

# Technology and Economic Assessment Panel (TEAP) 2023 Progress Report

TEAP Co-chairs  
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# Outline of Presentation

- TEAP 2023 Reports
- TEAP Activities
- TOCs Progress Reports
  - Interim CUN Report
  - Dec XXXIV/10: MB stocks and QPS uses
  - Dec XXXIV/6: CTC
- Per- and polyfluorinated alkyl substances (PFAS)
- Dec XXXIV/11: TOCs configuration
- TEAP Organisational Matters

# TEAP Membership 2023

Bella Maranion, TEAP Co-chair	USA	Kei-ichi Onishi, MCTOC Co-chair	JP
Marta Pizano, TEAP/MBTOC Co-chair	COL	Roberto Peixoto, RTOC Co-chair	BRA
Ashley Woodcock, TEAP Co-chair	UK	Fabio Polonara, RTOC Co-chair	IT
Omar Abdelaziz, RTOC co-chair	EGY	Ian Porter, MBTOC Co-chair	AUS
Paulo Altoe, FTOC Co-chair	BRA	Helen Tope, MCTOC Co-chair	AUS
Suely Carvalho, Senior Expert	BRA	Dan Verdonik, FSTOC Co-chair	USA
Adam Chattaway, FSTOC Co-chair	UK	Helen Walter-Terrinoni, FTOC Co-chair	USA
Ray Gluckman, Senior Expert	UK	Shiqiu Zhang, Senior Expert	PRC
Marco Gonzalez, Senior Expert	CR	Jianjun Zhang, MCTOC Co-chair	PRC
Sergey Kopylov, FSTOC Co-chair	RF		

# TEAP 2023 Reports

## January 2023:

FTOC, FSTOC, MBTOC, MCTOC, and RTOC 2022 Assessment Reports

TEAP 2022 Assessment Report

## May 2023:

**Volume 1:** Progress Report

**Supplement:** EE Report

**Volume 2:** Evaluation of 2023 CUNs for methyl bromide and related issues - Interim Report

**Volume 3:** Decision XXXIV/2: Assessment of the funding requirement for the replenishment of the Multilateral Fund for the period 2024-2026

**Synthesis Report**

# TEAP Activities

In general, TEAP and its TOCs have resumed face-to-face meetings.

- RTOC, the RTF, MBTOC, FSTOC and MCTOC met in the first semester of 2023. Further meetings planned for the rest of the year.
- TEAP met in London in April 2023.
- EEAP, SAP and TEAP co-chairs met also in London to prepare their Synthesis Report.
- TEAP, its TOCs, TF and WG have prepared and submitted on time all reports as required by decisions set out by the parties.

# Methyl Bromide Technical Options Committee (MBTOC)

**Co-chairs**

**Marta Pizano**

**Ian Porter**

# MBTOC Progress Report 2023

- MB has been recommended for inclusion in Annex III of the Rotterdam Convention allowing 165 Parties to influence potential tracking and importation of MB under the Prior Informed Consent procedure (PIC). Further consideration will be given at the 19<sup>th</sup> meeting of the Chemical Review Committee in October 2023.
- Sulfuryl fluoride (SF), a widely adopted alternative to MB for structures and commodities and some QPS uses has been listed under Annex II of the proposed F-gas regulation of the EU owing to its high GWP of 4780. If approved, this regulation mandates recapture of SF whenever feasible, use could be restricted and cost of use increased.
- Research on alternatives to MB for many QPS uses continues and registration of chemical alternatives e.g. hydrogen cyanide (HCN), ethane dinitrile (EDN), ethyl formate (EF) is expanding.
- Decline in atmospheric anthropogenic MB concentrations are solely dependent on future reduction in emissions from QPS.

# **Methyl Bromide Technical Options Committee (MBTOC)**

**Interim CUN Assessment  
2023**

**Co-chairs**

**Marta Pizano**

**Ian Porter**



# Application for Critical Use of MB

- MBTOC received one application for critical use in 2024 for 3.857 t from Canada.
- This represented a 17% reduction from the approved amount at 34<sup>th</sup> MOP.
- The party reported no stocks at the end of 2022 and indicated a reduction plan to potentially phase out by 2026
- No A5 party submitted a CUN for MB use.

