MONTREAL PROTOCOL

ON SUBSTANCES THAT DEPLETE

THE OZONE LAYER

UNEP

TECHNOLOGY AND ECONOMIC ASSESSMENT PANEL
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UNEP Technology and Economic Assessment Panel
Progress Report

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Decision XXVII/5 Working Group Report: Issues Related to the Phase-out of HCFCs

June 2016

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Executive Summary

1. At their 27th Meeting, in 2015, the Parties took Decision XXVII/5, "Issues related to the phase-out of HCFCs", subject of this report, *recognizing* that there is some uncertainty about the need after 2020 for essential uses and for servicing existing refrigeration and air-conditioning equipment by parties not operating under Article 5 of Annex C, group I, ozone-depleting substances.

2. This study gives an overview of the trends in HCFC production and consumption for both non-Article 5 and Article 5 parties in aggregated form for the specific HCFC chemicals for the years through 2014, based upon Article 7 reporting to UNEP. While in the 1990s, production of HCFCs was much higher in the non-Article 5 parties than in Article 5 parties, the reverse is observed in the 2000s for most HCFCs. Apart from the production of HCFC-123 and to some degree also HCFC-124, the production of HCFC-141b, -142b and -22 was 10-30 times higher in Article 5 parties compared to the production in non-Article 5 parties for the period 2010-2014.

3. It is currently premature to state categorically that no quantities of newly produced HCFCs (HCFC-22 in particular) will be required for refrigeration and air conditioning (R/AC) servicing in non-Article 5 parties during the period 2020-2030, however, it is not likely. An extra source of supply to servicing requirements would potentially come from recycled and reclaimed material from existing R/AC equipment that will be disposed of in the period 2020-2030. TEAP can continue to review HCFC quantities required for R/AC servicing as well as the availability of alternatives for servicing requirements.

4. In sectors other than R/AC, for servicing of the existing amounts of installed HCFC Blend B based equipment in fire protection, assuming that all current uses are considered essential, it is estimated that 160 tonnes per year would be required, beginning in 2020 (about 3 ODP tonnes) in non-Article 5 parties. It is possible that some niche solvent applications, such as aerospace or military, might require small quantities of HCFCs, to service existing equipment (e.g., HCFC-121, -122a, -141b and -225ca/cb). However, this is not yet clear; it is also not clear whether any suitable quantities of these HCFCs would be available from stockpile or recycled sources.

5. After careful investigation of all relevant sub-sectors by TEAP and its Refrigeration, Air Conditioning and Heat Pump Technical Options Committee (RTOC) and Flexible and Rigid Foams Technical Options Committee (FTOC), no information was found that any HCFC uses could be considered as potentially essential, satisfying the criteria established under Decision IV/25, after 2020 in R/AC and foams sub-sectors. However, there could be very specific, small, yet to be identified uses in niche applications that could potentially be essential (satisfying the criteria in Decision IV/25). For this reason, it would be important to continue monitoring this situation over the next couple of years.

6. In fire protection, TEAP and its Halons Technical Options Committee (HTOC) estimate that (as an upper limit for planning purposes and to assess impacts on the environment) volumes of HCFC-123 (for the production of HCFC-based Blend B) not exceeding 750 tonnes annually in non-Article 5 parties could be needed to meet requirements (combined with the potential amounts required for servicing, this would imply a total consumption of about 900 tonnes annually of HCFC-123 or, almost 20 ODP tonnes).

7. The Medical and Chemicals Technical Options Committee (MCTOC) considers that essential uses for non-Article 5 parties are likely to be required for laboratory and analytical uses, and for the research into and development of new substances, and perhaps for some

solvent uses. It is estimated that the applications might require in the 10s of tonnes annually (i.e., in the order of 1 ODP tonne).

8. For the determination of the need for production of HCFCs by non-Article 5 parties for the Basic Domestic Needs of Article 5 parties, one could first determine the baselines for Article 5 production and consumption as reported under Article 7 of the Montreal Protocol (i.e., the average of production and consumption reported for the years 2009 and 2010), and then compare consumption data, extrapolated towards 2020, with the allowed production under the Montreal Protocol in Article 5 parties.

9. Extrapolation of reported Article 5 consumption data (under Article 7) through 2020 shows that the expected aggregated HCFC consumption could be lower than the allowed HCFC production after 2020. Extrapolation of reported Country Program data (2009-2014) by Article 5 parties to the Multilateral Fund Secretariat also shows that the expected aggregated HCFC consumption could be lower than the allowed HCFC production after 2020. Nevertheless, this type of extrapolations has large uncertainties, so that straightforward conclusions cannot be drawn.

10. Consideration of all HCFC Phase-out Management Plan (HPMP) stage I data for HCFC consumption in all Multilateral Fund agreements drawn up for Article 5 parties also yields that the 2020 HCFC consumption would be lower than the allowed HCFC production under the Protocol. Based on this comparison, as well on the *indications* from the extrapolations performed, the conclusion can be drawn that no basic domestic needs production would be needed by non-Article 5 parties after 2020.

1 Introduction

1.1 Decision XXVII/5 and TEAP's approach to a response

At their 27th Meeting, in 2015, the Parties took Decision XXVII/5, "Issues related to the phase-out of HCFCs", the subject of this report and states:

> *Aware* that parties operating under Article 5 of the Montreal Protocol are taking measures to reduce and eventually eliminate the production and consumption of the ozone-depleting substances listed in Annex C, group I (hydrochlorofluorocarbons),
>
> *Recognizing* that there is some uncertainty about the future use by parties not operating under Article 5 of Annex C, group I, ozone-depleting substances after 2020 for essential uses and for servicing existing refrigeration and air-conditioning equipment, in accordance with Article 2F, paragraph 6 (a), of the Montreal Protocol,
>
> *Recalling* decision XIX/6, paragraphs 12, 13 and 14, in which the Meeting of the Parties indicated that further consideration by the parties of the issues of essential uses, servicing and basic domestic needs should occur by 2015, at the latest,

1. To request the Technology and Economic Assessment Panel, in relation to Annex C, group I, substances:

(a) *To identify sectors, including subsectors, if any, where essential uses for parties not operating under Article 5 may be needed after 2020, including estimations of the volumes of hydrochlorofluorocarbons to be used;*

(b) To assess the future servicing requirements between 2020 and 2030 for parties not operating under Article 5 of refrigeration and air-conditioning equipment, and to assess whether there is a need for servicing in other sectors;

(c) To report on recent volumes of production to satisfy basic domestic needs, projected estimates of such future production and estimated needs of parties operating under Article 5 to satisfy basic domestic needs beyond 2020;

2. To invite parties to provide relevant information to the Ozone Secretariat by 15 March 2016 for inclusion in the Panel's assessment;

3. To request the Panel to submit its report to the Open-ended Working Group at its thirty-seventh meeting, in 2016;

To respond to Decision XXVII/5, the Technology and Economic Assessment Panel (TEAP) constituted a XXVII/5 Working Group with the following members.

Working Group co-chairs
Lambert Kuijpers, member RTOC and senior expert member TEAP
Dan Verdonik, co-chair HTOC and member TEAP
Shiqiu Zhang, senior expert member TEAP

Working Group members
Suely Carvalho, TEAP senior expert
Bella Maranion, TEAP co-chair
Keiichi Ohnishi, co-chair MCTOC and member TEAP

Roberto Peixoto, co-chair RTOC and member TEAP
Helen Tope, co-chair MCTOC, member TEAP
Ashley Woodcock, co-chair TEAP and chair FTOC

The Working Group consulted, via their members serving as focal points, the respective TOC members for further information. In the preparation of the report, the Working Group also received assistance from UNEP Nairobi, i.e., Mr. Gerald Mutisya, who provided all Article 7 data information required in the most suitable form for review by the Working Group. Specific discussions were also had with Mr. Eduardo Ganem from the Montreal Protocol Multilateral Fund Secretariat and assistance on country data was obtained from Mr. Andrew Reed and Ms. Laura Duong, Multilateral Fund Secretariat (UNEP, 2016, MLFS, 2016).

