MONTREAL PROTOCOL

ON SUBSTANCES THAT DEPLETE

THE OZONE LAYER

UNEP

REPORT OF THE
TECHNOLOGY AND ECONOMIC ASSESSMENT PANEL

APRIL 2007

PROGRESS REPORT

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The text of this report is composed in Times New Roman.

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Layout: Meg Seki, Ozone Secretariat, UNEP

Reproduction: UNON Nairobi
Date: April 2007

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UNITED NATIONS ENVIRONMENT PROGRAMME
Ozone Secretariat, P.O. Box 30552, Nairobi, Kenya

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ISBN: 978-92-807-2829-3
Job No: OZO/0955/NA

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Acknowledgements

The Technology and Economic Assessment Panel, its Technical Options Committees and the Task Forces Co-chairs and members acknowledges with thanks the outstanding contributions from all of the individuals and organisations that provided support to Panel, Committees and Task Forces Co-chairs and members. The opinions expressed are those of the Panel, the Committees and Task Forces and do not necessarily reflect the reviews of any sponsoring or supporting organisation.

The TEAP thanks the FAO, Rome, for hosting the TEAP meeting, 26-30 March 2007, where this report was composed and reviewed, and thanks in particular its co-chair Lambert Kuijpers, for making all necessary arrangements for the meeting.

Foreword

In April 2007, The Technology and Economic Assessment Panel submitted two reports to the Montreal Protocol Parties:

1. April 2007 TEAP Progress Report

The annual TEAP Progress Report reports on and responses to various requests of the Parties. It also contains separate progress reports by the Technical Options Committees and a TEAP progress report on TEAP and TOC organisation (chapter 11).

Chapter 1 considers the essential use nominations by Parties, specifically by the European Community, the Russian Federation and the United States and recommends essential use CFC quantities for MDIs for the years 2008 and 2009. Chapter 2 contains the response by the MTOC to Decision XVIII/16 on the difficulties faced by some Article 5 Parties manufacturing MDIs using CFCs. It also contains information on the progress and the difficulties in the transition out of CFCs in separate Article 5 countries. Chapters 3 to 8 contain the progress reports by the Medical, Chemicals, Foams, Halons, Refrigeration and Methyl Bromide Technical Options Committees. The Progress Report by the CTOC (chapter 4) contains responses to Decision XVII/6, 7 and 8 on process agents; to Decision XVIII/8 on the essential use for CFC-113 by the Russian Federation; to Decision XVIII/11 on the update information for nPB; to Decision XVIII/10 on sources of CTC emissions and reduction options; and to Decision XVII/10 on laboratory and analytical uses for methyl bromide. Chapter 9 evaluates the Methyl Bromide Critical Use Nominations submitted in 2007 for the years 2008 and/or 2009. After the presentation of general issues, the TEAP progress report contains interim reports on the evaluations of the 2007 submissions presented by (1) the MBTOC Soils Subcommittee and (2) the MBTOC Quarantine, Structures and Commodities Subcommittee. Chapter 10 contains a description of how TEAP and its Task Force plan to respond to the requests made by Parties in Decision XVIII/12: "Future work following the Ozone Secretariat Workshop on the Intergovernmental Panel on Climate Change/ Technology and Economic Assessment Panel Special Report".

Three annexes give TEAP and TOC member information: (i) Annex I contains the TEAP member biographies (and Disclosure of Interest statements), (ii) Annex II lists the TEAP and TOC membership as of March 2007 and (iii) Annex III contains Disclosure of Interest statements by all TOC co-chairs and members, as requested by Parties.

2. Task Force Report on the Continuing TEAP Legacy

This report was produced by a Task Force which was formed on the occasion of the Twentieth Anniversary of the signing of the Montreal Protocol, to consolidate records of TEAP, its TOCs and Subsidiary Bodies such as Task Forces. It summarizes the history of TEAP assessments, assembles a comprehensive list of the publications, documents the membership over the years and reflects on how TEAP responded to the requests of the Parties.

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1 Essential Uses

1.1 Executive Summary

The following table summarises the recommendations of the Technology and Economic Assessment Panel (TEAP) and its Medical Technical Options Committee (MTOC) on nominations for essential use production exemptions for chlorofluorocarbons (CFCs) for metered dose inhalers (MDIs).

Table ES-1: Recommendations for essential use nominations

	European Community	**Russian Federation**	**United States**
2008	Recommend exemption for CFCs for MDIs for 316 tonnes (not for single-moiety salbutamol to be sold within Member States of the EC).	Recommend exemption for CFCs for MDIs for 212 tonnes (for single-moiety salbutamol to be sold within the Russian Federation).	
2009			Recommend exemption for CFCs for MDIs for 282 tonnes (not for single-moiety salbutamol).

The quantities requested by the European Community for 2008 are similar to those allocated in 2006 and 2007. It is not clear from the nomination how final phase-out of CFC use within the European Community will be achieved, nor how the European Community intends to reduce its production to zero.

The Russian Federation states that it will not make a nomination for 2009. However, MTOC is uncertain that a complete phase-out will be feasible within the timeframe stated in the nomination. It is important that measures be considered to avoid jeopardizing patient health due to an overall shortfall in inhaled therapy.

The United States' nomination shows a decrease in requested quantities compared to 2008. The active moieties for which these quantities are requested will shortly be subject to a US FDA rule-making process that may be completed in 2008. The recommendation by MTOC is made under the assumption that all the active moieties remain essential under US FDA rules in 2009. In order to better inform the Parties' essential use decision, the United States could clarify its stockpile status by the Meeting of Parties in 2007. Transfer of stocks between companies could more than offset the need for manufacture of CFCs. Companies producing MDIs other than single-moiety salbutamol may not have access to stockpiles held by other companies.

While MTOC recommends approval of these nominations, Parties may wish to consider the following issues in making its essential use decisions.

MTOC notes that the timelines for drug development and approval in non-Article 5 countries mean that any formulation that is going to be available by 1 January 2010 will already have to be a final commercial formulation in phase 3 regulatory studies in 2007 (assuming phase 3 studies take 18-24 months and regulatory approval 12 months). This means that several of the drugs, which are included in CFC quantities requested in the current nominations, will not be reformulated within this timeline. This raises the question for the nominations for 2008 and 2009, whether the quantities requested for certain active ingredients could be considered essential. Parties may wish to consider reducing the quantities approved for essential use

contingent on receiving further information from nominating Parties confirming the absence of active research and development on these moieties. Parties may also wish to consider not allocating CFCs to companies without a final CFC-free formulation in phase 3 studies.

For combination products for which the separate moieties are available as CFC-free alternatives, MTOC believes that these combination products continue to be used for patient convenience and commercial considerations. Patients will not come to any harm by using the drugs in separate inhalers. The combination inhalers cannot therefore be considered to be essential under Decision IV/25. Parties may wish to consider a decision not to allocate CFCs for these combination products.

MTOC emphasises that the management of stockpiles will be extremely important to avoid unnecessary production of CFCs and the potential need for excessive destruction. MTOC believes that complete accounting frameworks of CFC stockpiles, including pre-1996 stocks, should be provided. Parties may wish to consider the advantages of requiring that plans for use or disposal of stockpiles be included in future nominations.

1.2 Essential Use Nominations for Metered Dose Inhalers

1.2.1 Criteria for Review of Essential Use Nominations for MDIs

Decision IV/25 of the 4th Meeting and subsequent Decisions V/18, VII/28, VIII/9, VIII/10, XII/2, XIV/5, XV/5, XVI/12, XVII/5, and XVIII/7 have set the criteria and the process for the assessment of essential use nominations for metered dose inhalers (MDIs).

1.2.2 Review of Nominations

The review of essential use nominations by the Medical Technical Options Committee (MTOC) was conducted as follows.

Three members of the MTOC independently reviewed each nomination, each preparing an assessment. Further information was requested where necessary. The MTOC considered the assessments, made recommendation decisions and prepared a consensus report. Where appropriate, members declared a potential conflict of interest ahead of the discussion.

Nominations were assessed according to the guidelines for essential use contained within the *Handbook on Essential Use Nominations* (TEAP, 2005) and subsequent Decisions of the Parties.

Concurrent with the evaluation undertaken by the MTOC, copies of all nominations are provided to the Technology and Economic Assessment Panel (TEAP). The TEAP and its TOCs can consult with other individuals or organisations to assist in the review and to prepare TEAP recommendations for the Parties.

1.2.3 Summary of Parties' Essential Use Nominations and Quantities for 2008 and 2009 (in tonnes)

	European Community	**Russian Federation**	**United States**
2008	316	212	-
2009	-	-	282

1.2.4 Observations

Three essential use nominations were submitted for consideration in 2007: the European Community for 2008, the Russian Federation for 2008, and the United States for 2009.

Accounting frameworks for 2006 were not received from the Japan and Ukraine, which had previously reported end of year stock for 2005 of 13.68 and 47.4 tonnes respectively. MTOC understands that Japan has destroyed its stock, but has no information about the Ukraine.

Decision VIII/10 (1) states "*That Parties not operating under Article 5 will request companies applying for MDI essential-use exemptions to demonstrate ongoing research and development of alternatives to CFC MDIs with all due diligence and/or collaborate with other companies in such efforts and, with each future request, to report in confidence to the nominating Party whether and to what extent resources are deployed to this end and progress is being made on such research and development, and what licence applications if any have been submitted to health authorities for non-CFC alternatives*". Decision XVIII/7 reiterated a similar request.

The nominations for the European Community and the United States state that they have requested information on on-going research and development from individual companies, which remains confidential and is not provided for review by MTOC. While MTOC is confident nominating Parties received information regarding levels of research and development activity towards reformulation, MTOC believes that both nominations contain quantities for companies that could not be considered to be actively conducting research and development. For example, the European Community states "Companies targeting the export of generic type of CFC MDI to developing countries tend not to pursue very active research and development activities to develop alternative products. This is a remaining issue to be dealt with consistently with the phase-out of CFC MDI in Article 5 Parties."

MTOC notes that the timelines for drug development and approval in non-Article 5 countries mean that any formulation that is going to be available by 1 January 2010 will already have to be a final commercial formulation in phase 3 regulatory studies in 2007 (assuming phase 3 studies take 18-24 months and regulatory approval 12 months). This means that several of the drugs, which are included in chlorofluorocarbon (CFC) quantities requested in the current nominations, will not be reformulated within this timeline. This raises the question for the nominations for 2008 and 2009, whether the quantities requested for certain active ingredients could be considered essential. Parties may wish to consider reducing the quantities approved for essential use contingent on receiving further information from nominating Parties confirming the absence of active research and development on these moieties. Parties may also wish to consider not allocating CFCs to companies without a final CFC-free formulation in phase 3 studies.

For combination products for which the separate moieties are available as CFC-free alternatives, MTOC believes that these combination products continue to be used for patient convenience and commercial considerations. Patients will not come to any harm by using the drugs in separate inhalers. The combination inhalers cannot therefore be considered to be essential under Decision IV/25. Parties may wish to consider a decision not to allocate CFCs for these combination products.

MTOC notes that both the European Community and the United States have now reported pre-1996 stockpiles. MTOC emphasises that the management of stockpiles at this final stage of the phase-out will be extremely important to avoid unnecessary production of CFCs and

the potential need for excessive destruction. Parties may wish to remind CFC MDI manufacturers that any CFCs obtained under essential use exemptions must be used for this essential use (including through a transfer), transferred to an Article 5 country for basic domestic needs, or destroyed. In addition, Decision IV/25 (*Report of the TEAP, May 2005, Progress Report*, section 1.1.4.1, pg 35) requires companies that hold pre-1996 stocks to use them first before using newly produced CFCs.

MTOC believes that complete accounting frameworks of CFC stockpiles, including pre-1996 stocks, should be provided. Parties may wish to consider the advantages of requiring that plans for use or disposal of stockpiles be included in future nominations.

1.2.5 Committee Evaluation and Recommendations

Quantities are expressed in metric tonnes.

1.2.5.1 European Community

Year	**Quantity**
2008	316 tonnes

Specific Use: MDIs for asthma and COPD

Active ingredients and intended markets for which the European Community nomination applies

Active Ingredients	**Intended market**
Salbutamol	Central and South America
Beclomethasone	European Community, Asia-Pacific, Central and South America
Budesonide	Africa, Central and South America
Cromoglicic acid	European Community, United States, Central and South America
Nedocromil	United States
Salbutamol+Ipratropium bromide (combination)	European Community, New Zealand, Asia-Pacific, Middle-East, Mexico, Africa
Salbutamol+Flunisolide (combination)	European Community
Salbutamol+Beclomethasone dipropionate (combination)	European Community, Central and South America*
Isoproterenol HCl+Fenilefrina HCl (combination)	European Community

*MTOC understands this combination product is also exported to the Middle East

Recommendation: Exemption for CFCs for MDIs – 316 tonnes (not for single-moiety salbutamol to be sold within Member States of the European Community).

Comments

While MTOC accepts the European Community nomination and recommends its approval, there are several concerns noted by MTOC in addition to those discussed above.

MTOC notes that within the European Community the transition had proceeded well in the past, but now seems to have stalled. The quantities requested by the European Community for 2008 are similar to those allocated in 2006 and 2007. It is not clear from the nomination how final phase-out of CFC use within the European Community will be achieved, nor how the European Community intends to reduce its production to zero. An explanation of the final phase-out plan for the European Community is needed, especially for amounts requested for export to Article 5 countries and for products for which a CFC-free alternative will not become available.

MTOC notes that the requested quantities for use within the European Community appear to be primarily for combination products, the majority of which are separately available as single ingredient alternatives. MTOC also notes a significant proportion of the request is intended for export. While much of this export is to Article 5 countries, particularly for salbutamol for Central and South America (98 tonnes), it is not clear how this export will be handled into the future. Specifically, it would be helpful to understand better the details of these exports and the plans to assure availability of essential products as the transition is completed globally.

The reported stockpiles are low and appear reasonable. While significant pre-1996 stocks (~172 tonnes) have been recently reported, it is not clear these would be available to the companies still producing CFC MDIs. Transfer of stocks between companies could offset the need for manufacture of CFCs.

1.2.5.2 Russian Federation

Year	**Quantity**
2008	212 tonnes

Specific Usage: MDIs for asthma and COPD, for active ingredient salbutamol for use solely within the Russian Federation

Recommendation: Exemption for CFCs for MDIs – 212 tonnes (for single-moiety salbutamol to be sold within the Russian Federation)

Comments

The Russian Federation has made progress in reducing the annually nominated amounts for essential use, and states that it will not make a nomination for 2009. The current nomination for 2008 is for 212 tonnes; the exempted amounts for 2006 and 2007 were 400 and 243 tonnes, respectively. The nominated CFCs are for use only for salbutamol MDI, and for use solely within the Russian Federation. Finished MDIs (CFC-containing and CFC-free) are also imported. The market share of these imported products was 50 per cent in 2006. There is no CFC production in the Russian Federation. CFC is imported from Korea,

India and China and is purified in the Russian Federation before use in MDI manufacture.

MTOC estimates that there may be a sufficient supply of CFCs from stockpile and exempted/nominated quantities to continue manufacture of salbutamol MDIs through to phase-out by 2009 assuming current levels of utilization. However, it is uncertain that a complete phase-out will be feasible within the timeframe stated in the nomination. Domestic alternatives are still in early stages of development. Furthermore, relying on the importation of CFC-free MDIs to avert a potential domestic shortfall may not be feasible due to the higher price of imported products. It is important that measures be considered to avoid jeopardizing patient health due to an overall shortfall in inhaled therapy.

MTOC recommends that the Russian Federation establishes educational programs as it embarks on the final phase of the transition.

1.2.5.3 United States

Year	Quantity
2009	282 tonnes

Specific Use: MDIs for asthma and COPD, for the following active ingredients for use solely within the United States: cromolyn, epinephrine, ipratropium/salbutamol (combination), nedocromil, pirbuterol, triamcinolone.

Recommendation: Exemption for CFCs for MDIs – 282 tonnes (not for single-moiety salbutamol).

Comments

The nomination was completed in accordance with the *Handbook on Essential Use Nominations* (TEAP, 2005). It shows a decrease in requested quantities compared to 2008. The active moieties for which these quantities are requested will shortly be subject to a US FDA rule-making process that may be completed in 2008. The recommendation by MTOC for the nominated 282 tonnes is made under the assumption that all the active moieties remain essential under US FDA rules in 2009. In the opinion of MTOC, comparable alternative therapies already exist in the United States market for all of these moieties. If it is determined by the US FDA that any of these moieties is no longer essential under United States' law, depending on the timing of rulemaking, the CFC quantities for that moiety should be removed from the nomination, or not be allocated. The United States could provide in 2008 a revised nomination for 2009, based on the outcome of this rule-making.

The aggregate stock reported in the accounting framework at end of year 2006 is 2,466 tonnes. The proposed United States allocation of CFCs to MDI manufacturers for 2007 is about 1,000 tonnes less than its approved essential use quantity for this year, which means that the stockpile may be reduced accordingly by the end of 2007. While the remaining stock still appears to be in excess of the amount of CFCs needed for MDI manufacture (1,283 tonnes in 2006), MTOC does not know how much of this will be readily available to companies that are expecting to manufacture CFC MDIs in 2009, nor how the mix of different CFCs in stock matches the mix needed in 2009. Companies producing MDIs other than

single-moiety salbutamol may not have access to stockpiles held by other companies. The size of the stockpile will also be affected by the speed of phase-out of salbutamol CFC MDIs over the course of 2007 and 2008. Approval of the 2009 quantities assures availability of CFCs for MDIs other than single-moiety salbutamol if the CFC stockpile proves to be inaccessible due to business considerations. At the end of phase-out, the United States could hold a substantial stockpile of CFC, which may require destruction.

In order to better inform the Parties' essential use decision, the United States could clarify its stockpile status by the Meeting of Parties in 2007. Transfer of stocks between companies could more than offset the need for manufacture of CFCs.

2 Decision XVIII/16: Difficulties faced by some Article 5 Parties manufacturing metered-dose inhalers which use chlorofluorocarbons

2.1 Background to Decision XVIII/16

At the Seventeenth Meeting, the Parties to the Montreal Protocol discussed the difficulties faced by some Article 5 Parties with respect to the phase-out of chlorofluorocarbons (CFCs) used in the manufacture of metered dose inhalers (MDIs). In Decision XVII/14 the Parties expressed their concern that Article 5 Parties that manufacture CFC MDIs might find it difficult to phase out these substances without incurring economic losses to their countries. There was the further risk that, for some Article 5 Parties, consumption levels in 2007 of CFCs for MDIs might exceed the amounts allowed for all CFC uses under the Protocol.

The Parties considered the issue again at their Eighteenth Meeting and took Decision XVIII/16. Paragraph 12 of this Decision requests:

> "*…TEAP to assess and report on progress at the twenty-seventh meeting o f the Open-ended Working Group and to report to the NineteenthMeeting of the Parties on the need for, feasibility of, optimal timing of, and recommended quantities for a limited campaign production of chlorofluorocarbons exclusively for metered-dose inhalers in both Parties operating under paragraph 1 of Article 5 and Parties not operating under paragraph 1 of Article 5.*"

In responding to the Parties' request under Decision XVIII/16, the Medical Technical Options Committee (MTOC) considered information from an Executive Committee report, *Options for Addressing the Situation of Countries Referred to in Decision XVII/14 of the 17th Meeting of the Parties (Follow-up to Decision 49/33)*[1]. This included data from a questionnaire distributed to 138 Article 5 Parties, national phase-out plans under current implementation, and reports submitted by Article 5 Parties to the Ozone Secretariat pursuant to Decision XIV/5. MTOC also considered other sources of information on the MDI sub-sector in Article 5 Parties, including the May 2006 *Progress Report of the Technology and Economic Assessment Panel*, and industry sources.

2.2 Progress in transition in Article 5 Parties

It is clear from the experience in non-Article 5 countries that a successful transition strategy must have a clear, final date by which time the country expects no longer to need CFC MDIs for its patients with asthma and COPD. The details of a strategy required for a country to successfully meet that date, while protecting patient's health, vary by the circumstances of the country, its health system and whether it imports or locally produces CFC MDIs. Elements that must be considered include the following:

- Date for completion;
- Measures to assure the timely introduction of CFC-free alternatives into the market through technology development/transfer (for producers) and regulatory approval (for both producers and importers);

[1] UNEP/OzL.Pro/ExCom/51/39, http://www.multilateralfund.org/files/51/5139.pdf

- Phase-out plan for CFC MDIs when acceptable alternatives are available;
- Promotion of discussions between environmental and health authorities, and efforts to inform practitioners and patients about the transition.

Many countries have not yet submitted transition strategies. MTOC recommends that any country producing or importing CFC MDIs consider developing a transition strategy as a matter of urgency, taking into account the above considerations. Their timely development will help assure patient access to adequate inhaled therapies as the final phase-out date approaches. In particular, it is critical that all CFC MDI producing countries now implement a transition strategy.

The following section outlines information on the current status of transition in some countries that manufacture MDIs. Unfortunately, this does not represent a complete picture, with information missing for some countries with domestic production of CFC MDIs, such as Algeria and South Africa. Most of the data are derived from the Executive Committee report[2].

2.2.1 Argentina

CFC consumption for the production of MDIs in Argentina increased from 86 tonnes to 188 tonnes between 2003 and 2005. The Government of Argentina has indicated that the maximum allowable level of CFCs for all uses for each year from 2007 to 2009 is 704.6 ODP tonnes for consumption and 686.0 ODP tonnes for production. As the total CFC production will be entirely for domestic consumption, Argentina could import a maximum of only 18.6 ODP tonnes of CFCs each year for use in the MDI sector, which is much lower than the 188 ODP tonnes used for MDI production in 2005. Given those circumstances, Argentina may not be able to meet the demand for pharmaceutical-grade CFCs. However, Argentina has also reported that hydrofluorocarbon (HFC) MDIs have been produced there since 2005.

2.2.2 Bangladesh

There are 4 companies manufacturing CFC MDIs in Bangladesh (one a multi-national company with 18 per cent local ownership); all production lines were established after July 1995. CFC consumption for the production of MDIs has increased from 39 to 62 tonnes between 2003 and 2005, and to an estimated 76 tonnes in 2006. During 2006, one company announced the introduction of the country's first HFC salbutamol and beclomethasone MDIs, but that it will not cease its current production of CFC salbutamol and beclomethasone MDIs.

2.2.3 Brazil

Brazil has identified two national MDI manufacturing plants, as well as two multi-national companies manufacturing CFC MDIs, that used 134.5 ODP tonnes of CFCs in 2006 for the production of CFC MDIs for local use and for export to other Parties.

The locally owned manufacturers of MDIs were recently estimated to consume about 10 ODP tonnes of CFCs.

[2] UNEP/OzL.Pro/ExCom/51/39, http://www.multilateralfund.org/files/51/5139.pdf

2.2.4 China

Approximately 15 million CFC MDIs are locally manufactured in China, multi-national companies sell about 2.5 million MDIs each year, and a small quantity of HFC MDIs has been imported since 2004.

Some locally owned companies have developed and patented new technology for CFC-free MDIs (clinical trials are ongoing). Adequate bulk pharmaceutical-grade HFC is readily available from three multi-national producers and will likely be available from one local producer. China is committed to cease CFC manufacture for MDIs by the end of 2009.

2.2.5 Colombia

Colombia has reported that all CFC MDIs were imported into the country and that no CFC MDIs were manufactured in Colombia. The Government of Colombia and the health authorities were concerned about the MDI sub-sector and requested funding for the development of an MDI transition strategy that would establish a clear schedule for import substitution of CFC MDIs. However, one local company has recently been reported to be producing CFC MDIs in Colombia since 2003, although CFC quantities are small, estimated at 2 tonnes annually.

2.2.6 Croatia

One local company (Pliva Hrvatska) has been producing CFC MDIs in Croatia since 1975. By the end of 2004, the company had ceased production of CFC MDIs, and started manufacturing salbutamol HFC MDIs (128,190 units). By 2005, about 378,700 HFC MDI units were produced. This Croatian company has successfully effected a complete transition to CFC-free MDIs without external financial support.

2.2.7 India

There are 19 different MDIs currently produced in India by 7 manufacturing enterprises (less than 2 per cent of total production is by multi-national companies). The total CFC consumption for the production of MDIs increased from 635.5 tonnes to 748.3 tonnes between 2003 and 2005. India has a substantial number of affordable dry powder inhaler (DPI) alternatives and one company has had under-used HFC MDI production capacity for several years. MTOC understands that India should be able to phase out CFCs from MDIs by the end of 2009.

2.2.8 Indonesia

Indonesia indicated that some 30 ODP tonnes were used for the production of MDIs and other aerosol pharmaceutical products by several local (Daya Varia and Konimex) and multi-national companies (AstraZeneca, Boehringer Ingelheim, GlaxoSmithKline) (it would appear that a large portion of the 30 ODP tonnes of CFCs reported in the phase-out plan is used for the manufacturing of pharmaceutical aerosols).

2.2.9 Iran

One locally owned company (Sina-Darou) has produced CFC MDIs in Iran since April 1993. Iran previously reported that some 50 tonnes of CFCs were used for manufacturing MDIs. MTOC understands that approximately 90 tonnes of CFC was used to make MDIs in 2006.

2.2.10 Mexico

According to a recent report, CFC MDIs have been produced in Mexico since 1999 by a locally owned company and by a multi-national company that requested imports of some 20 tonnes of CFC-114 for 2007. The national phase-out plan stated "the Government of Mexico will manage to phase out the MDI usage of CFCs without any assistance from the Multilateral Fund".

2.2.11 Pakistan

There are two MDI manufacturing companies in Pakistan. One is a joint venture between a multi-national company and a local company (with 21 per cent ownership), which started production of MDIs in 1983; the other company started production of CFC MDIs in 2005. The number of MDIs imported into the country increased from about 450,000 units in 2003 to about 1,000,000 units in 2005. Of the total MDIs imported in 2005, about 500,000 units were imported for the first time, from one MDI manufacturing company in China.

2.3 Difficulties in the transition in Article 5 countries

In most developing countries there is limited inhaler use compared to developed countries, as a result of many factors, some of which are cost, prescribing practices, and patient and physician awareness. Further, transition to CFC-free MDIs has not been a high priority among many healthcare providers, who are generally the main point of contact with patients. Educational efforts and marketing by pharmaceutical companies have, for the most part, been the driving force in the uptake of CFC-free alternatives.

Based on the experience in non-Article 5 countries, Article 5 countries that do not have an MDI manufacturing plant, or where MDIs are locally manufactured but predominantly by multi-national companies, national transition approaches may not have a large impact in the absence of support for transition to CFC-free alternatives from the multi-national MDI manufacturers or importers

All countries need a national CFC MDI transition plan involving all stakeholders, Government regulatory authorities, medical societies, and industry. As pharmaceutical-grade CFCs become less available, multi-national companies will need to rapidly introduce already developed CFC-free alternatives in Article 5 Parties. Prompt government regulatory support actions to approve new alternative products are important to assure seamless availability of inhaled therapy. Such transition strategies should ensure adequate supplies of inhaled therapy throughout the transition period, including adequate supplies of pharmaceutical-grade CFCs to complete the transition as well as CFC-free alternatives.

For Article 5 countries with current local CFC MDIs manufacture, there are three choices for transition to CFC-free alternatives:

Option 1 – Complete redevelopment and conversion of plant;
Option 2 – Use of a third party to deliver a turnkey operation (as in Cuba);
Option 3 – Cease local production and rely on importing CFC-free alternatives (HFC MDIs and DPIs)

Transition will require an individualised solution. Some companies in Article 5 countries have the technical knowledge for transition without the need for external technology transfer, or financial support. Only a few countries that do not have access to modern aerosol/pharmaceutical technologies will need advice and support.

2.3.1 Technology transfer and product development

While technology transfer would often appear most expedient to effect transition, as opposed to a wholly independent effort, there may be some challenges to the transfer of technology for some Article 5 countries. Some of these challenges are discussed below:

2.3.1.1 Finance

Some companies may have significant barriers to financing the development and implementation of new inhaler manufacturing capacity. A delay in seeking such funding, where needed, can introduce significant delays into the development whilst such funding is sought, obtained and negotiated.

2.3.1.2 Knowledge

Innovator pharmaceutical companies may be reluctant to transfer knowledge around formulations or processes to local companies since this may lead to direct competition for their markets in the region. While there are generic companies prepared to offer a turnkey solution, this can prove very expensive and time-consuming. Nevertheless, this is a faster option than a local company starting now to develop this knowledge autonomously.

2.3.1.3 Equipment

In most Article 5 countries producing MDIs, orders are yet to be placed for the manufacturing equipment likely to be needed to produce HFC MDIs. This equipment may take significant time to obtain, and will impact on the ability of these countries to effect transition by 2010. There may also be lead times associated with the sourcing of valves and canisters suitable for new HFC formulations. In this context, single-dose dry powder inhalers may be an excellent alternative in Article 5 countries. The technology needed for production is simple and cheap, allowing the set up of manufacturing units even in the smaller and traditionally non-producing countries.

2.3.1.4 Regulatory approvals

Not all countries have yet developed guidelines on the content of the regulatory submission for an HFC MDI or for a DPI product approval. In particular, the regulatory authorities in several Article 5 countries have not yet set a standard specification for pharmaceutical-grade HFC propellant and, therefore no standard samples exist. It would be useful if these authorities could also consider an expedited approval process; an example of such a process exists in Japan where products were approved within 3 months. At present, this is causing delay to the development and approval of substitute products.

2.3.1.5 Price

There has been concern about the potential price of CFC-free alternative MDIs. However, as transition has occurred and HFC MDI component prices have fallen, competition has kept prices comparable to those of CFC MDIs. If there is a disincentive to treatment due to price, governments could consider actions to lower the cost to the patients. An affordable supply of CFC-free MDIs may also

be available from the Asthma Drug Facility of the International Union Against Tuberculosis and Lung Disease (IUATLD) (http://www.iuatld.org/index_en.phtml).

2.3.1.6 Patient acceptance

This has not been an impediment to transition. Transition has been relatively seamless because replacement MDIs are very similar to the CFC product. Nevertheless, patient and professional organisations need to respond to individual patient questions that may arise.

2.3.2 Case Studies in Transition

The following three examples show the varied experiences of Article countries in transition converting CFC MDI manufacture to CFC-free alternatives.

2.3.2.1 Cuba

Cuba received a turnkey solution (as in Option 2 above). After a difficult process to procure technology, Cuba has now manufactured pilot batches with the assistance of a product development company, who are also assisting in registration and manufacturing installation

2.3.2.2 Uruguay

In Uruguay, the local manufacturer had a laboratory with experienced staff, so they were able to develop the CFC-free alternative products without the need for a technology provider. Funding from the MLF covered the other costs of conversion. Other enterprises and distributors of MDIs have entered into voluntary agreements with the Government on "a plan for transition to CFC-free MDIs", which must be in accordance with the national MDI transition strategy. HFC MDIs should be available from this manufacturer in 2007.

2.3.2.3 Croatia and Tunisia

MTOC understands that local manufacturers in Croatia and Tunisia have transitioned to CFC-free MDI manufacture without any external financial support for technology transfer.

2.4 CFC requirements to supply MDIs in 2010 and beyond

Table 2.1 summarizes MTOC's analysis of CFC consumption for MDI manufacture in Article 5 countries.

For Article 5 countries, MTOC estimated CFC needs for those countries with local production of CFC MDIs. Calculations were based on information prepared by the MLF for the 51st meeting of the Executive Committee UNEP/OZl.Pro/ExCom/51/39[3], Table 1. MTOC made additional assumptions regarding modest increases in annual consumption in line with general economic growth, along with estimated timing of full transition to local production of HFC

[3] UNEP/OzL.Pro/ExCom/51/39, http://www.multilateralfund.org/files/51/5139.pdf

MDI alternatives. This was based on information available regarding potential projects and existing availability of locally produced HFC MDIs. Some of the data have been adjusted based on the local information available to MTOC: for example, the inclusion of Syria and new data for the Islamic Republic of Iran. MTOC is aware of local CFC MDI manufacturing in certain other Article 5 countries, for example South Africa and Algeria, but has insufficient information to include them in this analysis. Other countries, like Croatia and Tunisia, have already successfully converted domestic production of CFC MDIs to CFC-free alternatives.

The information in the table only presents CFC use for MDIs up to and including 2010. However, given the current status of transition and technology development a few countries may require continuing production of CFC MDIs beyond 2010, which MTOC estimates should not exceed about 300 tonnes. Estimates in Table 2.1 show continued growth until the phase-out date for each country. Although this is an unlikely scenario for countries implementing transition, it was chosen to provide an upper estimate of CFC requirements.

Table 2.1 Estimated CFC requirements for Article 5 countries with local CFC MDI production*

	CFC consumption for MDI (2005)		2006	2007	2008	2009	2010
Country	**Total**	**Nationally-owned**	**Nationally - owned Projected Consumption**				
Countries with an approved project for the complete phase-out of CFCs for MDIs							
Cuba	109.00	109.00	114.45	120.17	126.18		
Egypt	159.50	159.50	163.00	171.15	179.71	188.69	198.13
Uruguay	10.00	10.00	10.50	11.03	11.58		
Subtotal	278.50	278.50	287.95	302.35	317.46	188.69	198.13
Countries without an approved project for the complete phase-out of CFCs for MDIs							
Argentina	187.70	130.90	143.99	158.39	174.23	191.65	210.82
Bangladesh	61.80	51.40	76.00	83.60	91.96	101.16	111.27
Brazil	156.90	10.00	11.00	12.10	13.31	14.64	
China	418.50	369.00	405.90	446.49	491.14	540.25	
Colombia	2.10	2.10	2.31	2.54	2.80	3.07	
India	748.30	703.40	773.74	851.11	936.23	1,029.85	
Indonesia	30.10	30.10	33.11	36.42	40.06	44.07	48.48
Iran	68.20	68.20	96.40	106.04	116.64	128.31	141.14
Mexico	47.50	47.50	52.25	57.48	63.22	69.54	76.50
Pakistan	85.80	1.96	2.16	2.37	2.61	2.87	
Syria	20.00	20.00	22.00	24.20	26.62	29.28	32.21
Subtotal	1,826.90	1,434.56	1,618.86	1,780.74	1,958.82	2,154.70	588.20
Total	**2,105.40**	**1,713.06**	**1,906.81**	**2,083.09**	**2,276.28**	**2,343.39**	**786.33**

*For 2006-2010 estimates do not include consumption by multi-national companies

Although for 2005 the table shows about 400 tonnes of CFCs used by multinationals operating in Article 5 countries, it has been assumed that this use will decrease to zero in 2009. It should be noted, however, that the total quantities given for the years 2006 – 2010 do not include these quantities. MTOC believes that in some cases, the data in the column for total CFC consumption for MDIs in 2005 may be over-estimated due to uncertainties about whether they include quantities for imports or local production by multinational companies.

There may be a need for continued production of CFC MDIs beyond 2009 to supply the needs of Article 5 country patients for a limited period. This supply of MDIs to Article 5 countries from either local manufacture or imported products would require a supply of pharmaceutical-grade CFCs. This would need to be produced under a mechanism under the Montreal Protocol.

Based on this analysis, Parties may wish to consider whether the CFCs needed in 2010, and for any year beyond that, should be supplied either by:

- Continued annual production of pharmaceutical-grade CFCs; or

- A final campaign production in 2009.

2.4.1 Technical Option Appraisal – Annual Production of CFCs in 2010 and beyond

Bulk pharmaceutical-grade CFCs could theoretically be produced after 2009 by a number of current CFC producers in both non-Article 5 and Article 5 countries (Spain, the United States, India, China, Republic of Korea) through operating specific campaigns. However, a number of constraints limit the feasibility of this option.

- There is a certain minimum production quantity (estimated by one company as 200 tonnes) for a single CFC (CFC 11, 12 or 114) necessary for the efficient manufacture of pharmaceutical-grade CFCs. Given the projected quantities, it is likely that several small orders would need to be aggregated to meet this minimum production level. This would give rise to uncertainty as to the timing of any production and therefore also availability.

- Orders made by CFC MDI manufacturers for CFCs can only be placed with those suppliers for which regulatory approval has been obtained for a specific drug formulation. As CFC producers stop production through rationalisation, regulatory approval for a new supplier could take so long as to be impractical. This could further constrain the ability of the CFC producer to aggregate orders.

- Producers have indicated that firm orders for pharmaceutical-grade CFCs would need to be placed at least 3 months in advance to allow planning of any campaign to a certain timeline. CFC producing companies would require up-front, legally binding orders for production. This process needs to take into account commercial issues such as anti-competitive practices. The liability for future destruction of unsold CFCs would remain with the CFC MDI manufacturing company. The requirements of the *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal* would need to be considered.

- Even where quantities exceed 200 tonnes, the production of pharmaceutical-grade CFCs would generate 25-50 per cent of non-pharmaceutical-grade CFCs as a by-product. After 2009, these non-pharmaceutical-grade CFCs would have to be destroyed since there would be no basic domestic use in the subsequent years. Destruction costs of $3 - $5/kg would need to be built into the cost of production of pharmaceutical-grade CFCs, leading to an increase in price and making them comparable to HFCs. It is also important to note that the smaller the production run the higher the proportion of non-pharmaceutical-grade CFCs that would need to be destroyed and the higher the price of the final product.

- Due to current laws and regulations, companies within the European Community and the United States cannot produce CFCs after 31 December 2009 unless the CFCs are designated as production for "essential use." Therefore if CFC production is required beyond 2009 for the manufacture of MDIs in Article 5 countries, and in the absence of regulatory change, production by CFC producers in the United States or the European Community would need to be designated by the Parties as being for essential uses.

If annual CFC production to manufacture MDIs in Article 5 countries is considered, a mechanism very similar to that used currently for the essential use nominations by non-

Article 5 countries would be required. This mechanism would need to be put into effect by the Parties in 2007 to allow for the evaluation of nominations in 2008 so that production under this process could begin in or before 2010.

MTOC notes that this option would allow CFC manufacture to take place beyond the final CFC phase-out date for Article 5 Parties of 31 December 2009. MTOC believes that if an annual production process is developed, Parties may wish to set a future date beyond which any such annual production is no longer allowed. This date could be chosen to allow the Article 5 countries to complete transition but would make clear the firm outer limits of all CFC production under the Montreal Protocol. In the final period of any annual process, as quantities decrease, a final campaign will still be necessary in order to avoid an abrupt cessation of adequate product availability.

2.4.2 Technical Option Appraisal – Final Campaign Production of CFCs in 2009 for use in 2010 and beyond

A second option would be to allow the production of sufficient CFCs in 2009 to cover the manufacture of CFC MDIs needed to complete the transition in Article 5 countries. While some CFC MDIs may need to be manufactured in Article 5 countries in 2010 and beyond, MTOC believes that CFCs for these MDIs can all be manufactured before the end of 2009. These CFCs could be manufactured in a final campaign production together with CFCs that are required for use in 2009.

MTOC has provided an estimate of CFC needs for 2009 and 2010 in Table 3.1. CFC requirements for years beyond 2010 are currently difficult to estimate due to uncertainties in the rate of transition but are likely to be small. MTOC estimates that the total quantities required in such a campaign are modest (possibly 4,000 tonnes for Article 5 and non-Article 5 countries) and would not exceed current CFC production capacity. However, in order to assure patient health, and to avoid excess production of CFCs (that would later need to be destroyed), these estimates would need to be more precisely defined during 2008, to allow a final campaign production in 2009.

It also would be necessary for the orders to be received by the CFC manufacturers sufficiently in advance to allow them to take these quantities into account for their 2009 production schedules. CFC manufacturers would need firm orders early in 2009.

From a CFC manufacturing point of view, it would be considerably easier to produce CFCs during a final campaign in 2009 rather than manufacturing CFCs annually for "essential uses". A final CFC campaign could be an extension of a normal CFC production run; this would minimise the production of non-pharmaceutical-grade CFCs (which in 2009 and thereafter could not be used for basic domestic needs and therefore would require destruction).

The major concern for a final campaign would be ensuring that adequate high-quality storage facilities were available, together with careful consideration of location, management and distribution. MDI manufacturers would also need to pay upfront for the pharmaceutical-grade CFCs.

Any campaign post-2010 to produce pharmaceutical-grade CFCs would have a number of disadvantages. In particular, smaller production runs would result in relatively larger quantities of non-pharmaceutical-grade CFCs post-2010 that would require destruction and add to costs. Another disadvantage would be the timing of such a production run. It would be necessary for a CFC producer to collect sufficient orders for pharmaceutical-grade CFCs to

make a production run viable, with the result that it would be difficult to guarantee a date for production. Alternatively, a producer could announce a date for production, but then the minimum quantity required to initiate a production run may still not be achieved by the announced date. Either way, potential supply and delivery problems to the MDI manufacturers could result.

MDI manufacturers in Article 5 countries would also need to consider liability issues for destruction of any remaining unused CFCs, including consideration of the *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal*.

A final campaign in 2009 would require Article 5 Parties to have developed and implemented CFC MDI phase-out strategies that define the quantities of CFCs required. It would also be necessary to consider the specific situation of each country requiring CFCs to manufacture MDIs. For instance, in a final campaign some countries may have overall requirements for CFCs for MDI manufacture that in 2009 would place them in potential non-compliance with the phase-out schedule for Article 5 countries under the Montreal Protocol.

2.4.3 Information needed to define quantities for a final campaign production of pharmaceutical-grade CFCs in 2009

Any Party (Article 5 and non-Article 5 countries) that might require CFCs for MDI manufacture for use in an Article 5 country for 2010 and beyond would need to provide specific information in early 2008, in order for Parties to make a decision at their meeting in late 2008 and authorise production in 2009. For non-Article 5 Parties, the existing essential use process could be used to consider quantities for a final campaign. However for Article 5 Parties a process is needed to assess and grant quantities of CFCs for a final campaign production.

In order to calculate the quantities to be produced in a final campaign, the following information will need to be taken into account on a country-by-country basis:

- Country transition strategy for CFC MDIs, including a phase-out date for CFC MDI production
- Quantity required for each year (2009 and beyond), and historical 3 year consumption data
- Within the Party, a summary of conversion projects for CFC MDI manufacturing plants, including: timelines; availability of manufacturing equipment, delivery and commissioning dates;
- Availability of CFC-free alternatives from local manufacture and from import, status of CFC-free MDI development and approval, timing of introduction, relative pricing of imports compared with locally manufactured products and whether this presents a barrier to transition
- Information on storage capacity, facilities and capabilities, access to destruction facilities and consideration of Basel Convention requirements
- The date CFC MDI production commenced (to avoid start-up in 2009)
- Access to stockpile

An annual accounting process may also be needed to track the quantities of CFCs: produced for MDI manufacture; used in MDI manufacture; within exported finished product; stockpiled; and destroyed.

The Technology Economic Assessment Panel (TEAP) and its MTOC can assist Parties at their request in their assessment of this information in 2008.

There may be other mechanisms to source an affordable supply of CFC-free MDIs, for example the Asthma Drug Facility of the International Union Against Tuberculosis and Lung Disease (IUATLD) (http://www.iuatld.org/index_en.phtml). Article 5 countries may also wish to consider stopping the import of CFC MDIs after a certain date.

2.4.4 Conclusions

MTOC believes that there should be no need for new manufacture of CFCs for MDIs beyond 2009 for non-Article 5 countries for use within those countries.

CFC MDI production for Article 5 countries may need to continue for some limited period beyond 2010. However, MTOC believes that it will be possible to complete a global phase-out of the manufacture of pharmaceutical-grade CFCs (for MDI manufacture) by the end of 2009. This may require a final campaign in 2009 of up to 4,000 tonnes of CFCs for MDIs to include requirements for 2009, and requirements for all CFC MDI production for 2010 and beyond for Article 5 and non-Article 5 countries.

On the current assessment, India is likely to be the single largest global user of CFCs for MDIs in 2008. A final campaign quantity of 4,000 tonnes assumes a complete phase-out of CFC MDI manufacture in India by the end of 2009. If, for example, India were to transition sooner, the final campaign could be substantially smaller. Another variable is the potential transfer of stocks from non-Article 5 countries to Article 5 countries as the former complete phase-out around 2009. If significant stockpile were available and transferred from non-Article 5, the final campaign would also be smaller.

MTOC has serious concerns about the security of supply of diminishing quantities of pharmaceutical-grade CFCs if the option of annual production of CFCs for 2009, 2010 and beyond was chosen.

MTOC believes that a final campaign production in 2009 is technically feasible without harm to patient health. The success of final campaign production is contingent on:

- India and China completing the transition for which they will have adequate alternatives and industrial capacity;
- The remaining few countries phase out CFC MDI manufacture;
- A Decision being taken in 2007 to undertake final campaign, with CFC quantities accurately defined in 2008 based on information submitted by Parties. This process would allow CFC production orders to be placed in early 2009.

3 Medical Technical Options Committee (MTOC) Progress Report

3.1 Transition to alternatives to CFC MDIs

The Medical Technical Options Committee (MTOC) provided an extensive review of the use of chlorofluorocarbon (CFC) metered dose inhalers (MDIs) and alternatives for inhalation therapy in its Assessment Report 2006 (see http://ozone.unep.org/teap/Reports/MTOC/MTOC_Assessment_Report_2006.pdf).

3.2 Global Use of CFCs for MDIs

The global use of CFCs to manufacture MDIs in 2006 is estimated to be over 4,000 tonnes, of which about 50 per cent is used in Article 5 Parties.

Figure 3.1 and Table 3.1 show the use of chlorofluorocarbons (CFCs) for the manufacture of metered dose inhalers (MDIs) for asthma and chronic obstructive pulmonary disease (COPD) in non-Article 5 countries.

In 2006, 2,107 tonnes of CFCs were used by non-Article 5 countries in MDI manufacture under essential use exemptions, as reported through accounting frameworks. This represents a 23 per cent reduction in use compared to 2005, and a 76 per cent reduction in use compared with the year of maximum use in 1997 (8,905 tonnes). The nominated/exempted amount for 2008 is 913 tonnes of CFCs. Approximately 200 tonnes of the nominated essential use quantities for 2008 are for export from the European Community to Article 5 Parties.

Figure 3.1 Quantities of CFCs for MDI manufacture in non-Article 5(1) countries

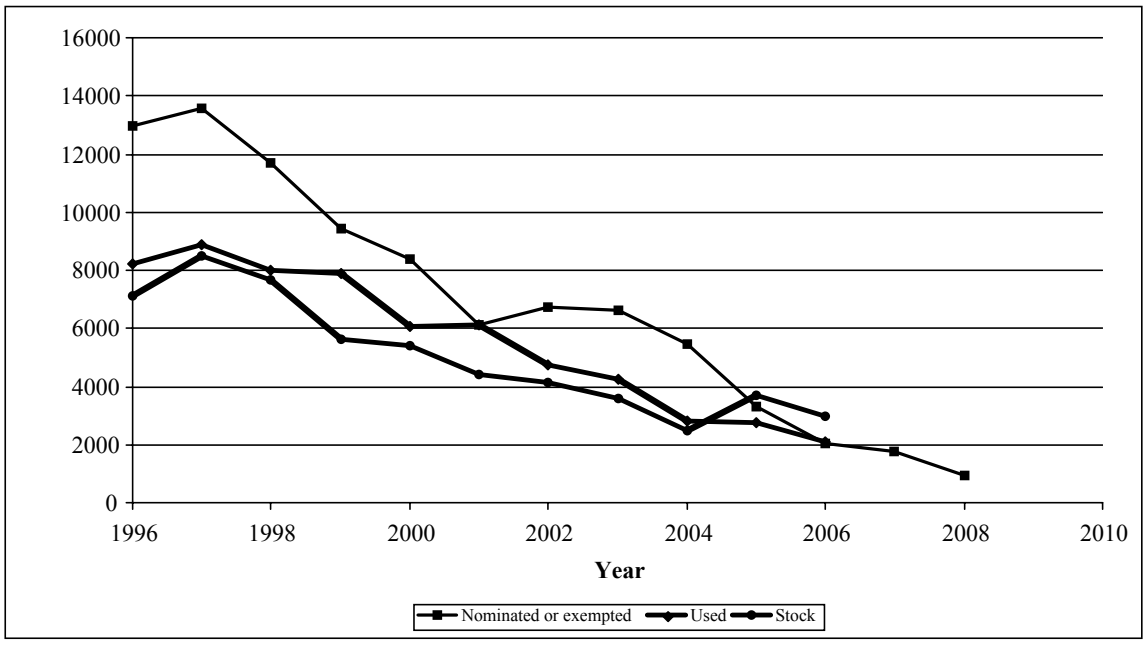


Table 3.1 Quantities (in tonnes) of CFCs for MDI manufacture in non-Article 5 countries

Year of Essential Use	Amount Exempted/ Nominated for year of Essential Use	Used for Essential Use	On Hand End of Year
1996	12,987.20	8,241.13	7,129.59
1997	13,548.00	8,904.99	8,515.24
1998	11,720.18	8,013.60	7,656.63
1999	9,442.13	7,906.35	5,653.95
2000	8,364.95	6,062.75	5,433.32
2001	6,126.53	6,121.62	4,402.59
2002	6,714.75	4,751.92	4,133.71
2003	6,641.55	4,261.91	3,570.27
2004	5,443.12	2,840.82	2,460.10
2005	3,321.10	2,735.40	3,671.01 *
2006	2,039.00	2,107.10**	2,957.37 *
2007	1,778.00	-	-
2008	913.00	-	-
2009	282.00	-	-

*Includes newly reported pre-1996 stock
**Includes material approved in 2005 but used in 2006 in the Russian Federation

Technically satisfactory alternatives to CFC MDIs are available for short-acting beta-agonists and a wide array of other therapeutic categories for asthma and COPD. The availability of CFC stocks coupled with these alternatives assures patient safety during the transition.

The management of stockpiles at this final stage of the phase-out will be extremely important to avoid unnecessary production of CFCs and the need for large quantities to be destroyed after the phase-out date. To ensure transparency, any pre-1996 stocks should be accounted for in the Reporting Accounting Framework for Essential Uses. In addition, Decision IV/25 (*Report of the TEAP, May 2005, Progress Report*, section 1.1.4.1, pg 35) requires companies that hold pre-1996 stocks to use them first before using newly produced CFCs.

Table 3.2 shows the use of chlorofluorocarbons (CFCs) for the manufacture of MDIs for asthma and COPD in many Article 5 countries. Unfortunately, this does not represent a complete picture, with information missing for some countries with known domestic production of CFC MDIs, such as Algeria and South Africa.

In 2005, Article 5 countries used about 2,100 tonnes of CFCs for MDI manufacture in those countries for which data are available. About 81 per cent of this was by locally owned companies manufacturing CFC MDIs; multi-nationals operating in Article 5 countries account for the remaining 19 per cent of CFC use for MDIs. With increasing use of CFCs for MDIs in Article 5 countries, it is likely that CFC use for the manufacture of MDIs in Article 5 countries will exceed that in non-Article 5 countries in 2007.

*Table 3.2 Quantities (in tonnes) of CFCs for MDI manufacture in Article 5 countries**

Country	CFC consumption for MDIs (2005)	
	Total	Nationally-owned
Argentina	187.70	130.90
Bangladesh	61.80	51.40
Brazil	156.90	10.00
China	418.50	369.00
Colombia	2.10	2.10
Cuba	109.00	109.00
Egypt	159.50	159.50
India	748.30	703.40
Indonesia	30.10	30.10
Iran	68.20	68.20
Mexico	47.50	47.50
Pakistan	85.80	1.96
Syria	20.00	20.00
Uruguay	10.00	10.00
Total	**2095.40**	**1703.06**

*Data taken from sources including UNEP/OzL.Pro/ExCom/51/39, http://www.multilateralfund.org/files/51/5139.pdf

3.3 Transition strategies

Transition strategies from 6 Parties are listed on the Ozone Secretariat's web site. Pursuant to Decision XV/5(4), plans of action regarding the phase-out of the domestic use of CFC-containing MDIs from the European Community, the Russian Federation and the United States are also listed on the Ozone Secretariat's web site.

According to Executive Committee Decision 45/54, Low Volume Countries (LVCs) submitting Terminal Phase-Out Management Plans (TPMPs) can obtain up to US$30,000 for MDI transition strategies upon provision of basic data demonstrating the need for such a strategy. However, there is the additional issue of whether funding can be extended to countries that have either submitted their TPMPs before the 45th Meeting of the Executive Committee or are not LVCs. Furthermore, according to the Executive Committee report, *Options for Addressing the Situation of Countries Referred to in Decision XVII/14 of the 17th Meeting of the Parties (Follow-up to Decision 49/33)*[4], a number of Article 5 countries with major manufacture of CFC MDIs are still in the process of preparing transition strategies.

3.3.1 Progress reports on transition strategies

Under Decision XII/2, Parties are required to report to the Secretariat by 31 January each year on progress made in transition to CFC-free MDIs. In 2007, a report was received from the People's Republic of China on the Hong Kong Special Administrative Region (HKSAR).

In 2002, the Government of the HKSAR submitted its strategy to facilitate transition to CFC-free MDIs. All MDIs in the HKSAR are imported products. Major registered substitutes available on the market include dry powder inhalers (DPIs) and hydrofluorocarbon (HFC) MDIs. In 2005, the percentages of consumption of CFC-free MDIs, CFC MDIs and DPIs were 81, 16 and 3 per cent respectively.

[4] (UNEP/OzL.Pro/ExCom/51/39, http://www.multilateralfund.org/files/51/5139.pdf)

3.4 Global database

Under Decision XIV/5, Parties are requested to submit information on CFC and CFC-free alternatives to the Secretariat by 28 February each year. In 2007, reports were only received from Australia, Bulgaria, European Community, and Uruguay. Twenty-two Article 5 Parties have submitted data pursuant to Decision XIV/5 since its inception. These are Argentina, Belize, Bosnia and Herzegovina, Brazil, China, Croatia, Cuba, Eritrea, Georgia, Guyana, India, Indonesia, Jamaica, Macedonia, Malaysia, Mauritius, Moldova, Namibia, Oman, Romania, Sri Lanka, and Uruguay [5].

[5] (UNEP/OzL.Pro/ExCom/51/39, http://www.multilateralfund.org/files/51/5139.pdf)

4 Chemicals Technical Options Committee (CTOC) Progress Report

4.1 Executive Summary

4.1.1 Process Agents (XVII/6, 7 and 8)

The CTOC examined the process agents listed in table A of decision XVII/7 and recommends that the thirty nine process agents can be grouped in ways that will be helpful for the Parties in their decision-making.

In the first group the CTOC places eighteen process agents which meet the technical criteria set out in Decision X/14 and which are still in active use, and for which there are no identified alternatives. The process agents in this group are #1, 2, 4, 6, 7, 8, 10, 11, 12, 13, 14, 15, 20, 21, 31, 35, 38 and 39. India has advised that two of the process agents listed above, #4 and #6, will be phased out by the end of 2007. The CTOC recommends that they remain in Table A until the processes are no longer active.

In the second group are five process agents that meet the technical criteria but are no longer in active use. These process agents that could thus be removed from Table A are #9, 16, 17, 18 and 29. China advised that #29 overlapped to #30. The CTOC finds that this is thus a duplicate entry and recommends that it be removed from Table A.

Thirdly, there are twelve process agents that the CTOC believes could be replaced by no- or low- ODP alternatives, including not-in-kind substitutes. In each case, some process development would be required, and expenditure would be required for this development and possibly for new items of manufacturing plant. The process agents that could be replaced are #3, 5, 19, 22, 23, 24, 25, 26, 27, 28, 30 and 36.

Finally, there is a group of process agents about which no information was received in response to the call for information arising from Decision XVII/6(2). These four process agents in this group (#32, 33, 34 and 37), although having initially been judged to meet the technical criteria of Decision X/14, must be classified as ‘unable to assess’.

The 29 new process agent applications listed in table A-bis in decision XVIII/8 were reviewed and the CTOC recommends that 11 applications (#40, 44, 46, 51, 53, 54, 56 59, 60, 67 and 68) meet the technical criteria for process agent uses but the other 18 applications do not meet the criteria (10 (#41, 43, 45, 47, 48, 50, 52, 55, 58 and 62) because the process is no longer operated, and 7 (#49, 57, 61, 63, 64, 65 and 66) because they are feedstock applications). One case (#42) was unable to assess due to no information received.

Besides the tables A and A-bis mentioned above, another list of potential process agent applications with 29 cases has been submitted by China to the CTOC for its considerations. The CTOC made preliminary studies of those cases and concluded that 18 applications (#2, 3, 4, 5, 6, 7, 9, 11, 12 (one of the two plants), 14, 18, 21, 23, 24, 25, 27, 28, 29) meet the technical criteria of process agents and could be listed by Parties as process agent uses, once complete information is provided as required by the process agent criteria. Until that information is received, the CTOC is ‘unable to assess’.

Limited information about emissions and make-up quantities of ODS used on process agents was available.

4.1.2 EUN of CFC-113 by Russian Federation (XVIII/8)

The documents submitted by Russian Federation have been reviewed by the TEAP/CTOC. They disclose the selection measures and the major applications of CFC-113 as cleaning and degreasing solvent and unsuccessful results of research to find alternatives to CFC-113. They also disclose a willingness to import CFC-113 for this purpose. The Russian Federation cannot make the planned transition to non-ODS in their aerospace program any sooner than is proposed, and therefore the CTOC recommends the EUE for 2008 and 2009. If suitable supplies of CFC-113 can be obtained from foreign sources, it will not be necessary to use newly manufactured CFC-113.

The CTOC will collaborate with rocket and aerospace experts to provide technical supports to the Russian Federation during the interim period. The useful experiences in the space technology in USA, Kazakhstan and Poland gained by the solvent experts in the CTOC will able to provide the advice for selecting alternative solvents to CFC-113 as well as improvements on containment systems through the collaboration in order to realize the time schedule of reducing the CFC-113 use planned by Russian Federation by 2010.

4.1.3 Normal-Propyl Bromide (n-PB) Update (XVIII/11)

n-PB is available in most regions, including Asia, with local productions in China, France, Israel, Jordan and the USA. The global consumption, as a solvent, increased at a growing rate of 15-20% per year. It reached a plateau in 2005 but since then it seems to be declining in Europe and Japan. The global n-PB emission is estimated to be 5,000 to 10,000 metric tonnes per year. In Europe, n-PB use has been progressively phased out due to various labelling reclassifications as well as the 1999 VOC-Directive.

The use of n-PB is promoted by its vendors as a substitute for trichloroethylene, perchloroethylene, HCFC-141b and ozone depleting chlorofluorocarbons (CFCs) in many applications. Thus its continuing use is supported by industry bodies, because it offers an effective replacement for solvents with higher ODP and chlorocarbons.

Based on recent findings and until more toxicological test data becomes available, the American Conference of Industrial Hygienists (ACGIH), for example, has recommended exposure guidelines for n-PB containing solvent to be limited to 10 ppm. So far only one of the n-PB vendors has reduced their recommended exposure guidelines to 10 ppm.

4.1.4 Sources of carbon tetrachloride emissions and opportunities for reductions (XVIII/10)

The CTOC study on this issue is still in progress and not yet complete, but can report the following results on the potential emissions of CTC from landfills. The levels of CTC resulting from emissions from landfills could be of the order of a few hundred tonnes per annum in OECD countries. These calculations indicate that there is insufficient concentration of CTC in landfill gas to account for the discrepancy between estimated industrial emissions of CTC and concentrations measured in the atmosphere. Other potential sources could include release from historical chemical dumps and emissions from groundwater contaminated with CTC but it is unlikely that such sources could provide sufficient sustained releases to account for the apparent discrepancy.

4.1.5 Laboratory and analytical uses of methyl bromide (XVII/10)

The CTOC considered this matter early in 2007 but was unable to provide any new information. It continues to review this issue, with a view to providing relevant information in future Progress Reports.

4.2 Introduction

The CTOC was mindful of the need for a limited report following its contribution to the TEAP 2006 Assessment Report, and also of the request to consider the appropriateness of limited or less frequent meetings so as to ease pressure on the meetings budget. The Committee approached the task of preparing its 2007 Progress Report by allocating particular tasks to sub-groups.

A sub-group consisting of approximately half of the membership of the CTOC met in Singapore on 13-16 February, 2007. That subgroup included co-chairs: Ian Rae, Masaaki Yamabe and Jiang Biao; members: D.D. Arora, Steven Bernhardt, Jianxin Hu, Abid Merchant, Claudia Paratori, Hans Porre and Nee Sun Choong Kwet Yive (Robert). Work was undertaken in accordance with decisions XVII/6, XVII/7, XVII/8, and XVIII/8 to review the process agent applications in Table A and Table A-bis, and also to form a response to the request by the Russian Federation for an Essential Use Exemption for the use of CFC-113 in 2008-2010. The meeting also discussed a list of potential process agents submitted by China. The TEAP and the CTOC highly appreciate the Sino Chem. Corporation and the Asahi Glass Singapore Chemicals Pte for the support of the meeting expenses and for the arrangement of accommodations, respectively.

Responses to decisions XVIII/11 (n-propyl bromide), XVIII/10 (CTC) and XVII/10 (laboratory and analytical uses of methyl bromide) were developed mainly by e-mail correspondence among CTOC members led by the corresponding lead authors, with information flowing to co-chairs for incorporation in the 2007 Progress Report.

4.3 Process Agents

4.3.1 The CTOC review of Table A (decision XVII/6(7))

Decision XVII/6(7) taken at the Dakar MOP in 2005 included the following:

> *To request the Technology and economic Assessment Panel to review the information submitted in accordance with this decision and to report and make recommendations to the Parties at their Twentieth Meeting in 2008, and every other year thereafter, on process-agent use exemptions; on insignificant emission associated with a use, and process-agent uses that could be added or deleted from table A of the decision X/14;*

Table A in decision XVII/7 was adopted as a revised table A for decision X/14 and subsequent revision through decisions at later Meetings of the Parties, and all the 39 applications have been recognized as process agent uses. The CTOC made an interim study for its report in 2008 on whether the process referred to in each case was still in operation or no longer operated by the information sought from Parties' reporting. The results of the review of each of the 39 process agents are shown in Table 4.1.

Table 4.1 Current status of the process agent applications in table A

No.	Process agent application	Substance	Party	References	Parties Reporting	Current Status on Operation
1.	Elimination of NCl3 in the production of chlorine and caustic	CTC	USA Other A(5) and non-A(5) countries	1997 and 2001 PATF (Case Study #1)	Not all Parties practising it. USA, EU, Brazil, Israel and Mexico reported	Process still operated
2.	Recovery of chlorine in tail gas from production of chlorine	CTC	USA Other A(5) and non-A(5) countries	1997 and 2001 PATF (Case Study #2)	Not all Parties practising it. USA and EU reported.	Process still operated
3.	Manufacture of chlorinated rubber	CTC	China, India, EU(Italy, Germany)	1997 and 2001 PATF (Case Study #3)	EU and China still practising it. India converted it in 2005	Process still operated in EU and China Could be replaced by non-ODS
4.	Manufacture of endosulphan (insecticide)	CTC	India	1997 and 2001 PATF (Case Study #4)	India converting it by December 2007	Process still operated
5.	Manufacture of isobutyl acetophenone (ibuprofen – analgesic)	CTC	India EU	1997 and 2001 PATF (Case Study #5)	India converted it in 2000. EU still practising it	Process still operated in EU Could be replaced by non-ODS
6.	Manufacture of 1-1, bis (4-chlorophenyl) 2,2,2- trichloroethanol (dicofol insecticide)	CTC	India	1997 and 2001 PATF (Case Study #6)	India converting it by 2007.	Process still operated
7.	Manufacture of chlorosulphonated polyolefin (CSM)	CTC	China, USA	1997 PATF and 2001 PATF Case Study #7)	China and USA still practising it.	Process still operated
8.	Manufacture of poly-phenylene-terephtal-Amide	CTC	EU (Netherlands)	1997 and 2001PATF (Case Study #8)	EU still practising it	Process still operated
9.	Manufacture of fluoropolymer resins	CFC-113	USA, China	1997 and 2001 PATF (Case Study #9)	Both USA and China stopped to use it.	No longer operated
10.	Manufacture of fine synthetic polyolefin fiber sheet	CFC-11	USA, EU	1997 and 2001 PATF (Case Study #10)	USA and EU still practising it	Process still operated
11.	Manufacture of styrene butadiene rubber	CTC	Brazil, Republic of Korea	2001 PATF (Case Study #11)	Both Brazil and Republic of Korea no longer in operation.	No longer operated
12.	Manufacture of chlorinated paraffin	CTC	China, India	2001 PATF (Case Study #12)	China still practising it? India stopped operation in 2005.	Process still operated in China? No use in India.