Country and Sector	Non-Article 5 Party Nomination (tonnes)	A5 Party Nomination (tonnes)	Interim Recommendation (tonnes)
1. Canada (2024) Strawberry runners	3.857	Nil	[3.857]
TOTAL (2024)	3.857	Nil	[3.857]

# **Methyl Bromide Technical Options Committee (MBTOC)**

**Response to Decision XXXIV/10  
Stocks and QPS uses of MB**

**Co-chairs**

**Marta Pizano**

**Ian Porter**

**TEAP**

## Response by Parties to Decision XXXIV/10

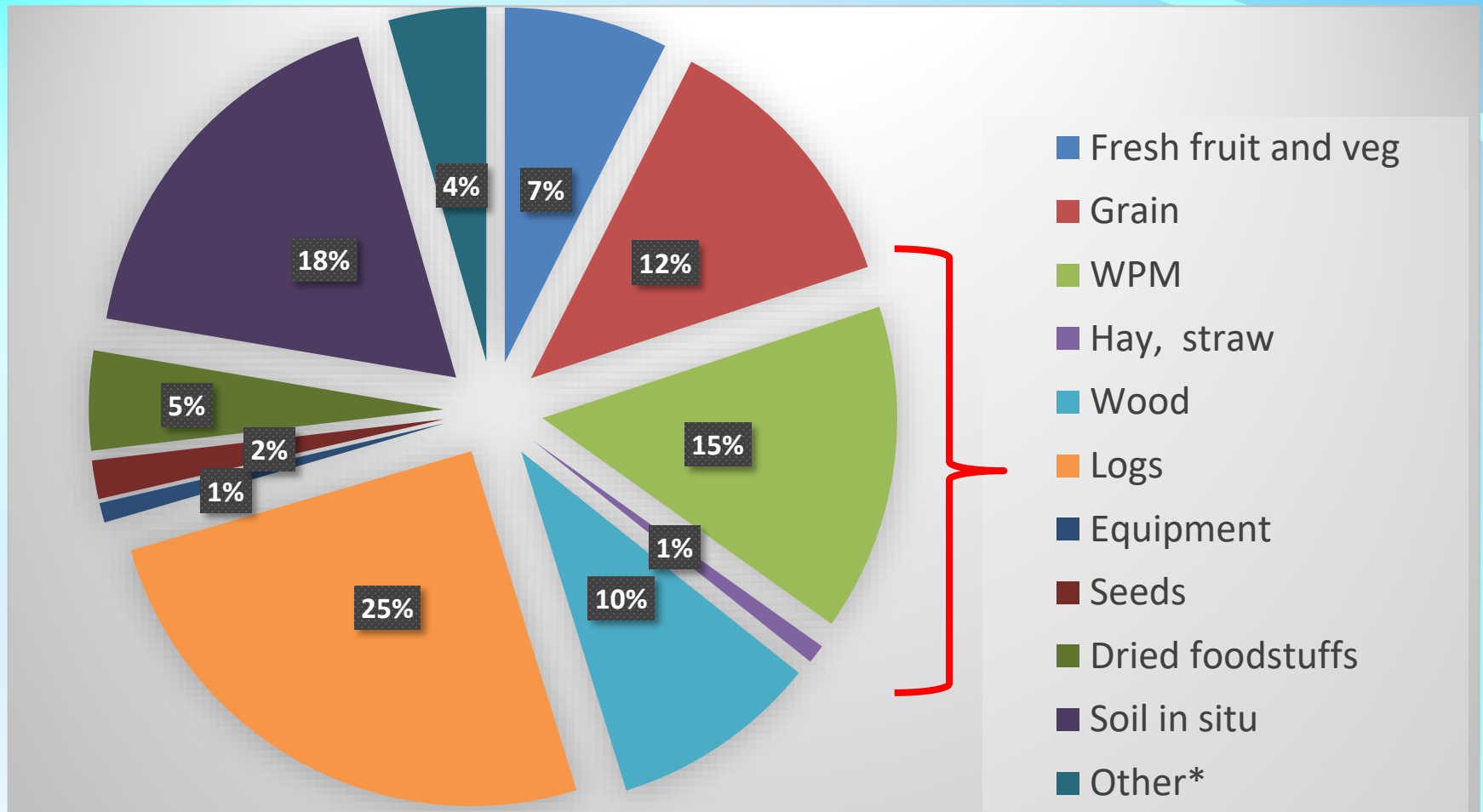
- Decision XXXIV/10 invited parties to submit to the Ozone Secretariat, by 1<sup>st</sup> June 2023 on a voluntary basis,
  - (a) A list of the pests and commodity combinations in which MB is needed and used in their respective countries; and*
  - (b) Accessible data on the volumes of pre-phase-out stocks of MB at the country level.*
- At the time of finalising the TEAP progress report, Australia had submitted data in response to the Decision. This information had been provided previously for the Assessment Report.
- Responses from Canada and US were received by the Secretariat later.
- The US reported that 50 t of pre 2005 MB were still available as of 31 December 2016, but as stocks of MB are privately held, recent data is not accessible publicly under domestic law.