This report is the result of efforts carried out by the Working Group, conducted primarily electronically. Preliminary information and findings were presented and discussed at the TEAP meeting, 9-13 May 2016, in Montreal. Based on comments received and additional drafting and reviewing, a final draft was submitted as a separate volume III of the TEAP Progress Report to UNEP's Ozone Secretariat, the beginning of June 2016.

1.2 Structure of the report

The structure of the report is as follows:

Chapter 1: Introduction, provides an overview of relevant decisions taken by the parties, on essential uses and on BDN, provides the text of the decision and the approach by TEAP via the establishment of a Working Group.

Chapter 2: Presents information on HFC consumption and production, per chemical, aggregated for non-Article 5 and Article 5 parties.

Chapter 3: Presents information on the use of certain HCFCs for servicing refrigeration and air conditioning and other sectors beyond 2020.

Chapter 4: Presents information on the need for HCFCs for essential uses in the various sectors in non-Article 5 parties.

Chapter 5: Presents the prediction of Article 5 HCFC consumption during 2014-2020, applying extrapolation procedures, as well as HCFC 2020 consumption estimates on the basis of the HPMP stage I target data decided. It then derives whether HCFC BDN production would be needed by non-Article 5 parties.

Chapter 6: Concluding remarks.

Annex I: Provides the communications received from parties;

Annex II: Presents HCFC production and consumption data per chemical as reported to UNEP's Ozone Secretariat, as well as an extrapolation of specific HCFC production and consumption data through 2020;

Annex III: Presents Article 5 HCFC consumption data through 2014 from the Country Program data, as well as an extrapolation through 2020;

Annex IV: Presents an estimate of Article 5 HCFC consumption for 2020, using available HPMP stage I (target) data for this year. Based on these data, conclusions for the period beyond 2020 are made.

1.3 Considerations on how to determine possible future Essential Uses

The following considerations apply to the "essential use" response to Decision XXVII/5. All TOCs, via their contact points, i.e., members of the working group, were asked to submit information on their sectors, including sub-sectors, if any, where essential uses for non-Article 5 parties may be needed after 2020, including estimations of the volumes of HCFCs to be used. Conclusions are given in chapter 4.

At the same time the RTOC assessed the future servicing requirements between 2020 and 2030 for non-Article 5 parties for refrigeration and air-conditioning equipment; other TOCs assessed whether there would be a need for servicing in their sectors. Conclusions are given in chapter 3.

For reference, the relevant Decision IV/25 on essential uses is given below.

1.4 Essential Uses Decision

The Fourth Meeting of the parties decided in Decision IV/25 on essential uses:

to apply the following criteria and procedure in assessing an essential use for the purposes of control measures in Article 2 of the Protocol:

- that a use of a controlled substance should qualify as "essential" only if:
    - it is necessary for the health, safety or is critical for the functioning of society (encompassing cultural and intellectual aspects); and
    - there are no available technically and economically feasible alternatives or substitutes that are acceptable from the standpoint of environment and health;
    - that production and consumption, if any, of a controlled substance for essential uses should be permitted only if:
        - all economically feasible steps have been taken to minimize the essential use and any associated emission of the controlled substance; and
        - the controlled substance is not available in sufficient quantity and quality from existing stocks of banked or recycled controlled substances, also bearing in mind the developing countries' need for controlled substances;
    - that production, if any, for essential use, will be in addition to production to supply the basic domestic needs of the Parties operating under paragraph 1 of Article 5 of the Protocol prior to the phase-out of the controlled substances in those countries;
- to request the Technology and Economic Assessment Panel and its Technical and Economic Options Committee to develop, in accordance with the criteria in paragraphs 1 (a) and 1 (b) of the present decision, recommendations on the nominations, after consultations with experts as necessary, regarding:
    - the essential use (substance, quantity, quality, expected duration of essential use, duration of production or import necessary to meet such essential use);

    - economically feasible use and emission controls for the proposed essential use;
    - sources of already produced controlled substances for the proposed essential use (quantity, quality, timing); and
    - steps necessary to ensure that alternatives and substitutes are available as soon as possible for the proposed essential use;

- to request the Technology and Economic Assessment Panel, while making its recommendations to take into account the environmental acceptability, health effects, economic feasibility, availability, and regulatory status of alternatives and substitutes;

- to request the Technology and Economic Assessment Panel to submit its report, through the Secretariat, at least three months before the Meeting of the Parties in which a decision is to be taken. The subsequent reports will also consider which previously qualified essential uses should no longer qualify as essential.

1.5 Basic Domestic Needs

The term Basic Domestic Needs (BDN) is included in Articles 2 and 5 of the Montreal Protocol. This term refers to an additional amount of production of the controlled substances under the Protocol by non-Article 5 parties to meet the needs of Article 5 parties for adequate and quality supplies of ozone-depleting substances at fair and equitable prices in their efforts to meet the phase-out of these substances under the Protocol.

A number of specific decisions on BDN has been taken by the parties to the Montreal Protocol. As early as their first meeting in May 1989, through their decision I/12C, the parties further clarified the term BDN; this term should be understood as "not to allow production of products containing controlled substances to expand for the purpose of supplying other countries".

Further decisions have been taken by the parties in relation to BDN.

- Decision IV/29 (1992) highlighted a report by the Executive Committee and requested parties to take the necessary steps to promote an adequate supply of controlled substances in order to meet the needs of Article 5 parties.
- Decision V/25 (1993) requested parties supplying controlled substances to annually provide the Ozone Secretariat with a summary of the requests received and to indicate in the report whether the receiving parties have affirmed that the supply is to meet their basic domestic needs.
- Decision VI/14A (1994) again highlighted the provision of information on the supply of controlled substances to Article 5 parties and mentioned that a party may opt to use either Decision V/25 or VI/14A.
- Decision VI/14B (1994) requested recommendations by parties concerning the need for clarification, amendment etc., regarding basic domestic needs and concerning which procedures should be taken for the implementation of the provisions related requested to BDN in Articles 2 and 5 in the Protocol.
- Decision VII/9 (1995) mentioned a number of issues: (1) Article 5 parties may supply substances to meet the BDN until the first control measure (1999), and thereafter they may still do so, with the production limits required by the Protocol, (2) all parties importing and exporting should monitor this by licenses, (3) exporting parties should report on quantities, types and destination of their exports to the Ozone Secretariat, (4) eligible incremental costs for the phase-out in the production sector, (5) no parties should

install any new capacity for the production of ozone-depleting substances (ODS) listed in Annex A or B of the Protocol as of 7 December 1995, (6) the incorporation into the Protocol by 1997 of the establishment of baselines for production and consumption of Annex A and B substances.

The paragraph in Decision XXVII/5 related to BDN requests TEAP:

c. *To report on recent volumes of production to satisfy basic domestic needs, projected estimates of such future production and estimated needs of parties operating under Article 5 to satisfy basic domestic needs beyond 2020.*

TEAP coordinated with the Ozone Secretariat (UNEP, 2016) in order to analyse the data reported to UNEP (under Article 7) on separate HCFCs through 2014.

- These data have been available for several TEAP reports in the past, including all replenishment reports;

- Data can be grouped for the various HCFCs in Article 5 and non-Article 5 parties, which will show general trends in these parties;

- However, UNEP's data reporting aggregates by chemicals so it does not differentiate the use of specific HCFCs within the various sectors. If specific information is needed from the R/AC, the foams, fire protection and technical aerosols-solvents sectors, this has to be derived from review of the Country Programs. For this report, the sector information was obtained from the Multilateral Fund Secretariat (MLFS, 2016) via their Country Program data on HCFCs, available from 2009 through 2014.

