be phased out by the Montreal Protocol (Section 5)
- *Challenge 2:* ODS that are not required to be phased out (Section 6)
- *Challenge 3:* Links between ODS and issues addressed by other MEAs (Section 7).

4.1 CHALLENGE 1: ODS SECTORS THAT ARE REQUIRED TO BE PHASED OUT BY THE MONTREAL PROTOCOL

34. Table 4 summarises the remaining global production and Consumption of the main ODS sectors for which the MP has set phase-out dates. (Annex 1 provides a list of the groups of ODS which have phase-out dates). In 2007, the latest year for which global statistics are available, the ODS remaining and required to be phased out under the Montreal Protocol was about 54,990 ODP-tonnes in developing countries and 13,710 ODP-tonnes in industrialised countries. For these groups of ODS, the largest areas of Consumption in 2007[8] were: HCFCs (42,170 ODP-tonnes), CFCs (15,350 ODP-tonnes), MB (7,316 ODP-tonnes), halons (2,145 ODP-tonnes) and carbon tetrachloride (1,174 ODP-tonnes).

35. In 2007 the remaining ODS production, required to be phased out by the MP, totalled about 45,000 ODP-tonnes in 6 developing countries and 22,310 ODP-tonnes in 11 industrialised countries. The largest areas of production in 2007 were: HCFCs (41,477 ODP-tonnes), CFCs (12,468 ODP-tonnes), MB (7,726 ODP-tonnes), carbon tetrachloride (2,993 ODP-tonnes) and halons (2,092 ODP-tonnes). China has recently become the world's largest producer of HCFCs, because worldwide production and consumption of HCFCs are permitted by the Montreal Protocol for many years to come.

36. For the CEIT-19, Table 5 summarises the remaining ODS for which the MP has set phase out dates. The remaining ODS production was about 436 ODP-tonnes in 2 CEITs, Romania and the Russian Federation. The remaining CEIT-19 Consumption in 2007 was 1,665 ODP-tonnes. The largest sectors in 2007 were: HCFCs (1,649 ODP-tonnes), CFCs (394 ODP-tonnes) and MB (~60 ODP-tonnes). Details of key sectors are provided in Section 5 below.

37. Achieving full compliance with the existing MP phase-out schedules remains important for repairing the ozone layer. The *Scientific Assessment of Ozone Depletion* in 2006 noted that a failure to comply with the MP phase-out schedules would delay or prevent the recovery of the ozone layer (WMO, 2007, p. xxxvii). In addition, the elimination of ODS will reduce global greenhouse gas emissions.

4.2 CHALLENGE 2: ODS SECTORS THAT ARE NOT COVERED BY PHASE OUT REQUIREMENTS

38. Various ODS groups are not required to be phased out by the MP. Several ODS sectors have general exemptions from the phase-out: feedstock and process agents (global emissions ~2326 to 75,493 ODP-tonnes/year) and quarantine uses of MB (7790 ODP-tonnes, >64,920 tonnes CO_2eq) as summarised in Table 1.

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[8] 2007 is the most recent year for which global data are available for ODS production and Consumption.

39. Other sectors have not yet been addressed by the MP, such as the ODS installed in equipment (banks of ~ 2.9 million ODP-tonnes, ~16,762 million tonnes CO_2eq), unwanted stockpiles, and new ozone-depleting substances (summarised in Table 1). The *Scientific Assessment of Ozone Depletion: 2006* has noted that the emissions from ODS installed in equipment and MB quarantine uses affect the recovery of the ozone layer, and new ODS are of greater importance than previously estimated (WMO, 2007, pp. xxxvi-xxxvii). The climate impact of ODS banks is also substantial, and would negate all of the CO_2 reductions due to be made under the first reduction target of the Kyoto Protocol. Further details are provided in Section 6 below.

4.3 CHALLENGE 3: LINKS BETWEEN ODS AND ISSUES ADDRESSED BY OTHER MEAs

40. HFCs have been widely adopted as substitutes for CFCs and HCFCs. HFCs are not ODS, but often have high GWPs. Global production was 234,000 – 249,000 tonnes in 2006[9], which is equivalent to approx. 489 - 518 million tonnes CO_2eq/year. During 2009 the MP meetings are considering proposals to reduce the global production and Consumption of HFCs and/or to adapt the existing institutions of the MP's Multilateral Fund to assist developing countries to replace HFCs with environmentally-sustainable technologies (UNEP, 2009). Further details are provided in Section 7 below.

41. The remainder of this report describes the three categories of challenges listed above, focusing on the issues relevant to CEIT countries that are classified as industrialised countries (Article 2 Parties) under the MP.

[9] AFEAS members reported HFC production of >211,367 tonnes in 2006, accounting for about 85-90% of global production (AFEAS, 2009). This suggests global production of about 234,852-248,667 tonnes.

Table 4: Remaining global production, Consumption and exemptions in 2007 of the ODS sectors that are required to be phased out (ODP-tonnes)

Ozone-depleting substances (a)	Industrialised countries (ODP-tonnes)			Developing countries (ODP-tonnes)			Global total in 2007 (ODP-tonnes)		
	Production	Consumption	Permitted exemptions (b)	Production	Consumption	Permitted exemptions (b)	Production	Consumption	Permitted exemptions (b)
HCFCs	10,506	10,069	(c)	30,954	32,102	(c)	41,460	42,171	(c)
CFCs	186	64	1,922	10,407	15,287	10	10,592	15,350	1,932
MB	7,313	3,575	4,950	412	3,741	(c)	7,725	7,316	4,950
Halons	0	0	0	2,092	2,145	(c)	2,092	2,145	0
CTC	0	0	3	1,031	1,174	3	1,031	1,174	6
MCF	431	0	0.1	78	541	(c)	509	541	0.1
HBFC	3	3	0	0	0	0	3	3	0
BCM	0	0	0	0	0	0	0	0	0
Total	18,439	13,709	6,875	44,973	54,990	13	63,412	68,699	6,888

Data source: (Ozone Secretariat, 2009). *(a) Refer to list of acronyms on page 3. (b) Including reported laboratory & analytical uses. Consumption for CFC and MB exemptions is also reported in Consumption column. (c) Exemptions will not be relevant until the phase-out date.*

Table 5: Remaining CEIT-19 production and Consumption in 2007 of the ODS sectors that are required to be phased out (ODP-tonnes and tonnes)

Ozone-depleting substances (a)	CEIT-19 in 2007 (ODP-tonnes)			CEIT-19 in 2007 (tonnes)		
	Production	Consumption	Exemptions (b)	Production	Consumption	Exemptions (b)
HCFCs	281	> 1,195	Not applicable	5,023	> 21,276	Not applicable
CFCs	120	394	366	~ 120	363	396
MB	0	76	0 (c)	0	127	0 (c)
CTC	35	0	8	32	0	10
Halons	0	0	0	0	0	0
MCF	0	0	0	0	0	0
HBFC	0	0	0	0	0	0
BCM	0	0	0	0	0	0
Total	436	> 1,665	374	~ 5,175	> 21,766	406

Data source: (Ozone Secretariat, 2009). *(a) Refer to list of acronyms on p.3. (b) Including reported laboratory & analytical uses. (c) New MB exemptions have been requested for 2010.*

5 Challenge 1: ODS sectors that are required to be phased out by the Montreal Protocol

42. Section 4.1 (Table 4 and Table 5) provided an overview of the remaining volume of ODS production and Consumption that is scheduled to be phased out under the Montreal Protocol. The following section, Section 5, provides a brief description of each of the key ODS sectors that the MP requires to be phased out, and their relevance to CEITs. These include: HCFCs, CFCs, MB, laboratory uses, and illegal trade.

5.1 HCFCs ACCELERATED PHASE-OUT SCHEDULE

43. HCFCs are used in similar applications to CFCs, mainly in refrigeration and air-conditioning equipment, fire protection systems and foam products. HCFCs have been regarded as 'little CFCs' because they had less impact on ozone than CFCs. HCFCs are greenhouse gases (GHG), contributing to global warming. Many enterprises have substituted CFCs with HCFCs as an interim measure, but they will need to adopt ODS-free technologies in future. Under the MP, the majority of HCFC Consumption is due to be phased out by 2020 in industrialised countries and by 2030 in developing countries[10]. Recently the MP decided to accelerate the phase-out schedule because the use of HCFCs has increased much more than expected.

5.1.1 Environmental issues

44. Atom for atom, HCFCs have significantly less impact on the ozone layer than CFCs. HCFCs have ozone impact values in the range of 0.001 - 0.52, compared to 1.0 for the benchmark CFC[11] (Ozone Secretariat, 2006, p. 24). The reported global consumption of HCFCs totalled about 35,800 ODP-tonnes in 2001, rising 42,171 ODP-tonnes in 2007 (Ozone Secretariat, 2009). Since each ODP-tonne of HCFC can equal about 9 - 18 normal tonnes, this amounts to large quantity of product to be eliminated, roughly 500,000 – 650,000 tonnes/year in 2007.

45. HCFCs have become the largest remaining ODS group that have a MP phase-out schedule (as seen in Table 2 and Figure 1). From 2006 to 2007, in one year alone, the global production of HCFCs increased by 18%, mainly in developing countries. HCFC Production and Consumption is expected to continue to grow rapidly in developing countries until 2013.

46. Many HCFCs are also potent greenhouse gases, with GWPs varying from 77 to 2,310[12]. HCFC-22 is the most common type of HCFC, and has a GWP of 1,810 (IPCC, 2007, pp. 33, Table TS.2). To provide an indication of the climate impact, for illustration purposes only, one could assume that all HCFCs are HCFC-22. In this case, 42,171 ODP-tonnes in 2007 would be equivalent to ~ 1,388 million tonnes CO_2eq/year[13]. To place the climate impact in context, this quantity of HCFC would erase about 70-100% of the first Kyoto Protocol reduction target of about 1,100 - 2,000 million tonnes CO_2eq/year[14]. TEAP estimated that an accelerated global phase-out of HCFCs could reduce the cumulative emissions

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10 The Copenhagen Amendment of 1992 also adopted interim HCFC reduction steps for industrialised countries (Ozone Secretariat, 2006, p. 33).

11 For example, the Ozone Depletion Potentials (ODP) of HCFC-22 and HCFC-141b are 0.055 and 0.11 respectively, compared to 1.0 for CFC-11 (Ozone Secretariat, 2006, pp. 23-24).

12 100-year GWPs estimated by the Intergovernmental Panel on Climate Change in 2007 (IPCC, 2007, pp. 33, Table TS.2).

13 A breakdown is not available for each type of HCFC. To provide an illustration of climate impact, we have assumed that all HCFCs are HCFC-22, with the following calculations: HCFC-22's ODP is 0.055, therefore 42,171 ODP-tonnes divided by 0.055 = 766,736 tonnes; multiplied by HCFC-22's GWP of 1,810 = 1,387,792,884 tonnes CO2eq = 1,388 Mt CO2eq.

14 Estimates of the size of the first KP target in 2008-2012 vary from ~ 1,100 million tonnes CO_2eq/year (UNFCCC 2005) up to ~ 2,000 million tonnes CO_2eq/year (Velders, 2007, p. 4818).

of HCFCs by 468,000 ODP-tonnes, and by up to 18,000 million tonnes CO_2eq[15] by the year 2050 (UNEP, 2007, p. 15).

5.1.2 Activities under the Montreal Protocol

47. In the 1990s the MP established phase-out dates for HCFC Consumption from 2030, but producer countries agreed only to freeze HCFC production, i.e. to restrict the growth in production at a future date (by 2004 in industrialised countries and by 2016 in developing countries)[16]. The production of HCFCs was permitted to increase until the freeze date, because HCFCs were seen as relatively cheap, short-term substitutes for CFCs. The Multilateral Fund (MLF) provided funding for enterprises to adopt HCFCs as CFC substitutes. However, the use of HCFCs has increased much more than expected, particularly in developing countries.