# MBTOC Response to Decision XXXIV/10

Decision XXXIV/10 (4) asked MBTOC, *'In consultation with the secretariat of the IPPC, to provide updated information ... to the 45th OEWG, on current QPS uses for which alternatives are available'* .

- MBTOC used surveys submitted for the Assessment Report in its response
- The surveys showed that most parties did not clearly identify which uses were for **Quarantine** (Q pests) and which were for **Pre-Shipment (PS)** (non-Q pests).
- The following confusion often existed with the **PS** use category, which is unique to the Montreal Protocol.
  - MB treatment for a **Q** pest was often wrongly described as **PS** when it was applied within 21 days prior to shipment.
  - **PS** was used very broadly, but should only comprise MB use for **non-quarantine pests if under official control** by the **importing country** and only for an **exporting country** if an **official regulation** existed before 7 December 1995.
- A review of **PS** uses by countries may identify situations where MB should not be used and consequently considered under the Critical Use Exemption process or phased out.

# Category of MB used for QPS



Source: Analysis of data from MBTOC 2018 and 2022 Assessment Reports

## Examples of MB Use which satisfy Quarantine (Refer Report)

Commodity traded	Specified Quarantine Pest	Treatment prior to Export or on Import
Packed commodity (e.g. rice, spices, wooden crates)	Khapra beetle	Could be treated prior to export or on import
Oak logs	Oak wilt fungus	Treated prior to export
Rice or fruit (e.g. oranges)	Restricted location of Quarantine pest, khapra beetle or Fruit fly (e.g. <i>Ceratitis capitata</i> )	Precautionary treatment for 'Q pest' of product going from one region to another - with official control
Houses and other structures	Localized Quarantine Pest - Dry wood termite	Subject to official control
Treatment of land prior to nursery production	No quarantine pest, but may have regulated non quarantine pests.	May satisfy quarantine if party accepts and has known Regulated Non quarantine Pests

## Examples of MB Use which satisfy Preshipment (within 21 days of export) (Refer Report)

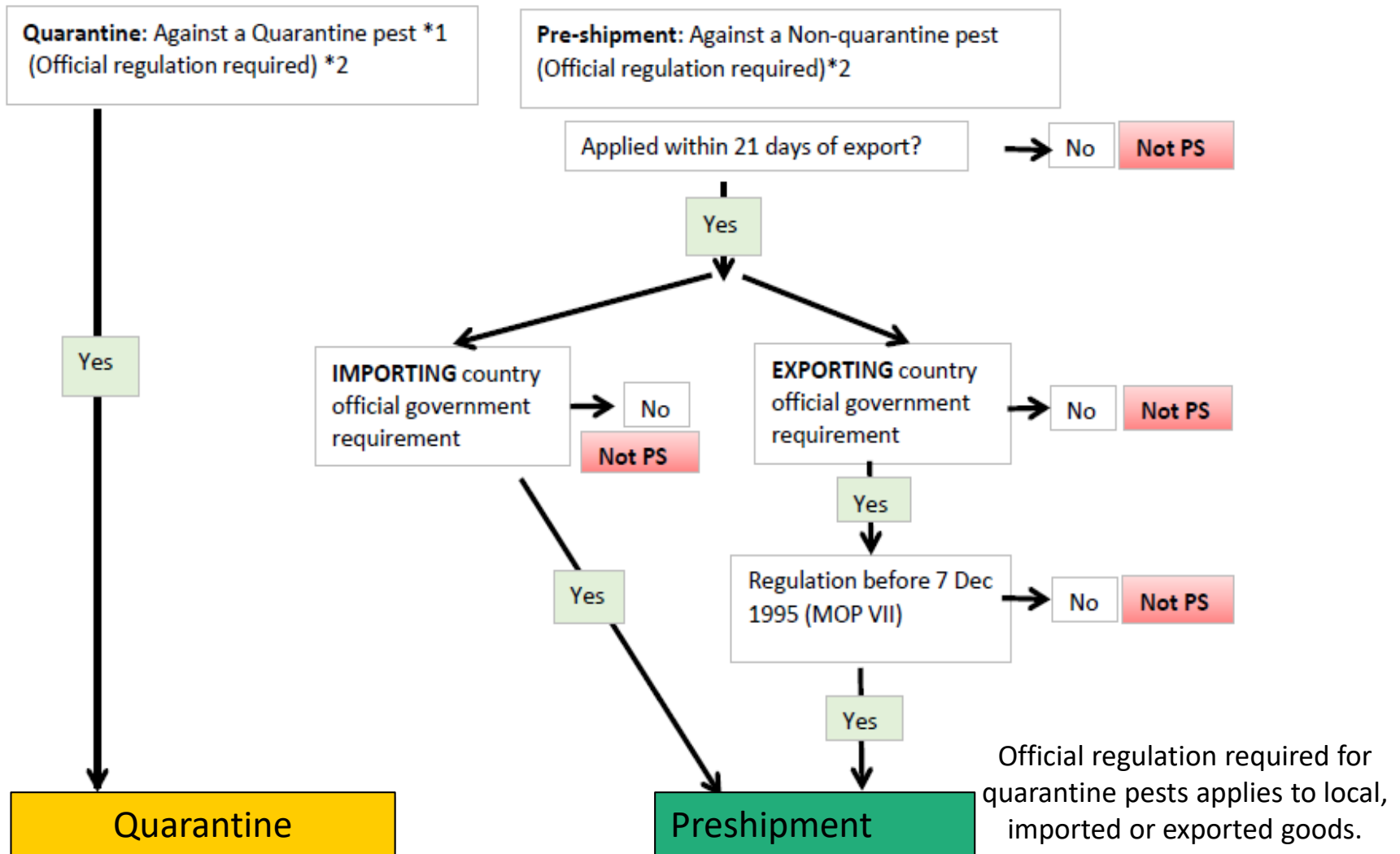
Commodity treated	Pest	Requirement
Wheat grain	Cosmopolitan Non-quarantine Pest	Export from a country which has an official government regulation for treatment. The regulation needed to be in place prior to Dec 1994 (non A5) and Dec 1995 (A5).
Empty ship holds	“	“
Milled rice in bags, in transit fumigation at mill, train, ship	“	“