Where it concerns the above paragraph "to report on recent volumes of production to satisfy basic domestic needs, projected estimates of such future production and estimated needs of parties operating under Article 5 to satisfy basic domestic needs beyond 2020", the following can be stated:

1. Past history on CFC consumption and production trends in non-Article 5 and Article 5 parties do not necessarily indicate what the situation may be by 2020 with regard to HCFCs;

2. For many years now, Article 5 parties have been the largest producers of many HCFCs, such as HCFC-22, -141b and -142b (this does not apply to HCFC-123);

3. Compared to the volumes in non-Article 5 parties, feedstock production processes for HCFC-22 and, to a limited degree, HCFC-142b have now been larger in Article 5 parties for quite some time. The HCFC feedstock production processes might also be used to supply these chemicals for potential Article 5 needs for emissive, non-feedstock uses. This might therefore also support a possible conclusion that no non-Article 5 production would be needed for Article 5 basic domestic needs.

2 HCFC production and consumption

The observations in this chapter are based on HCFC production and consumption data as reported to the Ozone Secretariat by all parties as required under Article 7 of the Montreal Protocol. Aggregated HCFC production and consumption data for non-Article 5 and Article 5 parties as of 2004 are given in Annex II.

2.1 HCFC production in non-Article 5 parties

Overall HCFC production peaked in non-Article 5 parties in the late 1990s with varying trends for the specific HCFCs after that time:

- A significant decrease took place during the years 2003-2004 for the HCFC-141b production, after production was halted in the United States (US).

- A decrease in HCFC-22 production is also clearly visible after the years 2009-2010, when the use of virgin HCFCs for production and servicing was halted in the European Union (EU). Compared to a peak level of about 300,000 tonnes in 1995, HCFC-22 production had decreased by a factor of 10 in the year 2014 in non-Article 5 parties.

- Production of HCFC-123 increased in the 1990s, decreased in 2010-2013 but was back again at a level of about 4,000 tonnes in 2014. Production is likely to be for specific air conditioning uses (manufacturing and servicing), but fire protection and cleaning uses are likely also to play important roles in the total.

- The production of HCFC-142b decreased substantially from 2008 to 2009, and remained at very low levels during 2010-2014.

Insofar as it can be gleamed from the data, it seems likely that reported production in (most) non-Article 5 parties will be below the mandated 10% of the HCFC baseline level for the year 2015.

While in the 1990s production of HCFCs was much higher in non-Article 5 parties than in Article 5 parties, the reverse is observed in the 2000s for most HCFCs. In 2010, the production of HCFC-141b and HCFC-22 was 5-10 times higher in Article 5 parties compared to the production in non-Article 5 parties; in 2014, it was 10-20(30) times higher. However, this situation differs for the production of HCFC-123 (and to some degree also for HCFC-124); during 2010-2014, HCFC-123 production remained at a higher level in non-Article 5 parties than in Article 5 parties.

2.2 HCFC production in Article 5 parties

The HCFC baseline for all Article 5 parties together can be calculated at 32,990 ODP tonnes, the 2014 level was at 87% of the baseline. Overall, this would already be sufficient enough for the mandated 10% reduction compared to the baseline for the year 2015. Specific country information can also be calculated, but this would in particular apply to one major producing Article 5 party only. The situation with regard to specific HCFC production are as follows:

- Production of HCFC-123 and -124 did not start until 2003 in Article 5 parties. It peaked around the year 2010, after which it decreased slightly. As mentioned above,

production of HCFC-123 was higher in non-Article 5 parties in recent years (2012-2014).

- Production of HCFC-141b in Article 5 parties saw a continuous increase between 1996 and 2012 when it reached a peak level of 117,000 tonnes, after which it decreased by 30,000 tonnes.
- HCFC-142b production reached a peak level around 2010 (at 30,000 tonnes), after which it decreased by almost 50% during the period 2010-2014.
- HCFC-22 was at a level of 10,000 tonnes in 1991, at a level of about 100,000 tonnes in the year 2000, and at a peak level of 412,000 tonnes in 2012. HCFC-22 production in Article 5 parties was reported at around 342,000 tonnes in 2014.

2.3 HCFC consumption in non-Article 5 parties

The consumption trends for HCFCs in non-Article 5 parties are reported as follows:

- Consumption levels of HCFC-123 and -124 increased for a number of years (in the 1990s) then decreased in the 2000s. After the year 2000, HCFC-124 consumption decreased much more than HCFC-123 (which remained at the same level), to about 100-300 tonnes (from a level of about 6000 tonnes in 1996).
- HCFC-141b and HCFC-142b consumption both decrease substantially, in parallel with the production levels (HCFC-141b after 2003, HCFC-142b after 2008).
- Consumption of HCFC-22 reached a level higher than 200,000 tonnes in the late 1990s, but decreased substantially after the years 2008-2009 (when the EU started to phase out the use of virgin HCFC-22 material). In 2014 consumption reached a level of about 40,000 tonnes in the year 2014. Reported consumption of HCFC-22 is higher than the reported HCFC-22 production (with a difference of about 6000 tonnes) so there must have been imports from Article 5 to some non-Article 5 parties in recent years (2012-2014). However, if one considers reported Article 5 production and consumption, the consumption in 2012-2013 is larger, which therefore cannot explain the difference in non-Article 5 parties (see further below in section 2.4 and Table 2-1).
- The reported consumption of the HCFC-225ca/cb isomers was at a high level (around 1500 tonnes per chemical) in the 1990s, and remained at a level of about 1000 tonnes during the period 2011-2014.

2.4 HCFC consumption in Article 5 parties

The consumption trends for HCFCs in Article 5 parties follow those for production:

- HCFC-123 is at a level of about 3000 tonnes in the 2000s, with consumption of HCFC-123 in all Article 5 parties then decreasing to a level 1200-1600 tonnes between the years 2010 and 2014.
- The consumption of HCFC-124 decreased to 200-300 tonnes in 2012-2014.
- HCFC-141b and HCFC-142b consumption decreases as of the early 2000s.
- HCFC-22 production is very much comparable to HCFC-22 consumption data for Article 5 parties; the consumption level is on average more than 10,000 tonnes larger than production, except for 2014 (which could be due to over-reporting of consumption). In principle, it cannot explain the higher consumption values compared to production values in non-Article 5 parties in the period 2010-2014 (see

Table 2-1 below, where the global balance, which is the total difference between production and consumption, for the year 2014 is less negative than before).

Table 2-1 HCFC-22 non-Article 5 and Article 5 production and consumption reported for 2011-2014, balance for non-Article 5 and Article 5 parties and global balance (total difference between production and consumption) (all in tonnes)

Year	NA5 production	NA5 consumption	NA5 balance	A5 production	A5 consumption	A5 balance	Overall balance
2011	47986	61375	-13389	379925	390101	-10176	-23565
2012	37043	41401	-4358	411634	435155	-23521	-27879
2013	29252	42823	-13571	330071	330677	-606	-14177
2014	32560	38325	-5765	341667	338986	2681	-3084

3 Prediction of possible HCFC servicing needs in non-Article 5 parties beyond 2020

In a first instance, TEAP, and its RTOC, has reviewed the possible future servicing requirements between 2020-2030 for non-Article 5 parties for refrigeration and air conditioning. It notes that the majority of non-Article 5 parties have already phased out the use of HCFCs for servicing in their countries through domestic or regional legislation. It further notes that the parties in Decision XIX/6 provided a small tail of 0.5% of the HCFC baseline (1989 HCFC consumption plus 2.8% of 1989 CFC consumption) for servicing in the period 2020-2030.

Looking at HCFC production and consumption data as reported under Article 7 by non-Article 5 parties, it is difficult to draw conclusions related to specific servicing needs beyond 2020. Based on the HCFC consumption data for non-Article 5 parties, consumption is reported as 38,325 tonnes for the year 2014. A calculation of the HCFC baseline for all non-Article 5 parties gives a baseline of 36,818 ODP; this can be split into an "EU" and an "other non-Article 5" baseline. This would yield a servicing tail consumption for other non-Article 5 Parties, since the EU has phased out the use of virgin HCFCs. This servicing tail consumption can be translated into the use of HCFC-22 only, or numerous combinations of HCFC-22 and HCFC-123 (two examples given here).[1] Data and examples are summarised in Table 2-1 below.