Table 6: Reported HCFC Consumption in CEIT-19 in 2001 and 2007 (ODP-tonnes, tonnes, and t CO_2eq)

Consumption	ODP-tonnes (c)		Estimated tonnes (assuming all HCFCs are HCFC-22) (d)		Estimated thousand tonnes CO_2eq. (assuming all HCFCs are HCFC-22) (e)	
	2001	2007	2001	2007	2001	2007
Armenia (f)	1.7	4.4	31	80	56	145
Azerbaijan	0.1	0.8	2	15	3	26
Belarus	9.3	0.8	169	15	306	26
Bulgaria	6.5	(a)	118	(a)	214	(a)
Czech Republic	7.7	(a)	140	(a)	253	(a)
Estonia	1.7	(a)	31	(a)	56	(a)
Hungary	80.5	(a)	1,464	(a)	2,649	(a)
Kazakhstan	48.4	60.9	880	1,107	1,593	2,004
Latvia	2.6	(a)	47	(a)	86	(a)
Lithuania	6.4	(a)	116	(a)	211	(a)
Poland	91.9	(a)	1,671	(a)	3,024	(a)
Romania	11	(a)	200	(a)	362	(a)
Russian Fed.	761.5	1,028.30	13,845	18,696	25,060	33,840
Slovakia	3.5	(a)	64	(a)	115	(a)
Slovenia	6.6	(a)	120	(a)	217	(a)
Tajikistan	1.1	3.8	20	69	36	125,055
Turkmenistan (f)	4.4	2.7	80	49	145	88,855
Ukraine	23.1	93.5	420	1,700	760	3,077
Uzbekistan	0.6	0.1	11	2	20	3
Total Consumption	1,068.6	1,195.3 (b)	19,429	21,733 (b)	35,167	39,336 (b)
Production						
Russian Fed.	684.3	281.4	12,442	5,116	22,520	9,261
Total production	684.3	281.4	12,442	5,116	22,520	9,261

(a) HCFC data are not available – HCFC Consumption is reported to the MP as part of the total EU Consumption.
(b) Excluding CEITs that are member states of the EU. Refer to footnote (a).
(c) Data source: (Ozone Secretariat, 2009).
(d) Estimated value, calculated by dividing ODP-tonnes by the ODP for HCFC-22 (0.055).
(e) Estimated value, calculated by multiplying tonnes of HCFC-22 by the GWP (1810).
(f) Now re-classified as Article 5 Parties under the MP.

48. In 2005 the technical bodies of the MP and UNFCCC highlighted the negative environmental impact of the growth in HCFCs, and identified important mitigation options (IPCC-TEAP, 2005) (TEAP, 2005). In 2007, aiming to protect both climate and ozone, the MP accelerated the HCFC Consumption reduction

[15] A reduction compared to the original MP schedule, assuming a 15-year advance in the linear phase-out of HCFCs.
[16] This initial schedule for HCFCs was adopted by the Beijing Amendment of the Montreal Protocol in 1999.

schedule, so that most of the HCFC Consumption will be phased out by 2020 and 2030 in industrialised and developing countries, respectively (see Annex 1). The MP also established a phase-out schedule for the production of HCFCs (UNEP, 2007, pp. 33, 62-63).

49. MP Decision XIX/6 authorised MLF funds to be used for phasing-out HCFCs, giving first priority to HCFCs with higher ODPs, and to SMEs and countries that Consume low volumes (UNEP, 2007, p. 33). Decision XIX/6 also promotes the use of HCFC substitutes that will minimize climate impacts in particular, taking account of GWP, energy use and other factors (UNEP, 2007, p. 34). When promoting substitutes for HCFCs, governments are therefore expected to avoid industrial greenhouse gases (such as HFCs) that have high GWPs and to promote energy efficient equipment (refer to Sections 7.1 and 7.2 below for details).

5.1.3 Relevance to CEITs

50. Table 6 compares HCFC Consumption and production in the CEIT-19 in 2001 and 2007. Their total HCFC Consumption rose to 1,069 ODP-tonnes in 2001, fell briefly, and then increased to 1,195 ODP-tonnes in 2007[17]. The true total quantity of HCFCs in CEITs is likely to be higher because, since 2004, national data have not been available for CEITs that are members of the EU[18]. 1,195 ODP-tonnes/year is roughly 21,700 normal tonnes/year, indicating that alternatives will need to be adopted for a very large volume of products.

51. To provide an indication of the climate impact, for illustration purposes, Table 6 assumed that all HCFCs in the CEIT-19 are HCFC-22. This indicates 2007 Consumption of about 39 million tonnes CO_2eq/year[19], generating a significant quantity of GHG emissions in the CEIT region. The production of HCFCs has been reported in only one CEIT country, the Russian Federation, and amounted to 281 ODP-tonnes in 2007, which is equivalent to about 9 million tonnes CO_2eq/year (Table 6).

52. The CEITs that are classified as industrialised countries (Article 2 Parties) by the Montreal Protocol are required to reduce HCFCs to 25% and 10% of their national baselines in 2010 and 2015 respectively. At least 4 CEITs (Kazakhstan, the Russian Federation, Tajikistan and Ukraine) need to eliminate 135 ODP-tonnes from their 2007 consumption level, in order to meet the Montreal Protocol reduction step in 2010. The same 4 countries will need to eliminate consumption of 766 ODP-tonnes (~13,600 tonnes) of HCFCs between 2007 and 2015, followed by further reductions before 2020. Data are not available for CEITs that are members of the EU.

53. GEF-4 funds for phasing-out HCFC Consumption and production are available to CEIT countries that have ratified the Copenhagen and Beijing Amendments of the MP, respectively (GEF Council, 2007). The MP Adjustment of 2007, which accelerated the HCFC reduction schedule, comes into force automatically and does not need to be ratified by individual countries. Several HCFC phase-out projects are currently being prepared by national governments and implementing agencies.

5.2 METHYL BROMIDE EXEMPTIONS AND CONSUMPTION

54. Methyl bromide (MB) is a broad-spectrum pesticide which has been used to control pests in certain agricultural crops and stored products since the 1930s. Under the MP, MB is scheduled to be phased out by 2005 in industrialised countries and by 2015 in developing countries. The majority of industrialised countries have successfully phased out MB now, although a handful of countries have been granted so-called ‘critical use’ exemptions (CUEs) after the phase-out date.

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[17] The fluctuations seen in recent years are largely due to fluctuations in Consumption in the Russian Federation.

[18] Consumption data for all 27 EU member states is reported as one total figure for the EU. The EU consumed 1087 ODP-t HCFCs in 2007. CEITs such as Poland and Hungary have been large HCFC consumers in the past.

[19] In calculating tonnes CO_2eq we have assumed that all HCFCs are HCFC-22. ODP-tonnes were divided by the ODP of 0.055 in order to calculate normal tonnes. Tonnes were then multipied by the GWP of 1,810, to obtain tonnes CO_2eq.

5.2.1 Environmental issues

55. The *Scientific Assessment of Ozone Depletion* of 2006 estimated that if MB exemptions (CUEs) continued indefinitely at the 2006 level [~ 7800 ODP-tonnes], the ODS in the atmosphere would increase by 4.7% in mid-latitudes compared to the level if CUEs were to cease in 2010 (WMO, 2007, p. xxxvii). The CUE exemptions have been reduced since that date, but at a slow pace. CUEs still amounted to 2,973 ODP-tonnes in 2009, 4 years after the scheduled phase-out date for MB (Table 7). MB has an effective GWP of 5 – 17[20] and a smaller climate impact than most other ODS. The CUEs in 2009 are equivalent to 24,775 - 84,235 tonnes CO_2eq/year.

56. Aside from the CUEs, two industrialised countries indicated continued MB use of 66 ODP-tonnes in 2007. This consumption is equivalent to about 550 - 1870 tonnes CO_2eq/year (details in Section 5.2.3).

57. In addition to being a potent ODS, MB is a very broad-spectrum pesticide which kills many beneficial and non-target soil organisms, reducing biodiversity in the soil. It is a highly toxic gas that can damage the nervous system of users or bystanders if accidents occur (UNEP, 2001, p. 173). The US National Institute for Occupational Safety and Health considers MB to be a potential carcinogen, and agricultural workers who use MB were found to have a higher-than-normal incidence of prostate cancer (Alavanja, 2003, p. 1).

Table 7: Methyl bromide CUE exemptions authorised by MP and recommended by TEAP (tonnes)

Blue text = quantities recommended by TEAP and subject to a decision by the MP in 2009

Countries	1991 base	2006	2007	2008	2009	2010	2011
Australia	704	75	49	48	38	36	27
Canada	200	54	53	42	39	34	19
EU (a)	19,697	3,537	689	245	0	0	0
Israel	3,580	880	967	861	611	291	
Japan	6,107	741	636	444	305	267	240
New Zealand	135	41	18	0	0	0	0
Russian Federation	(a) 0	0	0	0	(a) 0	[pending, 135 requested]	
Switzerland	43	7	0	0	0	0	0
USA	25,529	7,658	5,149	4,595	3,962	2,764	2,051
Total tonnes	55,995	12,993	7,561	6,235	4,955	t.b.d. < 3,527	t.b.d.
ODP-tonnes	33,597	7,796	4,537	3,741	2,973	t.b.d. < 2,116	t.b.d.

Data source: (TEAP, 2009). *(a) 13 countries of the EU, including Latvia and Poland. All CUEs ceased in the EU at the end of 2008.*

5.2.2 Activities under the Montreal Protocol

58. In 1992 the MP decided to phase-out the majority of MB sectors by 1 January 2005 in industrialised countries. Temporary exemptions (CUEs) are permitted in specific cases where alternatives are considered to be unavailable or not economically feasible[21]. Five years after the phase-out date, a handful of industrialised countries still request exemptions to continue consuming MB for specific agricultural products such as strawberries and flowers. The trend in CUE exemptions is shown in Table

[20] Methyl bromide's 100-year GWP is 5, and 20-year GWP is 17 (IPCC, 2007, pp. 33, Table TS.2). Since MB has a relatively short life in the atmosphere, the 20-year GWP provides a more realistic indication of climate impact.

[21] MP Article 2H(5) allows exemptions for production/Consumption for uses that are agreed by the Parties to be 'critical'. Decision IX/6 sets out the main criteria for these exemptions.

7. The tonnage shown in blue has been recommended by the MP's technical panel, TEAP, and may be authorised or revised by the MP meeting in November 2009. Various MP Decisions have placed additional reporting obligations on countries that have CUEs, such as annual reports on the quantity of MB stocks, and the submission of a national strategy for phasing out CUEs.

59. Aside from CUEs, some unusual MB consumption continues in several industrialised countries. In one case the country has not yet ratified the MP's Copenhagen Amendment, so it is not yet bound by the phase-out requirement. Another industrialised country that uses MB appears to have applied an unusual interpretation of the MP definition of quarantine and pre-shipment (QPS) uses of MB, a sector that has a general exemption from the MP phase-out (details in Section 6.4 below). The Ozone Secretariat has recently attempted to provide additional guidance on QPS definitions (Ozone Secretariat, 2008), but further guidance is desirable.

5.2.3 Relevance to CEITs

60. Three CEITs each face a different issue relating to MB consumption:

- ***Russian Federation*** reported some MB Consumption only in 1994-1996 (1,043 ODP-tonnes in 1994, 1,430 ODP-tonnes in 1995, and 96 ODP-tonnes in 1996), and reported zero in all years from 1997 to 2007 (Ozone Secretariat, 2009). But recently in 2009, for the first time, the Russian Federation requested an exemption of 81 ODP-tonnes MB for the post-harvest sector in 2010. Alternatives have been adopted in many post-harvest sectors world-wide. TEAP has asked for further information, and as of May 2009 has not yet made any recommendations about this request (TEAP, 2009, pp. 285-286). Details on the specific use(s) are not yet available, and part or all of this MB may possibly be used for quarantine (refer to section 6.4). This question is due to be clarified during 2009.
- ***Kazakhstan*** has not yet ratified the Copenhagen Amendment of the MP and is therefore not legally bound by the MB phase-out schedule. However, Kazakhstan made a clear commitment to phase out MB by 2004 in Decision XIII/19 of the Montreal Protocol. Kazakhstan used MB until 2000, and reported zero Consumption in 2001-2005. Recently the government reported new Consumption of 19.8 ODP-tonnes in 2006 and 60 ODP-tonnes MB in 2007 (Ozone Secretariat, 2009). The national ozone office indicated that MB is possibly used to treat soil in glasshouses for tomato production, and in grain elevators (GEF EO 2009b, section 8).
- ***Ukraine*** reported MB Consumption of 390 ODP-tonnes in the mid-1990s, and zero Consumption in 1996 to 2007. During this period about 150 to 840 ODP-tonnes/year was reported to be used for quarantine, a sector which has a general exemption from the MB phase-out schedule (details in Section 6.4). The MB was largely used for stored grain, suggesting that part or all of it may in fact be for uses that are scheduled to be phased out. Currently an estimated 60 ODP-tonnes MB is held in stock, and about 5-6 ODP-tonnes/year is believed to be used for grain (GEF EO 2009b, section 17).

5.3 CFC ESSENTIAL USE EXEMPTIONS

61. CFCs have mainly been used in refrigeration and air-conditioning equipment, fire protection systems, foam products and aerosols. CFCs were produced and Consumed in much larger volumes than all other ODS until 2005 (Table 2). Under the MP, most CFC sectors were scheduled to be phased out by 1996 in industrialised countries and by 2010 in developing countries. A handful of countries currently request temporary exemptions, so-called 'essential use' exemptions, mainly for pharmaceutical aerosols called Metered-Dose Inhalers (MDIs) for treating asthma.