No.	Process agent application	Substance	Party	References	Parties Reporting	Current Status on Operation
13.	Photochemical synthesis of perfluoropolyetherpolyperoxide precursors of Z-perfluoropolyethers and difunctional derivatives	CFC-12	EU	2002 TEAP 2001PATF (Case Study #14)	EU still practising it	Process still operated
14.	Reduction of perfluoropolyetherpolyperoxide intermediate for production of perfluoropolyether diesters	CFC-113	EU	2002 TEAP 2001PATF (Case Study #15)	EU still practising it	Process still operated
15.	Preparation of perfluoropolyether diols with high functionality	CFC-113	EU	2002 TEAP 2001PATF (Case Study #16)	EU still practising it	Process still operated
16.	Bromohexine hydrochloride	CTC	India	2001 PATF (Case Study #19)	India converted it in 2000.	No longer operated
17.	Diclofenac sodium	CTC	India	2001 PATF (Case Study #20	India converted it in 2000	No longer operated
18.	Phenyl glycine	CTC	India	2001 PATF (Case Study #22)	India converted it in 2000.	No longer operated
19.	Production of Cyclodime	CTC	EU, China	2002 TEAP 2001 PATF (Case Study #26)	EU and China still practising it	Process still operated Could be replaced by non-ODS
20.	Production of chlorinated polypropene	CTC	China	2002 TEAP Progress Report Chapter 9 (No.34)	China still practising it	Process still operated
21.	Production of chlorinated EVA	CTC	China	2002 TEAP (No.35)	China still practising it	Process still operated
22.	Production of methyl isocyanate derivatives	CTC	China	2002 TEAP (No.36)	China still practising it	Process still operated Could be replaced by non-ODS
23.	Production of 3-phenoxy benzaldehyde	CTC	China	2002 TEAP (No.37)	China still practising it	Process still operated Could be replaced by non-ODS
24.	Production of 2-chloro-5-methylpyridine	CTC	China	2002 TEAP (No.38)	China still practising it	Process still operated Could be replaced by non-ODS
25.	Production of Imidacloprid	CTC	China	2002 TEAP (No.39)	China still practising it	Process still operated Could be replaced by non-ODS

No.	Process agent application	Substance	Party	References	Parties Reporting	Current Status on Operation
26.	Production of Buprofenzin	CTC	China	2002 TEAP (No.40)	China still practicing it	Process still operated Could be replaced by non-ODS
27.	Production of Oxadiazon	CTC	China	2002 TEAP (No.41)	China still practising it	Process still operated Could be replaced by non-ODS
28.	Production of chloradized N-methylaniline	CTC	China	2002 TEAP (No.42)	China still practising it	Process still operated Could be replaced by non-ODS
29.	Production of Mefenacet	CTC	China	2002 TEAP (No.43)	China still practising it only in the production of its intermediate, DCBT.(See #30)	Recommend to delete
30.	Production of DCBT (1,3-dichlorobenzothiazole)	CTC	China	2002 TEAP (No.44)	China still practising it	Process still operated Could be replaced by non-ODS
31.	Bromination of a styrenic polymer	BCM	USA	2002 TEAP (No.45)	USA still practising it	Process still operated
32.	Synthesis of ascorbic acid	CTC	DPR Korea	2004 PATF	Waiting for information from DPR Korea	No information
33.	Synthesis of ciprofloxacin	CTC	DPR Korea	2004 PATF	Waiting for information from DPR Korea	No information
34.	Synthesis of norfloxacin	CTC	DPR Korea	2004 PATF	Waiting for information from DPR Korea	No information
35.	Synthesis of 2,4D (2,4-dichlorophenoxyaceti c acid)	CTC	Romania	2004 PATF (2006 TEAP)	Romania still practising it	Process still operated
36.	Synthesis of DHEPC (di (2-ethylhexyl) peroxydicarbonate)	CTC	Romania	2004 PATF (2006 TEAP)	Romania still practising it	Process still operated Could be replaced by non-ODS
37.	Production of sodium dichloroisocyanurate	CTC	DPR Korea	2004 PATF	Waiting for information from DPR Korea	No information
38.	Production of radio-labelled cyanocobalamin	CTC	EU (UK)	2004 PATF	EU still practising it	Process still operated
39.	Production of high modulus polyethylene fiber	CFC-113	USA	2004 PATF	USA still practising it	Process still operated

The thirty nine process agents can be grouped in ways that will be helpful for the Parties in their decision-making.

In the first group the CTOC places eighteen process agents which meet the technical criteria set out in Decision X/14 and which are still in active use, and for which there are no obvious alternatives. The process agents in this group are:

#1 CTC in elimination of NCl_3 in production of chlorine and caustic
#2 CTC in recovery of chorine in tail gas from production of chlorine
#4 CTC in manufacture of endosulphan (insecticide)*
#6 CTC in manufacture of 1,1-bis(4-chlorophenyl)2,2,2-trichloroethanol (docofol, insecticide)*
#7 CTC in manufacture of chlorosulfonated polyolefin CSM)
#8 CTC in manufacture of polyphenylene terephthalamide
#10 CFC-113 in manufacture of fine synthetic polyolefin sheet
#11 CTC in manufacture of styrene butadiene rubber
#12 CTC in manufacture of chlorinated paraffin
#13 CFC-12 in photochemical synthesis of perfluorpolyetherpolyperoxide precursors of Z-perfluoropolyethers and difunctional derivatives
#14 CFC-113 in reduction of perfluoropolyetherpolyperoxide intermediate for production of perfluoropolyether diesters
#15 CFC-113 in production of perfluoropolyetherdiols with high functionality
#20 CTC in production of chlorinated polypropylene
#21 CTC in production of chlorinated EVA
#31 BCM in bromination of styrenic polymer
#35 CTC in production of 2,4-dichlorophenoxy acetic acid
#38 CTC in production of radio-labeled cyanocobalamin
#39 CFC-113 in production of high modulus polyethylene fibre

* India has advised that two of the process agents listed above, #4 and #6, will be phased out by the end of 2007. The CTOC recommends that they remain in table A until the processes are no longer active.

In the second group are five process agents that meet the technical criteria but are no longer in active use. These process agents could be removed from table A:

#9 CFC-113 in manufacture of fluoropolymer resins
#16 CTC in manufacture of bromohexine hydrochloride
#17 CTC in manufacture of dicofenac sodium
#18 CTC in manufacture of phenyl glycine
#29 CTC in production of mefanacet*

* China advises that the last of these process agents (#29) relates to the production of DCBT (1,3-dichlorobenzothiazole, #30). The CTOC finds that this is thus a duplicate entry and recommends that it be removed from table A.

Thirdly, there are twelve process agents that the CTOC believes could be replaced by alternatives that are low-ODP or no-ODP substances and processes. In each case, some process development would be required, and expenditure would be required for this development and possibly for new items of manufacturing plant. The process agents that could be replaced are:

#3 CTC in manufacture of chlorinated rubber
#5 CTC in manufacture of isobutyl acetophenone (ibuprofen, analgesic)
#19 CTC in production of cyclodime

#22 CTC in production of methyl isocyanate derivatives
#23 CTC in production of 3-phenoxy benzaldehyde
#24 CTC in production of 2-chloro-5-methylpyridine
#25 CTC in production of imidocloprid
#26 CTC in production of buprofenzin
#27 CTC in production of oxadiazon
#28 CTC in production of chloradized N-methylaniline
#30 CTC in production of DCBT (1,3-dichlorobenzothiazole)
#36 CTC in production of di-(2-ethylhexyl)peroxydicarbonate

Finally, there is a group of process agents about which no information was received in response to the call for information in decision XVII/6(2). These four process agents in this group, while having initially been judged to meet the technical criteria of Decision X/14, must be classified as 'unable to assess'.

#32 CTC in synthesis of ascorbic acid
#33 CTC in synthesis of ciprofloxacin
#34 CTC in synthesis of norfloxacin
#37 CTC in production of sodium dichloroisocyanurate

Updated information will be expected from the relevant Parties by 31 December 2007 for the rest of 34 applications for the further assessment in 2008.

4.3.2 The CTOC review of interim table A-bis (decision XVII/8)

At the Dakar meeting of the Parties, 29 new applications were received for process agents as shown in the interim table A bis of decision XVII/8. The TEAP/CTOC was requested to review those applications and advise if they could include in a reassessed table A for decision X/14 and report in 2007 to MOP-19.

Since the applications listed in interim table A-bis had not previously been reviewed by the TEAP/CTOC, it was necessary to seek information on the nature of the processes, scale of production, the ODS involved, emissions or make-up quantities, and dates of the start-up for the process. Information was not available about any efforts that had been made to replace the ODS with other chemicals and/or to minimize emissions except for #50. The list of applications together with relevant data and comments from the CTOC is included in Table 4.2 below.

Table 4.2 Table A-bis annotated by CTOC

No.	Process agent application (in China except #42)	Substance	Annual capacity in 2005 (MT/Y)	Date of start-up	Make-up Quantities (MT) in 2005	2007 CTOC Comments
40	Production of 2-(*p*-Bromomethylphenyl) prop ionic acid (mistranslated as *p*-bromobenzaldehyde) (intermediate)	CTC	60	2000	33	Meet process agent technical criteria
41	Production of Fenvalerate (pesticide)	CTC				No longer in operation
42	Manufacture of Losartan potassium	BCM (Argentina)				Unable to assess due to no information received
43	Production of 1,2-Choro-1,4-naphthoquinone (pharmaceutical)	CTC				No longer in operation
44	Production of Prallethrin (pesticide)	CTC	250	1997	71.20	Meet process agent technical criteria
45	Production of 2-Methoxybenzoyl chloride (pharmaceutical)	CTC				No longer in operation

No.	Process agent application (in China except #42)	Substance	Annual capacity in 2005 (MT/Y)	Date of start-up	Make-up Quantities (MT) in 2005	2007 CTOC Comments
46	Production of o-Nitrobenzaldehyde (dyes) (4 production lines)	CTC	180	1989	235.47 (in total 4 plants)	Meet process agent technical criteria
			200	1995		
			50	1991		
			30	1986		
47	Production of Salimusk (perfume)	CTC				No longer in operation
48	Production of Epoxyconazole (pesticide)	CTC				No longer in operation
49	Production of Benzophenone (chemical)	CTC				Feedstock application
50	Production of Picloram; Lontrel (pesticide)	CTC				Converted to non-ODS process in 2006 in China
51	Production of 3-Methyl-2-Thiophenecarboxaldehyde	CTC	15	1994	0.94	Meet process agent technical criteria
52	Production of Difenoconazole (pesticide)	CTC				No longer in operation
53	Production of 2-Thiophenecarboxaldehyde (intermediate)	CTC	135	1993	9.66	Meet process agent technical criteria
54	Production of 2-Thiophene ethanol (pharmaceutical)	CTC	240	1997	91.50	Meet process agent technical criteria
55	Production of 5-Amino-1,2,3-thiadiazol	CTC	N/A	2003	N/A	No longer in operation
56	Production of Levofloxacin (pharmaceutical)	CTC		1999 (after 1 July)		Meet process agent technical criteria
57	Production of cinnamic acid (intermediate)	CTC				Feedstock application
58	Production of Ertaczo (pharmaceutical)	CTC				No longer in operation
59	Production of 3,5-Dinitrobenzoyl chloride (3,5-DNBC) (intermediate) (2 production lines)	CTC	36	1992	20.20 (in total 2 plants)	Meet process agent technical criteria
			10	2004		
60	Production of Fipronil (pesticide) (2 production lines)	CTC	30	2004	20.00 (in total 2 plants)	Meet process agent technical criteria
			30	2005		
61	Processing of aluminum and uranium	CTC, CFC				Feedstock application
62	Production of Furfural (volume chemical)	CTC				No longer in operation
63	Production of 3,3,3-Trifluoropropene (volume chemical)	CTC				Feedstock application
64	Production of Triphenylmethylchloride (intermediate)	CTC				Feedstock application
65	Production of Tetrachlorodimehylmethane (volume chemical)	CTC				Feedstock application
66	Production of 4,4'-difluorodiphenyl ketone (intermediate)	CTC				Feedstock application
67	Production of 4-trifluoromethoxybenzenamine (4 production lines)	CTC	200	2004	181.41 (in total 2 plants)	Meet process agent technical criteria (Two different processes are used for the synthesis of this substance; one process as process agent and the other as feedstock.)
			280	2004		
			400	2003	N/A	
			50	2002		
68	Production of 1,2-benzisothiazol-3-ketone	CTC	500	1999 (before 1 July)	389.06	Meet process agent technical criteria (regarded as PA as well as Feedstock application)

All but one of the applications are from China and have been included in the Sector Plan for Phaseout of ODS Process Agents in that Party. The exception is #42, use of bromochloromethane (BCM) in the production of Losartan potassium. The Process Agents Task Force (2004) had conducted a preliminary review of this application from another Party, but it was withdrawn and since no further information was received, it does not merit process agent status.

Information was received that some cases of the processes listed in table A-bis are not process agents, but may be feedstock uses. The intensive examination by the CTOC of the submitted data confirmed that this was the case for seven of the applications, #49, 57, 61, 63, 64, 65, and 66. Furthermore, each of the applications #67 and 68 concerned two processes for production of the same product, one process employing the ODS as process agent and the other as feedstock.

Information was also received that nine of the submitted applications (#41, 43, 45, 47, 48, 52, 55, 58, and 62) had ceased operation. In addition, the methods of production of Picloram and Lontrel pesticides (#50) had been converted to non-ODS process in 2006 so that ODS (originally CTC) was no longer involved.

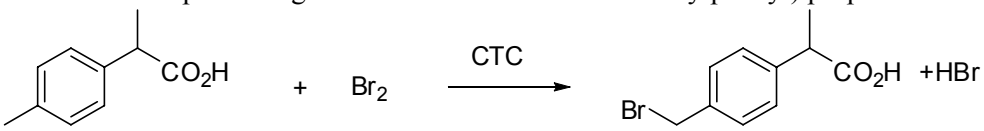
Furthermore, for four of the submitted applications (#40, 56, 60, and 67) it is noticed that their start-up dates are after 1 July 1999.

With these clarifications of the listed applications, the eleven continuing operations (#40 44, 46, 51, 53, 54, 56 59, 60, 67 and 68) are provided in the form of a case study.

4.3.3 Case Studies of the continuing process agent operations

- **Table A-bis #40: Production of 2-(*p*-Bromomethylphenyl) propionic acid (intermediate)**

CTC is used as process agent in the bromination of 1-methylphenyl) propionic acid.

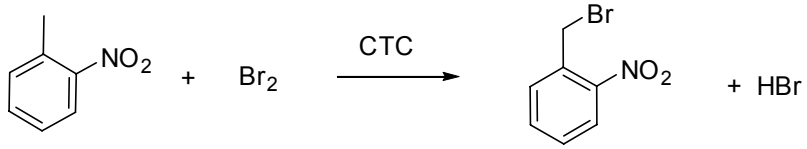


- **Table A-bis #44: Production of Prallethrin (pesticide)**

CTC is used as process agent for extracting the unreacted feedstock from the crude Prallethrin in the refining process.

- **Table A-bis #46: Production of *o*-Nitrobenzaldehyde (for dyes)**

CTC is used as process agent in bromination reaction of *o*-nitrotoluene and bromine. The brominated compound is subsequently converted to o-nitrobenzaldehyde.



- **Table A-bis #51: Production of 3-Methyl-2-thiophene carboxyaldehyde**

CTC is used as process agent for extracting 3-methyl-2-thiophenecarboxyaldehyde from the crude product in the refining process.

- **Table A-bis #53: 2-Thiophenecarboxyaldehyde (intermediate)**

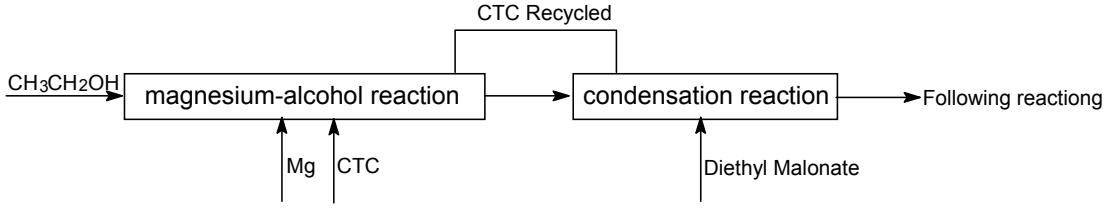
CTC is used as process agent for extracting 2-thiophenecarboxaldehyde from the crude product in the refining process.

➢ **Table A-bis #54: Production of 2-Thiophene ethanol (pharmaceutical)**

CTC is used as process agent for extracting 2-thiophene ethanol from the crude product in the refining process.

➢ **Table A-bis #56: Production of Levofloxacin (pharmaceutical)**

CTC is used as process agent for the reaction of ethanol with magnesium to form ethoxy magnesium, which will be reacted with diethyl malonate, the key intermediate for the production of Levofloxacin.

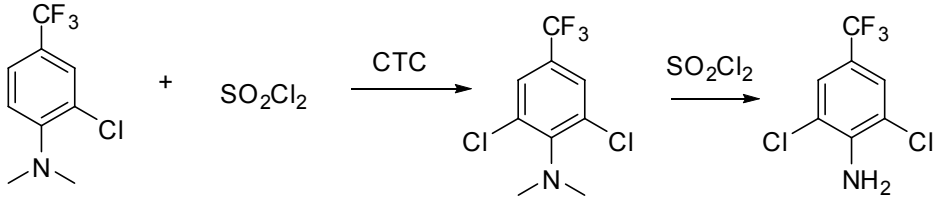


➢ **Table A-bis #59: Production of 3,5-Dinitrobenzoyl chloride (3,5-DNBC) (intermediate)**

CTC is used as process agent for refining the crude 3,5-dinitrobenzoyl chloride.

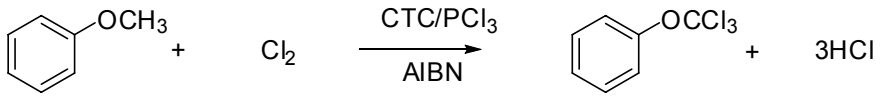
➢ **Table A-bis #60: Production of Fipronil (pesticide)**

CTC is used as process agent in the chlorination reaction of N,N-dimethyl 2-chloro-4-triflоromethylaniline for preparation of 2,6-dichloro-4-triflоromethylaniline, the key intermediate for manufacturing Fipronil.



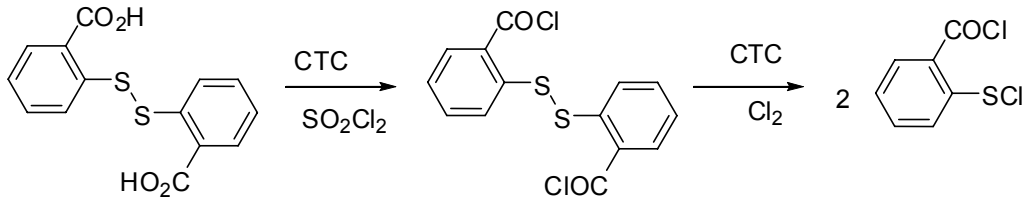
➢ **Table A-bis #67: Production of 4-Trifluoro-methoxy-benzeneamine**

CTC is used as process agent in chlorination reaction of methoxybenzene and chlorine gas. Several further steps are required to convert this first product into 4-trifluoromethoxy-benzene-amine.



➢ **Table A-bis #68: Production of 1,2-benzisothiazol-3-ketone**

CTC is used as process agent in chlorination reaction of this production process.
In the last step (not shown here), this chlorinated product is converted to 1,2-benzisothiazol-3-ketone.



4.3.4 A potential list of process agent applications from China

The People's Republic of China has submitted a further list of twenty nine possible process agent applications for consideration by the TEAP/CTOC, and these are shown in Table 4.3, which also includes information provided by the Party in response to requests by the CTOC: nature of the process and identity of the ODS involved, annual capacity, emissions or make-up quantities, and start-up date for the process, as well as the CTOC comments. Information was not provided about investigations of alternatives to the use of ODS and/or changes made to processes to minimize emissions.

Table 4.3 Comments of CTOC on the potential list of process agent applications from China

No.	Applications	Number of production lines	Annual capacity in 2005	Date of start-up	In continuous operation	Comments of CTOC
	CTC is used in all cases.		(MT/y)			
1	2-(*p*-Bromomethylphenyl) propionic acid	1	60	2000	Yes	Same as #40 in table A-bis
2	2-chloro-5-(trifluoromethyl) pyridine	1	150	2005	Yes	Meets process agent technical criteria
3	2-methoxy-3-methyl pyrazine	2	2	2002	Yes	Meets process agent technical criteria
			15	2005	Yes	Meets process agent technical criteria
4	2-Methyl-3-tetrahydrofuranthiol	1	0.1	2002	Yes	Meets process agent technical criteria
5	4-Bromoanisole	1	100	2005	Yes	Meets process agent technical criteria
6	4-Chloro-2-Trichloromethyl pyridine	1	150	2005	Yes	Meets process agent technical criteria
7	Acryl amide (N-(1,1-dimethyl-3-oxobutyl)（DAAM）	1	300	2004	Yes	Meets process agent technical criteria
8	Chlorfluazuron	1	75	N/A	No	Could be process agent, but no longer operated
9	Chloromethane-sulfonic ester	1	N/A	2005	No	Meets process agent technical criteria
10	Dope	2	250	2004	Yes	Unable to assess. (Feedstock application?)
			N/A	N/A	N/A	Unable to assess. (Feedstock application?)
11	Doxofylline	1	20	2005	Yes	Meets process agent technical criteria
12	Ethyl-4-Chloroacetoacetate	2	N/A	N/A	N/A	Unable to assess. More information needed
			180	2004	Yes	Meets process agent technical criteria
13	GCLE	1	360	2003	No	Unable to assess. More information needed
14	*m*-Nitrobenzaldehyde	2	240	1991	Yes	Meets process agent technical criteria
			140	1995	Yes	Meets process agent technical criteria

No.	Applications	Number of production lines	Annual capacity in 2005	Date of start-up	In continuous operation	Comments of CTOC
15	Ozagrel	1	N/A	N/A	Yes	Unable to assess. More information needed.
16	PVDF	1	500	1982	Yes	Could be process agent More information needed
17	Tetrafluorobenzoylethyl acetate	1	250	1992	Yes	Could be process agent More information needed on the role of CTC
18	Tichlopidine	1	50	1998	Yes	Meets process agent technical criteria
19	Using as G.I.	1	N/A	N/A	Yes	Unable to assess.
20	*β*-Bromopropionic acid	1	N/A	N/A	Yes	Unable to assess.
21	3-Nitrophthalic anhydride	1	120	2000	Yes	Meets process agent technical criteria
22	4-Bromophenol	1	80	1998	Yes	Could be process agent More information needed
23	4-Nitrophthalic anhydride	1	36	2002	No	Meets process agent technical criteria
24	Chlorophenyl-triapentanol	1	200	2005	Yes	Meets process agent technical criteria
25	4-Bromo-methyl dimethylbenzeneacetate	1	120	2005	Yes	Meets process agent technical criteria
26	Initiator for produce o-Nitrobenzaldehyde	1	300	2002	Yes	Same as #46 in table A-bis
27	*m*-Hydroxybenzaldehyde	1	60	2005	Yes	Meets process agent technical criteria
28	*p*-Nitro benzyl alcohol	1	96	1989	Yes	Meets process agent technical criteria
29	Tolclofos Methyl	1	200	1994	Yes	Meets process agent technical criteria

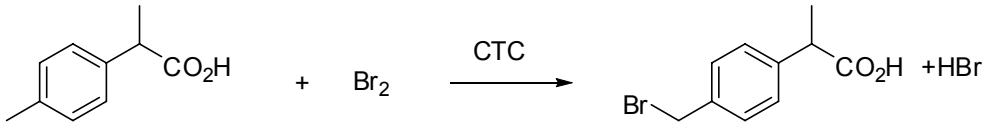
For two applications (#19 and 20), considerations of commercial confidentiality prevented submission of relevant data and so the CTOC is unable to assess them. One application (#10) appeared to be a feedstock application, not process agent. Three applications (#12 (one of the two plants), 13 and 15) are also unable to assess due to no information reported. The #8 application is considered as a process agent use, but was no longer operated. The other three applications (#16, 17 and 22) could meet the process agent technical criteria but more information would be needed for the further assessment.

Two applications (#1 and 26) are already included in the table A-bis (#40 and 46, respectively). The remaining 18 applications (#2, 3, 4, 5, 6, 7, 9, 11, 12 (one of the two plants), 14, 18, 21, 23, 24, 25, 27, 28, 29) could be qualified as process agents, even though a number of the applications have start-up dates later than 30 June 1999.

4.3.5 Case studies for the chemical reactions in Table 4.3

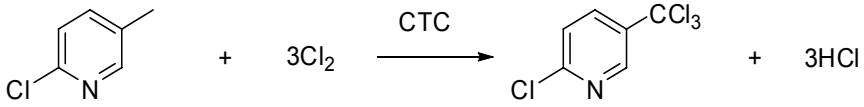
1. 2-(*p*-Bromomethylphenyl) propionic acid

CTC is used as process agent in bromination reaction of 1-methylphenyl) propionic acid and bromine.



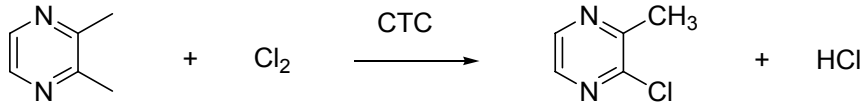
2. 2-Chloro-5-(trifluoromethyl)pyridine

CTC is used as process agent in chlorination reaction of 2-chloro-5-methylpyridine and chlorine gas to yield 2-chloro-5-(trichloromethyl)pyridine, the precursor of 2-Chloro-5- (trifluoromethyl) pyridine.



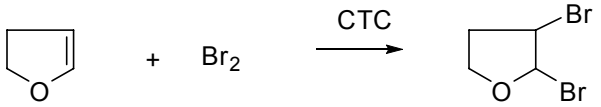
3. 2-Methoxy-3-methylpyrazine

CTC is used as process agent in chlorination reaction of 2-methylpyrazine and chlorine gas for synthesis of 2-chloro-3-methylpyrazine, the intermediate of 2-methoxy-3-methylpyrazine.



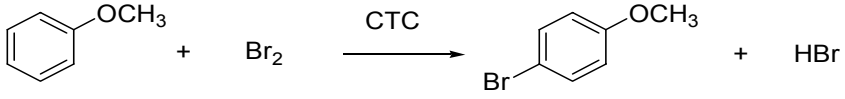
4. 2-Methyl-3-tetrahydrofuranthiol

CTC is used as process agent in bromination reaction of dihydrofuran and bromine.



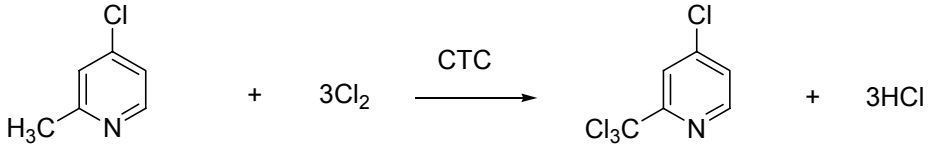
5. 4-Bromoanisole

CTC is used as process agent in the bromination reaction of anisole.



6. 4-Chloro-2-trichloromethyl pyridine

CTC is used as process agent in the chlorination reaction of 4-chloro-2-methyl pyridine to produce 4-chloro-2-trichloromethyl pyridine.

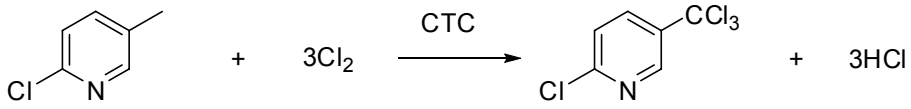


7. Diacetone acrylamide

CTC is used as process agent for refining crude diacetone acrylamide in this production process.

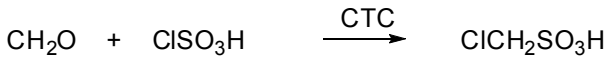
8. Chlorfluazuron

CTC used as process agent in chlorination reaction of 2-chloro-5-methylpyridine with chlorine gas.



9. Chloromethylsulfonic ester

CTC used as process agent in esterification reaction of methanal (formaldehyde) and chlorosulfonic acid.



10. Dope

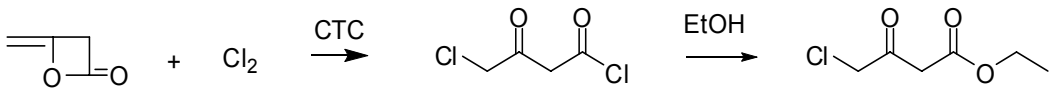
CTC is added in dope to improving its performance, such as fireproofing performance.

11. Doxofylline

CTC is used as process agent in the bromination reaction which is one step in the doxofylline production process.

12. Ethyl-4-chloroacetoacetate

CTC is used as process agent in chlorination reaction of ethyl-4-chloroacetoacetate production process.



13. GCLE

CTC is used as extraction agent for refining crude GCLE in GCLE production process. (GCLE is an abbreviation of 7-phenylacetamide-3-chloromethyl-3-cepham-4-carboxylic acid *p*-methoxybenzyl ester.)

14. *m*-Nitrobenzaldehyde

CTC is used as process agent for refining the crude product in this production process.

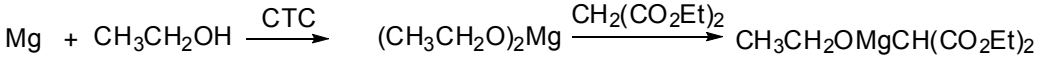
15. Ozagrel

The enterprise refused to provide any information in view of technology secret and so CTOC was unable to assess this application.

16. PVDF

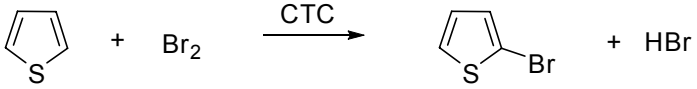
CTC is used as dispersant in pyrolysis of chlorodifluoroethane to produce vinylidene fluoride monomer. (PVDF is an abbreviation of poly(vinylidene fluoride).

17. Tetrafluorobenzoyl ethyl acetate
CTC is used as process agent in reaction of powdered magnesium and ethanol.



This application is the same as that in #56 of the table A-bis, although the use to which product is put (synthesis of a final product) is different.

18. Tichlopidine
CTC is used as process agent in bromination reaction in this production process.



19. Using as G.I.
The enterprise refused to provide any information because the technology is secret. Therefore, it cannot be accepted that the application is potential process agent application since CTOC is unable to assess it.

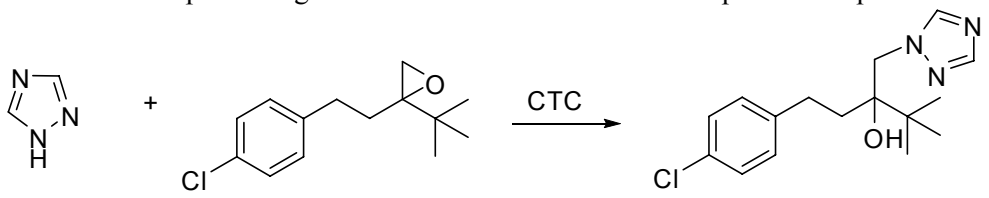
20. *β*-Bromopropionic acid
The enterprise refused to provide any information because the technology is secret. Therefore, it cannot be accepted that the application is potential process agent application since CTOC is unable to assess it.

21. 3-Nitrophthalic anhydride
CTC is used for crystallization of product in this production process.

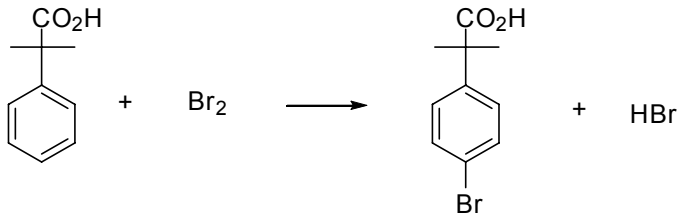
22. 4-Bromophenol
CTC is used as process agent for refining the product in this production process.

23. 4-Nitrophthalic anhydride
CTC is used for crystallization of the product in this production process.

24. Chlorophenyl-triapentanol
CTC is used as process agent for the addition reaction in this production process.



25. 4-Bromodimethylbenzeneacetate
CTC is used as process agent in bromination reaction in this production process.

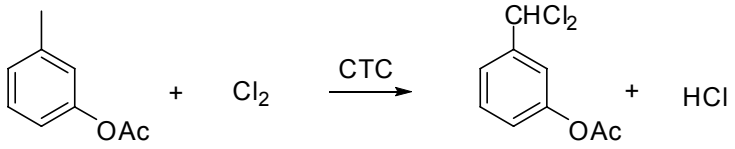


26. Initiator for production of *o*-nitrobenzaldehyde

CTC is added in initiator for produce *o*-nitrobenzaldehyde as thinner to keep stabilization of initiator and prevent it from exploding. This application is listed as #46 in table A-bis.

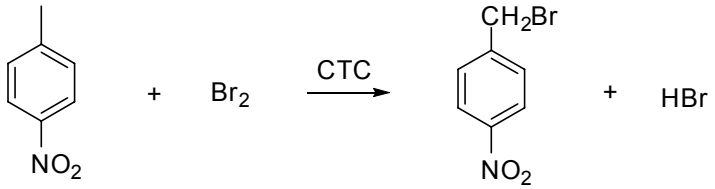
27. *m*-Hydroxybenzaldehyde

CTC is used as process agent in the chlorination reaction of this production process.



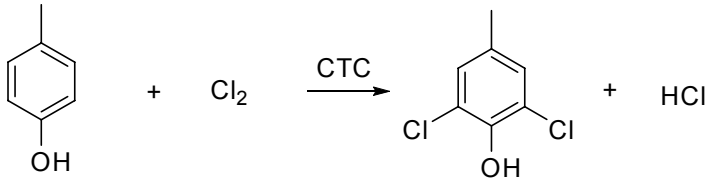
28. *p*-Nitrobenzyl alcohol

CTC is used as process agent in the bromination reaction in this production process.



29. Tolclofos methyl

CTC is used as process agent in the chlorination reaction of this production process.



4.3.6 ODS emissions and make-up quantities reported by Parties

Decision XVIII/6 taken at the Dakar MOP in 2005 included the following:

6. To request the Technology and Economic Assessment Panel and the Executive Committee to report to the Open-ended Working Group at its twenty-seventh meeting in 2007, and every other year thereafter unless the Parties decide otherwise, on the progress made in reducing emissions of controlled substances from process-agent uses; the associated make-up quantity of controlled substances; on the implementation and development of emissions-reduction techniques and alternative processes and products not using ozone-depleting substances;

In the time available, the CTOC has not been able to coordinate its work with that of the Executive Committee, but in gathering information about the continuing relevance of the process agents listed in table A, the CTOC received the following information on ODS for process agent uses from Parties.

Party	Emission (MT)	Make Up (MT)
EC	< Table B figure	(2005)
Israel		3.3/2005
Mexico		40.99/2006
Romania		173.0/Ave 2000-2002
USA	46*	1626*/2005

* ODP-weighted quantity

In addition, China has provided information regarding those uses in table A-bis. For the entries that are judged by the CTOC to meet the requirements for acceptance as process agents, the total make up quantity is 819.03 MT.

4.4 Essential Use Nomination of CFC-113 by the Russian Federation (XVIII/8)

4.4.1 Introduction

The ozone depleting substance CFC-113 (1,1,2-trichloro-1,2,2-trifluoroethane) is used in the civilian space program of the Russian Federation. A late request from the Russian Federation for an Essential Use Exemption shown in the table below in respect of this use was received in 2006 and a brief comment was made in the May 2006 report of the TEAP, as follows:

2006 EUN by Russian Federation	
Year	**Quantity (tonnes)**
2007	150
2008	140
2009	130
2010	120

Specific Usage: Solvent cleaning with CFC-113 for the manufacture of fine mechanical devices for the Russian Federal Space Agency.

Recommendation: TEAP: Unable to recommend because its nomination was received by UNEP after the submission deadline. CTOC: Prepared to review the nomination for 2007. Parties may wish to consider a one-year essential use exemption while TEAP and its TOCs properly evaluate the nomination and seek sources of stockpiled CFC-113.

Comments:
The Ozone Secretariat received this nomination on 19 April 2006, just before the TEAP met to complete the 2006 Progress Report. The nomination documented in detail diminishing uses of CFC-113 and the adoption of alternatives. Until 2006, CFC-113 was available from stockpiles, which have been depleted. In 2001 use of CFC-113 was 241 metric tonnes, but since then several alternative solvents and techniques have been implemented. TEAP notes that 65% of the quantity used is released to the atmosphere. With more time the CTOC could explore in detail whether other alternatives have been identified by other Space Agencies or whether they face similar problems.

Leading up to decision XVIII/8 (see below) at MOP-18 to grant an Essential Use Exemption for use of 150 metric tonnes of CFC-113 in 2007, the Russian Federation provided two documents, and the US government made available a 1995 report on the use of non-ODP alternative substances in their domestic space program. There was insufficient time to incorporate the information contained in these documents in the 2006 CTOC/TEAP report and so that information is presented here. As well as examining documents, TEAP co-chair Dr. Andersen and CTOC co-chairs Dr. Yamabe and Dr. Rae held extensive discussions during 2006 with delegates from the Russian Federation.

4.4.2 Decision XVIII/8: Essential-use exemption for chlorofluorocarbon-113 for aerospace applications in the Russian Federation for 2007

Decision XVIII/8 states as follows:

> *Recalling* that the Russian Federation has submitted a nomination for an essential-use exemption for chlorofluorocarbon-113 for aerospace applications in the Russian Federation,
>
> *Noting* that the nomination by the Russian Federation was submitted on 15 April 2006, several weeks after the deadline required for the essential use exemption process set out in decision IV/25,
>
> *Regretting* that the Technology and Economic Assessment Panel and its Chemicals Technical Options Committee were not provided sufficient time to review that nomination in detail and report to the Parties three months ahead of the Eighteenth Meeting of the Parties in accordance with the time schedule prescribed,
>
> *Recalling* that consultations took place between the Technology and Economic Assessment Panel and the Russian Federation during the twenty-sixth meeting of the Open-ended Working Group and thereafter and that, following such consultations, the Technology and Economic Assessment Panel stated in its May 2006 progress report that Parties might wish to consider granting the Russian Federation a one-year essential use exemption,
>
> *Taking into account* the information already made available by the Russian Federation in relation to its nomination for an essential use exemption for aerospace applications, which contains data on the anticipated gradual reduction of the Party's expected needs until 2010,
> *Recalling* that the Russian Federation has indicated that the amount of ozone-depleting substances being used for aerospace applications has been constantly decreasing owing to research into and transition to alternative ozone-safe substances and technologies and that the amount of chlorofluorocarbon-113 being used has been reduced from 241 metric tonnes in 2001 to 160 metric tonnes in 2006,
>
> 1. To permit the Russian Federation a level of production and consumption of 150 metric tonnes of chlorofluorocarbon-113 for its essential use in the aerospace industry of the Russian Federation in 2007;
>
> 2. To request the Technology and Economic Assessment Panel and its Chemicals Technical Options Committee to complete a comprehensive assessment of the information made available in the nomination submitted by the Russian Federation and, on the basis of any additional information that may be required from the Russian Federation, to conclude its analysis taking into account that the information underlying such analysis should address comprehensively the reason why existing alternatives to CFC-113 would not be applied for the use concerned;
>
> 3. To call upon the Russian Federation to continue to cooperate closely with the Technology and Economic Assessment Panel and its Chemicals Technical Options Committee further to the present decision and to submit, in accordance with the requirements of the Technology and Economic Assessment Panel and its Chemicals Technical Options Committee, the additional detailed technical information mentioned

in paragraph 2 on the use of chlorofluorocarbon-113 that may be required until the completion of the assessment;

4. To request the Technology and Economic Assessment Panel and its Chemicals Technical Options Committee to review all the information provided, as specified in paragraphs 2 and 3, and present the results of that review to the Open-Ended Working Group at its twenty-seventh meeting, in 2007;

5. To call upon the Russian Federation:
(a) To consider further the use of foreign sources of chlorofluorocarbon-113 stockpiles identified by the Technology and Economic Assessment Panel and its Chemicals Technical Options Committee as a contribution for addressing the needs mentioned under paragraph 1 or any possible future needs;
(b) To consider further the possibility of, and a timetable for, introducing the use of any new alternatives to chlorofluorocarbon-113 that become available and to continue its research and development activities with a view to finding new alternatives;

6. To further call upon the Russian Federation to provide in due time to the Technology and Economic Assessment Panel and its Chemicals Technical Options Committee, for the purpose of any future nomination of that Party for essential-use exemptions for chlorofluorocarbon-113 in relation to aerospace applications, comprehensive information in accordance with the conditions set out in decision IV/25;

7. To take into consideration the outcome of the continued consultations mentioned in paragraphs 2 to 4 between the Russian Federation and the Technology and Economic Assessment Panel and its Chemicals Technical Options Committee on the amount authorized for essential uses in 2007, in reviewing any possible additional nomination by the Russian Federation for aerospace applications for 2008.

4.4.3 Document from the Russian Federation

Following the inclusion in the May 2006 report of the Technical and Economic Assessment Panel (TEAP) (UNEP/OzL.pro.WG.1/26/L.1/Add.2) of comments relating to their request (see Appendix 2 to this paper), the Russian Federation provided an unofficial translation of a paper entitled 'Complementary Materials to Russian Federation Application for Exemption Regarding Principal Uses of CFC-113 in 2007-2010'. A summary of this paper follows.

1. Use of ozone-depleting CFCs and halons controlled by the Montreal Protocol in Space Industry.

A number of CFCs and halons had been widely used in the industry before the introduction of the Montreal Protocol. In particular, CFC-11, CFC-12 and CFC-13 were used in heat transfer and cooling applications. CFC-113 is used in cleaning and degreasing processes and also in strength and leak tests of parts and assembly units for space rocket hardware. Alternatives have been found for all these substances except the most critical one, CFC-113. Because of its universal solvent properties and excellent technical and consumer properties, its applications cover fuel tanks, pipeline fittings, precision gyro units and accelerometers of control systems, and other fine mechanical instruments and systems.

2. Technical issues of the use and possible options for substitution of CFC-113.

2.1 List of components, parts, and assembly units using CFC-113 in cleaning and degreasing processes. Materials used in manufacture of these components, parts and

assembly units. 2.1.1 has a number of sub-sections in which the components, parts and assemblies are listed. 2.1.2 lists the metals and alloys and the non-metal materials (synthetic polymers).

2.2 Russian industry standards governing the use of solvents for cleaning and degreasing of components, parts and assembly units (including electronic ones) of space rocket hardware. 2.2.1 notes that CFC-113 production is governed by State Standard 23844-79. 2.2.2 lists a number of Industry Standards and Guidelines for the cleaning and testing operations, including two relating to detergent water solutions.

2.3 Comparative data on purification efficiency of CFC-113 and alternative solvents used in cleaning and degreasing of components, parts and assemblies. Key data are presented in Table 1.

Test	Description		Solvent	
		CFC-113	**HCFC-122**	**HCFC-141b**
1	Degreasing and cleaning effect (kauri butanol value), units	31	86	56
2	Contaminant solution rate (inter-diffusion coefficient), cm^2/s	3.3×10^{-6}	3.9×10^{-6}	5.4×10^{-6}
3	Cleanliness achieved in surface processing/removal of mechanical impurities (surface residual impurity), mg/m^2	Within 20-5	Within 15-5	Within 15-5

It can be seen that HCFC-122 and HCFC-141b have better characteristics in the first two tests, but there is little difference on the third. Such solvents as methylene chloride and BR-1 solvent (Nefras C2-80/120) consisting of pre-treated through distillation and rectification benzene proved to have a strength equal to that of CFC-113, as applied to cleaning and degreasing processes.'

2.4 Description of existing alternative substances. Grounds for unsuitability of alternatives for cleaning and degreasing structural materials, components, parts and assemblies of space rocket hardware. Performed and ongoing researches to find new alternatives. Ozone-safe organic solvents such as benzene, alcohols and ethers can match the solvent power of CFC-113 in most applications. However, these solvents present explosion and fire hazards. Ozone-safe organic chlorine solvents can have even better solvent power than CFC-113 but this can be a disadvantage with some non-metal materials. Also, they cannot match CFC-113 for chemical stability (stabilizers have to be added), toxicity and explosion and fire safety. The HCFCs are suitable for most applications but, because of their solvent power, not those involving non-metals. Also, residual hydrocarbons cannot be detected in their presence (presumably infrared analysis, for which CFC-113 is suitable). The document points the way to the establishment of production facilities for HCFCs 122, 122a and 141b, and development of appropriate procedures for their use. The use of detergent water solutions was explored but these were not found to reduce surface contamination below 50 mg/m^2 and there were special difficulties with contamination in places like slot gaps and blind spaces. With open surfaces, performance comparable with that of CFC-113 has been achieved and such procedures are used routinely now. Satisfactory performance has been demonstrated for mixtures involving such components as FOL-62, Novec HFE-7100 and R-4062 (highly fluorinated) and research continues with them.

3. List of activities on gradual reduction of the use of CFC-113. Table 2, reproduced below, gives the schedule.

Item	Action description	Date
1	Further work on reviewing the possibility for the use of approved ozone-friendly and ozone-safe CFC-113 alternatives (HCFC-122, HCFC-122a, HCFC-141b ….) for processing of components, parts, and assembly units of space rocket hardware.	2007
2	Development and testing of new technologies designed to minimize the use of CFC-113 and other volatile solvents in cleaning, degreasing, washing, and testing of parts and assembly units of space rocket hardware.	2007
3	Adaptation and testing of the equipment operated by industry enterprises for cleaning, degreasing, washing, and testing of parts and assembly units of space rocket hardware with ozone-safe and ozone-friendly solvents.	2008
4	Development, manufacture, and testing of technological equipment that provides economical consumption of volatile solvents.	2008
5	Research, tests, and approval of new and more efficient ozone-safe and ozone-friendly solvents alternative to CFC-113 in space rocket production.	2009
6	Development of engineering documentation for standard designs of new technological equipment for cleaning, degreasing, and washing of parts and assembly units for space rocket hardware with ozone-safe and ozone-friendly solvents.	2009
7	Manufacture and operational development of prototype models of new technological equipment for cleaning, degreasing, and washing of parts and assembly units of space rocket hardware with ozone-safe and ozone-friendly solvents.	2010
8	In-production testing of technological processes for cleaning, degreasing and washing of parts and assembly units of space rocket hardware with new types of ozone-safe and ozone-friendly solvents and new technological equipment.	2010
9	Resolving or organizational issues with Russian ministries and agencies in order to create and operate capabilities for production of ozone-safe freons including HCFC-122, HCFC-122a, HCFC-141b and other solvents alternative to CFC-113.	2006-2008

4. Substantiation of inexpediency of acquisition and use of CFC-113 from foreign sources. In the Russian federation CFC-113 is produced as an end product of the polymer plant of B.P. Konstantinov Chemical Production Complex in Kirovo-Chepets and the Khimprom public corporation in Volgograd until December 2001. It is governed by the State Standard mentioned above. The State Standard is summarized in Table 3, below.

#	Characteristics	GOST 23844-79 spec
1	Physical state	Clear, color-less fluid
2	Mass content of trichlorotrifluoroethane (main substance), %, min.	99.96
3	Mass content of dichlorotetrafluoroethane, %, max.	0.01
4	Mass content of tetrachlorodifluoroethane, %, max.	0.01
5	Mass content of other impurities defined by chromatographic method, % each, max.	0.01
6	Mass content of fixed residues, %, max.	0.001
7	Mass content of free chlorine, %, max.	0
8	Mass content of water, %, max	0.003

The content of fluorescent soluble impurities, in particular mineral oils, fats and other organic compounds, in domestic CFC-113 did not exceed 10-15 mg/l (0.0001%). There are particularly strict requirements for these substances and water and acidity, so additional purification by distillation is used to ensure this. Samples of CFC-113 from two foreign sources, China and India, were obtained and their purity was checked. The results are reported in Table 4 (below).

#	Characteristics	GOST 23844-79 specs	Actual characteristics of foreign samples
1	Mass content of trichlorotrifluoroethane (main substance) %	>99.96	96.0 – 98.0
2	Mass content of fixed residue, %	<0.001	0.005 – 0.008
3	Mass content of water, %	<0.003	0.01 – 0.015

In addition, the fat content of the foreign samples was 30-60 mg/L, far above the Russian industry standard. It was felt that import of CFC-113 from industrially developed countries would be difficult given the lack of mutually agreed standards. In addition, the Russian federation did not wish to be 'dependent on foreign suppliers and international economical and political situation'.

4.4.4 Comments on supply of CFC-113 to the Russian Federation from foreign sources

In discussions with delegates of the Russian Federation, the case was put that the US held stocks of CFC-113 that were of good quality – likely to meet the requirements of the State Standard discussed above – and that these could be made available. The gain for the US would be that cost of destruction of this material would be avoided, and the world gain would be that there would be no need to produce CFC-113 for this use in the Russian Federation. It should be noted that CFC-113 is produced in a number of countries as a feedstock in the production of the monomer chlorotrifluoroethylene which is used to produce valuable polymers.

4.4.5 Document from the United States

This document, entitled 'Handbook of Solid Rocket Motor Manufacturing within the United States. Eliminating Use of Ozone Depleting Substances in Solid Rocket Motor Manufacturing', dated February 1995, was available in hard copy only.

The document explains the basic steps in the manufacture of solid rocket motors, the uses to which ozone depleting substances (ODS) were put, the identification of alternatives and the testing of rocket motors produced using these alternatives. The main ODS used were TCA (1,1,1-trichloroethane, methyl chloroform) and CFC-113, which were phased out by 2002 and 1997 respectively.

Three types of action facilitated the phase outs:

- managerial – point of use inventory control and management, manufacturing method changes (elimination of greasing and consequent degreasing), and manufacturing specification changes;
- solvent capture and recycling; and
- substitution of ODS with aqueous cleaners in mechanical washers, and with semi-aqueous cleaners in which the organic component was usually terpene.

The report also includes comments on the disadvantages brought about by the phase out of ODS. 'ODS substitutes may increase the number and duration of manufacturing steps and often increase the volume of liquid handled and disposed. For example, substituting an aqueous cleaner for TCA results in increasing liquid handled from 55 gallons TCA evaporated during use to 500 gallons of water and aqueous cleaning solution that must be treated prior to disposal.'

4.4.6 The 2007 EUN from the Russian Federation

On 24 January 2007 the Ozone Secretariat received a request from the Russian Federation submitting a request, in accordance with decision XVIII/8, for a EUN for use of CFC-113 in their aerospace industry. The Russian federation also sought advice from the Secretariat on the procedures for obtaining samples of CFC-113 that might be available for 'purchase from foreign ODS banks identified by TEAP and its TOC and the conformity of this CFC-113 with the Russian standard and branch norms'.

The request from the Russian Federation included much of the information set out in their document described above in Section 3.3 of this report. The EUN covers the years 2008 and 2009, as follows:

Ozone Depleting Substance	2008 MT	2009 MT
CFC-113	140.0	130.0
Total	**140.0**	**130.0**

The consumption by the Russian Federation in previous years (metric tonnes) was reported as follows:

ODS	2001	2002	2003	2004	2005	2006	2007
CFC-113	241.0	189.0	190.0	175.0	173.0	160.0	150.0

Other important information provided in the Russian Federation EUN concerned the fate of the CFC-113 used in the aerospace program.

ODS	% Contained in Product	% Released in Manufacture or Use	% Destroyed or Recycled	Total
CFC-113	0	70	30	100

4.4.7 Concluding remarks

The solvent experts in CTOC discussed this case and their advice is as follows:

- Use of HCFCs as alternatives to CFC-113 is only a temporary solution as cleaning agents. These HCFCs (122, 122a, 123, 141b and 225) are ozone depleters which will be phased out of use in the future. Only in the interim period, HCFC-225 could be a substitute of CFC-113 due to its excellent performance already experienced in cleaning of oxygen systems etc. Further, serious toxicity concerns need to be addressed to properly handle HCFC-122 and 122a. The CTOC recommends exploring commercially available alternatives with zero ozone depletion potential such as HFCs, HFEs and blends, as well as not-in-kind alternatives as long term replacements.

- In 2000 a group of experts in the field of precision cleaning visited one of the Russian torpedo manufacturing sites in Kazakhstan. The focus of the visit was to share information and technical know-how on precision-engineered instrument and oxygen system cleaning with non-ODS solvents. Samples of alternatives were provided for evaluation. A similar visit was also made to Poland's navy, which was using the Russian-made equipment that required CFC-113

for cleaning oxygen systems. These sites had agreed to submit their evaluations of alternatives for cleaning oxygen systems to the then-STOC, but no information was received.

- In addition to replacement of CFC-113 by other solvents, there are opportunities to reduce use of CFC-113 through improved containment systems in the equipment used in the cleaning operations. In other jurisdictions, quantities of CFC-113 required for particular operations can be reduced by up to 80% through such engineering changes. The replacement of equipment is somewhat more expensive, but information about upgrading the existing equipment could also be available. A decision would be made on cost-effectiveness grounds, taking into account direct costs and such factors as down-time involved in upgrading.

As experience in the United States has shown, the replacement of ozone depleting substances in almost all applications in the domestic space program is possible, but that even with extraordinary efforts some essential uses remain today. The Russian Federation timetable is a measured one, with testing of alternatives to be followed by construction and testing of necessary equipment in which the alternatives would be used, and finally implementation sometime after 2010. Along with these scientific and engineering steps, there needs to be change in government regulations and establishment of new standards for purity and effectiveness of alternative substances.

It might be expected, then, that complete phase out of CFC-113 could only take place after 2010 but should proceed quickly then, as new practices are adopted. In the meantime, the foreshadowed CUNs of the Russian Federation are presumably based on more effective usage of CFC-113, including recycling, so that total usage declines slowly.

It is not possible for the CTOC to suggest a faster timetable for the phase out of CFC-113, given the magnitude of the task facing the Russian Federation and the relatively late beginning of the replacement program, and therefore the CTOC recommends acceptance of the EUN proposed for 2008 and 2009.

However, there seem to be good prospects that CFC-113 of sufficient purity to meet the standards and norms of the Russian Federation could be obtained from banks maintained in one or more foreign countries that are Parties to the Montreal Protocol and would have an interest in (a) minimizing production of this ODS during the period when it is replaced by alternatives in the aerospace program of the Russian Federation, and (b) avoiding the cost of storage and destruction of this stockpiled material.

4.5 n-Propyl Bromide Update (XVIII/11, XIII/7)

4.5.1 Introduction

The TEAP/CTOC has reported the updates of normal-propyl bromide (n-PB) under decision XIII/7 with general information on production, consumption and emissions, as well as toxicity data and regulatory actions in the 2005 and 2006 TEAP Progress Reports. In view of the fact that this is not a controlled substance, no accurate production and emissions estimates are available because there is no yearly reporting by the Parties.

With these backgrounds, the decision XVIII/11 has requested the TEAP to continue its assessment of global emissions of n-PB by obtaining more complete data on its production and uses and by providing further information on the technological and economical availability of alternatives, to report at the 27th OEWG for the consideration of MOP-19.

Some information has been provided by two manufacturers of n-PB. For commercial reasons, production volumes are not disclosed. It is also known that n-PB is produced by other companies but no comprehensive data set is available.

4.5.2 Updated information on n-PB

Use of n-PB continues due to its good solvency and relatively low cost, in spite of toxicity concerns and pending proposals to reduce exposure guidelines. At this point n-PB is still a virtually unregulated chemical.

The use of n-PB as an intermediate for the synthesis of pharmaceuticals and other organic compounds was known for a long time. In the last few years, its uses have grown as a solvent for industrial cleaning for degreasing, metal processing and finishing, electronic defluxing and other cleaning applications in aerospace and aviation, and the manufacture of medical and optical devices. It has also successfully captured some applications in aerosol formulation and as a carrier solvent for adhesives, inks and coatings. The use of n-PB is also promoted by the its vendors as a substitute for trichloroethylene, perchloroethylene, HCFC-141b and ozone depleting chlorofluorocarbons (CFCs) in many applications.

It is marketed as n-propyl bromide or 1-bromo propane as well as under many trade names such as Leksol, Ensolve, Solvon, Abzol, VDS-3000, Hypersolve, and Lenium. This is not a complete list of all trade names under which n-PB and its blends are sold.

The suggested exposure guidelines have been lowered by most manufacturers and blenders to 10-25 ppm (except that at least one vendor has kept it as high as 100 ppm).

n-PB is available in most regions, including Asia, with local productions in China, France, Israel, Jordan and the USA. World production capacity for the manufacture of n-PB has continued to increase, resulting in a lowering of bulk prices to a level comparable to the upper range of chlorinated solvents. The global annual production capacity is estimated to exceed 20,000 metric tonnes, of which about 5,000 metric tonnes are probably used as a pharmaceutical intermediate or process agent. The consumption, as a solvent, increased at a growing rate of 15-20% per year in USA (5, 000 metric tonnes in 2005), Japan (1,400 metric tonnes in 2005) and other Asian countries. In Japan it reached a plateau in 2005 and then has declined to 1,310 metric tonnes in 2006. In Europe, n-PB use has increased rapidly in metal and precision cleaning until 2005 to reach a plateau around 2,000 metric tonnes; since then it is being progressively phased out. The global n-PB consumption is estimated to be 10,000 to 20,000 metric tonnes per year and the corresponding n-PB emissions are calculated to be 5,000 to 10,000 metric tonnes per year, when 50% of the consumption could be emitted as suggested by IPCC/TEAP Special Report (2005).

4.5.3 Recent Toxicity Data and Proposed Regulatory Actions

Long term (chronic) testing of n-PB in animals has shown toxicity to the reproductive systems of both male and female. In males, it affects sperm counts and motility, testicles and prostrate. In females it damages ovaries and results in sterilization. Based on the reproductive toxicity data, the Commission of the European Communities has proposed to add n-PB to the list of dangerous chemicals that can cause cancer, have mutagenic properties or be toxic to reproduction. The Environmental Protection Agency of the USA (US-EPA) has suggested exposure guidelines of 25 ppm (www.epa.gov/ozone/snap/regs/68fr33284.pdf).

n-PB also has significant neurotoxicty to animals and humans. The animal study showed significant neurological effects on animals at various dose levels. A recent case study involved five workers whose job involved gluing foam cushion with glue containing the solvent n-PB.

Due to the extremely high exposure in excess of 500ppm they developed serious neurological symptoms, some of which appear to be permanent.

Based on these recent findings and until more toxicological test data becomes available, the American Conference of Industrial Hygienists (ACGIH) has recommended that exposure guidelines for n-PB containing solvent be limited to 10 ppm. Hazard Evaluation System and Information Services (HESIS) of California Department of Health Services have gone a step further and have suggested limiting worker exposure to about 1 ppm. Also the Office of Environmental Health Hazard Assessment (OEHHA) of California announced on Nov 8, 2004 its intention to add n-PB to the Proposition 65 list as a chemical known to the State to cause reproductive toxicity. So far only one of the n-PB vendors has reduced their recommended exposure guidelines to 10 ppm, In Europe, n-PB use has been progressively phased out; its labelling reclassification

- R 11 Highly flammable.
- R 36/37/38 Irritating to eyes, respiratory system and skin.
- R 48/20 Harmful: danger of serious damage to health by prolonged exposure through inhalation.
- R 60 May impair fertility.
- R 63 Possible risk of harm to the unborn child.
- R 67 Vapors may cause drowsiness and dizziness.

Substitution is not only due to this classification but also to the 1999 VOC-Directive which forces the reduction of emissions of volatile organic compounds.

4.5.4 Latitude-specific ODP of n-PB

The Scientific Assessment Panel (SAP) 2006 Assessment Report includes the latest estimates of the latitude-specific ODPs. The Ozone Depletion Potentials of n-propyl bromide are 0.1 for tropical emissions and 0.02-0.03 for emissions restricted to northern mid-latitudes, unchanged from the previous assessment. The ODP for n-PB, when used and emitted in the tropics is comparable to the ODPs of other substances already controlled by the Montreal Protocol.

While no consensus has been reached in the scientific community over appropriate models for estimating the ODP of short-lived substances such as n-PB, most estimates put the top of the range near 0.1, while estimates of the minimum figure range from 0.0033 to approximately 0.02. It is understood that Professor D. Wuebbles is undertaking an industry-funded study, using a new three-dimensional model of its behaviour in the atmosphere. This study is expected to be completed by May 2007.

4.5.5 Global Warming Potential (GWP)

The 100-year GWP for n-PB is estimated to be 0.31 (Atmospheric and Environmental Research, Inc., 1995). To put this figure into context, typical figures for other ODS are: CFC-113, 6000; HCFC-141b, 700; chloroform (not a controlled substance), 140.

4.5.6 Concluding remarks

The continuing use of n-PB is supported by industry bodies, because it offers an effective replacement for solvents with higher ODP and chlorocarbons. However, it is recognised that occupational health and safety (OHS) considerations and its ozone depleting potential are important factors in dictating the handling of n-PB, specifically the minimisation of worker exposure and prevention of release to the environment. Nonetheless, its use in some jurisdictions is growing. In other regions, as a result of concern over toxicity and ozone depletion, n-PB is being phased out.

4.6 Sources of carbon tetrachloride (CTC) emissions and opportunities for reductions (XVIII/10)

4.6.1 Introduction

Following the detailed analyses carried out by TEAP and included in its 2006 report, the Parties in Decision XVIII/10 requested TEAP to:

3. continue its assessment of global emissions of carbon tetrachloride, as set out in Decision XVI/14 and other related decisions such as Decision XVII/19, paragraph 6, paying particular attention to
4. obtaining better data for industrial emissions such as those from HCFC-22 production to enable resolution of the significant discrepancy with atmospheric measurements;
5. further investigating issues related to production of carbon tetrachloride (including its production as a by-product and subsequent use, storage, recycling or destruction;
6. estimating emissions from other sources such as landfills.
7. Prepare a final report on the assessment referred to above in time for the twenty-seventh meeting of the Open-ended Working Group for the consideration of the Nineteenth Meeting of the Parties in 2007.

The CTOC can report that this task is not yet complete, partly due to the shortened inter-sessional period and partly due to difficulties in accessing relevant information. The following text is a report of work in progress.

4.6.2 Information from the Science Assessment Panel

The Science Assessment Panel in its 2006 Report carried out a thorough analysis of the atmospheric concentrations of carbon tetrachloride and concluded that *"For CTC the only detectable current emissions were from China, but the amount was only a relatively small fraction (31%) of the inferred global emissions for a 26 year lifetime. Unfortunately, only limited data are available from regions such as Korea and India, which might be responsible for significant emissions. There are indications that India in particular is still a source of CTC emitted from solvent use and from process agent applications. For example, air from India observed at a background site in the Indian Ocean has been found to contain elevated concentrations of CTC (Lobert and Harris, 2002). Furthermore, a study in Mumbai (India) fond concentrations of CTC those were noticeably above the background (Srivastava et al., 2006)."* (Science Assessment 2006, Section 1.3.1) Furthermore it noted, *"Overall the budget of CTC remains poorly understood" and it recommended to make "no change from the lifetime of 26 years given in WMO 2002."*

India has made substantial efforts to replace CTC, and all process agent applications of CTC will have been phased out by the end of 2007 under the Sector Plan.

4.6.3 Can Landfill emissions of CTC account for the discrepancy?

A number of recent publications provide relevant information, although emissions of CTC were not the main focus of these works.

A thorough review of the literature of emissions from landfills and the effects of soil cover was carried out by Charlotte Scheutz in 2002. This demonstrated that fully substituted hydrocarbons (such as tetrachloromethane (CTC)) were not degraded under oxidative conditions.

Furthermore, she noted that "*higher chlorinated compounds such as CFCs and CTC were found degradable in the anaerobic zone (of landfill soil covers)*" Thus, although indicating that CTC could be destroyed in landfills or their soil covers, Scheutz's review did reveal the extent to which this might occur and did not provide data on emissions from landfills or CTC concentrations in nearby air.

An analysis by Allen *et al.* of halocarbon emissions from seven landfill sites in the UK indicated CTC levels of between 2 and 21 mg m^{-3} in the sites, whilst work by Emerson on Californian landfills indicated that mean concentrations of CTC were comparable, being between 8.0 – 12.8 ppb (22 detections out of 558 samples).

In order better to understand the potential emissions of CTC from landfills, the following estimate was carried out:

The Report by IPCC, SRES quotes the release of methane from landfill as 23 million tonnes/yr for OECD90 in 1990 and 60 million tonnes/yr globally. Landfill gas, according to the UK Environment Agency, is 65% methane by volume, with the rest predominantly CO_2. So the total landfill gas releases become 57 and 149 million tonnes/yr.

Estimations by Emerson from California show a mean range up to 12.8 ppb (volume) from only 4% of the landfill sites. Allen *et al.*'s results are much higher at 2 mg/m^3, or just under 2 ppm weight from 43% of the sites studied.

Therefore, if it is assumed that all OECD sites release CTC, the product of less than 2 ppm and 57 million tonnes is 98 tonnes. This would rise to 255 tonnes for global landfill. It is likely to arise from seepage of historically dumped chemical and not from material generated within landfills. When CTC use was low, there would be correspondingly less CTC in landfills, for example in many Article 5 countries.

These calculations would indicate that there is insufficient concentration of CTC in landfill gas to account for the discrepancy between estimated industrial emissions of CTC and concentrations measured in the atmosphere.

Other potential sources could include release from historical chemical dumps and groundwater emissions but it is unlikely that such sources could provide sufficient sustained releases to account for the discrepancy. The CTOC has collected some data on groundwater contaminated with CTC and is seeking evidence of emission to air of CTC contaminated groundwater. It should be noted that CTC has water solubility 0.8 g/L at 20^{o}C and so could be present as dilute solutions but may also be transported with groundwater as a separate liquid phase.

4.6.4 Conclusions on CTC emissions from landfills

Although it is not possible to draw concrete conclusions from an analysis of the recent literature, the indications are that the levels of CTC resulting from emissions from landfills could be of the order of a few hundred tonnes per annum in OECD countries. It is highly unlikely that emissions from landfills in Article 5 countries would greatly exceed these levels given the considerably lower levels of historical CTC use. Our analysis does not determine whether CTC emissions are significant from non-landfill solvent disposal sites.

Furthermore, recent atmospheric measurements by Chan *et al.* over 45 Chinese cities, in the Pearl River Delta, one of the most important manufacturing centres of South China, have indicated levels of CTC source 20% above those of the background. This could indicate that Chinese/SE Asian emission levels could be higher than previously calculated/measured. It should be noted that the papers of *Chan et al*. report the situation in 2001. It is not known

whether or not a similar situation arises for other regions. However, it should be noted that CTC levels in the United States have been *"virtually undetectable in the regional studies."* (Science Assessment 2006, Section 1.3.1) whilst, as reported in 2005, for East Asia (China, Japan and Korea), emissions of 21.5 million tonnes/year were found.