Parties	Baseline (ODP-t)	Parties	Baseline (ODP-t)	2020 serv. tail (ODP-t)			Example 1 (tonnes)	Example 2 (tonnes)
All N-A5	36,818	EU	10,450	0			0	0
		Other N-A5	26,380	131.9		HCFC-22	2400	2000
						HCFC-123	0	1100

Table 2-1 Baseline consumption for all non-Article 5 Parties (split into EU and other non-Article 5 Parties), 2020 HCFC consumption as well as two examples for HCFC-22 and HCFC-123 servicing consumption

The data reported under Article 7 for HCFC consumption can be extrapolated (on the basis of a 5 year trend analysis) to 2020-2021 (see Annex II), even though this will have large uncertainties. Extrapolation of HCFC-22 reported consumption data yields a possible consumption of 3,400 tonnes in 2019 and (minus) -2,000 tonnes (set to a zero value in Annex II) in 2020. This might imply that it is currently difficult to predict a reliable estimate for HCFC-22 consumption in 2020, although it seems likely to be zero. In the paragraph above it is mentioned that about 2,000 tonnes of HCFC-22 would be available for servicing R/AC equipment, together with 1,000-1,200 tonnes for servicing with HCFC-123, HCFC-225ca/cb etc. Combined with the consumption estimates of 3,400 and -2,000 tonnes given above for HCFC-22 (2019/2020), it is clear that it is difficult to draw real conclusions.

One could also estimate HCFC-22 servicing requirements on the basis of a bottom-up model for certain regions, but the accuracy in the extrapolation of the equipment volumes is thought to be too inaccurate to make reasonable forecasts for the period for 2020 and beyond.[2]

[1] Canada indicates production for continued HCFC-123 manufacture and servicing in its submission (Annex I)

[2] A U.S. Environmental Protection Agency study in 2014 "The U.S. Phaseout of HCFCs: Projected Servicing Needs in the U.S. Air-Conditioning, Refrigeration, and Fire Suppression Sectors, Updated for 2015 and 2025," projects the servicing need for HCFC-

For the fire protection sector, servicing of existing amounts of installed HCFC Blend B[3] may be required. HCFC Blend B contains mainly HCFC-123 with a small amount of PFC-14 and argon. Under the assumption that all current uses would need to continue in the period 2020-2030, it is estimated that servicing would require up to 160 tonnes per year beginning in 2020. Lesser amounts would be needed if not all current uses continue post 2020. The source of supply for servicing requirements could potentially come from recycled and reclaimed material from existing R/AC and fire protection equipment reaching end of life in the period 2020-2030. TEAP can continue to review the HCFC quantities required for fire protection servicing and the availability of alternatives for servicing requirements.

For servicing in the R/AC sector, it is currently premature to state categorically that no quantities of newly produced HCFCs (HCFC-22 in particular) will be required in non-Article 5 parties for the period 2020-2030, however, it is not likely. The source of supply of servicing requirements would potentially come from recycled and reclaimed material from existing R/AC and fire protection equipment reaching end of life in the period 2020-2030[4]. TEAP can continue to review the HCFC quantities required for R/AC servicing and the availability of alternatives for servicing requirements.

22 and HCFC-123 for R/AC and fire suppression for the period 2020-2025; the study cautions that the accuracy of projections for the post-2015 servicing needs could be marginally to significantly lower if factors such as system charge size, leak rate, and/or equipment lifetime are less than current assumptions.

[3] The name, HCFC Blend B, was created by the U.S. Environmental Protection Agency during the approval process under its Significant New Alternatives Policy program in the early 1990s

[4] Australia indicates no need for HCFC-22 servicing amounts since they are assumed to be recovered during the decommissioning of equipment in 2020-2030

4 HCFCs needed for essential uses in Non Article 5

4.1 R/AC

After careful investigation of all relevant sub-sectors by TEAP and its RTOC, no information was found that any HCFC uses could be considered as potentially essential, satisfying the criteria established under Decision IV/25, after 2020 in refrigeration and air conditioning sub-sectors. Very specific small (yet unidentified) uses in niche applications could be potentially essential (satisfying the criteria in IV/25). TEAP can monitor the situation over the next couple of years.

4.2 Foams

TEAP and its FTOC have not been able to identify any uses that could qualify as potentially essential after 2020. There will be monitoring over the next couple of years to see if this situation changes.

4.3. Fire protection

4.3.1 Introduction

Decision IV/25 requested the TEAP to make recommendations on the Essential Use Nominations (EUNs). As halons were the first group of Ozone-depleting Substances (ODS) to be phased out, the Halons Technical Options Committee (HTOC) was responsible for reviewing the first set of EUNs, providing recommendations to the parties in 1993. The HTOC found that in general, there were alternative technologies for almost all of those EUNs, particularly for new applications. Just as importantly, the HTOC found that no EUN for halon 1211 or halon 1301 satisfied the requirements that those halons were not available in sufficient quantity and quality from existing stocks of recycled halons, and thus the HTOC made no specific recommendation as to the essentiality of any of the EUNs. Subsequently, although there were no EUNs submitted for halon 2402, the HTOC provided an opinion in its 1994 Assessment Report that there were technical reasons why the phase-out of halon 2402 in countries with economies in transition might need assistance, and recommended production be considered for the Russian Federation in 1995 and subsequent years to facilitate the establishment of a bank in order to facilitate an orderly phase out. After 2000, no additional EUNs for any of the halons have been submitted on the premise that there remain sufficient quantity and quality from existing stocks of recycled halons.

4.3.2 Assessment of possible future essentiality of any fire protection sector use relying on HCFCs

In considering the potential future "essentiality" of HCFCs in the fire protection sector, it is important to note that this assessment is theoretical in that it is assessing generally what might be able to meet the essential use criteria. In doing so, TEAP makes no assertion of what would meet that definition. Any future nomination for an essential use would be considered on its merits and based on the specific circumstances and information provided. The information available at this point in time is insufficient for a detailed analysis of the fire protection options available for specific cases in the post-2020 period, including the availability and uptake of current and potentially new alternatives, status of halon and HCFC banks and the

availability of recycled material, changes to relevant policies and standards, understanding of cultural norms and biases, risk acceptance, economic factors, etc., that would be needed for any recommendation on any actual EUN. As such, the following sections are informational only, providing further context to parties of the factors that may be important in the event of a future review by the HTOC for essential use in fire protection.

The final decision on essentiality for fire protection will also need to consider the specific requirements established by the Authority Having Jurisdiction (AHJ[5]) for the application(s) involved. These considerations might include the following:

- fire extinguishing capabilities such as the size and type of fires to be protected against
- purpose of the equipment such as for first responders use versus for professional fire fighters use
- the acceptability of residue from the agent or need for a clean agent
- regulatory considerations for environmental concerns of ODP and GWP
- understanding of cultural norms and biases,
- risk mitigation and acceptance, and
- economic factors and implications

4.3.3 Potential essential use of HCFCs in fire protection

Research by the HTOC indicated that HCFC-123 is being used on its own and in two blends, HCFC Blend B (HFC-123, PFC-14 and argon) and HCFC Blend E (HCFC-123, HFC-125 and d-limonene) in fire protection as halon 1211 replacements in Article 5 parties, with a larger use seen for HCFC-123 alone. Both of the blends have been formulated and their systems have been optimized to meet internationally recognized fire extinguishing performance. Testing has shown that HCFC-123 on its own is not as effective on a weight/volume basis. Therefore, a similar sized extinguisher using one of these blends will have a higher performance than one using just HCFC-123 alone. Conversely, an extinguisher using only HCFC-123 would have a lower performance and might not be sufficient to meet the actual requirement.

The HTOC has identified an application, Aircraft Rescue and Fire Fighting (ARFF) at commercial and military airports, where certain requirements may currently only be met through the original halon 1211 or the use of an HCFC product, HCFC Blend B, in jurisdictions[6] where their use is still allowable. In addition to handheld extinguishers, it is quite common to have larger wheeled clean agent extinguishers at

[5] The definition of authority having jurisdiction is taken from NFPA 418 (2016) as follows: The phrase "authority having jurisdiction," or its acronym AHJ is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labour department, or health department; building official; electrical inspector; or others having statutory authority.