5.3.1 Environmental issues

62. The CFC exemptions authorised in industrialised countries totalled 656 ODP-tonnes in 2009 (Table 8). This is equivalent to about 5.5 million tonnes CO_2eq/year. The phase-out date for developing countries is approaching and some have requested exemptions to use CFCs for MDIs (Table 8). As a result the exempted quantity of CFCs may quadruple in 2010, reaching about 2,462 ODP-tonnes, which is equivalent to about 19 million tonnes CO_2eq/year[22].

5.3.2 Activities under the Montreal Protocol

63. After the phase-out date in industrialised countries, several countries requested 'essential use' exemptions[23] to allow continued CFC production/Consumption for pharmaceutical products (metered-dose inhalers, MDIs) and the aerospace sector. The MP has created a number of reporting obligations related to these CFC exemptions.

64. The MLF has funded several projects for the installation of CFC-free MDI production facilities in developing countries, and these are due to be completed by the end of 2010, the scheduled phase-out date in developing countries (TEAP, 2009, p. 39). TEAP has recently reported that technically satisfactory alternatives to CFC-MDIs are available in almost all countries world-wide (TEAP, 2009, p. 38). In the past, this has not prompted transition in some developing countries largely due to affordability problems. However, MDI products are now manufactured in developing countries at lower cost, and this may help to reduce the price difference, in TEAP's view. CFC phase-out remains highly dependent on the progress of projects to convert domestic manufacture (TEAP, 2009, p. 40).

Table 8: Global CFC essential use exemptions authorised in 2006-2010, and requested for 2010 (tonnes)

Blue text = quantities recommended by TEAP, subject to a decision by the MP in 2009

Sector	Countries	CFC exemptions authorised by MP (tonnes)				
		2006	2007	2008	2009	2010
MDIs (aerosols)	EU	539	535	200	22	0
	Russian Fed.	400	243	212	248	(a) 212
	USA	1,100	1,000	385	282	92
	Developing countries (b)	-	-	-	-	(a) 2,063
	Total MDIs	2,039	1,778	797	552	t.b.d. ≤ 2,366
Aerospace (solvents)	Russian Fed.	0	150	140	130	(a) 120
	Total aerospace	0	150	140	130	t.b.d. ≤ 120
Total tonnes		2,039	1,928	937	682	t.b.d. ≤ 2,486
ODP-tonnes		2,039	1,898	909	656	t.b.d .≤ 2,462

Compiled from: MP Decision XVII/5 (UNEP, 2005, p. 40)*; Decision XVIII/7* (UNEP, 2006, p. 73)*; Decision XIX/13* (UNEP, 2007)*;* (Ozone Secretariat, 2009).

(a) *Exemptions for 2010 recommended by TEAP* (TEAP, 2009, pp. 7, 60)*, subject to consideration by the MP during 2009.*

(b) *The CFC phase-out date for developing countries (Article 5 Parties) is 2010; several developing countries have recently requested exemption for MDIs starting in 2010.*

22 This estimate assumes that MDI exemptions will comprise 50% CFC-11 and 50% CFC-12.

23 MP Articles 2A(4) and 2C(3) allow production/Consumption exemptions for uses that are agreed by the Parties to be 'essential'. Decision IV/25 sets out the main criteria for these exemptions.

5.3.3 Relevance to CEITs

65. Among CEITs, CFC exemptions have been authorised since 2005 for the Russian Federation only, although Hungary, Poland and Ukraine were granted exemptions prior to this date. In 2009 the Russian Federation's exemptions totalled 352 ODP-tonnes or 378 tonnes (Ozone Secretariat, 2009) and accounted for 55% of the global exempted volume of CFCs (Table 8).

66. ***Aerospace:*** The Russian Federation uses CFC-113 as a solvent in the space and rocket industries. 130 tonnes CFC-113 is equivalent to about 796,900 tonnes CO_2eq[24]. TEAP has provided a review of these applications (TEAP, 2009, pp. 62-79), and concluded that CFC phase-out will require the introduction of appropriate alternatives, adoption of newly designed equipment and materials compatible with alternatives (TEAP, 2009, p. 61). TEAP also recommended the sharing of successful experiences from other countries.

67. ***MDIs***: In 2004 the Russian Federation submitted to the MP a plan of action for the phase-out of salbutamol CFC MDIs in the period 2005-2007 (Ministry of Natural Resources of the Russian Federation, 2004), however the transition has been repeatedly delayed (TEAP, 2009, p. 27). The Russian Federation was estimated to use about 250 tonnes CFCs for MDIs in 2008, which is about 9% of global use (TEAP, 2009, p. 37). For 2010, 212 tonnes CFCs have been requested for 2 state enterprises (TEAP, 2009, p. 27); this is equivalent to about 2 million tonnes CO_2eq[25]. As noted above, alternative technologies have been approved and adopted in many countries. Recently TEAP has strongly urged the Russian Federation to define a new phase-out strategy, either using technologies which require less investment or by allowing imports of low-priced CFC-free products (TEAP, 2009, pp. 27-28).

5.4 LABORATORY AND ANALYTICAL ODS

68. CFCs, methyl chloroform (MCF), carbon tetrachloride (CTC) and other types of ODS are used in laboratories and for conducting analytical tests. Although these ODS substances are scheduled to be phased out, MP Decisions have allowed a general exemption for a large number of laboratory and analytical (L&A) uses. The exemption is currently authorised until the end of 2011.

5.4.1 Environmental issues

69. The reported levels of production and Consumption of ODS for L&A uses amounted to 187 and 40 ODP-tonnes respectively (Table 9). However, the reported data may be incomplete. Consumption of 40 ODP-tonnes is estimated to be equivalent to approximately 633,000 tonnes CO_2eq/year.

5.4.2 Status under the Montreal Protocol

70. MP Decision VII/11 and subsequent Decisions[26] allowed a general 'essential use' exemption for many laboratory and analytical (L&A) uses of ODS, currently valid until 31 December 2011. The EU has recently tabled a proposal to extend this global exemption until 2015 (UNEP, 2009). Some L&A uses are not covered by the exemption[27] because alternatives have been identified (TEAP, 2005). On the basis of information provided in annual progress reports by TEAP, the MP is scheduled to decide which uses of ODS are no longer eligible for the exemption. Alternatives exist for many L&A ODS; about 60% have been eliminated in Scandinavia (Nordic Council 2005). TEAP noted that some opportunities for substitution exist, but there has been very little progress in replacing ODS (TEAP, 2006, p. 72). The MP's

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[24] According to the IPCC, CFC-113 has a 100-year GWP of 6130 (IPCC, 2007, pp. 33, Table TS.2)

[25] Assuming 22% CFC-11 and 78% CFC-12 (proportions calculated from data in (Ministry of Natural Resources of the Russian Federation, 2004, p. 7), and applying GWPs of 4750 and 10,900 respectively (IPCC, 2007, pp. 33, Table TS.2). 46.64 t CFC-11 x 4750 = 221,540 tCO2eq.. 165.36 t CFC-12 x 10,900 = 1,802,424 tCO2eq. Total = 2,023,964 tCO2eq.

[26] Decisions X/9, XV/8, XVI/16 (Ozone Secretariat, 2006, pp. 159, 105, 106), and XIX/18 (UNEP, 2007, p. 43).

[27] L&A uses that are not covered by the general exemption are identified in Decisions VII/11, XI/15 and XIX/18.

annual reporting forms require countries to report on ODS production, imports and exports for exempted L&A uses, however the reports may be incomplete in this sector.

5.4.3 Relevance to CEITs

71. The CEIT-19 reported zero production of ODS for L&A uses in 2007, and in the past production was reported only by the Czech Republic. Reported Consumption indicates approximately 10.3 ODP-tonnes in 2007 (Table 10). However there may be significant under-reporting for L&A uses globally, so the figures in Table 10 might not reflect the actual situation in CEITs.

Table 9: Reported global production and Consumption of ODS for exempted laboratory and analytical uses (ODP-tonnes, tonnes, and tonnes CO_2eq)

ODS	Reported global production in 2007			Reported global Consumption in 2007		
	ODP-tonnes	Tonnes	Tonnes CO_2eq	ODP-tonnes	Tonnes	Tonnes CO_2eq
CTC	162.5	90.0	126,056	5.8	95.3	133,420
CFCs	24.2	30.2	185,126	34.4	70.6	499,666
MCF	0	0.3	38	0.1	1.2	175
Other ODS	0	0	0	0	0	2
Total	186.7	120.5	311,220	40.3	167.1	633,264

Compiled from data in (Ozone Secretariat, 2009) *and* (Ozone Secretariat, 2008, pp. 58-59).

Table 10: Estimated CEIT-19 production and Consumption of ODS for exempted laboratory and analytical uses (ODP-tonnes and tonnes)

ODS	Reported production in 2007		Estimated Consumption in 2007	
	ODP-tonnes	Tonnes	ODP-tonnes	Tonnes
CTC	0	0	7.5	9.5
CFCs	0	0	2.8	2.5
Others	0	0	0	0
Total	0	0	10.3	12

Compiled from data in (Ozone Secretariat, 2009).

5.5 ILLEGAL TRADE IN ODS

72. Under the MP, most countries have adopted licensing systems intended to regulate the type and quantity of ODS imports and exports. The large volume of legitimate ODS trade that takes place for exempted and legal uses provides cover for illegal trade. One study calculated that more than 24,000 legitimate transboundary shipments of ODS occurred in 2004 (EIA & Chatham House, 2006, p. 8), so customs officers face a complex task in differentiating between legal and illegal shipments.

73. Illegal trade in ODS can arise in many forms (UNEP, 2001). For example, ODS containers can be disguised to look like other substances. Traders can attempt to import or export ODS without licenses, using false descriptions in customs documents. In other examples, traders have pretended that ODS were going to be exported legitimately from industrialised to developing countries (where the phase-out date occurs later) but in fact they exported empty cylinders, and sold the ODS illegally in industrialised countries (UNEP, 2001, p. 8). The World Customs Organisation's (WCO) Regional Intelligence Liaison Offices (RILO) serve as focal points for intelligence analysis and liaison enforcement cooperation with customs administrations in major regions of the world. RILO regional offices collect, collate, evaluate and disseminate information on customs offences, and periodically produce bulletins

describing seizures of global and regional relevance, trend analyses and analytical reports. Examples of illegal trade in ODS that have been reported by RILO are shown in Annex 2.

5.5.1 Environmental issues

74. During the 1990s the volume of illegal CFCs entering the USA was estimated to be about 10,000 tonnes[28] (UNEP, 2002, p. 2), while illegal CFC imports in Europe were estimated to be 8,000 tonnes in 1995 (UNEP, 2001, p. 10). In the mid-1990s the global illegal trade in ODS was estimated to be < 20,000 tonnes/year, equivalent to more than 12% of global ODS production, with an approximate value of US$150 - 300 million per year, although others estimated 20% of production (EIA & Chatham House, 2006, p. 4).

75. Based on experiences in individual countries, ODS smuggling was recently estimated to be around 10-20% of the total volume of legitimate ODS trade (EIA & Chatham House, 2006, p. 5). This indicates a volume of about 6,900-13,700 ODP-tonnes of illegal trade in 2007, with a value around $28-56 million per year (assuming a market price of $4/kg). The level of illegal trade is expected to increase after 1 January 2010, when the Consumption of CFCs and halons is due to be phased-out in developing countries.

5.5.2 Activities under the Montreal Protocol

76. The Ozone Secretariat has noted that, as the phase-out of ODS constrains supplies, '*the temptation to make money through illegal trade in such substances often increases*' (Ozone Secretariat, 2007, p. 1). The different phase-out dates set for industrialised and developing countries opened up tremendous potential for smuggling ODS (UNEP, 2001, p. 8). During the 1990s, the problem was experienced mainly in the USA and Europe. Now the problem has spread to many countries with developing economies. The MP has commissioned reports on the issue, and adopted several Decisions that encourage voluntary action[29]. The MLF has funded the development of guidance documents, training programmes for customs and related agencies, and ODS networking activities by UNEP. UNEP has promoted Green Customs activities, and UNEP networks of ODS officers in several regions (particularly in Asia and CIS) have undertaken joint activities with RILO and customs departments[30]. The issue of illegal trade has been discussed at many MP meetings. However, the activities and voluntary Decisions adopted by the MP to date have not tackled the problem, and further steps are needed.

5.5.3 Relevance to CEITs

77. During the mid-1990s most of the ODS illegally entering Europe and the USA were believed to originate in the Russian Federation (UNEP, 2001, pp. 5-6), and cases of illegal trade in CFCs manufactured in the Russian Federation were detected in Estonia, UK, USA and other countries (EIA, 2008, p. 15)[31]. Illegal ODS trade in CEITs became a cause of serious concern during the 1990s (UNEP, 2001, p. 9). However, Asia is increasingly cited as the likely production site of illegal ODS that are detected in CEITs. Although illegal cylinders of ODS sometimes bear Chinese brand names some may in fact be produced in other countries. The reported cases are relatively small-scale, but the large amounts of CFCs available on the market in Central Asian countries are suspected to indicate large scale smuggling (UNEP DTIE, 2009, p. 3). Table 11 provides some examples of illegal trade and infringements reported in CEITs since 2002,

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28 As of Sept 1999, 662 seizures of illegal ODS imports had been made in the USA, resulting in 133 criminal cases. 87 defendants had been convicted with imprisonment totalling 48 years & fines totalling $38 million (UNEP, 2001, p. 12).