This analysis assists in bridging the gap between measured atmospheric levels of CTC and those calculated from current and past emissive uses. Atmospheric levels, according to the Science Assessment Panel are declining at a rate of about 1% per year.

4.6.5 References

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4.7 Laboratory and analytical uses of methyl bromide (XVII/10)

Extensive information on laboratory and analytical uses of ODS and especially methyl bromide (MB) was provided in the 2006 TEAP Report (Section 6.4, pages 69-73), following which decision XVIII/15 clarified the permitted laboratory and analytical uses of methyl bromide.

Since decision XVII/10(8) asked the TEAP to report in 2007 and every other year thereafter on the development and availability of laboratory and analytical procedures that can be performed without using the controlled substances in Annex E of the Protocol, the CTOC considered this matter early in 2007 but was unable to provide any new information. The possibilities for and actualities of such replacements are kept under review by the CTOC, with a view to providing relevant information in future Progress Reports.

5 Foams Technical Options Committee (FTOC)

The 2006 Foam Assessment Report has provided an important overview of the progress made in ODS management and phase-out over the last four year period and has reflected the status in the areas of:

- Transition from ODSs to non-ODS alternatives in many developed countries
- Transitions from CFCs to non-CFC alternatives in developing countries
- Barriers to transition in both instances
- Analysis and validation of banked blowing agent quantities and a review of current end-of-life practices

Leading on from this overview, a number of issues covered in that report have grown in relevance since the Foams Assessment Report's publication. These are addressed briefly in sections 5.1, 5.2 and 5.3 below.

5.1 Comprehensive Environmental Assessment of Alternatives

As the focus of the evaluation of alternatives has broadened to include other environmental impacts, factors such as life cycle climate performance (LCCP) are being proposed as means of assessing alternative technologies. Whilst this is a legitimate approach, care needs to be taken in applying such analysis to foams, since the LCCP for a foam or, indeed, any other thermal insulation type is much more related to its specific application than to the characteristics of the product itself. Other factors also need to be considered, such as the basis for comparison (e.g. constant thermal performance vs. constant thickness) and end-of-life management assumptions.

The Foams TOC would therefore caution against the use of LCCP as a way of delineating alternatives when the specific applications are not described.

5.2 Voluntary Carbon Projects

Chapter 3 of the Foam Assessment Report contained a short section (pages 63-64) on the possible role of voluntary carbon projects in facilitating the recovery of banked ODS from installed foams at end-of-life. This agenda is continuing to develop and the approach would alleviate the problems in trying to legislate for the recovery and destruction of blowing agents from foams in buildings where some foams would be technically unrecoverable, while others might be technically recoverable but the processes to do so might be uneconomic.

Recent interest from a number of reputable voluntary carbon project developers (e.g. Climate Care) has only served to clarify the need for appropriate protocols to assess and verify the ODS and climate benefits of recovery projects. This matter is likely to be addressed further in the response to Decision XVIII/12.

5.3 Global Warming Potentials of non-methane hydrocarbons

As part of the overall environmental assessment of alternatives, there is a continuing need to identify referenced sources of information on the global warming potentials (GWPs) of commonly used blowing agents. These include cyclo-pentane, iso-butane, n-pentane and iso-pentane. Although some data on radiative forcing exists, the Foams Technical Options Committee continues to work with experts on the Science Assessment Panel and elsewhere to select atmospheric lifetimes that are appropriate for the estimation of representative GWPs.

This issue is becoming particularly pertinent because several “green building” schemes are using the GWP of blowing agents as an assessment criterion for products, rather than adopting the more comprehensive life cycle climate performance (LCCP) approach.

6 Halons Technical Options Committee (HTOC) Progress Report

The HTOC does not plan to meet in 2007 unless tasks arise from the OEWG-27 or MOP-19.

6.1 Update on Decision XV/11

As reported at MOP-18, serious delays in the joint HTOC/International Civil Aviation Organisation (ICAO) action plan occurred because of the retirement of the ICAO focal point. This resulted in the planned ICAO State letter - inviting States to require, where possible, the use of proven alternatives to halons in new aircraft designs - not being issued in 2006 and also stalled the plan for the ICAO Secretariat to introduce an ICAO/HTOC working paper on halon phase-out at the 36th ICAO Assembly Session in 2007. At the request of the Parties, and in cooperation with the HTOC, the Ozone Executive Secretary met with the ICAO Secretary General in March 2007, and received assurances that the ICAO/HTOC working paper would be introduced at the 36th ICAO Assembly Session in September, 2007 during the agenda item for Other Technical Matters. ICAO will provide the format for the working paper, which the HTOC has now been tasked with preparing.

6.2 Implementation challenges in Article 5 countries

The South African Halon Bank has reported problems in getting access to the regional halon recycling machine provided by a UNDP regional project. The Bank operators would like to move the machine to an approved site and begin recycling accumulated halon.

6.3 Halon-2402 Phase-out

India continues to report difficulties in obtaining halon-2402 for the servicing of critical equipment.

6.4 Halon-1211 Bank

HTOC members continue to report that large quantities of halon-1211 that can no longer be used in China are accumulating within China.

7 Refriegeration, Air Conditioning and Heat Pumps Technical Options Committee (RTOC) Progress Report

The authors of the various chapters of the RTOC have not issued detailed reports on technical progress following the information that was reported in the 2006 RTOC Assessment Report just two months ago, although developments are continuing in increasing energy efficiency and reducing refrigerant consumption in many sub-sectors. New low-GWP refrigerants have been announced.

Generally speaking, the change from CFCs to non-CFCs in refrigeration AC and heat pumps has virtually been completed globally. However, servicing with CFCs still remains an issue of importance in Article 5 countries. Whilst the use of HCFC-22 for new equipment was halted in the EU several years ago and will be halted in the USA shortly, the use of HCFC-22 for new air conditioning and refrigeration (in particular commercial refrigeration) equipment is growing rapidly in many Article 5 countries.

Rapid development of low-GWP responses to the EU F-Gas directive for MACs is proceeding. Designations were recommended for five new refrigerant blends to replace HFC-134a in January 2007. To meet the EU F-gas directive for MACs, at least one additional manufacturer has begun focused research on low-GWP replacements for HFC-134a in automotive use and potentially for stationary air conditioning and refrigeration as well. At the end of March, two refrigerant manufacturers announced a global joint development agreement to accelerate the development and commercialisation of a next generation, low global warming refrigerant (GWP<150, ITH 100 years) for the automotive air conditioning industry (which are assumed to be more energy efficient than CO_2 based air conditioning systems, particularly at high ambient air temperature conditions). Refrigerant manufacturing companies have announced to work closely with the automotive industry to qualify a low GWP alternative by mid-2007. Announcements so far have not indicated whether the new low-GWP refrigerants are also suitable to replace HFC-134a or other HFC-134a based blends in different refrigeration and air conditioning applications.

The initiatives underway will have significant impacts and will reduce current uncertainty as to which solution will emerge as the ultimate choice for HFC-134a. This may impact not only the automotive sector but all stationary refrigeration and AC sectors as well.

8 Methyl Bromide Technical Options Committee (MBTOC) Progress Report

8.1 MBTOC Soils Progress Report

8.1.1 Scope of the Report

The MBTOC 2006 Assessment Report has been recently published and is accessible at the Ozone Secretariat website (www.unep.org/ozone). The Assessment contains a thorough analysis on the technical and economic feasibility of alternatives to replace methyl bromide, on the commercial adoption of alternatives and potential alternative treatments to MB as a soil fumigant. It also shows trends in methyl bromide production and consumption in both Article 5 and non-Article 5 Parties; estimated levels of emissions of MB to the atmosphere, and strategies to reduce those emissions. In addition, the report describes critical uses of MB that have been approved by the Parties for 2005 onwards and a review of economic issues relating to MB phase-out.

In light of the above, this progress report gives a short update of research findings, registration and adoption of alternatives occurring after publication of the MBTOC 2006 Assessment Report.

8.1.2 Chemical alternatives for soil fumigation

The major alternatives, such as 1,3-D/Pic (Telone C35), chloropicrin (Pic) and metham sodium (MS), used alone or in combination with other alternatives continue to be widely adopted as key alternatives in most preplant soil applications. Recent research publications confirm that the crop yields and level of control achieved for target pests is comparable to that of MB, for example:

- Recent trials in Florida and Spain comparing three key alternatives in strawberry fruit crops for example, have shown that 1,3-D/Pic, Pic alone and di-methyl disulphide (DMDS) combined with Pic gave yields that did not differ from MB/Pic (Santos *et al*, 2007). Large scale validation trials with 1,3-D/Pic in conjunction with herbicides (e.g. trifluralin) confirmed that this combination is as effective in tomatoes as MB/Pic (67:33) for controlling *Cyperus* (nutsedge) and nematodes (Gilreath *et al*., 2006). In late 2006 a review article on alternatives research in SE USA, concluded that specific combinations of treatments (1,3-D, Pic, metham, dazomet, herbicides or LPBF, also methyl iodide, DMDS) provided effective control against most soil-borne diseases and nematodes, assuming that correct application methods and rates are used. However, in situations where *Cyperus* infestations are severe, alternative fumigants could be combined with herbicides to minimize weed interference (Santos and Gilreath, 2006).
- In studies on forest nursery production of pine seedlings, chloropicrin and metham sodium/chloropicrin are proving effective alternatives to methyl bromide for reducing soil-borne fungi and nematodes, but the effectiveness of chloropicrin for nutsedge control may be affected by soil type (Cram *et al*, 2007, South 2007).
- In Calla lily soils, propagules of nutsedge were controlled by a range of alternatives, some previously considered ineffective against nutsedge. These included Pic, 1,3-D/Pic, 1,3-D alone, Chloropicrin, furfural and metham sodium (Gerik, 2006).
- Trials on cucurbit rotations in SE USA have shown that combinations of chisel injected fumigants (MB, 1,3-D, metham sodium and chloropicrin) on a first crop followed by drip irrigation (MS, 1,3-D and Pic) on the second crop, with and without a nematicide treatment (oxamyl), provided good nematode control and increased yields to the same level as MB (Desaeger and Csinos, 2006)

- The University of Florida extension service, USA has recently developed recommendations for growers on MB alternative treatments for strawberry, tomato, eggplant and pepper, based on TC35 + VIF + herbicides (Noling *et al*., 2006)
- Transition strategies based on the use of formulations of MB/Pic with lower concentrations of MB (i.e. 50:50 or 30:70) continue to provide an effective means to reduce dosage rates, especially in combination with barrier films (Gilreath *et al*., 2006, Santos *et al*., 2006).

8.1.3 Update on registration status of MB and chemical alternatives

- MB, Pic, 1,3-D and many other pesticides are under review in the USA and EC. A technical assessment of MB's toxicological characteristics for the EC review found that MB did not meet many of the critiera necessary for approval as a pesticide in plant protection products under EC Directive 91/414/EEC (EFSA, 2006), and as a result it is expected that MB will be taken off the market in the EC next year or soon afterwards. Concern still exists about the future registration status in the US and EC of several key alternatives, Pic and 1,3-D which have helped to replace MB in specific regions and sectors, such as strawberry fruit in California, USA, and Spain.
- A permit for use of methyl iodide, a major potential alternatives to MB, has recently been approved in the United States and Australia and registration is pending.
- A number of other chemicals are now in the registration process in specific countries, including dimethyl disulphide (DMDS) in Europe and US (for cantaloupe, cucumber, squash, other cucurbits, peppers, strawberry, tomato) and Europe, ethane dinitrile (EDN) in Australia, dazomet in the US (for strawberry and tomato), and various herbicides.

8.1.4 Emissions reduction of chemical alternatives

- Recent studies by Ou *et al*., 2007, have confirmed that barrier films can dramatically reduce emissions from strip treated beds. The reduction is dependent on application rate, injection depth of MB and bed temperature and was greatest with the higher rate of MB applied at 396 kg/ha (39.9 g/m^2) than when applied at 196 kg/ha (19.6 g/m^2).
- Metham sodium efficacy could be improved by replacing standard LDPE films with barrier films (Ou *et al*., 2006).
- Fumigant emissions of MITC and Pic in forest soils are considered to be more efficiently controlled by use of plastic tarps, than water seals although both are effective methods to reduce emissions and consequently improve effectiveness of the fumigants (Wang *et al*., 2005, 2006).
- Barrier films in combination with lower MB/Pic formulations (eg 50:50) are improving the efficacy of weed control, including *Cyperus*. Studies are also indicating their use for effective dosage reduction of alternatives, such as 1,3D and Pic (Austerweil *et al.,* 2006; Ou *et al*., 2006, MBTOC 2007). This is important because dosage reduction may increase the potential application area where present restrictions exist (e.g. township caps in the US) and possibly reduce the buffer zone requirements in some countries where fumigant emission studies have been conducted previously without films or with standard fumigation films.
- In the absence of available alternatives, full implementation of barrier films (VIF or semi permeable LPBF) is the quickest means to reduce use and emissions of MB in the soils sector for the remaining uses of MB in both non A5 and A5 countries. MBTOC estimates that complete use of barrier films on the remaining preplant uses of MB worldwide has the potential to reduce dosage rates of MB and subsequent emissions of methyl bromide by approximately 6,000 ODP tonnes compared to the current practice using standard polyethylene films.

8.1.5 Non chemical alternatives in the soil sector

Chemical fumigant alternatives in general, like MB, have issues related to their long-term suitability for use. As mentioned above, in the EC and US, MB and most other fumigants are subject to a rigorous review that could affect future regulations over their use. Thus, consideration of sustainable, long –term alternatives and IPM programs which include non-chemical options is particularly important. Methods which avoid the use of MB, such as substrate production, grafting and resistant varieties, have gained wider adoption in the horticulture sector in particular. Recent research on these topics is available, for example:

- New resistant varieties against nematodes (*Meloidogyne* sp.) and resistant rootstocks for grafting peppers and tomatoes which may assist offset use of fumigants have been found in studies in Spain (Piedra Buena *et al*., 2006, Lopez-Perez *et al*., 2006).
- The use of grafted plants (combined with other relevant treatments) has continued to increase as a MB alternative in tomato, eggplant, melon, zucchini and other vegetable crops in Mediterranean countries, for example in Italy (Morra and Bilotto, 2005).
- The use of low-cost substrates for protected vegetables, strawberries and flowers has increased in both A5 and non-A5 countries, and also for open field crops in certain situations (e.g. Mutitu *et al.* 2006ab, Mukunya *et al.* 2006, Vos and Bridge, 2006,
- The combination of solarisation and *Trichoderma* significantly reduced soil populations of *Phytophthora cactorum* in strawberry fields and has been successful in areas never subjected to MB fumigation before (Porras *et al*., 2007).
- Solarisation is also being used as a promising alternative for treatment of fungal pathogens in flower crops in the US (McSorley *et al*, 2006).
- Advances in other non-chemical techniques continue to be made and need to be considered in any integrated program to control soilborne diseases. A recent study by Runia *et al.*, (2007), for example, presents an integrated program that has proven effective for managing fungi and nematodes affecting strawberry runners in The Netherlands.

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8.2 MBTOC Quarantine Structures and Commodities Progress Report

8.2.1 Introduction

The MBTOC 2006 Assessment Report was placed on the web in March 2007. Since that extensive report included most of the information normally included in a MBTOC Progress Report, this year the Progress Report will only discusses new matters or important highlights. The reader is referred to the MBTOC 2006 Assessment Report for further information on methyl bromide and alternatives, including Quarantine and Pre-shipment (QPS) uses (UNEP, 2007).

8.2.2 Registration Status of Methyl Bromide Alternatives used for QSC Applications

The registration news for alternatives for quarantine, structural and commodity alternatives is mixed. Several countries are reviewing the use of methyl bromide as part of its registration or re-registration processes. For example, both the European Union and the US are in process of reviewing registration of MB. The proposed regulations indicate additional restrictions on its use, beyond the production and consumption restrictions of the Montreal Protocol. In the US, there is a draft regulatory proposal available for public comment on the website of the US Environmental Protection Agency (http://www.epa.gov/oppsrrd1/reregistration/methyl_bromide/index.htm).

While progress is being made on the registration of some alternatives, in other cases, the deregistration of alternatives may increase pressure to retain the continued use of methyl bromide or even revert to methyl bromide. It is for this reason that MBTOC QSC encourages Parties and CUN applicants to consider the long term sustainability of the alternatives adopted.

For quarantine, where the use of MB has increased in some sectors, particularly in the treatment of timber and wood packaging, some progress has been made on alternatives. In Japan, sulfuryl fluoride (SF) plus methyl isothioscyanate (MITC) and methyl iodide (MI) have been registered for the treatment of timber and packaging materials for products intended for import to Japan. The Japanese government submitted these treatments for consideration for inclusion in ISPM 15 (IPPC 2006) standard for quarantine treatments of wooden packaging materials. This standard is currently a major impetus for increasing consumption of QPS methyl bromide.

In the US, a generic dose for the use of irradiation as a quarantine treatment is now allowed for any fruit and vegetable infested with class *Insecta* but not if infested with pupae or adults of *Lepidoptera*. The broad approval of the irradiation treatment for all fruits and vegetables represents a paradigm shift in the approval of quarantine treatments, since normally quarantine treatments are approved only on a specific product and pest basis. Countries wishing to use this treatment have to establish framework equivalency and inspection agreements with the US. Several countries are developing these agreements to allow greater expansion of their exports into the US.

In the European Union, following support by the Czech Republic, hydrogen cyanide (HCN) continues to be permitted for biocide use. HCN has been used in Singapore and several EU countries for the treatment of pests on aircraft and ships. HCN continues to be used as a disinfestant for both perishable and durable commodities in New Zealand, Japan and several other Asian countries

In the European Community, MB is included in review programmes under two major pieces of legislation (EC Directives) relating to the authorisation of pesticides in plant protection products and biocidal products available in the 27 countries of the EC.

(a) The EC Plant Protection Products Directive (PPPD, 91/414/EEC) covers MB used in pesticide products which aim to protect plants, mainly for soil fumigation and post-harvest treatments of plant products. A dossier covering MB's toxicological characteristics and risks has undergone a technical assessment according to the PPPD criteria (EFSA 2006). The technical assessment noted that MB is highly toxic and mutagenic and identified a number of areas where MB does not meet the requirements for approval under Directive 91/414/EEC. The report calculated that the operator exposure level (Acceptable Air Concentration, 7 hour repeated) should be 0.08ppm instead of the current level of about 1ppm. The assessment estimated that consumers could exceed (by 7-30 times) the Acceptable Daily Intake of methyl bromide residue in food, and considered that the consumer risks were unacceptable. It noted that MB residues were expected to exceed the EC regulatory limit on residues in drinking water (<0.1 µg/l) and that fish mortalities had occurred in drainage water following MB soil fumigation. The report also listed areas where necessary technical data had not been provided by the registrants (EFSA 2006). The technical assessment has undergone several stages of review to date and is in the pipeline for regulatory decision-making, which may take place in 2007. Since the technical assessment found that MB did not meet the criteria under 91/414/EEC, the expected end result is that plant protection products containing MB will be taken off the market in all EC countries in the next year or so.

(b) The EC Biocides Directive (98/8/EC) covers MB's use as a biocide product in processed food facilities, stores of cheese, meat and other non-plant products, use of MB as a rodenticide for public health purposes, and other uses that are not related to the protection of plants. MB was officially 'identified' as a biocidal active substance under Regulation 2032/2003 and as a result biocidal products containing MB had to be taken off the market in all EC countries by 1 September 2006. Also from 1 September 2006 any stockpiles of MB biocide products were not allowed to be sold or stored but must be disposed of (HSE 2006). Several requests were made for specific 'essential use' exemptions from this biocide product phase-out date (as permitted under Regulation 2032/2003) but no exemptions have been approved by the regulatory authorities to date.

The EC pesticide legislation and the ODS legislation exist side by side, so any restrictions on MB made under either piece of legislation have to be respected under EC law. Consequently, for example, the use of MB for cheese stores in the UK was not permitted after 1 September 2006 under the Biocides Directive, even though a Critical Use Exemption was authorised for cheese stores in the UK under the Montreal Protocol and EC ODS legislation (Arash 2005). Likewise, any future Critical Use Exemptions authorised under the EC ODS legislation can only be used until the date that MB is taken off the market under the Plant Protection Products Directive.

For the registration of structural alternatives, sulfuryl fluoride has achieved conditional registration for empty mills and food processing facilities in Canada. This registration allows for government supervised full site trials as a means to generate efficacy data. Additionally, a supplier of SF, has applied for SF registration in Thailand for commodities.

In the EU, new maximum residue limit of 0.01 ppm for dichlorvos have been announced. This will essentially remove the use of dichlorvos for mill and commodity treatment, including rapid disinfestations of grain at time of shipment. Use of dichlorvos, where permitted by regulation, resistance status and market preference, presents a potential alternative to methyl bromide for rapid disinfestation of bulk grain at time of export.

For commodity treatment, progress continues on the registration and deployment of faster-acting, cylinderised gas or generated forms of phosphine. Phosphine is the most widely used alternative treatment for commodities, but its slower action against pests limits its use in some specific circumstances. Most solid phosphine-generating formulations require time for evolution of the gas, but gas supplied in cylinders or by generators can reduce the time for treatment somewhat, with actual savings depending on environmental conditions, commodity and pest species. Additionally, some solid phosphine-generating formulations may also generate ammonia, which has limited its use for some commodities, particularly perishables. Registration for cylinderised phosphine has been applied for in Philippines and is in place in several other Article 5 countries.

Use of the organophosphate insecticide, pirimiphos-methyl, for commodity treatment is under review in the EU. It was used on its own or as a component of Integrated Pest Management (IPM) treatment of commodity and surface treatment in grain storage and for structural treatment in some food processing areas.

8.2.3 Update on Alternatives for Post-harvest and Structural Treatments

IPM practices are a necessary part of any modern pest control system that intends to reduce chemical use, including use of methyl bromide, and particularly toxic residues in foodstuffs. A possible biological antagonist or biocontrol agent has been identified for nearly all insect pest species infesting durable stored products (e.g. stored grains). Agents include various parasitic wasps, various insect predators and even microbiological pathogens. Intensive research has been carried out on the biology and orientation of the antagonists and their suitability for use instead of chemical products. Lepidopterous pests, such as Indianmeal moth (*Plodia interpunctella)* and the moths of the *Ephestia* group, can be controlled very effectively by use of parasitic wasps that attack eggs, larvae or pupae. Control of weevils and other beetles is more difficult, but strategies are being developed for these pests as well, and some are already in place. Certainly, biological control methods do not fully replace all chemicals in all situations but there are many appropriate circumstances where they do. Many suitable agents, e.g. *Bracon hebator*, are now available commercially in some countries. Similar considerations apply for physical control. Heat, cold, controlled atmosphere, irradiation and mechanical shock have been established as alternative approaches in various niches of the protection of stored and perishable products and these methods are slowly gaining more economic importance. The successful disinfestation of empty structures such as mills and food processing facilities with heat of about 55°C for 24 h represents a good example of the growing adoption of physical processes.

8.2.3.1 Update on Quarantine Issues

Within the last year, potato cyst nematode has been discovered in Idaho, US, a major potato-growing region. Work by state and Federal officials is in process of defining the geographical limits of this quarantined pest. The pest appears to be localized to a small area and relatively few potato fields. An eradication program is under consideration, based at least in part on use of MB fumigation over a period of several years (Vick, K. pers. comm.)

Timber Fumigation

There is little data available on the relative performance of various approved and potential alternatives for methyl bromide for ISPM 15. Several are currently under consideration. Ren (2006 and pers. comm.) found that sulphuryl fluoride, cyanogen, phosphine and carbonyl sulphide all had superior penetration to methyl bromide along the grain of dry pine timber (Table 8.1).

Table 8.1 Relative penetration of potential alternatives to methyl bromide through dry pine (along the grain) (Ren, Y. L., pers. comm.)

Sample Location (distance from ends)	Exposure time	Concentration x time (*ct*) products (g h m^{-3}) relative to methyl bromide				
(cm)	(hours)	MB	PH3	SF	C2N2	COS
Headspace	8 24	273 700	*1.5* *1.7*	*1.3* *1.5*	*0.8* *0.8*	*0.9* *0.8*
5	8 24	109 405	*3.2* *2.7*	*2.2* *1.9*	*1.7* *1.3*	*1.1* *1.1*
10	8 24	60 283	*5* *3.5*	*3* *2.7*	*2.9* *1.8*	*1.1* *1.0*
15	8 24	14 76	*18* *13*	*10* *9*	*12* *6.7*	*2.9* *3.2*

Test wood: 'Oregon', 10cm×10cm×30cm, moisture content 7.8%, temperature 25C, initial dosages 50 g m^{-3}, except phosphine (1 g m^{-3}). Figures in *italics* scaled to methyl bromide values.

Controlled Atmospheres

Since MBTOC's Assessment report in 2002, knowledge about and commercial adoption of controlled atmosphere treatment has grown considerably.

Bell and Conyers (2003) noted that modified atmospheres have the potential to kill all pests but require supplementary measures to increase their speed of action. Raised pressure or temperature can each shorten treatment times to those used in methyl bromide container fumigations. Their work concluded that tests at raised temperatures on a range of commodities have shown no unacceptable quality or shelf life effects from exposures up to 6 days at temperatures up to 45 to 55°C. One of the more susceptible commodities to heating was dried apricots, but even for these a temperature limit of 45°C was identified over a 4-day exposure in a low oxygen atmosphere. Rice was unaffected by exposure at 55°C for 6 days.

Neven (2006) and Mitcham (2006) summarized many years of research done to develop controlled atmosphere temperature treatment system (CATTS) and adjusting CA equipment for the development of CA treatments for apples and cherries. Collaborating with Guy Hallman USDA – Agriculture Research Service in Weslaco Texas, they developed treatments for codling moth, oriental fruit moth, plum curculio and western fruit fly, and learned how to avoid product quality problems that were associated with both the high temperature and high CO_2 conditions needed for pest control. Treatments were developed for cherries, apples, pears, peaches, nectarines, apricots. Neven reported that fruit quality is better than when MB fumigation is used. The methods developed for apples and pears were approved for quarantine treatment by USDA APHIS and will be raised at bilateral meetings with importers.

However, it must be noted that the development of CA treatments for perishable foods is difficult and the work in this field is not fully conclusive. Brown (2006), working in Tasmania reported the development of quarantine treatments for stored apples for shipment to Japan. Their treatment which involves temperature tempering of the cold-stored fruit before the CATTS treatment, while technically effective, was still reported to require improvements to decrease the incidence of product browning and to improve economic viability.

An improved understanding of the combination of temperature with controlled atmosphere on pest efficacy and product quality contributed to development of commercial systems with faster heat-up times and improved methods for the generation of the controlled atmospheres. Controlled atmosphere (CA) treatments are far more competitive than a few years ago. Barriers of treatment time, price, usability and availability have been lowered. A Netherlands based company has installed controlled atmosphere chambers, operated on a product lease basis, in several locations in the world. There are treatment centres in The Netherlands, Belgium, United Kingdom, Turkey, Greece, Vietnam and India (Vroom, 2006). Controlled atmosphere treatments, sometimes combined with supplementary heating, are in use for pest control for a wide variety of durable commodities, including spices, grains and cereals, pulses, dried fruit, seeds and cocoa beans. One company has installed capacity for CA treatments exceeding 400,000 tonnes of commodity annually (Bergweff, F. pers. comm.)

Irradiation

Following the publication of a generic approach to using irradiation as a quarantine disinfestation treatment for fruits and vegetables, the US announced an irradiation treatment agreement to allow the import of irradiated Indian mango that have been treated at a minimum dose of 400 Gy, have a phytosanitary certificate, and following inspection of the fruit and orchards at time of harvest. Fruit found to be infected by fungi or bacteria of medium risk quarantine concern will also be treated with anti-fungal dips (Federal Register, March 12, 2007)

Systems Approach

Systems approaches involve numerous measures to reduce or eliminate pests or pest pressure, throughout growing, harvest, packing shipping, etc, with the result that pest control can be assured without treatment, or through the use of less damaging treatments. Systems approaches are among the most difficult quarantine treatments to achieve, because they are specific to one particular region; each step in the system must be quantified and the end result of the extent of quarantine security is the same as with fumigation. A systems approach requires a much deeper knowledge of the pest(s), its conditions for growth and development, the local environmental conditions and how to mitigate pests usually without post-harvest fumigation. Several systems approaches are in place as quarantine measures; the two reviewed below have newly come to MBTOC's attention.

Johnson (2006), working with one of the most important perishable crops exported to Japan, fresh cherries, reported on a project resulting from the finding of cherries infested with codling moth by Japanese inspectors. Codling moth is a quarantine pest whose presence or possible presence results in fumigation by several importing countries. Johnson's work involved the harvesting of 10,000 cherries from each of 10 cherry orchards located near orchards of apple and pear (known to be good hosts for codling moth). Following inspection of the harvested cherries, Johnson concluded that cherries are not a host of codling moth, and a systems approach that included monitoring and the use of pheromone traps should provide sufficient control. The system approach is now being negotiated with Japan for possible use on cherry exports to Japan. Japan has previously negotiated a systems approach for cherries for New Zealand.

Leach (2006) outlined how systems approaches are used in combination with irradiation as a quarantine treatment for fruit from Queensland to New Zealand. When a systems approach is used to ensure that peach moth does not infest the fruit in the field, a lower dosage rate treatment of irradiation (150 Gy) can be used for quarantine with resulting savings and improved fruit quality.

8.2.3.2 New Potential Alternatives for Difficult MB Use Situations

In its reports, MBTOC has noted that alternatives to control pests of cheese in storage and ham in ham houses have not been found. There are two main difficulties in obtaining effective alternatives for these uses: the pests of concern are mites, which are more difficult to control; because the pests infest the food itself it is difficult to obtain registration for treatments. However, recently two papers have been submitted for publication proposing possible alternatives for control of mites in cheese and ham.

Sanchez-Ramos and Castanera (in press), have examined mite development at low temperatures finding that 7˚C stops development of mites and does not adversely affect the cheese. Cheese is typically stored at just slightly higher temperatures (around 10˚C), and therefore lowering cheese storage temperature may be a good mite control option.

Mites are also the main, but not the only, pest of concern in the production of cured pork in the US. It is a regional product, referred to as 'Southern Cured Ham'. In Spain, the production of cured ham is also very important and hams made in Spain are also subject to infestation by mites. Species of concern include: *Tyrophagus putrescentiae*, *T. longior*, *T. casei* and *Blattisocius dentriticus*. MBTOC has obtained unpublished information that indicates the treatment against mites in ham is to dip the product into melted lard and oil at 90ºC for a short time (Roca, pers comm. 2007). Cured ham facilities in Spain are reportedly sprayed with insecticides such as phenothrin, and/or tetramethrin with or without piperonyl butoxide synergist. MBTOC has no basis for comparison of these pork products, or to know if the mite species of concern are the same. However, given the difficulty in finding effective and safe methods, and in light of the US multi-state research program on this problem, MBTOC offers this information as a possible avenue for investigation.

8.2.4 Methyl Bromide Recapture Technologies Update

The RAZEM methyl bromide recapture and recycling system has been under test in 2006 (Spruyt *et al*. 2006). In one test series, 80% of methyl bromide added to an empty freight container was recovered in 30 minutes, with 99.98 % recovery in 4 hours. A pre-series version was tested in July 2007 by the Belgian authorities. About 100 kg of methyl bromide has been recaptured and recycled during the last 7 months, representing a 50% saving on normal methyl bromide use. The Belgian Federal Authority is reported to support the use of QPS methyl bromide with recovery until an equivalently effective, and more ecological gas, for quarantine has been found (Williame, E. 2007. pers comm.). It was also said that a replacement gas would also need to be recoverable. A decision has been made to build the first 8 commercial RAZEM units with capability of recovering methyl bromide from up to 200 containers per day in the port of Antwerp, by July 1, 2007 (Williame, E. 2007. pers comm.).

In the US, Value Recovery's Methyl Bromide Scrubbing System has become commercially available and has made further technical advances (Joyce, P. 2007. pers. comm.). The process uses liquid scrubbing with ammonium thiosulphate solution. A modification has been introduced that integrates the scrubber with carbon adsorption allowing for the recapture and destruction of methyl bromide vented from large systems at rates that will not interrupt current operations, e.g. from QPS chambers of 5,700 m^3, and structural fumigations of 28,000 m^3. In trials, the scrubber achieved 91% MB destruction with one pass. Value Recovery will guarantee 99% recovery and destruction, but with increased capital cost, by adding a secondary carbon adsorption unit onto the exhaust from the liquid system (Joyce, P. 2007. pers. comm.).

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9 2007 Critical Use Nominations

9.1 Evaluation of 2007 Critical Use Nominations for Methyl Bromide and Related Matters; General Considerations and Scope of the Report

This 2007 interim report provides initial evaluations by MBTOC of CUNs submitted for methyl bromide by Parties in 2007 in accordance with Decision IX/6 (Annex I). CUNs were submitted to the Ozone Secretariat by the Parties, in accordance with the timetable set out in the Annex I referred to by Decision XVI/4 (Annex II). MBTOC is reporting following a temporary schedule to ensure reports are prepared early enough to meet the meeting scheduled by Parties in this year of the 20th anniversary of the Montreal Protocol.

In late 2006, TEAP Co-Chairs announced a reorganization of MBTOC, separating it into two independent sub-committees, recognizing the differing expertise required for the two main groupings of CUNs, those relating to postharvest and structural uses and those involved with soil fumigation. MBTOC Soils (MBTOC S) has responsibility for the pre-plant uses and alternatives of methyl bromide. MBTOC Quarantine, Structures and Commodities (MBTOC QSC) has responsibility for issues concerning methyl bromide uses and alternatives for quarantine, pre-shipment, structural and commodities. Evaluations of CUNs for the two categories are reported separately below.

9.2 Critical Use Nominations for Methyl Bromide

9.2.1 Mandate

Under Article 2H of the Montreal Protocol the production and consumption (defined as production plus imports minus exports) of methyl bromide is to be phased out in Parties not operating under Article 5(1) of the Protocol, by 1 January 2005. However, the Parties agreed to a provision enabling exemptions for those uses of methyl bromide that qualify as critical. Parties established criteria, under Decision IX/6 of the Protocol, which all such uses need to meet in order to be granted an exemption. Refer to Annex 1 for a copy of Decision IX/6.

All reviews of CUNs made in 2007 are to be in accordance with the 'Annex I' referred to in Decision XVI/4. This annex also sets out the procedure and timetable for the annual review of critical use nominations. In addition to the criteria for the evaluation provided in Decision IX/6, the Parties have given further guidance for the review of CUNs in Annex 1 of MOP-16 meeting report. *Inter alia*, this requires that TEAP and MBTOC provide a clear description of why any part of a nomination is not recommended, including references to the relevant studies used as the basis for such a decision. Para. 32 emphasizes that exemptions must fully comply with Decision IX/6 and other relevant decisions, and are intended to be limited to the levels needed for critical use exemptions. These are considered as temporary derogations from the phaseout of methyl bromide in that they are to apply only until there are technically and economically feasible alternatives that meet the criteria in Decision IX/6, and that MBTOC should take a precise and transparent approach to the application of the criteria, having regard, especially, to paragraphs 4 and 20 of Annex I.

Paragraphs 4 and 20 read:

> *4. Although the burden of proof remains with the Party to justify a request for a critical-use exemption, MBTOC will provide in its report a clear explanation of its operation with respect to the process of making determinations for its recommendations, and clearly state the approach, assumptions and reasoning used in the evaluation of the critical-use nominations. When cuts or denials are proposed, the description should include citations and also indicate where*

alternatives are technically and economically feasible in circumstances similar to those in the nomination, as described in decision Ex.1/5, paragraph 8.

20. In line with paragraph 4 above, in any case in which a Party makes a nomination which relies on the economic criteria of decision IX/6, MBTOC should, in its report, explicitly state the central basis for the Party's economic argument and explicitly explain how it addressed that factor, and, in cases in which MBTOC recommends a cut; MBTOC should also provide an explanation of its economic feasibility.

9.2.2 Evaluations of CUNs – 2006 round for 2007 and 2008 exemptions

MBTOC S and MBTOC QSC subcommittees met concurrently19-23 March 2007 in Alassio, Italy. This meeting was held as required by the time schedule for considerations of CUNs given in Annex I referred to in Decision XVI/4 and in light of the advanced dates resulting from an earlier MOP this year in celebration of the 20th anniversary of the Montreal Protocol. If required, further meetings to consider further input from nominating Parties on their various CUNs will be held separately by each MBTOC sub committee in July, 2007. These meetings will produce a final report on this round of CUNs in August, 2007.

CUNs in this report relate to CUEs sought for 2008 and 2009. No nominations in this particular round were submitted for longer periods. Some nominations were for both 2008 and 2009.

MBTOC Soils made an initial assessment of the 14 critical use nominations for 2008 and 29 nominations for 2009. These totalled 1194.396 and 5843.066 metric tonnes respectively. At this time for these nominations, MBTOC has been able to recommend a total of 3183.407 tonnes, being 996.746 tonnes for 2008 and 2186.660 tonnes for 2009.

MBTOC QSC made an initial assessment of the seven new or additional critical use nominations for 2008 and nine nominations for 2009, totalling 11.535 and 529.721 metric tonnes respectively. At this time for these nominations, MBTOC has been able to recommend 3.952 tonnes for 2008 and 476.017 tonnes for 2009.

All Parties submitting nominations had done so in previous CUN rounds. The total number of nominations and nominating Parties has been reduced from about 90 nominations submitted by 14 countries in the last round, to 59 in this round with 10 being for two years. Three Parties that had CUEs in the previous round did not submit further nominations in the final round for 2008 and others submitted nominations for a reduced number of sectors. Two Parties submitted new requests (for sweet potato production and for fumigation of rodenticides/molluscicides) which had not been applied for previously by that Party. Some CUNs were for increased acreages of crop under methyl bromide treatment.

One Party met with MBTOC during the Alassio meeting for discussions with regard to their CUNs, in accordance with paragraph 8 of Annex 1 referred to in Decision XVI/4.

MBTOC has sometimes recommended quantities of MB for 2008 or 2009 different from that nominated. Grounds used for these recommendations are given in detail after the relevant CUNs in Tables 9.9 and 9.11. The adjustments follow the standard presumptions given in Tables 9.4, 9.5 and 9.10.

Some nominations were placed in the 'unable to assess' category where MBTOC found information insufficient as required under paragraph 10 of Annex 1 of the final report of MOP-16. Additionally, some nominations were placed in the 'unable to assess' category where reports were not submitted to substantiate commercial trials of alternatives; this allows

Parties additional time to conduct the trials and/or send the reports. One nomination was placed in the 'unable to assess' category awaiting cost data substantiating the inability to begin to adopt alternatives at some level. In some nominations, more information was required where a more specific characterisation of the crop varieties and system was needed, where clarification of cropping areas impacted by regulatory control (e.g. township) was necessary or when justification as to why chemical or non chemical alternatives, or MB/Pic formulations with lower amounts of MB (e.g. 50:50, 33:67), could not be used under the circumstances of the nomination.

In paragraph 20 of Annex 1 referred to in Decision XVI/4, Parties, among other things, specifically requested that MBTOC explicitly state the central basis for the Party's economic argument relating to CUNs. Tables 9.9 and 9.11 provide this information for each CUN. This information was prepared by MBTOC economists.

In general, CUNs resulted mainly from the following issues: regulatory restrictions on alternatives, scale-up of alternatives, economic issues and to a much smaller degree, the technical unavailability of alternatives. For the most part technical alternatives exist, but they may be less commercially adopted than methyl bromide. Additionally, MBTOC notes that some Parties continue to struggle with the ability to adapt previously identified alternatives to their circumstances, within their definition of economic feasibility.

As in 2006, MBTOC has been unable to identify alternatives, or has inadequate information, for CUNs relating to treatment of some cheese in storage and for dry cure pork, during curing.

9.2.3 Disclosure of Interest

MBTOC members have prepared disclosure of interest forms relating specifically to their level of national, regional or enterprise involvement for the 2007 CUN process, according to a standardised format developed by TEAP. This was required to ensure that those with a high level of involvement and interest in developing a particular nomination did not bias the process of evaluation through participation in the detailed review. The Disclosure of Interest statements are found in the Annex III to this TEAP Progress Report. As in previous rounds, some members withdrew from a particular CUN assessment or only provided technical advice on request for those nominations where a potential conflict of interest was declared.

9.2.4 MBTOC Process

Following a restructuring or refocusing of MBTOC by TEAP, the MBTOC QSC subcommittee considered the nominations relating to the use of MB for fumigation of structures and commodities. The MBTOC Soils subcommittee considered the nominations relating to the use of MB for soil fumigation. Consensus decisions were made in subcommittees. Outcomes from deliberations by the two MBTOC subcommittees were presented in plenary to allow comments from members of either subcommittees to be submitted in writing, in event of disagreement with findings of the other subcommittee, for later consideration.

Unless otherwise indicated, the most recent CUE approved by the Parties for a particular CUN was used as baseline for consideration of continuing nominations. In some instances, this quantity differed from that used as a baseline by the nominating Party. Assessments were independent of the size of the nominated quantity. Specific circumstances of each nomination were taken into account.

Standard presumptions were used by MBTOC to assess nominations and are given in the sections below.

9.2.5 Critical Use Nominations Review

In considering the CUNs submitted in 2007, as previously, both MBTOC subcommittees applied the standards contained in Annex I of the final report of MOP-16, and, where relevant, the standard presumptions given below in Tables 9.4, 9.5 and 9.10. In particular MBTOC sought to provide consistent treatment of CUNs within and between Parties while at the same time taking local circumstances into consideration, and also to provide transparency in its processes and conclusions.

In evaluating the CUNs for soil treatments, MBTOC assumed that a technically feasible alternative to MB would need to provide sufficient pest and/or weed control for continued production of that crop to existing market standards.

For commodity and structural applications, it was assumed that technically and economically feasible alternatives would provide disinfestation to a level that met the objectives of a MB treatment, e.g. meeting infestation standards in finished product from a mill, while ensuring the costs were economically feasible in the context of that nomination, to the extent that could be determined.

Technically feasible alternatives do not necessarily provide superior pest control results than are achieved in practice by MB; economically feasible alternatives do not necessarily cost the same as MB.

9.2.6 Plans to Develop, Register and Deploy Alternatives

To qualify for a CUE, Decision IX/6 in part states that Parties must demonstrate that "...an appropriate effort is being made to evaluate, commercialise and secure national regulatory approval of alternatives and substitutes, taking into consideration the circumstances of the particular nomination..." and "…must demonstrate that research programmes are in place to develop and deploy alternatives and substitutes…"

In many nominations in the 2007 round, plans to identify alternatives were often not adequate in MBTOC's opinion and future plans to phase out MB were not given. As with the 2004, 2005 and 2006 rounds, MBTOC did not use lack of phaseout plans as a basis to 'not recommend' a nomination. Appendix V summarizes the National Management Plans submitted to the Ozone Secretariat.

Several Parties did however, identify feasible alternatives and reduced their nominations to allow for phase-in of these alternatives. MBTOC did not reduce a Party's requested amount for phase-in of alternatives without technical and economic evaluation and suitable justification.

9.2.7 Fulfilment of Decision IX/6

Decision XVI/2 directed MBTOC to indicate whether all CUNs fully met the requirements of Decision IX/6. When the requirements of Decision IX/6 were met, MBTOC recommended the full amount of the request. Where some of the conditions were not fully met, MBTOC recommended a decreased amount, or was unable to assess, depending on its technical and economic evaluation. MBTOC reduced a nomination when a technical alternative was considered effective or, in a few cases, when the Party failed to show that it was not effective. In this round of CUNs, as in previous rounds, MBTOC considered answers submitted by Parties in response to questions previously sent.

MBTOC's interpretation of fulfilment of Decision IX/6, in respect to evaluating alternatives, has become more definite as time has made more information about alternatives known. Decision XVI/6 (b, iii) requires Parties to

> (iii) It is demonstrated that an appropriate effort is being made to evaluate, commercialise and secure national regulatory approval of alternatives and substitutes, taking into consideration the circumstances of the particular nomination and the special needs of Article 5 Parties, including lack of financial and expert resources, institutional capacity, and information. Non-Article 5 Parties must demonstrate that research programmes are in place to develop and deploy alternatives and substitutes. Article 5 Parties must demonstrate that feasible alternatives shall be adopted as soon as they are confirmed as suitable to the Party's specific conditions and/or that they have applied to the Multilateral Fund or other sources for assistance in identifying, evaluating, adapting and demonstrating such options;

In the past, MBTOC has found that some applicants had conducted no research and/or no commercial trials and/or did not document an effort made to evaluate alternatives. In earlier years, these applicants tended to be small operators, where research costs would have been prohibitive. MBTOC QSC has not required all applicants to conduct their own research where that would duplicate work done elsewhere. In earlier years, MBTOC QSC relied on its own knowledge to determine if alternatives would have been effective in the circumstances of the nomination.

However, as time has passed and since knowledge of alternatives is better known to applicants and Parties, MBTOC has become firmer on this aspect of Decision IX/6. Applicants and Parties are expected to conduct research and/or evaluate the research conducted by others in the circumstances of their nomination, to document that effort and submit the documents to MBTOC. Now that alternatives have been identified for most applications, the documents should take the form of reports of field trials and commercial scale up trials, directly pertinent to the circumstances of that particular nomination. Nominations were classed as 'unable to assess' where Parties did not conduct commercial trials, substantiated by reports, unless the alternative was not registered.

Economic feasibility of alternatives is also being more definitely requested. MBTOC has encountered difficulty in assessment when yield losses presented in some nominations differ markedly from those reported in a large number of studies in similar circumstances and are not substantiated by references. This further ensures that aspects of Decision IX/6 are met.

In some cases, MBTOC has proposed to Parties potential research and regulatory issues that could assist research on alternatives and phase out of MB.

9.2.8 Consideration of Stocks

One criterion for granting a critical use under Decision IX/6 is that methyl bromide for the use "is not available in sufficient quantity and quality from existing stocks of banked or recycled methyl bromide" (para 1 (b) (ii)). Parties nominating critical use exemptions are requested under decision Ex.I/4(9f) to submit an accounting framework, which provide the information on stocks. By the end of March 2007, accounting frameworks (incomplete in some cases) had been received from the following nominating Parties: Australia, Canada, European Community, Japan and the United States of America.

Parties holding stocks of MB can use these stocks for multiple purposes, not only for the purpose of critical use exemptions. Hence, determination by MBTOC of whether or not existing stocks held by a Party is 'sufficient' for critical uses is a difficult task. MBTOC has requested information from relevant Parties on the use of their stocks. However, the

information received from the Parties in this regard did not enable MBTOC to adjust the nominations to take account of reported stocks.

In accordance with decision XVIII/13(7), a summary of the data on stocks reported by the Parties in 2007 for 2006 has been summarised in Table 9.2 below. Parties may wish to consider this information in light of Decision IX/6 1(b)(ii). Table 9.1 shows the stocks data that were reported by the Parties in 2006 for 2005.

Table 9.1 Quantities of MB 'on hand' at the beginning and end of 2005, as reported by Parties in 2006 under Decision XVI/6.

Party	Critical use exemptions authorized by MOP for 2005	Quantity of MB as reported by Parties (metric tonnes)				
		Amount on hand at start of 2005	Quantity Acquired for CUEs in 2005 (production +imports)	Amount available for use in 2005	Quantity used for CUEs in 2005	Amount on hand at the end of 2005
Australia	146.600	0	114.912	114.912	114.912	0
Canada	61.792	0	48.858	48.858	45.146	3.712
EC	4,392.812	216.198	2,435.319	2,651.517	2,530.099	121.023
Israel	1,089.306	16.358	1,072.350	1,088.708	1,088.708	0
Japan	748.000	0	546.861	546.861	546.861	0
New Zealand	50.000	6.900	40.500	47.400	44.580	2.810
USA(a)	9,552.879		7,613.000	not reported	7,170.000	443.000

(a) Additional information on stocks was reported on US EPA website, September 2006: Methyl bromide inventory held by US companies: 2004 = 12,994 tonnes; 2005 = 9,974 tonnes.

Table 9.2 Quantities of MB 'on hand' at the beginning and end of 2006, as reported by Parties in 2007 under Decision XVI/6.

Party	Critical use exemptions authorized by MOP for 2006	Quantity of MB as reported by Parties (metric tonnes)				
		Amount on hand at start of 2006	Quantity acquired for CUEs in 2006 (production + imports)	Amount available for use in 2006	Quantity used for CUEs in 2006	Amount at the end of 2006
Australia	75.100	0	55.308		55.308	0
Canada	53.897	3.7	41.967	54.667	Not yet available	Not yet available
EC	3,527.030	114.953	1,472.781	1,587.734	[1,519.184](a)	[68.550](a)
Israel	880.295	-	-	-	-	-
Japan	741.400	70.735	488.810	559.545	540.207	19.338
USA	8,081.753	9,974.000(b) 443.000(c)	6,924.000	16,898.000	7,168.000(d)	7,671.000(e) 539.000(f)

(a) Preliminary data subject to update.
(b) Amount of pre-2005 stock on hand.
(c) Amount of stocks at the end of 2005 from production/imports specifically made for CUEs (acquired in 2005).
(d) The sum of 6,384 tonnes of production/imports for CUEs plus 784 tonnes used from stocks.
(e) Amount of pre-2005 stocks remaining at the end of 2006.
(f) Amount of stocks at the end of 2006 remaining from production/imports specifically made for CUEs (acquired in 2006).

9.2.9 Decisions Ex.I/4 (9d) and Decision XVII/9(10)

Decision XVII/9(10) of MOP-17 requests TEAP and its MBTOC to "report for 2005 and annually thereafter, for each agreed critical use category, the amount of methyl bromide nominated by a Party, the amount of the agreed critical use and either:

(a) The amount licensed, permitted or authorised; or
(b) The amount used"

Since 2005, there has been a progressive trend by all Parties to reduce their consumption and CUN nominations, although this has occurred at different rates. Table 9.3 below shows the amounts nominated and exempted for 'Critical Use' fopr each Party in 2008 and 2009. Appendix III shows the trends since 2005 for each nomination. The amounts licensed, authorized, permitted or used for each category of critical use are not available.

9.2.10 Rates of Adoption

In previous rounds of CUNs, the Parties have recognised that time is needed to effect phase-in of alternatives and has accepted this as a reasonable technical argument for lack of availability to the end user sensu Decision IX/6. MBTOC has used this approach in making evaluations of this round of CUNs.

Some CUNs in the 2007 round argued that time was required to allow the relevant industry to transition to available alternatives. They showed a reduction in nominated quantity requested from that of the preceding year, reflecting progressive adoption of alternatives; while others had the same or similar quantities of MB nominated to the preceding CUNs.

In several of the CUNs adoption rates were low. In some cases, alternatives at varying stages of readiness for adoption were identified in the CUN and in others they were identified by MBTOC. In cases where adoption rates indicated by the Party were considered too slow because alternatives were available and had been adopted by users in the nominated region and similar industries elsewhere, MBTOC made an assessment for uptake of such alternatives.

Data on the commercial use of soil alternatives shows that substantial adoption of alternatives in regions with similar pests and climates to those seeking CUNs has occurred within 4 years or less (e.g. many countries within the EC, Australia, USA with specific regions e.g. California).

Adoption of structural and commodity alternatives has not been linear; early adoption rates were low, in part because of the then recent registration of alternatives. In the past two years however, adoption of alternatives for commodity and structural uses has ranged from 5 – 40%, depending on the situation; the use of MB for some commodities has been completely phased out. In many countries there has been time for fumigator training, logistical changes, the building of appropriate fumigation chambers etc, and so MBTOC has expected phase-out rates in the higher ranges, unless there are registration restrictions or other issues specific to a Party's particular circumstances.

There is limited guidance and data available on what is a reasonable rate of transition to existing and available alternatives, though paragraph 35 of Annex I referred to in Decision XVI/4 states that "In situations where MBTOC recommends a nomination on grounds that it is necessary to have a period for adoption of alternatives, the basis for calculating the time period must be explained fully in the TEAP report and take fully into account the information provided by the nominating Party, the supplier, the distributor or the manufacturer. Relevant

factors for such a calculation include the number of enterprises that need to transition, e.g., the number of fumigation and pest control companies, estimated training time assuming full effort, opportunities for importing alternative equipment and expertise if not available locally, and costs involved."

In the past, where several industries have been heavily dependent on MB, e.g. strawberries, tomatoes and other vegetable crops (eg. Italy, Spain, Belgium, Portugal and other countries of the EC, Australia) almost complete adoption of alternative technologies (especially those requiring similar application technologies) has been achieved in a 3 to 4 year period. Theses regions have similar pests complexes to those requesting CUNs but may have different regulatory issues.

Improved guidance from the Parties, giving expected rates of adoption of alternatives following registration, would assist MBTOC in evaluation of CUNs in future.

In the MBTOC QSC nominations one Party has indicated that its harvest quantities of a commodity, for which a CUE is sought, have been diminished over several years as a result of global warming; as a result it has reported an inability to invest in methyl bromide alternatives.

A key transitional strategy for treatment of structures has been the use of alternatives in rotation with methyl bromide. For some CUNs related to structural treatments, reductions in MB could have been achieved, where effective alternatives were identified, by reducing the frequency of MB use. Some structural methyl bromide users have reduced frequency of fumigation by substituting alternatives for some or most of the MB fumigations. This strategy is at an early stage of trial and understanding. MBTOC QSC suggests that in these and other instances MB may only be required every 2, 3 or 4 years at most and suggests that Parties consider further reductions in MB nominated where appropriate. Accepting alternative use as part of a strategy to reduce MB fumigation may also help provide or extend user confidence and experience in alternatives.

Table 9.3 Summary of Critical Use Nomination (2005 – 2009 in part) and Exemption (2005 – 2008 in part) amounts of MB granted by Parties under the CUN/CUE process. (Note: A breakdown of CUN and CUE amounts by commodity is given in the ANNEX after 9.3)

PARTY	QUANTITIES NOMINATED					QUANTITIES APPROVED			
	Total Nomination For 2005	**Total Nomination For 2006**	**Total nominations for 2007**	**Nomination for 2008**	**Nomination for 2009**	**2005 (1ExMOP and 16MOP)**	**2006 (16MOP+ 2ExMOP+ 17MOP)**	**2007 (17MOP + 18MOP)**	**2008 (18MOP)**
Australia	206.950	81.250	52.145	52.900	38.990	146.600	75.100	48.517	48.45
Canada	61.992	53.897	46.745	42.241	34.443	61.792	53.897	52.874	36.112
European Community[6]	5754.361	4213.47	1239.873	245.000	*	4392.812	3536.755	689.142	0
Israel	1117.156	1081.506	1236.517	952.845	851.395	1089.306	880.295	966.715	0
Japan	748.000	738.700	651.700	589.600	508.900	748.000	741.400	636.172	443.775
New Zealand	53.085	53.085	32.573	0	0	50.000	42.000	18.234	0
Switzerland	8.700	7.000	0	0	0	8.700	7.000	0	0
USA	10753.997	9386.229	7417.999	6415.153	4942.227	9552.879	8081.753	6749.060	5884.283
TOTALS	**18704.24**	**15615.135**	**10677.55**	**8297.739**	**6375.955**	**16050.089**	**13418.200**	**9160.714**	**5884.283**

* Not yet available.

[1] Members of the European Community having CUNs/CUEs in 2005 – 2007 include: Belgium, France, Germany, Greece, Ireland, Italy, Latvia, Malta, Netherlands, Poland, Portugal, Spain, and the United Kingdom.

[6] Members of the European Community having CUNs/CUEs include:

2005 – Belgium, France, Germany, Greece, Italy, Netherlands, Poland, Portugal, Spain, and the United Kingdom.
2006 – Belgium, France, Germany, Greece, Ireland, Italy, Latvia, Malta, Netherlands, Poland, Portugal, Spain, and the United Kingdom.
2007 – France, Greece, Ireland, Italy, Netherlands, Poland, Spain, and the United Kingdom
2008 – Poland, Spain

9.3 Evaluation of 2007 Critical Use Nominations for Methyl Bromide and Related Matters; MBTOC Soils Interim Report – March 2007 (MBTOC-S)

9.3.1 Scope of the MBTOC - S Report

This 2007 MBTOC Soils interim report provides initial evaluations of MBTOC/TEAP on CUNs submitted by Parties in 2007, in accordance with the timetable set out in the Annex I referred to by Decision XVI/4. MBTOC has provided MB consumption figures in the 2006 Assessment Report and also provided updated tables and figures of trend lines for previous critical use exemptions in this report. This information has been reviewed in the light of management strategies previously submitted by Parties pursuant to Decision Ex.I/4 (9d).

9.3.2 Critical Use Nominations for Methyl Bromide

9.3.2.1 Evaluations of CUNs – 2006 round for 2007 and 2008 exemptions

MBTOC- Soils met 19-23 March 2007 in Alassio, Italy. If required a further meeting to consider further input from nominating Parties on their various CUNs, particularly those 'unable-to-assess' in this report, is scheduled for 9-13 July 2007 in Costa Rica. This latter meeting will produce a final report on this round of CUNs.

For pre-plant soil uses, seven Parties submitted 14 critical use nominations for 2008 and 29 nominations for 2009. These totalled 1194.396 and 5843.066 metric tonnes respectively. These Parties had submitted nominations in previous CUN rounds. The total number of nominations and nominating Parties has been reduced from about 70 nominations submitted by 14 countries in the last round, to 43 in this round with 10 being for two years. Three Parties that had CUEs in the previous round did not submit further nominations in the final round for 2008 and others submitted nominations for a reduced number of sectors. One Party submitted a new request for sweet potatoes which had not been applied for before in that country.

One Party made arrangements to meet with MBTOC Soils during the Alassio meeting for discussions with regard to their CUNs, in accordance with paragraph 8 of Annex 1 referred to in Decision XVI/4.

9.3.2.2 Consideration of alternatives

As in previous years, MBTOC used the guidance given in Annex I where ‘alternatives’ were defined as any practice or treatment that can be used in place of methyl bromide. ‘Existing alternatives’ are those alternatives in present or past use in some regions; and ‘potential alternatives’ are those alternatives in the process of investigation or development. MBTOC also used information on the suitability of alternatives for a nomination by considering the commercial adoption of alternatives in regions nominated for CUNs. Also, adoption in regions with similar climatic zone and cropping practices was used as an indication of the feasibility (technical and economic) of an alternative in a similar region. For example, 1,3-dichloropropene/chloropicrin (1,3-D/Pic), metham sodium alone or in combination with Pic, dazomet, substrates and the use of resistant varieties and grafted plants (for solanaceous crops, melons and other cucurbits) have been adopted to replace MB for a range of crops in industries applying for CUNs and in many regions where MB was once used. MBTOC was ‘unable to assess’ several nominations that did not explain or provide sufficient evidence why these major alternatives were unsuitable for the specific circumstances of a nomination.

In evaluating the CUNs for soil treatments, MBTOC assumed that a technically feasible alternative to MB would need to provide sufficient pest and/or weed control for continued production of that crop to existing market standards.

MBTOC evaluation of CUNs relating to production of strawberries, tomatoes and some other crops was assisted by information provided by a large number of published studies on MB alternatives and by a meta-analysis (TEAP 2006, Porter *et al*., 2006). The published studies provided additional transparency to MBTOC evaluations, as requested by the Parties in Decision 15/4.

In paragraph 20 of Annex 1 referred to in Decision XVI/4, Parties, inter alia, specifically requested that, in cases where a nomination relies on the economic criteria of Decision IX/6, MBTOC's report should explicitly state the central basis for the Party's economic argument relating to CUNs. Tables 9.9 provides this information for each CUN that relied on economic criteria.

9.3.2.3 Period of nominations

CUNs in this report relate to CUEs sought for 2008 and 2009. No nominations in this particular round were submitted for years following 2009. One Party, Israel, submitted nominations for both 2008 and 2009, for several crops.

9.3.2.4 Standard presumptions used in assessment of nominated quantities.

The tables below (Tables 9.4, 9.5) provide statements of standard presumptions applied by MBTOC/TEAP in assessing this round of CUNs where continued methyl bromide use is sought. These standard presumptions were first proposed in the MBTOC report of October 2005 and were presented to the Parties at MOP-17.

Presently the rates and practices adopted by MBTOC as standard presumptions are based on maximum rates considered acceptable by published literature. For soil treatments, the dosage levels of methyl bromide given in these presumptions are considered the maximum dose for almost all instances and may exceed those required for good agricultural practice in all but exceptional circumstances, particularly when used in conjunction with low gas permeability barrier films (LPBF), such as various VIF and metallised barrier films. A copy of the actual dosage rate of MB in MB/Pic formulations and those used as standard presumptions is shown in Tables 9.4 and 9.5. MBTOC is presently reviewing these guidelines to more accurately reflect feasible doses with methyl bromide/chloropicrin combinations and will present a revised set of presumptions to the MOP-19.

As in the evaluations in previous years, MBTOC considered reductions to quantities of MB in particular nominations to a standard rate per treated area where technical evidence supported its use. Although 250 kg/ ha (25g/m^2) is often used, MBTOC considers the maximum MB application rate for 98% MB to be 350 kg/ha (35 g/ m^2), in conjunction with low barrier permeability films (e.g., VIF or equivalent), combined with extended exposure periods, as effective in most circumstances when correctly applied. In cases where use of high chloropicrin-containing mixtures (approximately MB:Pic 67:33 or 50:50) is considered feasible, maximum dosage rates of 175 kg MB/ha (17.5 g/ m^2) where nutgrass is the key pest and 150 kg/ha for pathogens are regarded as reasonable and were used as the maximum standard presumptions unless there was a regulatory or technical reason indicated otherwise by the Party.

As a special case, MBTOC accepted a maximum rate of 200 kg/ ha (20 g/m^2) for certified strawberry runner production in the absence of data that showed certification standards could

be met in the circumstances of particular nominations. However, several Parties indicated that rates of 200 kg/ha (20g/m^2) or less (Table 9.6) of MB:Pic 50:50 were effective with barrier films for production of 'certified' strawberry runners and may be suitable for other propagation material. Several Parties indicated that 250 kg/ha (25g/m^2) of 98:2 were effectively used in standard commercial application.

The indicative rates used by MBTOC were maximum guideline rates, for the purpose of calculation only. MBTOC recognises that the actual rate appropriate for a specific use may vary with local circumstances, soil conditions and the target pest situation. Some nominations were based on rates lower than these indicative rates.

Table 9.4 Standard presumptions used in assessment of CUNs for the 2007 round – soil treatments.

	Comment	**CUN adjustment**	**Exceptions**
1. Dosage rates	Maximum guideline rates for MB:Pic 98:2 35 g/m^2 with barrier films (VIF or equivalent); for MB/Pic 67:33 - 15g or 17.5g MB/m^2 for pathogens and nutsedge respectively, under barrier films. All rates on a 'per treated hectare' basis.	Amount adjusted to maximum guideline rates. Maximum rates set dependent on formulation and soil type and film availability.	Higher rates accepted if specified under national legislation or where the Party had justified otherwise.
2. Barrier films	All treatments to be carried out under low permeability barrier film (e.g. VIF)	Nomination reduced proportionately to conform to barrier film use.	Where barrier film prohibited or restricted by legislative or regulatory reasons
3. MB/Pic Formulation: Pathogen control	Unless otherwise specified, MB/Pic 50:50 (or similar) was considered to be the standard effective formulation for pathogen control, as a transitional strategy to replace MB/Pic 98:2.	Nominated amount adjusted for use with MB/Pic 50:50 (or similar).	Where MB/Pic 50:50 is not registered, or chloropicrin (Pic) is not registered
4. MB/Pic Formulation: Weeds/nutgrass control	Unless otherwise specified, MB/Pic 67:33 (or similar) was used as the standard effective formulation for control of resistant (tolerant) weeds, as a transitional strategy to replace MB/Pic 98:2.	Nominated amount adjusted for use with MB/Pic 67:33 (or similar).	Where chloropicrin or chloropicrin-containing mixtures are not registered
5. Strip vs. Broadacre	Fumigation with MB and mixtures to be carried out under strip	Where rates were shown in broadacre hectares, the CUN was adjusted to the MB rate relative to strip treatment (i.e. treated area). If not specified, the area under strip treatment was considered to represent 67% of the total area.	Where strip treatment was not feasible e.g. some protected cultivation or open field production of high health propagative material

Table 9.5 Actual dosage rates applied during pre-plant fumigation when different rates and formulations of methyl bromide/chloropicrin mixtures are applied with and without barrier films. Rates of application reflect standard commercial applications rates

Commercial application rates of formulation	***MB/Pic formulation (dose of MB in g/m^2)***			
	98:2	***67:33***	***50:50***	***30:70***
A. With Standard Polyethylene Films				
400	*39.2*	*26.8*	*20.0*	*12.0*
350	*34.3*	*23.5*	*17.5*	*10.5*
300	*29.4*	*20.1*	*15.0*	*9.0*
B. With Low Permeability Barrier Films (LPBF)				
250	*24.5*	*16.8*	*12.5*	*7.5*
200	*19.6*	*13.4*	***10.0******	*6.0*
175	*17.2*	*11.8*	*8.8*	*5.3*

** Note: Trials from 1996 to 2007 (Table 9.6) show that a dosage of 10g/m^2 (eg. MB/Pic 50:50 at 200kg/ha with LP Barrier Films) is technically feasible for many situations and equivalent to the standard dosage of >20g/m^2 using standard films*

9.3.2.5 Use/Emission reduction technologies - Low permeability barrier films and dosage reduction

Decision IX/6 states in part that critical uses should be permitted only if 'all technically and economically feasible steps have been taken to minimise the critical use and any associated emission of methyl bromide'. Decision Ex.II/1 also mentions emission minimisation techniques, requesting Parties "…to ensure, wherever methyl bromide is authorised for critical-use exemptions, the use of emission minimisation techniques such as virtually impermeable films, barrier film technologies, deep shank injection and/or other techniques that promote environmental protection, whenever technically and economically feasible."