[6] Some jurisdictions, such as the European Union, have banned or limited the use of halons or HCFCs in fire protection. Other jurisdictions such as the U.S. have not banned halon or HCFC use in fire protection and they continue to be used to meet certain requirements. HCFC based agents are reported as being used in both Article 5 and non-Article 5 parties. For non-Article 5 parties, they are reported as being used in Australia, Canada, Israel, Japan, and the U.S.

commercial and military airports that are typically intended for first responders. In certain cases, ARFF vehicles may also contain larger quantities of clean agent in internal tanks that provide increased fire extinguishing capability and can be dispersed from a further standoff distance than from portable extinguishers. Additionally, even in jurisdictions that still allow ODS use in fire protection, it must be noted that some requirements within ARFF have non-halon and non-HCFC alternatives, albeit some of them are high-GWP HFCs. It must also be noted that civil aviation has approved but not implemented the use of HCFC Blend B for internal aircraft use, which may be due in part to the impending HCFC phase-out of production and consumption.

Based on existing alternatives and technology options today, HTOC considers that there is some likelihood that there might be ARFF applications that would continue to need clean agents in the 2020 - 2030 timeframe that currently can only be met through the supply of halon 1211 or HCFC Blend B. (HTOC notes that there are several new fire extinguishing agents under development that might change this situation in the near future.) From an environmental perspective, the HTOC has reported previously that the low ODP and low GWP of HCFC-123 make it a favourable option compared to halon 1211. For example, see TEAP reports (TEAP, 2010) and (TEAP, 2012), both available on the Ozone Secretariat website.

4.3.4 Estimate of possible volumes needed for potential essential uses

Some information on the potential amount of HCFC Blend B used globally was made available for this assessment. Based on current HCFC Blend B consumption estimates, the possible amount of HCFC-123 for non-Article 5 parties that might be needed to meet future requirements could be in the order of 500 tonnes annually. However, there are alternatives in most applications that could reduce that amount. On the other hand, it is also recognized that some of the current alternatives to HCFC Blend B are high-GWP HFCs that may not be considered environmentally acceptable in some jurisdictions, which could reduce the potential reductions from the use of alternatives. As an upper limit for planning purposes and to assess impacts on the environment, volumes of HCFC-123 for Blend B not exceeding 750 tonnes annually in non-Article 5 Parties could be needed to meet requirements. This amount assumes that no additional approvals from AHJs will occur between now and 2020 for any of the new agents that are currently under development, and that large amounts of existing uses of halon 1211 will not need to convert to HCFC Blend B, such as portable extinguishers in civil aviation or wide-spread increases in military uses (existing military uses are factored in to this amount). This amount is also consistent with the 310 tonnes of HCFC-123 estimated as needed for fire protection in the US only, beginning in 2020 (ICFI, 2014). Even when combined with potential amounts needed for servicing, this would equate to total consumption of about 900 tonnes annually of HCFC-123, or less than 20 ODP tonnes on an ODP basis. On a climate basis, this would correspond to less than 200,000 t CO_2-eq of potential emissions annually.

Recyclers of firefighting agents and refrigerants report that there are only small quantities of HCFC-123 being currently recycled. The main use of HCFC-123 is as a cleaning agent and as a low-pressure refrigerant in large (centrifugal) chillers. While the small amount being recycled may change as older chillers are phased out and replaced with non-HCFC-123 equipment, it does not appear at this stage that there will be sufficient quantity of HCFC-123 to meet the potential demand of HCFC Blend B for ARFF applications in the period beginning in 2020, assuming that no

new agents meet the approval of AHJs for this specific application beginning in 2020. The recyclers also report that there is no technical reason that they are aware of at this time that would prevent them from being able to recycle or reclaim HCFC-123 to appropriate purity levels sufficient for use in HCFC Blend B.

4.4 Medical applications and chemical sectors

MCTOC reviewed the potential sectors and sub-sectors where essential uses of HCFCs for Parties not operating under Article 5 may be needed after 2020. At present, MCTOC considers that essential uses for non-Article 5 parties are likely to be required for laboratory and analytical uses, for example to be used as analytical standards for the measurement of atmospheric levels of HCFCs, and for the research into and development of new substances. It is possible that some other niche solvent applications, such as aerospace or military, might also require small quantities of HCFCs, potentially to service existing equipment (e.g. HCFC-122, -122a, -141b, -225). For example, HCFC-225 replaced CFC-113 in precision cleaning and cleanliness verification of sensitive equipment, such as oxygen systems, in aerospace applications. HCFO-1233zd has undergone successful laboratory testing for this application, but for at least one important user there is currently no on-going production of large systems that would allow prove-out of that solvent based on actual system use. If HCFO-1233zd fails for some unforeseen reason, the application would need to return to either HCFC-225 or the original CFC-113. It is estimated that this application would require small quantities, possibly in the order of 10s of tonnes annually (i.e., in the order of 1 ODP tonne).

Parties may identify these and other potential essential uses as the phase-out approaches and bring them to the MOP for consideration by the parties. It would be unlikely for all such HCFC solvent uses to exceed several hundred metric tonnes (i.e., several ODP tonnes) in total per year. However this is not yet clear, or whether any quantities would be available and suitable from stockpile or recycled sources.

Sterilants and aerosols uses will almost certainly *not* require any production of HCFCs for essential uses in non-Article 5 parties. There are a variety of technically and economically feasible alternatives to the use of HCFCs in sterilization and aerosols, making them unlikely to be justifiable as an essential use in non-Article 5 parties.

5 HCFC production for BDN

The majority (>90%) of HCFC production is currently concentrated in a few Article 5 parties. These parties export to the remaining Article 5 and non-Article 5 parties that still use HCFCs in some applications. A minority (<10%) of HCFC production is occurring in non-Article 5 parties. Based upon the HCFC Stage I Phase-out Management Plans (HPMPs), it is considered that presently reduction in consumption of HCFCs in Article 5 parties might be proceeding faster than the phase-out schedule.

It seems unlikely that significant quantities, if any, of HCFCs produced in non-Article 5 parties would be required to meet BDNs of Article 5 parties. However, it should be noted that during the final stages of CFC phase-out, some applications became apparent requiring CFC production in non-Article 5 Parties for BDN in Article 5 parties. Further information is given below.

5.1 Introduction

For the determination of the need for production of HCFCs by non-Article 5 parties to satisfy the need of Article 5 parties, one could first determine the baselines for Article 5 production and consumption (the average of production and consumption reported for the years 2009 and 2010) as reported under Article 7. This is shown in Table 5-1 below.

Table 5-1 Baseline and allowed production and consumption levels in ODP tonnes

Year	**Baseline (average of 2009-2010)**	**2013**	**2015**	**2020**	**2025**
Production	32989	32989	29690	21443	10721
Consumption	35873	35873	32286	23318	11659

On the basis of the data given in Table 5-1, it is clear that the baseline for HCFC consumption for all Article 5 parties is higher than the baseline for HCFC production. This implies that if one follows the allowed consumption under the Montreal Protocol, additional production after 2020 would be needed (at a level of about 1,000-2,000 ODP tonnes).

However, before drawing this conclusion, three methods can be applied to investigate possible HCFC consumption levels in the year 2020 and beyond:

1. Extrapolation of consumption data following Article 7;
2. Extrapolation of country program data for consumption of all HCFCs;
3. Determination of consumption data following HPMPs for the year 2020 (and beyond).

5.2 Extrapolation of consumption data

From the consumption reported under Article 7 through the year 2014, one can make a five year based trend analysis; this is shown in Annex II. If a negative value is calculated it is assumed that consumption will be zero (as given in the table in Annex II).