29 For example, Decisions VIII/20, XII/10, XIV/7, XVI/33, XVII/16 (Ozone Secretariat, 2006).

30 Examples can be found in (UNEP DTIE, 2009), http://www.uneptie.org/ozonaction/topics/customs.htm and http://www.unep.fr/ozonaction/partnerships/greencustoms.htm

31 EIA noted that the EU system of so-called Inward Processing Relief (IPR) for ODS provided a convenient front for laundering CFCs onto the black market because traders were free to import CFCs in bulk tankers to be repackaged in smaller containers (EIA, 2008, p. 15). IPR now applies in the CEITs that are EU member states.

and further details are provided in Annex 2. It should be noted that a large number of reported cases (notably in Uzbekistan) often indicates that a country is more vigilant in monitoring for illegal trade than countries that report low numbers of cases. A recent study on the GEF ODS projects in CEITs found that the risk of illegal ODS trade still remains high in most Central Asian CEITs today (GEF EO, 2009a).

Table 11: Examples of illegal ODS trade and infringements reported in CEITs since 2002

Country	No. of reported events	Implied sources of ODS	Substances	ODP-tonnes	tonnes	Year of events
Armenia	2	Saudi Arabia, United Arab Emirates	CFC	?	?	2007?
Belarus	1	Not stated	CFC	?	?	2003
Czech Rep.	3	Czech Rep., other not stated	HCFC	> 0.021	> 0.380	2002-2003
Estonia	13	Estonia, other not stated	Halon, HCFC	> 2.404	> 0.470	2005, 2007?
Georgia	1	United Arab Emirates	CFC	?	?	2004
Kazakhstan	1 + reported risk	Russia, China	CFC, HCFC	> 0.006	> 0.110	2007, 2009
Kyrgyzstan	5	South Korea, China	Halon, CFC	> 1.440	> 0.467	? 2007, 2008
Poland	> 2	Ukraine	HCFC, CFC	> 0.150	> 0.150	2005, ?
Russian Federation	4 + reported risk	China, Germany, Russia, other not stated	CFC, MCF, other	46.377	> 109.960	2007, 2008, 2009
Slovakia	20	Not stated	?	?	?	2004-2009
Tajikistan	several	Not stated	CFC mainly	?	?	?
Turkmenistan	1 + reported risk	Not stated	CFC, other?	?	> 1.224	2006, 2009
Ukraine	Reported risk	Not stated	CFC	?	?	2009
Uzbekistan	> 21	China, Kyrgyzstan, Uzbekistan	CFC, HCFC, MB, other	?	> 1.764	2002-2008

See Annex 2 for further details and information sources.

Illustration of illegal ODS trade:

Officials detected 2400 car fire extinguishers containing halons that were imported into Kyrgyzstan from South Korea using forged documents

Source: Rodichkin 2008 p.33

6 Challenge 2: ODS sectors that are not required to be phased out

78. Several ODS sectors are not covered by phase-out requirements, or are exempted from the phase-out requirements, so their production and consumption can continue without restriction. The *Scientific Assessment of Ozone Depletion: 2006* has noted that the emissions associated with exempted sectors – such as quarantine and pre-shipment uses of MB, ODS process agents and feedstock - may delay the recovery of the ozone layer (WMO, 2007, p. xxxvii). Moreover, large volumes of ODS from past Consumption are installed in equipment and their emissions will continue to have a large impact on the environment. This section describes the main areas and issues associated with ODS sectors that are not subject to phase-out requirements.

6.1 ODS BANKS INSTALLED IN EXISTING EQUIPMENT

79. Large quantities of ODS (CFCs, HCFCs and halons) are still installed in equipment such as refrigerators, air-conditioning units, fire protection systems and foam products. These installed ODS are often called 'banks'. The ODS are released to the atmosphere when leaks arise, when equipment is serviced, and when a product reaches the end of its useful life. Some ODS are emitted rapidly, while others are emitted very slowly, during many years. The MP has encouraged countries to take voluntary steps to reduce emissions, and is now considering more substantive measures to address the problems posed by ODS banks.

6.1.1 Environmental issues

80. The *Scientific Assessment of Ozone Depletion* of 2006 found that ODS banks are a substantial problem for the ozone layer, contributing the largest ODS emissions to the atmosphere (WMO, 2007, pp. xxxvi, Table 1)[32]. The volume of ODS installed in equipment and products is difficult to quantify accurately. Extrapolating from estimates made by TEAP (Table 12), there may be about 2,900,000 ODP-tonnes of ODS installed in equipment and products worldwide at present, totalling approximately 16,760 million tonnes CO_2eq. All of this will be emitted to the atmosphere eventually, unless preventive measures are taken. TEAP estimated that ODS banks installed in equipment/products were about 3,779,000 ODP-tonnes in 2002 and would fall to about 2,110,000 in 2015 (TEAP, 2005)[33], as shown in Table 12. This means that the ODS emissions from banks, in the period from 2002 to 2015 alone, are expected to total about 1,669,000 ODP-tonnes.

Table 12: Estimates of global banks of ODS and HFCs 2002 and 2015 (ODP-tonnes, tonnes and CO_2eq)

Substances	ODP-tonnes		tonnes		million tonnes CO_2eq.	
	2002	2015	2002	2015	2002	2015
Halons	1,173,000	457,000	168,000	55,000	531	229
CFCs	2,412,000	1,406,000	2,430,000	1,411,000	15,749	8,302
HCFCs	194,000	247,000	2,651,000	3,317,000	3,841	4,871
Total ODS	3,779,000	2,110,000	5,249,000	4,783,000	20,121	13,402
HFCs	0	0	545,000	2,951,000	1,108	5,231
Total ODS + HFCs	3,779,000	2,110,000	5,793,000	7,735,000	21,229	18,633

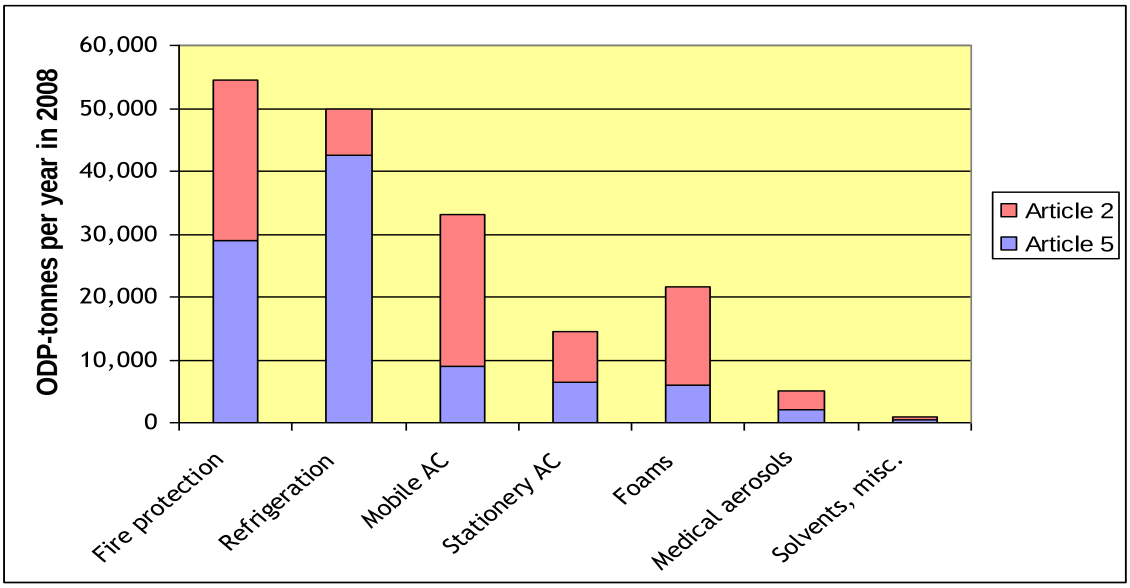
Compiled from data in (TEAP, 2005). *Figures are rounded to nearest thousand.*

32 Column B in Table 1 of WMO 2007 (p.xxxvi) indicates that the largest emissions emanate from ODS banks, and that the elimination of emissions from banks would bring a substantial reduction in future chlorine/bromine loading to the atmosphere.

33 Uncertainties in these estimates are approximately ±20%.

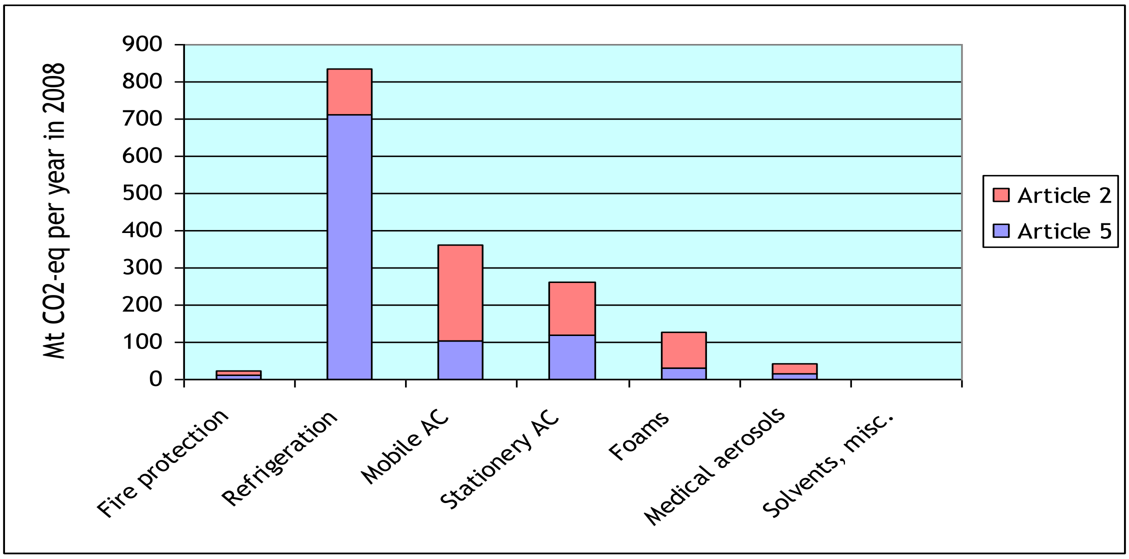
81. Figure 5 and Figure 6 illustrate the annual emissions from ODS banks in 2008, from the various types of equipment and products that contain ODS in industrialised (Article 2) countries and developing (Article 5) countries. During this current decade, the annual ODS emissions from banks total more than 1,000 million tonnes CO_2eq/year. The emissions from ODS banks are therefore expected to erase all of the benefits of the Kyoto Protocol's CO_2eq reduction target of 2008-2012[34].

Figure 5: Estimated global annual emissions from ODS banks by sector in 2008, ODP-tonnes /year



Extrapolated from TEAP (2005) estimated data for 2002 and 2015. AC = air-conditioning.
Article 2 = industrialised countries. Article 5 = developing countries.

Figure 6: Estimated global annual emissions from ODS banks by sector in 2008, Mt CO_2eq /year



Extrapolated from TEAP (2005) estimated data for 2002 and 2015. AC = air-conditioning.
Article 2 = industrialised countries. Article 5 = developing countries.

[34] Estimates of the total impact of the Kyoto Protocol's reduction target in 2008-2012 vary from about 4,300 million tonnes CO_2eq (UNFCCC 2005) to roughly 10,000 million tonnes CO_2eq (Velders et al. 2007).

82. TEAP has concluded that 'a considerable portion' of ODS banks is 'available for collection and destruction at costs justified by benefits in reducing ozone-depleting substances and greenhouse gas emissions' (UNEP, 2007, pp. 6, para.21). There is a limited window of opportunity to prevent these emissions of ODS, particularly in refrigeration, air-conditioning and fire protection systems. In addition to the problem of ODS banks, there are increasing banks of HFCs. which are greenhouse gases controlled under the Kyoto Protocol (see section 7.3). HFCs have replaced many ODS, and are installed in similar types of equipment and products, such as refrigeration equipment and foam. Banks of HFCs are expected to increase from 1,108 million tonnes CO_2eq in 2002 to 5,231 million tonnes CO_2eq in 2015 (Table 12). Further details are provided in Section 7.3 below.