## Example of MB Use which Does Not satisfy Preshipment (Refer Report)

Commodity treated	Pest	Requirement
Cocoa beans	None Specified	No official regulation available.



# Clarification of whether MB use is Quarantine or Pre-shipment



Official regulation required for quarantine pests applies to local, imported or exported goods.

\*1 Pest of potential importance to an area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled.  
 \*2 Official control is that performed by, or authorized by, a national plant, animal or environmental protection or health authority.

# Main QPS pests and key alternatives to MB

Commodity	List of Main Quarantine Pests	Key Alternatives to MB
Whole logs, not debarked	Bark beetles, wood borers, <i>Sirex</i> spp., pinewood nematodes, fungi (oak wilt, <i>Ceratocystis ulmi</i> ).	<b>Heat treatment, ethanedinitrile (EDN), irradiation, methyl iodide, removal of bark, phosphine, sulfuryl fluoride (SF)</b>
Solid wood packaging materials	Various bark beetles, wood borers, <i>Sirex</i> spp., pinewood nematodes ( <i>Bursaphelenchus xylophilus</i> ).	<b>Heat treatments, SF and EDN</b> (although not yet ISPM 15 approved)
Grain and similar foodstuffs	<i>Trogoderma</i> spp., <i>T. granarium</i> ; <i>Prostephanus truncatus</i> ; <i>Sitophilus granarius</i> ; cotton boll worm, snails.	Seed weevils on beans ( <i>Phaseolus vulgaris</i> ), <i>Trogoderma granarium</i> on grains - <b>phosphine</b>
Fresh fruit and vegetables	Numerous species of Tephritidae (fruit flies), thrips, aphids, scale insects and other sucking bugs, various Lepidoptera and Coleoptera, various mites, spiders.	<i>Brevipalpus chilensis</i> on grapes various pests on asparagus - <b>irradiation</b> <i>Anastrepha ludens</i> on citrus - <b>irradiation, heat, cold</b> <i>Drosophila suzukii</i> on cherries and grapes - <b>irradiation [possibly cold]</b> Fruit flies on citrus, blueberries - <b>cold treatments</b>
Cut flowers	Large number of pests	<b>Irradiation, cold treatment or systems approach</b>
Soil for crop production, including propagation material	Potato Cyst or golden nematodes ( <i>Globodera pallida</i> ) <i>Globodera rostochiensis</i> , <i>Orobanche</i> spp. Production of some nursery materials (USA).	Fumigants ( <b>methyl iodide, dazomet, 1,3 - dichloropropene, metham sodium</b> )
Bamboo, cane	Borers, Bostrichidae	<b>Heat treatments, SF, other fumigants</b>