Table 5-2 Extrapolated Article 5 HCFC consumption data 2015-2025 versus allowed production and consumption (ODP tonnes)

Year	Baseline	2013	2015	2020	2025
Production	32989	32989	29690	21443	10721
Consumption	35873	35873	32286	23318	11659
Consumption	Extrapolated		27604	13716	<5000

The extrapolation of trends during 2012-2014 results in a significantly lower number for consumption than production (allowed) in 2020, and also for the period after 2020 (based on the amounts given for the separate HCFCs in Annex II). On the basis of the calculations, BDN production by non-Article 5 for Article 5 parties would not be needed. However, the extrapolation may be too stringent, leading too rapidly to zero HCFC consumption, which is a reason to also investigate other methods.

5.3 Extrapolation of country program data

During the years 2010-2014, Article 5 country program data have been reported to the UNMLFS, for all applications and for all refrigerants.

It becomes clear in which sectors HCFC chemicals are used, but an extrapolation needs to be made using the above mentioned trend analysis. If a negative value is calculated, it is assumed that consumption will be zero (as given in the table in Annex III)

It results in the data for the consumption levels in ODP-tonnes shown in Table 5-3.

Table 5-3 Extrapolated HCFC consumption data on the basis of 2010-2014 (Article 5) Country Program data versus allowed production and consumption (ODP tonnes)

Year	Baseline	2013	2015	2020	2025
Production	32989	32989	29690	21443	10721
Consumption	35873	35873	32286	23318	11659
Consumption	extrapolated	28585	29181	20913	--

The extrapolation of trends during 2012-2014 results in a much higher amount for consumption than determined in section 5.2 for the year 2020, however, it is still slightly lower than the production quantity allowed in ODP tonnes (e.g. with a 500 ODP tonnes higher production than consumption (i.e., only 2.5%). Since the data considered are aggregated (taking into account all relevant HCFCs) it is difficult to draw conclusions about whether production for the individual HCFCs would be representative for the consumption of all of the various HCFCs. In principle, one can conclude that BDN production for Article 5 parties might not be needed. However, the extrapolation has significant uncertainties.

5.4 Consideration of HPMP data

During the years 2011-2014 all Article 5 parties have HPMPs (stage I) that have target consumption agreements until 2015-2017, 2020 or beyond. These HPMPs have also specified specific HCFC levels that are still eligible for funding after a certain date.

All these stage I HPMPs (for large, medium size and LVC countries) have been studied, on the basis of which a calculation has been made on what could be the eligible consumption (if consumption is still occurring) in the year 2020.

This analysis makes clear which HCFC chemicals would still be eligible but no further analysis can be done where it concerns specific HCFC consumption (on the basis of aggregated country HCFC data). Table 5-4 shows the 2020 consumption data calculated.

Table 5-4 HCFC consumption data on the basis of 2010-2014 Country Program data and HPMP (stage I) 2020 eligible consumption versus allowed production and consumption (ODP tonnes)

Year	**Baseline**	**2013**	**2015**	**2020**	**2025**
Production	32989	32989	29690	21443	10721
Consumption	35873	35873	32286	23318	11659
Consumption	(extrapolated) and HPMP	(28585)	(29181)	**18656 (HPMPs)**	--

On the basis of the anticipated 2020 HCFC consumption level derived from HPMPs, consumption would be about 15% lower than the allowed production level. One could analyse the eligible consumption of specific HCFCs in the year 2020. However, the allowable production level is only specified in ODP tonnes, which would allow for shifts in production of separate HCFC chemicals. Therefore, further analysis is not warranted.

On the basis of the HPMP analysis for 2020, it does not seem necessary to consider production in non-Article 5 for the BDN needs of Article parties for the year 2020 and beyond. If the stage II HPMPs consider a further reduction of 32.5% (as of 2025), allowed production in Article 5 parties is also expected to cover consumption in Article 5 parties, so that no BDN production by non-Article 5 countries would need to be considered.

6 References

ICFI, 2014 ICF International, "The U.S. Phase-out of HCFCs: Projected Servicing Needs in the U.S. Air-Conditioning, Refrigeration, and Fire Suppression Sectors Updated for 2015 to 2025", 2014: available at https://www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2013-0263-0124

MLFS, 2016 Personal Communications Multilateral Fund Secretariat Montreal (A. Reed, L. Duong)

TEAP, 2010 Technology and Economic Assessment Panel (TEAP) 2010 Progress Report, Volume 1, "Assessment of HCFC and Environmentally Sound Alternatives," May, 2010.

TEAP 2012 Report of the Technology and Economic Assessment Panel (TEAP), Volume 2, Decision XXIII/9 Task Force Report, "Additional Information on Alternatives to Ozone-depleting Substances, May 2012.

UNEP, 2016 Personal Communications UNEP Ozone Secretariat Nairobi (G. Mutisya)

Annex I Parties submissions

Australia

Issues related to the phase-out of hydrochlorofluorocarbons (HCFCs) in Australia: Submission to the Technology and Economic Assessment Panel (February 2016)

Decision XXVII/5 asks the Technology and Economic Assessment Panel to assess a number of issues related to HCFC phase-out by non-Article 5 Parties. It also invites Parties to provide relevant information to the Ozone Secretariat for inclusion in the Panel's assessment.

> XXVII/5: Issues related to the phase out of hydrochlorofluorocarbons
>
> By this decision, the Twenty-Seventh Meeting of the Parties invited parties to provide relevant information for inclusion in the report of the Technology and Economic Assessment Panel on HCFCs on:
>
> (a) sectors and subsectors, if any, where essential uses for parties not operating under paragraph 1 of Article 5 may be needed after 2020, including estimations of the volumes of HCFCs to be used;
> (b) the future refrigeration and air-conditioning equipment servicing requirements between 2020 and 2030 of parties not operating under paragraph 1 of Article 5, and whether there is a need for servicing in other sectors;
> (c) recent volumes of production to satisfy basic domestic needs, projected estimates of such future production and estimated needs of parties operating under paragraph 1 of Article 5 to satisfy basic domestic needs beyond 2020.

Australia, by way of this submission, is providing information related to part (b) of the decision, namely the servicing requirements for the refrigeration and air conditioning (RAC) sectors after 2020 and whether there is a need for the servicing of equipment by use of HCFCs in other sectors.

In developing this submission, the Australian Government sought the input of relevant industry groups. In summary, Australia supports the existing 0.5% servicing tail to the end of 2029. While there is no need to increase the servicing tail, it would be prudent to remove the RAC only restriction, as HCFCs may be required to service other equipment. Australia views the premature replacement of functional equipment as an unnecessary burden on industry.

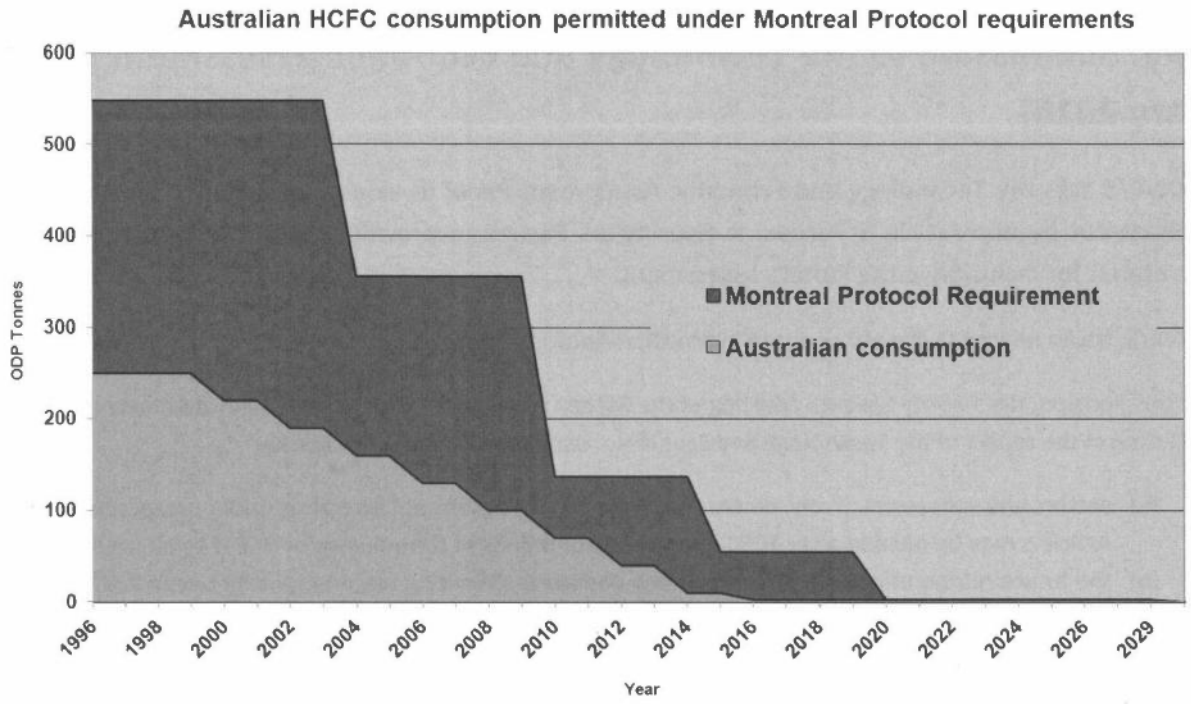
Refrigeration and Air Conditioning (RAC) Industry