6.1.2 Status under the Montreal Protocol

83. Several major reports by TEAP and other bodies drew attention to the large emissions of ODS (CFCs, HCFCs and halons) and F-gases (mainly HFCs) from equipment and products, and noted that it is technically feasible to prevent a large part of these emissions (IPCC-TEAP, 2005) (TEAP, 2005) (TEAP Task Force, 2009). But experience has shown that any technical or economic impediment to recovering the ODS provides an incentive to release the gases to the atmosphere (TEAP, 2008, p. 92). MP Decisions adopted since 1992 have encouraged countries to minimise ODS emissions, and to recover and destroy ODS when equipment reaches end-of-life, however only a few countries have adopted such measures on a large scale[35]. Japan, for example, collects and destroys ODS from many refrigerators, vehicle air-conditioning units and other equipment, as part of national programmes on waste reduction/recycling and producer responsibility. The MP recently indentified ODS banks as one of the key challenges facing the Protocol[36] (UNEP, 2007, p. 2) and adopted a Decision on ODS banks which, *inter alia*, set up a workshop in July 2009, invited countries to submit strategies, requested the MLF to commence pilot projects urgently[37], and committed the MP to consider possible actions on banks in 2009 (UNEP, 2008, pp. 39-41, Decision XX/7).

6.1.3 Relevance to CEITs

84. While ODS and HFCs have been consumed, these substances have accumulated in equipment and products in CEITs. Table 14 shows some of the available estimates of the volume of ODS banks in specific CEIT countries and sectors. However, reliable statistics are not available in many cases, so the estimates vary greatly. Estimates of the quantity of halon-2402 installed in Ukraine, for example, vary from 769 ODP-tonnes to 3,612 ODP-tonnes (Table 14).

85. The ODS banks installed in CEITs can also be estimated from the global total, to provide a preliminary figure. The CEIT-19 countries have consumed about 17% of the global baseline of ODS. Assuming that CEITs therefore hold about 17% of the global ODS banks, there could be up to 642,400 ODP-tonnes in CEITs in 2002 and 358,700 ODP-tonnes in 2015, which is equivalent to about 3,400 and 2,300 million tonnes CO_2eq, respectively (shown in Table 13). Taking the mid-point of 2002 and 2015, this indicates that there may be up to 500,500 ODP-tonnes of ODS currently installed, or about 2,850 million tonnes CO_2eq from ODS alone. However, to provide more reliable estimates it would be necessary to carry out surveys and compile an inventory of the existing equipment and foam products in CEITs. Banks of HFCs (F-gases) are discussed in Section 7.3 below.

[35] Large-scale recovery and destruction programmes for ODS and HFCs are operating in Japan, Australia and some EU countries.

[36] Paragraph 6 stated that: '*On the issue of banks, virtually all participants recognized that their size meant they could not be ignored…*'

[37] Pilot projects may cover the collection, transport, storage and destruction of ODS. A report will also be compiled on possible funding sources for the management and destruction of banks (Decision XX/7(2) and (9)).

Table 13: Potential CEIT-19 banks of installed ODS and HFCs, in 2002 and 2015 (ODP-tonnes, tonnes and CO_2eq)

Substances	ODP-tonnes		tonnes		million tonnes CO_2eq.	
	2002	2015	2002	2015	2002	2015
Halons	199,410	77,690	28,560	9,350	90	39
CFCs	410,040	239,020	413,100	239,870	2,677	1,411
HCFCs	32,980	41,990	450,670	563,890	653	828
Total ODS	642,430	358,700	892,330	813,110	3,421	2,278
HFCs	0	0	92,650	501,670	188	889
Total ODS + HFCs	642,430	358,700	984,810	1,314,950	3,609	3,168

Data above were calculated on the assumption that CEIT-19 banks are about 17% of the global bank estimates shown in Table 12.

Table 14: Examples of ODS installed in equipment in CEITs

Country	ODS	System	ODP-tonnes	tonnes	Year	Information source
Armenia	Halons	Fire	?	?	2005	GEF EO 2009b, s.1
Azerbaijan	Halon-2402	Fire (ships)	~ 66	~ 11	?	GEF EO 2009b, s.2
Azerbaijan	Halons	Fire	~ 501	~ 84	?	GEF EO 2009b, s.2
Bulgaria	CFCs HCFCs	RAC	?	847	2001	Ministry Environment & Water 2003 p.13
Bulgaria	CFCs HCFCs	Foam products	~ 472	550	2001	Ministry Environment & Water 2003 p.13
Hungary	CFCs, HCFCs	Foams	~ 503	3,500	2006	Milieu 2007 Annex I
Latvia	Halons	Fire (ships)	?	?	recent	GEF EO 2009b, s.9
Poland	CFCs	RAC	~ 1,200	1,200	2003	Milieu 2007 Annex I
Poland	CFCs	Foams	~ 5,500	5,500	2003	Milieu 2007 Annex I
Russian Federation	Halon-2402, 1301, 1211	Fire	~ 30,000 – 66,000	5,000 - 11,000	2008	GEF EO 2009b, s.15
Russian Federation	Halon-2402	Fire	5,680	947	2007	TEAP 2009 p.111
Slovakia	Halons	Fire	~ 8	1	~ 2008	GEF EO 2009b, s.12
Ukraine	Halon-2402	Fire	769	128	~ 2008	GEF EO 2009b, s.17
Ukraine	Halon-2402	Fire	1,800-3,612	300-602	~ 2008	TEAP 2009 p.112
Ukraine	Halon-1301	Fire	713	71	~ 2008	GEF EO 2009b, s.17
Ukraine	Halon-1211	Fire	10	3	~ 2008	GEF EO 2009b, s.17
Ukraine	Halon BF-2	Fire	20	33	~ 2008	GEF EO 2009b, s.17
Ukraine	CFCs	Refrigeration in steel mill	?	?	?	GEF EO 2009b, s.17
CEITs	Halon-1211	Fire	8,550	~ 2,850	2007	HTOC 2007 p.47
CEITs	Halon-1301	Fire	15,370	~ 1,537	2007	HTOC 2007 p.39

For details of information sources refer to Bibliography. RAC= Refrigeration and air conditioning

6.2 UNWANTED STOCKS OF ODS

86. A number of countries have reported that they hold stockpiles of ODS that are unwanted or contaminated. The cost of transportation and environmentally-safe destruction of these stocks is a substantial hurdle in some countries.

6.2.1 Environmental issues

87. Although several preliminary surveys have been carried out, reliable information on the quantity and type of unwanted ODS stocks is not available at present. The MP is compiling further information. If concerted efforts are made to adopt ODS-alternatives and to collect ODS banks, the resulting quantity of unwanted ODS would be very large (refer to Section 6.1.1 above), and well-organised programmes would be required to carry out destruction using environmentally-safe methods.

6.2.2 Status under the Montreal Protocol

88. During MP meetings developing countries have expressed concern about the fate of unwanted stockpiles of ODS, and recently submitted draft proposals to assist the collection and destruction of such stocks. MP Decision XX/7 requested the MLF to consider, as an initial priority, pilot projects to address ODS stocks that have high GWPs (UNEP, 2008, pp. 39-41). This topic is linked to ODS banks and is scheduled to be discussed further during the MP meetings of 2009 (UNEP, 2009).

Table 15: Examples of problems with unwanted stocks of ODS in CEITs

Country	ODS	Comment	ODP-tonnes	tonnes	Year	Information source
Armenia	CFC, HCFC	No facilities to collect and store unwanted ODS refrigerants, so they are usually released to the atmosphere	n.d.	n.d.	2009	GEF EO 2009b, s.1
Estonia	halons	Cost of destroying contaminated halon (shipped to Sweden) was €4-5/kg in 2005. If costs increase, owners may be unwilling to pay, with risk that halon may be released to the air	n.d.	n.d.	2009	GEF EO 2009b, s.6
Kazakhstan	CFC or HCFC	Some enterprises are storing unwanted ODS which they collected from refrigeration equipment	n.d.	n.d.	2009	GEF EO 2009b, s.8
Tajikistan	CFC-11, HCFC-22	ODS stocks found in a company producing aluminium	n.d.	> 2.3	2007	Rodichkin 2008 p.35
Tajikistan	CFC-11	ODS stocks found in enterprise producing domestic refrigerators	6.0	6.0	2008	Rodichkin 2008 p.35
Uzbekistan	CFC or HCFC	Some enterprises reported that they are storing unwanted ODS which they collected from refrigeration equipment	n.d.	n.d.	2009	GEF EO 2009b, s.18

For details of information sources refer to Bibliography.

6.2.3 Relevance to CEITs

89. Data on unwanted stocks is not available for CEITs, although individual examples are shown in Table 15. It would be necessary to conduct a survey in CEITs in order to find out the locations, quantities and types of unwanted ODS stocks. During the GEF evaluation study of ODS projects in CEITs, several countries indicated difficulties in collecting and destroying unwanted ODS stocks, as illustrated in Table 15. Some enterprises reported that they are storing unwanted ODS that they collected from refrigeration equipment; they expressed frustration at the lack of procedures for disposing of the ODS in an environmentally-safe manner (GEF EO, 2009b). If enterprises do not have access to appropriate destruction methods, there is a high risk that they will dispose of the ODS by simply releasing them to the air, resulting in damage to the ozone layer and climate.

6.3 PROCESS AGENTS, FEEDSTOCK AND INDUSTRIAL EMISSIONS

90. Many types of ODS are used as feedstock in industrial processes, when producing other chemicals. The MP has traditionally assumed that the ODS are almost entirely converted to other substances and that ODS emissions are negligible. However, the emissions are likely to be greater than assumed.

6.3.1 Environmental issues

91. Global production of ODS for feedstock was reported to be 400,182 ODP-tonnes or 823,320 tonnes in 2007 (Ozone Secretariat, *pers. comm*.). The global use of ODS as process agents was estimated to be approx. 5,378 ODP-tonnes or 5,130 tonnes in 2006 (calculated from data in (TEAP, 2008, pp. 52, Table 4.2) and (TEAP, 2007, pp. 41-42)). Assuming emissions of 0.5% - 4% (TEAP, 2005, p. 86) global emissions were estimated to be in the range of 2,362 - 16,330 ODP-tonnes in 2007 (Table 16). However, the atmospheric concentration of CTC has recently been found to be 3.5 times greater than expected (TEAP, 2009, p. 5); TEAP data indicated that emissions may possibly be as much as 38%[38] of the CTC production level (TEAP, 2008, p. 23). If correct, this would indicate total feedstock emissions up to 67,100 - 75,170 ODP-tonnes[39].

6.3.2 Status under the Montreal Protocol

92. ***Feedstock.*** The use of ODS as feedstock in industrial and other types of processing was exempted from all MP phase-out schedules. The ODS emissions were thought to be insignificant, because it was assumed that the feedstock was almost entirely converted to other substances during processing. However TEAP recently noted that the emissions arising from feedstock are taking on greater importance; it will be necessary to examine the magnitude of emissions and to identify options for avoiding emissions to protect the ozone layer (TEAP, 2009, p. 6). In particular the emissions of CTC appear to be far greater than previously assumed (TEAP, 2009, p. 5). Countries that are Parties to the MP are required to report annually on ODS feedstock production, imports and exports (under Article 7 of the MP).

93. ***ODS emissions during production****.* Emissions of ODS may also occur during the production of ODS, and as by-products during the production or processing of other substances. The CTC emission problem noted above may arise partly as a result of this issue. The MP has not placed restrictions on ODS emissions arising from production, although a number of MP Decisions discourage ODS emissions in general.

94. ***Process agents*** are ODS that are used as catalysts, remaining largely unchanged during reactions, so Decision IV/12 exempted process agents from the definition of a controlled substance. Decision X/14 adopted a list of exempted process agent uses and placed limits on the Consumption and emissions in

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[38] Slide 23 indicates emissions ~70,000 ODP-t and production ~180,000 ODP-t in 2006. So emissions are ~38.8%.

[39] Assuming 38.8% emissions from 170,000 ODP-tonnes CTC production, plus 0.5 – 4% emissions from other types of ODS feedstock.

10 countries. The lists are supposed to be updated every 2 years[40]. TEAP has provided extensive reports on alternatives for ODS process agents but the general exemption means there are no phase-out targets in industrialised countries and no incentives to adopt alternatives. In contrast, developing countries are encouraged to adopt alternatives with the assistance of MLF funds. Countries have to report annually on process agents under Decisions X/14 and XVII/6 of the MP.