In this round, MBTOC assessed CUNs where possible for reductions in MB application rates and deployment of MB emission reduction technologies, such as use of LPBF, including VIF, or other appropriate sealing and emission control techniques including deep injection of MB, use of formulations with a lower proportion of MB and/ or reduced frequency of application.

A large number of studies under field conditions in a number of regions (Table 9.6), together with the large scale adoption of barrier films in Europe (e.g. VIF), support the use of these films as a means to reduce MB dosage rates. Controlled studies have also shown substantial reductions in MB emissions (Wang 1997, Yates 2005, Fraser *et al.,* 2006, Ou *et al.*, 2007). Research and development on low permeability barrier films (LPBF) has been summarised in the previous MBTOC Assessment Reports (MBTOC 1998, 2002, 2006). Typically, equivalent effectiveness is achieved with 25 –50% lower methyl bromide dosage applied under LPBF compared with normal polyethylene containment films (See Tables 9.5 and 9.6). Recent advancements in the cost and technical performance of barrier films, especially metallised polyethylene films have reduced cost and extended their suitability for use with methyl bromide and also some of the alternatives. Previous difficulties with sealing and gluing barrier films are no longer seen as a technical impediment to implementation of barrier films as new application technologies (i.e. glues, polyethylene edges and perforated films) have solved earlier problems.

The use of low permeability barrier films (VIF or equivalent) is compulsory in the 25 member countries of the European Union (EC Regulation 2037/2000). In other regions LPBF films are considered technically feasible and large adoption has occurred, e.g. Israel and SE USA. In Florida the reported use of barrier films in vegetable crops has expanded from 3000 acres 2005/06 to 30,000 acres in 06/07 (Allen, pers. comm.). The exception is the State of California in the US however, where a regulation currently prevents use of VIF with MB (California Code of Regulations Title 3 Section 6450(e). This regulation has been set over concerns of possible worker exposure to MB when the film is removed or when seedlings are planted due to altered flux rates of MB.

In 2003 and 2004 (TEAP 2003, 2004), MBTOC/TEAP evaluations of CUNs used conservative maximum allowable dosage rates for use with standard films and barrier films. Since then, high levels of success have been demonstrated in many countries at lower rates of methyl bromide with barrier films (Table 9.6). This information was used to set revised standard presumptions for dose rates of MB/Pic formulations that are effective in conjunction with use of barrier films.

To assist the adoption of lower dosage rates, researchers, extension specialists, fumigators and farmers need to continue to build confidence in the effectiveness of lower dosage levels and optimise the methods based on range of pests and pest pressure and type of low permeability barrier films used in the field. Practical permeabilities for barrier films are identified by suppliers and offer MB users a wider range of opportunities for lowering MB dosages.

9.3.2.6 Adjustments for standard dosage rates using MB/Pic formulations

One key transitional strategy to reduce MB dosage has been the adoption of MB:Pic formulations with lower concentrations of methyl bromide (e.g. MB:Pic 50:50 or less). These formulations are considered to be equally as effective in controlling soilborne pathogens as formulations containing higher quantities of methyl bromide (e.g. 98:2, 67:33) (e. g. Porter *et al*., 1997; Melgarejo *et al*., 2000; Lopez-Aranda *et al*., 2003; Santos *et al*., 2007). Formulations containing high proportions of chloropicrin in mixtures with methyl bromide have been adopted widely by non-Article 5 countries to meet Montreal Protocol restrictions where such formulations are registered or otherwise permitted. Their use can be achieved with similar application machinery which allows co-injection of methyl bromide and chloropicrin or by use of premixed formulations. Consistent performance has been demonstrated with both barrier (Table 9.6, Fig. 9.1) and non barrier films. Parties are urged to consider lower dosage rates, i.e., as low as 75 kg/ha of 30:70 or 100 kg/ha of 50:50 MB/Pic in conjunction with barrier films as these have shown similar effectiveness to rates of 335 to 800 kg/ha of MB 98% using standard polyethylene (Fig 9.1).

9.3.2.7 Use of disposable canisters of MB

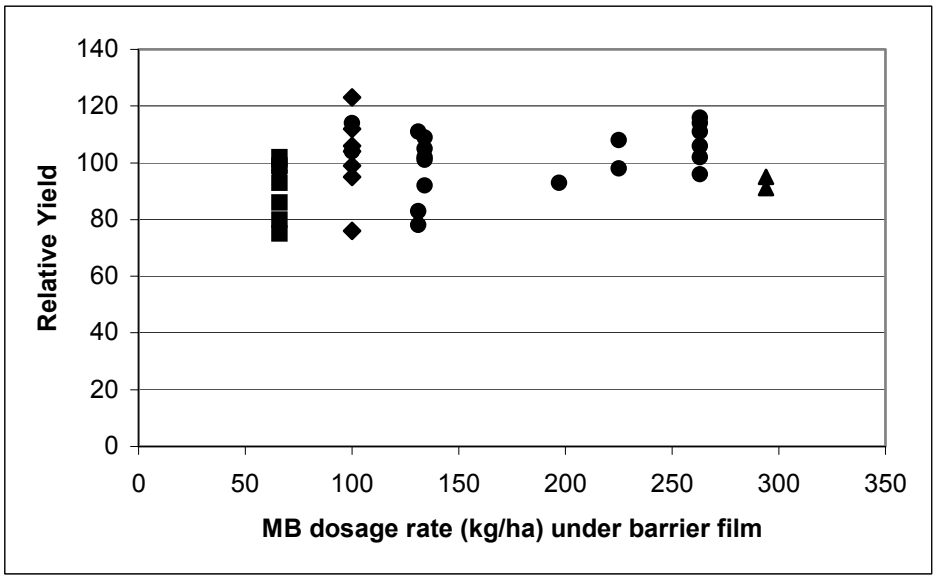
One Party still used small disposable canisters (i.e. 500 to 750g canisters) for application of MB under plastic films. This practice is not considered as effective for pathogen control as use of MB/Pic mixtures and also leads to high emissions of methyl bromide. Canisters have been eliminated in most non- Article 5 countries as they were considered dangerous. According to the Party, canisters are used because they provide small-scale farmers with an easy application method and the ability to apply targeted amounts of MB to small areas where injection machinery may be difficult to use in these circumstances.

Table 9.6 Relative effectiveness of MB/Pic formulations applied in combination with low permeability barrier films compared to the commercial standard MB/Pic formulation applied under standard low density polyethylene films

Country	Region	Commodity	Brand or Type of Barrier Film	Untreated	Methyl Bromide/Chloropicrin Mixtures (Product rate per treated area)												Notes	Reference
				Std film			Barrier Film - Relative yield compared to standard polyethylene												
				Yield	MB/Pic Formuln.	Product Rate	Not Spec	98:2	98:2	67:33	67:33	67:33	67:33	67:33	67:33	50:50	33:67	
						kg/ha	300	400	300	98	196	200	294	336	392	200	200	
MB Dosage rate (g/m2)								**392**	**294**	**66**	**131**	**134**	**197**	**225**	**263**	**100**	**66**		
Spain	Vinderos	Strawb. Runner	VIF - NotSpec	74	50:50	400											93	Fusarium, Phytophthora, Pythium, Rhizoctonia and Verticillium	De Cal et al 2004
	Navalmanzano			78	50:50	400											80		
Spain	Vinderos	Strawb. Runner	VIF - Not Spec	68	50:50	400										114	102	Fusarium, Cladosporium, Rhizoctonia	Melgarejo et al 2003
	Navalmanzano			34	50:50	400										76	75		
Spain	Avitorejo	Strawb. Fruit	VIF - Not Spec		50:50	400											97	2003 results	Lopez-Aranda et al 2003
	Malvinas				50:50	400											99		
Spain	Valencia	Strawb. Fruit	VIF - Not Spec	59	Not Spec	600	94											1998 Fusarium At 10cm & 30cm	Bartual et al 2002
				53	Not Spec	600	93											1999 results	
Spain	Avitorejo	Strawb. Fruit	VIF - Not Spec	80	67:33	400										112		Meloidogyne and weeds (unspec.)	Lopez-Aranda et al 2001a
	Tariquejo			54	67:33	400										106			
Spain	Moguer/Cartaya	Strawb. Runner	VIF - Not Spec		50:50	392										99		Inoculum not specified	Lopez-Aranda et al 2001b
Spain	Cabeza, Nav.	Strawb. Runner	VIF - Not Spec	74	67:33	400						105, 92						1998 Two sites 1999 results, nurseries	Melgarejo et al 2000
	Arevalo, Nav.			84	50:50	400										104, 104			
	Vinaderos, Nav.			49	50:50	400										95, 123		2000 results, nurseries	
Spain	Huelva	Strawb. Fruit	VIF - Not Spec	82	67:33	400						101						1997-1998 Inoc.unspecified	Lopez-Aranda et al 2000
				72	67:33	400						102						1998-1999 Inoc. Unspecified	

				68	67:33	400						109						1999-2000 Inoc. Unspecified	
Spain	Moncada	Strawb. Fruit	VIF - Not Spec	60	98:2	600			95									1998 No major pathogens but Fusarium buried 10cm&30cm.	Cebolla et al 1999
				54	98:2	600			91										
France	Douville	Strawb. Fruit	VIF - Not Spec	65	Not Spec	800		99										Inoculum not specified	Fritsch 1998
NZ	Havelock North	Strawb. Fruit	VIF - Not Spec	83	67:33	500								98				Phytophthora present	Horner 1999
USA	Florida	Pepper	VIF Plastopil	69	67:33	392					78							Nutgrass	Gilreath et al 2005
			VIF Plastopil	69	67:33	392				99								Present	
			VIF Vikase	69	67:33	392					83								
			VIF Vikase	69	67:33	392				86									
USA	Florida	Strawb Fruit, Cantaloupe	Barrier - Pliant, Metallised		98:2 67:33	Trials on 18 Commercial Farms between 2000-2004; no increase in disease or weeds when rates reduced up to 50% under VIF wrt. Polyethylene												Nutgrass and pathogens present	Noling and Gilreath 2004
USA	California	Strawb. Fruit	VIF - Not Spec	72	67:33	336								108				Inoculum not specified	Ajwa et al 2004
				80	67:33	392									96				
USA	Florida	Tomato	VIF - Not Spec	31	67:33	392					111		93		114			Nutgrass and rootknot nematodes	Hamill et al 2004
USA	California	Strawb. Fruit	VIF - Not Spec	75	67:33	392									106				Ajwa et al 2003
				83	67:33	392									111			Watsonville, high pathogen pressure	
				65	67:33	392									102				
USA	Florida	Tomato	VIF - Not Spec		67:33	392	"No significant reduction in yield"												Noling et al 2001
USA	California	Strawb. Fruit	VIF - Not Spec	45	67:33	364									116				Duniway et al 1998
USA	Florida		VIF – not spec			392/ 196													Ouet al., 2007
Unweighted averages (relative % yield)				66			94	99	93	93		102		103	108	104	91		

Figure 9.1 Relative yield of crops (strawberries, tomatoes, peppers, cantaloupes) grown under barrier films with different MB/Pic formulations compared to the standard commercial treatment using standard polyethylene from trials between 1998 and 2004



(▲MB/Pic 98:2; ● MB/Pic 67:33; ♦ MB/Pic 50:50; ■ MB/Pic 33:67). Data from Table 9.6.

9.3.2.8 Rate of adoption of alternatives

MBTOC recognises that time is needed to effect phase-in of alternatives and accepts this as a reasonable technical argument for lack of availability to the user *sensu* Decision IX/6. Some CUNs in the 2007 round argued that time was required to allow the relevant industry to transition to available effective alternatives. Some CUNs showed a reduction in nominated quantity requested from that of the preceding year, reflecting progressive adoption of alternatives; while others had the same or even slightly increased quantities of MB nominated to the preceding CUNs. Some CUNs showed slow rates of adoption. In some cases, alternatives at varying stages of readiness for adoption were identified in the CUN and in others they were identified by MBTOC. In cases where adoption rates indicated by the Party were considered too slow because alternatives were available and had been adopted by users in the nominated region and similar industries elsewhere, MBTOC made an assessment for uptake of such alternatives. Data on the commercial use of soil alternatives shows that substantial adoption of alternatives in regions with similar pests and climates to those seeking CUNs has occurred within 4 years or less (e.g. many countries within the EC, Australia, USA with specific regions e.g. California).

There is limited guidance and data available on what is a reasonable rate of transition to existing and available alternatives, though paragraph 35 of Annex I referred to in Decision XVI/4 states that "In situations where MBTOC recommends a nomination on grounds that it is necessary to have a period for adoption of alternatives, the basis for calculating the time period must be explained fully in the TEAP report and take fully into account the information provided by the nominating Party, the supplier, the distributor or the manufacturer. Relevant factors for such a calculation include the number of enterprises that need to transition, e.g., the number of fumigation and pest control companies, estimated training time assuming full effort, opportunities for importing alternative equipment and expertise if not available locally, and costs involved." Since 2004, MBTOC has requested nominating Parties to provide the

information listed in paragraph 35, for relevant CUNs, however no detailed information has been received.

In the past, where several industries have been heavily dependent on MB, e.g. strawberries, tomatoes and other vegetable crops (e.g. Italy, Spain, Belgium, Portugal and other countries of the EC, Australia) almost complete adoption of alternative technologies (especially those requiring similar application technologies) has been achieved in a 3 to 4 year period. Theses regions have similar pests complexes to those requesting CUNs but may have different regulatory issues. Improved guidance from the Parties, giving expected rates of adoption of alternatives following registration, would assist MBTOC in evaluation of CUNs in future. Rates of adoption for various uses and alternatives have been considered by the European Commission in February 2006 as part of its National Management Plan. The report states that alternative fumigants were adopted at the rate of up to 2000 ha/year in sectors such as strawberry fruit (EC 2006). Adoption was achieved in periods of about 4 years for industries that were previously dependent on MB, for example the Italian and French tomato industries, or the strawberry fruit sectors of Italy, Spain and France. A new use (sweet potato production including nurseries) was presented by Israel; the nomination was explained as arising from unprecedented expansion in the sector and is envisaged for 2 years only, whilst a feasible alternative becomes registered.

9.3.2.9 Sustainable Alternatives

In a large proportion of the remaining CUNs, the most currently appropriate alternatives are chemical fumigant alternatives, which themselves, like MB, have issues related to their long term suitability for use. In both the EC and USA, MB and most other fumigants are involved in rigorous a review that could affect future regulations over their use. MBTOC urges Parties to consider the long term sustainability of treatments adopted as alternatives to MB, to continue to adopt chemical and non-chemical alternatives for the short to medium term and to develop sustainable IPM or non-chemical approaches for the longer term. In Europe most of the sectors that had CUNs have now adopted a wide range of both chemical and non-chemical alternatives, with the exception of several sectors (e.g. strawberry fruit in Spain which has adopted primarily chemical alternatives to date). Further work to develop non-chemical options, as well as additional chemical options, is continuing in Europe and elsewhere. Decision IX/6 1(a)(ii) refers to alternatives that are ‘acceptable from the standpoint of environment and health’. MBTOC has consistently interpreted this to mean alternatives that are registered or allowed by the relevant regulatory authorities in individual CUN regions.

9.3.2.10 Frequency

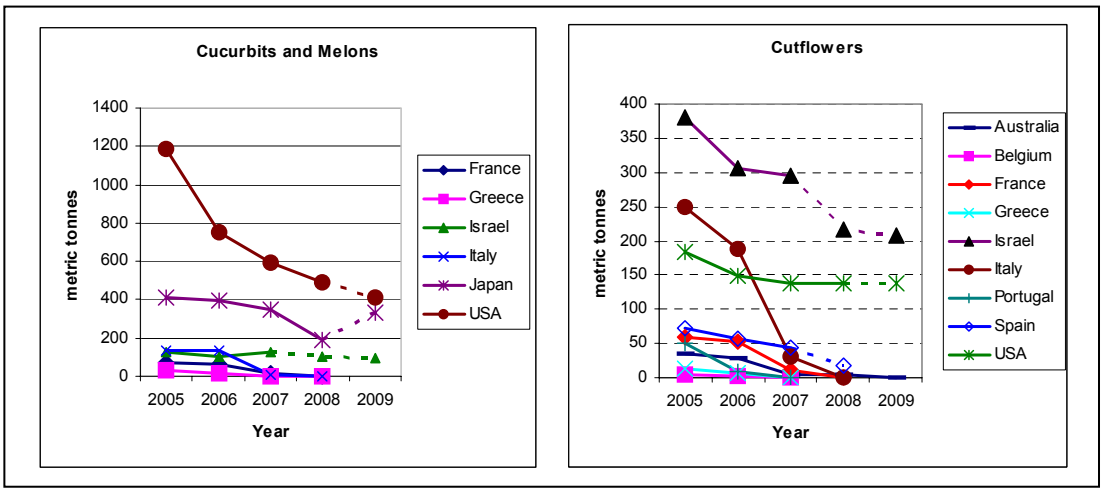
In the CUN round for 2007, reductions in MB for pre-plant soil use could be achieved in some nominations, where effective alternatives were identified, by reducing the frequency of MB fumigations. In some countries, present regulations already restrict the frequency of use of MB (e.g. to every second year) on similar crops and circumstances to those nominated by other Parties. MBTOC suggests that in these and other instances MB only be required every 2, 3 or 4 years and suggests that Parties further consider reductions where appropriate. Alternation of pest control measures may also help provide or extend user confidence and experience in alternatives. New pest control measures may also be good agricultural practice, reducing risk of development of resistance and providing control of a wider spectrum of pests.

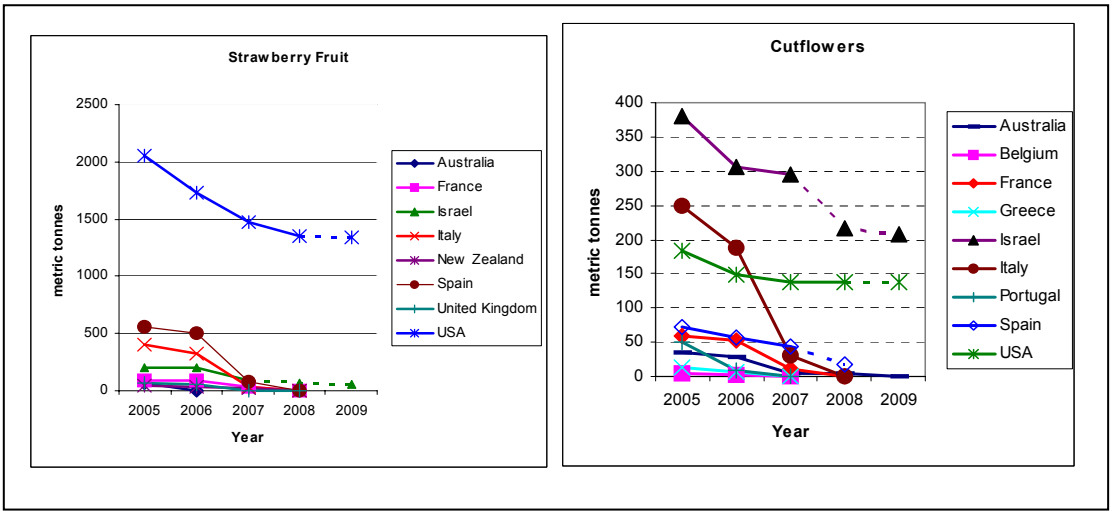
9.3.3 Decisions Ex.I/4 (9d) and Decision XVII/9 (10)

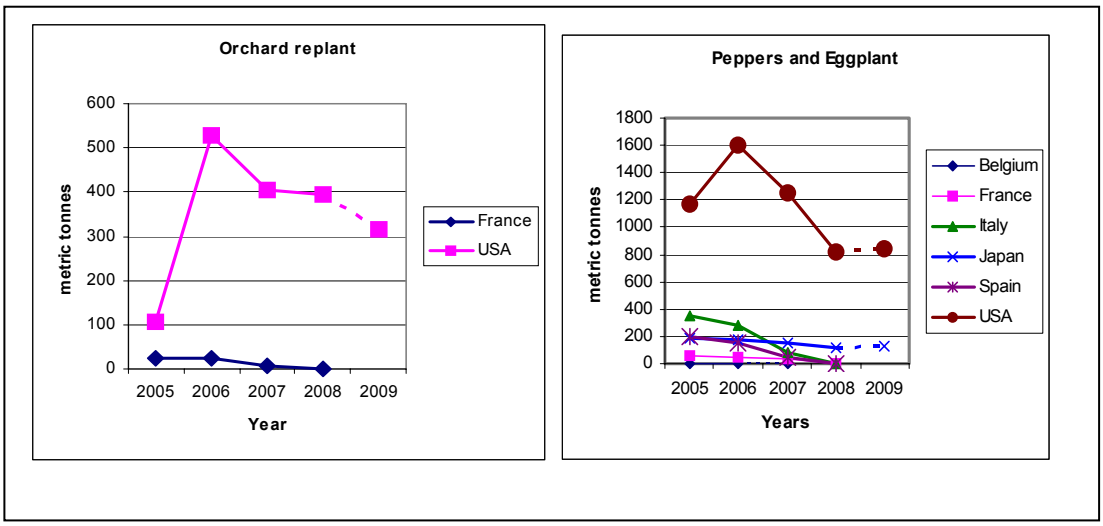
In response to Decision XVII/9 (10) of the MOP-17, MBTOC-S has reviewed, where possible, for each agreed critical use category, the amount of methyl bromide nominated by a Party, the amount of the agreed critical use and either:

Since 2005, there has been a progressive trend by all Parties to reduce their consumption and CUN nominations for pre-plant soil use, although this has occurred at different rates. Fig. 9.2 shows the trends in the reduction in amounts approved/nominated by Parties for 'Critical Use' from 2005 to 2009 in 2008 and 2009.

Figure 9.2(a-f) Amounts of MB exempted for CUE uses in pre-plant soil industries from 2005 to 2009. Solid lines indicate trend in CUE methyl bromide. Dashed lines indicate quantity of methyl bromide nominated by the party in either 2008 or 2009.







9.3.4 Interim evaluations of CUNs submitted in 2007 for 2008 or 2009

9.3.4.1 Details of evaluations

MBTOC/TEAP assessed the 43 CUNs for soils and recommended 28, with 15 placed in the 'unable to assess' category. Details of the CUN submitted and recommendations are shown in Table 9.7 – 9.9. Two CUNs were only partially recommended with portions remaining 'unable to assess'.

A total of 3183.406 tonnes of MB has been recommended, 996.746 for 2008 and 2186.660 for 2009.

Tables 9.7 and 9.8 below provide further information on nominations received for 2008 and 2009, including the number of nominations for each industry or sector, nominating Parties, amounts nominated and preliminary recommendations.

In general, CUNs resulted mainly from the following issues: regulatory restrictions on one or two specific alternatives, scale up of alternatives, and economic issues. Unusually large buffer zone restrictions on fumigant alternatives particularly limit their adoption in one Party, Israel. For the most part technical alternatives exist, but uptake of alternatives varies between countries, crops and pest pressure. As in the previous round, Parties have found alternatives for propagation materials such as strawberry runners and nurseries more difficult to adopt.

MBTOC has sometimes suggested quantities of MB for 2008 or 2009 different from those nominated. Grounds used for these changes are given in detail after the relevant CUNs in Table 9.9. The adjustments follow the standard presumptions given in Tables 9.4 and 9.5, unless indicated otherwise.

Registration of key alternatives such as 1,3-D/Pic in Israel and the recent permits for methyl iodide use in Australia and USA are expected to impact the number of future nominations and their basis may become economic rather than technical.

A number of recommendations on CUNs were not accepted by MOP-18, and this led to the full or partial restoration of the original CUN amount requested in the 2006 round. As MBTOC in most cases uses the technical information from the previous years CUE as the basis for its calculations of future nominations, it is important that Parties clearly present all technical calculations used to make adjustments to any nominations otherwise CUNs may be not assessable.

Nominations were placed in the 'unable to assess' category where MBTOC found information insufficient as required under paragraph 10 of Annex 1 of the final report of MOP-16. For example, more information was required where a more specific characterisation of the cropping system and species was needed, where clarification of cropping areas impacted by regulatory control (e.g. township) was necessary or when justification as to why chemical or non chemical alternatives, or MB/Pic formulations with lower amounts of MB (e.g. 50:50, 33:67), cannot be used under the circumstances of the nomination.

Table 9.7 Overview of CUNs received in 2007 for pre-plant soil use of Methyl Bromide (tonnes) and preliminary recommendations

Country	CUE Granted at MOP-18	2008 CUN Request	2009 CUN Request	MBTOC-S Recommendation	
				2008	2009
Australia	35.75		29.790		29.790
Canada	14.124		7.462		7.462
EC (Poland, Spain)	689.142	244.151		244.146	-
Israel	933.315	950.245	848.795	752.6 (a)	Unable to Assess
Japan	443.775		502.600		299.580
USA	4806.723		4454.419		1849.828 (a)

(a) a portion of the nominated amount is also classified as unable to assess pending further information.

Table 9.8 General Crops/Uses for MB as per CUNs submitted in 2007 for 2008 and 2009

Sector	Key Target	No of CUNs and Parties	Nominated (tonnes)	
			2008	2009
Strawberry Fruit	Fungi,Nematode (Nutsedge)	2 (US and Israel)	135.4	1461.3
Strawberry Runners	Fungi, Weeds	6 (AUS, Canada, Israel, USA, Poland, Spain)	263.7	46.1
Tomato	Nutsedge, Fungi, Nematode	1 (USA)		1246.0
Peppers	Nutsedge, Fungi, Nematode	2 (Japan, USA)		918.2
Cucurbits	Nutsedge, Fungi, Nematode	6 (Japan, Israel, USA)	106.3	758.6
Orchard Replant	Fungi, Nematode, Bacteria	1 (USA)		314.0
Sweet potatoes/potatoes (including nurseries)	Fungi, Nematode	3 (Israel, USA)	205.2	154.4
Broomrape	Parasitic Plant	1 (Israel)	250	250
Propagative Material	Fungi, Nematode	2 (USA forest nurseries, flower)		153.4
Cut Flowers	Fungi, Nematode Nutgrass (Israel)	4 (USA, Spain, Israel)	233.7	346.3
Ginger	Fungi (Pythium)	2 (Japan)		115.1
Eggplant	Nutsedge, Fungi, Nematode	1 (USA)		62.8
Research	Trials evaluating comparisons with MB	12 (1 Spain, I Japan, 11 US)	0.151	22

Table 9.9 includes all evaluations of CUNs made in the interim report on the 2007 round of nominations.

Table 9.9 Interim evaluations of CUNs for pre-plant soil use submitted in 2007 for 2008 or 2009

Country	Industry	Quantity approved for 2005 (ExMOP1 and MOP16)	Quantity approved for 2006 (MOP16+ ExMOP2+ MOP17)	Quantity approved for 2007 (MOP17+MOP 18)	Quantity approved for 2008 (MOP18)	Quantity nominated for 2008 (additional or new)	MBTOC recommend-ation for 2008 (additional or new)	Quantity nominated for 2009 (new)	MBTOC recommend-ation for 2009 (new)
Australia	Strawberry runners	35.750	37.500	35.750	35.750	None	none	29.790	29.790
	MBTOC comments: MBTOC recommends 29.79 tonnes for this use in 2009. The key pests affecting strawberry runner production are fungi (*Phytophthora, Pythium, Rhizoctonia, Verticillium*) and weeds (*S. arvensis, Agrostis tenuis, Raphanus, Poa annus, Cyperus*). The CUN states that MB/Pic 50:50 at a dose of 50 g/m^2 is required to meet certification standards. The Party's request exceeds MBTOC's standard presumption of 20 g/m2 but this rate is not currently registered. The Party is currently examining the efficacy of a rate of 125 kg/ha (12.5 g/m^2) of MB using LDPE films. The Party states that the most promising alternative, 1,3-D/Pic, is reported to have been phytotoxic due to the heavy and wet soil in cold climate growing conditions. The CUN provided recent data from specific local trials which indicated phytotoxicity in runners that resulted in a doubling of the time required before planting compared to MB, problems with weed control and inconsistent results [up to a 30% decrease in runner yields]. Other alternatives tested included MS, dazomet, PIC, steam, hot water and solarization. The Party reported that plug plants are possibly a technically feasible alternative, but that the costs associated with this technology are too high and they result in 10% lower yields than bare-rooted runners. Barrier film (VIF) initially reduced emissions 10-fold when compared with standard LDPE films, but off gassing issues when lifting tarps after 4 days posed a potential risk to workers and bystanders. The Party notes that two currently unregistered alternatives appear promising – methyl iodide and ethane dinitrile, and that methyl iodide has been granted a commercial scale up permit for 2007 to 2009. MBTOC encourages the Party to (1) expedite the use of the MB/Pic 50:50 formulation at 25 g/m2 with barrier films and (2) to expedite the registration of the two alternatives as quickly as possible.								
	MBTOC comments on economics: The nomination was not based on economic arguments. **Economic statements provided in CUN**: The CUN is based on assertion of lack of technically feasible alternatives in circumstances in Australia.								
Canada	Strawberry runners (PEI)	6.840	6.840	7.995	7.462			7.462	7.462
	MBTOC recommends 7.462 tonnes for this use in 2009. The key pests affecting strawberry runner production are weeds and nematodes. The nomination states that MB/Pic 67:33 at a dose of 500 kg/ha (50 g/m2) is required to meet the certification standards for strawberry runners. MBTOC's standard presumption is 200 kg/ha (20 g/m^2) with low permeability barrier films (LPBF) for propagative materials. The Party's request exceeds MBTOC's standard presumption; however, rates that conform with MBTOC's standard presumption are not currently registered and therefore cannot be used commercially to treat soils. The Party has indicated that in order to register the MBTOC recommended rate of 200 kg/ha (20 g/m2) with LPBF, the Pest Management Regulatory Agency would require the cooperation of the registrant and testing to demonstrate that the rate would be effective. The Party has attempted to replace MB with 1,3-D, but 1,3-D was banned in January 2003 due to groundwater contamination. Chloropicrin has recently been provisionally registered in Canada, but has yet to receive a permit from Prince Edward Island. The sector applying for the nomination has not yet trialled this alternative. Nor has the sector trialled low permeability barrier films (LPBF). MBTOC encourages the Party (1) to finalize the permits necessary for use of chloropicrin and dazomet, (2) implement the use of LPBF which are currently used worldwide and (3) in the absence of an effective alternative becoming available, conduct the necessary trials to support a lower application rate of MB to conform with MBTOC's standard presumption.								
	MBTOC comments on economics: The nomination was not based on economic arguments. **Economic statements provided in CUN**: The nomination provides no economic data. CUN is based on technical feasibility reasons.								

Country	Industry	Quantity approved for 2005 (ExMOP1 and MOP16)	Quantity approved for 2006 (MOP16+ ExMOP2+ MOP17)	Quantity approved for 2007 (MOP17+MOP 18)	Quantity approved for 2008 (MOP18)	Quantity nominated for 2008 (additional or new)	MBTOC recommend-ation for 2008 (additional or new)	Quantity nominated for 2009 (new)	MBTOC recommend-ation for 2009 (new)
Israel	Broomrape	None	none	250.000		250.000	250.000	250.000	U
	MBTOC comments: MBTOC recommends 250 tonnes for this use in 2008 and is unable to assess the nomination for 2009. The use is for broomrape eradication and land rehabilitation of 1000 ha in the Upper Galilee and the Golan Heights. A large area, 5700 ha are severely infested with this parasitic plant making it impossible to produce tomatoes in these regions. The recommended CUE is based on a dose of 250 kg/ha (25 g/m2) of MB/Pic 98:2 using LPBF. MB will be used only once in each region and the treatment is expected to bring the pathogen population below the disease threshold allowing for adoption of other alternatives. The Party has identified some alternatives for controlling low infestations of *orobanche* (e.g. sulfosulfuron, solarization) but they are considered not adequate for controlling severe infestations of *O. aegyptiaca*. Additionally, the Party expects some alternatives (1,3-D/Pic, sequential application of 1,3-D and metham sodium) to be registered and/or available in 2007or 2008 and these could impact on future nominations. MBTOC acknowledges that a registration for chloropicrin is being considered in Israel and that this would possibly allow for lower dosages of MB to be used for orobanche in the absence of other effective alternatives.								
	MBTOC comments on economics 2007: The nomination was not based on economic arguments. **Economic statements provided in CUN**: The CUN states that broomrape infestation is aggravated by the phase out of MB, as registered alternatives do not prevent area-wide infestation with the parasitic weed. The same is true for agrotechnical means, long-term fallow cropping and biological control, which in practice and in economic terms do not cope with the long-term vitality of broomrape seeds and their gradual germination mechanism. CUN also states that prospects for the registration of Imazapic are low and the manufacturer is having doubts about the cost-effectiveness of its registration, might refrain from its further development. Further, soil solarization, usually applied on intensive vegetable crops, is too expensive for extensive outdoor crops.								
Israel	Cucumber – protected	none	none	25.000		18.750	18.750	6.250	U
	MBTOC comments: MBTOC recommends 18.750 tonnes for 2008 and is unable to assess this nomination for 2009. Cucumbers are grown in open ended polyhouses in 3 cropping cycles per annum in the proximity of the residential houses of cooperative family and private family farms. A large proportion, 70%, of the critical use is concentrated in one village (Achituv), where the growers specialized for years in the cultivation of indoor cucumbers for the domestic market. For two out of the three cropping cycles, solutions were found despite the monoculture production pattern, which reflects the specialization of the growers but narrow rotations enhances the pressure from soil-borne pathogens. Additional reasons for this nomination are the appearance of a new race of a fungus, *F. oxysporum f. sp. radicis cucumerinum,* and buffer zone limitations on the use of the MS+1,3-D mixtures. The pathogen is highly virulent and the infestation level particularly high in the affected location and it could devastate entire greenhouses in a short period of time. MBTOC requested whether this was a contingency use for this pathogen, but no response has been received by the Party. MBTOC encourages the Party to consider the technical and economical feasibility of non-chemical alternatives (steam, substrates, heat, crop rotation) already in use in many parts of the world for this crop. The nominated amount is based on a dosage of 250 kg/ha (25 g/m2) of 98:2 MB/Pic in conjunction with use/ emission reduction technologies. MBTOC further encourages the Party to revise buffer zone regulations in light of the current generalized use of VIF films. The Party is requested to conduct a thorough review of the technically feasible use and economic cost of low cost substrate systems for future nominations.								
	MBTOC comments on economics 2007: The nomination was not based on economic arguments. **Economic statements provided in CUN**: The CUN states that the costs of grafted seedlings are a limiting factor because the technology in cucumbers is in its infancy in Israel. Furthermore, the CUN states that dazomet is not economically feasible due to its high prices and its low efficacy in the winter in Israel when prevailing soil temperatures are too low for its use.								

Country	Industry	Quantity approved for 2005 (ExMOP1 and MOP16)	Quantity approved for 2006 (MOP16+ ExMOP2+ MOP17)	Quantity approved for 2007 (MOP17+MOP 18)	Quantity approved for 2008 (MOP18)	Quantity nominated for 2008 (additional or new)	MBTOC recommend-ation for 2008 (additional or new)	Quantity nominated for 2009 (new)	MBTOC recommend-ation for 2009 (new)
Israel	cutflowers - bulbs - protected	303.000	240.000	220.185		163.400	114.450	155.200	U
	MBTOC comments: MBTOC recommends 114.45 tonnes for this use in 2008 and is unable to assess for 2009. The nomination is for a variety of cut flowers produced under cover, which are mainly affected by weeds (*Cyperus* in particular) and nematodes (root-knot but also ectoparasites such as *Longidorus)* and fungi. MBTOC does not recommend the use of 1.8 tonnes for fumigating substrates used in rose production as alternatives such as steam are efficient for this use. MBTOC has adjusted the amount requested for carnations grown in Ghaza to conform to the standard presumptions of 350 kg/ha (35 g/m2) of MB/Pic 98:2. *Fusarium oxysporum f.sp.* dianthi is the key pest affecting carnations in the Ghaza region. Lack of registration of key alternatives and chloropicrin mixtures continues to be the major factor restricting adoption of alternatives, which have been identified as technically feasible. MBTOC considers that adoption of substrate production is possible for lilium, calla lilies, gerberas and carnations outside the Ghaza area. A 25% transition rate has been applied for adoption of this alternative in the 104 ha grown with these crops. Steam is a technically feasible alternative for other flower types but the Party states that it is economically unfeasible (economic information provided is however insufficient). 1,3-D and metham sodium are also available and a further 25% reduction was applied for phase-in of these alternatives in those flowers not suited for substrate production. MBTOC encourages the Party to seek registration of alternatives that have been identified as promising through research such as 1,3-D/Pic and to explore different steam application methods and equipment which have proven to be economically feasible in other countries. MBTOC requests the Party to submit a new nomination for 2009 as the envisaged registration of key alternatives could impact this nomination.								
	MBTOC comments on economics: The nomination was not based on economic arguments. **Economic statements provided in CUN**: The CUN provides partial budgets for MB and the next best alternatives. The net revenue for the next best alternatives is negative in all cases. CUN also states that soil steaming and solarisation is not cost effective. Some net revenue analysis was reported in 2006 round of CUNs.								
Israel	Cutflowers - open field	77.000	67.000	74.540		53.345	44.750	53.345	U
	MBTOC comments: MBTOC recommends a reduced amount of 44.75 tonnes for this nomination in 2008 and is unable to assess for 2009. The dose of MB proposed by the Party (250 kg/ha or 25 g/m2 of 98:2 formulation) conforms with MBTOC's standard presumptions. The nomination is for open field production of cut flowers which are mainly affected by weeds (*Cyperus* in particular) and nematodes (root-knot but also ectoparasites such as Longidorus) and fungi. Lack of registration of key alternatives on flowers such as 1,3-D+Pic, dazomet and metham sodium, continue to be the major constraints affecting substitution of MB at this time. MB formulations with higher chloropicrin content are also not registered. However MBTOC estimates that, solarisation, plate steaming, substrates and the few chemical alternatives registered allow for 25% reduction in the amount nominated. This reduction is not applied to the 18.95 t requested for nurseries of geophytes where high health plant material needs to be produced, although no certification issues are involved. MBTOC encourages the Party to seek registration of alternatives identified as suitable through research. MBTOC requests the Party to submit a new nomination for 2009 as possible registration of alternatives could impact this nomination.								
	MBTOC comments on economics: The nomination was not based on economic arguments. **Economic statements provided in CUN**: The CUN states that steaming and solarization are not cost effective while the economic assessment refers the reader to the indoor flowers CUN. However the information provided in the CUN 2006 for indoor flowers is insufficient.								

Country	Industry	Quantity approved for 2005 (ExMOP1 and MOP16)	Quantity approved for 2006 (MOP16+ ExMOP2+ MOP17)	Quantity approved for 2007 (MOP17+MOP 18)	Quantity approved for 2008 (MOP18)	Quantity nominated for 2008 (additional or new)	MBTOC recommend-ation for 2008 (additional or new)	Quantity nominated for 2009 (new)	MBTOC recommend-ation for 2009 (new)
Israel	Melon - protected and field	125.650	99.400	105.000		87.500	87.500	87.500	U
	MBTOC comments: MBTOC recommends a CUE for 87.5 tonnes for this use for 2008 and is unable to assess the nomination for 2009. *Monosporascus cannonballus* is the key pathogen in the Arava Valley. *Fusarium oxysporum* f.sp. *melonis* and root-knot nematodes, mainly *M. javanica, also cause problems*. The requested amount at a rate of 250 kg/ha (25 g/m2) of 98:2 MB under barrier films (LDPF) complies with MBTOC's standard presumptions. MBTOC notes that alternatives are already used for 100% of the fall melons grown in the Arava valley and including metham sodium, dazomet, solarization, Formaldehyde+MS and 1,3-D/Pic (only in the southern Arava). The CUN is solely for the winter crop as the alternatives do not control the key pathogens and the plant back time is too short. The nominated amount has been reduced by 12% by the Party, with respect to the 2007 amount approved. MBTOC considers alternatives, such as substrates, grafting and the use of formalin + MS to be effective alternatives and notes recent studies which may assist transition to alternatives (Pivonia et al 2002, 2004). MBTOC notes that Pic and MB/Pic mixtures are effectively used for *Monosporascus* in other countries under similar conditions (eg. Stanghellini et al. 2003; Martyn 2002). The Party is requested to conduct a thorough review of the technically feasible use and economic cost of low cost substrate systems for future nominations.								
	MBTOC comments on economics: The nomination was not based on economic arguments. **Economic statements provided in CUN**: The CUN provides partial budgets for the next best alternatives. The net revenue for the next best alternatives is negative.								
Israel	Potato	239.000	165.000	137.500		93.750	93.750	75.000	U
	MBTOC recommends 93.75 tonnes of MB for this use in 2008 and is unable to assess the nomination for 2009. Potatoes are produced in a small cultivable area of the Sharon and Ghaza regions where intensive cropping of groundnuts and potato occur in the same year and infestation with fungal and bacterial pathogens, nematodes, parasitic and perennial weeds take place, some of them common to the two predominant crops: *Rhizoctonia solani, Verticillium dahliae*, root knot nematodes, mainly *Meloidogyne javanica*, common scab (*Streptomyces scabies)*, deep scab- (*Streptomyces* spp.), powdery scab (*Spongospora subterranea)*, *Orobanche* spp. and nutsedge. Volunteer potato plants in the succeeding crop may carry PVY type viruses.The Party has made a 31.8% reduction with respect to the amount approved by the MOP for 2007. The dosage rate of 250 kg/ha (25 g/m2) of MB 98:2 conforms to MBTOC's standard presumptions. The nomination however is for both seed potatoes subjected to high health standards and regular crop production which is normally achieved without MB worldwide in locations where all the pest complexes exist. The applicant identified that 550 of 15,000 ha are located in highly populated areas where winter production occurs, pathogens are high, and regulatory constraints are in place for feasible alternatives such as 1,3 D + Pic (61:35) which as a result of buffer zones prohibit their use. The party indicates that effective control alternatives are in development for the pest complexes and that they are transitioning to these. The CUN indicates that new technologies are allowing increased use of alternatives such as metham sodium and formaldehyde. MBTOC notes that there are effective alternatives but that their use is affected by buffer zones, which are larger than in other countries (for 1,3-D stated as 250m compared to 31m in USA for example). MBTOC urges the Party to consider review of these buffers in the light of use with barrier films. The continuing reduction of requested amounts of methyl bromide is an indication that this strategy is successful.								
	MBTOC comments on economics: The nomination was not based on economic arguments. **Economic statements provided in CUN**:The CUN provides no economic analysis								

Country	Industry	Quantity approved for 2005 (ExMOP1 and MOP16)	Quantity approved for 2006 (MOP16+ ExMOP2+ MOP17)	Quantity approved for 2007 (MOP17+ MOP18)	Quantity approved for 2008 (MOP18)	Quantity nominated for 2008 (additional or new)	MBTOC recommend-ation for 2008 (additional or new)	Quantity nominated for 2009 (new)	MBTOC recommend-ation for 2009 (new)
Israel	Strawberry fruit – protected (Sharon and Ghaza)	196.000	196.000	93.000	none	64.125 + 71.250 for Ghaza	U	57.000 + 67.500 for Ghaza	U
	MBTOC comments: MBTOC is unable to assess the nomination, pending further information from the Party. The key pests affecting strawberry fruit are fungi (*Rhizoctonia solani, Colletotrichum acutatum, Macrophomina phaseolina, Verticillium dahliae, Fusarium* spp.), nematodes (*Meloidogyne hapla)*, and weeds (*Cyperus rotundus,*purple nutsedge). In 2004 a fungal disease, *Macrophomina phaseolina* was newly reported in the area and is considered a major concern for the industry. The CUN states that 1,3-D/Pic is registered and has been used on part of the crop but further adoption is limited to 20% of the Sharon area by buffer zones. The Party is requested to provide technical data to quantify the impact of buffer zones. The buffer zones for 1,3-D/pic are unusually large (250m compared to 31m normally in the USA, for example), and it is desirable for these buffer zones to be examined in the light of LPBF or VIF. No other fumigant alternatives have been registered. MBTOC considers that soilless systems are effective in greenhouses, tunnels or plastic cloches (López-Medina *et al.,* 2004; Lieten, 2004; Savvas and Passam, 2002; Mutitu *et al*., 2006). Substrates have been used on a small area in this CUN, but the Party states that further uptake is limited by cost although adoption of substrates is the main strategic goal of this sector for the future after 2010. The CUN used old data on MB prices, so MBTOC requests updated information on economics, including low-cost substrate systems. MBTOC encourages the applicant to continue adopting low-cost substrate systems which are used in similar circumstances in other regions (Mutitu *et al.* 2006; Vos and Bridge, 2006; MBTOC, 2007; Sonneveld, 2004; Lieten, 2004). Substrates have been adopted at the rate of up to 80 ha/year for protected strawberry in Mediterranean climates (EC 2006). MBTOC considers that the transition to alternatives will be assisted by reducing the infection (from *Macrophomina* and other diseases) arising from nursery runner production, improved cultural practices to reduce pathogen pressure, and greater use of available resistant varieties. If dazomet is submitted for re-registration, dazomet + barrier film and dazomet + short solarisation are effective for the major pests affecting strawberry fruit in Israel, providing yields that are 92 - 108% of yields obtained with MB (Ausher, 2004; Lopez-Aranda 2001, 2003, 2004; Pietr, 2002; IR-4 2000; Yücel, 2002; TEAP 2006b). MBTOC requests the Party to provide information about plans for registering alternative chemicals and transitioning to alternatives such as low-cost substrates and combinations of resistant cultivars, registered nematicides and fungicides, cultural practices or other relevant techniques.								
	MBTOC comments on economics: The nomination was not based on economic arguments. **Economic statements provided in CUN**: CUN shows that the net revenue using MB is lower than for the alternatives. Dazomet and 1,3 D/pic provided net revenues that were 70% and 53% higher than MB at 2005 prices. CUN states that the registered chemical alternatives carry environmental costs [although this also applies to MB]. CUN also states that soilless cultures are a possibility, but not before 2010 due to the high costs of the capital-intensive versions considered in the CUN.								

Country	Industry	Quantity approved for 2005 (ExMOP1 and MOP16)	Quantity approved for 2006 (MOP16+ ExMOP2+ MOP17)	Quantity approved for 2007 (MOP17+ MOP18)	Quantity approved for 2008 (MOP18)	Quantity nominated for 2008 (additional or new)	MBTOC recommend-ation for 2008 (additional or new)	Quantity nominated for 2009 (new)	MBTOC recommend-ation for 2009 (new)
Israel	Strawberry runners (Sharon and Ghaza)	None	none	0.000		36.625	31.900	35.75	U
	MBTOC comments: MBTOC recommends a reduced CUE of 31.9 tonnes for 2008 (11.9 t for Ghaza Strip and 20 t for Sharon, Israel) and unable to assess the nomination for 2009.. The key pests affecting strawberry runner production are fungi (*Rhizotonia solani, Verticillium dahliae, Fusarium, Phytophthora, Sclerotinia sclerotiorum, Macrophomina phasoeolina)*, root knot nematodes, purple nutsedge. The Party stated that MB 98:2 at a rate of 500 kg/ha (50 g/m2) with PE and 250 kg/ha (25 g/m2) with barrier films are necessary to meet certification standards. The requested amount for the Ghaza region has been adjusted to MBTOC's standard presumption of 35 g/m2 for 98:2 MB. The Party stated that 1,3-D + PIC mixture has been the leading alternative; however, adoption of this alternative is limited by the required 250 m buffer which significantly limits its use in the Sharon strawberry nursery growing area which is heavily populated. Hot gas application method is used in the Ghaza Strip growing area because the plots are small, adjacent to houses and there are no injection tools or qualified applicators in the area. 10% of the treated area in the Ghaza strip will be tested with barrier films with a reduced application rate. MBTOC encourages faster adoption of LPBF in the Ghaza Strip. 100% of the treated area in Sharon uses barrier films (VIF).								
	MBTOC comments on economics: The nomination was not based on economic arguments. **Economic statements provided in CUN**: This CUN is based in regulatory restrictions and lack of technically feasible alternatives.								
Israel	Sweet Potatoes	None	none	none		111.5	111.5	61.25	U
	MBTOC comments: MBTOC recommends 111.5 tonnes of MB for 2008 and is unable to assess this nomination for 2009. This is a new nomination comprising both seed potato requiring high health and regular crop production. The key pests affecting sweet potatoes are root-knot nematodes, sweet potato scab (*Streptomyces ipomoea*) and *Pythium* spp. The applicant identified that MB is the only registered chemical for use for sweet potato production in Israel. The rates to be used in the CUN are consistent with MBTOC's standard presumptions under VIF. The party indicates that the only effective control alternative to MB is 1,3-D/Pic (Telopic) but this product is not currently registered for sweet potato. It is expected to receive registration by 2008. The applicant indicates that a 50% transition to this alternative by 2009 is possible and MBTOC recognizes that this is an effective rate of uptake of an alternative. MBTOC notes there are numerous nematode resistant varieties of sweet potato available and these are widely used in countries where nematodes are the primary pest problem (Bello A., pers. comm.). MBTOC suggests that the applicability of these varieties in Israel be investigated.								
	MBTOC comments on economics: The nomination was not based on economic arguments. **Economic statements provided in CUN**: Trial data shows that there may be economically feasible alternatives but these need to be verified.								

Country	Industry	Quantity approved for 2005 (ExMOP1 and MOP16)	Quantity approved for 2006 (MOP16+ ExMOP2+ MOP17)	Quantity approved for 2007 (MOP17+ MOP18)	Quantity approved for 2008 (MOP18)	Quantity nominated for 2008 (additional or new)	MBTOC recommend-ation for 2008 (additional or new)	Quantity nominated for 2009 (new)	MBTOC recommend-ation for 2009 (new)
Japan	Cucumber	88.300	88.800	72.400	51.450	none	none	61.400	34.30
	MBTOC comments: MBTOC recommends a reduced amount of 34.30 tonnes for 2009 as a transition amount making part of a 3 yr program for complete phaseout by 2011. The recommended quantity represents a 33% reduction from the CUE amount for 2008 approved at MOP-18. MBTOC has considered this nomination, which is based on the need to control particular viruses of cucumber, since 2005. Globally, such viruses are not considered as soilborne pathogens but can survive in crop debris for several years. The problem mainly arises from continuous monoculture. An integrated program including cultural practices e.g. sanitation, rotation with a non-host, removal and destruction of crop debris, cleaning and sanitation of the greenhouse and the surrounded area, and pathogen free seeds has proven very effective in similar situations around the world. The Party has indicated that rotation to non-susceptible hosts such as tomatoes and strawberries is an effective way to reduce virus incidence (Matsuo and Suga, 1993). As a transition strategy, MBTOC urges the Party to increase adoption of LPBF which allow for reducing MB doses by up to 50%. Since the last nomination the 1,3-D/Pic mixture has become registered, however, farmers fear possible phytotoxicity. MBTOC thus urges the Party to conduct trials on the correct use of this mixture in some cucumber production. MBTOC recognises the unique farming system used for cucumber in Japan which has been in place for many years. However, in many countries cucumber production has already shifted to substrates in greenhouse conditions and has become the most widely used technique for eliminating a wide array of soilborne plant pathogens. Inexpensive and simple systems (buckets, bags, etc.) are available for this kind of production and are widely used in around the world. (Leoni & Ledda, 2004; Budai, 2002; Savvas and Passam 2002; Akkaya & Ozkan, 2004; Engindeniz, 2004). The Party is encouraged to consider substrate production, which implemented correctly can produce higher yields than MB (MBTOC, 2002, 2006; Batchelor 2000, 2002; Savvas and Passam 2002). Studies conducted in Japan support soilless culture as a feasible option (Fukuda and Anami 2002, Sakuma and Suzuki 1995). MBTOC notes however that even when growing in substrates there is a critical need for a high degree of sanitation and for the use of pathogen free transplants. Large numbers of growers can be trained to use substrates systems in a short period of time as experienced in many MLF projects (UNEP/TEAP, 2004). The CUN states that the Aichi Agricultural Research Center (2005) identified the effectiveness of KGMMV control by methyl iodide in pot tests. MBTOC encourages the Party to continue to pursue the registration of methyl iodide for soil uses (methyl iodide was registered for imported timber in Japan in 2004, under JMAFF registration No. 21407).								
	MBTOC comments on economics 2007: The nomination was not based on economic arguments. **Economic statements provided in CUN**: The economic evidence provided shows a reduction in net revenue of more than 90% in capital-intensive soilless systems. As a result capital-intensive soilless culture systems are not economically feasible.								

Country	Industry	Quantity approved for 2005 (ExMOP1 and MOP16)	Quantity approved for 2006 (MOP16+ ExMOP2+ MOP17)	Quantity approved for 2007 (MOP17+ MOP18)	Quantity approved for 2008 (MOP18)	Quantity nominated for 2008 (additional or new)	MBTOC recommend-ation for 2008 (additional or new)	Quantity nominated for 2009 (new)	MBTOC recommend-ation for 2009 (new)
Japan	Ginger (field)	119.400	119.400	109.701	84.075			102.200	63.056
	MBTOC comments: MBTOC recommends 63.056 tonnes for this use in 2009 as a transition amount making part of a 4 yr program for complete phaseout by 2012. The recommended amount has been reduced 25% from the CUE approved amount for 2008 at MOP18 in 2008 as alternatives are considered available. The nomination is for control of Pythium spp. (*Pythium ultimum var. ultimum, Pythium zingiberium*) in ginger fields using MB (98:2) applied from small cans. This nomination has been submitted several times with no change in production and cultural practices to minimize disease. MBTOC conducted a field visit to Japanese open field ginger production sites in August 2006 and recognized the difficulties that growers have in adopting some alternatives, however dazomet is considered an effective alternative which is economically feasible. Difficulties in applying dazomet occur during wet and cold weather which sometimes cause phytotoxicity, unacceptable plant back times and reduced crop yields. Chloropicrin is registered in Japan but the Party states that the plant back time for chloropicrin is 40 days which could disrupt crop scheduling and result in delays in planting and lower yields compared to MB treatment. MBTOC urges the Party to encourage adoption of LPBF films and MB formulations with a higher proportion of pic which would allow for reduced rates of MB. Further, metham sodium and dazomet can be used more efficiently if drip irrigation is adopted. The Party indicates that metalaxyl combined with dazomet is highly effective for managing Pythium diseases but does not refer to cultural practices such as soil drainage, sowing date, organic amendments (Smith et al 1988) or fungicides specific to Oomycetes, such as phosphonates. MBTOC kindly requests that updated information relating to trials with alternatives and a detailed prospect for relevant fumigant\pesticide registration during 2007-2009 be submitted with any future nominations.								
	MBTOC comments on economics 2007: The nomination was not based on economic arguments. **Economic statements provided in CUN**: The CUN states that the net revenue for the next best alternative (dazomet) is negative, because of a 58% decline in yield. As a result dazomet is not economically feasible.								
Japan	Ginger (protected)	22.900	22.900	14.471	11.100			12.900	8.325
	MBTOC comments: MBTOC recommends 9.675 tonnes for this use in 2009 as a transition amount making part of a 4 yr program for complete phaseout by 2012. The recommended amount has been reduced 25% from the CUE approved amount for 2008 at MOP-18 as alternatives are considered available. The nomination is for control of *Pythium* spp. (*Pythium ultimum var. ultimum, Pythium zingiberium*) in ginger fields using MB (98:2) applied from small cans. This nomination has been submitted several times with no change in production and cultural practices to minimize disease. MBTOC conducted a field visit to Japanese open field ginger production sites in August 2006 and recognized the difficulties that growers have in adopting some alternatives, however dazomet (Basamid) is considered an effective alternative which is economically feasible. Under protected production conditions, difficulties arising with dazomet during wet, cold conditions can be overcome as moisture and temperature can be controlled in protected environments. This would make plant back times more reasonable. MBTOC therefore considers that protected ginger can implement the use of dazomet much more quickly. Chloropicrin is registered in Japan but the Party states that the plant back time for chloropicrin is 40 days which could disrupt crop scheduling and result in delays in planting and lower yields compared to MB treatment. MBTOC urges the Party to encourage adoption of LPBF films and MB formulations with a higher proportion of Pic that allow for reduced rates of MB.The CUN states that metalaxyl does not control Pythium efficiently as resistant strains to this fungicide have been reported. The Party indicates that metalaxyl combined with dazomet is highly effective for managing Pythium diseases but does not refer to cultural practices such as soil drainage, sowing date, organic amendments (Smith et al 1988) or fungicides specific to Oomycetes, such as phosphonates. MBTOC kindly requests that updated information relating to trials with alternatives and a detailed prospect for relevant fumigant\pesticide registration during 2007-2009 be submitted with future nominations.								
	MBTOC comments on economics 2007: The nomination was not based on economic arguments. **Economic statements provided in CUN**: The CUN states that the net revenue for the next best alternative (Hot water treatment) is positive but 75% less then the net revenue for MB. As a result hot water treatment is not economically feasible.								

Country	Industry	Quantity approved for 2005 (ExMOP1 and MOP16)	Quantity approved for 2006 (MOP16+ ExMOP2+ MOP17)	Quantity approved for 2007 (MOP17+ MOP18)	Quantity approved for 2008 (MOP18)	Quantity nominated for 2008 (additional or new)	MBTOC recommend-ation for 2008 (additional or new)	Quantity nominated for 2009 (new)	MBTOC recommend-ation for 2009 (new)
Japan	Melon	194.100	203.900	182.200	136.650			168.000	91.1
	MBTOC comments: MBTOC recommends a reduced amount of 91.1 tonnes for 2009 as a transition amount making part of a 3 yr program for complete phaseout by 2011. The recommended quantity represents a 33% reduction from the CUE approved amount for 2008 at MOP-18. MBTOC has considered this nomination, which is based on the need to control a particular virus of melon, since 2005. Globally, such viruses are not considered as soilborne pathogens but can survive in crop debris for several years. The problem mainly arises from continuous monoculture. An integrated program including cultural practices e.g. sanitation, rotation with a non-host, removal and destruction of crop debris, cleaning and sanitation of the greenhouse and the surrounded area, and pathogen free seeds has proven very effective in similar situations around the world. The Party has indicated that rotation to non-susceptible hosts such as tomatoes and strawberries is an effective way to reduce virus incidence (Matsuo and Suga, 1993). MBTOC urges the Party to increase adoption of LPBF which allow for reducing MB doses by up to 50%. Since the last nomination the 1,3-D/Pic mixture has become registered, however, farmers fear possible phytotoxicity. MBTOC thus urges the Party to conduct demonstration trials on the correct use of this mixture in melon production. MBTOC recognises the unique farming system used for melon in Japan which has been in place for many years. However, in many countries some melon production has already shifted to substrates in greenhouse conditions and has become the most widely used technique for eliminating a wide array of soilborne plant pathogens. Inexpensive and simple systems (buckets, bags, etc.) are available for this kind of production and are widely used in around the world. (Leoni and Ledda, 2004; Budai, 2002; Savvas and Passam 2002; Akkaya & Ozkan, 2004; Engindeniz, 2004). Substrate production, when implemented correctly can produce higher yields than MB (MBTOC, 2002, 2006; Batchelor 2000, 2002; Savvas and Passam 2002). Studies conducted in Japan support soilless culture as a feasible option (Fukuda and Anami 2002, Sakuma and Suzuki 1995). MBTOC notes however that even when growing in substrates there is a critical need for a high degree of sanitation and for the use of pathogen free transplants. Large numbers of growers can be trained to use substrates systems in a short period of time as experienced in many MLF projects (UNEP/TEAP, 2004).								
	MBTOC comments on economics 2007: The nomination was not based on economic arguments. **Economic statements provided in CUN**: The economic evidence provided states that resistant varieties (used alone) result in a 70% decrease in net revenue. The yield of the soilless culture is higher, however the unit price of the product is lower because of problems of appearance and uniformity of the fruit. As a result the gross income for this system of soilless culture is lower. In addition costs of capital-intensive soilless culture are higher hence net income is lower. As a result resistant varieties and capital-intensive soilless culture are not economically feasible.								

Country	Industry	Quantity approved for 2005 (ExMOP1 and MOP16)	Quantity approved for 2006 (MOP16+ ExMOP2+ MOP17)	Quantity approved for 2007 (MOP17+ MOP18)	Quantity approved for 2008 (MOP18)	Quantity nominated for 2008 (additional or new)	MBTOC recommend-ation for 2008 (additional or new)	Quantity nominated for 2009 (new)	MBTOC recommend-ation for 2009 (new)
Japan	Pepper (green & hot)	187.200	190.700	156.700	121.723			134.400 (inc. 0.010 t for research)	81.149 (Inc. 0.010 for research)
	MBTOC comments: MBTOC recommends a reduced amount of 81.149 tonnes for 2009 as a transition amount making part of a 3 yr program for complete phaseout by 2011. The recommended quantity represents a 33% reduction from the CUE approved amount for 2008 at MOP-18. MBTOC has considered this nomination, which is based on the need to control particular viruses of peppers, since 2005. Globally, such viruses are not considered as soilborne pathogens but can survive in crop debris for several years. The problem mainly arises from continuous monoculture. An integrated program including cultural practices e.g. sanitation, rotation with a non-host, removal and destruction of crop debris, cleaning and sanitation of the greenhouse and the surrounded area, and pathogen free seeds has proven very effective in similar situations around the world. The Party has indicated that rotation to non-susceptible hosts such as tomatoes and strawberries is an effective way to reduce virus incidence (Matsuo and Suga, 1993). MBTOC urges the Party to increase adoption of LPBF which allow for reducing MB doses by up to 50%. Since the last nomination the 1,3-D/Pic mixture has become registered, however, farmers fear possible phytotoxicity. MBTOC thus urges the Party to conduct demonstration trials on the correct use of this mixture in pepper production. MBTOC recognises the unique farming system used for peppers in Japan which has been in place for many years. However, in many countries some pepper production has already shifted to substrates in greenhouse conditions and has become the most widely used technique for eliminating a wide array of soilborne plant pathogens. Inexpensive and simple systems (buckets, bags, etc.) are available for this kind of production and are widely used in around the world. (Leoni and Ledda, 2004; Budai, 2002; Savvas and Passam 2002; Akkaya & Ozkan, 2004; Engindeniz, 2004). Substrate production, when implemented correctly can produce higher yields than MB (MBTOC, 2002, 2006; Batchelor 2000, 2002; Savvas and Passam 2002). Studies conducted in Japan support soilless culture as a feasible option (Fukuda and Anami 2002, Sakuma and Suzuki 1995). MBTOC notes however that even when growing in substrates there is a critical need for a high degree of sanitation and for the use of pathogen free transplants. Large numbers of growers can be trained to use substrates systems in a short period of time as experienced in many MLF projects (UNEP/TEAP, 2004)								
	MBTOC comments on economics 2007: The nomination was not based on economic arguments. **Economic statements provided in CUN**: The economic evidence provided shows that the higher cost of soilless culture is largely due to the higher cost of seeds, fertilizers, depreciation and miscellaneous, and is only partly offset by lower costs of pesticides and insurance in capital-intensive systems. Given these data, the net revenue for capital-intensive soilless culture is negative and hence is not economically feasible.								