In recent years, imports of HCFCs for use in RAC equipment have followed a predictable trend downwards, as the Australian RAC industry and importers continue to deliver on the timetable for the phase-out of HCFCs they committed to under the Montreal Protocol.

Under the *Ozone Protection and Synthetic Greenhouse Gas Management Act 1989* (the Act), the import of equipment containing HCFC or designed to operate on HCFCs is prohibited, except where an exemption applies. For further information on the ban on import and manufacture of HCFC products and equipment in Australia, including exemptions, please visit the following Australian Government webpage -

http://www.environment.gov.au/protection/ozone/licences/hcfc-ban

In accordance with the Act, the national cap on HCFC imports will this year decline to a tail of 2.5 ODP tonnes per annum (equivalent to around 45 tonnes of HCFC-22), which is maintained until 2030.



The Australian RAC industry plans to meet the servicing needs of the existing bank of HCFC equipment from the 0.5% servicing tail and HCFCs recovered from decommissioned equipment.

Further information on the structure of the RAC industry in Australia and its projected use of refrigerants is contained in the *Cold Hard Facts 2* report, which can be found at the following link –

http://www.environment.gov.au/system/files/resources/fa48d00d-1fb9-4797-90f4-47a6eed2c9c7/files/cold-hard-facts2.pdf

Fire protection industry

Another industry likely to require the use of HCFCs for the servicing of equipment after 2020 is the fire protection industry. The majority of HCFCs for this purpose are expected to come from recovered gas out of decommissioned systems.

Based on advice from Australia's national peak body for fire safety, the Fire Protection Association Australia (FPA Australia), the only HCFC likely to be of ongoing interest to the fire protection industry post 2020 is HCFC Blend A (NAF-S-III). This extinguishing agent is typically applied in relatively small total flooding systems in trawlers and similar work boats. FPA Australia has indicated there may be some limited requirement for servicing of these systems after 2020.

By contrast, HCFC Blend C (NAF-P-III), a streaming agent, is used in a limited number of portable extinguishers, but is not likely to be required for servicing after 2020. Halotron I is similarly HCFC based and is used in wheeled extinguishers for airfield duty. FPA Australia is not aware of much, if any, Halotron use in Australia. Other HCFCs, such as FE-241, have not been applied commercially in Australia.

Response to Decision XXVII/5
Canada
April 2016

1) *To request the Technology and Economic Assessment Panel, in relation to Annex C, group I, substances:*
   a) *To identify sectors, including subsectors, if any, where essential uses for parties not operating under paragraph 1 of Article 5 may be needed after 2020, including estimations of the volumes of hydrochlorofluorocarbons to be used;*
   b) *To assess the future refrigeration and air-conditioning equipment servicing requirements between 2020 and 2030 of parties not operating under paragraph 1 of Article 5 and to assess whether there is a need for servicing in other sectors;*
   c) *To report on recent volumes of production to satisfy basic domestic needs, projected estimates of such future production and estimated needs of parties operating under paragraph 1 of Article 5 to satisfy basic domestic needs beyond 2020;*
2) *To invite parties to provide relevant information to the Ozone Secretariat by 15 March 2016 for inclusion in the Panel's assessment;*

In relation to the continued need for HCFCs after the phase-out date of 2020, Canada currently uses HCFCs for analytical standard applications. While the quantity of 0.8217 ODP kg (in 2015) is quite small, it is envisaged that this use will be essential post-2020, particularly as a means to calibrate enforcement tools used to identify concentrations and types of HCFCs in bulk shipments and products.

Canada does have a number of fire-extinguishing systems that contain HCFCs currently in service. However, at this time, it is unclear whether there will be a need for servicing for fire extinguishing systems. Canada will continue to consume HCFC-123 for the servicing of refrigeration and air-conditioning equipment between 2020 and 2030.

With respect to the production of HCFCs, Canada has one of only two HCFC-123 production facilities worldwide. The other production facility is operated by a company in a developing country. The Canadian facility produces HCFC-123, and its by-products HCFC-124 and HCFC-124b, for use in refrigeration and air-conditioning and fire extinguishing sectors and for feedstock applications.

The Canadian producer foresees the need to be able to produce enough HCFC-123 in the years 2020-2030 in order to have ample supply for those users who do not have production rights but who may have valid HCFC consumption allowances. While difficult to anticipate the need post-2030, allowing for production for refrigeration and air-conditioning equipment servicing may be required to ensure enough global supply of HCFC-123 for servicing purposes after the production phase-out date.

In 2014, 100% of the HCFC-123 produced in and exported from Canada was exported to developed countries. Over 97% of the substance is being exported to the U.S. for repackaging prior to being distributed. No information is available to the Environment and Climate Change Canada on the final destination of the HCFC-123.

In 2014, the total quantity produced at the Canadian facility was comprised of 30% for feedstock and 70% for controlled uses. Production for feedstock uses alone would not be economically viable for the company. Therefore, production for BDN would allow the company to continue to produce HCFC-123 for feedstock uses in the future, assuming sufficient demand for HCFC-123 for controlled uses post-2020.

Annex II UNEP reported HCFC data (2004-2014)

Non-Article 5 HCFC production data (2004-2014) (tonnes)

Status	SubstName	ODP	2004 MT	2005 MT	2006 MT	2007 MT	2008 MT	2009 MT	2010 MT	2011 MT	2012 MT	2013 MT	2014 MT
NA5	HCFC-123	0,02	5145	4727	4105	4259	2987	3639	2223	2398	2512	2342	3917
NA5	HCFC-124	0,022	2689	3409	3154	3585	3493	3259	493	1692	1020	333	429
NA5	HCFC-141b	0,11	35070	11838	9777	7318	15746	10436	7482	6183	3723	5300	4767
NA5	HCFC-142B**	0,065	34196	23297	26557	27790	31313	6033	1337	872	693	16	101
NA5	HCFC-22	0,055	141576	160098	117582	140592	117952	74670	61804	47986	37043	29252	32560
NA5	HCFC-225	0,07											
NA5	HCFC-225CA**	0,025	1061	1010	1107	1049	706	503	715	447	121	192	501
NA5	HCFC-225CB**	0,033	1296	1251	1343	1330	862	615	800	899	1157	1260	671

Article 5 HCFC production data (2004-2014) (tonnes)

Status	SubstName	ODP	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
A5	HCFC-123	0.02	503	1116	2136	2072	2558	2238	2819	3083	1687	2078	1931
A5	HCFC-124	0.022	175	369	426	398	365	474	401	233	221	209	315
A5	HCFC-141B**	0.11	42618	46794	74785	86837	81298	91880	98857	111922	117131	87124	86911
A5	HCFC-142B**	0.065	3854	6125	21932	22994	22724	24890	30449	27074	22159	16954	16566
A5	HCFC-21	0.04	0	8	0	0	0	0	0	0	0	0	0
A5	HCFC-22	0.055	229326	272059	312686	360795	330078	371418	379105	379925	411634	330071	341667