Table 16: Estimates of global use and emissions of ODS as process agents and feedstock

Sector	ODS substances	Use in 2007, estimates		Emissions in 2007, estimates		
		tonnes	ODP-tonnes	tonnes	ODP-tonnes	tonnes CO_2eq
Process agents (catalysts)	CTC, CFC,11, CFC-12, CFC-113, BCM [41]	~ 5,130 (a)	~ 5,378 (a)	~ 311 (a)	~ 326 (a)	Insufficient data
Feedstock in industrial processes	CTC, HCFCs, CFCs, MB, halons, MCF	823,320 (b)	400,182 (b)	~4,120 - 32,930 or possibly much higher (c)	~ 2,362 - 16,330 or possibly much higher (c)	Insufficient data

Data sources: (a) Calculated by Touchdown from data in (TEAP, 2008, pp. 52, Table 4.2) *and* (TEAP, 2007, pp. 41-42). *Data submitted to the Ozone Secretariat is confidential due to the small number of countries that have reported data. (b) Data from Ozone Secretariat (pers. comm.),* (TEAP, 2008, p. 54). *(c) Calculated by Touchdown based on suggested emissions of 0.5% - 4% and estimated CTC emission of 38% (refer to Section 5.3.2).*

6.3.3 Relevance to CEITs

95. ***Feedstock:*** The CEIT-19 have reported production of ODS for feedstock totalling 3,274 ODP-tonnes or 29,223 tonnes in 2007 (Ozone Secretariat, pers. comm, June 2009). The majority of feedstock production takes place in the Russian Federation (Cooke, *pers. comm*. 2009).

96. ***Process agents:*** MP Decision X/14 allocated to the Russian Federation a maximum Consumption or 'make-up' quantity of 800 tonnes/year and maximum emissions of 17 tonnes/year for ODS process agents. Poland has an allocation of 68 tonnes/year Consumption or make-up, and maximum emissions of 0.5 tonnes/year (Ozone Secretariat, 2006, p. 85). Other CEITs have not been allocated any Consumption, although CEITs that are member states of the EU are included in the EU allocation. It is likely that other CEITs use ODS as process agents.

6.4 METHYL BROMIDE QUARANTINE AND PRE-SHIPMENT SECTOR

97. MB is used for controlling pests in specific types of import/export commodities, mainly as a requirement of quarantine authorities. When the MP first placed controls on MB in 1992, a general exemption was created for all quarantine and pre-shipment (QPS) uses of MB. This means that the MP does not require QPS uses to be phased out at present.

6.4.1 Environmental issues

98. The *Scientific Assessment of Ozone Depletion* of 2006 calculated that, if MB QPS production were phased-out in 2015, the total ODS levels[42] in the atmosphere would decrease by 3.2% compared with

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40 Decision XVII/6(8), and Decisions XVII/7, XVII/8, XIX/15 (Ozone Secretariat, 2006, pp. 82-90).

41 Substances listed in Decision XIX/15.

42 The 'integrated equivalent effective stratospheric chlorine' level, i.e. the total amount of chlorine and bromine in the stratosphere during a specific period of time.

continued QPS production at about 6,420 ODP-tonnes/year (WMO, 2007, pp. xxxvii, 8.20). The global MB production for QPS averaged 6,176 ODP-tonnes in 2000-2004 and increased recently to 7,790 ODP-tonnes in 2007, which is equivalent to 64,920 - 220,728 t CO_2eq[43]. Reported global Consumption was 6,452 ODP-tonnes in 2007 (Ozone Secretariat, 2009). However, this data set is incomplete and the true Consumption is likely to be higher.

6.4.2 Status under the Montreal Protocol

99. When MB became a controlled ODS in 1992, a general exemption[44] was created for quarantine and pre-shipment (QPS) uses because countries believed there were no alternatives at that time. QPS uses are defined in Decisions VII/5 and XI/12 of the MP (Ozone Secretariat, 2006, pp. 130-132). Countries are required to report annually on QPS data[45] using the approved forms for Article 7 reporting. Several MP Decisions have encouraged countries to adopt alternatives and minimise emissions from QPS treatments[46]. Alternatives have been identified for a number of QPS uses (TEAP, 1999), (MBTOC, 2003), and several countries have ceased all QPS uses (Batchelor & Miller, 2008). The EU has banned all pesticide uses of MB, including QPS uses, by 18 March 2010 (European Union, 2008) due to the toxicity problems associated with MB. The MP recently adopted Decision XX/6 which encourages countries to put in place a national strategy describing actions to reduce MB use and/or emissions in the QPS sector, as recommended by the international UN body responsible for quarantine issues, the International Plant Protection Convention. The MP will hold a workshop in November 2009 to discuss an assessment report on QPS and possible further actions (UNEP, 2008, pp. 37-39, Decision XX/6).

6.4.3 Relevance to CEITs

100. One CEIT country (Ukraine) manufactured MB for QPS in the past, and no CEITs manufacture MB currently. Based on reported data (Ozone Secretariat, 2009), CEIT-19 Consumption for QPS was estimated to be 92 ODP-tonnes in 2006 and 24 ODP-tonnes in 2007, however this data may be incomplete. The Russian Federation recently asked the Montreal Protocol for a Critical Use Exemption (see section 5.2.3) of 81 ODP-tonnes of MB, and part or all of this may possibly be for quarantine. This question is due to be clarified during 2009.

101. In addition, experts have indicated informally that several CEITs may be mis-classifying normal MB uses as 'QPS', due to general difficulties in interpreting the MP's definition of QPS. If MB consumption has been mis-classified as QPS, it would mean that the countries concerned are consuming MB for uses that should have been phased out by 2005. It is desirable to clarify the interpretation of the QPS definitions in these cases.

6.5 'NEW' OZONE-DEPLETING SUBSTANCES

102. In the last decade scientists have found that several substances which are not controlled by the MP are also ODS or suspected ODS. In past years, several countries have made efforts to control these substances under the MP, but at present there are no controls and no reporting requirements.

6.5.1 Environmental issues

103. The *Scientific Assessment of Ozone Depletion* of 2006 reported that the role of very short-lived halogenated substances in ozone depletion is now believed to be of greater importance (WMO, 2007, p. xxxvii). These gases are not controlled by the MP. The study concluded that any chlorinated very

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43 Methyl bromide's 100-year GWP is 5, and 20-year GWP is 17 (IPCC, 2007, pp. 33, Table TS.2). Since MB has a relatively short life in the atmosphere, the 20-year GWP provides a more realistic indication of climate impact.

44 The MP phase-out schedule for MB production and Consumption does not include the quantities of MB used for QPS, under Article 2H(6) (Ozone Secretariat, 2006, p. 11).

45 Article 7(3) as amended by the Beijing Amendment. It applies to Parties that have ratified this Amendment.

46 For example, Decisions VI/11, VII/5, XI/13, XVI/11, XX/6.

short-lived gas with a lifetime of about 25 days, one chlorine atom, and a similar molecular weight to CFC-11 has an ODP of about 0.003 (WMO, 2007, p. xxxvii). This would fall within the range of ODPs of the substances that are currently controlled by the MP, which have ODPs in the range of 0.001 to 10.0 (Ozone Secretariat, 2006, pp. 23-26). Annex 3 lists substance that have been identified as new ODS, and substances that require further research to determine whether they are ODS.

6.5.2 Status under the Montreal Protocol

104. The MP currently controls 96 substances (Ozone Secretariat, 2006, pp. 23-26). Additional ozone-depleting substances (actual and suspected) have been identified, but have not been added to the MP. Several proposals and Decisions have been tabled since 1997. However producers often oppose controls, claiming that Consumption is low, or that the ODP is low or needs further research. This means potential and suspected ODS can become widely used in industry before controls are considered. The MP does not require reporting and does not make a systematic review of the ODPs of all potential ODS. As a result there are some significant gaps in the data shown in Annex 3.

6.5.3 Relevance to CEITs

105. No data are available on the production and Consumption of suspected or potential new ODS in CEITs. To compile this data it would be necessary to carry out a detailed survey in relevant industry sectors.

7 Challenge 3: Links between ODS and issues addressed by other MEAs

106. The MP is currently considering whether to address new areas such as HFCs (details in Section 7.1 below). The GEF-4 strategy for the ozone focal area has stated that 'GEF will retain the flexibility to respond to policy evolutions under the Montreal protocol, for example regarding metered dose inhalers transition strategies or the destruction of unwanted ODS' (GEF Council, 2007). The GEF-4 strategy also noted that the ozone area has strong linkages with climate change, persistent organic pollutants (POPs), and chemicals management (GEF Council, 2007). Recently the GEF Secretariat highlighted the fact that global environmental issues are interrelated and that solutions cannot be pursued in isolation: '*Increasingly the global community would need to show its capacity to build synergies among the global environmental agreements in order to remediate and protect the ozone layer, the global climate'* and other global commons (UNEP, 2007, p. 9). The infrastructure required for addressing the problem of ODS is similar to the infrastructure and activities needed to address some other substances that are controlled under other multilateral environmental agreements (MEAs). This offers strong opportunities for joint work and improved cost efficiency.

7.1 PROPOSED ACTION ON HFCs UNDER THE MONTREAL PROTOCOL

107. Hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) are not ODS, however many are potent greenhouse gases (GHG). They are sometimes called industrial GHG, fluorinated gases, or F-gases. They are controlled under the Kyoto Protocol of the UNFCCC. HFCs and PFCs are used in the same applications as CFCs and HCFCs, so they are found in refrigeration equipment, air-conditioning units, foam products and aerosols. In fact the use of HFCs has increased greatly in recent years because many enterprises were encouraged to adopt HFCs as ODS substitutes. PFCs are used very little, so the rest of this description focuses mainly on HFCs.

7.1.1 Environmental issues

108. HFCs have GWPs ranging from about 124 to 14,800 (IPCC, 2007, pp. 33, Table TS.2), although several new HFCs with much lower GWPs are currently under development. HFC-134a, the most common HFC, has a GWP of 1,430. The UNFCCC GHG emissions inventory data indicate that total emissions of F-gases (HFCs, PFCs, SF_6) increased by 10% in 1990-2006, and accounted for 1.7% of total GHG emissions of about 40 Annex I Parties[47] in 2006 (UNFCCC, 2008, p. 8). Global production of HFCs has grown rapidly from low levels in 1990 to about 234,000 – 249,000 tonnes in 2006[48], which is equivalent to about 489 – 518 million tonnes CO_2eq/year.

109. Under a business-as-usual scenario, demand for HFCs is expected to more than double by 2015, reaching about 663,000 tonnes/year, equivalent to about 1,323 million tonnes CO_2eq/year (TEAP, 2005). Industry has adopted some emission reduction techniques so that a portion of HFCs is not emitted to the air. However, the atmospheric concentration of HFC-134a, the most common HFC, has risen from zero in the past to 26 ppt in 2003, increasing at the rate of about 4 ppt/year in 2001 to 2003 (IPCC-TEAP, 2005, pp. 21, TS-2). EIA has estimated that a phase-out of HFCs could save almost 90,000 million tonnes CO_2eq between now and 2040 (EIA, 2009, p. 3).

7.1.2 Status under MEAs

110. HFCs are included in the basket of greenhouse gas (GHG) emissions controlled under the UNFCCC and Kyoto Protocol. Many enterprises have adopted HFCs as substitutes for CFCs and HCFCs, assisted by MLF and GEF funds in some cases. The MP has therefore contributed to the large growth in the use of HFCs since the 1990s. The GEF-4 strategy for ozone protection took account of this problem and

[47] 41 industrialised countries and CEITs are classified as Annex I Parties under the UNFCCC.

[48] AFEAS members reported HFC production of >211,367 tonnes in 2006, accounting for about 85-90% of global production (AFEAS, 2009). This suggests global production of about 234,852-248,667 tonnes.

specifically aimed to give preference to low-GHG technologies as ODS alternatives (GEF Council, 2007, pp. 3, 6). Alternatives with zero or low GWPs are available for most foam sectors and for many refrigeration and air-conditioning sectors, although sometimes the capital or operating cost may be higher and energy efficiency also needs to be considered. Countries that have restricted the use of HFCs (e.g. Denmark, Norway, Sweden) have shown that HFC-free refrigeration systems are feasible and can achieve comparable energy efficiencies with other systems (Rhiemeier, 2009, p. 125).

111. In June 2009 the UNFCCC meeting in Bonn considered a proposal to address HFCs[49] (UNFCCC, 2009, p. 38). The MP meetings in 2009 are also considering a proposal to control and reduce the production and Consumption of HFCs that have high-GWPs and/or to adapt the institutions of the Multilateral Fund to assist developing countries to address the problem of HFCs (UNEP, 2009). The outcome of the MP discussion will not be known until November 2009. If the MP decides to restrict the production and consumption of HFCs, action would be required in many countries.

7.1.3 Relevance to CEITs

112. Like other regions of the world, CEITs have adopted HFCs for refrigeration, foam-blowing, fire systems and aerosols. The GEF-4 strategy on ozone recognised this problem, and stated that countries receiving GEF assistance must demonstrate a willingness to adopt the policies necessary for long-term sustainability, including policies that prohibit the replacement of ODS by fluorinated GHG (such as HFCs) when technologically feasible (GEF Council, 2007, p. 6). Statistics on HFC consumption are not readily available for CEITs. The European Commission holds HFC Consumption data for CEITs that are members of the EU but these data are not public available. UNFCCC Annex I (industrialised) Parties have reported emission estimates to the Secretariat, and these estimates indicate that the use of HFCs has grown rapidly in some CEITs. The emissions of HFCs reported by the Russian Federation, for example, increased from a low level in 1995 to 1.9 million tonnes CO_2eq in 2006 [50].