Country	Industry	Quantity approved for 2005 (ExMOP1 and MOP16)	Quantity approved for 2006 (MOP16+ ExMOP2+ MOP17)	Quantity approved for 2007 (MOP17+ MOP18)	Quantity approved for 2008 (MOP18)	Quantity nominated for 2008 (additional or new)	MBTOC recommend-ation for 2008 (additional or new)	Quantity nominated for 2009 (new)	MBTOC recommend-ation for 2009 (new)
Japan	Watermelon	129.000	98.900	94.200	32.475			23.700	21.65
	MBTOC comments: MBTOC recommends a reduced amount of 21.65 tonnes for 2009. The nomination has been reduced over the CUE amount accepted by Parties at MOP-18 to allow for a 3 year transition to alternatives. MBTOC acknowledges that the Party has made a substantial reduction since the previous nomination and this reflects a marked transition to alternatives. The nomination is based on the need to control particular viruses of watermelon, since 2005. Globally, such viruses are not considered as soilborne pathogens but can survive in crop debris for several years. The problem mainly arises from continuous monoculture. An integrated program including cultural practices e.g. sanitation, rotation with a non-host, removal and destruction of crop debris, cleaning and sanitation of the greenhouse and the surrounded area, and pathogen free seeds has proven very effective in similar situations around the world. The Party has indicated that rotation to non-susceptible hosts such as tomatoes and strawberries is an effective way to reduce virus incidence (Matsuo and Suga, 1993). MBTOC urges the Party to increase adoption of LPBF which allow for reducing MB doses by up to 50%. Since the last nomination the 1,3-D/pic mixture has become registered, however, farmers fear possible phytotoxicity. MBTOC thus urges the Party to conduct trials on the correct use of this mixture in watermelon production. MBTOC recognises the unique farming system used for cucumber in Japan which has been in place for many years. However, in many countries watermelon production has already shifted to substrates in greenhouse conditions and has become the most widely used technique for eliminating a wide array of soilborne plant pathogens. Inexpensive and simple systems (buckets, bags, etc.) are available for this kind of production and are widely used in around the world. (Leoni & Ledda, 2004; Budai, 2002; Savvas and Passam 2002; Akkaya & Ozkan, 2004; Engindeniz, 2004). Substrate production, when implemented correctly can produce higher yields than MB (MBTOC, 2002, 2006; Batchelor 2000, 2002; Savvas and Passam 2002). Studies conducted in Japan support soilless culture as a feasible option (Fukuda and Anami 2002, , Sakuma and Suzuki 1995). MBTOC notes however that even when growing in substrates there is a critical need for a high degree of sanitation and for the use of pathogen free transplants. Large numbers of growers can be trained to use substrates systems in a short period of time as experienced in many MLF projects (UNEP/TEAP, 2004)								
	MBTOC comments on economics: The nomination was not based on economic arguments. The economic evidence provided shows a reduction in net revenue of more than 50%. As a result soilless culture is not economically feasible.								
Poland	Strawberry runners	40.000	40.000	24.500		12.000	11.995	none	none
	MBTOC comments: MBTOC recommends a reduced CUE of 11.995 tonnes for this nomination in 2008. The key pests affecting strawberry runner production are fungi (*Verticillium dahliae, Phytophthora cactorum, P. fragariae, Fusarium oxysporum),* and nematodes *(Globodera rostochiensis).*The nomination states that a dosage of 98:2 MB of 400 kg/ha with barrier films are needed to meet the certification standards for strawberry runners. The Party's CUN for 2008 is less than 50% of what MBTOC recommended for 2007 (24.5 t). The requested amount has been adjusted to account for the Party's inclusion of the entire amount of the formulation in their nomination instead of the MB portion only (392 kh/ha (39.2 g/m2)). The Party's request exceeds MBTOC's standard presumption of 20 g/m2 MB for propagation materials, however formulations enabling the use of these rates are currently not registered. The Party tested a reduced rate [MB/Pic 300 kg/ha (30 g/m^2) under VIF], but results indicated that plant vigor, productivity and weed control were too low in the low soil temperatures prevailing during autumn fumigation. Potentially effective alternatives such as 1,3-D & Pic and Pic alone are not currently registered. While dazomet and metham sodium are registered, their slow decomposition and long plant back time in the early spring has precluded expanded use due to production timing using currently available application equipment. Poland has recently acquired (July 2006) improved application equipment such as rotary spader machines which enhance efficiency of metam sodium and dazomet (Runia and Molendijk, 2006; Runia *et a*l. 2007). MBTOC encourages the Party to expedite the adoption of this new application equipment and encourage the registration of Pic and other fumigants if needed. .								
	MBTOC comments on economics: The nomination was not based on economic arguments. **Economic statements provided in CUN**: The Economic Analysis (page 17-18) shows 11 percent yield loss with dazomet and 80 percent loss with metam sodium when applied by traditional methods. The revenue analysis shows net revenue decrease of 54% in year 1, then 10% loss in year 2, and an increase of 7 % over MB in year 3. The increases in net revenue are due to adverse weather conditions in the first year, and is expected that Dazomet will be economically feasible in 3 years.								

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Spain	Cut flowers (Andalucia and Catalonia)	53 + 20	42 + 15	43.490		17.000	17.000	none	none
	MBTOC comments: MBTOC recommends 17 t for this use in 2008 (12t for Andalusia and 5t for Catalonia). This request represents a 60% reduction over the amount approved for 2007. The key pests are weeds, particularly *Cyperus* spp., nematodes such as *Meloidogyne* spp and in the case of carnations which make up an important proportion of the nomination, *Fusarium oxysporum* f.sp. *dianthi.* The Party states that in spite of longer plantback times being necessary when using 1,3-D/Pic and other difficulties encountered when using alternatives (e.g. higher costs and technical requirements when using substrates), full phaseout of MB will be achieved by the end of 2008.								
	MBTOC comments on economics: The nomination was not based on economic arguments. **Economic statements provided in CUN**: CUN states that 1,3-D, Telone presents economic disadvantages because of the longer waiting period, longer application period and changes required in drip irrigation systems to prevent corrosion , while 1,3-D + Chloropicrin leads to a loss of yield and steam has economic disadvantages. CUN argues that capital-intensive substrates are not economically feasible because of the cost. CUN states that substrates require high investment and increases the costs of the crop. Adoption needs a gradual process of farm modernization, and is expensive. CUN cites data that show that an investment of 270,455 € is necessary on an area of 5,000 m2, and the enterprise is unprofitable for the first five years. CUN also states that the transformation cost for the industry in Catalonia is estimated at more than 108 million € if they adopted capital-intensive soilless systems.								
Spain	Strawberry runners	230.000	230.000	230.000		215.000	215.000	none	none
	MBTOC comments: MBTOC recommends the 215 tonnes be approved for this use in 2008. The key pests affecting strawberry runner production are fungi (*Phytophthora, Rhizoctonia, Verticillium*) and weeds (*Chenopodium, Portulacca oleracea, Senecio, Solanum, Cynodon dactylon*). The Party states that MB (MB:Pic 50:50 at a dose of 300 kg/ha (30 g/m^2) is required to meet the EU Nursery Plant Certification and Control Regulations. The cold climate growing conditions of high elevation nurseries in Spain substantially limit the feasibility of alternatives (1,3-D/PIC, dazomet, MS, DMDS) to control target pests in order to meet certification standards. The Party claims that there is no technically feasible alternative available at this time. The Party's strategy to minimize MB use is to implement a stepwise reduction program. MBTOC encourages the Party to expedite the next steps in their application rate reduction program using lower MB/Pic application rates and lower MB ratio in the formulation in conjunction with LPBF and continue to pursue the registration of additional alternatives.								
	MBTOC comments on economics: The nomination was not based on economic arguments. **Economic statements provided in CUN**: The CUN provides data on the costs and net revenue of alternatives to MB, but not that of MB itself. CUN states that yields of alternatives are 14% to 16.7%% lower.								
Spain	Strawberry and Pepper	None	none	0.080	0.080	0.151	0.151	none	None
	MBTOC comments: MBTOC recommends 0.151 tonnes for research purposes. The CUN states that MB is needed as the reference treatment in the MB Alternatives National Project. In particular, studies on the environnmental effects of some fumigants applied to soils are being conducted in Spain. Spain has not submitted requests for MB for pepper and strawberry fruit production in 2008. The 29.6 kg are specifically requested for strawberry research trials, 70.56 kg for pepper research trials and 50 kg will be used in studying the environmental effects of chemical soil fumigants in soil (strawberry cultivation). These trials are part of a new triennial project to optimise use and adoption of alternatives to MB in strawberries and pepper that was approved by the party last year for the period 2006-2008.								
	MBTOC comments on economics: The nomination was not based on economic arguments. **Economic statements provided in CUN**:The CUN provides no economic information as it does not apply to the particular nature of the nomination.								

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United States	Cucurbits	1187.800	747.839	592.891	486.757			411.765 Inc. 0.941 t for research)	U
	MBTOC comments: MBTOC is unable to assess this nomination for use in 2009. The nomination refers to all cucurbit crops together, but at this point MBTOC requests the Party to disaggregate the nomination by crop (eg watermelon, melon, cucumber, zucchini, etc.). The reason is that whilst they may have common key pests, they differ in the perspective of management options. In Michigan, the key pests are Phytophthora capsici and Fusarium. MBTOC notes the Party's statement that 1,3-D + Pic may be an effective alternative but growers will miss the optimal market window due to longer plant back times. According to the Party, this treatment cannot be applied in autumn because of the bad climatic conditions. In addition, a fall application of a methyl bromide is not feasible because, over the fall and winter months deer and other animals damage the plastic and irrigation tape. In SE and Georgia, the key pest is nutsedge. Karst topography limits affects the use of alternatives which include 1,3-Dichloropropene, which are the best alternatives for these pests. The Party states that metam sodium or metam potassium are also promising alternatives but still do not provide consistent control under the circumstances of the nomination and require further trialling. In addition, the Party states that trials are underway to investigate lower MB/Pic formulations such as 50:50 as there are no regulatory restrictions to the use of these formulations. The main reasons for the nomination are soil borne fungi, and nutsedge. 1,3-D/chloropicrin may be an effective alternative but growers will miss the optimal market window (only in Michigan). The adoption of LPBF and formulation changes of MB/Pic to achieve the reductions of MB dosage were stated by the party in the past, but were not clearly demonstrated in the current CUN. Furthermore, the Party states yield losses for alternatives which do not conform with published literature. Modifications of formulations, for example of MB/Pic 50:50 are available and versions of LPBF, (eg.VIF and metalized films) have been widely tested since 2000 in the US and have shown equivalent effectiveness to MB at approximately 50% of the commercial dosage rate. The Party states that trials are underway to investigate lower MB/Pic formulations such as 50:50 as there are no regulatory restrictions to the use of these formulations. However, the party did not provide data regarding the adoption of these formulations or LPBF films on a commercial scale. The Party states that metam sodium or metam potassium are also promising alternatives but still do not provide consistent control under the circumstances of the nomination and require further trialling. In addition, the nomination for 2009 is lower that of 2008, but still is high to meet the scale of phaseout. As some answers to key questions had not been received from the Party prior to this assessment is was not assessable. Further assessment will be conducted once these have been received.								
	MBTOC comments on economics: Part of the nomination for Michigan, Maryland and Delaware were based on economic arguments. **Economic statements provided in CUN**: The CUN states next best alternative in all regions is 1,3-D with chloropicrin with expected yield losses of 6 percent in Michigan, Maryland and Delaware and 29 percent in South Eastern States and Georgia. CUN states 1,3-D with chloropicrin is considered technically feasible in Michigan. However, CUN noted that for Michigan in addition to the yield loss, delayed planting and harvest with the alternatives results in lower average price received from missed market windows and negative net revenue. In remaining regions yield losses significantly reduce net revenues. In Maryland and Delaware, 1,3-D with chloropicrin is considered technically feasible but use is constrained by water table concerns, land low soil temperatures leading to reduced yields and missed market windows. CUN notes other regions may also experience lower prices because of missed market windows.								

Country	Industry	Quantity approved for 2005 (ExMOP1 and MOP16)	Quantity approved for 2006 (MOP16+ ExMOP2+ MOP17)	Quantity approved for 2007 (MOP17+ MOP18)	Quantity approved for 2008 (MOP18)	Quantity nominated for 2008 (additional or new)	MBTOC recommend-ation for 2008 (additional or new)	Quantity nominated for 2009 (new)	MBTOC recommend-ation for 2009 (new)
United States	Eggplant (field)	76.712	81.162	85.363	66.018			62.789 (Inc. 0.433 t for research)	48.691 (Inc. 0.433 t for research)
	MBTOC comments: MBTOC recommends 48.691tonnes for this use in Georgia, Florida and Michigan in 2009 which includes 0.433 tonnes for research. The Party has stated that it based its nomination on MBTOCs standard maximum dosage rates of MB/Pic formulations of 175 kg/ha (17.5 g/m2) for nutsedge and 150 kg/ha (15 g/m2) for pathogens with adoption of LPBF and also made an adjustment for strip fumigation based on 0.58 of the area treated. The Party states that registration of a key alternative (eg. methyl iodide) is pending. In Michigan, the key pests are *Phytophthora capsici* and *fusarium*. According to the Party, *P.capsici* has been found in the irrigation water in Michigan and occurred after soil treatment with Telone C35 and metham sodium, however MBTOC considers reinfestation can occur with any fumigants, including methyl bromide. MBTOC recognizes the Party's statement that 1,3-D/chloropicrin may be an effective alternative, but growers will miss the optimal market window due to longer plant back times with this alternative. According to the Party, this treatment cannot be applied in autumn because of climatic conditions. In addition, a fall application of methyl bromide is not feasible because over the fall and winter months deer and other animals damage the plastic and irrigation tape. MBTOC considers that their are alternatives in other countries that should be considered for use in this region including grafted plants, resistant varieties and modifications to the application of 1,3-D/Pic with and without metham sodium may reduce plant back times. In Florida, the key pests are yellow and purple nutsedge, *Phytophthora*, nematodes, *Pythium* and *Sclerotinia*. In Georgia the key pests are yellow and purple nutsedge, Phytophthora, nematodes, southern blight and Pythium and sclerotinia. Karst topography limits the use of alternatives which include 1,3-dichloropropene, which are the best alternatives for these pests on 40% of the growing acreage in Florida and 8% of the acreage in Georgia. The Party claims that research on alternatives for peppers could be adopted for eggplant. The Party proposed a 7% transition in 2009 for Florida and Georgia and no transition for Michigan, and stated it will take more than 7 years to transition the full amount. MBTOC, however, considers that alternatives are available for both karst and non-karst areas in Florida and Georgia (1,3-D/Pic, Pic alone, metham with or without herbicides (napropamide, trifluralin) (Noling *et al* 2006; Chellemi *et al.* 2006; Simonne *et al.* 2006) for areas of moderate pest pressure at least. MBTOC has adjusted the nomination for these regions by 25%, which is in line with the 26% transition suggested by the Party in 2006. MBTOC requests that the Party provide further information to substantiate the lack of feasibility of some key alternatives used for eggplants in other countries, such as grafted plants and the key chemical alternatives. MBTOC notes that uptake of alternatives for this crop in regions with similar pests has occurred within 4 years or less in many countries e.g Spain, Italy, Australia. (Leoni and Leda, 2004; Spotti, 2004; Tostovrsnik et al 2005; Minuto et al, 2003; Thanassoulopoulos, 2006). MBTOC also notes that Ristaino and Johnson (1999), Babadost and Islam (2002), Johnston et al (2002), Driver and Lows (2003) , Hausbeck and Lamour (2004) and others have reported many efficient management strategies to control Phytophthora on pepper in Michigan including 3-4 years crop rotation with non susceptible hosts (carrots, beans, onions, asparagus, soybeans, alfalfa , cultural control (water management, plant density, soil amendments, protective mulch and raised beds) and use of registered fungicides in Michigan (Mefonoxan, Dimethomorph (Acrobat), Zoxamide + Mancozebe, Copper hydroxide+Acrobat). Seed treatment with Mephenoxan or metalaxyl control Phytophthora during seed germination. In tomato trials conducted in Florida on a key pest, nutsedge, 1,3-D/pic 65:35 with and without VIF and MNa/Pic provided similar yields as MB/Pic 67:33 in 3 trials over the spring and fall of 2003 and spring of 2004 (Santos, *et al*, 2005) even with moderate to severe nutsedge infestations. Recent studies continue to confirm the benefits of LPBF, (eg.VIF and metalized films) as a means to reduce emissions and dose rate of MB (Ou et al 2006). MBTOC considers that further reductions in MB amount is also possible with changes to formulations of 50:50 MB/Pic or less (e.g. to 30:70) used in combination with barrier films.								
	MBTOC comments on economics: Part of the nomination for Michigan was based on economic arguments. **Economic statements provided in CUN**: The CUN states next best alternative in all regions is 1,3-D with chloropicrin with expected yield losses of 6 percent in Michigan and 29 percent in Georgia and Florida. CUN states 1,3-D with chloropicrin is considered technically feasible in Michigan. However, CUN noted that for Michigan in addition to the yield loss, delayed planting and harvest with the alternatives results lower average price received from missed market windows and negative net revenue. In Florida and Georgia yield losses significantly reduce net revenues. CUN notes Florida and Georgia producers may also experience lower prices because of missed market windows.								

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United States	Forest nursery	192.515	157.694	122.032	131.208			125.758	U
	MBTOC comments: MBTOC is unable to assess this nomination for this use in 2009. MBTOC requires further clarification from the Party as to why alternatives in recent studies are not considered effective treatments and whether these can be used under the certification rules. In the absence of effective alternatives, MBTOC considers formulations of MB/Pic 67:33 suitable for the whole of the nomination in conjunction with barrier films and is requesting whether this combination satisfies certification requirements if required. MBTOC also considers that time is available to overcome the issues of gluing sheets. MBTOC recognizes that propagative material requires a very high level of soilborne pest and pathogen control in order to avoid widespread distribution of pests and pathogens from the nursery to the production fields. This nomination is for certified forest seedlings. This nomination is for 2% of the total forest nursery crop area. The CUN is based on economic infeasibility of use of substrates and the lack of effective alternatives for control of nutsedge and a range of fungal pathogens and nematodes. It covers certified seedling production in 6 forest nursery regions. The key alternatives are 1,3-D/Pic, 1,3-D/Pic/metam sodium, metham sodium and Pic, and dazomet as a follow-up application to 1,3-D/Pic or Pic alone. MBTOC notes that recent studies show that Pic, and metham sodium and chloropicrin have given equivalent performance to methyl bromide for pathogen control (Cram *et al*, 2007, South 2007), however dazomet has resulted in reduced seedling growth compared to MB (Enebak *et a*l., 2006 (MBAO). The Party acknowledged that Pic and MS when used in conjunction with LPBF, may provide an effective technical alternative and avoid crop injury. MBTOC recognizes that the Party stated in the 'Summary of Significant Changes' that technical problems still exist when gluing VIF for broadcast applications, however MBTOC considers that this issue should be able to be overcome. MBTOC also considers glyphosate can be used as a pre-treatment to reduce pressure from nutgrass and 1,3-D + metham sodium (or glyphosate) should be further evaluated for control of nutsedge as results in trials have been promising (Culpepper and Langston, 2004). MBTOC considers that alternatives are available and that time for transition may be required. Limited substrate production of these crops is economical for small niche markets. Frequency of fumigation is once in two to four years, depending on crop. Rotation and cover crops are not fumigated. Research is on-going to reduce rates from 98:2 MB/Pic commonly used where nutsedge populations are severe to using reduced rates of 67:33 MB/Pic. LBPF films have been conducted on a broadacre basis in Europe for many years and technology should be available to the USA. LPBF will be adopted when the effective gluing technologies are locally, commercially available.								
	MBTOC comments on economics: The nomination was not based on economic arguments. **Economic statements provided in CUN**: Partial budgets are provided for major alternatives in six regions: 1,3-D/Pic, dazomet, and metham sodium with Pic. The CUN reports yield losses of 3 to 5 percent with higher operating costs. Reported net revenue declines with these alternatives ranged from 8% to 53%. The CUN cites an analysis of the costs of containerized production that demonstrates large scale containerized production is not economically feasible.								
United States	Nurseries stock (fruit, nut, flower)	45.800	64.528	28.275	51.102			27.663 (Inc. 1.506 t for research)	16,711 and U (Inc. 1.506 t for research)
	MBTOC comments: MBTOC is unable to assess the portion of the CUN that refers to raspberries. MBTOC recommends 16.711 t for the other sectors, comprising 1.579 t for roses, 13.626 t for fruit trees and 1.506 t for research. The Party has clarified that the amount nominated for raspberry nurseries in 2009 is for 10,952 kg to be used on 47ha however, MBTOC requires information on the proportion of the raspberry nomination that is grown in Washington State and in California in order to assess this portion of the nomination. Previously, MBTOC understood that all raspberry production was in Washington and not subject to the same constraints on use of 1,3-D and MB with VIF that are present in California. It is essential to establish the percentage of the raspberry nursery production that can use 1,3-D and VIF. The nomination is for certified propagation material, which is mandatory for California and voluntary in Washington (but without certification the crop has little value and the grower risks 100% loss of the crop if nematodes or pathogens are found). 1,3-D is an approved certified nursery treatment under specific crop and soil conditions but use of this fumigant is limited by regulatory restrictions (Township Caps in CA). Limited substrate production of these crops is economical for small niche markets. Large scale use of containerization is not economical.								
	MBTOC comments on economics: The nomination was not based on economic arguments. **Economic statements provided in the CUN:** CUN states an economic analysis was not done because the alternatives are not technically feasible, particularly for certification needs and so no economic analysis were done. CUN also reports large scale use of substrates is not economically feasible.								

Country	Industry	Quantity approved for 2005 (ExMOP1 and MOP16)	Quantity approved for 2006 (MOP16+ ExMOP2+ MOP17)	Quantity approved for 2007 (MOP17+ MOP18)	Quantity approved for 2008 (MOP18)	Quantity nominated for 2008 (additional or new)	MBTOC recommend-ation for 2008 (additional or new)	Quantity nominated for 2009 (new)	MBTOC recommend-ation for 2009 (new)
United States	Orchard replant	706.176	527.600	405.400	393.720			314.007 (Inc 1.658 t for research)	U (Inc. 1.658 t for research)
	MBTOC comments: MBTOC is unable to assess this renomination at this time. The CUN is for 3 situations: Orchard/vineyard replant disorder of unknown aetiology; heavy soils or soils which cannot be dried to a sufficient depth to effectively use the reduced rates of 1,3-D now allowed in California; and areas in which Township caps prevent the use of 1,3-D. Regulatory restraints (maximum label rate) prevent the use of 1,3-D at the rates needed for effective kill of old roots and the associated pathogens in deeper soil layers for heavier (fine-textured) soils. Three alternatives,1,3-D alone and 1,3-D combined with chloropicrin or metham sodium, are available technical for treatment in light soils. Although a two year fallow was found to be effective under Mediterranean conditions by Bello, *et al* (2004), Schneider, *et al* (2004) found that a three year fallow did not sufficiently eliminate the causative nematodes. MBTOC notes and questions the large disparity between the application rates of MB/Pic 98:2 used for California Stone fruit of 204 kg/ha (20.4 g/m2), Raisin grapes 310 kg/ha (31 g/m2), Wine grapes 350 kg/ha (35 g/m2), Walnut 140 kg/ha (14 g/m2) and Almonds 123 kg/ha (12.3 g/m2) and request an explanation of this extreme spread. MBTOC considers the MB/Pic 67:33 formulation effective against both fungal pathogens and nematodes. Commercial adoption of this formulation and others containing lower amounts of MB (eg. 50:50) were used predominantly for orchard replant treatment in other countries before switching to alternatives. Results obtained with MI/Pic 50:50 mixtures (Lampinen *et al*, 2006) in California lends additional support to the efficacy of 67:33 MB/Pic (and MB/Pic 50:50 mixture) as MB and MI are quite similar. MBTOC requests the Party to provide data on the suitability of using MB/Pic 67:33 for replant disorder of Stone fruit, Raisin grapes and Wine grapes. MBTOC acknowledges that according to the renomination, low rates of MB are effective for Walnut and Almonds and requests information why these rates are deemed not effective for Stone fruit, Raisin grapes and Wine grapes.								
	MBTOC comments on economics 2007: The nomination was not based on economic arguments. **Economic statements provided in CUN:** An economic analysis was not done for this sector because most of the losses cannot be quantified. Factors that contribute to losses include delayed planting, fallow, additional use of herbicides, tree loss, replant costs to replace tree losses, loss of trees replanted, yield loss of fruit or nuts, delayed achievement of full yield potential, earlier loss of productivity of whole orchard. McKenry 1999, suggests that in some cases tree losses are likely to be greater than 20 % if replant disorders are not controlled.								
United States	Ornamentals	154.000	148.483	137.835	138.538			137.776 (Inc. 4.06 t for research)	U (Inc. 4.06 t for research)
	MBTOC comments: MBTOC is unable to assess this nomination at this time. The Party is requested to specify, to the best extent possible, the flower types and products (e.g. cut flowers, cut foliage, bulbs, cuttings, etc) needing MB, the amounts needed and the circumstances making this need critical. Further information previously requested is essential in order to fully assess the nomination. Also, the nomination needs to be disaggregated by protected and field production for each region where possible. MBTOC would also appreciate receiving an indication of the proportion of the crops already using MB and alternatives and a strategy or plan to transition to alternatives, particularly for those flower types where research has indicated that promising alternatives exist (e.g Elmore et al., 2003; Gerik, 2005 a,b,c; Gerik and Greene, 2004; McSorley et al, 2006 a,b; Gerik et al, 2006; McSorley and Wang, 2004, and others). Reasons to justify why MB:Pic formulations such as 67:33 or 50:50 are not being used (or only to a low proportion of the nominated area) are also sought.								
	MBTOC comments on economics 2007: The nomination was not based on economic arguments. **Economic statements provided in CUN:** The economic analysis show decreases in yield in California of 20% to 25% result in negative net revenues. In Florida net revenues decrease 65% to 81% because of yield losses with alternatives. In Michigan herbaceous perennials, yield losses of 25% lead to net revenue declines of 37%.								

Country	Industry	Quantity approved for 2005 (ExMOP1 and MOP16)	Quantity approved for 2006 (MOP16+ ExMOP2+ MOP17)	Quantity approved for 2007 (MOP17+ MOP18)	Quantity approved for 2008 (MOP18)	Quantity nominated for 2008 (additional or new)	MBTOC recommend-ation for 2008 (additional or new)	Quantity nominated for 2009 (new)	MBTOC recommend-ation for 2009 (new)
United States	Peppers (field)	1094.782	1243.542	1106.753	756.339			783.821 (Inc. 2.844 t for research)	548.984 (Inc. 2.844 t for research)

MBTOC comments: MBTOC recommends 548.984 t for this use in SE, Georgia, Florida and Michigan in 2009 but does not recommend use in California in 2009. The amount recommended includes 2.844 t for research. MBTOC has reduced the amounts in SE, Georgia, Florida by 25% from the amount approved for 2008 to allow for adoption of alternatives and further rate reduction by adoption of formulations of MB/Pic with lower ratios of MB in conjunction with barrier films. According to the available information, MBTOC has determined that the amounts for each region are 47.754 t for the SE, 84.072 t for Georgia, 404.137 t for Florida, 10.177 t for Michigan. The Party has stated that it based its nomination on MBTOCs standard maximum dosage rates of MB/Pic formulations of 175 kg/ha (17.5 g/m^2) for nutsedge and 150 kg/ha (15 g/m^2) for pathogens with adoption of LPBFand also made an adjustment for strip fumigation based on 0.58 of the area treated. An adjustment was also made for dosage rate for Michigan suitable for pathogens of 150 kg/ha (15 g/m^2). MBTOC noted that the area of land using MB has increased by approx 10% compared to 2008. In California, methyl bromide is requested for the control of crown and root rots caused by *Phytophthora capsici; Rhizoctonia, Verticillium*, and *Pythium*, root knot (*Meloidogyne* spp). According to the Party, metam sodium is used on nearly as many acres as MB and has been considered a viable alternative for hillsides and in areas affected by township caps, however is possibly becoming less effective because of enhanced degradation, but this is not supported by studies within the region. The Party also did not provide evidence to support infeasibility of alternatives especially metham sodium and chloropicrin and Telone. Telone/Pic is also considered an effective alternative. The key pest of peppers in Michigan is *Phytophthora capsici* and in the Southeastern United States, including Florida and Georgia, nutsedge and *P. capsici*. In Michigan, *P. capsici* has been found in the irrigation water in Michigan and occurred after soil treatment with Telone C35 and metham sodium. However MBTOC considers reinfestation can occur with any fumigants, including methyl bromide. 1,3-D/chloropicrin may be an effective alternative but the Party states growers will miss the optimal market window. According to the Party, this treatment cannot be applied in autumn because of climatic conditions. In Florida and Georgia karst topography limits the use of alternatives which include 1,3-dichloropropene, which are considered the best alternatives for these pests on 40% of the growing acreage in Florida and 8% of the acreage in Georgia. The Party in the past has stated that metam sodium or metam potassium is promising alternatives but no further data has been provided on their performance. MBTOC, however, considers that alternatives are available for both karst and non-karst areas in SE, Florida and Georgia ((Noling et al 2006; Rosskopf et al, 2005; Gilreath and Santos 2004a; Gilreath et al 2003a, 2005a; Gilreath 1999, Santos et al 2006; Chellemi et al 2004; Chellemi 2006) and can be adopted on areas of moderate pest pressure at least, and has adjusted the nomination for these regions by 25%. The Party indicated that 42% transition to alternatives was possible in these regions over a seven year period. MBTOC considered a 25% reduction possible in this year by further rate reductions of MB using formulations of MB/Pic with lower ratios of MB in conjunction with barrier films, and adoption of alternatives. It has based this reduction on the amount approved at MOP-18. (This amount reflected a further 18% transition over the Parties suggested 7% transition for 2009). The Party showed references which supported use of alternatives in combination with LDPF (Culpepper, 2006). Other studies on possible effective alternatives are avilable (Ristaino and Johnson (1999), Babadost and Islam (2002), Johnston et al (2002), Driver and Lows (2003). A combinaton of 1,3-D or metham sodium with chloropicrin + herbicides (Trifluralin, napropamide, halosulfuron, s-metalochlor) is considered as the best alternative strategy in Florida. No future indication for the use of this combination was given by the Party. Hausbeck and Lamour (2004) and others have reported many efficient management strategies to control Phytophthora on pepper, including crop rotation with non susceptible hosts (carrots, beans, onions, asparagus, soybeans, alfalfa , cultural control (water management, plant density, soil amendments, protective mulch, raised beds etc….) and use of registered fungicides (Mefonoxan, Dimethomorph (Acrobat), Zoxamide + Mancozebe, Copper hydroxide+Acrobat). Seed treatment with Mephenoxan or metalaxyl control Phytophthora during seed germination.. MBTOC notes that uptake of alternatives for this crop in regions with similar pests has occurred within 4 years or less in many countries e.g Spain, Italy, Australia. (Leoni and Leda, 2004; Spotti, 2004; Tostovrsnik et al 2005;Minuto et al, 2003). MBTOC considers that further reductions in MB amount are possible due to changes to formulations of 50:50 MB/Pic or less (e.g. to 30:70) used in combination with barrier films. The Party states that registration of a key alternative (eg. methyl iodide) is pending. MBTOC has adjusted the nomination for these regions by 25%. In 2007 the Party indicated that 42% transition to alternatives was possible in these regions over a seven year period. MBTOC considered a 25% reduction possible in this year by further rate reductions of MB using formulations of MB/Pic with lower ratios of MB in conjunction with barrier films, and adoption of alternatives. It has based this reduction on the amount approved at the

Country	Industry	Quantity approved for 2005 (ExMOP1 and MOP16)	Quantity approved for 2006 (MOP16+ ExMOP2+ MOP17)	Quantity approved for 2007 (MOP17+ MOP18)	Quantity approved for 2008 (MOP18)	Quantity nominated for 2008 (additional or new)	MBTOC recommend-ation for 2008 (additional or new)	Quantity nominated for 2009 (new)	MBTOC recommend-ation for 2009 (new)
	MOP-18. (This amount reflected a further 18% transition over the Parties suggested 7% transition for 2009). The Party showed references which supported use of alternatives in combination with LDPF (Culpepper, 2006). Other studies on possible effective alternatives are avilable (Ristaino and Johnson (1999), Babadost and Islam (2002), Johnston et al (2002), Driver and Lows (2003). A combinaton of 1,3-D or metham sodium with chloropicrin + herbicides (Clomazone, s-metalochlor) is considered as the best alternative strategy in Florida. No future indication for the use of this combination was given by the Party. Hausbeck and Lamour (2004) and others have reported many efficient management strategies to control Phytophthora on pepper, including crop rotation with non susceptible hosts (carrots, beans, onions, asparagus, soybeans, alfalfa , cultural control (water management, plant density, soil amendments, protective mulch, raised beds) and use of registered fungicides (Mefonoxan, Dimethomorph (Acrobat), Zoxamide + Mancozebe, Copper hydroxide+Acrobat). Seed treatment with Mephenoxan or metalaxyl control Phytophthora during seed germination.. MBTOC notes that uptake of alternatives for this crop in regions with similar pests has occurred within 4 years or less in many countries e.g Spain, Italy, Australia. (Leoni and Leda, 2004; Spotti, 2004; Tostovrsnik et al 2005;Minuto et al, 2003). MBTOC considers that further reductions in MB amount is possible changes to formulations of 50:50 MB/Pic or less (e.g. to 30:70) used in combination with barrier films. The Party states that registration of a key alternative (eg. methyl iodide) is pending.								
	MBTOC comments on economics: Part of the nomination for Michigan was based on economic arguments. **Economic statements provided in CUN:** The CUN states next best alternative in all regions is 1,3-D with chloropicrin with expected yield losses of 6 percent in Michigan and California and 29 percent in other regions. CUN states 1,3-D with chloropicrin is considered technically feasible Michigan. In Michigan delayed planting and harvest with the alternatives results in lower average price (7.5%) received from missed market windows, and negative net revenue. In remaining regions yield losses significantly reduce net revenues.								

Country	Industry	Quantity approved for 2005 (ExMOP1 and MOP16)	Quantity approved for 2006 (MOP16+ ExMOP2+ MOP17)	Quantity approved for 2007 (MOP17+ MOP18)	Quantity approved for 2008 (MOP18)	Quantity nominated for 2008 (additional or new)	MBTOC recommend-ation for 2008 (additional or new)	Quantity nominated for 2009 (new)	MBTOC recommend-ation for 2009 (new)
United States	Strawberry (field)	2052.846	1730.778	1476.019	1349.575			1336.754 (Inc. 2.377 t for research)	204.765 for SE and U for CA (Inc. 2.377 t for research)
	MBTOC comments: MBTOC recommends 70.088 tonnes for Eastern USA and 132.300 tonnes for Florida and 2.377 tonnes for research, but is unable to fully assess the amount for California. MBTOC is awaiting clarification of feasible rates of adoption of alternatives and updated economic information. The BUNNIE assumed a yield loss of 14% which is not explained in the CUN and appears to contradict the quantitative data presented in the CUN (which indicated that specific alternative treatments provide equal or higher yields compared to MB). For California the Party nominated 1,064,556 kg for 2009 (5452 ha at 195 kg/ha (19.5 g/m^2)). The nomination is based on the grounds that township caps and county restrictions limit further adoption of 1,3-D and pic, hilly terrain prevents the use of drip-applied alternatives, and economic issues result from longer set-up or treatment times. In the case of township caps, alternatives that do not contain 1,3-D (such as Pic, Pic EC, Pic + metham, Pic + dazomet, often with LPBF) provide yields that are statistically comparable with MB (Ajwa et al. 2002, 2003, 2004, 2005; Nelson et al. 2001ab; Shem-Tov et al. 2005, 2006ab). Pic EC provided an average 99% yield compared to MB, with low variance (studies cited in TEAP 2006). Alternatives based on 1,3-D, pic and metam were commercially adopted on about 5000 ha by 2004, and the annual adoption rate was 860ha/year in 2003-4. MBTOC considers hilly terrain can use pressure-compensated drip systems or injection in some cases and alternatives can be adopted on areas that are not restricted by limits on 1,3-D and pic. The Party is requested to quantify the regions that can and cannot use 1,3-D and pic to assist in determining whether the regulatory ceiling has been reached. MBTOC plans to adjust the remaining portion for 50:50 formulations (90% broadacre @ 193 kg/ha (19.3 g/m^2; 10% strip @ 143 kg/ha (14.3 g/m^2)). LPBF cannot be used with MB in California. For Eastern states the Party nominated 93,488 kg (534 ha @ 175 kg/ha (17.5 g/m^2)). The nomination is based on moderate to severe pest pressure (*Meloidogyne* spp., *Pythium, Rhizoctonia, Phytophthora cactorum, Cyperus esculentus, C. rotundus*, *Lolium* spp.) affecting 33% of the crop area, and small farm buffer zones on 40% of the area which affects use of 1,3-D formulations. MBTOC considers that alternatives are available for part of the CUN area (on both buffer and non buffer areas) by use of combinations of 1,3-D, pic, metham with herbicides and/or (Ferguson et al. 2001; Sydorovych et al. 2004; Driver et al. 2005; López-Aranda et al. 2005; Norton et al. 2002; Gilreath et al. 2003c; studies cited in TEAP 2006). MBTOC accordingly reduced the nomination by 23.372 tonnes (about 25%) to allow for transition to alternatives and MB dose adjustment to 150 kg/ha for the areas of low nutsedge pressure affected by buffer zones (allowing 175 kg/ha for the high pest pressure areas). However MBTOC notes that the Eastern states planned to implement MB/Pic mixtures with lower dosage rate formulations of MB/Pic in combination with LPBF in the previous nomination (US CUN 06). For Florida the Party nominated 176,333 kg (1008 ha @ 175 kg/ha (17.5 g/m^2)). The nomination is based on the grounds that currently available alternatives are not able to control moderate-severe nutsedge (33% of area), 1,3-D is restricted in karst/seepage areas (56%), and economic issues. MBTOC considers that alternatives are available for part of the CUN area on both karst and non karst areas by use of combinations of 1,3-D, pic, metham with herbicides and/or LPBF as studies provide evidence for yields that are statistically similar to MB (Gilreath et al. 2003bc; Norton et al. 2002; Ajwa et al. 2003, 2004, 2005; López-Aranda et al. 2005; studies in TEAP 2006). Accordingly the nomination was reduced by 44.083 tonnes to allow for transition to alternatives and dose adjustments to 150 kg/ha on areas of low nutsedge pressure on karst (allowing 175 kg/ha (17.5 g/m^2) for high pest pressure areas).								
	MBTOC comments on economics: The nomination was not based on economic arguments. **Economic statements provided in CUN:** CUN reports costs for three next best alternatives for California, Florida, and Eastern United States. 1,3-D with chloropicrin is reported to reduce yield by 10 to 14 percent. Resulting lower production leads to large losses of net revenue. Planting and harvesting delays with alternatives are reported to lead to lower average prices received in all regions, but are only shown in the revenue analysis for California.								

Country	Industry	Quantity approved for 2005 (ExMOP1 and MOP16)	Quantity approved for 2006 (MOP16+ ExMOP2+ MOP17)	Quantity approved for 2007 (MOP17+ MOP18)	Quantity approved for 2008 (MOP18)	Quantity nominated for 2008 (additional or new)	MBTOC recommend-ation for 2008 (additional or new)	Quantity nominated for 2009 (new)	MBTOC recommend-ation for 2009 (new)
United States	Strawberry runners	54.988	56.291	4.483	8.838			8.837 (Includes 0.454 t for research)	7.944 (Includes 0.454 t for research)
	MBTOC comments: MBTOC recommends a reduced amount of 7.944 tonnes for this use in 2009. This comprises 4.69 tonnes for CA, 2.8 tonnes for SE and 0.454 tonnes for research. The key pests affecting strawberry runners are weeds (purple and yellow nutsedge), fungi (*Rhizoctonia* and *Pythium* in SE, *Phytophthora, Verticillium*), nematodes (root-knot, sting in CA). The CUN states that MB at a dosage of 26.3 g/m2 in CA and 35.0 g/m2 in SE is required to meet the certification standards for strawberry runners. The Party's request exceeds MBTOC's standard presumption of 200 kg/ha (20 g/m2) of MB which is considered effective for production of 'high health' strawberry runners using LPBF and other emission control technologies (TEAP October 2005); however, California's certification requirements specify minimum amounts of MB that must be applied. Furthermore, California regulations prohibit the use of LPBF with MB. The reduction is for the SE to conform to MBTOC presumptions. The Party indicates that key alternatives include 1,3-D + PIC followed by dazomet, PIC followed by dazomet and MI + PIC but that these have not been sufficiently tested on a commercial scale. Furthermore, MI is not currently registered. MBTOC encourages the Party to expedite the commercial scale testing of these alternatives as well as the registration of MI.								
	MBTOC comments on economics: The nomination was not based on economic arguments. **Economic statements provided in CUN:** CUN identifies 1,3-D with chloropicrin as the next best alternative with a 10-percent yield loss in California and the Southeastern States. Operating costs with 1,3-D plus chloropicrin are marginally higher in the Southeast and marginally lower in California. In both regions the alternative is predicted to result in a 46 percent decrease in net revenues.								
United States	Sweet potato slips	None	80.830	0.000	18.144			18.144 (Inc. 2.377 t for research)	18.144 (Inc. 2.377 t for research)
	MBTOC comments: MBTOC recommends a CUE of 18.144 MB for 2009 for this use.The key pests affecting production of sweet potato slips are nematodes (*Meloidogyne incognita*), fungi (*Streptomyces ipomea, Monilochaetes infuscans, Fusarium oxysporum, Ceratocystis fimbriata*), weeds (*Chenopodium* spp., *Digitaria* spp.) and insects (Scarabid beetles, *Limonius* spp). The Party identifies that Telone effectively controls the key pests of sweet potatoes in California. However, Telone cannot be used in Dec-Jan as township caps are exceeded by November which is the fumigation window for slips. The party requests MB for use only in slips where high quality seed is produced. The rates stated in the CUN are consistent with MBTOC's standard presumptions. However, MBTOC notes that desirable nematode resistant cultivars are widely available elsewhere in the world and may be useful in managing nematode pests. The nomination does state that resistant varieties were to be tested in California from 2001 to 2003 but no results are provided.								
	MBTOC comments on economics: The nomination was not based on economic arguments. **Economic statements provided in CUN:** No economic data on alternatives given. Factors that contribute to losses include delayed planting due to use of alternatives; fallow; additional use of herbicides; losses due to weeds, insects and diseases resulting in smaller, less attractive produce (quality loss).								

Country	Industry	Quantity approved for 2005 (ExMOP1 and MOP16)	Quantity approved for 2006 (MOP16+ ExMOP2+ MOP17)	Quantity approved for 2007 (MOP17+ MOP18)	Quantity approved for 2008 (MOP18)	Quantity nominated for 2008 (additional or new)	MBTOC recommend-ation for 2008 (additional or new)	Quantity nominated for 2009 (new)	MBTOC recommend-ation for 2009 (new)
United States	Tomatoes (field)	2876.046	2476.364	2065.246	1406.484			1245.249 (Inc. 5.501 t for research)	1004.589 (Incl. 5.501 t for research)
	MBTOC comments: MBTOC recommends 1004.589 t for this use in SE, Georgia, Florida and Michigan in 2009. The amount recommended includes 5.501 tonnes for research. A new nominated amount has been requested for Maryland a region which the Party has stated previously used MB from stocks. A reduction was made in the SE, Georgia, Florida by 25% from the amount approved for 2008 to allow for adoption of alternatives and to account for further rate reduction by adoption of formulations of MB/Pic with lower ratios of MB in conjunction with barrier films. According to the available information, MBTOC has determined that the amounts for each region are 231.085 t for the SE, 55.786 t for Georgia, 686.280 t for Florida, 24.915 t for Michigan and 1.022 t for Maryland. The Party has stated that it based its nomination on MBTOCs standard maximum dosage rates of MB/Pic formulations of 175 kg/ha for nutsedge and 150 kg/ha for pathogens with adoption of LPBF and also made an adjustment for strip fumigation based on 0.58 of the area treated. An adjustment was also made for dosage rate for Michigan suitable for pathogens of 150 kg/ha (15 g/m^2.) No information was provided on the key pests in Maryland and an assumption was made that pests were similar to the other regions in the SE. MBTOC has assumed this region was not included in the "region SE and middle Atlantic, US". If this assumption is not correct the party is requested to provide the appropriate information. The key pest of tomatoes in the south eastern United States, including Florida and Georgia are nutsedge, nematodes and P. capsici. In Florida and Georgia karst topography limits the use of alternatives which include 1,3-dichloropropene, which are considered the best alternatives for these pests on 54% of the growing acreage in Florida, 11% in Georgia and 6% of the acreage in Georgia. The Party in the past has stated that metham sodium or metham potassium is promising alternatives but no further data has been provided on their performance. MBTOC, however, considers that alternatives are available for both karst and non-karst areas in SE, Florida and Georgia (Noling et al. 2006; Santos et al. 2006; Noling and Gilreath 2004; Gilreath and Santos 2004bc; Gilreath *et al*. 2002, 2003, 2004, 2005bc, 2006; Rosskopf et al, 2005; Chellemi and Browne, 2006; McMillan and Bryan 1998, 1999, 2002; Rich and Olson 2003) which can be adopted on areas of moderate pest pressure at least. MBTOC has adjusted the nomination for these regions by 25%. The Party indicated that 42% transition to alternatives was possible in these regions over a seven year period. MBTOC considered a 25% reduction possible in this year by further rate reductions of MB using formulations of MB/Pic with lower ratios of MB in conjunction with barrier films, and adoption of alternatives. It has based this reduction on the amount approved at MOP-18 (This amount reflects a further 18% transition over the Parties suggested 7% transition for 2009). The Party showed references which supported use of alternatives in combination with LDPF (Culpepper, 2006). Other studies on possible effective alternatives are available (Ristaino and Johnson (1999), Babadost and Islam (2002), Johnston et al (2002), Driver and Lows (2003). A combination of 1,3-D or metham sodium with chloropicrin + herbicides (Trifluralin, Devrinol, napropamide, halosulfuron, s-metalochlor) is considered as the best alternative strategy in Florida. No future indication for the use of this combination was given by the Party. Husbeck and Lamour (2004) and others have reported many efficient management strategies to control Phytophthora on vegetables, including crop rotation with non susceptible hosts (carrots, beans, onions, asparagus, soybeans, alfalfa , cultural control (water management, plant density, soil amendments, protective mulch, raised beds etc….) and use of registered fungicides (Mefonoxan, Dimethomorph (Acrobat), Zoxamide + Mancozebe, Copper hydroxide+Acrobat). Seed treatment with Mephenoxan or metalaxyl control Phytophthora during seed germination. MBTOC notes that uptake of alternatives for this crop in regions with similar pests has occurred within 4 years or less in many countries e.g Spain, Italy, Australia. (Leoni and Ledda, 2004; Spotti, 2004; Tostovrsnik et al 2005;Minuto et al, 2003; Vos and Bridge 2006; EC 2006). MBTOC considers that further reductions in MB amount is possible changes to formulations of 50:50 MB/Pic or less (e.g. to 30:70) used in combination with barrier films. The Party states that registration of a key alternative (eg. methyl iodide) is pending.								
	MBTOC comments on economics 2007: Part of the nomination for Michigan was based on economic arguments. **Economic statements provided in CUN:** The CUN reports yield losses for 1,3-D with chloropicrin as the next best alternative ranging from 1.75% to 6%. Net revenue declines reported for all regions. Changes in pest control costs are less than 4 percent of total variable costs so have little impact on economic measures. Missed market window in Michigan cited as main reason.								

9.3.5 References

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9.4 Evaluation of 2007 Critical Use Nominations for Methyl Bromide and Related Matters; MBTOC Quarantine, Structures and Commodities Interim Report – March 2007 (MBTOC-QSC)

9.4.1 Standard presumptions used in assessment of nominated quantities

Table 9.10 below states the standard presumptions applied by MBTOC QSC in assessing this round of CUNs where continued methyl bromide use is sought. These have not changed since presentation to the Parties at MOP-17.

Table 9.10 Standard presumptions used in assessment of CUNs – Structures and Commodities

	Comment	**CUN Adjustment**	**Exception**
Dosage rate - structural	20 gm^{-3}	Nominations using higher dosage rates were reduced proportionally	Where approved label rates require higher dosage rate or where substantiated by the Party
Dosage rate – commodities	EPPO standard for bulk commodities as given in MBTOC (1994, 1998)	Nominations using higher dosage rates were reduced proportionally	Where approved label rates require higher dosage rates or where substantiated by the Party

MBTOC recognises that the actual rate appropriate for a specific use may vary with local circumstances, soil conditions and the target pest situation. Some nominations were based on rates lower than these indicative rates.

9.4.1.1 Adjustments for standard dosage rates

MBTOC assessed CUNs for appropriate MB dosage rates and deployment of MB emission/use reduction technologies, such as appropriate sealing techniques.

Decision IX/6 requires that critical uses should be permitted only if 'all technically and economically feasible steps have been taken to minimise the critical use and any associated emission of methyl bromide'. Decision Ex.II/1 also mentions emission minimisation techniques, requesting Parties "…to ensure, wherever methyl bromide is authorised for critical-use exemptions, the use of emission minimisation techniques that improve gastightness or the use equipment that captures, destroys and/or reuses the methyl bromide and other techniques that promote environmental protection, whenever technically and economically feasible."

In structures, it is feasible to reduce MB use and emissions by the use of improved sealing techniques, with monitoring to ensure only the minimum effective dosage is used. The average dosage rates now quoted in the CUNs, typically around 20 g m^{-3} for mills and similar structures, are reasonable.

In commodities, methyl bromide dosage rates vary with commodity temperature and by commodity sorption rates. Accordingly, MBTOC uses the dosage rates published by the European Plant Protection Organization (EPPO) and found in annexes to the MBTOC 2006 Assessment Report (MBTOC, 2007) Parties are encouraged to use the lowest possible dosage rate appropriate for the circumstances and as allowed by the label. Where possible, the use of

lower dosages, combined with longer exposure periods, can reduce MB use while maintaining efficacy. (MBTOC. 2007. 2006 Report of the Methyl Bromide Technical Options Committee; 2006 Assessment Report.)

9.4.1.2 Details of evaluations

Parties have submitted 16 CUNs for the use of MB in structures and commodities in 2007.

Of the 2007 nominations, 7 were for 2008 for a total of 11.535 tonnes. Of nominations for 2008, MBTOC QSC recommended 5, with 2 recommended at less than the full amount nominated, for a total of 3.952 tonnes. MBTOC was unable to assess one nomination for 2008 and did not recommend one CUN.

Of the 2007 nominations 9 were for 2009 for a total of 529.721 tonnes. Of the nominations for 2009, MBTOC QSC recommended 8, with 4 recommended at less than the full amount nominated , for a total of 476.017 tonnes. MBTOC QSC was unable to assess one nomination.

Table 9.11 provides the MBTOC QSC interim recommendations for the CUNs submitted in 2007.

Table 9.11 MBTOC QSC Interim Recommendations for the CUNs Submitted in 2007

Country	Industry	Quantity approved for 2005 (ExMOP1 and MOP16)	Quantity approved for 2006 (MOP16+ ExMOP2+ MOP17)	Quantity approved for 2007 (MOP17+ MOP18)	Quantity approved for 2008 (MOP18)	Quantity nominated for 2008 (additional or new)	MBTOC recommend-ation for 2008 (additional or new)	Quantity nominated for 2009 (new)	MBTOC recommend-ation for 2009 (new)
Australia	Rice	6.150	6.150	9.205	7.400	1.800	0.840	9.200	U
	MBTOC comments: **On 2008 CUN:** MBTOC recommends an additional 0.84 tonnes to the 7.4 tonnes of MB already granted by the Parties for rice treatment in 2008. The Party had submitted a supplemental nomination of 1.8 tonnes for 2008. MBTOC's recommendation for this reduced amount was based on the following calculation: a paddy harvest of 261.300 tonnes, milled to 209,000 tonnes and fumigated at 20g/m3 giving a total MB usage of 8.24 tonnes. Parties already approved 7.4 tonnes. **On 2009 CUN:** MBTOC is unable to assess the nomination of 9.2 tonnes for 2009. MBTOC recommends that this nomination be reviewed again when the Party provides further information on costs of moving at least some production to alternatives by 2009. Technically effective and registered alternatives are available and in use in most rice producing countries, but they have not been adopted in Australia. The Party indicates that the applicants cannot afford any investment in alternatives because for several years, drought, caused by global warming, has severely decreased rice harvests. Government of Australia has indicated its intention to continue use of MB until at least three years of non-drought conditions enable sufficient investment. Should there be an easing of drought conditions and a return to normal crop sizes, Government of Australia has indicated phase out could begin in 2009 with the resulting complete phase out expected in 2012. The applicant has invested in recapture equipment on its largest treatment site with quoted savings of about 45% of MB emissions. Pest control treatments for milled rice, and methods that avoid the need for pest control in milled rice are available and in use world wide. For example, reasonably-costed controlled atmosphere treatments are commercially available on a lease basis (per tonne of commodity) and in use in other countries. This method would avoid investments in additional silos. Phosphine is registered and would be effective to treat rice either before or after processing. The applicant has suggested that it can not adopt phosphine because doing so would require investment of A$40 million to build 100 silos and that phosphine would cost 58 times the cost of methyl bromide. The Party's stated technical need for the 100 silos requires further clarification. Rice is stored as paddy without fumigation, and then milled in an orderly fashion as needed. MBTOC believes that the additional number of treatment facilities for non-QPS rice would be considerably fewer given that the applicant would only require sufficient silos for 7-10 days treatment time with phosphine and not the 28 days suggested by the applicant. A 7-day treatment time is acceptable for milled rice with phosphine according to the label rate. A 7-10 day treatment time would allow for fumigation to occur immediately after production and keep pace with milling with fewer additional silos. The applicant has indicated it can not afford to change its packaging method. Improved packaging would prevent re-infestation and would be an effective measure. Packaging methods that prevent new infestation are in use in numerous rice producing countries. In 2006, Parties granted 10.3 tonnes of methyl bromide, of which 6.745 tonnes was actually used in 2006 on rice, according to the accounting framework of the Government of Australia								
	MBTOC comments on economics: The CUN states: drought has made it impossible to undertake investment in phosphine facilities. Estimated costs for up to 100 silos would be Aus $40 million. CUN states it would involve three years of transition, potentially complete in 2012. However, CUN does not provide annual cost of this capital expenditure. Even if borrowing or raising external capital is not feasible, the calculations of the annual cost have to be based on the amortised capital cost over the economic life of the investment. CUN Tables 3, 4, and 5 compare costs of phosphine and MB treatment on an annual basis. MBTOC analysis concludes that phosphine would costs $19.02 per ton for each of the first 10 years. For a 1-kilo retail package this amounts to $0.19, or about 2 cents. With any elasticity of demand and with any branding value, some of this could be is passed on to consumers. Further, per capita domestic use (broadly defined and may include use for beer, pet food, seed and residual) is about 9 kg per person. This suggests an annual cost to consumers if higher fumigation costs were passed fully of about 20 cents per year per person. Some distributional issues remain as certain ethnic groups have much higher than average per capita consumption.								

Country	Industry	Quantity approved for 2005 (ExMOP1 and MOP16)	Quantity approved for 2006 (MOP16+ ExMOP2+ MOP17)	Quantity approved for 2007 (MOP17+ MOP18)	Quantity approved for 2008 (MOP18)	Quantity nominated for 2008 (additional or new)	MBTOC recommend-ation for 2008 (additional or new)	Quantity nominated for 2009 (new)	MBTOC recommend-ation for 2009 (new)
Canada	Mills	47 (included mills and pasta)	34.774	30.167 (included mills only)	28.650			26.913	26.913
	MBTOC comments: MBTOC recommends 26.913 tonnes for flour mill fumigation in 2009 with the understanding that Canadian flour millers continue their rigorous research program and complete reports in 2007. Industry-government commercial scale trials of heat treatment, sulfuryl fluoride and heat, phosphine and carbon dioxide combination, are ongoing. Sulfuryl fluoride is only allowed under conditional registration and can only be used in empty flour mills. No maximum residue levels for fluoride resulting from SF fumigations have been established in Canada. Furthermore, it is unknown if any use limits will be placed on the use of sulfuryl fluoride by Provincial governments. The nomination for 2009 represents a decrease of about 5% relative to 2008 levels. MBTOC would expect a considerable decrease in any further nomination if the trials currently being conducted show economic feasibility and technical efficacy in Canadian climate conditions. MBTOC notes that a growing body of research and practical experience indicates that best results in SF fumigations are obtained when facility temperatures of approximately 30˚C are achieved. MBTOC awaits the results of Canadian testing to determine if this result is also observed in Canada.								
	MBTOC comments on economics: CUN states: It appears that heat remains very costly and has not provided comparable efficacy. Lack of trials makes adoption of alternatives unlikely. Technical feasibility issues and lack of registration still exist. This nomination does not rely on economic arguments.								
Canada	Pasta	(see Canada mills)	10.457	6.757		6.067	U		
	MBTOC comments: MBTOC is unable to assess the nomination for use in pasta manufacturing facilities in 2008. MBTOC will be able to reassess this nomination when the Party supplies reports detailing the results of trials, concrete plans for trials (such as contracts), or explains why trials can not be conducted in the available time frame. The applicant indicates that trials to test and adopt heat and sulfuryl fluoride will be made in 2007. Previous CUNs have also indicated this intent but trials have not yet been reported. In Oct 2006 in response to this CUN MBTOC wrote, 'For any future CUN, MBTOC hopes to receive extensive, detailed research or commercial trial data evaluating the technical effectiveness and economic feasibility of alternatives used in other countries and why these alternatives are not applicable in the circumstances of Canada. Specifically, (1) effectiveness of improvements in IPM, including a pest audit, cleaning, facility improvements, monitoring and inspection, (2) facility heat treatments, and (3) sulfuryl fluoride when applicable." MBTOC acknowledges that sulfuryl fluoride, a possible alternative, is only conditionally registered in Canada and there are no maximum residue levels for fluorine in foods in Canada. Pasta manufacturers have accomplished some of the improvements in IPM that seem needed. The 2008 nominated amount is 10.2% less than the 2007 CUE granted by the Parties. There are non-MB techniques available for pest control use in pasta mills that are used in other countries. Successful heat treatment in a North American pasta mill has been detailed by Subramanyam (2006). Pasta facilities consist of two areas (production and warehousing) with potentially different avenues for adoption of alternatives for each. It seems likely that the production facility should be able to adopt heat treatments, given that the operation of production equipment results in elevated temperatures in the processing facility. Increasing the mill temperature to the lethal point of 55˚C would be effective and seems achievable. In warehousing, where heat can not be used on finished product, rigorous modern IPM including contact pesticide applications may succeed. If Canada's intended trials fail and MB treatment is viewed as necessary in the short term, for warehousing, it should be possible to considerably reduce MB nominations by treating only the warehouse and not the full facility. (Subramanyam., B., Kashyap S.., Ruby, C., and X. Hou. 2006. Summary of a heat treatment conducted at New World Pasta. Presented to Methyl Bromide Alternatives Organization annual conference. Orlando Nov 2006. Full report presented to New World Pasta Oct 2006, full report submitted to Government of Canada.).								
	MBTOC comments on economics: CUN states: that heat treatment remains a very costly alternative. In general, the pest control service provider estimates the cost to carry out the heat treatment at twice the cost of doing a methyl bromide treatment. The cost of a heat treatment increased to three or four times the cost of methyl bromide when the cost of monitoring to ensure comparable results to a methyl bromide fumigation are included.								

Country	Industry	Quantity approved for 2005 (ExMOP1 and MOP16)	Quantity approved for 2006 (MOP16+ ExMOP2+ MOP17)	Quantity approved for 2007 (MOP17+ MOP18)	Quantity approved for 2008 (MOP18)	Quantity nominated for 2008 (additional or new)	MBTOC recommend-ation for 2008 (additional or new)	Quantity nominated for 2009 (new)	MBTOC recommend-ation for 2009 (new)
Canada	Commodities	0.000	0.000	0.000	0.000	0.068	NR		
	MBTOC comments: MBTOC does not recommend the use of methyl bromide for rodenticides and molluscicides in 2008. The critical need for methyl bromide has not been demonstrated. Data has not been submitted substantiating that mould would develop in bait for rodents or molluscs if manufacturing methods were improved and standard good manufacturing practices were used. The applicant indicates that product may become subject to mould development while it is sitting open at room temperatures, awaiting final processing and packaging without any effort made to cool or aerate the product. If the product was dried during processing to less than 75% equilibrium relative humidity the *Aspergillus* spp, said to be of concern, should not proliferate. Similarly if the product was stored using standard grain handling techniques of air circulation, aeration, and/or air conditioning in the storage room, mould would also not grow. If final processing occurred before the product was subjected to a long mid-process storage time, mould growth would not occur. The applicant has not established that ethylene oxide and irradiation used worldwide for the production of sterile lab animal feed would not be acceptable and available in this circumstance. The Party has not substantiated that the circumstances of this nomination are different than those of bait-food producers in other countries who do not use MB for this purpose.								
	MBTOC comments on economics: CUN based on technical reasons. No economic data provided for alternatives								
Israel	Dates	3.444	2.755	2.200		1.800	1.8		
	MBTOC comments: MBTOC recommends 1.8 tonnes for dates in 2008. Israel's research programme combined with technology transfer to rural packing houses has allowed the successful adoption of heat treatment by packers of Medjool dates, the main variety. The Party has continued its 20% decrease for the third year. However, heat treatment has not been successful, thus far, for other date varieties. Work continues on this prospective treatment. Controlled atmosphere treatment may provide a technically effective alternative. A heat and carbon dioxide combination treatment has been found to be technically effective for one variety. The 'cocoon' method of vacuum in flexible container has worked for some varieties but requires packing houses to invest and adapt to a non-fumigation technology. At least one date variety is harmed by this method, but the applicant is encouraged to make the investments and shift in thinking to this and other alternatives where technically feasible and where product quality is not harmed. Phosphine is not feasible from the viewpoint of product quality. Sulfuryl fluoride and ethyl formate, although they have proven successful in the treatment of other dried fruit, are not registered.								
	MBTOC comments on economics: CUN states: Alternative 3 (Cold) is not technically suitable, alternative 1 (Heat) is being carried out in part for Medjool only while alternative 2 (CO_2), 4 (vacuum) and 5 (Heat + CO_2) require further studies to reveal whether they are economically feasible or not. Otherwise CUN provides no economic data.								
Israel	Flour mills	2.140	1.490	1.040		0.800	0.312		
	MBTOC comments: MBTOC recommends 0.312 tonnes for Israel flour mills in 2008, a 61% reduction in the nominated amount of 0.8 tonnes. Adoption of a rigorous IPM program combined with heat treatment seems a likely avenue for success in the circumstances of this nomination. The MB recommended will allow the applicant to complete transition to alternatives. The applicant indicates spot treatment with MB is used in the case of infestation, but in this circumstance spot treatment by heat seems quite possible, especially given the generally high ambient temperature. Although the applicant indicates an intended future reliance on sulfuryl fluoride, it seems unlikely to resolve their infestation problems in the short or middle term since there has not even been an application for registration submitted yet. The applicant indicates it uses 35 g m^{-3} of MB based on the poor penetration of MB through flour residues. Flour residues should be cleaned out before fumigation as a standard sanitation practice and a normal part of IPM. The MBTOC standard dosage rate is 20g m^{-3}. This dosage rate is sufficient for full site treatments and would be more than sufficient for spot treatment. The amount of MB recommended was based on the following considerations. Five mills were reported to need to fumigate mills and equipment totalling 15,600m3. When MBTOC standard dosage rate of 20g m^{-3} is used, the result is 0.312 tonnes of MB needed.								
	MBTOC comments on economics: CUN states: that heat treatment is not economically feasible. Suitable equipment might overcome that problem. Otherwise CUN provides no economic analysis.								

Country	Industry	Quantity approved for 2005 (ExMOP1 and MOP16)	Quantity approved for 2006 (MOP16+ ExMOP2+ MOP17)	Quantity approved for 2007 (MOP17+ MOP18)	Quantity approved for 2008 (MOP18)	Quantity nominated for 2008 (additional or new)	MBTOC recommend-ation for 2008 (additional or new)	Quantity nominated for 2009 (new)	MBTOC recommend-ation for 2009 (new)
Japan	Chestnuts	7.100	6.800	6.500	6.300			5.800	5.800
	MBTOC comments: MBTOC recommends 5.8 tonnes for Japan chestnuts in 2009. The Party has decreased the request for MB use in this sector by 8% by requiring growers and packing houses to amalgamate fumigation loads. The Party is encouraged to continue these improvements and to reduce dosage by increasing fumigation time. The Party has a rigorous research program that, in preliminary results, has identified some effective alternatives. Unfortunately many of the alternatives tested are either ineffective disinfestants or harms this fresh product. More encouraging research results indicate efficacy for methyl iodide which is not yet registered in Japan.								
	MBTOC comments on economics: CUN provides no economic analysis								
Poland	Coffee & Cocoa Beans	See Medicinal Herbs	2.160	1.420		0.500	0.500		
	MBTOC comments: MBTOC recommends 0.5 tonnes for this use in 2008, a reduction of 64.3% for this sector over last year's nomination. In recent years the Party has significantly reduced its requirement for MB by the reuse of recaptured MB. Additionally, the Party is adopting phosphine as an alternative. Registration of fast generated forms of phosphine is anticipated this year and will increase the rate of transition. If there are delays or ineffectiveness discovered in this planned treatment, another avenue is the use of heat and low oxygen as a combination controlled atmosphere treatment. This treatment, already in use in several ports, would control the mite infestation in an approximate treatment time of 5 days.								
	MBTOC comments on economics: CUN states: that phosphine (which is not registered, inter alia because of the expected small market) is 30% more expensive, largely as a result of additional costs associated with fumigation time of 12 days; high cost of speed boxes and phosphine generators. These additional costs make the fumigation treatments with phosphine more expensive by 50 Euro per tonne. CUN states that irradiation is expensive because of the high cost of transportation to the facility.								
Poland	medicinal herbs and mushrooms	4.100	3.560	1.800		0.500	0.500		
	MBTOC comments: MBTOC recommends 0.5 tonnes for this use in 2008, a reduction of 81.5% for this sector over last year's nomination. In recent years the Party significantly reduced MB use in this sector by moving commodities to alternatives as technologies and treatments became available. The CUN this year represents the last remaining uses which are moving to use of carbon dioxide/high pressure.								
	MBTOC comments on economics: CUN states: that phosphine (which is not registered, inter alia because of the expected small market) is more expensive, largely as a result of additional costs associated with fumigation time of 12 days; high cost of speed boxes and phosphine generators. These additional costs make the fumigation treatments with phosphine more expensive. CUN states that irradiation is expensive because of the high cost of transportation to the facility.								