# Alternatives available in IPPC international standards

- ISPM No. 15 (last revision 2021) Treatment of Wood Packaging Materials. Main ISPM that specifically deals with a major volume use of MB.
- ISPM No. 18 (last revision 2023) Guidelines for the use of irradiation as a phytosanitary measure
- ISPM No. 28 (last revision 2023) Phytosanitary treatments for regulated pests. See Annex 2 at the end of the MBTOC report
- ISPM No. 29 (last revision 2021) Recognition of pest free areas and areas of low pest prevalence
- ISPM No. 35 (last revision 2021) Systems approach for pest risk management of fruit flies
- ISPM No. 39 (last revision 2021) International movement of wood
- ISPM No 44 (2022) Requirements for the use of modified atmosphere treatments as phytosanitary measures

For a full list of ISPMs and pertinent revisions please visit  
<https://www.ippc.int/en/core-activities/standards-setting/ispms/>

## Improving the adoption of QPS Alternatives

- Consistent differentiation between quarantine and endemic pests
- Acceptance of efficacy levels below the default Probit 9 (99.997% efficacy).
- Increasing registration of alternatives in different regions.
- Continually reviewing trade partner approvals and implementing IPPC accepted alternatives.
- Trials or demonstration and information exchange to build confidence in alternatives. These should be coupled with training on safe handling of chemicals, management/prevention of residues and others.

# Flexible and Rigid Foams Technical Options Committee (FTOC)

**Co-chairs**

**Paulo Altoe**

**Helen Walter-Terrinoni**

# FTOC 2023 Progress Report

- Generally, transitions to non-ozone depleting substances (ODSs) and low global warming potential (GWP) alternatives have been successful and transitions continue to move forward.
  - There is no single ‘drop-in’ FBA replacement for currently used HCFCs or hydrofluorocarbons (HFCs).
  - There are different technical, economic, safety, and environmental performance properties for each low GWP, zero ozone depletion potential (ODP) alternative and different needs for each market subsector.
  - There is a proliferation of blends across the whole of the foam sector which is an indication of the reality that there is no single best solution.
- Technical and economic challenges remain for some sectors and small and medium enterprises.
  - The price of HFC blowing agents has risen substantively and is nearly as high as hydrofluoroolefin (HFO) and hydrochlorofluoroolefin (HCFO) prices were in some A5 parties. This is especially challenging for Small- and Medium-sized Enterprises

# FTOC Key Messages

- Newly announced low global warming potential (GWP) foam blowing agent capacity has eased the shortage of supply and cost of alternatives, especially cyclopentane and HFOs.
  - Additional capacity required to alleviate the shortage suggests that there was insufficient capacity to meet regulated needs for low GWP FBAs
  - HFC-365 manufacture will cease in 2023, after significant resource investment by foam manufacturers to convert.
  - Insufficient capacity to meet regulatory mandates is likely to recur without intervention
  - Patents have restricted options to address local supply chains.

# Energy Efficiency Challenges and Opportunities

- There continues to be a trend away from the use of fluorocarbon (FC) FBAs with every transition.
- As the phaseout of HCFCs and the phasedown of HFCs progress, there will be limited availability and increasing prices of FBAs which will drive the selection of alternative foam blowing agents.
- It has been estimated that less than 20% of the FBA volume will be comprised of FCs after the transition to low GWP FBAs globally.
- This is in part due to direct conversions to other FBAs and in part as a result of the use of blends with lower concentrations of FCs.
- In parties without standards related to minimum thermal performance requirements, optimizing foam costs could result in higher energy consumption for buildings and refrigerating equipment.