7.2 ENERGY EFFICIENCY

7.2.1 Environmental issues

113. The IEA has estimated that all types of cost-effective energy efficiency measures could save around 8,200 million tonnes CO_2/year by 2030 if implemented globally without delay (International Energy Agency, 2008, p. 7).

7.2.2 Status under MEAs

114. The UNFCCC bodies have noted that energy efficiency measures would contribute significant and essential reductions in GHG emissions. When adopting alternatives to CFCs, HCFCs and HFCs, there are many opportunities to adopt energy efficient equipment/processes at the same time. The GEF-4 strategy for ozone protection recognized this opportunity for climate synergies by seeking to integrate ODS projects with energy efficiency work supported by the climate change focal area in participating countries (GEF Council, 2007, pp. 6-7). When the MP recently decided to accelerate the phase-out of HCFCs (Section 4.1.1 above) they also decided that the MLF should give priority to alternatives that minimize impacts on the climate, taking into account GWP, energy use and other factors (UNEP, 2007, p. 34)[51].

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[49] The Ad Hoc Working Group on Long-term Co-operative Action (AWG-LCA) considered a proposal for a four-year programme of work for rapid, near-term climate mitigation, such as promoting the phase-down of HFCs (para. 144).

[50] UNFCCC national greenhouse gas inventory data: http://unfccc.int/di/DetailedByParty.do

[51] The MP Decision also encouraged Parties to promote the selection of HCFC alternatives that that minimize environmental impacts, in particular impacts on climate (Decision XIX/6(9) and 11(b)).

7.2.3 Relevance to CEITs

115. When adopting substitutes for CFCs, HCFCs and HFCs, there continue to be many opportunities to improve energy efficiency. Further data on this topic could be compiled if required.

7.3 HFC BANKS INSTALLED IN EQUIPMENT

116. Large volumes of HFCs have been installed in equipment, and these gases are eventually emitted to the atmosphere. The problem is very similar to the problem of ODS banks described in Section 6.1 above. The solutions for ODS and HFCs are very similar because the same type of infrastructure and activities would be required to address these sectors.

7.3.1 Environmental issues

117. TEAP estimated that HFC and PFC banks installed in equipment/products amounted to approx. 545,000 tonnes in 2002 worldwide, and would increase to about 2,951,000 tonnes in 2015. HFCs comprise the vast majority. The total is equivalent to about 1,108 and 5,231 million tonnes CO_2eq in 2002 and 2015 respectively (Table 12). Unless preventive steps are taken, much of this will be emitted to the atmosphere when products are serviced or reach end-of-life. Substantial benefits can be gained for the climate and the ozone layer by addressing both ODS and HFC banks at the same time.

7.3.2 Status under MEAs

118. As reported in Sections 7.1 and 6.1 above, HFCs and banks are not controlled under the MP, but might potentially become controlled in future. HFCs, PFCs and ODS are usually installed in the same types of equipment and products. Dealing with the problem of HFC, PFC and ODS banks would require a similar infrastructure and often the same destruction technologies, providing opportunities for joint work.

7.3.3 Relevance to CEITs

119. Banks of HFCs and PFCs have accumulated in CEITs, but reliable estimates are not available. If one assumes that the CEIT-19 have consumed about 17% of the global total, then HFC & PFC banks in CEIT-19 would amount to about 92,650 tonnes in 2002 and 501,670 tonnes in 2015. This is equivalent to about 188 and 889 million tonnes CO_2eq in 2002 and 2015, respectively, as shown in Table 13 (in Section 6.1.3 above).

7.4 DISPOSAL OF HAZARDOUS WASTE

120. A number of harmful substances have been classified as hazardous waste by national governments and several MEAs address these issues, particularly relating to imports/exports or the international movement of waste. Some countries have classified unwanted ODS as hazardous waste.

7.4.1 Environmental issues

121. Section 6.1.1 provides estimates of the size of banks of ODS and HFCs. The quantity of waste would depend on the adoption of new measures to collect and destroy ODS and HFCs from equipment, and the speed at which alternatives can be adopted.

7.4.2 Status under MEAs

122. Several UN bodies are currently involved in chemicals management and the disposal of hazardous wastes, and there is potential for synergies in the collection and destruction of unwanted ODS and other substances:

- The Stockholm Convention aims to control the production, import, export, use and disposal of persistent and bio-accumulative pollutants (POPs). GEF is already a major funding body in this area.

- The Basel Convention addresses the transboundary movement and disposal of hazardous waste. The Parties to the Convention have not taken a definitive position on whether the Convention covers the transboundary movement of ODS wastes. However, ODS would be covered by the Convention in cases where a Party involved in import export or transit has national legislation that classifies ODS waste to be hazardous. A similar situation applies to HFCs. In such cases, projects on ODS or HFC waste could potentially be co-funded by Convention donors.
- UN Strategic Approach to International Chemicals Management (SAICM): an international policy framework that promotes the sound management of chemicals throughout their lifecycle. There are potential synergies with the Quick Start Programme which provides seed money to support initial capacity building and implementation.

123. The GEF-4 strategy on ozone recognised the strong linkages between ozone and POPs. The strategy noted that the capacities to manage ODS, such as trade and licensing measures, can be harnessed to manage POPs and vice-versa. Specific technologies suitable for the destruction of CFCs are also suitable for the destruction of polychlorinated biphenyls (PCBs) (GEF Council, 2007, p. 6). The GEF-4 strategy also identified the destruction of unwanted ODS as an example of areas where GEF will retain the flexibility to respond to policy evolutions under the MP (GEF Council, 2007, p. 5).

7.4.3 Relevance to CEITs

124. Refer to Sections 7.1.3 and 7.2.3 above.

8 CEIT needs and potential GEF assistance

125. The existing GEF-4 strategy on ozone recognises a number of the problems described in the preceding sections. The GEF-4 strategy mandated support for activities to phase-out HCFC while encouraging synergies with climate protection by encouraging low-GHG alternatives and replacing HCFC-equipment in the context of energy efficiency programmes. The GEF-4 strategy also recognized strong linkages with work on POPs and chemicals management, such as the management and destruction of hazardous substances (GEF Council, 2007).

126. To date the GEF has assisted many CEITs in addressing the problem of ODS. Table 17 provides an overview of areas where further work could be undertaken to address the remaining ozone challenges and linked issues.

Table 17: Areas where GEF could assist in meeting CEIT needs

Category	Remaining ODS sectors	Potential future GEF assistance to support ODS phase-out
Challenge 1: ODS sectors that the MP requires to be phased out	Accelerated HCFC phase-out	• Preparation of phase-out plans (under MP Decision XIX/6,7) and necessary regulatory measures • Investment and technical assistance for the adoption of low-GWP alternatives (MP Decision XIX/6) • Assistance for preparation of reports required by the MP (e.g. Decision XIX/6,10)
	MB critical use exemptions and continued Consumption after the MB phase-out date	• Technical assistance and possibly investment for the adoption of MB alternatives to achieve MB phase-out (Kazakhstan, Russian Federation and Ukraine) • Technical guidance on MP definitions of QPS and non-QPS uses • Assistance for meeting MP reporting obligations on MB exemptions
	CFC essential use exemptions	• Investment and/or technical assistance to adopt CFC-free alternatives to complete the phase-out of CFC-113 solvents and CFC-MDIs • Assistance for meeting MP reporting obligations on CFC exemptions
	Laboratory and analytical ODS	• Surveys or similar to identify L&A sectors and relevant alternatives • Technical assistance for approval of alternative methods • Technical assistance and/or investment for the adoption of alternatives • Assistance for meeting MP reporting obligations on L&A uses
	Illegal trade in ODS	• Technical assistance for training customs officers and others • Information materials and awareness raising among customs officers and others • Participation in regional meetings to address illegal ODS trade, e.g. UNEP ODS networks, green customs networks
Challenge 2: ODS sectors that are not required to be phased out	ODS banks installed in equipment	• Studies and surveys to estimate the existing and future inventory of equipment containing ODS, major sectors and locations • Equipment and training for ODS technicians so they can reduce leakage during servicing of equipment and recover ODS. • Technical assistance for establishing market-based networks to capture and collect ODS from servicing and end-of-life equipment, including incentive programmes (TEAP, 2008, p. 92) such as those operated in Australia and Japan

Category	Remaining ODS sectors	Potential future GEF assistance to support ODS phase-out
(cont...) *Challenge 2:* ODS sectors that are not required to be phased out	Unwanted ODS stocks	• Surveys to identify the location, type and volume of unwanted stocks • Assistance for the collection and safe transportation of unwanted ODS to suitable destruction facilities, including the cost of destruction
	ODS process agents, feedstock and industrial emissions	• Surveys of targeted industrial sectors to identify significant sources of ODS emissions from feedstock, process agents, by-products etc. • Technical and/or investment assistance for adopting ODS-free alternatives where possible, or measures to minimise emissions
	MB quarantine and pre-shipment sector	• Development of national strategy (MP Decision and International Plant Protection Convention Recommendation) • Surveys of phytosanitary (quarantine) agencies and fumigation companies to identify the products treated with MB, target pest species, destination countries and regulatory requirements • Technical assistance for the approval of alternatives by the relevant phytosanitary authorities • Technical and investment assistance for the adoption of alternatives
	New ODS	• Surveys to identify which new ODS are being produced and consumed, volumes, sectors and anticipated trends • Technical assistance and investment to adopt alternatives where feasible
Challenge 3: Issues linked to ODS	HFC Consumption and production	• Investment and technical assistance for the adoption of low-GWP and ODS-free alternatives
	Energy efficiency	• Investment and technical assistance for the adoption of energy efficient equipment while adopting alternatives to ODS and HFCs
	F-gas banks installed in equipment	• Measures to address both ODS and F-gases at the same time, as identified above under *ODS banks installed in equipment*
	Disposal of hazardous waste	• Measures to address ODS and other hazardous substances such as POPs and unwanted pesticides, using similar procedures

Annex 1: List of ozone-depleting substances and greenhouse gases mentioned in this report

ODS groups	Name of substance(s)	Uses	ODP [1]	GWP [2]	Phase-out date set by the Montreal Protocol [3]		
					Industrialised countries	Developing countries	Uses exempted from the phase-out
CTC	Carbon tetrachloride	Solvent, chemical feedstock, laboratories	1.1	1400	1996	2010	• Feedstock • Process agents • Many laboratory and analytical uses • Other specific uses, called Essential or Critical Uses, in cases where alternatives are not feasible
CFCs	Chlorofluorocarbons	Refrigeration equipment, air-conditioning equipment, foam products, fire protection equipment, aerosols, laboratories, feedstock	0.6 – 1.0	4750 - 14400	1996	2010	
HCFC	Hydro chlorofluorocarbons	Refrigeration equipment, air-conditioning equipment, foam products, fire protection equipment, aerosols, feedstock,	0.001 – 0.52	77 - 2310	2030 (99.5% elimination by 2020)	2040 (97.5% elimination by 2030)	
Halons	Halons	Fire protection equipment, feedstock	3.0 – 10.0	1640 - 7140	1994	2010	
MCF	Methyl chloroform	Solvent, chemical feedstock, laboratories	0.1	146	1996	2015	
MB	Methyl bromide	Agricultural pesticide, fumigant, laboratories, chemical feedstock	0.6	5 - 17 [4]	2005	2015	• Quarantine and pre-shipment
Others							
HFCs	Hydrofluorocarbons	Refrigeration equipment, air-conditioning equipment, foam products, fire protection equipment	0	124 - 14800	Kyoto Protocol	Kyoto Protocol	Not applicable

[1] *This column shows the range of ODPs of substances in the ODS group. ODP = Ozone Depletion Potential, an index of potency or ability of a single molecule of ODS to destroy ozone molecules, compared with the benchmark substance CFC-11 which has an ODP of 1.0. The higher the ODP value, the more damaging the ODS is to the ozone layer and the environment. Source of ODP values: Ozone Secretariat, 2006, p.23-25.*

[2] *This column shows the range of GWPs of common substances in each group. GWP - The GWP, or Global Warming Potential. A measurement (usually measured over a 100-year period) of how much effect a substance will have on Global Warming in relation to carbon dioxide. CO_2 has a GWP of 1. The higher the value of GWP, the more damaging a substance is for the climate. Source of GWP values: IPCC, 2007, p.33, Table TS.2.*

[3] *The date for phasing out ODS consumption is 1 January of the year stated in this table. Source: Ozone Secretariat, 2006, p.28-36. HBFCs and bromochloromethane are not shown in table.*

[4] *The 100-year GWP of methyl bromide is 5. However, methyl bromide has a short lifetime in the atmosphere, so the 20-year GWP of 17 is a more realistic indicator.*