Non-Article 5 HCFC consumption data (2004-2014) (tonnes)

Status	SubstName	ODP	2004 MT	2005 MT	2006 MT	2007 MT	2008 MT	2009 MT	2010 MT	2011 MT	2012 MT	2013 MT	2014 MT
NA5	HCFC-123	0,02	3153	2844	1475	1637	1872	1215	833	1298	1346	1560	1401
NA5	HCFC-124	0,022	2185	2473	1187	1663	2191	1229	330	1376	709	157	313
NA5	HCFC-141B**	0,11	14787	6085	9348	9648	10970	7657	2266	4082	2269	2550	1667
NA5	HCFC-142B**	0,065	19260	17949	20571	12999	27817	5201	542	393	258	127	142
NA5	HCFC-22	0,055	145311	152074	137706	151051	139692	96060	64875	61375	41401	42823	38325
NA5	HCFC-225	0,07	0	1	44	0	0	0	0	0	0	0	0
NA5	HCFC-225CA**	0,025	1075	923	662	769	630	453	610	389	107	216	432
NA5	HCFC-225CB**	0,033	1315	1096	715	909	631	533	702	810	937	1175	577

Article 5 HCFC consumption data (2004-2014) (tonnes)

Status	SubstName	ODP	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
A5	HCFC-123	0,02	1439	1701	2156	2048	1979	2164	2556	2607	3345	2919	3389
A5	HCFC-124	0,02	405	201	830	963	317	1498	1113	899	550	363	391
A5	HCFC-141B**	0,11	71329	61685	83863	94046	94273	103418	112805	122998	122821	90904	89578
A5	HCFC-142B	0,065	5890	9027	29314	28939	26869	33783	32457	30304	24950	16120	15385
A5	HCFC-21	0,04	0	15	1	0	6	37	0	3	2	0	0
A5	HCFC-22	0,055	210205	258676	298136	357975	332230	381671	409155	390101	435155	330677	338986
A5	HCFC-225	0,07	495	433	369	57	104	55	10	40	77	38	58
A5	HCFC-225CA**	0,025	0	75	82	65	93	58	83	82	31	57	66
A5	HCFC-225CB**	0,033	0	115	116	60	8	19	23	17	33	15	21

Non-Article 5 HCFC production data, extrapolated 2015-2021 (tonnes)

Status	SubstName	ODP	2015	2016	2017	2018	2019	2020	2021
NA5	HCFC-123	0,02	3678	4159	4711	5255	5457	6048	6483
NA5	HCFC-124	0,022	347	0	0	0	0	0	0
NA5	HCFC-141b	0,11	3598	3476	3514	2672	2323	2110	1642
NA5	HCFC-142B**	0,065	0	0	0	0	0	0	0
NA5	HCFC-22	0,055	18563	14082	9317	3250	0	0	0
NA5	HCFC-225	0,07							
NA5	HCFC-225CA**	0,025	190	250	328	299	234	301	284
NA5	HCFC-225CB**	0,033	988	903	761	687	744	605	556

Article 5 HCFC production data, extrapolated 2015-2021 (tonnes)

Status	SubstName	ODP	2015	2016	2017	2018	2019	2020	2021
A5	HCFC-123	0.02	1485	1167	1179	800	542	359	134
A5	HCFC-124	0.022	217	258	269	272	256	282	278
A5	HCFC-141B**	0.11	85782	73024	63128	60630	51330	42389	36180
A5	HCFC-142B**	0.065	11275	7648	4510	1249	0	0	0
A5	HCFC-21	0.04	0	0	0	0	0	0	0
A5	HCFC-22	0.055	331062	308564	283054	280742	258061	240150	225568

Non-Article 5 HCFC consumption data, extrapolated 2015-2021 (tonnes)

Status	SubstName	ODP	2015	2016	2017	2018	2019	2020	2021
NA5	HCFC-123	0.02	1331	1423	1390	1325	1346	1343	1305
NA5	HCFC-124	0.022	201	0	0	0	0	0	0
NA5	HCFC-141B**	0.11	1748	882	751	205	0	0	0
NA5	HCFC-142B**	0.065	0	0	0	0	0	0	0
NA5	HCFC-22	0.055	28264	21648	18273	10133	3416	0	0
NA5	HCFC-225	0.07	0	0	0	0	0	0	0
NA5	HCFC-225CA**	0.025	192	247	315	285	243	298	286
NA5	HCFC-225CB**	0.033	875	806	705	614	687	567	527

Article 5 HCFC consumption data, extrapolated 2015-2021 (tonnes)

Status	SubstName	ODP	2015	2016	2017	2018	2019	2020	2021
A5	HCFC-123	0.02	3557	3747	3824	4137	4259	4443	4631
A5	HCFC-124	0.02	69	0	0	0	0	0	0
A5	HCFC-141B**	0.11	84257	68894	56940	51531	39217	27935	19011
A5	HCFC-142B	0.065	9345	3776	0	0	0	0	0
A5	HCFC-21	0.04	0	0	0	0	0	0	0
A5	HCFC-22	0.055	320886	292781	255335	248666	217474	191747	169222
A5	HCFC-225	0.07	73	71	70	85	87	90	97
A5	HCFC-225CA**	0.025	46	45	55	46	42	45	43
A5	HCFC-225CB**	0.033	20	19	15	18	15	14	13

Annex III Article 5 HCFC consumption data from UNMLFS Country Program data and extrapolation

Country Program data from UNMLFS								Extrapolation					
A5	Chemical	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total	HCFC-123	1.465,17	1.641,87	1.787,46	2.205,08	1.937,84	2.141,80	2332	2432	2520	2587	2773	2865
Total	HCFC-124	984,05	1.064,04	750,30	467,50	387,95	292,53	81	0	0	0	0	0
Total	HCFC-141b	92.205,69	103.748,50	114.514,80	113.443,86	88.387,05	84.896,78	91163	81675	72227	66637	65206	58819
Total	HCFC-142b	30.875,05	30.410,26	28.109,65	22.201,65	15.608,42	11.834,01	8621	3028	0	0	0	0
Total	HCFC-22	323.509,05	377.887,48	360.884,00	410.442,38	323.590,61	316.083,54	337020	311759	295957	273777	276227	261322
Total	HCFC-225	1,25	9,96	19,74	68,90	37,00	94,66	98	118	137	151	177	188
Total	HCFC-225ca	41,92	74,79	60,46	28,50	40,92	34,55	30	16	12	11	1	0
Total	HCFC-225cb	0,20	23,09	0,97	34,51	14,59	1,32	14	8	8	0	2	1
ODP tonnes		29.994,60	34.232,39	34.327,56	36.557,32	28.585,99	27.549,26	29.180,91	26.385,39	24.283,13	22.450,30	22.433,08	20.913,37

Annex IV Article 5 HCFC consumption data from UNMLFS Country Program data plus anticipated 2020 HCFC consumption data from HPMPs stage I

Country Program data from UNMLFS													HPMP data
	Chemical	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total	HCFC-123	1.465,17	1.641,87	1.787,46	2.205,08	1.937,84	2.141,80						1260
Total	HCFC-124	984,05	1.064,04	750,30	467,50	387,95	292,53						220
Total	HCFC-141b	92.205,69	103.748,50	114.514,80	113.443,86	88.387,05	84.896,78						55390
Total	HCFC-142b	30.875,05	30.410,26	28.109,65	22.201,65	15.608,42	11.834,01						13362
Total	HCFC-22	323.509,05	377.887,48	360.884,00	410.442,38	323.590,61	316.083,54						211960
Total	HCFC-225	1,25	9,96	19,74	68,90	37,00	94,66						100
Total	HCFC-225ca	41,92	74,79	60,46	28,50	40,92	34,55						
Total	HCFC-225cb	0,20	23,09	0,97	34,51	14,59	1,32						
ODP tonnes		29.994,60	34.232,39	34.327,56	36.557,32	28.585,99	27.549,26						18.656