Country	Industry	Quantity approved for 2005 (ExMOP1 and MOP16)	Quantity approved for 2006 (MOP16+ ExMOP2+ MOP17)	Quantity approved for 2007 (MOP17+ MOP18)	Quantity approved for 2008 (MOP18)	Quantity nominated for 2008 (additional or new)	MBTOC recommend-ation for 2008 (additional or new)	Quantity nominated for 2009 (new)	MBTOC recommend-ation for 2009 (new)
United States	Commodities	89.166	87.719	78.983	58.921 inc. 0.021 for research			58.912	45.623 inc. 0.020 for research
	MBTOC comments: MBTOC recommends 45.623 tonnes for US commodities in 2009. This amount includes 20 kilograms for research. The Party had requested 58.921 tonnes for 2009, which included 21 kilograms for research purposes, but which included no transition to alternatives over the amount granted by the Parties for 2008. MBTOC's recommendation represents a 20% decrease in the nomination for walnuts, dried fruit and dates to allow for transition to alternatives. In the case of dried beans, we did not recommend a 20% reduction this year but reduced the dosage rate from 44g m^{-3} to 20g m^{-3}. Therefore, on a sectoral basis the tonnes recommended are: walnuts (28.088); dried fruit (13.928); beans (1.980); dates (1.607). There are several alternatives available for use by this sector. Phosphine is in widespread use, but its slower action sometimes makes it logistically impractical for meeting holiday market windows. Phosphine is registered for treatment of beans in California, but is not registered if the beans are stated to be infested with cowpea weevils. Trials using phosphine and sulfuryl fluoride have been conducted with dates. Sulfuryl fluoride is technically effective and available; MRLs have recently been established in Germany, one of the largest importers of US walnuts. Some importing countries, however, have not yet established MRLs for fluoride residues, which limits its use in some cases. Controlled atmosphere treatment would also be effective and the technology is available on a lease basis.								
	MBTOC comments on economics: CUN provides economic data on alternatives for walnuts and dried fruit other than dates. CUN states: that phosphine fumigant costs are higher because it takes longer to accomplish so sellers don't reach December holiday export market window; its use leading to increased labour costs, and it corrodes equipment. CUN states walnuts and dried fruit all experience substantial additional downtime and subsequent lost revenues if phosphine is used. Net revenues for alternatives are negative. CUN states that profit margin decreases from 13.3% to –7.5% for Walnuts and from 5% to -16.8% for dried fruits. An economic analysis was not done for dates and dried beans.								
United States	Cocoa beans - NPMA subset	61.519	55.367	64.082	53.188			51.002	32.659
	MBTOC comments: MBTOC recommends 32.659 tonnes of methyl bromide for cocoa beans in 2009. Cocoa beans are included in the US NPMA CUN, but MBTOC disaggregates it. Although the Party had indicated they could achieve a 4.2% reduction in MB use over 2008, MBTOC notes the potential for commercial adoption in this sector for some of the commodity. Bookout (2006) reported a successful commercial trial with sulfuryl fluoride for over 200,000 bags of cocoa during the summer months. The amount of MB recommended was based on the following considerations. Sulfuryl fluoride is registered for use on cocoa beans but permitted residue limits make it available for only one fumigation. Concerns about possible egg survival in the instance of high infestation combined with concerns of cold bean temperature means that sulfuryl fluoride is more suitable for the second fumigation just before shipment to chocolate manufacturers. Sulfuryl fluoride should have its highest effectiveness in the warmer parts of the year. Since cocoa bean imports vary annually, MBTOC calculated a five year average of historical use of MB for cocoa beans, then reduced it by 25% to allow for adoption of sulfuryl fluoride during the warm half of the year for the second fumigation immediately before shipment to chocolate manufacturers. (A five-year average of historical MB use is 43.545 tonnes, minus 25% = 32.659 tonnes.) MBTOC notes further that, during the coldest months, not all cocoa is given the second fumigation, according to fumigator reports, making this reduction in MB use more easily accomplished. In future years, there are opportunities to replace chemical treatments with controlled atmosphere treatments or storage. (Bookout, A. (2006). Commercial use of ProFume on stored cocoa beans. In: Annual International Research Conference on Methyl Bromide Alternatives and Emissions Reductions, November 3 to 6, 2006, Orlando, Florida, USA, Paper 105).								
	MBTOC comments on economics: CUN states: that for commodities listed in the NPMA CUN, an economic analysis was not conducted because this sector did not have an alternative registered. The comment about alternative registration is incorrect. For food-processing facilities listed in the NPMA CUN, economic feasibility of such alternatives was not assessed due to the lack of revenue information, which is necessary to quantify the economic impacts to food-processing facilities.								

Country	Industry	Quantity approved for 2005 (ExMOP1 and MOP16)	Quantity approved for 2006 (MOP16+ ExMOP2+ MOP17)	Quantity approved for 2007 (MOP17+ MOP18)	Quantity approved for 2008 (MOP18)	Quantity nominated for 2008 (additional or new)	MBTOC recommend-ation for 2008 (additional or new)	Quantity nominated for 2009 (new)	MBTOC recommend-ation for 2009 (new)
United States	NPMA food processing structures (cocoa beans removed)	83.344	69.118	82.771	69.208			66.777 cocoa beans removed	54.606
	MBTOC comments: MBTOC recommends 54.606 tonnes for processed food facilities in 2009. Cocoa beans has been disaggregated from this CUN and reported elsewhere. The Party has requested 66.777 tonnes for these sectors, cocoa removed. The Party indicates it can achieve a five-year transition at 17% per year of 84% of its facilities in this sector. The constant reduction in absolute tonnes annually of 84% of the total of this CUN is 13.871 tonnes (cocoa and cheese not included). 2009 will be the second year of this transition plan. MBTOC has not included a reduction for cheese stores because no alternatives have been registered, but the Party has reduced its MB nomination in this sector through various improvements. The total tonnage recommended is composed of the following sectoral amounts: processed foods (49.103); herbs and spice facilities (3.238); cheese (2.265). The Party is requested to ensure the recommendation for herb and spice facilities is used only for the facilities and not the commodity, especially not if intended for QPS. There are alternatives for herb and spice commodity in widespread commercial use in the US, and QPS uses cannot be included in critical uses.								
	MBTOC comments on economics: CUN states: For commodities listed in the NPMA CUN, an economic analysis was not conducted because this sector did not have an alternative registered. The comment about alternative registration is incorrect.. For food-processing facilities listed in the NPMA CUN, economic feasibility of such alternatives was not assessed due to the lack of revenue information which is necessary to quantify the economic impacts to food-processing facilities.								
United States	Mills and processors	483.000	461.758	401.889	348.237			291.418	291.418
	MBTOC comments: MBTOC recommends 291.418 tonnes for US mills and structures in 2009. Overall this is a 16.3% decrease for the entire sector. This decrease is distributed over each sector as follows: rice mills 26.7%, bakeries 41.8%, pet food 17.7% and flour millers 11.9%. The Parties granted 348.231 tonnes of MB for this use in 2008. The overall decrease in MB use is also similar to transition estimates by suppliers of alternative products and technologies. The total tonnages of MB recommended can be broken down into sectors as follows: rice mills (48.804); bakeries (8.308); pet food (21.955); and flour mills (212.352). US bakeries are making the fastest transition to alternatives and seem to have resolved earlier facility design problems that resulted in difficulties transitioning to heat. Gastightness should continue to be improved and numerous techniques are available to do so. MB should not be used in facilities that are of poor or very poor gastightness. These situations are especially prevalent in rice and flour mills. Transition to adoption of heat treatments should be encouraged, especially where gastightness is poor.								
	MBTOC comments on economics: The CUN states: that heat will cost 1.5 times and sulfuryl fluoride costs 1.3 times the cost of MB treatment. Heat treatment is reported to result in lost operating days and thus lower throughput and gross revenues. Where sulfuryl fluoride is technically feasible it results in loss of net revenue of 57% (rice millers), but only 4% (bakeries) and 2% (pet food manufacturers and North American Millers Association). Profit margins were added to the economic assessment.								

Country	Industry	Quantity approved for 2005 (ExMOP1 and MOP16)	Quantity approved for 2006 (MOP16+ ExMOP2+ MOP17)	Quantity approved for 2007 (MOP17+ MOP18)	Quantity approved for 2008 (MOP18)	Quantity nominated for 2008 (additional or new)	MBTOC recommend-ation for 2008 (additional or new)	Quantity nominated for 2009 (new)	MBTOC recommend-ation for 2009 (new)
United States	Cured pork	67.907	40.854	18.998	19.669			19.699	18.998
	MBTOC comments: MBTOC recommends 18.998 tonnes for 2009. This amount was also granted by the Parties for this use in 2007, but represents a decrease from the amount granted by the Parties in 2008 of 19.669 tonnes and renominated for 2009. There are no registered alternatives for the treatment of insects and mites on pork hanging in curing houses. Reliable historical use volumes for the largest group of producers in this sector are still not available due to the large number of small units. Therefore there is no justification for increase in use in this sector. A multi-state research project has begun and has released preliminary results. The research will identify potential for improvements in IPM, facility gastightness, processing methods and efficacy of alternatives which may result in decrease in MB use and eventual transition to alternatives. The Party is encouraged to investigate efficacy of non-chemical alternatives for this commodity, which would then allow for faster transition away from MB in this sector. Controlled atmosphere at increased temperature may be effective. An additional avenue for investigation might be dips in hot oil as is done in European countries for similar pork products. (Schillings W. 2006. Methyl Bromide use to combat mite infestation in dry cured ham during production. In: Annual International Research Conference on Methyl Bromide Alternatives and Emissions Reductions, November 3 – 6, 2006 Orlando, Florida, USA.).								
	MBTOC comments on economics: No economic data given. This is a minor use and there is little economic incentive to develop alternatives								

SUMMARY

	Total post harvest CUN amounts	Total recommended amounts
2008	11.535	3.952
2009	529.721	476.017

APPENDIX I to Chapter 9

Common Acronyms

1,3-D	1,3-dichloropropene
A5	Article 5 Party
CUE	Critical Use Exemption
CUN	Critical Use Nomination
DOI	Disclosure of Interest
EC	European Commission
EMOP	Extraordinary Meeting of the Parties
EPA	Environmental Protection Agency
EPPO	European Plant Protection Organisation
IPM	Integrated Pest Management
ISPM	International Standard Phytosanitary Measure
LPBF	Low Permeability Barrier Film (including VIF films)
MB	Methyl bromide
MBTOC	Methyl Bromide Technical Options Committee
MBTOC QSC	Methyl Bromide Technical Options Committee Quarantine, Structures and Commodities Subcommittee
MBTOC S	Methyl Bromide Technical Options Soils Subcommittee
MITC	Methyl isothiocyanate
MOP	Meeting of the Parties
MS	Metham sodium
Pic	Chloropicrin
QPS	Quarantine and Pre-shipment
SF	Sulfuryl fluoride
TEAP	Technology and Economics Assessment Panel
US	United States of America
VIF	Virtually Impermeable Film

APPENDIX II to Chapter 9

Decision IX/6

1. To apply the following criteria and procedure in assessing a critical methyl bromide use for the purposes of control measures in Article 2 of the Protocol:

(a) That a use of methyl bromide should qualify as "critical" only if the nominating Party determines that:

(i) The specific use is critical because the lack of availability of methyl bromide for that use would result in a significant market disruption; and

(ii) There are no technically and economically feasible alternatives or substitutes available to the user that are acceptable from the standpoint of environment and health and are suitable to the crops and circumstances of the nomination;

(b) That production and consumption, if any, of methyl bromide for critical uses should be permitted only if:

(i) All technically and economically feasible steps have been taken to minimise the critical use and any associated emission of methyl bromide;

(ii) Methyl bromide is not available in sufficient quantity and quality from existing stocks of banked or recycled methyl bromide, also bearing in mind the developing countries' need for methyl bromide;

(iii) It is demonstrated that an appropriate effort is being made to evaluate, commercialise and secure national regulatory approval of alternatives and substitutes, taking into consideration the circumstances of the particular nomination and the special needs of Article 5 Parties, including lack of financial and expert resources, institutional capacity, and information. Non-Article 5 Parties must demonstrate that research programmes are in place to develop and deploy alternatives and substitutes. Article 5 Parties must demonstrate that feasible alternatives shall be adopted as soon as they are confirmed as suitable to the Party's specific conditions and/or that they have applied to the Multilateral Fund or other sources for assistance in identifying, evaluating, adapting and demonstrating such options;

2. To request the Technology and Economic Assessment Panel to review nominations and make recommendations based on the criteria established in paragraphs 1 (a) (ii) and 1 (b) of the present decision;

3. That the present decision will apply to Parties operating under Article 5 and Parties not so operating only after the phase-out date applicable to those Parties.

Para. 2 of Decision IX/6 does not assign TEAP the responsibility for determining the existence of "significant market disruption" specified in paragraph 1(a)(i).

TEAP assigned its Methyl Bromide Technical Options Committee (MBTOC) to determine whether there are *no technically and economically feasible alternatives or substitutes available to the user that are acceptable from the standpoint of environment and health and are suitable to the crops and circumstances of the nomination*, and to address the criteria listed in Decision IX/6 1(b).

APPENDIX III to Chapter 9

Report of the Sixteenth Meeting of the Parties to the Montreal Protocol (Annex I), Prague, 22–26 November 2004), paragraph 15.

(Decision XVI/4. Review of the working procedures and terms of reference of the Methyl Bromide Technical Options Committee)

"15. An annual work plan will enhance the transparency of, and insight in, the operations of MBTOC. Such a plan should indicate, among other things:

(a) Key events for a given year;

(b) Envisaged meeting dates of MBTOC, including the stage in the nomination and evaluation process to which the respective meetings relate;

(c) Tasks to be accomplished at each meeting, including appropriate delegation of such tasks;

(d) Timing of interim and final reports;

(e) Clear references to the timelines relating to nominations;

(f) Information related to financial needs, while noting that financial considerations would still be reviewed solely in the context of the review of the Secretariat's budget;

(g) Changes in the composition of MBTOC, pursuant to the criteria for selection;

(h) Summary report of MBTOC activities over the previous year, including matters that MBTOC did not manage to complete, the reasons for this and plans to address these unfinished matters;

(i) Matrix with existing and needed skills and expertise; and

(j) Any new or revised standards or presumptions that MBTOC seeks to apply in its future assessment of critical-use nominations, for approval by the Meeting of the Parties. "

APPENDIX IV to Chapter 9 – Part A: Preplant Soil Applications

List of nominated (2005 – 2009 in part) and exempted (2005 – 2008 in part) amounts of methyl bromide granted by Parties under the CUE process for each crop or commodity.

Party	Industry	Total CUN MB Quantities					Total CUE MB Quantities			
		2005	2006	2007	2008	2009	2005	2006	2007	2008
Australia	Cut Flowers – field	40.000	22.350				18.375	22.350		
Australia	Cut flowers – protected	20.000					10.425			
Australia	Cut flowers, bulbs – protected Vic	7.000	7.000	6.170	6.150		7.000	7.000	3.598	3.500
Australia	Strawberry Fruit	90.000					67.000			
Australia	Strawberry runners	35.750	37.500	35.750	35.750	29.790	35.750	37.500	35.750	35.750
Belgium	Asparagus	0.630	0.225				0.630	0.225		
Belgium	Chicory	0.600	0.180				0.180	0.180		
Belgium	Chrysanthemums	1.800	0.720				1.120			
Belgium	Cucumber	0.610	0.545				0.610	0.545		
Belgium	Cut flowers – other	6.110	1.956				4.000	1.956		
Belgium	Cut flowers – roses	1.640								
Belgium	Endive (sep from lettuce)		1.650					1.650		
Belgium	Leek & onion seeds	1.220	0.155				0.660			
Belgium	Lettuce(& endive)	42.250	22.425				25.190			
Belgium	Nursery	Not Predictable	0.384				0.900	0.384		
Belgium	Orchard pome & berry	1.350	0.621				1.350	0.621		
Belgium	Ornamental plants	5.660					0.000			
Belgium	Pepper & egg plant	5.270	1.350				3.000	1.350		
Belgium	Strawberry runners	3.400	0.900				3.400	0.900		
Belgium	Tomato (protected)	17.170	4.500				5.700	4.500		
Belgium	Tree nursery	0.230	0.155				0.230	0.155		
Canada	Strawberry runners (PEI)	14.792	6.840	7.995	7.462	7.462	(a)14.792	6.840	7.995	7.462
Canada	Strawberry runners (Quebec)		1.826	1.826			(a)	1.826	1.826	
Canada	Strawberry runners (Ontario)			6.129					6.129	
France	Carrots	10.000	8.000	5.000			8.000	8.000	1.400	
France	Cucumber	85 revised to 60	60.000	15.000			60.000	60.000	12.500	
France	Cut-flowers	75.000	60.250	12.000			60.000	52.000	9.600	
France	Forest tree nursery	10.000	10.000	1.500			10.000	10.000	1.500	
France	Melon	10.000	10.000				7.500	6.000		
France	Nursery: orchard, raspberry	5.000	5.000	2.000			5.000	5.000	2.000	

Party	Industry	Total CUN MB Quantities					Total CUE MB Quantities			
		2005	2006	2007	2008	2009	2005	2006	2007	2008
France	Orchard replant	25.000	25.000	7.500			25.000	25.000	7.000	
France	Pepper	Incl in.tomato cun	27.500	6.000				27.500	6.000	
France	Strawberry fruit	90.000	86.000	34.000			90.000	86.000		
France	Strawberry runners	40.000	4.000	35.000			40.000	40.000	28.000	
France	Tomato (and eggplant for 2005 only)	150(all solanaceous)	60.500	33.250			125.000	48.400		
France	Eggplant		27.500	33.250				48.400		
Greece	Cucurbits	30.000	19.200				30.000	19.200		
Greece	Cut flowers	14.000	6.000				14.000	6.000		
Greece	Tomatoes	180.000	73.600				156.000	73.600		
Israel	Broomrape			250.000	250.000	250.000			250.000	
Israel	Cucumber - protected new 2007			25.000	18.750	6.250			25.000	
Israel	Cut flowers – open field	77.000	67.000	80.755	53.345	53.345	77.000	67.000	74.540	
Israel	Cut flowers – protected	303.000	303.000	321.330	163.400	155.200	303.000	240.000	220.185	
Israel	Fruit tree nurseries	50.000	45.000	10.000			50.000	45.000	7.500	
Israel	Melon – protected & field	148.000	142.000	140.000	87.500	87.500	125.650	99.400	105.000	
Israel	Potato	239.000	231.000	137.500	93.750	93.750	239.000	165.000	137.500	
Israel	Seed production	56.000	50.000				56.000	28.000		
Israel	Strawberries – fruit	196.000	196.000	176.200	64.125	57.000	196.000	196.000	93.000	
Israel	Strawberry runners	35.000	35.000		20	20	35.000	35.000	28.000	
Israel	Strawberry runners and fruit Ghaza				87.875	83.250				
Israel	Tomatoes			90.000					22.750	
Israel	Sweet potato				111.500	61.250				
Italy	Cut flowers (protected)	250.000	250.000	30.000			250.000	187.000	30.000	
Italy	Eggplant (protected)	280.000	200.000	15.000			194.000	156.000		
Italy	Melon (protected)	180.000	135.000	10.000			131.000	131.000	10.000	
Italy	Pepper (protected)	220.000	160.000	67.000			160.000	130.000	67.000	
Italy	Strawberry Fruit (Protected)	510.000	400.000	35.000			407.000	320.000		
Italy	Strawberry Runners	100.000	120.000	35.000			120.000	120.000	35.000	
Italy	Tomato (protected)	1300.000	1030.000	418.000			871.000	697.000	80.000	
Japan	Cucumber	88.300	88.800	72.400	68.600	61.400	88.300	88.800	72.4	51.450
Japan	Ginger – field	119.400	119.400	112.200	112.100	102.200	119.400	119.400	109.701	84.075
Japan	Ginger – protected	22.900	22.900	14.800	14.800	12.900	22.900	22.900	14.471	11.100
Japan	Melon	194.100	203.900	182.200	182.200	168.000	194.100	203.900	182.2	136.650
Japan	Peppers (green and hot)	189.900	200.700	169.400	162.300	134.400	187.200	200.700	156.700	121.725
Japan	Watermelon	126.300	96.200	94.200	43.300	23.700	129.000	98.900	94.2	32.475
Malta	Cucumber		0.096					0.127		

Party	Industry	Total CUN MB Quantities					Total CUE MB Quantities			
		2005	2006	2007	2008	2009	2005	2006	2007	2008
Malta	Eggplant		0.128					0.170		
Malta	Strawberry		0.160					0.212		
Malta	Tomatoes		0.475					0.594		
New Zealand	Nursery material	1.085	1.085					0.000		
New Zealand	Strawberry fruit	42.000	42.000	24.780			42.000	34.000	12.000	
New Zealand	Strawberry runners	10.000	10.000	5.720			8.000	8.000	6.234	
Poland	Strawberry Runners	40.000	40.000	25.000	12.000		40.000	40.000	24.500	
Portugal	Cut flowers	130.000	8.750				50.000	8.750		
Spain	Cut Flowers – Cadiz	53.000	53.000	35.000			53.000	42.000		
Spain	Cut Flowers – Catalonia	20.000	18.600	12.840	17.000 (+Andalucia)		20.000	15.000	43.490 (+Andalucia)	
Spain	Pepper	200.000	155.000	45.000			200.000	155.000	45.000	
Spain	Strawberry Fruit	556.000	499.290	80.000			556.000	499.290	0.0796	
Spain	Strawberry Runners	230.000	230.000	230.000	215.000		230.000	230.000	230.000	
Spain	Peppers and Strawberries				0.151					
UK	Cut flowers		7.560					6.050		
UK	Ornamental tree nursery	12.000	6.000				6.000	6.000		
UK	Strawberry (& raspberry in 2005)	80.000	63.600				68.000	54.500		
UK	Raspberry nursery		4.400					4.400		
USA	Chrys. Cuttings/roses	29.412					29.412	0.000		
USA	Cucurbits – field	1187.800	747.839	598.927	588.949	411.765	1187.800	747.839	592.891	486.757
USA	Eggplant – field	76.761	101.245	96.480	79.546	62.789	76.721	82.167	85.363	66.018
USA	Forest nursery seedlings	192.515	157.694	152.629	133.140	125.758	192.515	157.694	122.032	131.208
USA	Ginger	9.200					9.200	0.000		
USA	Orchard replant	706.176	827.994	405.415	405.666	314.007	706.176	527.600	405.400	393.720
USA	Ornamentals	210.949	162.817	149.965	138.538	137.776	154.000	148.483	137.835	138.538
USA	Nursery stock - fruit trees, raspberries, roses	45.789	64.528	12.684	51.102	27.663	45.800	64.528	28.275	51.102
USA	Peppers – field	1094.782	1498.530	1151.751	919.006	783.821	1094.782	1243.542	1106.753	756.339
USA	Strawberry fruit – field	2468.873	1918.400	1733.901	1604.669	1336.754	2052.846	1730.828	1476.019	1349.575
USA	Strawberry runners	54.988	56.291	4.483	8.838	8.837	54.988	56.291	4.483	8.838
USA	Tomato – field	2876.046	2844.985	2334.047	1840.100	1245.249	2876.046	2476.365	2065.246	1406.484
USA	Turfgrass	352.194	131.600	78.040	52.189	0	206.827	131.600	78.04	0
USA	Sweet potato	224.528			18.144	18.144				18.144

APPENDIX IV to Chapter 9 – Part B: Post-harvest Structural and Commodity Applications

List of nominated (2005 – 2008 in part) and exempted (2005 – 2008 in part) amounts of methyl bromide granted by Parties under the CUE process for each crop or commodity.

Party	Industry	Total CUN MB Quantities					Total CUE MB Quantities			
		2005	2006	2007	2008	2009	2005	2006	2007	2008
Australia	Almonds	1.900	2.100				1.900	2.100		
Australia	Rice consumer packs	12.300	12.300	10.225	9.200 +1.8	9.200	6.150	6.150	9.205	7.400
Belgium	Artefacts and structures	0.600	0.307				0.590	0.307		
Belgium	Antique structure & furniture	0.750	0.199				0.319	0.199		
Belgium	Churches, monuments and ships' quarters	0.150	0.059				0.150	0.059		
Belgium	Electronic equipment	0.100	0.035				0.100	0.035		
Belgium	Empty silo	0.050	0.043				0.050	0.043		
Belgium	Flour mill see mills below	0.125	0.072				See mills below	0.072		
Belgium	Flour mills	10.000	4.170				9.515	4.170		
Belgium	Mills	0.200	0.200				0.200	0.200		
Belgium	Food processing facilities	0.300	0.300				0.300	0.300		
Belgium	Food Processing premises	0.030	0.030				0.030	0.030		
Belgium	Food storage (dry) structure	0.120	0.120				0.120	0.000		
Belgium	Old buildings	7.000	0 .306				1.150	0.306		
Belgium	Old buildings and objects	0.450	0.282				0.000	0.282		
Belgium	Woodworking premises	0.300	0.101				0.300	0.101		
Canada	Flour mills	47.200	34.774	30.167	28.650	26.913	(a)47	34.774	30.167	28.650
Canada	Pasta manufacturing facilities	(a)	10.457	6.757	6.067		(a)	10.457	6.757	
Canada	Commodities					0.068				
France	Seeds sold by PLAN-SPG company	0.135	0.135	0.100			0.135	0.135	0.096	
France	Mills	55.000	40.000	8.000			40.000	35.000	8.000	
France	Rice consumer packs	2.000	2.000				2.000	2.000		
France	Chestnuts	2.000	2.000	1.800			2.000	2.000	1.800	
Germany	Artefacts	0.250	0.100				0.250	0.100		
Germany	Mills and Processors	45.000	19.350				45.000	19.350		
Greece	Dried fruit	4.280	3.081	0.900			4.280	3.081	0.45	
Greece	Mills and Processors	23.000	16.000	1.340			23.000	15.445	1.340	

Party	Industry	Total CUN MB Quantities					Total CUE MB Quantities			
		2005	2006	2007	2008	2009	2005	2006	2007	2008
Greece	Rice and legumes		2.355					2.355		
Ireland	Mills		0.888	0.611				0.888		
Israel	Artefacts	0.650	0.650	0.600			0.650	0.650		
Israel	Dates (post harvest)	3.444	3.444	2.200	1.800		3.444	2.755	2.200	
Israel	Flour mills (machinery & storage)	2.140	1.490	1.490	0.800		2.140	1.490	1.040	
Israel	Furniture– imported	1.422	1.422	2.042			1.422	0.000		
Italy	Artefacts	5.500	5.500	5.000			5.225	0.000	5.000	
Italy	Mills and Processors	160.000	130.000	25.000			160.000	65.000	25.000	
Japan	Chestnuts	7.100	6.500	6.500	6.300	5.800	7.100	6.800	6.500	6.300
Latvia	Grains		2.502					2.502		
Netherlands	Strawberry runners post harvest		0.120	0.120				0		
Poland	Medicinal herbs & dried mushrooms as dry commodities	4.000	3.560	1.800	0.500		4.100	3.560	1.800	1.800
Poland	Coffee, cocoa beans	(a)	2.160	2.000	0.500			2.160	1.420	1.420
Spain	Rice		50.000					42.065		
Switzerland	Mills & Processors	8.700	7.000				8.700	7.000		
UK	Aircraft			0.165					0.165	
UK	Mills and Processors	47.130	10.195	4.509			47.130	10.195	4.509	
UK	Cereal processing plants		8.131	3.480			(a)	8.131	3.480	
UK	Cheese stores	1.640	1.248	1.248			1.640	1.248	1.248	
UK	Dried commodities (rice, fruits and nuts) Whitworths	2.400	1.256				2.400	1.256		
UK	Herbs and spices	0.035	0.037	0.030			0.035	0.037		
UK	Mills and Processors (biscuits)	2.525	1.787	0.479			2.525	1.787		
UK	Spices structural equip.	1.728					1.728	0.000	0.479	
UK	Spices stored	0.030					0.030	0.000		
UK	Structures buildings (herbs and spices)	3.000	1.872	0.908			3.000	1.872	0.908	
UK	Structures, processors and storage (Whitworths)	1.100	0.880	0.257			1.100	0.880	0.257	
UK	Tobacco equipment	0.523					0.050			
UK	Woven baskets	0.770					0.770			
USA	Dried fruit and nuts (walnuts, pistachios, dried fruit and dates and dried beans)	89.166	87.719	91.299	67.699	58.912	89.166	87.719	78.983	58.921
USA	Dry commodities/ structures (cocoa beans)	61.519	61.519	64.028	52.256	51.002	61.519	55.367	64.082	53.188

Party	Industry	Total CUN MB Quantities					Total CUE MB Quantities			
		2005	2006	2007	2008	2009	2005	2006	2007	2008
USA	Dry commodities/ structures (processed foods, herbs and spices, dried milk and cheese processing facilities) NPMA	83.344	83.344	85.801	72.693	66.777	83.344	69.118	82.771	69.208
USA	Smokehouse hams (Dry cure pork products) (building and product)	136.304	135.742	40.854	19.669	19.699	67.907	81.708	18.998	19.699
USA	Mills and Processors	536.328	505.982	401.889	362.952	291.418	483.000	461.758	401.889	348.237

APPENDIX V to Chapter 9

Summary of CUE trends and information provided in National Management Strategies for phase-out of critical-use exemptions.

Party	CUE industry 2007/2008)	CUEs approved by MOP (tonnes)			CUNs (tonnes)		Expected or planned schedule for MB phase-out for Critical Uses	Constraints to Phase Out and progress with evaluation of alternatives
		2005	2006	2007	2007 (new)	2008		
Australia	Rice, strawberry, protected flowers	146.6	75.1	40.88	10.25	51.1	Reduce the imports of methyl bromide to zero by 2010 or earlier. CUE holders to identify and transition to alternatives before 2010. Turf growers and flour mills have been using stocks from before 2005 and have not requested CUEs so far.	Demonstrating technical and economic feasibility for VIF (LPBF) barrier films will require the Australian industry to overcome some barriers that currently prevent widespread adoption. A national programme tested more than 20 alternatives. A number of non-fumigant treatments (bio-fumigants, steam, hot water and solarisation) have also been tested. Telone C 35, methyl iodide and cyanogen are considered to be the prospective in the short term. However all require further trials and/or registration. Telone C 35 (a 1,3- dichloropropene/ chloropicrin mixture) has been identified and registered for the fruit industry, but not yet for the strawberry runner industry.
Canada	Mills, strawberry runners	61.79	53.90	39.99	12.87	36.11	As fast as possible following transition strategy principles to phaseout. No figures provided.	Potential alternatives have been identified for the relevant industries. The government is committed to a priority review of the technology/substances identified and submitted (by the technology owner) as alternatives to methyl bromide. The Canadian National Millers Association (CNMA) has completed one collaborative project to evaluate alternatives with the support of AAFC and is currently managing a second two-year (2005-2006) initiative to assist companies and pest controls service providers in evaluating alternatives. Results of the evaluations will be published by CNMA by the first quarter of 2007.

Party	CUE industry 2007/2008)	CUEs approved by MOP (tonnes)			CUNs (tonnes)		Expected or planned schedule for MB phase-out for Critical Uses	Constraints to Phase Out and progress with evaluation of alternatives
		2005	2006	2007	2007 (new)	2008		
Japan	Chestnuts, cucumber, ginger, pepper, melons, watermelons	748	741.4	636.172	0	589.6	Will ensure the reduction of critical uses nomination successively. No figures provided NMS to promote the phase-out of uses of methyl bromide as soon as technically and economically feasible. Difficult to suggest standard reduction level in general.	Experimental research plan for the development of pest control for crop diseases and virus (in e.g. peppers); development of alternative technologies ongoing. Prospective alternatives (tests done): • methyl iodide fumigation and storage under low temperature and high humidity to control chestnut weevil • control of melon necrotic spot virus (MNSV) with the use of resistant stock - demonstration field test on the efficacy • green pepper resistant variety with L4 gene against pepper tobamovirus.
New Zealand	Strawberry fruit, strawberry runners	50	42	0	30.50	-	Government has determined that 2007 will be the last nominations that will be supported for the critical use of methyl bromide by the strawberry industry.	The most likely alternative is Telone C35. It is recognised there are ongoing difficulties with the effectiveness of this product, especially in sub-optimal weather conditions. Current research into alternatives will not be completed until September 2007.
USA	Dried commodities, mills and processors, ham, cucurbits, eggplant, forest seedlings, nurseries, orchard replant, ornamentals, peppers, strawberry fruit, strawberry nurseries, tomatoes, turfgrass, sweet potato	9552.879	8081.753	6749.060	0	15105.78	Manage CUEs in accordance with the policies, procedures and regulations that are in place to address the elements in Ex.I/4(3) (i.e. avoid increases except under unforeseen circumstances; encourage use of alternatives; provide information on the potential market penetration of alternatives; promote emissions reductions measures; provide a description of phase-in of feasible alternatives)	Sector-by-sector description of the status of alternatives is provided.

10 Development of the Response to Decision XVIII/12

Since 1998, TEAP has progressively published its own special reports on the interrelationship of the technologies to protect stratospheric ozone and the technologies to protect climate. Early in 2005, the Intergovernmental Panel on Climate Change (IPCC) and the Technology and Economic Assessment Panel (TEAP) published the Special Report "Safeguarding the Ozone Layer and Global Climate System" (SROC). That report provided information relevant to decision-making in regard to the fact that some alternatives and substitutes to ozone-depleting substances (ODSs) are themselves potent greenhouse gases, included in the basket of chemicals controlled by the Kyoto Protocol. It also highlighted the significance of banked ODSs in respect of their future climate impacts. In November 2005, TEAP responded to an additional request from Parties and published "The Supplement to the IPCC/TEAP Report" to further elaborate the ozone depletion implications of the issues raised in the IPCC/TEAP Special Report and in particular to translate the "Mitigation" and "Business as Usual" scenarios contained within the SROC into ozone-specific units in order to highlight the potential benefits to the ozone layer. In accordance with decision XVII/19, the Ozone Secretariat convened an experts' workshop on 7 July 2006 to identify practical measures for reducing emissions of ODSs; it subsequently published a report of that workshop.

At MOP-18 in New Delhi, Parties took another decision asking TEAP to further assess measures deemed as practical in the report of the 7 July 2006 workshop, with a particular focus on the timing, feasibility and environmental benefits of HCFC control schedules for Article 5 Parties.

Decision XVIII/12 requests TEAP to address the following:

> *… to further assess the measures listed in the report of Ozone Secretariat workshop on the Intergovernmental Panel on Climate Change/Technology and Economic Assessment Panel special report, in the light of current and expected trends of ozone-depleting substance production and consumption and with a focus on hydrochlorofluorocarbons, taking into account timing, feasibility and environmental benefits in Parties operating under Article 5 and Parties not operating under Article 5 of the Protocol;*
>
> *… to provide information on current and future demand for, and supply of, hydrochlorofluoro-carbons, giving full consideration to the influence of the Clean Development Mechanism on hydrochlorofluorocarbon-22 production, as well as on the availability of alternatives to hydrochlorofluorocarbons;*
> *while requesting the Ozone Secretariat*
>
> *…to facilitate consultations, as appropriate, by the Technology and Economic Assessment Panel with relevant organizations, namely, the United Nations Framework Convention on Climate Change Secretariat, the Intergovernmental Panel on Climate Change, the Executive Board of Clean Development Mechanism of the Kyoto Protocol, and the secretariat of the Multilateral Fund, to enable the Technology and Economic Assessment Panel to draw on the work already carried out under these organizations, including any work relating to hydrochlorofluorocarbon-22, and consider, in cooperation with the Scientific Assessment Panel, the implications of these findings for the recovery of the ozone layer;*

In preparing its response to this Decision at its Rome meeting, TEAP has nominated the following TEAP members and invited other experts to form a Task Force. TEAP may need to supplement the Task Force membership if the nominated and invited experts are unable to serve or if the work of the Task Force ultimately requires additional expertise.

Radhey Agarwal (India) - Co-chair
Paul Ashford (UK) - Co-chair
Lambert Kuijpers (Netherlands) - Co-ordinator

TEAP
Stephen O. Andersen (United States)
Biao Jiang (China)
Jose Pons (Venezuela)
Miguel Quintero (Colombia)
Helen Tope (Australia)
Dan Verdonik (United States)
Masaaki Yamabe (Japan)
Shiqiu Zhang (China)

Other Invited Experts (not yet confirmed)
Denis Clodic (France)
Sukumar Devotta (India)
Jean Lupinacci (United States)
Roberto Peixoto (Brazil)
Guus Velders (Netherlands)

TEAP's evaluations in response to this Decision will be based on a series of scenarios which will assess the impacts in both magnitude and timing of various external factors on supply, demand and emissions of ODSs and their alternatives. TEAP is likely to use the same base-case scenario for future HCFC emissions as presented by the Scientific Assessment Panel (SAP) in the 2006 Assessment Report, which assumes full compliance with existing control measures, business-as-usual growth rates prior to the freeze in production and consumption by Article 5 Parties, and then production and consumption at the allowable limits into the future until scheduled phaseout in 2040.

In responding to paragraph 1 of the Decision, the Task Force is intending to group by 'type of measure' the 31 measures that were identified as practical at the Montreal Workshop in July 2006. These groupings will then form the basis of the Task Force's analysis which will cover impacts on both stratospheric ozone and climate, taking into account timing, feasibility and environmental benefits to Parties operating under Article 5 and Parties not operating under Article 5 of the Protocol for each of the measures considered. Particular emphasis will be placed on issues affecting HCFCs. The following matrix illustrates the intended approach:

Grouping by 'Type of Measure'

	Dom Refrig	Com Refrig	Trans Refrig	Stat A/C	Mob A/C	Foam	Halon
Emission reduction in use phase	3,5	6	11	15	18,19,20	25	28
Earlier transition from ODS	4	8	12	17	21	23,24	29,30
Design issues & material selection		9		13	19	26	
End-of-life Management	1	10		14	18	22,27	31
Early retirement of equipment	2	7		16			

The interaction of the Clean Development Mechanism (CDM) as it relates to HFC-23 projects with supply/demand for HCFC-22 will be the focus of TEAP's response to the subject matter of the second operative paragraph of the Decision. Work has already begun in assessing the scenarios currently under consideration by the Executive Board of the CDM. In these new

scenarios, TEAP will assess the sensitivity of HCFC production, consumption, and emissions estimates, prior to the cap for Article 5 Parties to the price of HCFC-22, where the latter may vary as a consequence of the incentives to capture profits from HFC-23 emissions mitigation under the CDM and other public and private greenhouse gas emissions trading schemes.

An interim Task Force Report covering both operative paragraphs will be presented at OEWG-27 and will take the form of a PowerPoint presentation, giving preliminary results of the above analyses and suggesting other findings that can be developed by TEAP prior to MOP-19. This interim report will be followed by a final written report, which will be circulated ahead of MOP-19 and will take full consideration of any comments received during discussions at OEWG-27 in Nairobi.

To support the response to Decision XVIII/12, the Ozone Secretariat has already been in contact with the Executive Board of the Clean Development Mechanism and the Secretariat of the Multilateral Fund. The Chief Officer of the Secretariat also attended the TEAP meeting in Rome as an observer in order to present the findings of the recently completed HCFC Surveys and to assist the TEAP in its deliberations. Informal discussions continue between the TEAP and the UNFCCC secretariat as well as with members of the Science Assessment Panel.

11 TEAP/TOC Organisation Issues

11.1 Budget

TEAP is grateful for the continuing support of those national governments, the European Commission, associations and companies that finance the time and expenses of the participation of experts in the TEAP, TOCs and Task Forces. However, TEAP and its TOCs are facing the continued loss of some of their most experienced members, who are critical to the quality, objectivity, and timeliness of TEAP findings. While it is often the case that some experts committed to the Montreal Protocol may work without payment for their working time, it is much less feasible to work without reimbursement of actual costs relating to travel and subsistence. In 2006, some TEAP members were forced to pay thousands of dollars in travel out of pocket, and to take unpaid leaves-of-absence for participating in TEAP and TOC meetings, while others had to cash in frequent-flyer miles for travel to TEAP meetings. These extraordinary actions and sacrifices are unsustainable.

It is fortunate that the costs relating to travel are paid by the Ozone Secretariat for Article 5 participants, but it is unfortunate and unfair that some self-employed developing country experts working as consultants have been unable to find funding to compensate the considerable time spent working for TEAP and the TOCs.

Therefore, TEAP renews its request for emergency funding of up to 26 travels per year for 2007 and 2008 to cover travel for non-Article 5 members of TEAP and TOCs. If direct funding out of the Ozone Trust Fund through the Secretariat is not possible, TEAP respectfully requests that assignments to TEAP be paid on time and a cost basis from the Ozone Secretariat, the Multilateral Fund or other appropriate sources.

Mindful that Parties have repeatedly rejected requests for financing, individual TEAP and related TOC members will continue to seek adequate funding from governments, associations, and companies, while TEAP itself will investigate funding from foundations. Parties may also wish to consider other options such as fees per application for essential and critical uses. Another option Parties could consider is financing from the Multilateral Fund for studies such as the Multilateral Fund Replenishment Assessment on topics such as process agents where a MOP commissions a study from the TEAP and the MLF Executive Committee commissions it from the MLF Secretariat, which is a duplication of effort. TEAP notes that if a lack of travel funds for MBTOC members results in resignations, and if these resignations all come from only one or two regions, MBTOC's ability to ensure that CUNs are reviewed by experts not in conflict of interest will be jeopardised. The MBTOC QSC subcommittee currently has several members from the EU with no funding; resignations of these experts would jeopardise the management method used to ensure CUNs are reviewed by experts without any conflict of interest.

11.2 Methyl Bromide Technical Options Committee Adjustments

At MOP-18 in New Delhi, Parties decided not to finance extraordinary travel of TEAP and TOC members and not to finance the budget put forward in the MBTOC Workplan. Parties also decided to hold MOP-19 during the week of 17-21 September 2007, which is earlier than usual. The accelerated schedule for consideration of methyl bromide Critical Use Nominations (CUNs) made it necessary for the MBTOC to meet 19-23 March 2007, just days before the TEAP meeting, which took place 26-30 March 2007 in Rome.

After consultation among all TEAP members including MBTOC Co-Chairs, TEAP adjusted the MBTOC operations to accommodate the challenges of inadequate funding and the early date in September 2007 when the 19th Meeting of the Parties will be held.

TEAP is pleased to report that MBTOC Co-Chairs agree that the recent subcommittee strengthening has improved the links between topics and experts; populated each subcommittee with the best experts; improved the efficiency of meetings, which may reduce the length of future meetings; and simplified the process of coming to consensus. TEAP anticipates that the new structure will be even more successful in 2008 with the experience gained. The strengthening and revitalizing process has not yet finished and will continue in the coming months.

MBTOC has always been divided into two subcommittees, which are now designated as the Methyl Bromide Technical Options Committee Soils Sub-Committee (MBTOC-S) and the Methyl Bromide Technical Options Committee Quarantine, Structures and Commodities Sub-Committee (MBTOC-QSC). Mindful of the increasing importance of QPS uses of methyl bromide and in order to economise costs of operations, TEAP's Quarantine and Preshipment Task Force (QPS Task Force) members have been integrated into the MBTOC QSC subcommittee for 2007. Each subcommittee has specific expertise necessary for the competent assessment of relevant CUNs. The operation is consistent with the old format and ensures that members who form consensus on the CUNs are present at all the discussions during the meetings.

TEAP has instructed MBTOC and all TOCs that, when consensus cannot be reached, experts not in agreement with the technical and economic findings of the majority are to be invited to submit signed minority reports substantiating the technical or economical basis of their judgement.

In 2006, MBTOC had four Co-Chairs approved by Parties (Dr. Mohamed Besri, Ms. Michelle Marcotte, Ms. Marta Pizano, and Dr. Ian Porter) and each MBTOC Co-Chair also serves as a Co-Chair of one of the two Subcommittees. Each MBTOC subcommittee Co-Chair has the same authority as other Co-Chairs and no Co-Chair has diminished or reduced authority. As Chair of the 2006 Methyl Bromide QPS Task Force, Dr. Jonathan Banks was a member of TEAP, but not considered a Co-Chair of MBTOC. TEAP Task Forces are 'Temporary Subsidiary Bodies' that normally conduct their work within a year, but because Parties had not submitted information required to complete the work of the QPS Task Force, Parties asked the QPS Task Force to continue its work in 2007.

TEAP had moved Dr. Jonathan Banks from the position of Chair of the QPS Task Force to a position of Temporary Co-Chair of the MBTOC-QSC. However, after one Party questioned this decision, TEAP realised that its Terms-of-Reference can be interpreted to allow a temporary appointment only to replace a departing Co-Chair and therefore suspended the temporary appointment of Dr. Jonathan Banks to the position of MBTOC Co-Chair. However, Dr. Banks remains as a member of TEAP in 2007 through his position as Task Force Co-Chair.

11.3 Change of Employment for Foams Technical Options Committee Article 5 Co-Chair

Dr. Miguel Quintero Guzman, Article 5 Co-Chair of the Foams TOC, has recently moved from employment as a university professor in Colombia to a senior position at Dow Europe in Switzerland, although his will keep a position as visiting professor at the university for at least the next year. Dow Europe has agreed to pay the cost of time and travel for his future participation in TEAP and Foams TOC activities.

It is already the case that Jose Pons serves as Co-Chair of the TEAP and Co-Chair of the MTOC while owning and operating an Article 5 national company that manufactures ODS (HCFC) aerosol products and ozone-safe alternatives to ODS aerosol products. However, Dr. Quintero would be the first TOC Co-Chair and TEAP member to be employed by a non-A5 multinational company manufacturing ODS products and alternatives.

TEAP has confidence that Dr. Quintero can continue to be an objective and valuable member and recommends that Parties confirm his continuing position as Co-Chair of the FTOC and member of TEAP. However, in view of his likely continuing residence and employment in Switzerland, TEAP will ask the Ozone Secretariat to advertise the position of an additional Article 5 FTOC Co-Chair and will present relevant candidates for consideration and approval at MOP-19.

11.4 Notice of Positions Available on the TEAP and its TOCs

TEAP welcomes nominations of experts for all committees at any time. Currently, TEAP is particularly seeking:

- Article 5 Co-Chair for the Foams Technical Options Committee
- Article 5 Co-Chair for the Halons Technical Options Committee
- Article 5 and non-Article 5 Experts in QPS for the Methyl Bromide Technical Options Committee (MBTOC-QSC Subcommittee)
- Expert in nutsedge control for the Methyl Bromide Technical Options Committee (MBTOC-S Subcommittee)
- Experts in aviation fire protection for the Halons Technical Options Committee
- Article 5 experts in the manufacture of ODS MDIs and ODS-free alternatives

11.5 Conflict of Interest

In response to decisions at MOP-18, TEAP and its TOCs have expanded the scope and detail of disclosure reporting and are publishing available summaries in this report. Eventually, TEAP hopes to comply with the decision by maintaining the latest information on the Ozone Secretariat web site.

ANNEX I: TEAP Member Biographies

The following contains the background information for all TEAP members as at April 2007.

Dr. Radhey S. Agarwal
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Dr. Radhey S. Agarwal, Co-chair of the Refrigeration, Air-conditioning and Heat Pumps Technical Options Committee, is the Professor of Mechanical Engineering at the Indian Institute of Technology Delhi (IIT Delhi). He co-chaired the 2003 HCFC Task Force and the 2004 Chiller Task Force. IIT Delhi has an interest in the topics of the Montreal Protocol since it is one of the academic institutes of higher learning in India. Dr. Agarwal holds a M. Tech. and a Ph.D. from IIT Delhi. Dr. Agarwal has been actively pursuing research in the area of refrigeration & air-conditioning. He has guided a number of Ph.D. and M. Tech. theses and published research papers in the field of refrigeration and air-conditioning. Dr. Agarwal has no proprietary interest in alternatives or substitutes to ODSs, does not own any stock in companies producing ODS or alternatives/substitutes to ODSs. Dr. Agarwal's spouse has no interest in matters related to the Protocol. Dr. Agarwal occasionally takes consultancies and advisory roles operated through IIT Delhi from the engineering industry, UNEP, GTZ and INFRAS for research & development, technical advice, developing technical manuals and training materials etc. IIT Delhi makes in-kind contribution for wages. Cost of travel and other expenses related to participation in the TEAP and the RTOC are paid by UNEP's Ozone Secretariat.

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Stephen O. Andersen, Co-chair of the Technology and Economic Assessment Panel since 1989, is Director of Strategic Climate Projects in the Climate Protection Partnerships Division of the U.S. Environmental Protection Agency. He chaired and co-chaired the Solvents TOC from 1989 to 1995, chaired the 1999 HFC and PFC Task Force, and co-chaired several Task Forces. He served on the Steering Committee to the "IPCC/TEAP Special Report Safeguarding the Ozone Layer and the Global Climate System: Issues Related to Hydrofluorocarbons and Perfluorocarbons" and he participated in the Science Assessment Panel in 2006. He currently co-chairs the Task Force on the TEAP Legacy. Dr. Andersen's spouse works for the U.S. EPA Office of Pesticide Programs and Toxic Substances in a division that registers bio-pesticides, including potential substitutes for methyl bromide. The U.S. EPA makes in-kind contributions of wages, travel, communication, and other expenses and some travel is sponsored by the U.S. DoD. With approval of its government ethics officer, EPA allows expenses to be paid by other governments and organisations such as the United Nations Environment Programme (UNEP).

Mr. Paul Ashford
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Paul Ashford, Co-chair of the Rigid and Flexible Foams Technical Options Committee since 1998 is the owner and managing director of Caleb Management Services Ltd., a consulting company working in the chemical regulatory and sustainability arenas. He co-chaired the TEAP Task Force on the Supplement Report to the "IPCC/TEAP Special Report: Safeguarding the ozone layer and the global climate system: issues related to hydrofluorocarbons and perfluorocarbons" (2005) and the Task Force on Emissions Discrepancies in 2006. Until 1994, he worked for BP Chemicals in the division that developed licensed foam technology using ODS and was responsible for the adoption of alternatives. He has over 25 years direct experience of foam related technical issues and has conducted numerous studies to characterise the foam sector and inform future policy development. His funding for TEAP activities, which includes some sponsorship of time, is provided jointly under contract by the Department of Trade and Industry (DTI) and the Department of Environment, Food and Rural Affairs (DEFRA) in the UK. Much of his recent work on banks, emissions and foam end-of-life management, performed to inform both IPCC and TEAP processes has been supported by the US EPA. There is increasing overlap with IPCC and UNFCCC objectives in support of greenhouse gas emissions reporting by Governments. Other related non-TEAP work is covered under separate contracts from relevant commissioning organisations including international agencies (e.g. UNEP DTIE), governments, industry associations and corporate clients. A considerable portion of the work with private clients relates to the lifecycle assessment of products based on ODS alternatives and advice on carbon management strategies.

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Dr. Jonathan Banks, Chair of TEAP's QPS Task Force, is a private consultant. He was a member of the 1992 Methyl Bromide Assessment and from 1993 to 1998 and 2001 to 2005 co-chaired the Methyl Bromide TOC. He worked as a Research Scientist with the Australian Commonwealth Scientific and Industrial Research Organization (CSIRO) from1972 to 1999 on grain storage technologies, including use of improved use of fumigants. He is co-inventor of carbonyl sulfide, an alternative fumigant to methyl bromide in some applications. Patent rights have been assigned to his employer, CSIRO. Dr Banks has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs. He has stock in Brambles Ltd, a company that inter alia leases wooden pallets for freight. The pallets may or may not be treated with methyl bromide or alternatives. His spouse is co-owner of their commercial organic apple orchard. She has no financial interests relating to ozone-depleting substances. He has served on some national committees concerned with ODS and their control, and within the last 4 years has received contracts from UNEP, other institutions and public companies related to methyl bromide alternatives and grain storage technology--including training in fumigation (methyl bromide and alternatives) and fumigation technology and recapture systems for methyl bromide. In 2005 and 2006 he received some support from UNEP for TEAP and MBTOC activities. Other funding for his MBTOC activities has been through grants or contracts from the Department of Environment and Heritage, Australia or from personal contributions.

Prof. Mohamed Besri
(MBTOC Co-chair)
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Prof. Mohamed Besri, is a full time Professor of Plant Pathology and Integrated Disease Management at the Hassan II Institute of Agronomy and Veterinary Medicine, Rabat, Morocco (HII IAVM). The HII IAVM has an interest in the topics of the Montreal Protocol because it houses specialists in Soil-borne Plant Pathogens and MLF projects (strawberries, bananas, cut flowers). It advises the Ministry of Agriculture on all aspects of alternatives to Methyl Bromide. Dr Besri, his spouse, his business partner and dependant children have no proprietary interest in alternatives or substitutes to ODSs, nor do any of them own stock in companies producing ODS or alternatives or substitutes to ODSs. Dr Besri works occasionally as a consultant to UNEP on matters related to the Montreal Protocol. Costs associated to travel, communication, and others related to participation in the TEAP, MBTOC, and relevant Montreal Protocol meetings, are paid by UNEP's Ozone Secretariat.

Mr. David Catchpole
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Mr. David V. Catchpole, Co-Chair of the Halons Technical Options Committee and Member of the Technology and Economics Assessment Panel since 2005, works part time for Petrotechnical Resources Alaska (PRA), an Anchorage, Alaska based company that provides consulting services to oil companies in Alaska. From 1991 to 2004 he was a member of the HTOC. From 1970 until 1999, he was an employee of the BP group of companies, most recently BP Exploration Alaska, where he worked for nine years in the environmental department on alternatives to halon and on halon banking. Mr. Catchpole advises BP Exploration Alaska on fire protection and halon issues as his main activity for PRA. BP Exploration Alaska has an interest in the topics of the Montreal Protocol because it uses halon 1301 for explosion prevention and fire suppression in its enclosed oil and gas processing modules on the North Slope of Alaska. Mr. Catchpole has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, however his retirement portfolio contains stock in BP plc. Mr. Catchpole's spouse does not work for or consult for any organisation that has an interest in the topics of the Montreal Protocol. His spouse has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consult for organisations seeking to phase-out ODSs. Mr. Catchpole typically receives funding to support salary and travel to TEAP/TOC meetings from the United States Environmental Protection Agency and the United States Department of Defense; and the Halon Recycling Corporation and the Halon Alternatives Research Corporation, which are not-for-profit industry coalitions that in turn receive contributions for this funding from members. Contributors are: BP Exploration Alaska, ConocoPhillips Alaska, DuPont, Chemtura, American Pacific, Firetrace, Halon Banking Systems, Westco and Remtec.

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Dr Biao Jiang, Co-chair of the Chemicals Technical Options Committee since 2005, is Professor of Chemistry of Shanghai Institute of Organic Chemistry, Chinese Academy Of Sciences and a member of editorial advisory board of Chemical Communication, Royal Society of Chemistry, United Kingdom. Professor Jiang involves in the research and the development of new methodology of organic synthesis, medicinal chemistry, fluorine chemistry as well as organic process research and development of clean chemistry. Dr Jiang has no proprietary interest in alternatives or substitutes to ODSs, nor does he own stock in companies producing ODS or alternatives or substitutes to ODSs. Costs of travel, communication, and other expenses related to participation in the TEAP, its Chemicals TOC, and relevant Montreal Protocol meetings, are paid by UNEP's Ozone Secretariat.

Dr. Lambert Kuijpers
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Lambert Kuijpers, Co-chair of the Technology and Economic Assessment Panel since 1992 and Co-chair of the Refrigeration, Air-conditioning and Heat Pumps Technical Options Committee since 1989, works on a part-time basis for the Department "Technology for Sustainable Development" at the Technical University Eindhoven, The Netherlands. He is a member of the Task Force on the TEAP legacy; he co-chaired the Replenishment Task Forces between 1996 and 2005. He served on the Steering Committee to the "IPCC/TEAP Special Report "Safeguarding the ozone layer and the global climate system: issues related to Hydrofluorocarbons and Perfluorocarbons", he co-chaired the 2005 Task Force for the TEAP Supplementary Report to the IPCC/TEAP Special Report and the 2006 Task Force on Emissions Discrepancies. He was a member of the Science Assessment Panel in 2005-2006. Until 1993, he worked for Philips in the development of refrigeration, air conditioning, and heat pump systems to use alternatives to ozone-depleting substances. He is financially supported (through the UNEP Ozone Secretariat) by the European Commission (and in certain years by some EU member state governments) for his activities related to the TEAP and the Refrigeration TOC. The general lack of adequate funding and also the high variability of available funding per year imply that, in many recent years, Dr. Kuijpers had to add significant voluntary contributions from private funds. Dr. Kuijpers has no proprietary interest in alternatives or substitutes to ODS and does not own stock in companies producing ODS or alternatives or substitutes to ODS. He occasionally is a consultant to governmental and non-governmental organisations, such as the World Bank, UNEP DTIE and the Multilateral Fund (e.g. for the 2006 Expert Meeting). Dr. Kuijpers is also an advisor to the Re/genT Company, Netherlands, which he co-founded in 1993 and where he still has a minority interest (R&D of components and equipment for refrigeration, air-conditioning and heating).

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Ms Michelle Marcotte was a member of the 1992 Methyl Bromide Assessment and subsequently a member of the Methyl Bromide Technical Options Committee between 1992 and 2005; she was confirmed as Co-Chair in 2005. Until 1993 she worked for MDS Nordion, a supplier of radiation processing equipment which is an alternative to the use of methyl bromide in some commodity and quarantine situations. Since then, Ms Marcotte, through Marcotte Consulting, has provided consulting services to governments and agri-food companies in eight countries on agri-environmental issues, food technology, regulatory affairs and radiation processing. Marcotte Consulting has an interest in the topics of the Montreal Protocol because of its long time market development work in food irradiation, an alternative to some methyl bromide uses, and because of its interest in food processing, food safety and trade. In the field of methyl bromide alternatives, Ms Marcotte has published case studies in pest control in food processing, in stored commodities, in alternatives for quarantine and in greenhouse use. She is a member of the Canada Industry-Government Methyl Bromide Working Group and the Canada-US Methyl Bromide Working Group; both organisations work to achieve the phase-out of methyl bromide in the agri-food sector. Marcotte has consulted to companies, industry associations, the International Atomic Energy Agency and US AID on irradiation as a methyl bromide alternative in food processing, quarantine and trade. She has also prepared consulting reports summarising research in methyl bromide alternatives and case studies on food processing for the U.S. Environmental Protection Agency. Ms Marcotte has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs. Ms Marcotte's spouse works for United States Department of Agriculture managing research in methyl bromide alternatives and is a member of MBTOC. He does not have proprietary interest in alternatives or substitutes to ODS and does not own stock in companies producing ODS or alternatives or substitutes to ODSs. Ms Marcotte receives a consulting contract from the Government of Canada, Environment Canada. The funds for Ms Marcotte for travel to TEAP, MBTOC and Montreal Protocol meetings and to support her work on the MBTOC are provided by the the Government of Canada, Environment Canada.

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Thomas Morehouse, Senior Expert Member for Military Issues since 1997, is a Research Adjunct at the Institute for Defense Analyses (IDA), Washington D.C., USA. From 1989 until 1996 he co-chaired the Halons TOC. From 1986 to 1989 he was an officer in the United States Air Force responsible for developing alternatives to halon. From 1989 until 1994 his responsibilities as an Air Force officer included broader environmental and energy policy issues for the U.S. Department of Defense. Mr. Morehouse's spouse works for the U.S. National Oceanographic and Atmospheric Administration (NOAA) in a position that plans long term spending for NOAA, including research and operations affecting stratospheric ozone and climate. IDA makes in-kind contributions of communications and miscellaneous expenses. Funding for wages and travel is provided by grants from the Department of Defense and the Environmental Protection Agency. IDA is a not-for-profit Federally Funded Research Center (FFRDC) that undertakes work exclusively for the US Department of Defense. He also occasionally consults independently to corporate clients, national laboratories and other government agencies on environmental and energy related issues. Mr

Morehouse –and his spouse- have no proprietary interest in alternatives or substitutes to ODSs, nor do they own stock in companies producing ODS or alternatives or substitutes to ODSs.

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Ms Marta Pizano is a consultant on methyl bromide alternatives, particularly for cut flower production, and has actively promoted methyl bromide alternatives among growers in many countries. She is a regular consultant for the Montreal Protocol Multilateral Fund (MLF) and its implementing agencies. In this capacity, she has contributed to the methyl bromide phase-out programs in nearly twenty Article 5 countries around the world, assisting growers with the adoption of sustainable alternatives and the implementation of IPM programs. She is a frequent speaker at national and international methyl bromide conferences and has authored numerous articles and publications on alternatives to this fumigant. She has been a member of MBTOC since 1998 and a co-chair since 2005. Neither Ms Pizano nor her husband or their children own stock or have proprietary interest in companies producing ODS or their alternatives or substitutes. Costs associated to travel, communication, and others related to participation in the TEAP, MBTOC, and relevant Montreal Protocol meetings, are paid by UNEP's Ozone Secretariat.

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Jose Pons, Co-chair of the Technology and Economic Assessment Panel and the Medical Technical Options Committee and Member of the 2007 Task Force on the TEAP Legacy, is President of Spray Química C.A. Jose Pons is a full time manager/engineer at the Spray Química aerosol filling plant in La Victoria, Venezuela. Spray Química has an interest in the topics of the Montreal Protocol because it used, and still uses, ODS in some of its aerosol products for industrial maintenance. Mr Pons has no proprietary interest in alternatives or substitutes to ODS, does not own stock in companies producing ODS or alternatives or substitutes to ODS, does not have an interest in the outcome of essential use nominations, and does not consult for organisations seeking to phase out ODS. Mr Pons's spouse has no interest in matters before the Protocol; she is also a manager/engineer at Spray Química. Mr Pons has worked occasionally as a consultant to MLF on matters related to the Montreal Protocol. The Task Force worked by e-mail and there was no travel or other expenses paid by any organisations to participate in this activity. Travel related to participation in the TEAP and MTOC, and relevant Protocol meetings, are paid by UNEP's Ozone Secretariat. Spray Química makes in-kind contributions of wage, and miscellaneous and communication expenses.

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Dr Ian Porter is the Statewide Leader of Plant Pathology with the Victorian Department of Primary Industries (DPI). DPI has an interest in developing sustainable control measures for plant pathogens and biosecurity. He is a member of a number of National Committees regulating ODS, has led the Australian research program on methyl bromide alternatives for soils and has 26 years experience in researching sustainable methods for soil disinfestation of plant pathogens with over 200 research publications. He has been a member of MBTOC since 1997, Soils sub committee chair since 2001 and MBTOC Co-chair since 2005. Neither Dr Ian Porter, wife or children have any proprietary interest in alternatives or substitutes to ODSs, nor own stock in companies producing ODS or alternatives or substitutes to ODSs. Dr Porter is presently assisting national research agencies in Australia develop national priorities for IPM and soil health. He has acted occasionally as a key consultant for UNEP and UNIDO in developing programmes to assist China, Mexico and CEIT countries to replace methyl bromide. The Victorian DPI has in the past made in-kind contributions to attend MBTOC and UNEP meetings, but provides no support at present. In 2007, Dr Porter funds his own participation. The Australian Federal Government Research Fund and funds obtained through the Ozone Secretariat have provided support to finance travel and expenses for MBTOC activities.

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Prof. Miguel W. Quintero, Co-chair of the Foams Technical Options Committee since 2002, has been a professor at the Chemical Engineering Department at Universidad de los Andes in Bogota, Colombia, in the areas of polymer processing and transport phenomena during 2000-2006, where he is now a visiting professor. Prof. Quintero worked during 21 years (until 2000) for Dow Chemical at the Research & Development and Technical Service & Development Departments in the area of rigid polyurethane foam. In January 2007, he returned to Dow Europe as Development Leader for Polyurethane Product Research, located in Freienbach, Switzerland. He owns stock in companies that now or previously manufactured ozone-depleting substances and products made with or containing ozone-depleting substances and their substitutes and alternatives. He has been a regular consultant for the Montreal Protocol's implementing agencies. The participation of Prof. Quintero in TEAP and FTOC related activities is funded by Dow Chemical.

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Dr. Rae, Co-chair of the Chemicals Technical Options Committee since 2005, is a Honorary Professorial Fellow at the University of Melbourne, Australia, and a member of advisory bodies for several Australian government agencies dealing with chemical issues and in

particular the Stockholm Convention. He co-chaired the 2001 and 2004 Process Agent Task Forces. He is a member of the POPs Review Committee for the Stockholm Convention. On occasions, he acts as consultant to government agencies and to universities and companies and he has been an expert witness in a case involving alleged patent infringement involving HFC-134a and its lubricants. He contributes the time for his own participation in TEAP activities. The Australian Government Department of the Environment and Water Resources finances the cost of travel and accommodation for Dr. Rae's attendance at meetings of the CTOC, TEAP, OEWG and MOP.

Mr. K. Madhava Sarma
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K. Madhava Sarma, Senior Expert Member since 2001, and member of the Task Force on the TEAP Legacy, retired in 2000, after nine years as Executive Secretary, Ozone Secretariat, UNEP. Earlier, he was a senior official in the Ministry of Environment and Forests (MOEF), Government of India and held various senior positions in a state government in India. He works occasionally as a consultant to UNEP and is an unpaid member of the Technical and Finance Committee of the Ozone Cell, MOEF, Government of India. He is working on a research and writing project on technology transfer and change for the protection of the ozone layer financed by the Global Environmental Facility (GEF). Neither he or his spouse own stock in any company connected to ODS or alternatives or substitutes. Costs of travel, communication, and other expenses related to participation in the TEAP and relevant Montreal Protocol meetings, are paid by UNEP's Ozone Secretariat.

Ms. Kristen Taddonio
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Kristen Taddonio is Co-chair of the Task Force on TEAP Legacy in 2007. The Task Force worked via the internet and never met as a group. A student from the University of California, Ms. Liu Liu, assisted with developing and proofing the extensive TEAP membership database that is one analytical basis of the report. In conjunction with other meetings, Ms. Taddonio met with the TEAP to complete the report. The U.S. EPA makes in-kind contributions of wages, communication and other expenses. Ms. Taddonio and her immediate family have no priority interest in alternatives and substitutes to ODS, do not own stocks in companies producing ODS or alternatives and do not consult for organisations seeking to phase out ODS.