Annex 2: Examples of illegal trade in ODS reported in CEIT countries

Country	Brief description of event	Implied source of ODS	Substance	ODP-tonnes	Tonnes	Year	Information source
Armenia	Waste ODS mixture incorrectly labelled as new HFC-134a	United Arab Emirates	CFC, HCFC	?	?	2007	UNEP 2008 p.2
Armenia	Contaminated CFC imported from Saudi Arabia, incorrectly labelled as new CFC	Saudi Arabia	CFC	?	?	?	UNEP ECA 2007 p.2
Belarus	Company imported and sold CFC under other names	?	CFC-12		?	2003	Rodichkin 2008 p.28
Czech Republic	Heat pumps containing ODS were imported illegally	?	HCFC-22	0.02	0.37	2002	UNEP 2004 p.2
Czech Republic	air-conditioning units containing ODS were exported illegally	Czech Rep.	HCFC-22	0.001	0.01	2002	UNEP 2004 p.2
Czech Republic	Air-conditioning units containing ODS were imported illegally	?	HCFC-22	?	?	2003	UNEP 2004 p.2
Estonia	10 companies were fined a total of $5,000 for smuggling various types of ODS	?	?	?	?	?	GEF EO 2009b, s.6
Estonia	Owners of 2 ships were fined for exporting halon to Russian Federation and Georgia	Estonia	halon	~ 2.4 ?	0.4	2007	GEF EO 2009b, s.6
Estonia	ODS were exported illegally to a Russian ship	Estonia	HCFC	0.004 ?	0.07	2005	UNEP 2008 p.3
Georgia	Cylinders containing CFC imported from Dubai, described as HFC-134a	United Arab Emirates	CFC-12	?	?	2004	UNEP 2004 p.2
Kazakhstan	8 cylinders containing ODS were hidden from customs in a train coming from the Russian Federation	Russia	HCFC-22, 124, 142b	~ 0.006	0.11	2007	Rodichkin 2008 p.29
Kazakhstan	Companies stated that cheap CFCs from the Russian Federation and China can be purchased on the market	Russia, China	CFCs	?	?	2009	GEF EO 2009b, s.8
Kyrgyzstan	Small refrigerant cylinders were imported, not controlled by China's licensing system	China	?	?	?	?	UNEP ECA 2007 p.2
Kyrgyzstan	Company in Free Economic Zone imported 2400 car fire extinguishers from South Korea using forged documents	South Korea through China	Halon-1211	1.44	0.467	2007	UNEP 2008 p4; Rodichkin 2008 p.33
Kyrgyzstan	Batch of 27 fridges + 6 showcase refrigerators containing ODS were imported	South Korea through China	CFC-12, HCFC-22	?	?	2007	UNEP 2008 p.4; Rodichkin 2008 p.33
Kyrgyzstan	110 freezers containing ODS arrived at border without permission	China	CFC	?	?	2007	UNEP 2009 p.8
Kyrgyzstan	8 refrigerators containing ODS arrived at border without permission	South Korea through China	CFC	?	?	2008	UNEP 2009 p.8
Poland	Illegal trade has been detected and smugglers fined e.g. HCFCs illegally imported from Ukraine	Ukraine	HCFCs	?	?	?	GEF EO 2009b, s.11

Country	Brief description of event	Implied source of ODS	Substance	ODP-tonnes	Tonnes	Year	Information source
Poland	Attempted import of CFC from Ukraine in private car	Ukraine	CFC-12	0.15	0.15	2005	UNEP 2008 p.3
Russian Fed.	Indications that some CFCs on sale did not come from local stocks but potential illegal imports	?	CFCs	?	?	2009	GEF EO 2009b, s.15
Russian Fed.	Attempted export of methyl chloroform to the United Arab Emirates without required documents	Russia	MCF	6.22	62.2	2007	Rodichkin 2008, p.34
Russian Fed.	Customs detected 300 cylinders containing ODS imported illegally from China	China	CFC-12 ?	4.08	4.08	2007	Rodichkin 2008, p.34
Russian Fed.	False information (description and codes) for 160 barrels of CFC-113 imported from China	China	CFC-113	34.944	43.68	2007	Rodichkin 2008, p.34
Russian Fed.	Container(s) transported from Germany via Smolensk region to Vladimir	Germany	?	1.113	?	2008	UNEP 2009 p.10
Slovakia	20 recorded cases of fines imposed by customs officers for illegal ODS	?	?	?	?	2004 - 2009	GEF EO 2009b, s.12
Tajikistan	Several cases of illegal trade, mainly smugglers carrying small quantities of ODS without licenses	?	Mainly CFC-12	?	?	?	GEF EO 2009b, s.14
Turkmenistan	Plentiful supply of CFC-12 at relatively low price indicates potential illegal imports	?	CFC-12	?	?	2009	GEF EO 2009b, s.16
Turkmenistan	Imported ODS was detained because it exceeded the permitted quota	?	?	?	1.224	2006	GEF EO 2009b, s.16
Ukraine	Risk of illegal CFC imports	?	CFC	?	?	2009	GEF EO 2009b, s.17
Uzbekistan	Several instances of smuggling of refrigerators containing ODS	?	CFC ?	?	?	2002	UNEP 2007 p.26
Uzbekistan	Instances of illegal importation of CFC and HCFC	?	CFC-12, HCFC-22	?	?	2003	UNEP 2007 p.26
Uzbekistan	Illegal imports of CFC were intercepted and destroyed	?	CFC-12	0.328	0.328	By 2007	UNEP 2007 p.26
Uzbekistan	24 cylinders of ODS bearing a Chinese trade name were detected in a private vehicle	China	CFC	~ 0.024	0.024	2007	Rodichkin 2008 p.37
Uzbekistan	Compressors for refrigerators and containers of ODS bearing a Chinese trade name were found in a private vehicle	China	?	?	0.0001	2007	Rodichkin 2008 p.37
Uzbekistan	Cylinders of ODS bearing a Chinese trade name were found in a private vehicle	China	CFC	?	72 litres	2007	Rodichkin 2008 p.37
Uzbekistan	Attempted illegal import from Kyrgyzstan of 36 cylinders of ODS bearing a Chinese trade name	Kyrgyzstan	CFC	~ 0.036	0.036	2007	Rodichkin 2008 p.38
Uzbekistan	30 cylinders of ODS produced in China, illegally imported from	Kyrgyzstan, made in	?	?	0.408	2008	*RILO CIS 2009 p.1

Country	Brief description of event	Implied source of ODS	Substance	ODP-tonnes	Tonnes	Year	Information source
	Kyrgyzstan, hidden in luggage area of a bus	China					
Uzbekistan	4 cylinders of ODS produced in China was illegally imported from Kyrgyzstan, hidden in a car	Kyrgyzstan, made in China	?	?	0.054	2008	RILO CIS 2009 p.1
Uzbekistan	Air-conditioner unit containing ODS produced in China was imported illegally	China	?	?	1 piece	2008	RILO CIS 2009 p.1
Uzbekistan	2 cylinders of ODS produced in China were imported illegally from Kyrgyzstan, hidden in a car	Kyrgyzstan, made in China	?	?	0.027	2008	RILO CIS 2009 p.1
Uzbekistan	12 cylinders of ODS with Chinese trade name were detected hidden in a car	Kyrgyzstan, possibly made in China	CFC	?	?	2008	RILO CIS 2009 p.1
Uzbekistan	25 refrigerators + 4 cylinders containing ODS were detected during a documentary check	China to Tajikistan	?	?	0.091	2008	RILO CIS 2009 p.1
Uzbekistan	49 litres of ODS were detected hidden in a car	Uzbekistan	?	?	49 litres	2008	RILO CIS 2009 p.1
Uzbekistan	48 cylinders of ODS produced in China were illegally imported from Kyrgyzstan, hidden in a car	Kyrgyzstan, made in China	?	?	0.048	2008	RILO CIS 2009 p.1
Uzbekistan	12 cylinders of ODS produced in China were illegally imported from Kyrgyzstan, hidden in a car	Kyrgyzstan, made in China	?	?	0.163	2008	RILO CIS 2009 p.1
Uzbekistan	13.6 kg ODS produced in China were illegally imported from Kyrgyzstan, hidden in a car	Kyrgyzstan, made in China	?	?	0.014	2008	RILO CIS 2009 p.2
Uzbekistan	195 cans of ODS pesticides intercepted	Kyrgyzstan	MB	?	?	2008	RILO CIS 2009 p.2
Uzbekistan	9 cylinders of ODS produced in China were illegally imported from Kyrgyzstan, hidden in a car	Kyrgyzstan, made in China	?	?	0.122	2008	RILO CIS 2009 p.2
Uzbekistan	6 cylinders of ODS produced in China were illegally imported from Kyrgyzstan, hidden in a car	Kyrgyzstan, made in China	?	?	0.082	2008	RILO CIS 2009 p.2
Uzbekistan	27 cylinders of ODS produced in China were illegally imported from Kyrgyzstan, hidden in a car	Kyrgyzstan, made in China	?	?	0.367	2008	RILO CIS 2009 p.2

See Bibliography for full details of information sources cited above. Additional information was also taken from (UNEP DTIE, 2009).

** Regional Intelligence Liaison Offices (RILO) which operate under the World Customs Organisation (WCO):*
http://www.wcoomd.org/home_wco_topics_epoverviewboxes_tools_and_instruments_eprilo.htm. *Rodichkin (2008) also reports on activities under RILO.*

Annex 3: List of substances identified by government bodies as known or potential ODS

Substance	Status	ODP	GWP	Estimated annual use (tonnes/year)
Halon-1202 (dibromodifluoro methane, CBr_2F_2, CAS 75-61-6)	Restricted by EU ODS regulation (b)	1.25 (b), 1.7 (f)	?	No data
n-propyl bromide (nPB, 1-bromopropane, $CH_2BrCH_2CH_3$, CAS 106-94-5)	Reporting will be required in EU (e); banned in Norway (h)	0.1 for emissions in tropics, 0.02-0.03 in mid-latitudes (a)	?	20,000 - 30,000 tonnes in 2008; emissions approx 50% (d)
Ethyl bromide (bromoethane, C_2H_5Br)	Reporting will be required in EU (b)	0.1 – 0.2 (b)		No data
Methyl chloride (chloromethane, CH_3Cl)	Reporting will be required in EU (b)	0.02 (b)	13 (c)	~ 10,000 tonnes emissions/year (a)
Trifluoromethyl iodide (CF_3I)	Reporting will be required in EU (b)	0.01 – 0.02 (b) 0.018 for emissions in tropics, 0.011 in mid-latitudes (a)	?	No data
Hexachlorobutadiene (HCBD, C_4Cl_6, CAS 87-68-3)	OzSec list (e)	0.07	?	No data
1,1,1-trichloro-2,2,2-trifluoroethane (CFC-113a, CAS 354-58-5)	OzSec list (e), Nordic Council report (g)	0.65	?	No data
1-bromo-3-chloropropane (CH_2ClBr or C_3H_6BrCl, CAS 109-70-6)	OzSec list (e), Nordic Council report (g)	0.05 estimated	?	10-5,000 tonnes, 1990-1992 (e)
Dibromomethane (CH_2Br_2, CAS 74-95-3)	OzSec list (e)	No estimate	?	Approx 300-1500 tonnes, 1991-1993 (e)
Bromochloroethane (C_2H_4BrCl, CAS 107-04-0)	OzSec list (e)	No estimate	?	No data
Dibromoethane (ethylene dibromide, $C_2H_4Br_2$, CAS 106-93-4)	OzSec list (e), Nordic Council report (g)	No estimate	?	No data
Bromoethane (ethylene bromide, C_2H_5Br, CAS 74-96-4)	OzSec list (e), Nordic Council report (g)	No estimate	?	10-500 tonnes per year, 1990-1993 (e)
1,3-Dibromopropane ($C_3H_6Br_2$, CAS 109-64-8)	OzSec list (e)	No estimate	?	10-50 tonnes in 1993 (e)
2-Bromopropane (isopropyl bromide, C_3H_7Br, CAS 75-26-3)	OzSec list (e), Nordic Council report (g)	0.018 (g)	?	10-500 tonnes per year, 1990-1993 (e)
2,2,3,3-Tetrachloro hexafluorobutane ($C_4Cl_4F_6$, CAS 375-34-8)	OzSec list (e), Nordic Council report (g)	No estimate	?	No data
Tetrachlorohexafluorobutane ($C_4Cl_4F_6$, CAS 28107-59-9)	Nordic Council report (g)	No estimate		

Sources: (a) (WMO, 2007, pp. xxxvii, 1.17); (b) (Council of the EU, 2009, p. 41); (c) (IPCC, 2007, pp. 33-34, Table TS.2); (d) (TEAP, 2008, p. 63), (TEAP, 2007, p. 50); (e) (Ozone Secretariat, 2003);(UNEP, 2003) (f) (WMO, 2007, pp. 8.7, Table 8.1).(g)(Nordic Council, 2005, p. 48). (h) (Norway, 2008, pp. Ch 6, Appx II).

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