# Fire Suppression Technical Options Committee (FSTOC)

**Co-chairs**

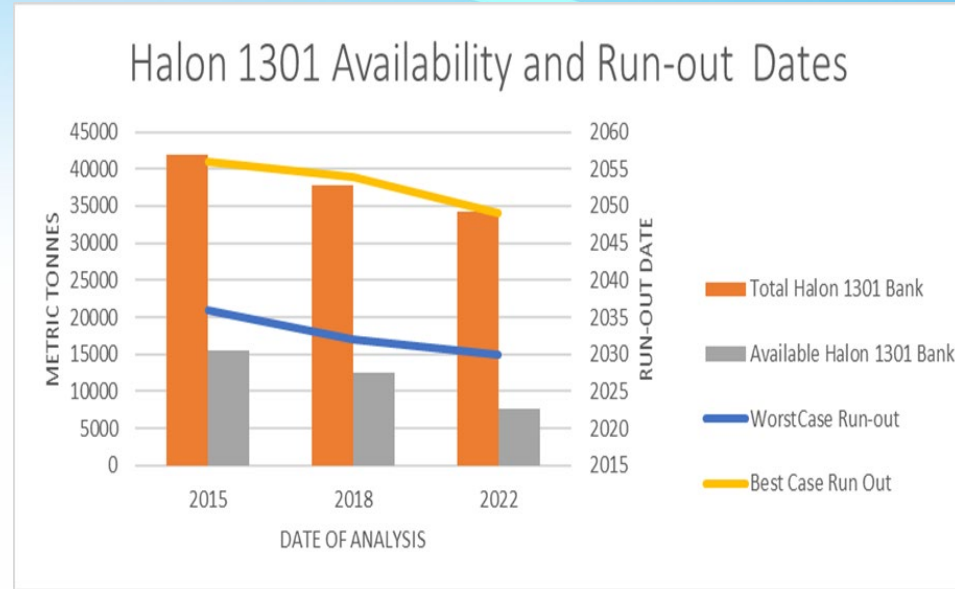
**Adam Chattaway**

**Sergey Kopylov**

**Dan Verdonik**

# FSTOC 2023 Progress Report

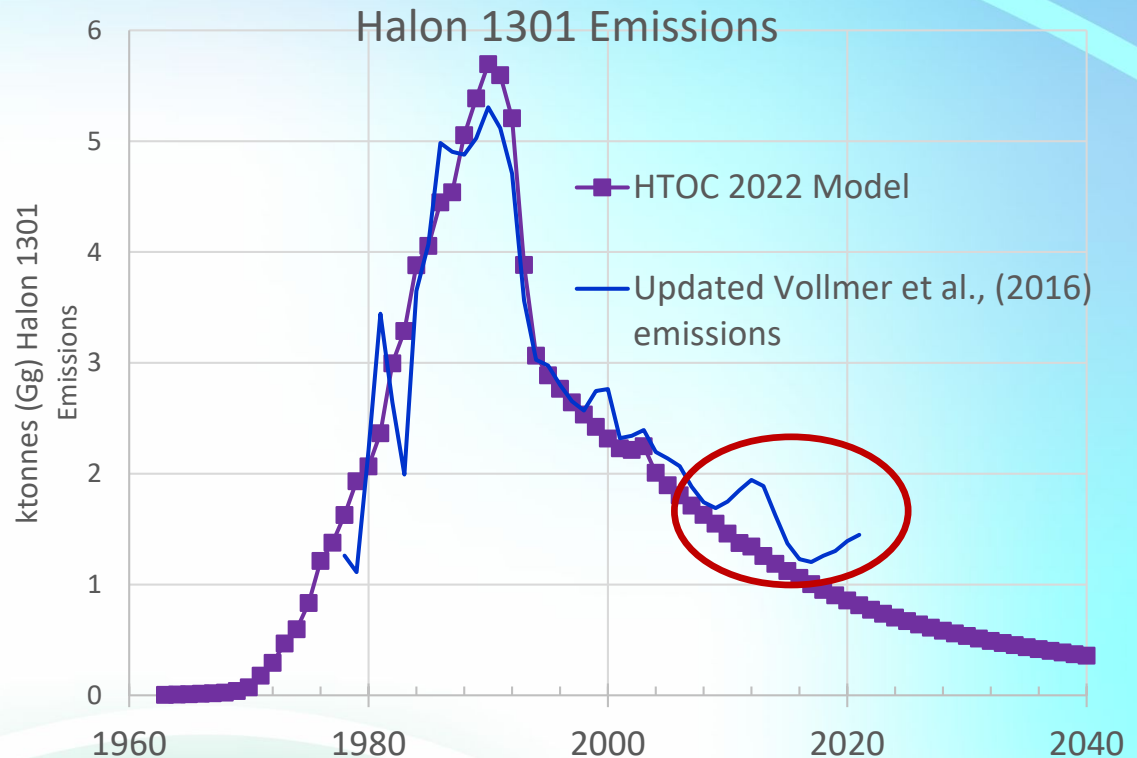
- Halon 1301 run-out date range continues to move earlier
- Available halon 1301 bank being depleted faster than total bank
- More halon 1301 is tied up in the unavailable part of the bank (Japan, military, civil aviation, etc.)
- Where does this leave enduring uses?
- Emerging PFAS policies are influencing halon transition to alternatives



Decision	Date of Analysis	Total Halon 1301 Bank (tonnes)	Available Halon 1301 Bank (tonnes)	Worst case Run-out date	Best case Run-out date
XXVI-7	2015	42,000	15,500	2036	2056
XXIX-8	2018	37,750	12,500	2032	2054
XXX-7	2022	34,310	7,620	2030	2049

# FSTOC 2023 Progress Report (2)

- Halon 1301 emissions continue to show unexplained deviations
- FSTOC thinks these could be from production for feedstock (Fipronil etc.).
- FSTOC requests additional information feedstock production, and, where available, resulting emissions.