Dr. Helen Tope
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Helen Tope, Co-chair Medical Technical Options Committee since 1995, Member of the 2007 Task Force on the TEAP Legacy, is Principal Consultant of Energy International Australia (since 2006) and also Director of Planet Futures (since 2007) with whom she is an independent consultant providing strategic, policy and technical advice and facilitation services to government, industry and other non-governmental organisations on climate change, ozone-depleting substances, and other environmental issues. Dr Tope's business has an interest in the topics of the Montreal Protocol because her potential clients are also interested in these topics. Dr Tope has no proprietary interest in alternatives or substitutes to ODS, does not own stock in companies producing ODS or alternatives or substitutes to ODS, does not have an interest in the outcome of essential use nominations, and does not currently consult for organisations seeking to phase out ODS. Dr Tope's spouse has no interest in matters before the Protocol. The Ozone Secretariat provides a grant for travel, communication, and other expenses of the Medical Technical Options Committee from funds granted to the Secretariat unconditionally by the International Pharmaceutical Aerosol Consortium (IPAC). IPAC is a non-profit corporation.

Dr. Daniel P. Verdonik
(Halons TOC Co-chair)
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Dr. Daniel P. Verdonik, Co-Chair, Halons Technical Options Committee and Member, Technology and Economic Assessment Panel is the Director, Environmental Programs, Hughes Associates, Inc. Dr. Verdonik is a full time, salaried employee at Hughes Associates, Inc., in Baltimore, MD and Arlington, VA providing consulting services in fire protection and environmental management. Hughes Associates, Inc. has an interest in the topics of the Montreal Protocol because it provides a wide range of fire protection research, design and consulting services to government and corporate clients, including work related to halons and halon alternatives. Dr. Verdonik has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and through Hughes Associates, Inc. provides consulting services for organisations seeking to phase-out ODSs. Dr. Verdonik is a partner in Hughes Associates, Inc., which does not own stock in companies producing ODS or alternatives or substitutes to ODSs. Dr. Verdonik currently provides consulting services through Hughes Associates, Inc, for the U.S. Army and U.S. Navy on matters related to the Montreal Protocol and has previously provided services through Hughes Associates Inc. for Implementing Agencies, U.S. EPA, U.S. Air Force and Chemtura. Dr. Verdonik's spouse works for the U.S. Army, which has an interest in the topics of the Montreal Protocol because it is trying to phase-out halons but in the interim, continues to rely on halons for purposes of national security. Dr. Verdonik's spouse and dependant child have no proprietary interest in alternatives or substitutes to ODSs, do not own stock in companies producing ODS or alternatives or substitutes to ODSs, and do not consult for organisations seeking to phase out ODSs. Hughes Associates, Inc. typically receives funding to support Dr. Verdonik's salary and travel to TEAP/HTOC/TSB meetings from MLF, UNEP, the U.S. Department of Defense, the U.S. EPA, the U.S. National Aeronautics and Space Administration, the Halon Recycling Corporation, and the Halon Alternatives Research Corporation, who in-turn currently receives funding to support these efforts from the

following sponsors: BP Exploration, Alaska, ConocoPhillips, Alaska; DuPont; Chemtura; American Pacific; Firetrace; Halon Banking Systems; Wesco; Remtec. From time-to-time, Hughes Associates, Inc may also provide support for labor and travel.

Prof. Ashley Woodcock
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Prof. Ashley Woodcock, Co-chair of the Medical Technical Options Committee and Member of the Technology and Economic Assessment Panel, is a Respiratory physician at the South Manchester University Teaching Hospital. Prof. Woodcock is a full time physician and academic at the North West Lung Centre Manchester United Kingdom. The Hospital and University have no direct interest in the topics of the Montreal Protocol. Prof. Woodcock has no proprietary interest in alternatives or substitutes to ODS, does not own stock in companies producing ODS or alternatives or substitutes to ODS, does not have an interest in the outcome of essential use nominations. Prof. Woodcock carries out unrelated consulting and educational lectures for pharmaceutical companies, some of which have continued to produce CFC MDIs, and some of which have sought to accelerate phase out of CFC MDIs. He regularly advises companies on study design for new drugs, some of which have been ODS replacements. Prof. Woodcock's spouse has no interest in matters before the Protocol. Prof. Woodcock does not work as a consultant to the UN, UNEP, MLF or Implementing Agencies. In the past, he has responded to requests for technical information on CFC MDI phase-out from the European Community and the United Kingdom Government. Travel and subsistence for meetings of TEAP, MTOC, OEWG, MOP meetings is paid by the UK Department of Environment, and Prof. Woodcock's employer allows leave of absence.

Dr. Masaaki Yamabe
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Dr. Masaaki Yamabe, Co-Chair of the Chemical Technical Options Committee since 2005, is research coordinator (Environment and Energy) at the AIST. He is a member of the Task Force on the TEAP Legacy and he co-chaired the 2004 Process Agent Task Force. He was a member of the Solvents TOC during 1990-1996. Until 1999, Dr. Yamabe was Director of Central Research for Asahi Glass Company, which previously produced CFCs, methyl chloroform, and carbon tetrachloride, and currently produces and distributes HCFC, carbon tetrachloride, and HFCs. He is the co-inventor of HCFC-225, which is controlled under the Montreal Protocol as a transitional substance in the phase-out of ozone-depleting substances and is a substitute for CFC-113 in solvent and process agent applications. He owns stock in Asahi Glass Company that produces ozone-depleting substances and their substitutes. He also works for the Japan Industrial Conference for Ozone Layer and Climate Protection (JICOP) as a senior advisor. AIST generally pays wages, travelling and other expenses, except in some cases where JICOP sponsors travel.

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Dr. Shiqiu Zhang, Senior Expert Member for economic issues of the TEAP since 1997, is a Professor on Environmental Economics and Policy at the College for Environmental Sciences of Peking University. She is a member of the Task Force on the TEAP Legacy and co-chaired the 2002 and 2005 Replenishment Task Forces. She is involved in the work to help the Chinese government to develop the country program for the phase-out of ODS, and in studies of related relevant policies. She occasionally consults for UNEP. Dr. Zhang has no proprietary interest in alternatives or substitutes to ODSs, nor does she own stock in companies producing ODS or alternatives or substitutes to ODSs. Costs of travel, communication, and other expenses related to participation in the TEAP and relevant Montreal Protocol meetings, are paid by UNEP's Ozone Secretariat.

ANNEX II: TEAP-TOC Membership Lists Status March 2007

Technology and Economic Assessment Panel (TEAP)

Co-chairs	Affiliation	Country
Stephen O. Andersen	Environmental Protection Agency	USA
Lambert Kuijpers	Technical University Eindhoven	Netherlands
Jose Pons Pons	Spray Quimica	Venezuela

Senior Expert Members	Affiliation	Country
Thomas Morehouse	Institute for Defense Analyses	USA
K. Madhava Sarma	Consultant	India
Shiqiu Zhang	Center of Environmental Sciences, Peking University	China

TOC Chairs	Affiliation	Country
Radhey S. Agarwal	Indian Institute of Technology Delhi	India
Paul Ashford	Caleb Management Services	UK
Jonathan Banks	Consultant	Australia
Mohamed Besri	Institut Agronomique et Vétérinaire Hassan II	Morocco
Biao Jiang	Shanghai Institute of Organic Chemistry	China
David Catchpole	Petrotechnical Resources Alaska	UK
Michelle Marcotte	Marcotte Consulting LLC and Marcotte Consulting Inc	Canada
Marta Pizano	Consultant	Colombia
Ian Porter	Department of Primary Industries	Australia
Miguel Quintero	Universidad de los Andes	Colombia
Ian Rae	University of Melbourne	Australia
Helen Tope	EPA, Victoria	Australia
Ashley Woodcock	Wythenshawe Hospital	UK
Daniel Verdonik	Hughes Associates	USA
Masaaki Yamabe	National Institute of Advanced Industrial Science and Technology	Japan

TEAP Chemicals Technical Options Committee (CTOC)

Co-chairs	Affiliation	Country
Biao Jiang	Shanghai Institute of Organic Chemistry	China
Ian Rae	University of Melbourne	Australia
Masaaki Yamabe	National Institute of Advanced Industrial Science and Technology	Japan

Members	Affiliation	Country
D. D. Arora	The Energy Research Institute	India
Steven Bernhardt	Honeywell	USA
Olga Blinova	Russian Scientific Center “Applied Chemistry”	Russia
Nick Campbell	Arkema Group	France
Bruno Costes	Airbus Industries	France
Jianxin Hu	Center of Environmental Sciences, Peking University	China
A.A. Khan	Indian Institute of Chemical Technology	India
Michael Kishimba	University of Dar-es-Salaam	Tanzania
Abid Merchant	Consultant	USA
Koichi Mizuno	National Institute of Advanced Industrial Science and Technology	Japan
Claudia Paratori	Environmental Consultant	Chile
Hans Porre	Teijin Twaron	Netherlands
Shuniti Samejima	Asahi Glass Foundation	Japan
John Stemniski	Consultant	USA
Fatima Al-Shatti	Kuwait Petroleum Corporation	Kuwait
Peter Verge	Boeing Manufacturing	USA
Nee Sun Choong Kwet Yive (Robert)	University of Mauritius	Mauritius

TEAP Flexible and Rigid Foams Technical Options Committee (FTOC)

Co-chairs	Affiliation	Country
Paul Ashford	Caleb Management Services	UK
Miguel Quintero	Dow Europe GmbH / Universidad de Los Andes	Switzerland

Members	Affiliation	Country
Kyoshi Hara	JUFA	Japan
Mike Hayslett	Maytag/AHAM	USA
Mike Jeffs	ISOPA	Belgium
Shigeru Wakana	Dow	Japan
Suzie Kocchi	Environmental Protection Agency	USA
Candido Lomba	ABRIPUR	Brazil
Yehia Lotfi	Technocom	Egypt
Kirsten Makel	Arkema	USA
Christoph Meurer	Solvay	Germany
Mudumbai Sarangapani	Polyurethane Council of India	India
Ulrich Schmidt	Haltermann/Dow	Germany
Bert Veenendaal	RAPPA	USA
Mark Weick	Dow	USA
Dave Williams	Honeywell	USA
Jinhuang Wu	Huntsman	USA
Qiang Xu	Shanghai Haohai Chemical Corporation	China
Allen Zhang	Owens Corning	China

TEAP Halons Technical Options Committee (HTOC)

Co-chairs	Affiliation	Country
David V. Catchpole	Petrotechnical Resources Alaska	UK
Daniel P. Verdonik	Hughes Associates	USA
Members	**Affiliation**	**Country**
Ahmad AL-Khatib	Ministry of Environment	Jordan
Geok Kwang Boo	Civil Defence Force	Singapore
Fareed Bushehri	UNEP	Bahrain
Seunghwan (Charles) Choi	Hanju Chemical Co., Ltd.	South Korea
Michelle Collins	Consultant	USA
Andrew Greig	Protection Projects Inc.	South Africa
Matsuo Ishiyama	Halon Recycling & Support Committee	Japan
H.S. Kaprwan	Consultant	India
Nikolai P. Kopylov	All Russian Research Institute for Fire Protection	Russia
Barbara Kucnerowicz-Polak	State Fire Services Headquarters	Poland
David Liddy	Ministry of Defence	UK
Bella Maranion	US EPA	USA
John O'Sullivan, MBE	British Airways	UK
Erik Pedersen	World Bank	Denmark
Donald Thomson	MOPIA	Canada
Robert Wickham	Wickham Associates	USA
Kaixuan Zhou	CAAC-AAD	China
Consulting Experts	**Affiliation**	**Country**
Tom Cortina	HARC	USA
Sergey Kopylov	All Russian Research Institute for Fire Protection	Russia
Steve McCormick	United States Army	USA
Jawad Rida	National Concorde Est.	Jordan
Mark Robin	DuPont	USA
Joseph Senecal	Kidde-Fenwal	USA
Ronald S. Sheinson	Naval Research Laboratory – Department of the Navy	USA
Ronald Sibley	Defense Supply Center, Richmond	USA
Mitsuro Yagi	Fire and Environment Protection Network	Japan

TEAP Medical Technical Options Committee (MTOC)

Co-chairs	Affiliation	Country
Jose Pons Pons	Spray Quimica	Venezuela
Helen Tope	Energy International Australia	Australia
Ashley Woodcock	University Hospital of South Manchester	UK

Members	Affiliation	Country
Emmanual Addo-Yobo	Kwame Nkrumah University of Science and Technology	Ghana
Paul Atkins	Oriel Therapeutics Inc.	USA
Sidney Braman	Rhode Island Hospital	USA
Yingyun Cai	Zhongshan Hospital	China
Nick Campbell	Arkema SA	France
Hisbello Campos	Centro de Referencia Prof. Helio Fraga, Ministry of Health	Brazil
Jorge Caneva	Favaloro Foundation	Argentina
Christer Carling	Private Consultant	Sweden
Mike Devoy	Bayer Schering Pharma AG	Germany
Antoine Haddad	Chiesi Farmaceutici	Italy
Charles Hancock	Charles O. Hancock Associates	USA
Eamonn Hoxey	Johnson & Johnson	UK
Javaid Khan	The Aga Khan University	Pakistan
Nasser Mazhari	Sina Darou Laboratories Company	Iran
Robert Meyer	Food and Drug Administration	USA
Hideo Mori	Otsuka Pharmaceutical Company	Japan
Tunde Otulana	Aradigm Corporation	USA
John Pritchard	AstraZeneca	UK
Raj Singh	The Chest Centre	India
Roland Stechert	Boehringer Ingelheim (Schweiz)	Switzerland
Adam Wanner	University of Miami	USA
Kristine Whorlow	National Asthma Council Australia	Australia
You Yizhong	Journal of Aerosol Communication	China

TEAP Methyl Bromide Technical Options Committee (MBTOC)

Co-chairs	Affiliation	Country
Mohamed Besri	Institut Agronomique et Vétérinaire Hassan II	Morocco
Michelle Marcotte	Marcotte Consulting	Canada
Marta Pizano	Consultant	Colombia
Ian Porter	Department of Primary Industries	Australia

Members	Affiliation	Country
Alessandro Amadio	UNIDO	Italy
Marten Barel	Consultant	Netherlands
Jonathan Banks	Consultant	Australia
Chris Bell	Central Science Laboratory	UK
Antonio Bello	Centro de Ciencias Medioambientales	Spain
Aocheng Cao	Chinese Academy of Agricultural Sciences	China
Peter Caulkins	US Environmental Protection Agency	USA
Fabio Chaverri	IRET-Universidad Nacional	Costa Rica
Ricardo Deang	Consultant	Philippines
Patrick Ducom	Ministère de l'Agriculture	France
Abraham Gamliel	Agricultural Research Organisation	Israel
Darka Hamel	Inst. For Plant Protection in Ag. And Forestry	Croatia
Saad Hafez	University of Idaho	USA
Mokhtarud-Din Bin Husain	Department of Agriculture	Malaysia
George Lazarovits	Agriculture and Agri-Food Canada	Canada
Nahum Marbán Mendoza	Universidad Autónoma de Chapingo	México
Carlos Medeiros	EMBRAPA	Brazil
Melanie Miller	Consultant	Belgium
Andrea Minuto	Agroinnova Universitá di Torino	Italy
Takashi Misumi	MAFF	Japan
Kazufumi Nishi	Nat Institute of Vegetables and Tea Science	Japan
David Okioga	Ministry of Environment and Natural Resources	Kenya
Christoph Reichmuth	BBAGermany	Germany
Jordi Riudavets	IRTA – Department of Plant Protection	Spain
Ariane Elmas Saade	UNDP	Lebanon
John Sansone	SCC Products	USA
Jim Schaub	US Department of Agriculture	USA
Sally Schneider	US Department of Agriculture	USA
JL Staphorst	Plant Protection Research Institute	South Africa
Akio Tateya	Japan Fumigation Technology Association	Japan
Robert Taylor	Consultant	UK
Alejandro Valeiro	Department of Agriculture	Argentina
Ken Vick	United States Department of Agriculture	USA
Nick Vink	University of Stellenbosch	South Africa
Chris Watson	IGROX	UK
Jim Wells	Environmental Solutions Group	USA

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

Co-chair	Affiliation	Country
Radhey S. Agarwal	Indian Institute of Technology Delhi	India
Lambert Kuijpers	Technical University Eindhoven	Netherlands

Members	Affiliation	Country
James A. Baker	Delphi Automotive Systems	USA
Julius Banks	Environmental Protection Agency	USA
Dariusz Butrymowicz	Institute of Fluid Flow Machinery	Poland
James M. Calm	Engineering Consultant	USA
Guangming Chen	Inst. Refrigeration and Cryogenic Eng., Shanghai	China
Denis Clodic	Ecole des Mines	France
Daniel Colbourne	Consultant	UK
Jim Crawford	Trane /American Standard	USA
Sukumar Devotta	National Env. Eng. Research Institute (NEERI)	India
Kenneth E. Hickman	York – Consultant	USA
Takuo Hirahara (temp.)	Mitsubushi Electric Corp.	Japan
Martien Janssen	Re/gent	Netherlands
Makoto Kaibara	Matsushita Electric Industrial Corporation	Japan
Ftouh Kallel	Sofrifac	Tunisia
Michael Kauffeld	Fachhochschule Karlsruhe	Germany
Fred Keller	Carrier Corporation	USA
Jürgen Köhler	University of Braunschweig	Germany
Holger König	Jaeggi / Guentner	Germany
Edward J. McInerney	Consultant	USA
Petter Nekså	SINTEF Energy Research	Norway
Hezekiah B. Okeyo	Ministry of Industrial Development	Kenya
Andy Pearson	Star Refrigeration	UK
Per Henrik Pedersen	Danish Technological Institute	Denmark
Roberto de A. Peixoto	IMT, Maua Technological Institute	Brazil
Frederique Sauer	Dehon Service	France
Adam M. Sebbit	Makerere University	Uganda
Arnon Simakulthorn	Thai Compressor Manufacturing	Thailand
Aryadi Suwono	Thermodynamic Research Lab Bandung University	Indonesia
Peter Tomlein	Slovak Refrigeration Association	Slovakia
Pham Van Tho	Ministry of Fisheries	Vietnam
Vassily Tselikov	ICP "Ozone"	Russia
Paulo Vodianitskaia	Multibras Electrodomesticos	Brazil
Jianjun Zhang	Zhejian Lantian Env Protection Hi-Tech Co	China
Attila Zoltan	Refrigeration Association	Hungary

ANNEX III: TOC Members – Disclosure of Interest, status March 2007

AIII.1 Disclosure of Interest Declarations MTOC

Emmanuel Addo-Yobo **Ghana (A5)**

Emmanuel Addo-Yobo, member of the Medical Technical Options Committee since 2005, is a full time Specialist Paediatrician and Senior Lecturer in the Department of Child Health, Kwame Nkrumah University Sciences and Technology, and the Komfo Anokye Teaching Hospital, Kumasi, Ghana, with a special interest in paediatric pulmonology. Dr Addo-Yobo is the physician in charge of paediatric asthma in the hospital and has been involved in several research activities on childhood asthma epidemiology in Ghana as Principal or Co-Investigator, some of which have been sponsored partly or fully by pharmaceutical companies. Dr Addo-Yobo has attended an American Academy of Allergy Asthma and Immunology (AAAAI) meeting sponsored by a pharmaceutical company in 1999. Dr Addo-Yobo does not receive any form of remuneration from any drug companies. The UNEP's Ozone Secretariat funds his travels for MTOC meetings. Dr Addo-Yobo's spouse is a business secretary working with a local financial institution.

Paul J.Atkins **USA (Non-A5)**

Dr Paul Atkins, member of the Medical Technical Options Committee since 1993, is the full time Chief Executive Officer of Oriel Therapeutics Inc, a privately held pulmonary drug delivery company based in Research Triangle Park, USA. Oriel Therapeutics Inc. has an interest in the topics of the Montreal Protocol because it is developing active dry powder inhalers. Dr Atkins has a proprietary interest in developing alternatives to ODS-based MDIs and owns stock in Oriel Therapeutics, Inc. Dr Atkins has an extensive background in both MDI and DPI product development and commercialisation and is an internationally recognised expert in this area. Previously Dr Atkins was employed by GlaxoSmithKline, a leading provider of inhaled medicines including CFC based MDIs, and his spouse is currently a GlaxoSmithKline employee and owns stock in that company. Dr Atkins has worked occasionally as a consultant for both MLF and UNDP on matters related to the Montreal Protocol. Travel to MTOC meetings has been paid by either his employer or out of his personal funds.

Sidney Stuart Braman **USA (Non-A5)**

Dr Sidney Braman, member of the Medical Technical Options Committee since 2005, is a Professor of Medicine at Brown Medical School and Director of the Division of Pulmonary and Critical Care Medicine at Brown University and the Rhode Island Hospital. These organizations have no direct interest or business relating to the topics of the Montreal Protocol. Dr Braman has no proprietary interest to alternatives or substitutes to ODS, does not own stock in companies producing ODS or alternatives or substitutes to ODS, does not have an interest in the outcome of essential use nominations and does consulting for organizations seeking to phase out ODS but does not consult on these products. He has received research grant support and been a consultant to several pharmaceutical companies relating to research on new drug development. Dr Braman has not received any consultancy fees for work related to or associated with the Montreal Protocol. Dr Braman's spouse has no interest in matters before the Protocol. Dr Braman does not work as a consultant on matters relates to the Montreal Protocol. Travel to the MTOC meetings is provided by the American Thoracic Society.

Prof. Yingyun Cai **China (A5)**

Prof. Yingyun Cai, member of the Medical Technical Options Committee since 2005, is a professor of Shanghai Medical College of Fudan University. Yingyun Cai is a full time physician in Zhongshan Hospital affiliated to Fudan University as the vice-director of the Institute of Respiratory Diseases and the director of the Department of Geriatrics, mainly engaging in asthma and COPD. Yingyun Cai has no proprietary interest in alternatives or substitutes to ODS, does not own stock in companies producing ODS or alternatives or substitutes to ODS, does not have an interest in the outcome of essential use nominations, and does not consult for organizations seeking to phase out ODS. Yingyun Cai's spouse, a retired physician, also has no interest in matters before the Montreal Protocol. UNEP's Ozone Secretariat pays for travel to MTOC meetings.

Nick Campbell **France (A5)**

Dr. Nick Campbell has been a member of this Technical Options Committee since 1991. Dr Campbell has spent 19 years working primarily on the ozone layer issue and climate change. Dr Campbell works for ARKEMA SA, based in Paris, as the Environment Manager for the Fluorinated Products Division. ARKEMA SA is a producer of CFCs, HCFCs and HFCs. ARKEMA SA supports his participation and travel on MTOC. Dr Campbell has stock options in ARKEMA SA. He is Chairman of the European Fluorocarbon Technical Committee (EFCTC) that

represents the producers of fluorocarbons in the European Union and the European Chemical Industry Council (CEFIC) Working Party on Climate Change. Dr Campbell is also the Chairman of the International Chamber of Commerce (ICC) Working Party on Climate Change and the Chairman of the BusinessEurope Climate Change Working group, representing European Union Employers' federations. Dr Campbell has been a member of the World Bank's Ozone Operations Resource Group. Nick was a Coordinating Lead Author for the IPCC/TEAP joint Report on HFCs and PFCs (April, 2005). Dr Campbell was awarded a 1997 United States EPA Stratospheric Ozone Protection Award for his role in the phase-out of ODS.

Hisbello Campos **Brazil (A5)**

Dr. Hisbello S. Campos, member of the Medical Technical Options Committee since 1997, is a medical physician (pulmonologist) who works for Brazil´s Ministry of Health at Centro de Referencia Prof. Helio Fraga. Dr Campos is a full time physician at the Centro de Referencia Prof. Helio Fraga and gives medical consultations at his private office. The Centro de Referencia Prof. Helio Fraga has an interest in the topics of the Montreal Protocol because it is the government department responsible for proposing guidelines for respiratory diseases control. Dr Campos has no proprietary interest in alternatives or substitutes to ODS, does not own stock in companies producing ODS or alternatives or substitutes to ODS, does not have an interest in the outcome of essential use nominations, and does not consult for organizations seeking to phase out ODS. Dr Campos's spouse has no interest in matters before the Protocol. Dr Campos works occasionally as a consultant to the Brazilian Government on matters related to the Montreal Protocol. Travel to TOC meetings is paid by UNEP's Ozone Secretariat.

Jorge Osvaldo Cáneva **Argentina (A5)**

Dr. Jorge Osvaldo Cáneva is member of the MTOC since 2007. His full-time job is as Chief of the Pulmonary Section of the Cardiovascular Institute at the Favaloro Foundation (Buenos Aires, Argentina), since it was established in 1992. Currently Dr Cáneva states as President of the Argentine Association of Respiratory Medicine (Asociación Argentina de Medicina Respiratoria), main association in pulmonary medicine in Argentina. Dr Cáneva has been involved in severe respiratory diseases, pulmonary vascular diseases and lung transplantation programmes. During 2003 and 2004 Dr Cáneva has been involved in consultation for AstraZeneca Argentina about dry powder inhalers. Since 1993 to the present, Dr Cáneva has served as independent consultant on Long-Term Oxygen Therapy for Air Liquide Argentina. Furthermore, he serves as independent consultant about inhaled (nebulized) therapy for the treatment of pulmonary vascular diseases. Dr Cáneva does not own stock in companies producing ODS or alternatives or substitutes to ODS; he does not consult for organizations seeking to phase out ODS. Dr Cáneva's spouse has no relationship with any pharmaceutical company. Dr Cáneva has not yet travelled to any MTOC meeting since he has only recently been named as a member of the MTOC.

Christer Carling **Sweden (Non-A5)**

Christer Carling, member of the Medical Technical Options Committee, is, since about two years, retired from a position as Director Global Licensing at the pharmaceutical company AstraZeneca. Mr Carling is at present an independent consultant in the pharmaceutical area. His ongoing consultancy activities do not involve services to any organization with an interest in the topics of the Montreal Protocol. Mr Carling has no proprietary interest in alternatives or substitutes to ODS, does not own stock in companies producing ODS or alternatives or substitutes to ODS, does not have an interest in the outcome of essential use nominations, and does not consult for organizations seeking to phase out ODS. His spouse has no interest in matters before the Protocol. Mr Carling's travel to MTOC meetings is paid entirely out of his own pocket.

Mike Devoy **Germany (Non-A5)**

Dr. Mike Devoy, member of the Medical Technical Options Committee since 2003, is a physician working in a pharmaceutical industry. Dr Devoy has wide experience in drug development including inhaled medicines. He works for Schering AG as head of Global Medical Affairs and Pharmacovigilance. His current employer has no interest commercially in the areas of respiratory medicine and metered dose inhalers. His employer sponsors travel expenses in relation to Dr. Devoy's Montréal Protocol activities. Dr Devoy is a minor shareholder in a range of companies concluding GlaxoSmithKline. His wife is a physician working as a consultant anaesthologist, with no conflict of interest associated with the Montreal Protocol.

Antoine Haddad **Italy (Non-A5)**

Antoine Haddad, MTOC member since 2007, is a full time Area Manager Middle East at Chiesi Farmaceutici S.p.A. located in Parma, Italy. The company has interest in the topics of the Montreal Protocol as a producer and licensor of MDIs and have proprietary interest in alternatives or substitutes to ODS. Mr Haddad does not own stock in companies producing ODS or alternatives or substitutes to ODS, does not have an interest in the outcome of essential use

nominations, and does not consult for organizations seeking to phase out ODS. Mr Haddad's family members and parents have no direct or indirect interest in matters relative to the Protocol. He does not work as a consultant on matters related to the Montreal Protocol. Travel to MTOC meetings is paid by Chiesi Farmaceutici S.p.A., which do not receive contributions for this travel. Mr Haddad has significant experience with more than 20 years of activity in the specific field, in licensing, technology and know-how transfer, for local production in many Middle East countries.

Charles Hancock **USA (Non-A5)**

Charles O. Hancock, is a private medical device sterilization consultant with Charles O. Hancock Associates, Inc. Mr Hancock has an interest in the topics of the Montreal Protocol because he is actively engaged in the safe and effective delivery of sterilization processes for medical devices in healthcare applications. Mr Hancock has proprietary interest in alternatives or substitutes to ODS, owns stock in a company producing alternatives or substitutes to ODS, does not have an interest in the outcome of essential use nominations, and does provide consulting for organizations seeking to phase out ODS. Mr Hancock's spouse has no interest in matters before the Protocol. Mr Hancock works frequently as a consultant to governments, companies, and healthcare institutions on matters related to the Montreal Protocol. Travel to MTOC meetings is paid by Mr Hancock.

Eamonn Hoxey **UK (Non-A5)**

Dr. Eamonn Hoxey, member of the Medical Technical Options Committee since 1996, is an Executive Director for Quality and Compliance for Johnson & Johnson. Dr Hoxey is a full time employee based in the UK. Johnson & Johnson has an interest in the topics of the Montreal Protocol as a manufacturer of healthcare products, including sterile products, and utilize in-house and external sterilization facilities that do not employ ODS. Dr Hoxey is chairman of the European standards committee on sterilization of medical devices. Dr Hoxey has no stock in companies involved in ODS, with the possible exception of stock held in portfolio accounts where he has no control over purchase or sale. Dr Hoxey's partner has no interest in matters before the Protocol. Johnson & Johnson makes in-kind contributions of wage and miscellaneous expenses.

Javaid Khan **Pakistan (A5)**

Prof. Javaid Khan, member of the Medical Technical Options Committee since 1999, is a Professor and Head Section of Pulmonology and Critical Care Medicine at the Aga Khan University, Karachi Pakistan. UNEP funds Dr Khan's travel expenses to attend the meetings of MTOC. No conflict of interest exists for himself or his spouse in relation to his MTOC work. Dr Khan has attended Chest Conferences, such as ATS, sponsored by pharmaceutical companies. Dr Khan takes an active role in educating doctors and the public on asthma and COPD. Pharmaceutical companies have sponsored some of these meetings. Dr Khan has never received any honorarium from pharmaceutical companies for his lectures. He is also a member of the Global Initiative for Asthma (GINA) assembly and Head of the Tobacco Prevention Section of the International Union Against Tuberculosis and Lung Diseases.

Nasser Mazhari Motlagh **Iran (A5)**

Dr. Nasser Mazhari Motlagh, new member of the Medical Technical Option Committee, is a pharmacist at the Sina Darou Laboratories Company plc. Nasser Mazhari is a full time Quality Assurance Manager and Executive Deputy at the Sina Darou pharmaceutical and hygienic manufacturing plant, Tehran. Nasser Mazhari holds a doctorate in pharmacy and has about 40 years experience in pharmaceutical industry (manufacturing), and the last decade in MDIs. The Sina Darou Laboratories Co. plc has an interest in the topics of the Montreal Protocol because it is manufacturing CFC MDIs and it is in the process to phase-out CFCs. Nasser Mazhari has no proprietary interest in alternatives or substitutes to ODSs, does not owns stock in companies producing ODS or alternatives or substitutes to ODS, does not have an interest in the outcome of essential use nominations, and does consulting and working for Sina Darou to phase-out CFCs. Nasser Mazhari is a minor stock holder of Sina Darou Labs Co. plc. Nasser Mazhari's spouse has no interest in matters before the Protocol. Travel expenses to MTOC meetings are paid by UNEP's Ozone Secretariat.

Robert Meyer **USA .(Non-A5)**

Dr. Robert J. Meyer, MD, a member of the Medical Technical Options Committee (MTOC), is a Director of an Office of Drug Evaluation at the U.S. Food and Drug Administration. Dr Meyer is a full time clinician/physician at the FDA's Headquarters in Silver Spring, Maryland, USA. The FDA has an interest in the topics of the Montreal Protocol because it regulates all drugs sold in the United States, including the asthma and COPD metered-dose inhalers containing CFCs. Dr Meyer has no proprietary interest in alternatives or substitutes to ODS, does not own stock in companies producing ODS or alternatives or substitutes to ODS, does not have a financial interest in the outcome of essential use nominations, and does not consult for organizations seeking to phase out ODS. Dr. Meyer's spouse also has no financial or other interests in matters before the Protocol. Dr. Meyer works occasionally as a subject matter expert in consultation with other US government

agencies involved in matters related to ozone protection on matters related to the Montreal Protocol, but does not directly participate in the U.S. delegation to the Meetings of the Parties or the Open-Ended Working Group meetings. Dr Meyer's travel to the MTOC meeting is paid by U.S. FDA.

Hideo Mori **Japan (Non-A5)**

Hideo Mori, member of the Medical Technical Options Committee since 1999, is a chemist employed at Otsuka Pharmaceutical, based in Tokushima Japan. He is engaged in strategic regulatory work and scientific documentation of new drugs including MDIs and DPIs. Mr Mori is the chair of the CFC Committee of the Federation of Pharmaceutical Manufacturers' Association of Japan, which was organized to accomplish phase-out of CFCs in MDIs and smooth transition to the alternatives. The CFC Committee provides a grant for travel to attend MTOC and MOP/OEWG meetings. Otsuka Pharmaceutical provides other expenses for work relating to ozone layer protection. His spouse has no activity related to the matters before the Protocol.

Tunde Otulana **USA (Non-A5)**

Dr Tunde Otulana, member of the Medical Technical Options Committee since 1995, is a Senior Vice President, Development at Aradigm Corporation. Dr Otulana is a full time executive at the Aradigm Corporation in Hayward, California. Aradigm has an interest in the topics of the Montreal Protocol because it operates in the general field of respiratory diseases. Dr Otulana has no proprietary interest in alternatives or substitutes to ODS, does not own stock in companies producing ODS or alternatives or substitutes to ODS, does not have an interest in the outcome of essential use nomination, and does no consulting for organizations seeking to phase out ODS. Dr Otulana's wife has no interest in matters before the Protocol. Dr Otulana's travel to MTOC meetings is paid by Aradigm Corporation.

Jose Pons Pons (co-chair) **Venezuela (A5)**

Jose Pons, Co-chair of the Technology and Economic Assessment Panel and the Medical Technical Options Committee and Member of the 2007 Task Force on the TEAP Legacy, is President of Spray Química C.A. Jose Pons is a full time manager/engineer at the Spray Química aerosol filling plant in La Victoria, Venezuela. Spray Química has an interest in the topics of the Montreal Protocol because it used, and still uses, ODS in some of its aerosol products for industrial maintenance. Mr Pons has no proprietary interest in alternatives or substitutes to ODS, does not own stock in companies producing ODS or alternatives or substitutes to ODS, does not have an interest in the outcome of essential use nominations, and does not consult for organizations seeking to phase out ODS. Mr Pons's spouse has no interest in matters before the Protocol; she is also a manager/engineer at Spray Química. Mr Pons has worked occasionally as a consultant to MLF on matters related to the Montreal Protocol. The Task Force worked by e-mail and there was no travel or other expenses paid by any organizations to participate in this activity. Travel related to participation in the TEAP and MTOC, and relevant Protocol meetings, are paid by UNEP's Ozone Secretariat. Spray Química makes in-kind contributions of wage, and miscellaneous and communication expenses.

John Pritchard **UK (Non-A5)**

Dr. John Pritchard, member of the Medical Technical Options Committee since February 2006, is currently Strategic Technology Director for Pharmaceutical and Analytical R&D in AstraZeneca, having previously held a variety of roles within 3M, GlaxoSmithKline and AEA Technology (formerly UK Atomic Energy Authority). He has published extensively in the field of aerosol science and is a past President of The Aerosol Society, a past member of the UK Government Committee on the Medical Effects of Airborne Pollutants and has served as editor on a number of journals. Participation in MTOC is supported by AstraZeneca, which develop and supply medicinal products, including inhalable drugs in a range of dosage forms, some of which are MDIs. Mr Pritchard is also a minor shareholder in a range of companies, including GlaxoSmithKline.

Raj Bright Singh **India (A5)**

Dr Raj B Singh is a clinical respiratory physician engaged in private practice in Chennai, South India. Nearly 90 per cent of his work concerns clinical respiratory medicine, with out-patients at the Chest Centre and in-patient facilities at the Apollo Hospital, Chennai where he is a senior consultant. He is the founder of the Chest Foundation of India and its Managing Trustee. Dr Singh has been a member of the Executive Committee of the Global Initiative for Asthma (GINA) since 2003 and a member of MTOC since 2005. UNEP's Ozone Secretariat funds his travel expenses for participation on MTOC.

Roland Stechert **Switzerland (Non-A5)**

Dr. Roland Stechert, member of the Medical Technical Options Committee since 2000, is a Medical Director for Boehringer Ingelheim in Switzerland. As an expert of respiratory research he

was involved in the development of CFC-free MDIs with Boehringer Ingelheim. Dr Stechert headed the German regional International Pharmaceutical Aerosol Consortium (IPAC) Group until 2002. Since he took over his recent role in 2003 in Switzerland Dr Stechert is no longer a member of IPAC. Participation costs are all borne by the affiliate in Switzerland.

Helen Tope (co-chair) **Australia (A5)**

Helen Tope, Co-chair Medical Technical Options Committee since 1995, Member of the 2007 Task Force on the TEAP Legacy, is Principal Consultant of Energy International Australia (since 2006) and also Director of Planet Futures (since 2007) with whom she is an independent consultant providing strategic, policy and technical advice and facilitation services to government, industry and other non-governmental organisations on climate change, ozone-depleting substances, and other environmental issues. Dr Tope's business has an interest in the topics of the Montreal Protocol because her potential clients are also interested in these topics. Dr Tope has no proprietary interest in alternatives or substitutes to ODS, does not own stock in companies producing ODS or alternatives or substitutes to ODS, does not have an interest in the outcome of essential use nominations, and does not currently consult for organizations seeking to phase out ODS. Dr Tope's spouse has no interest in matters before the Protocol. The Ozone Secretariat provides a grant for travel, communication, and other expenses of the Medical Technical Options Committee from funds granted to the Secretariat unconditionally by the International Pharmaceutical Aerosol Consortium (IPAC). IPAC is a non-profit corporation.

Adam Wanner **USA (Non-A5)**

Dr. Adam Wanner, member of the Medical Technical Options Committee since 1995 has had a long-standing interest in aerosol therapy for obstructive lung disease, both as a researcher and clinician. On occasion, the American Lung Association has sponsored his travel to MTOC meetings. Dr Wanner has received academic grants (unrelated to the CFC phase-out) from several pharmaceutical companies. Dr Wanner and his spouse have no financial interests relevant to his work on MTOC.

Kristine Whorlow **Australia (Non-A5)**

Kristine Whorlow, member of the Medical Technical Options Committee since 2006, is the CEO of the National Asthma Council Australia. The National Asthma Council Australia has an interest in the topics of the Montreal Protocol because it led the phase-out of CFC-containing inhalers for respiratory disease in partnership with the Australian Department of the Environment in Australia. Ms Whorlow has no proprietary interest in alternatives or substitutes to ODS, does not own stock in companies producing ODS or alternatives or substitutes to ODS, does not have an interest in the outcome of essential use nominations, and does not consult for organizations seeking to phase out ODS. Ms Whorlow's partner has no interest in matters before the Protocol. Ms Whorlow pays her own travel to MTOC meetings.

Ashley Woodcock (co-chair) **UK (Non-A5)**

Prof. Ashley Woodcock, Co-chair of the Medical Technical Options Committee and Member of the Technology and Economic Assessment Panel, is a Respiratory physician at the South Manchester University Teaching Hospital. Prof. Woodcock is a full time physician and academic at the North West Lung Centre Manchester United Kingdom. The Hospital and University have no direct interest in the topics of the Montreal Protocol. Prof. Woodcock has no proprietary interest in alternatives or substitutes to ODS, does not own stock in companies producing ODS or alternatives or substitutes to ODS, does not have an interest in the outcome of essential use nominations. Prof. Woodcock carries out unrelated consulting and educational lectures for pharmaceutical companies, some of which have continued to produce CFC MDIs, and some of which have sought to accelerate phase out of CFC MDIs. He regularly advises companies on study design for new drugs, some of which have been ODS replacements. Prof. Woodcock's spouse has no interest in matters before the Protocol. Prof. Woodcock does not work as a consultant to UN, UNEP, MLF, and Implementing Agencies. In the past, he has responded to requests for technical information on CFC MDI phase-out from the European Community and the United Kingdom Government. Travel and subsistence for meetings of TEAP, MTOC, OEWG, MOP meetings is paid by the UK Department of Environment, and Prof. Woodcock's employer allows leave of absence.

You Yizhong **China (A5)**

Dr. You Yizhong, member of the Medical Technical Options Committee since 1997, is a chief pharmacist and associate chief physician. Dr You has been devoted to promoting the wide use of inhalation therapy in China for 35 years and to phasing out CFCs from aerosols for 15 years. Dr You developed some anti-asthmatic drugs including MDI, tablet, syrup and suppository. Dr You receives his salary from The First People's Hospital of Changzhou and has no interest or economic relationship with pharmaceutical companies, and does not receive any fees for work associated with MTOC. UNEP's Ozone Secretariat funds his travel expenses to attend MTOC meetings.

AIII.2 Disclosure of Interest Declarations CTOC

D.D. Arora **India (A5)**

Mr. DD Arora has been a member of the CTOC member since 2005 after having served as an ATOC member since mid 1990s, and is currently working as an independent consultant for (a) The Energy and Resources Institute in the field of energy, environment and global warming, (b) UNDP for preparation and implementation of Aerosols projects to phase out ODS usage and (c) INFRAS, Zurich for formulation of a CDM project in India under Kyoto protocol. He has no proprietary interest in alternatives or substitutes to ODSs, and he does not own stock in companies producing ODS or alternatives or substitutes to ODSs. None of his family members have interest in matters before the Protocol. His travel to TOC meetings is paid by UNEP only.

Steven H. Bernhardt **USA (Non-A5)**

Dr. Steven H. Bernhardt has been a member of the CTOC since 2005. He is the Global Director Regulatory Affairs for Honeywell Specialty Products at their Morristown, New Jersey global headquarters. He has earned Bachelors, Masters and Doctor of Philosophy degrees in Chemical Engineering. He was previously a Member of the UNEP Process Agents Task Force since 1997 and has participated in Meetings of the Parties since 1996. He owns stock in Honeywell who is a producer of CFCs, HCFCs and HFCs and who has a process agent exemption. He is a Board Member of the Alliance for Responsible Atmospheric Policy and the International Climate Change Partnership. Travel expenses for TOC meetings are paid by Honeywell International.

Olga Blinova **Russian Fed. (Non-A5)**

Olga Blinova has been a member of the CTOC since 2005 after having served as an ATOC member for a long time, and is currently working at Federal State Unitary Enterprise "Russian Scientific Center "Applied Chemistry" (RSC "Applied Chemistry") as a full-time Main Research Fellow at its Fluorochemical Research Center. The RSC "Applied Chemistry" has an interest in the topics of the Montreal Protocol because it is engaged in ODS phaseout in Russian industrial sector. She is a chemist (Ph.D. in Chemistry, 1989), currently engaged in research in the field of fluorine chemistry. She has no proprietary interest in alternatives or substitutes to ODSs, and she does not own stock in companies producing ODS or alternatives or substitutes to ODSs. None of her family members have interest in matters before the Protocol. Dr. Blinova occasionally works as a consultant to Russian Government, implementing agencies or companies on matters related to the Montreal Protocol, mostly to ODS phaseout in Russian industrial sectors. Her travel to TOC meetings is paid by UNEP only.

Nick Campbell **France (Non-A5)**

Dr. Nick Campbell has been a member of the CTOC since 2005. Nick has spent 19 years working primarily on the ozone layer issue and climate change. He works for ARKEMA SA, based in Paris, as the Environment Manager for the Fluorinated Products Division. ARKEMA SA is a producer of CFCs, HCFCs and HFCs. ARKEMA SA supports his participation on CTOC. Nick has stock options in ARKEMA SA. He is Chairman of the European Fluorocarbon Technical Committee (EFCTC) that represents the producers of fluorocarbons in the European Union and the European Chemical Industry Council (CEFIC) Working Party on Climate Change. He is also the Chairman of the International Chamber of Commerce (ICC) Working Party on Climate Change and the Chairman of the UNICE Climate Change Working group, representing European Union Employers' federations. Dr Campbell has been a member of the World Bank's Ozone Operations Resource Group. He was a Chapter/ Co-ordinating Lead Author for the IPCC/TEAP joint Report on HFCs and PFCs (April 2005). Dr Campbell was awarded a 1997 United States EPA Stratospheric Ozone Protection Award for his role in the phase-out of ODS.

Bruno Costes **France (Non-A5)**

Dr. Bruno Costes has been a member of the CTOC since 2005 after having served as a member of the SOC for more than ten years. He is a Director in Environmental Affairs at Airbus Company. The Airbus Company has an interest in the topics of the Montreal Protocol because of its intensive efforts for replacing ODS solvents used in producing various parts of airplanes to non-ODS alternatives. Dr. Costes has no proprietary interest alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consulting for organizations seeking to phase out ODSs. Travel to TOC meetings is paid by Airbus Company.

Jianxin Hu **China (A5)**

Prof. Jianxin Hu has been a member of the CTOC since 2005. He is Director of Environmental Process Division, College of Environmental Sciences in Peking University. He has spent 12 years working on the ozone layer issue and persistent organic pollutants. He is a member of the POPs Review Committee for the Stockholm Convention. He was one of Lead Authors for the IPCC/TEAP joint Report on HFCs and PFCs (April, 2005). He was the team leader to draft many sector phase-out plans for ODS phase-out in China, the Strategy for the Long Term Management of HCFCs in China and to draft the National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants in China. As one of the key team member, he was awarded the 2004 "Special Gold Award of Ozone Layer Protection contribution Award of China" by the Chinese Government; and was awarded USEPA Stratospheric Ozone Protection Awards for Leadership in ODS Phaseout in Developing Countries in 2005. His travel to TOC meetings is paid by UNEP only.

Biao Jiang **China (A5)**

Dr. Biao Jiang, Co-chair of the Chemicals Technical Options Committee since 2005, is Professor of Chemistry of Shanghai Institute of Organic Chemistry, Chinese Academy of Sciences and a member of editorial advisory board of Chemical Communication, Royal Society of Chemistry, United Kingdom. Professor Jiang involves in the research and development of new methodology in organic synthesis, medicinal chemistry, fluorine chemistry as well as organic process and green chemistry. He has no proprietary interest in alternatives or substitutes to ODSs, and he does not own stock in companies producing ODS or alternatives or substitutes to ODSs. None of his family members have interest in matters before the Protocol. Cost of travel, communication and other expenses related to participation in the TEAP, CTOC, and relevant Montreal protocol meetings, are paid by UNEP only.

Asad A. Khan **India (A5)**

Dr. A.A.Khan has been a member of the CTOC since 2005 after having served as a STOC member for more than ten years. He is a chemical engineer. He was at the Indian Institute of Chemical Technology, Hyderabad, India and retired in 2001 as a full time Head, Chemical Engineering Division. He continued as an 'Emeritus Scientist' for 5 years after retirement. The Indian Institute of Chemical Technology has an interest in the topics of the Montreal Protocol because it is a constituent institution of the Council of Scientific and Industrial Research (CSIR) and has proprietary interest in alternatives or substitutes to ODSs. Dr. Khan does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does not have an interest in the outcome of EUN or CUNs, and does consulting for organizations seeking to phase out ODSs. His spouse has no interest in matters before the Protocol. Dr. Khan works occasionally as a consultant to UN, UNEP, MLF, Implementing Agencies, Governments, companies, etc. on matters related to the Montreal Protocol. Travel to TOC meetings is paid by UNEP, which receives contributions for this travel from member organizations, if relevant.

Michael Kishimba **Tanzania (A5)**

Prof. M.A. Kishimba has been a member of the CTOC member since 2006. He is an Associate Professor of Chemistry at the University of Dar es Salaam (UDSM), Tanzania, where he teaches, researches and supervises under- and postgraduate students in environmental and organic chemistry. UDSM has an interest in the topics of the Montreal Protocol because as an esteemed tertiary educational and research institution in the region, it has to be in the forefront in the knowledge search, confirmation and dissemination of topical environmental issues, one of which is the Montreal Protocol. Prof. Kishimba has no proprietary interest alternatives or substitutes to ODSs, and does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consult for organizations seeking to phase out ODSs. However, he teaches the chemistry behind the Montreal Protocol to MSc students and leads a research group on environmental aspects of pesticides. Travel to CTOC meetings is paid by UNEP, which receives contributions for this travel from UN Member countries

Abid Merchant **USA (Non-A5)**

Mr. Abid Merchant has been a member of the CTOC since 2005 after having served as an STOC member since 1997, and is currently working as an independent consultant for DuPont and UNDP to assist with solvent replacement projects to phase out ODS usage. Until 2001, Mr. Merchant worked for DuPont as a research and product development engineer to develop alternatives to ODS solvents. DuPont, previously produced CFCs, and currently produces and distributes HFCs and HCFCs. He is an inventor or co-inventor for many applications patents for HFC solvent alternatives for CFC-113 in solvent and process agent applications He does own DuPont stock. None of his family members have interest in matters before the Protocol. He was a Lead Author for the solvent section of the IPCC/TEAP Special Report on HFCs and PFCs (April, 2005). His travel to CTOC meetings is paid by DuPont..

Koichi Mizuno **Japan (Non-A5)**

Dr. Koichi Mizuno, a member of the CTOC since 2005, is principal reviewer (Environment and Energy) at the AIST. He was a member of the Destruction Technology Sub Committee in 1991-1995, of the Task Force Destruction Technology in 2001-2003, and co-chair of the F-TOC Task Force on Foam End-of-Life Issue in 2004-2005. He was also a Lead Author of IPCC-TEAP Special report on “Safeguarding the Ozone Layer and the Global Climate System: Issues related to Hydrofluorocarbons and Perfluorocarbons (April 2005).” He invented two processes using inductively-coupled radio-frequency plasma and solid catalysis for destruction of fluorinated compounds such as CFCs, HCFCs, HFCs, and PFCs. He is a member of Science Advisory Board of the Organisation for the Prohibition of Chemical Weapons. Dr. Mizuno has no proprietary interest alternatives or substitutes to ODSs, and does not own stock in companies producing ODS or alternatives or substitutes to ODSs. AIST pays wages, travelling and other expenses.

Claudia Paratori **Chile (A5)**

Ms. Claudia Paratori, Chemist, has been a member of the CTOC since 2005. She is an Environmental Consultant to UNEP and Governments on chemicals and POPs management. Ms. Claudia is a full time Coordinator of the Ozone Programme at the Department of Pollution Control in the National Commission for the Environment – CONAMA. This institution has an interest in the topics of the Montreal Protocol because it is the National Focal Point. Ms. Claudia has no proprietary interest in alternatives or substitutes to ODSs substances, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consulting for organizations seeking to phase out ODSs. She worked as a consultant to UNIDO on matters related to the

Montreal Protocol solvents in Venezuela. Travel to CTOC meetings have been paid only by UNEP, which receives contributions for this travel from the Multilateral Fund of the Montreal Protocol.

Hans Porre **Netherlands (Non-A5)**

Dr. J.G.W. (Hans) Porre has been involved in the Process Agent Task Force activities since 1998. He has joined in the CTOC since 2005. He is an analytical/technical chemist and has been active since 1983 in chemical industry (lead industry, precious metal industry, organic polymer industry and laboratory and environmental management. He is expertised in CTC adsorption, emissions and destruction technology. He is a member of Eurochlor and the Society of the Dutch Chemical Industry. Dr. Porre is an Environmental Coordinator at the Teijin Twaron. He works a full time job at the Teijin Twaron site in Delfzijl, Netherlands. Teijin Twaron has an interest in the topics of the Montreal Protocol because in the plant of Delfzijl CTC is used as a process agent and Teijin Twaron wants to give a contribution to sustainable development in ODS uses by an active participation of Dr. Porre in the CTOC activities. He has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consulting for organizations seeking to phase out ODSs. Travel to TOC meetings is paid by Teijin Twaron.

Ian D. Rae **Australia (Non-A5)**

Dr. Ian Rae, Co-chair of the Chemicals Technical Options Committee since 2005, is Honorary Professorial Fellow at the University of Melbourne, Australia, and a member of advisory bodies for several Australian government agencies, including on implementation issues for the Montreal Protocol and the Stockholm Convention. He also co-chaired the 2001 and 2004 Process Agent Task Forces. He and his spouse do not own stock in a company that distributes ODSs and ODS alternatives. He is a member of the POPs Review Committee for the Stockholm Convention. On occasions, he acts as consultant to government agencies and to universities and companies and he has been an expert witness in a case involving alleged patent infringement involving HFC-134a and its lubricants. He contributes the time for his own participation in TEAP activities. The Australian Government Department of the Environment and heritage finances the cost of travel and accommodation for Dr. Rae's attendance at meetings of CTOC, TEAP OEWG and MOP.

Shunichi Samejima **Japan (Non-A5)**

Mr. Shunichi Samejima has been a member of the CTOC since 2005, after having served as a member of the STOC from 1998. He is Head of Secretariat and Director of Commendation at the Asahi Glass Foundation. The Asahi Glass Foundation recognizes activities in global environmental problems including the topics of the Montreal Protocol and commends such by awarding the Blue Planet Prize, and also conducts other environment-related activities. Mr. Samejima has extensive research experience in organic fluorine chemistry and developed alternative to ODSs and had marketing experience in precision cleaning area while being employed by Asahi Glass Co., Ltd. which produces alternatives or substitutes to ODSs. He is an inventor or co-inventor for many applications patents for solvent alternatives for CFC-113 in solvent and precision cleaning applications. He does own Asahi Glass stock. He does not consult for organizations seeking to phase out ODSs. His travel to TOC meetings is paid by Asahi Glass Co., Ltd.

Fatima Al-Shatti **Kuwait (A5)**

Dr. Fatima Al-Shatti has been a member of the CTOC since 2005. She has 21 years of experience in the area of environment, with a degree in environmental science, and PhD form Salford University in England 2003. She is a member of the Kuwait Society of environment, and Institute of Environment Management & Assessment. She worked for 10 years with Public Authority of Environment, as the manager of waste management. Dr. Al-Shatti involved in the incinerators work for a Kuwait hospital during working with KEPA. She used to represent Kuwait in Basel Convention, worked with British team as supervisor in removing contaminated soil with PCB, worked with all international, regional and national environmental policies, rules and regulations, to help solving the environmental problems in the country. She worked closely for more than 4 years with The US Army troops – especially how to handle their hazardous waste according to the Basel Convention and all other environmental issues. In 1996, she worked with Petrochemicals Industry as a plant environmental engineer, and established the environmental system as the first company in Kuwait with HSEMS. In 1999-2001, she worked for KEPA as a consultant for waste management. Dr. Al-Shatti worked with KEPA and United Nation team in the environmental strategy and also worked to review the Kuwait environmental regulations. From 1998 to 2004, she worked as a consultant for the KPC, with HSE committee, to develop an environmental policy and the HSE reporting system. Since 1st of July 2004 she works for KPC. She is a member of the ozone committee with KEPA. Travel to TOC meetings is paid by UNEP, which receives contributions for this travel from member organizations, if relevant.

John R. Stemniski **USA (Non-A5)**

Dr. John R Stemniski is a member of the CTOC since 2005 after having served a STOC member since 1990. He was retired from MIT/Draper Laboratory where he was a Principal Member Technical Staff for 47 years. He maintains a part time position at MIT/Draper as Mentor to Junior Staff Members. As a consultant, Dr. Stemniski has interests in the topics of the Montreal protocol because of his continuing interest in searching for alternatives to ODS solvents for the US Navy, US Air Force and space craft applications. He has no proprietary interest in alternatives or substitutes to ODSs and does not own stock in companies producing ODS or alternatives or substitutes to ODSs. He does have an interest in the outcome of EUN or CUN and does consulting for organizations seeking to phase out ODSs – AGC Chemicals, America Inc. His spouse has no interest in mattes

before the Protocol. Dr. Stemniski works occasionally as a consultant to UNEP, MIT/Draper Laboratory, US Navy, US Air Force, US EPA and AGC Chemicals America, Inc. on matters related to the Montreal Protocol. Travel to CTOC meetings is paid by AGC Chemicals America, Inc. Dr. Stemniski holds a BS in chemistry and a PhD in synthetic organic chemistry.

Peter Verge **USA (Non-A5)**
Dr. Peter Verge is a member of the CTOC since 2005 after having served as a member of the STOC for more than 10 years. He is a chemical engineer and works for the Boeing Company. The Boeing Company has an interest in the topics of the Montreal Protocol because of its intensive efforts for replacing ODS solvents used in producing various parts of airplanes to non-ODS alternatives. Dr. Verge has no proprietary interest alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consulting for organizations seeking to phase out ODSs. Travel to CTOC meetings is paid by the Boeing Company.

Masaaki Yamabe **Japan (Non-A5)**
Mr. Masaaki Yamabe, Co-Chair of the Chemicals Technical Options Committee since 2005, is research coordinator (Environment and Energy) at the AIST. He also co-chaired the 2004 Process Agent Task Force. He was a member of the Solvents TOC during 1990-1996. Until 1999, Mr. Yamabe was Director of Central Research for Asahi Glass Company, which previously produced CFCs, methyl chloroform, and carbon tetrachloride, and currently produces and distributes HCFC, carbon tetrachloride, and HFCs. He is the co-inventor of HCFC-225, which is controlled under the Montreal Protocol as a transitional substance in the phase-out of ozone-depleting substances and is a substitute for CFC-113 in solvent and process agent applications. He owns stock in Asahi Glass Company that produces ozone-depleting substances and their substitutes. Mr. Yamabe was a Coordinating Lead Author for the IPCC/TEAP joint Report on HFCs and PFCs (April, 2005). He also works for the Japan Industrial Conference for Ozone Layer and Climate Protection (JICOP) as a senior advisor. AIST pays wages, travelling and other expenses.

Nee Sun Choong Kwet Yive **Mauritius (A5)**
Dr Choong Kwet Yive, who has been a member of the CTOC since 2006, is senior lecturer of analytical / physical chemistry at the University of Mauritius. Dr. Choong Kwet Yive is currently doing research on inorganic (heavy metals) and organic pollutants (PAHs and pesticides) in the environment. Travel to CTOC meetings is paid by UNEP.

AIII.3 Disclosure of Interest Declarations FTOC

Kiyoshi Hara **Japan (Non-A5)**
Kiyoshi Hara is working as a consultant in Japan Polyurethane Industries Institute. He has been a member of FTOC since 1999 and participated in the Task Force on Foam E-o-L issues as an expert in the polyurethane and phenolic Foam industries in Japan. He was a member of a national project "Investigation of CFC recovery from the construction" sponsored by METI. Previously, Mr. Hara was Secretary General of Japan Industrial Conference for Ozone Layer Protection (JICOP) from 1994 to 2002, seconded from Asahi Glass. He had 40 years experience in Fluorocarbon applications, 35 years in Chlorinated Solvent applications and 30 years in Polyurethane Foam technologies. He worked in Asahi Glass from 1961 to 2002. He received 1997 Stratospheric Ozone Layer Protection Award by US-EPA. His participation in FTOC activities is funded by the Japan Polyurethane Industries Institute.

Michael S. Hayslett **USA (Non-A5)**
Mike Hayslett is a Leader for material development for Whirlpool Corporation. He has been a member of Appliance Research Consortium (ARC) Insulation Technical Advisory Committee (ITAC) since 1995. He has worked in the appliance industry since 1994. His participation in FTOC activities is funded by the Appliance Research Consortium.

Mike Jeffs **Belgium (Non-A5)**
Mike Jeffs is the Secretary General of ISOPA, the European Diisocyanates and Polyols Association. He has been in this role since 2002 and is seconded from Huntsman. The members of ISOPA are Bayer, Dow, Elastogran (BASF), Huntsman, Lyondell, Repsol and Shell. He has been employed by ICI and Huntsman for more than 39 years and has been involved in the polyurethane industry since 1975. ISOPA funds his current work in support of the Montreal Protocol. He has been e member of the Foams TOC since 1990 and lead author on rigid foams since 1993. He has been a contributor to both the TEAP Special Report on the Implications to the Montreal Protocol of the Inclusion of HFCs and PFCs in the Kyoto Protocol (1999) and the IPCC/TEAP Report on Safeguarding the ozone layer and the global climate system: issues related to hydrofluorocarbons and perfluorocarbons (2005). He was a member of The World Bank Ozone Operations Resource Group (OORG) where he covered all foam issues relating to the World Bank's activities for the Multilateral Fund from its setting up in 1992 to the OORG's disbandment in 2006. This included responsibilities for project review. His current role includes engagement with EU institutions on chemicals issues including the regulations on fluorinated gases.

Candido Souza Lomba Neto **Brazil (A5)**

Candido Souza Lomba Neto, Foam TOC Member since 1997, is an Economist working at the trade association ABRIPUR as Executive Secretary. His responsibilities include legal issues, financial issues, marketing issues, technical support to the industry for Environmental Programs, Quality Assurance Programs, Export Programs, Participation in National and International Exhibitions and any other activity to improve the business of ABRIPUR members. Relating to Montreal Protocol his most relevant activities have been as collaborator in the Brazilian Ozone Layer Programme (1993-94) and in-country consulting for various Implementing Agencies under the Montreal Protocol (1994 to present). His work has assisted more than 200 companies to phase-out CFCs as blowing agents for foam processes. Candido's time for participation in FTOC activities is funded by ABRIPUR, whilst his travel costs and other expenses are supported through the Ozone Secretariat.

Yehia Lotfy **Egypt (A5)**

Yehia Lotfy has been a member of the Rigid and Flexible Foams Technical Options Committee (TOC) since 1990. He is the managing director and owner of Technocom for Commercial Agencies, a consulting and trading company covering the needs of the different industries and sectors where polyurethanes, solvents, blowing agents and refrigerants are used (materials, equipments and know how). He previously worked for ICI from 1980 to 2000 in charge of the technical services for polyurethane products; solvents, refrigerants and related equipment in different sectors (appliances, constructions, transport, furniture, automotive, foot wear, coating,...etc). From 1989 to 2002, he worked as the local consultant for UNDP and UNIDO to assist the Egyptian government and the local enterprises to implement the Montreal Protocol Projects for the (ODS) phasing out in the Foam and Refrigeration sectors. Mr. Yehia Lotfy has been involved over the last 27 years in the consultation and the start up of many projects in the different Polyurethane applications in Egypt and other Arab countries. His time commitment to FTOC activities is covered by Technocom, whilst his travel costs and other expenses are supported through the Ozone Secretariat.

Kirsten Makel **USA (Non-A5)**

Kirsten Makel, a member of the Foam Technical Options Committee since 2006, is the Global Business Director responsible for the Foams, Solvents and Aerosols market sector at Arkema Inc. Makel joined Arkema (formerly ATOFINA Chemicals, Inc.) in 1990 and has been involved in the Fluorochemicals business for the past 11 years. Promoted to Business Director in 2006, Makel is responsible for the strategic leadership and financial results of the global business. This position establishes and implements the short-term and long-term strategic business plans, which includes all R&D programs and understanding the implications of global environmental regulations. As HCFC blowing agents are being phased out under the Montreal Protocol, she has been intimately involved with the commercialization of next generation foam technologies for the PUR, PIR and XPS industries. In her previous roles as Business Manager North America (2004-2006) and Global New Business Development Manager (2001-2004), Makel lead the Fluorochemical division's global efforts to develop and commercialize next generation foam technologies to replace HCFCs. Her participation in the FTOC is funded by Arkema Inc.

Christoph Meurer **Germany (Non-A5)**

Christoph Meurer joined Solvay in 1996 and held several positions in the field of technical service for HFCs in their various applications. In 2005 he became Technical Service Manager for all HFC applications (blowing agents, refrigerants, feedstock, aerosols). In this function he works with the foam industry in the development and optimisation of foam formulations based on non-ODS substitutes. As of 1st of April 2007 Christoph has taken over new responsibilities as Global Technical Marketing Manager for blowing agents, feedstock and solvents. . Christoph joined the Foams TOC in 2005. His participation in FTOC activities is fully funded by Solvay.

Mudumbai Saragapani **India (A5)**

Mr Sarangapani is the Secretary General of the Polyurethane Council of India and has served as a member of the Foams Technical Options Committee since its inception. Travel costs and other related expenses incurred while participating in FTOC activities are covered by the Ozone Secretariat.

Ulrich Schmidt **Germany (Non-A5)**

Ulrich Schmidt joined Haltermann in 1986 as R&D Manager for hydrocarbons. Since the early 1990's he was involved in the implementation of pentanes as blowing agents for PU foams as a CFC replacement. His activities were initially concentrated in Europe but have since been extended to cover overseas areas as well. Following the purchase of Haltermann by The Dow Chemical Company in 2002, Ulrich has maintained this function. Ulrich has been a member of the Foams TOC since 2001 and his continued involvement is funded in full by The Dow Chemical Company.

Bert Veenendaal **USA (Non-A5)**

Bert Veenendaal is specialized in environmental compliance, environmental remediation and sustainable industrial process technologies. He has 35 years experience in the handling of chemicals in a sustainable way in a true international setting. Since January 1992 he has worked as an independent consultant through his own company, Rappa, Inc, primarily as a contractor to UNDP on projects supported under the Multilateral Fund of the Montreal Protocol. Some of his activities include engineering assistance, industry-wide emission studies, technical assessments, project and process assistance for more than 300 projects in about 30 countries worldwide, workshops and demonstration programs for foams and in refrigeration, design, preparation and implementation of

study missions, chemical safety training for foam and appliance manufacturers, air permit acquisitions in the USA for PU foam manufacturers, petitions and other submissions to the USEPA. Before, Mr. Veenendaal had managing positions in the PU foam industry in the USA and Germany. He has been a member of the UNEP Foams Technical Options Committee since 1989. Rappa Inc funds Mr. Veenendaal's participation in the FTOC.