# Medical and Chemicals Technical Options Committee (MCTOC)

**Co-chairs**

**Keiichi Ohnishi**

**Helen Tope**

**Jianjun Zhang**

# MCTOC 2023 Progress Report

- In 2021, total ODS production and import reported for feedstock uses was 1.8 million tonnes, a significant increase from 2020.
- The largest reported HFC feedstock is HFC-152a (thousands of tonnes).
- Elaboration of challenges that could emerge in transition from high-GWP propellant pressurised metered dose inhalers (pMDIs) to inhalers with lower GWPs and with continued supply of technical- and pharmaceutical-grade HFC-134a and HFC-227ea.
- These and other market-based challenges and uncertainties, within the context of the HFC phase-down, reinforce the need for a well-planned transition to ensure patients do not face critical shortages or price increases that make pMDIs unaffordable.

# MCTOC 2023 Progress Report (2)

- As global HFC production diminishes, pMDI manufacturers, including in A5 parties, may find bulk pharmaceutical-grade high-GWP propellant sourced from UK increasingly difficult to obtain. Cost will increase.
- These pMDI manufacturers may have to switch to pharmaceutical-grade propellant currently available in India or China. Gaining qualification for an alternative propellant source takes months to years.
- For pMDI manufacturers in A5 parties that export to non-A5 parties, a switch of propellant manufacturer requires additional studies to gain pMDI regulatory approval, which would take time and could impact the continued supply of these pMDIs to non-A5 markets.
- There will be incremental costs for pMDI manufacturers in A5 parties in the transition from high GWP pMDIs to pMDIs with lower GWP propellants that parties may need to consider.

# MCTOC 2023 Progress Report (3)

- Two options are possible for provision of pharmaceutical-grade propellant in future years if technical-grade feedstock plants can no longer supply HFC-134a “just-in-time”.
  - 1) Pharmaceutical-grade HFC (134a or 227ea) could be produced in earlier years and stored in a way that retains its purity and medical status.
  - 2) Technical-grade HFC could be stockpiled and later converted to pharmaceutical-grade by passing through a medical purifier plant.
- Planning for both would be very challenging, considering cost, regulatory, practical issues.
- There is a risk that insufficient time may be left between when decisions are made to build stock and when technical-grade HFC manufacturing assets must shut down, so that stock building may become impractical.

# Response to Decision XXXIV/6 - CTC

- MCTOC provides a response to decision XXXIV/6 on on-going emissions of CTC in the Progress Report.
- In response to Decision XXXIV/6, information was submitted by five parties: China, the EU, Japan, UK, and the US.
- MCTOC provides a generic summary of the information in the submissions, identifying similar elements of national procedures and frameworks that have been established by this sample of parties.
- A non-exhaustive list of national procedures and frameworks taken from the submissions is included in the report.



# Refrigeration, Air Conditioning and Heat Pumps Technical Options Committee (RTOC)

**Co-chairs**

**Omar Abdelaziz**

**Roberto Peixoto**

**Fabio Polonara**

# RTOC 2023 Progress Report

- Work on 2022 RTOC AR continued to the end of February 2023.
- No compelling new information on technology is available since then.
- RTOC started a process of appointing members for 2 years, considering current commitments and new challenges
  - 33 Men, 10 Women
  - 26 re-nominations, 17 new-nominations
  - 22 members from nonA5, 21 members

# RTOC 2023 Progress Report (2)

- In response to Decision XXXIV/3, TEAP established an Energy Efficiency Working Group (EEWG) to provide information to parties on energy efficiency during HFC phase-down.
- The EEWG working group includes 15 members of RTOC.
- The report responding to Decision XXXIV/3 can be found as a supplement to the TEAP 2023 Progress Report.

# Per- and poly-fluoroalkyl substances (PFAS): Emerging policies and sector information

- There is increasing focus on the use, emissions, and environmental and health effects of PFAS
- Ongoing regional, national and subnational actions related to PFAS may or may not restrict products using chemicals controlled under the Montreal Protocol and their substitutes, as well as their breakdown products, such as trifluoroacetic acid and its salts (TFA).
- This is creating uncertainty for industry regarding the long-term availability of certain alternatives to ODS and HFCs.
- This could have unintended impacts, i.e., delaying the phase-out of ODS and phase-down of high GWP HFCs.

# Definition of PFAS

- PFAS have been defined differently by national and sub-national jurisdictions
  - Organisation for Economic Co-operation (OECD) definition would include controlled substances under the Montreal Protocol, includes most HFCs, HFOs, and TFA
  - U.S. Environmental Protection Agency working definition of PFAS excludes most, if not all, HFCs, HFOs, and specifically TFA
  - In U.S., some states considering or enacting policies on PFAS with definition and scope to include substances controlled under the Montreal Protocol

# PFAS Regulations

- ECHA proposes bans under REACH regulations-18 months after entry into force” but may allow for some exceptions for a limited period of time
- US EPA: evaluating priority groups of PFAS chemicals under their-“PFAS Strategic Roadmap: EPA Commitments to Action 2021-2024”
- US States: Some states have enacted bans for controlled substances effective 2030 and beyond, with an opportunity for exceptions.
- Canada: initiated a rulemaking considering the OECD definition
- Some jurisdictions (e.g., China and Japan) restrict certain PFAS under the Stockholm Convention on Persistent Organic Pollutants or POPs, including PFOS, PFOA, PFHxS only

# Considerations Under a Broad-ranging Definition of PFAS and Associated Restrictions (1)

- Fire-suppression: low GWP alternatives 2-BTP, FK-5-1-12 would be considered PFAS, but all Halons,  $\text{CF}_3\text{I}$ , and high-GWP HFC-23 would not be considered PFAS. This will affect civil aviation's replacement of Halon 1211 with 2-BTP
- Foams: HFO/HCFO alternatives would be considered PFAS, with uncertainty delaying selection
- pMDIs: HFC-134a, HFC-227ea, and potential alternative HFO-1234ze(E) would be considered PFAS with impact on global supply, affordability, and accessibility of current propellants
- Specialist uses could have limited, if any, lower GWP options: e.g. electronics manufacturing, magnesium production, and precision cleaning for aerospace and military use

# **Considerations Under a Broad-ranging Definition of PFAS and Associated Restrictions (2)**

## **RACHP:**

- Most current and low GWP alternative fluorinated refrigerants (except five e.g., HFC-32) would be considered PFAS, including HFC-134a, R-404A and R-410A and all HFOs.
- A broad-ranging PFAS restriction could affect:
  - uptake of low GWP alternative refrigerants
  - energy efficiency of medium-sized RACHP systems
  - adoption of decarbonising heat pumps
- Most of the fluoropolymers used as flexible seals in compressors, valves and other RACHP components would also fall within OECD definition of PFAS.



# Decision XXXIV/11 – TOC configurations

- Decision XXXIV/11 asks TEAP, in consultation with its TOCs, “*to provide further information on existing challenges and options for future configuration and function of its TOCs*”, taking into account:
  - Discussions and questions raised by parties at OWEG-44 and MOP-34
  - The fact that the majority of HFC uses occur in the RACHP sectors
  - Expertise required to provide technical and cost-related information including in the context of the Kigali Amendment
  - Guidance provided in TEAP's TOR
  - The need to ensure continued collaboration and coordination across TOCs

# TEAP considerations

- TEAP anticipates its workload and that of its TOCs will remain at least at the same high level as in the past several years.
- In addition to yearly requests for technical and economic information, the TEAP and its TOCs have several standing requirements for annual, triennial, quadrennial and quintennial analyses and reports on ODS phase-out, HFC phase-down and alternatives, destruction technologies, process agents, *n*-propyl bromide, laboratory and analytical uses, replenishment, energy efficiency, cross panel issues, etc.
- TEAP has in the past, and will continue in the future, to organise its activities to meet all of these current and emerging technical and economic assessment needs of the parties.
- TOC co-chairs continually review their membership to ensure having the expertise necessary to provide parties with the latest technical and economic information in their sector, and to be able to respond to specific party requests

# Proposal for TOCs

- TEAP proposes to maintain the structure of its current five TOCs aligned along the Montreal Protocol sectors: FTOC, FSTOC, MBTOC, MCTOC, RTOC.
- Considering its workload, TEAP proposed that the RTOC continues as a single body primarily organised around two specific areas, the cold chain and space heating and cooling.
- TEAP proposes a fourth RTOC co-chair, two from A5 and two from non-A5 parties to better manage its two specific areas.
- RTOC will continue to meet in one location, holding separate breakout working groups focused on these two areas, and producing a single consensus report. The co-chairs will manage the work across cross-cutting issues.

# TEAP Organisational Matters

- At the end of 2023, terms of appointment will end for some TEAP members including two co-chairs each for MCTOC and RTOC and all Senior Experts (see Annex 4 of the TEAP 2023 Progress Report).
- As indicated in the TEAP TOR, the Senior Experts to the TEAP fulfil an important role by providing specific expertise not covered by the other members (TEAP or TOC co-chairs).
- TEAP has identified its current needed expertise for Senior Experts and TOC members in the matrix of needed expertise contained in Annex 5 of the TEAP 2023 Progress Report