Shigeru Wakana **Japan (Non-A5)**
Shigeru Wakana is a technical committee member of Extruded Polystyrene Foam Association in Japan, and also has 23 years technical experience in extruded polystyrene foam business with Dow Kakoh K.K. He is now R&D/TS&D Leader for Dow Kakoh. K.K. He has been a member of Foams TOC since 2004 and was a member of a project "Investigation of CFC recovery from the construction" sponsored by METI. His participation in FTOC activities is full funded by The Dow Chemical Company.

Mark Weick **USA (Non-A5)**
Mark Weick has 25 years technical experience in plastic foams business and technology with The Dow Chemical Company. He has served in a variety of research, technical service, management, and business leadership roles with Dow dealing with styrenic, ethylenic, and urethane foam products. He currently serves as the Environment, Health and Safety Global Product Stewardship Leader for Dow's Building Solutions business unit. He has been a member of the UNEP Rigid and Flexible Foams Technical Options Committee since 2003, and assumed Lead Author responsibilities for the polystyrene foams sector in 2006. Mark's participation in FTOC related activities is funded by The Dow Chemical Company.

David J. Williams **USA (Non-A5)**
Mr. David J. Williams has been a member of the Foams Technical Options Committee since 1996. Since 1994, Mr. Williams has worked at Honeywell's Buffalo Research Laboratory in Buffalo New York in the fluorocarbon blowing agent technology group and since 1998 has been the manager of this group. In this role, Mr. Williams is responsible for the development and technical support of Honeywell's fluorocarbon blowing agents used in the production of rigid polyurethane, polyisocyanurate, and phenolic foams and in extruded thermoplastic foams. Prior to this, Mr. Williams worked for 20 years for The Dow Chemical Company/The Upjohn Company in various roles related to the development and technical support for polyurethane, polyisocyanurate, and extruded polystyrene foams or foam systems. He owns stock in companies that now or previously manufactured ozone-depleting substances and products made with or containing ozone-depleting substances and their substitutes and alternatives. Participation of Mr. Williams in FTOC related activities is funded by Honeywell.

Jinhuang Wu **USA (Non-A5)**
Dr. Jinhuang Wu has been a member of the Foams Technical Options Committee since 2000. He was also a lead author of the "IPCC/TEAP Special Report: Safeguarding the ozone layer and the global climate system: issues related to hydrofluorocarbons and perfluorocarbons." From 1997 to 2005, Jinhuang worked for Arkema Inc. (formerly known as ATOFINA Chemicals, Inc. and Elf Atochem N.A.), where he was responsible for application development of blowing agents in rigid insulating foams including polyurethane and extruded polystyrene. He is currently an employee of Huntsman. His current responsibilities include research and development of polyurethane based technologies. He owns stocks in companies that produce chemicals for foam and refrigerant applications. Jinhuang Wu's continued participation in FTOC activities is funded by the Huntsman Corporation.

Qiang Xu **China (A5)**
Mr. Xu is currently R&D Director for Shanghai Haohai Chemical Corporation,Ltd. He has worked in the Chinese polyurethanes industry for over 20 years and is a member of the China Polyurethane Industry Association. He joined the FTOC in 2005 and his travel costs and associated expenses are covered by the Ozone Secretariat.

Allen Zhang **China (A5)**
Allen Zhang has 10 years technical and management experience in extruded polystyrene foam technology and business with Owen Corning. He has served in a variety of production technical, operation management, and business leadership roles with Owens Corning dealing with XPS and fibreglass insulations operations. He currently serves as insulation manufacturing leader to be accountable for five plants operations for Owens Corning Asia Pacific. He has been a member of ISO/TC61 since 2002 and lead author of China national XPS product standard. He is very familiar with China foam industry. He has been a member of the UNEP Rigid and Flexible Foams Technical Options Committee since 2005. His participation is directly funded by Owens Corning with travel and other expenses eligible for cover by the Ozone Secretariat.

AIII.4 Disclosure of Interest Declarations HTOC

Ahmad AL-Khatib **Jordan (A5)**
Mr. Ahmad AL-Khatib, Halons Technical Options Committee (HTOC) Member, works as a technical consultant for the Ministry Of Environment / Ozone Unit of ODSs Phase out Project / JORDAN and has no conflicts of interest, does not consult for any other organisation, and does not have his own trade or firm. Mr. Ahmad AL-Khatib is committed as a member of the HTOC not to disclose any information to any organization in either a

direct or indirect way. Mr. Ahmad AL-Khatib's travel to HTOC meetings is paid for by UNEP's Ozone Secretariat.

Geok Kwang Boo **Singapore (A5)**

Mr. Geok Kwang Boo, Halons Technical Options Committee (HTOC) Member, is the Director of Fire Safety & Shelter Department (FSSD) of the Singapore Civil Defence Force (SCDF). He is a full time Engineering Profession Officer at the Headquarters of the SCDF, which is located at 91 Ubi Avenue 4, Singapore 408827. The FSSD is the regulatory arm of the SCDF, administering and enforcing fire safety regulations in all buildings in the Republic of Singapore; that includes the regulating of fixed fire protection systems and portable fire extinguishers using halons. Mr. Geok Kwang Boo has no proprietary interest in alternatives or substitutes to ODSs, owns no stock in companies producing ODS or alternatives or substitutes to ODSs, and does not provide consultation to companies seeking to phase-out ODSs. Mr. Geok Kwang Boo has no person related to him, being his spouse, children or social partner, who works for or consults for any organization that has an interest in the topics of the Montreal Protocol. Mr. Geok Kwang Boo's travel to HTOC meetings is paid by UNEP's Ozone Secretariat.

Fareed I. Bushehri **UNEP (Bahrain) (A5)**

Fareed I. Bushehri, Halons Technical Options Committee (HTOC) Member, is employed by the United Nations Environment Programme. Mr. Bushehri is a full time Programme Officer at the Regional Office for West Asia. The United Nations Environment Programme has an interest in the topics of the Montreal Protocol because it is one of the implementing agencies under the Montreal Protocol. Mr. Bushehri has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consult for organizations seeking to phase-out ODSs. Mr. Bushehri works full time as an employee of UNEP on matters related to the Montreal Protocol. Mr. Bushehri's spouse and dependant children living at same home have no proprietary interest in alternatives or substitutes to ODSs, do not own stock in companies producing ODS or alternatives or substitutes to ODSs and do not consult for organizations seeking to phase-out ODSs. Mr. Bushehri's travel to HTOC meetings is paid for by the United Nations Environment Programme.

David V. Catchpole **UK (Non-A5)**

Mr. David V. Catchpole, Co-Chair of the Halons Technical Options Committee and Member of the Technology and Economics Assessment Panel since 2005, works part time for Petrotechnical Resources Alaska (PRA), an Anchorage, Alaska based company that provides consulting services to oil companies in Alaska. From 1991 to 2004 he was a member of the HTOC. From 1970 until 1999, he was an employee of the BP group of companies, most recently BP Exploration Alaska, where he worked for nine years in the environmental department on alternatives to halon and on halon banking. Mr. Catchpole advises BP Exploration Alaska on fire protection and halon issues as his main activity for PRA. BP Exploration Alaska has an interest in the topics of the Montreal Protocol because it uses halon 1301 for explosion prevention and fire suppression in its enclosed oil and gas processing modules on the North Slope of Alaska. Mr. Catchpole has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, however his retirement portfolio contains stock in BP plc. Mr. Catchpole's spouse does not work for or consult for any organization that has an interest in the topics of the Montreal Protocol. His spouse has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consult for organizations seeking to phase-out ODSs. Mr. Catchpole typically receives funding to support salary and travel to TEAP/TOC meetings from the United States Environmental Protection Agency and the United States Department of Defense; and the Halon Recycling Corporation and the Halon Alternatives Research Corporation, which are not-for-profit industry coalitions that in turn receive contributions for this funding from members. Contributors are: BP Exploration Alaska, ConocoPhillips Alaska, DuPont, Chemtura, American Pacific, Firetrace, Halon Banking Systems, Wesco and Remtec.

Seunghwan (Charles) Choi **Rep. Of Korea (A5)**

Mr. Charles (Seunghwan) Choi, Halons Technical Options Committee (HTOC) Member, is a CEO and Representative Director at the Hanju Chemical Co. ("Hanju"). Mr. Choi has a full time management job at Hanju in 326-79 Songjeong-ri, Whasung city, Kyunggi-do, Korea. The Hanju has an interest in the topics of the Montreal Protocol because it produces halon 1301 and halon 1211 products in accordance with the Montreal Protocol. Mr. Choi owns stock in companies producing ODS but does not consult for organizations seeking to phase-out ODSs. Mr. Choi does not work as a consultant on matters related to the Montreal Protocol. Mr. Choi's spouse and dependant children living at same home do not work for or consult for any organization that has an interest in the topics of the Montreal Protocol. Mr. Choi's spouse and dependant children have no proprietary interest in alternatives or substitutes to ODSs, do not own stock in companies producing ODS or alternatives or substitutes to ODSs, and do not consult for organizations seeking to phase-out ODSs. Mr. Choi's travel to HTOC meetings is paid for by UNEP's Ozone Secretariat.

Michelle M. Collins **USA (Non-A5)**

Dr. Michelle M. Collins, Halons Technical Options Committee (HTOC) Member, is the President of EECO International and a former full-time research engineer for the United States National Aeronautics and Space Administration (from 1990-2005). Dr. Collins is a full time consultant at the offices of EECO International, 3600 Travis Place, Titusville, Florida, 32780, U.S.A. Dr. Collins continues to report to NASA on the HTOC through

EECO International in an unofficial capacity. The company has an interest in the topics of the Montreal Protocol because of NASA's needs. Dr. Collins has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, and does not perform consulting for organizations seeking to phase-out ODSs. Dr. Collins may work occasionally as a consultant to NASA (U.S. government) on matters related to the Montreal Protocol. Dr. Collins' spouse works for NASA in an unrelated field, and Dr. Collins' dependant children living at same home do not work for or consult for any organization which has an interest in the topics of the Montreal Protocol. Dr. Collins' spouse and their children have no proprietary interest in alternatives or substitutes to ODSs, do not own stock in companies producing ODS or alternatives or substitutes to ODSs and do not consult for organizations seeking to phase-out ODSs. Dr. Collins' travel to HTOC meetings is paid by EECO International, which may receive contributions for this travel from NASA, if relevant.

Andrew Greig **South Africa (A5)**

Mr. Andrew Greig, Halons Technical Options Committee (HTOC) Member, is a Principal Engineer at Protection Projects, a consulting fire engineering company located in Johannesburg, South Africa. He is in full time employment with Protection Projects. Mr. Greig is also a joint manager of the Halon Bank of Southern Africa, which organisation is operated on behalf of the South African Government's Department of Environmental Affairs. The Halon Bank of SA is a non-profit organisation, established in terms of the Montreal Protocol and Amendments; to manage the reduction of existing stocks of halon, facilitate the disposal of halons, assist in locating halons to keep critical systems running, and to provide quality assurance services relating to these objectives. The Halon Bank thus has an interest in the topics of the Montreal Protocol in order to carry out the obligations of the South African Government as a Signatory. Services are rendered on behalf of the Bank on an as-required basis by two joint managers, for industry-standard time-related fees. Mr. Greig has no proprietary interest in alternatives or substitutes to ODSs, does not own shares in companies producing ODS or alternatives or substitutes to ODSs, and does occasional consulting for organizations seeking to phase-out ODSs. Mr. Greig's spouse and dependant children have no proprietary interest in alternatives or substitutes to ODSs, do not own stock in companies producing ODS or alternatives or substitutes to ODSs and do not consult for organizations seeking to phase-out ODSs. Mr. Greig's travel to HTOC meetings is paid by Protection Projects, which receives contributions for this travel from the UNEP's Ozone Secretariat.

Matsuo Ishiyama **Japan (Non-A5)**

Mr. Matsuo Ishiyama, Halons Technical Options Committee (HTOC) Member since 1996, is Corporate Advisor of Nohmi Bosai Ltd., a leading Japanese fire protection company, manufacturing, sales and contracting for installation of fire detection-alarm systems and all kinds of fire extinguishing systems. He has been appointed as Advisor of the Japan Fire Extinguishing Systems Manufacturer's Association, and Board Auditor of the Fire and Environment Protection Network (National Halon Bank of Japan). Nohmi Bosai Ltd. provides his ordinary salary and the Fire and Environment Protection Network pays for travel expenses for attending HTOC meetings.

Zhou Kaixuan **China (A5)**

Mr. Zhou Kaixuan, Halons Technical Options Committee (HTOC) Member since 2006, is the Deputy Director General of Aircraft Airworthiness Certification of General Administration of Civil Aviation of China. Mr. Zhon has been in the Civil Aviation area for more than 20 years. He participated in Rule-making for most of the Civil Aviation Regulations of China and Type Certifications on Civil Aircraft of China such as Y12/Y7/MA60/Y8/LE500/Z9/Z11. Mr. Zhou previously worked for Macau Civil Aviation Authority of Macau for 3 years (from 1995 to 1998). He has been the Deputy Director of Standard Division, Director of Aircraft Supervision Division and Director of Liaison Division in Aircraft Airworthiness Department of General Administration of Civil Aviation of China (CAAC) for many years. In 2000, he was appointed as the Deputy Director General of Aircraft Airworthiness Certification Department of CAAC. Mr. Zhou has no interest or economic relationship with halon production companies or any aviation industry company, and does not receive any fees for work associated with HTOC. Mr. Zhou's travel expenses to attend HTOC meeting are paid for the UNEP's Ozone Secretariat.

H. S. Kaprwan **India (A5)**

Mr. H. S. Kaprwan, Halons Technical Options Committee (HTOC) Member, retired as Add. Director from the Defense Institute of Fire Research, Ministry of Defense, Government of India, in July 2004. Since then he has been a free lancer fire protection consultant in India associated with various government and semi-government organizations. He has been assisting them with information sharing on various fire protection technologies including halon alternatives and technology transfers under financial and technical assistance of the MLF of the Montreal Protocol. Mr. Kaprwan is not employed by any government or private company in India or abroad on the subject of fire protection technologies or halon replacement technologies. Mr. Kaprwan also provides free and voluntary advice to various Indian government and private organizations on fire protection related subjects, including the Ministry of Environment Ozone Cell, Indian Military organizations, and the aviation sector. Mr. Kaprwan is not employed by and does not receive any financial assistance of any kind from commercial companies in India or abroad where he would have any conflict of interest of any kind regarding halon or halon alternative related matters. Mr. Kaprwan's spouse and sons are not involved in subjects related to the Montreal Protocol. Mr. Kaprwan's travel to HTOC meetings is paid for by the UNEP's Ozone Secretariat.

Nikolai Kopylov **Russian Fed. (Non-A5)**

Dr. Nikolay Kopylov is the Head of the All-Russian Scientific Research Institute for Fire Protection (VNIIPO). VNIIPO has an interest in the topics of the Montreal Protocol as a body responsible for technical control of Montreal Protocol related issues in Russia. VNIIPO has no proprietary interest in alternatives or substitutes to ODSs, does not own or own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consult for organizations seeking to phase-out ODSs. Dr. Kopylov works as a consultant to the Russian government on matters related to the implementation of the Montreal Protocol. Dr. Kopylov's spouse and son have no proprietary interest in alternatives or substitutes to ODSs, do not own or own stock in companies producing ODS or alternatives or substitutes to ODSs, and do not consult for organizations seeking to phase-out ODSs. Dr. Kopylov's travel to HTOC meetings is paid for by UNEP's Ozone Secretariat.

Barbara Kucnerowicz-Polak **Poland (Non-A5)**

Dr. Barbara Kucnerowicz-Polak, Halons Technical Options Committee (HTOC) Member, is the Senior Adviser to the Head of the Polish Fire Service and Civil Protection at the National Headquarters of the State Fire Service. Dr. Kucnerowicz-Polak is responsible for international co-operation on chemical safety, including implementation of the European Union directives and OECD recommendations regarding chemical safety programs, as well as the Montreal Protocol related issues. Dr. Kucnerowicz-Polak has extensive experience in combustion science and fire protection research and was head of the Extinguishing media department under the National Certification Authority for almost 15 years. Since 1994 when she became a member of the HTOC, Dr. Kucnerowicz-Polak has served as the national expert on problems related to halon phase-out for the Polish Government and fire protection community. She developed Poland's national strategy for phasing out halons, including a set of guidelines for the fire protection community that provide step by step technical approaches to implementing the Montreal Protocol decisions. Over the last ten years she has also served as a member of the Ozone Operation Resource Group, consulting to the World Bank for the Implementation of the Montreal Protocol. The National Headquarters of the State Fire Service has no proprietary interest in alternatives or substitutes to ODSs, does not own or own stock in companies producing ODS or alternatives or substitutes to ODSs. Dr. Kucnerowicz-Polak's sons do not work for or consult for any organization or companies and have no proprietary interest in alternatives or substitutes to ODSs, do not own or own stock in companies producing ODS or alternatives or substitutes to ODSs and do not consult for organizations seeking to phase-out ODSs. Dr. Kucnerowicz-Polak travel to HTOC meetings is paid for by the National Headquarters of the State Fire Service and she does not receive contributions for this travel from any other sources.

David Liddy **UK (Non-A5)**

Dr. David Liddy, Halons Technical Options Committee (HTOC) Member, is an employee of the UK government. Dr. Liddy has a Ph.D. in chemistry and works full time on environmental policy issues for the UK Ministry of Defence (UK MOD) in London. The UK MOD has an interest in the topics of the Montreal Protocol because it continues to use some ODSs in equipment and facilities. Dr. Liddy has no proprietary interest in any alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consult for any other organizations seeking to phase out ODSs. Dr. Liddy's travel to HTOC meetings is paid for by UK MOD.

Bella Maranion **USA (Non-A5)**

Ms. Bella Maranion, Halons Technical Options Committee (HTOC) Member, is a Program Analyst at the U.S. Environmental Protection Agency (USEPA). Ms. Maranion is a full time industry sector analyst and project manager in the USEPA's Stratospheric Protection Division, Washington, DC. The USEPA has an interest in the topics of the Montreal Protocol because the Agency is responsible for implementing national regulations and policies to meet the US commitments under the Protocol. Ms. Maranion has no proprietary interest in alternatives or substitutes to ODSs or in companies producing ODS or alternatives or substitutes to ODSs, and does not consult for organizations seeking to phase-out ODSs. Ms. Maranion's spouse and dependant children have no proprietary interest in alternatives or substitutes to ODSs or companies producing ODS or alternatives or substitutes to ODSs and do not consult for organizations seeking to phase-out ODSs. Ms. Maranion's travel to HTOC meetings is paid for by the USEPA.

John J. O'Sullivan **UK (Non-A5)**

Mr. John J. O'Sullivan, Halons Technical Options Committee (HTOC) Member since 1992, has worked as a full time aviation fire protection expert for British Airways and adviser to the International Air Transport Association (IATA) for 40 years. Mr. O'Sullivan recently took early retirement from British Airways and is now employed by Bureau Veriitas, one of the leading environmental companies in the world, as their Fire Consultant and is still acting as adviser to IATA. Acknowledged as one of the leading fire protection specialists in the world, in 1998 Mr. O'Sullivan was, on the recommendation of Tony Blair, Prime Minister UK, awarded the MBE by Her Majesty Queen Elizabeth II for services to Aviation and the Environment. In 1996 he was awarded the United States Environment Award for his role in the phase out of ODS and 1994 awarded the Ben Franklin Medal for work with Fire Services. Mr. O'Sullivan has no financial interest in any company or organisation that benefits from him being a member of the HTOC. Mr. O'Sullivan's spouse does not work for any company and is now retired. Mr. O'Sullivan's two children are not involved with any company that would benefit from his membership of HTOC. His attendance at meetings has been funded by his employer or paid for out of his personal funds.

Erik Pedersen **Denmark (Non-A5)**

Mr. Erik Pedersen, Halons Technical Options Committee (HTOC) Member, is a consultant to the World Bank for the Implementation of the Montreal Protocol. The World Bank has an interest in the topics of the Montreal Protocol as one of the four implementing agencies under the Multilateral Fund of the Montreal Protocol, and working with developing countries for the implementation of the Montreal Protocol. Mr. Pedersen has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consult for organizations seeking to phase-out ODSs. Mr. Erik Pedersen works as a consultant to The World Bank on matters related to the implementation of the Montreal Protocol. Mr. Pedersen's spouse does not work for or consult for any organization or company. Mr. Pedersen's children have no proprietary interest in alternatives or substitutes to ODSs, do not own stock in companies producing ODSs or alternatives or substitutes to ODSs and do not consult for organizations seeking to phase-out ODSs. Mr. Pedersen's travel to HTOC meetings is partly paid by the World Bank and from his own funds. He does not receive contributions for this travel from other sources.

Donald Thomson **Canada (Non-A5)**

Mr. Donald Thomson, Halons Technical Options Committee (HTOC) Member, is the Past Chairperson of the Manitoba Ozone Protection Industry Association (MOPIA) board of directors and the Chairperson of their Halon Section. MOPIA is a partnership between industry, the public and government committed to successfully protecting the stratospheric ozone layer through the control, reduction and eventual elimination of emissions of ozone depleting and climate changing substances to the atmosphere**.** MOPIA, a non-exclusionary association, is the primary conduit for liaison between the various ozone depleting substances industry associations, Manitoba Environment and any other interested stakeholders. Mr. Thomson has a full time position as the Fire Marshal for Manitoba Hydro responsible for their fire prevention and protection programs. Manitoba Hydro is a public utility having an interest in the topics of the Montreal Protocol because of their use of halon as a fire suppressant and the use of other ODS in AC/Chillers systems. In addition Mr. Thomson is looking to the future for the elimination and disposal of halons for the stakeholders of Manitoba. Mr. Thomson has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not do any consulting for organizations seeking to phase-out ODSs. Mr. Thomson has worked as a consultant to UNEP through the Canadian Government on matters related to halon management for the Montreal Protocol. Mr. Thomson's social partner works for or consults for Manitoba Hydro and is also a Past Chairperson of MOPIA, which has an interest in the topics of the Montreal Protocol for the same reason as Mr. Thomson. Mr. Thomson's social partner has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not do consulting for organizations seeking to phase-out ODSs. Travel to HTOC meetings is paid in part by MOPIA and wages are maintained by Manitoba Hydro.

Daniel P. Verdonik **USA (Non-A5)**

Dr. Daniel P. Verdonik, Co-Chair, Halons Technical Options Committee and Member, Technology and Economic Assessment Panel is the Director, Environmental Programs, Hughes Associates, Inc. Dr. Verdonik is a full time, salaried employee at Hughes Associates, Inc., in Baltimore, MD and Arlington, VA providing consulting services in fire protection and environmental management. Hughes Associates, Inc. has an interest in the topics of the Montreal Protocol because it provides a wide range of fire protection research, design and consulting services to government and corporate clients, including work related to halons and halon alternatives. Dr. Verdonik has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and through Hughes Associates, Inc. provides consulting services for organizations seeking to phase-out ODSs. Dr. Verdonik is a partner in Hughes Associates, Inc., which does not own stock in companies producing ODS, or alternatives or substitutes to ODSs. Dr. Verdonik currently provides consulting services through Hughes Associates, Inc, for the U.S. Army and U.S. Navy on matters related to the Montreal Protocol and has previously provided services through Hughes Associates Inc. for Implementing Agencies, U.S. EPA, U.S. Air Force and Chemtura. Dr. Verdonik's spouse works for the U.S. Army, which has an interest in the topics of the Montreal Protocol because it is trying to phase-out halons but in the interim, continues to rely on halons for purposes of national security. Dr. Verdonik's spouse and dependant child have no proprietary interest in alternatives or substitutes to ODSs, do not own stock in companies producing ODS or alternatives or substitutes to ODSs, and do not consult for organizations seeking to phase-out ODSs. Hughes Associates, Inc. typically receives funding to support Dr. Verdonik's salary and travel to TEAP/HTOC/TSB meetings from MLF, UNEP, the U.S. Department of Defense, the U.S. EPA, the U.S. National Aeronautics and Space Administration, the Halon Recycling Corporation, and the Halon Alternatives Research Corporation, who in-turn currently receives funding to support these efforts from the following sponsors: BP Exploration, Alaska, ConocoPhillips, Alaska; DuPont; Chemtura; American Pacific; Firetrace; Halon Banking Systems; Wesco; Remtec. From time-to-time, Hughes Associates, Inc may also provide support for labour and travel.

Robert T. Wickham **USA (Non-A5)**

Mr. Robert T. Wickham, Halons Technical Options Committee (HTOC) Member, is the principal of Wickham Associates, a consulting engineering firm located in Stratham, New Hampshire, U.S.A. Mr. Wickham is an engineering graduate of the University of Wisconsin and is a registered professional engineer in several states. Mr. Wickham has had and continues to have a long term interest in assuring that only environmentally sound and safe alternatives to halons are employed, views that are consistent with the interests of the Montreal Protocol. Mr.

Wickham has no proprietary interest in alternatives or substitutes for ODSs, does not own stock in companies producing ODS or alternatives or substitutes for ODSs and does not consult for organizations seeking to phase-out ODSs. While Mr. Wickham has at times performed consulting services for the World Bank and the U.S. Environmental Protection Agency in the area of alternatives to halons, he currently has no assignments of this type nor is seeking any. In addition to his work on the HTOC, Mr. Wickham has been a member of the U.S. delegation to the International Maritime Organization's Fire Protection Sub-committee for the past 12 years, the head of the U.S. delegation to ISO TC 21/SC 8, the Chair of the NFPA Aerosol Extinguishing Technology committee, a member of the NFPA technical committee on Gaseous Fire Extinguishing Systems, a Board Member of the International Water Mist Association and a Lead Author for the IPCC/TEAP joint Report on HFCs and PFCs (April, 2005). Further, Mr. Wickham is one of only two people to earn both the U.S. EPA Stratospheric Ozone Protection Award (1999) and the U.S. EPA Climate Protection Award (2002) for his work in the field of halon replacements. Mr. Wickham's spouse and children have no interest in the topics of the Montreal Protocol. Mr. Wickham's travel to HTOC meetings is paid for by Wickham Associates from general company funds.

Consulting Experts

Thomas Cortina **USA (Non-A5)**

Mr. Thomas Cortina, Halons Technical Options Committee (HTOC) Consulting Expert, is a partner at Alcalde & Fay Inc., 2111 Wilson Boulevard, Arlington, VA, USA. Mr. Cortina serves as Executive Director of the Halon Alternatives Research Corporation (HARC) and the Halon Recycling Corporation (HRC). HARC and HRC have an interest in the topics of the Montreal Protocol because they are non-profit associations focused on issues related to halon recycling and replacement. Mr. Cortina has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs but may do consulting for organizations seeking to phase-out ODSs. Mr. Cortina's spouse and children living in the same household have no proprietary interest in alternatives or substitutes to ODSs and do not own stock in companies producing ODS or alternatives or substitutes to ODSs. Mr. Cortina works occasionally as a consultant on matters related to the Montreal Protocol. Travel to HTOC meetings is paid by HARC.

Sergey Kopylov **Russian Fed. (Non-A5)**

Dr. Sergey Kopylov is the Head of the Department of Fire Extinguishing tools & media of the All-Russian Scientific Research Institute for Fire Protection (VNIIPO). VNIIPO has an interest in the topics of the Montreal Protocol as a body responsible for technical control of Montreal Protocol related issues in Russia. VNIIPO has no proprietary interest in alternatives or substitutes to ODSs, does not own or own stock in companies producing ODS or alternatives or substitutes to ODSs. Dr. Kopylov works as a technical expert to the Russian government on matters related to the implementation of the Montreal Protocol. Dr. Kopylov's spouse does not work for or consult for any organization or company. Dr. Kopylov's spouse and children have no proprietary interest in alternatives or substitutes to ODSs, do not own or own stock in companies producing ODS or alternatives or substitutes to ODSs and do not consult for organizations seeking to phase-out ODSs. Dr. Kopylov's travel to HTOC meetings is paid for by UNEP's Ozone Secretariat.

Steve McCormick **USA (Non-A5)**

Mr. Steve McCormick, Halons Technical Options Committee (HTOC) Consulting Expert since 1996, is a survivability team leader at the US Army Tank-Automotive Command. He is a full time researcher at the Tank-Automotive Research, Development and Engineering Center (TARDEC) in Warren, MI. TARDEC has an interest in the topics of the Montreal Protocol because the vehicles it supports rely on halons and their replacements for fire protection. For more than 20 years, Mr. McCormick has developed fire protection systems to protect soldiers and their equipment and has led Army efforts to replace halons in ground vehicles. Mr. McCormick has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consult for organizations seeking to phase out ODSs. Mr. McCormick's spouse and child do not work for or consult for any organization that has an interest in the topics of the Montreal Protocol. They have no proprietary interest alternatives or substitutes to ODSs, do not own stock in companies producing ODS or alternatives or substitutes to ODSs and do not consult for organizations seeking to phase out ODSs. Mr. McCormick's travel to HTOC meetings is paid for by TARDEC.

Jawad Rida **Jordan (A5)**

Mr. Jawad Rida, Halon Technical Options Committee (HTOC) Consulting Expert, is the Managing Director at the National Concorde Establishment. Mr. Rida is a full time Director at the Head Office in Jordan. The National Concorde Establishment has an interest in the topics of the Montreal Protocol because it provided technical support to Jordan's National Halon Management Project. Mr. Rida has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consult for organizations seeking to phase-out ODSs. Mr. Rida works occasionally as a consultant to the United Nations Environment Programme (UNEP) on matters related to the Montreal Protocol. Mr. Rida's spouse and dependant children living at the same home have no proprietary interest in alternatives or substitutes to ODSs, do not own stock in companies producing ODSs or alternatives or substitutes to ODSs, and do not consult for organizations seeking to phase-out ODSs. Mr. Rida's travel to HTOC meetings is paid for by UNEP's Ozone Secretariat.

Mark L. Robin **USA (Non-A5)**

Dr. Mark L. Robin, Halons Technical Options Committee (HTOC) Consulting Expert, is a Senior Technical Consultant at DuPont Fluoroproducts in Wilmington, Delaware, U.S.A. Dr. Robin has over 20 years experience in the synthesis and applications of specialty organofluorine compounds, including HCFCs and HFCs in propellant foam blowing, solvent, refrigeration and fire suppression applications. DuPont Fluoroproducts has an interest in the topics of the Montreal Protocol because they are a major manufacturer of ODSs and substitutes to ODSs. Dr. Robin has no proprietary interest in alternatives or substitutes to ODSs, but he owns stock in companies producing ODS, alternatives and substitutes to ODSs (DuPont). Dr. Robin does not serve as a consultant for organizations seeking to phase-out ODSs. Dr. Robin's spouse and dependant children living at same home do not work for or consult for any organizations that have an interest in the topics of the Montreal Protocol. Dr. Robin's spouse and dependant children have no proprietary interest in alternatives or substitutes to ODSs, and do not own stock in companies producing ODS or alternatives or substitutes to ODSs, and do not consult for organizations seeking to phase-out ODSs. Dr. Robin's travel to HTOC meetings is paid by DuPont Fluoroproducts.

Joseph A. Senecal **USA (Non-A5)**

Dr. Joseph A. Senecal, Halons Technical Options Committee (HTOC) Consulting Expert, is employed full-time as the manager of the Combustion Research Center of Kidde-Fenwal Inc., Holliston, Massachusetts, USA, a United Technologies Corporation (UTC) company. United Technologies has an interest in the topics of the Montreal Protocol because it is a supplier of fire extinguishing and refrigeration products that formerly employed ozone depleting substances. Dr. Senecal has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, except as may be held by mutual funds in which he owns shares, and does not consult for organizations seeking to phase-out ODSs. Dr. Senecal does not act as a consultant to UN, UNEP, MLF, Implementing Agencies, Governments, companies, etc. on matters related to the Montreal Protocol. Dr. Senecal's spouse has no connection with any organization that has an interest in the topics of the Montreal Protocol, does not have a proprietary interest in alternatives or substitutes to ODSs or own stock in companies producing ODS or alternatives or substitutes to ODSs, and does not consult for organizations seeking to phase-out ODSs. Dr. Senecal's travel to HTOC meetings is paid for by his employer, UTC.

Ronald S. Sheinson **USA (Non-A5)**

Dr. Ronald S. Sheinson, Halons Technical Options Committee (HTOC) Consulting Expert, is a research chemist (Head, Combustion Dynamics) at the US Naval Research Laboratory (NRL). Dr. Sheinson is a full time employee at the NRL, located in Washington, DC, USA. The Navy has an interest in the topics of the Montreal Protocol because of its need for fire protection, and its commitment supporting the minimization of employing ozone depleting substances. Dr. Sheinson has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consult for organizations seeking to phase-out ODSs, outside of efforts consistent with Navy efforts. Any such information exchange is of a technical nature and not for remuneration. Dr. Sheinson's spouse and dependant child living at same home do not work for or consult for any entity that has an interest in the topics of the Montreal Protocol. They have no proprietary interest in alternatives or substitutes to ODSs, do not own stock in companies producing ODS or alternatives or substitutes to ODSs and do not consult for organizations seeking to phase-out ODSs. Dr. Sheinson's travel to HTOC meetings is paid for by NRL.

Ronald Sibley **USA (Non-A5)**

Mr. Ronald Sibley, Halons Technical Options Committee (HTOC) Consulting Expert since 1994, is currently a contract consultant to the US Department of Defense ODS Reserve Program Office in Richmond, Virginia. Mr. Sibley retired in January 2007 from US Government employment where he served for the most recent fifteen years as the US Government Program Manager for the US Department of Defense Military Inventory for halon/CFCs. The US Department of Defense has interest in all aspects of the Montreal Protocol given its global operations with bases in many different nations. Additionally, the US military has led in the development and implementation of many halon reclaiming and storage procedures and techniques which have been adopted worldwide. Mr. Sibley continues to receive funding for travel and HTOC participation from the US military. Mr. Sibley and his spouse have no financial interest relevant to alternatives or substitutes and do not consult for organizations seeking to phase out halon/ODSs.

Mitsuru Yagi **Japan (Non-A5)**

Mr. Mitsuru Yagi, Halons Technical Options Committee (HTOC) Consulting Expert since 2006, is a mechanical engineer working for a leading Japanese fire protection equipment manufacturer, Nohmi Bosai Ltd., based in Tokyo. He has been engaged in designing fire fighting equipment using water, foam, dry chemical and gas for 20 years. He is also a manager of the Japanese national Halon Bank (Fire and Environment Protection Network), which was organized to contribute to protect the ozone layer and to prevent global warming by controlling all kinds of gaseous fire extinguishing agents, including halons, restraining unnecessary emission of agents and promoting reclamation of agents that can be recycled. The Network provides the expenses for travel to attend HTOC meetings and other expenses for work relating to ozone layer protection and global warming prevention. Nohmi Bosai provides his ordinary salary.

AIII.5 Disclosure of Interest Declarations RTOC

R.S. Agarwal **India (A5)**

Dr. Radhey S. Agarwal, Co-chair of the Refrigeration, Air-conditioning and Heat Pumps Technical Options Committee, is the Professor of Mechanical Engineering at the Indian Institute of Technology Delhi (IIT Delhi). He co-chaired the 2003 HCFC Task Force and the 2004 Chiller Task Force. IIT Delhi has an interest in the topics of the Montreal Protocol being one of the academic institutes of higher learning in India. Dr. Agarwal holds a M. Tech. and a Ph.D. from IIT Delhi. Dr. Agarwal has been actively pursuing research in the area of refrigeration & air-conditioning. He has guided a number of Ph.D. and M. Tech. theses and published research papers in the field of refrigeration and air-conditioning. Dr. Agarwal has no proprietary interest in alternatives or substitutes to ODSs, does not own any stock in companies producing ODS or alternatives/substitutes to ODSs. Dr. Agarwal's spouse has no interest in matters related to the Protocol. Dr. Agarwal occasionally takes consultancies and advisory roles operated through IIT Delhi from the engineering industry, UNEP, GTZ, INFRAS for research & development, technical advice, developing technical manuals and training materials etc. IIT Delhi makes in-kind contribution for wages. Cost of travel and other expenses related to participation in TEAP and the RTOC are paid by the Ozone Secretariat.

James A. Baker **USA (Non-A5)**

James A. Baker, member of the RTOC, is a full-time senior staff research scientist at Delphi Corporation's Lockport Technical Center in Lockport, NY (USA). Delphi has an interest in the topics of the Montreal Protocol because Delphi makes air conditioning systems for vehicles to provide passenger comfort. James A. Baker has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does not provide consulting for organisations seeking to phase out ODSs. Neither James, nor his wife, Marianne A. Baker, have any material interest in matters related to the Protocol beyond philosophical support of its goals and objectives. James works occasionally as a consultant to UNEP, MLF, Implementing Agencies, Governments, companies, etc. on matters related to the Montreal Protocol. James A. Baker holds a B.A. in Chemistry (1970) and an M.S. in Physical Chemistry (1975) from Wright State University, Dayton, Ohio. James has been employed by Delphi (formerly as GM) for 33 years as a materials engineer and refrigerant systems expert. James was awarded the 1990 and 1997 US EPA Stratospheric Ozone Protection Awards for his contribution to pioneering the technology to recycle refrigerant.

Julius Banks **USA (Non-A5)**

Julius Banks, member of the RTOC, is the team lead on refrigerant recycling and emissions reduction at the U.S. Environmental Protection Agency (USEPA). Julius Banks is a full time environmental engineer at the Washington, DC Headquarters office of USEPA. The USEPA has an interest in the topics of the Montreal Protocol because as a signatory to the Protocol the U.S. government has an interest in making certain that assistance is provided to parties to the Protocol, specifically A5 signatories. Julius Banks has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does not provide consulting services to organisations seeking to phase out ODSs. Julius Bank's spouse/partner/significant other has no interest in matters related to the Protocol. Julius Banks works as regulation writer at USEPA and occasionally consults on issues related to UN, UNEP, MLF, Implementing Agencies, governments, companies, etc. on matters related to the Montreal Protocol.

Dariusz J. Butrymowicz **Poland (Non-A5)**

Dr. Dariusz J. Butrymowicz, member of the RTOC, is an expert at the National Refrigeration Forum, Poland. Dariusz J. Butrymowicz is a full time associate professor at the Institute of Fluid-Flow Machinery of Polish Academy of Sciences in Gdansk, Poland as well as a full time associate professor at the Bialystok Technical University in Bialystok, Poland. The National Refrigeration Forum, Poland has an interest in the topics of the Montreal Protocol because the activity of this organisation deals with usage and consumption of ODSs for refrigeration, air-conditioning and heat pump applications in Poland. Dariusz J. Butrymowicz has no proprietary interest alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does consulting for the National Refrigeration Forum, Poland seeking to phase out ODSs. Dariusz J. Butrymowicz's spouse has no interest in matters related to the Protocol. Dariusz J. Butrymowicz works occasionally as a consultant to UNEP, and the National Refrigeration Forum, Poland on matters related to the Montreal Protocol.

James M. Calm **USA (Non-A5)**

James M. Calm, member of the RTOC and CLA for *Refrigerants* in prior assessments, is an independent engineering consultant. Mr. Calm specialises in heating, air-conditioning, and refrigerating systems. His services include performance, environmental, and safety analyses as well as feasibility studies, assessments, research, and strategic planning. His clients frequently have included manufacturers (including but not limited to those producing refrigerants, equipment utilising them, components for them, and ancillary safety devices such as leak detection devices), engineering and architectural firms, building owners, and research organisations and occasionally have included utilities, trade associations (including those directly involved in refrigerant and related equipment manufacture), and governmental agencies. Mr. Calm also has consulted for clients regarding ODS alternative selections for processes other than refrigeration, such as for devices for medical and cosmetic treatments. The clients are primarily the United States, but sometimes also in Canada, Asia, Europe, and the

Middle East; the majority are in non-Article 5 countries, but some are in Article 5 countries. The topics of the Montreal Protocol and RTOC assessment are germane to aspects of Mr. Calm's work addressing refrigerant management, transition planning, performance analyses, and evaluation of environmental and safety impacts. Mr. Calm has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, and does not own a proprietary interest or stock in companies engaged in processes for ODSs, alternatives, or substitutes.

Guangmin Chen **China (A5)**

Prof. Guangming Chen, member of the RTOC, is a professor at Zhejiang University, China. Guangming Chen is a full time professor at the Institute of Refrigeration and Cryogenics of Zhejiang University, Hangzhou, China. The University has an interest in the topics of the Montreal Protocol because there are some professors and students who are doing the researches related to the alternatives to ODS refrigerants. Guangming Chen has no proprietary interest alternatives or substitutes to ODSs, does not own any stock in companies producing ODS or alternatives or substitutes to ODSs, does not consult for any organisations seeking to phase out ODSs. Guangming Chen's wife has no interest in matters related to the Montreal Protocol. Guangming Chen works occasionally as a consultant to UNEP on matters related to the Montreal Protocol.

Denis Clodic **France (Non-A5)**

Dr. Denis Clodic, member of the RTOC, is a Research Director at the Ecole des Mines de Paris. Denis Clodic is a full time research director and deputy-director at the Center for Energy and Processes of Ecole des Mines de Paris in Paris. Denis Clodic manages a laboratory of 65 persons among them 36 Ph.D. students. The laboratory is deeply involved in improvement of energy efficiency of refrigerating systems, air conditioning, and industrial processes as well as high efficiency in buildings. Moreover he has developed with his team efficient methods of measurements of leak flow rates of refrigerating systems. The Ecole des Mines de Paris has an interest in the topics of the Montreal Protocol because of its research policy on substitution of refrigerants. Denis Clodic has no proprietary interest alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does consulting for organisations seeking to phase out ODSs. Denis Clodic works occasionally as a consultant to UNEP, MLF, Implementing Agencies, governments, companies, etc. on matters related to the Montreal Protocol.

Daniel Colbourne **UK (Non-A5)**

Daniel Colbourne, member of the RTOC, is an independent consultant, belonging to no organisation. Daniel Colbourne is a full time consultant at his home-based office in Stratford-upon-Avon, UK. Daniel Colbourne consultant has an interest in the topics of the Montreal Protocol because of his personal experience within the related subjects, and a personal concern over the balance of outputs from the RTOC, and is funded by the UK Government for attendance at meetings. Daniel Colbourne has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, and does consulting for organisations seeking to phase-out ODSs. Daniel Colbourne's partner has no interest in matters related to the Protocol, except for those related to environmental issues in general. Daniel Colbourne works occasionally as a consultant to GTZ (Germany) and DEFRA (UK) on matters related to the Montreal Protocol, and otherwise is involved with various private companies in technical adaptation of their refrigeration systems to use various alternative refrigerants. No further details thought important.

James G Crawford **USA (Non-A5)**

James G Crawford [Jim], member of the RTOC, is the Director of Regulatory Affairs of The Trane Company, a division of American Standard Inc. Mr. Crawford is a full time employee at the Trane Company's facility in Tyler, Texas. The Trane Company has an interest in the topics of the Montreal Protocol because Trane is a leading manufacturer of heating and air conditioning equipment. Mr. Crawford has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, and does not consult for organisations seeking to phase out ODSs. Mr. Crawford's spouse has no interest in matters related to the Protocol. Mr. Crawford works occasionally as an unpaid advisor to UN agencies and US government agencies on matters related to the Montreal Protocol. Mr. Crawford holds a Bachelor's degree in Physics from Temple University [Summa cum Laude with Distinction in Physics] and a Master's degree in System Science from Polytechnic Institute of New York, and is a graduate of General Electric's three-year post-graduate Advanced Engineering Program. He has been involved in various aspects of environmental systems and environmental studies for over 45 years, and has been an NGO participant in the Montreal Protocol, the Framework Convention on Climate Change and the Kyoto Protocol since 1993.

Sukumar Devotta **India (A5)**

Dr. Sukumar Devotta, member of the RTOC, is the Director at the National Environmental Engineering Research Institute (NEERI). Dr. Devotta is a full time Director at the NEERI, Nagpur, India. NEERI has an interest in the topics of the Montreal Protocol because of NEERI's mandate to provide service in the area of environmental engineering and science. Dr. Devotta, holds a M. Tech. (1973) Ph.D. (1978) in chemical engineering from the University of Madras and M.Sc. (1984) from the University of Salford, UK in heat energy recycling. Dr. Devotta also has research interest in the broad areas of refrigeration, A/c and heat pumps and has been working for the last 25 years or so. Dr. Devotta has published many research papers in peer reviewed journals and international conferences. He has also guided many post-graduate and Ph.D. students in this area. Dr. Devotta has no

proprietary interest alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does not consult for organisations seeking to phase out ODSs. Dr. S. Devotta's spouse has no interest in matters related to the Protocol. Dr. Devotta has not worked as a consultant to any organisation on matters related to the Montreal Protocol for the last four years or so.

Kenneth Hickman **USA (Non-A5)**

Dr. Kenneth Hickman is a part-time consultant at Johnson Controls Building Efficiency Group in York Pa, USA, formerly York International Corp. He retired as Vice President of Engineering at York and continues as a consultant to the Advanced Technology Engineering Department. JCI-York has an interest in the topics of the Montreal Protocol because the company manufactures a wide range of HVACR products that are sold world-wide. These products in many cases use refrigerants that are regulated by the Montreal Protocol. Dr. Hickman has no proprietary interest in alternatives or substitutes to ODSs, and does not own stock in companies producing ODS (except perhaps as part of diversified mutual funds). He does not consult for organisations other than JCI-York. Dr. Hickman's spouse has no interest in matters relating to the Protocol.

Takuho Hirahara (temporary) **Japan (Non-A5)**

Mr. Takuho Hirahara, applying member of the RTOC, is Managing Director at Living Environment System Laboratory of Mitsubishi Electric Corporation. He is a full time manager at the office of Living Environment System Laboratory located at Kamakura-city in Japan. He graduated Physical Mechanical Engineering of Tokyo Institute of Technology and got Master Degree of Engineering at Purdue University. He has over 30 years experience of technical and quality issues related to hermetic compressors and refrigeration cycles. He has no proprietary interest alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does not consulting for organisations seeking to phase out ODSs.

Martien Janssen **Netherlands (Non-A5)**

Martien Janssen, member of the RTOC, is a full-time director of Re/genT b.v., located in Helmond, The Netherlands. Re/genT BV has an interest in the topics of the Montreal Protocol because it works on R&D topics related to Refrigeration, AC and Heat Pump systems, which may involve substitutes and alternatives to substances regulated by the Montreal Protocol. Martien Janssen has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, and occasionally consults for organisations seeking to phase out ODSs. Martien Janssen's spouse has no interest in matters related to the Protocol. Martien Janssen works occasionally as a consultant to Implementing Agencies on matters related to the Montreal Protocol.

Maikoto Kaibara **Japan (Non-A5)**

Mr. Makoto Kaibara, member of the RTOC, is a Research & Technology Manager of Refrigeration, Air Conditioning & Heating Business Group of Matsushita Home Appliances Company of Matsushita Electric Industrial Co., Ltd. He participated as a member of RTOC for 2002 Report and 2006 Report since 1999. He also participated as a review editor to the "IPCC/TEAP Special Report Safeguarding the Ozone Layer and the Global Climate System:Issues Related to Hydrofluorocarbons and Perfluorocarbons". He is a full time engineer at the office of Refrigeration, Air Conditioning & Heating Business Group of Matsushita Electric Industrial Co., Ltd located in Shiga Japan. He graduated Mechanical Engineering of Osaka University in Japan, and he has over 30 years experience of technical issues related to air-conditioning and refrigeration. He is Managing Director of JASRAE Japan Society of Refrigerating and Air Conditioning Engineers and chairs the Technical Planning Committee. He also chaired the Residential Air Conditioner Technical committee in JRAIA the Japan Refrigeration and Air conditioning Industry Association. He has no proprietary interest alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does not consulting for organisations seeking to phase out ODSs.

Ftouh Kallel **Tunisia (A5)**

Dr. Ftouh Kallel, member of the RTOC, is a president at the SOFRIFAC SA company. Dr. Ftouh Kallel is a full time manager at the head office as well as at the factory located at Radès / Ben Arous City. The company has an interest in the topics of the Montreal Protocol because actually our process is using HCFC 141 b as a blowing agent when making air conditioning injected polyurethane ducts. Dr. Ftouh Kallel has proprietary interest alternatives or substitutes to ODSs, owns stock in companies producing ODS or alternatives or substitutes to ODSs, ensuring consulting for organisations seeking to phase out ODSs (such as ANPE-TUNISIA, Public Environment Agency). Dr. Ftouh Kallel works occasionally as a consultant to UNEP on matters related to the Montreal Protocol.

Michael Kauffeld **Germany (Non-A5)**

Prof. Dr. Michael Kauffeld, member of the RTOC, is a professor at the Karlsruhe University of Applied Sciences. Michael Kauffeld is a full time professor at the Institute of Refrigeration, Air Conditioning and Environmental Engineering. The Karlsruhe University of Applied Sciences has an interest in the topics of the Montreal Protocol because of environmental awareness. Michael Kauffeld has no proprietary interest alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does not consulting for organisations seeking to phase out ODSs. Michael Kauffeld's spouse has no interest in matters related to the Protocol. Michael Kauffeld works occasionally as a consultant to UNEP, Governments, companies, etc. on

matters related to the Montreal Protocol. Michael Kauffeld's work time is funded by the Karlsruhe University of Applied Sciences, travel costs related to participation in the RTOC are funded by the German Ministry for the Environment, Nature Conservation and Nuclear Safety.

Fred J. Keller **USA (Non-A5)**

Fred J. Keller, member of the RTOC, is the Vice President Engineering for Carrier Corporation's Residential and Light Commercial Systems business unit. Fred holds a Bachelor of Science in Mechanical Engineering from Purdue University and is a Licensed Professional Engineer. Fred has 37 years design experience in air conditioning and refrigeration systems. He is a full time Executive at Carrier's Residential Light Commercial Systems engineering center located in Indianapolis, Indiana USA. Carrier Corporation has an interest in the topics of the Montreal Protocol because their products utilise ODS substances as refrigerants. Fred J. Keller has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does no consulting for organisations seeking to phase-out ODSs. Fred's spouse, Laura L. Hintz-Keller, has no interest in matters related to the Protocol.

Juergen Koehler **Germany (Non-A5)**

Juergen Koehler, member of the RTOC, is a full professor at the Technical University of Braunschweig, Germany. Juergen Koehler has no proprietary interest alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does not consulting for organisations seeking to phase out ODSs. Juergen Koehler's spouse has no interest in matters related to the Protocol. Juergen Koehler has about 20 years of work experience in the mobile air conditioning and refrigeration industry. He has investigated theoretically and experimentally alternative refrigerants and refrigeration processes (compression and absorption). Since 1998 he has been a professor in the field of thermal sciences with special research interests in sustainable residential and mobile a/c and heat pump systems.

Holger König **Germany (Non-A5)**

Holger König, member of the RTOC, is a CTO at the Jaeggi/Guentner (Switzerland) AG, and a full-time technical director at the department in Trimbach, Switzerland. The Jaeggi/Guentner AG has an interest in the topics of the Montreal Protocol because the company is manufacturing products as components for environmentally friendly or natural refrigerants and technologies. Holger König has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, and does not consult for organisations seeking to phase out ODSs. Holger König's partner has no interest in matters related to the Protocol. Holger König occasionally works as a consultant to UNEP on matters related to the Montreal Protocol. He has received his diploma in engineering at the University of Hannover, Germany, in 1990, worked for different companies in research and development areas as well as for technical applications. He ha s published more than 20 technical papers dealing with the phase-out possibilities of ODS substances as well as new technologies to reduce energy consumption of refrigeration equipment. Since 1994 Holger König is spokesman of the German Research Council for Refrigeration.

Lambert Kuijpers **Netherlands (Non-A5)**

Lambert Kuijpers, Co-chair of the Technology and Economic Assessment Panel since 1992 and Co-chair of the Refrigeration, Air-conditioning and Heat Pumps Technical Options Committee since 1989, works on a part-time basis for the Department "Technology for Sustainable Development" at the Technical University Eindhoven, The Netherlands. He is a member of the Task Force on the TEAP legacy; he co-chaired the Replenishment Task Forces between 1996 and 2005. He served on the Steering Committee to the "IPCC/TEAP Special Report "Safeguarding the ozone layer and the global climate system: issues related to Hydrofluorocarbons and Perfluorocarbons", he co-chaired the 2005 Task Force for the TEAP Supplementary Report to the IPCC/TEAP Special Report and the 2006 Task Force on Emissions Discrepancies. He was a member of the Science Assessment Panel in 2005-2006. Until 1993, he worked for Philips in the development of refrigeration, air conditioning, and heat pump systems to use alternatives to ozone-depleting substances. He is financially supported (through the UNEP Ozone Secretariat) by the European Commission (and in certain years by some EU member state governments) for his activities related to the TEAP and the Refrigeration TOC. The general lack of adequate funding and also the high variability of available funding per year imply that, in many recent years, Dr. Kuijpers had to add significant voluntary contributions from private funds. Dr. Kuijpers has no proprietary interest in alternatives or substitutes to ODS and does not own stock in companies producing ODS or alternatives or substitutes to ODS. He occasionally is a consultant to governmental and non-governmental organisations, such as the World Bank, UNEP DTIE and the Multilateral Fund (e.g. for the 2006 Expert Meeting). Dr. Kuijpers is also an advisor to the Re/genT Company, Netherlands, which he co-founded in 1993 and where he still has a minority interest (R&D of components and equipment for refrigeration, air-conditioning and heating).

Ed McInerney **USA (Non-A5)**

Edward J. McInerney, member of the RTOC, retired January 1, 2007 from his position as the Chief Engineer for GE Consumer & Industrial Business (GE C&I). Chief Engineer, GE C&I is a full time engineering management position in the GE C&I Business, Technology Division, Office of Chief Engineer, a global business with headquarters in Louisville, Kentucky, U.S.A. GE C&I includes GE's Home Appliance, Lighting and Industrial businesses. The Industrial business segment includes the motors, appliance controls, electrical switchgear, electrical distribution and controls businesses. GE C&I has an interest in the topics of the Montreal Protocol

because it manufactures and/or markets products which contained and/or used in their manufacture ODSs at the time the Montreal Protocol was defined and ratified; for example, domestic refrigerators, room air conditioners and electronic board assemblies. Mr. McInerney has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consult for organisations seeking to phase out ODSs. Mr. McInerney's spouse is a housewife who does not work outside the home and has no interest in matters related to the Protocol. In the future, Mr. McInerney plans to work occasionally as a consultant to government and non-government organisations on matters, which could include those related to the Montreal Protocol. Mr. McInerney received his BS and MS in chemical engineering and has more than 42 years experience as an engineering technical contributor and engineering manager on broad topics, including those directly related to the application and use of ODSs.

Petter Nekså **Norway (Non-A5)**

Petter Nekså, member of the RTOC, is a Senior Research Scientist at SINTEF Energy Research (Energiforskning). Petter Nekså is a full time researcher at the department of Energy Processes, with offices located in Trondheim, Norway. Nekså holds an PhD and is the Group Manager of a group concentrating on refrigeration technology. SINTEF Energy Research has an interest in the topics of the Montreal Protocol because SINTEF does contract research within the field of refrigeration, partly with special emphasis to alternatives to fluorocarbon refrigerants. Petter Nekså is co-inventor to some patents, thus has proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does consulting for organisations seeking to phase out ODSs. Petter Nekså's spouse has no interest in matters related to the Protocol. Petter Nekså works frequently as a consultant to companies, etc. on matters related to the Montreal Protocol.

Hezekiah B. Okeyo **Kenya (A5)**

Hezekiah B. Okeyo, Assistant Director of Industries, is a full time employee of the Ministry of Trade and Industry, Government of the Republic of Kenya. His offices are located on the 22nd floor of Telposta Towers along Kenyatta Avenue in the City of Nairobi. Mr Okeyo has a Bachelor of Science Degree in Chemistry from the University of Nairobi, Kenya (1989) and Masters of Environmental Science and Technology from UNESCO-IHE Delft, The Netherlands. At the Ministry of Trade and Industry, where he has works since 1990 he is responsible undertaking environmental audits, analysis, assessment, monitoring and evaluation of environmental impacts of industrial production technologies and systems. He also gives recommendations for policy formulation; and advisory services to industries to enable them establish programs and strategies for pollution prevention, energy conservation and efficiency, and waste minimization through clean production technologies. He has been a member of The Ministry of Trade and Industry has an interest in the Montreal Protocol because of its mandate of promoting commerce, trade, industry and investment. The ozone depleting substances are used in the industrial and commercial sectors as refrigerants, fire extinguishers, foam blowing agents, aerosol propellants, and solvents. Mr Okeyo has been a member of the Kenya National Sub-Committee on ODS (NACODs) co-ordinated by the National Ozone Unit/Kenya Ozone Office for ten years and has served in the RTOC since 1996. He has no proprietary interest alternatives or substitutes to ODSs and does not own stock in companies producing or consuming ODS or alternatives or substitutes to ODSs. He does not consult for organisations seeking to phase-out ODSs. He has undertaken the following consultancies for the Multilateral Fund of the Protocol for the phase-out of ODS in Kenya.

Andy Pearson **UK (Non-A5)**

Dr Andy Pearson, member of the RTOC, is a director of Star Refrigeration Ltd. Dr Pearson is a full time Managing Director at the head office of Star Refrigeration in Glasgow, UK. Star Refrigeration has an interest in the topics of the Montreal Protocol because it provides design and construction services to the industrial refrigeration market in the United Kingdom. Dr Pearson has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consulting for organisations seeking to phase out ODSs. Dr Pearson's wife has no interest in matters related to the Protocol. Dr Pearson is chairman of the Technical Committee of the Institute of Refrigeration and is a member of the board of directors of the International Institute of Ammonia Refrigeration.

Per H. Pedersen **Denmark (Non-A5)**

Per Henrik Pedersen, member of the RTOC, is a senior consultant at the Danish Technological Institute (DTI). Per Henrik Pedersen is a full time project manager at the DTI in Taastrup outside Copenhagen. The DTI has an interest in the topics of the Montreal Protocol because it is helping governments and industry to phase out ODS. Per Henrik Pedersen has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does consulting for organisations seeking to phase out ODSs. Per Henrik Pedersen works frequently as a consultant to Governments and companies on matters related to the Montreal Protocol.

Roberto de Aguiar Peixoto **Brazil (A5)**

Prof. Dr. Roberto de Aguiar Peixoto, member of the RTOC, is a Professor of Mechanical Engineering at the Instituto Maua de Tecnologia – IMT (Maua Institute of Technology). Roberto de Aguiar Peixoto is a full time professor at the IMT campus in Sao Caetano do Sul, SP, Brazil. The IMT has an interest in the topics of the Montreal Protocol because it has undergraduate and graduate courses and research activities on refrigeration and air conditioning technologies, thermal sciences and energy and environment areas. Roberto de Aguiar Peixoto has

no proprietary interest alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does not consulting for organisations seeking to phase out ODSs. Roberto's spouse has no interest in matters related to the Protocol. Roberto de Aguiar Peixoto works occasionally as a consultant to UNEP, and UNDP on matters related to the Montreal Protocol. Roberto A. Peixoto received a Bachelor of Science and a Master of Science in Naval Engineering from the University of Sao Paulo and a Ph.D. in Mechanical Engineering and Thermal Sciences from the University of Sao Paulo, Brazil. He is presently Professor of Mechanical Engineering at Maua Technological Institute (SP- Brazil), where he is teaching and co-ordinating studies and research in energy and environment area, and consultant to international institutions.

Frédérique Sauer **France (Non-A5)**

Frédérique Sauer, member of the RTOC, is a Marketing and Communication Manager at the Balas Group. Frédérique Sauer is a full time responsible for Marketing and Communication at the BALAS office in St-Ouen (Paris area). The Balas Group has an interest in the topics of the Montreal Protocol because it installs and services Refrigeration systems, Heat Pumps and AC systems. Frédérique Sauer has no proprietary interest alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does not do consulting for organisations seeking to phase out ODSs. Frédérique Sauer's relatives have no interest in matters related to the Protocol. Frédérique Sauer works occasionally as a consultant to UNEP and AFCE (Alliance Froid Climatisation Environnement) on matters related to the Montreal Protocol.

Adam M. Sebbit **Uganda (A5)**

Dr. Adam M Sebbit, member of the RTOC, is a Senior Lecturer at the Department of Mechanical Engineering, Makerere University. Dr. Adam M Sebbit is a full time lecturer at the Department of Mechanical Engineering, at the main campus, Kampala, Uganda. The Makerere University has an interest in the topics of the Montreal Protocol because it trains students and carry our research in refrigeration and air conditioning, which use chemical that has effect on ozone layer. Dr. Sebbit has no proprietary interest alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does not consulting for organisations seeking to phase out ODSs. Dr Sebbit's spouse has no interest in matters related to the Protocol. She works as an account clerk in Kibuli Secondary School in Kampala.

Jongmin Shin **Rep. of Korea (A5)**

Dr. Jongmin Shin, a member of the RTOC, is a Vice President at the Digital Appliance Company of LG Electronics. Dr. Jongmin Shin is a full time Refrigeration R&D manager at the Refrigerator Group, DAC Laboratory, LG Electronics, 391-2, Changwon, Kyoungnam, Korea. The Digital Appliance Company of LG Electronics has an interest in the topics of the Montreal Protocol because it produces refrigerators, air-conditioners, and compressors, which use refrigerants. Dr. Jongmin Shin has no proprietary interest alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does not consulting for organisations seeking to phase out ODSs. Dr. Jongmin Shin's spouse has no interest in matters related to the Protocol. Dr. Jongmin Shin works occasionally as a consultant to UNEP on matters related to the Montreal Protocol.

Arnon Simakulthorn **Thailand (A5)**

Mr. Arnon Simakulthorn, member of the RTOC, is an Executive Chairman at Thai Compressor Manufacturing Co., Ltd (THACOM). Mr. Arnon Simakulthorn is a full time Executive Chairman at factory No. 33/3 Moo 21, Chachoengsao, 24000 Thailand. THACOM Ltd has an interest in the topics of the Montreal Protocol because THACOM cares for the environment and expects to have green environment products for its new generation. Mr. Arnon Simakulthorn has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does consulting for organisations seeking to phase out ODSs. Mr. Simakulthorn' s partner has no interest in matters that are related to the Protocol. Mr. Arnon Simakulthorn occasionally works as a consultant to Government on matters related to the Montreal Protocol.

Aryadi Suwono **Indonesia (A5)**

Aryadi Suwono, DSc. Ir., is a Professor of Mechanical Engineering at the Bandung Institute of Technology. Prof. Aryadi Suwono is a full time professor and Head of Energy Conversion Division at the Faculty of Industrial Technology at the Bandung Institute of Technology, Bandung, Indonesia. The Bandung Institute of Technology has interest in the topic of Montreal Protocol because was asked to assist the Indonesian Government via the State Ministry of Environment after ratification of the Protocol. Prof Aryadi Suwono has no proprietary interest on alternatives or substitute to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, however does consulting for organisations seeking to phase out ODSs. Prof. Aryadi Suwono works occasionally as consultant to UNEP, Implementing Agencies and Governments and companies on matters related to the Montreal Protocol.

Peter Tomlein **Slovakia (Non-A5)**

Peter Tomlein, member of the RTOC, is a secretary of Association for RAC, SZ CHKT, university teacher and member of committee for substitution of ODPs substances in Slovakia and responsible for certification of persons competent to break in to cooling circuits. SZ CHKT has an interest in the topics of the Montreal Protocol because it is responsible for implementing of the substitutions of ODP and GWP substances. Peter Tomlein has no proprietary interest alternatives or substitutes to ODSs, does not own stock in companies producing ODS or

alternatives or substitutes to ODSs, does not consult for organisations seeking to phase out ODSs. Peter Tomlein's spouse/partner has no interest in matters related to the Protocol. Peter Tomlein works occasionally as a consultant for Implementing Agencies, governments, companies, etc. on matters related to the Montreal Protocol.

Vassily N. Tselikov **Russian Fed. (Non-A5)**

Vassily N. Tselikov, a member of the Refrigeration, Air-conditioning, and Heat Pumps Technical Options Committee (RTOC) since 1997, is General Director of the Investment Centre of ODS Consumption and Production Phase-out Projects (ICP "Ozone"). ICP "Ozone" is a non-profit organisation. At present time he is a short-term consultant to the World Bank and Gazprom Export Company. In 1995 – 2004 he acted as a Project Manager for the projects "Russian Federation. GEF ODS Consumption Phase-out Project" # TF 028314-RU and "Russian Federation. Special Initiative for ODS Production Closure" # TF 020131-RU. As a Project Implementation Unit (PIU) for the above mentioned World Bank's projects in the Russian Federation, ICP "Ozone" has dealt with the topics of the Montreal Protocol and in this capacity provided preparation of national plans, analytical and national reports in the field of ozone layer protection and environmental safety as delegated by the Ministry of Natural Resources of the Russian Federation (MNR of Russia). Vassily has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODSs or alternatives or substitutes to ODSs. He is frequently engaged as consultant to MNR of Russia, the Russian Space Agency and its entities on matters related to the Montreal Protocol. Also he provides consulting support for Russian companies seeking to phase-out ODSs in metered dose inhalers production. His spouse/partner/significant other has no interest in matters related to the Protocol. Vassily N. Tselikov is a Laureate of the Prize of the Government of the Russian Federation in the field of science and technology (2002) and holds the title "Honorary specialist on nature protection of Russia" (2005). He has more than 30 publications and 1 certificate of invention in the field of environment protection. From 1998 to 1999 he was President of the Bureau of the Vienna Convention and President of the Bureau of the Montreal Protocol. From 1999 to 2000 he was a Deputy Chairman of the Inter-Agency Commission for the Ozone Layer Protection (Russian Federation). Since April 2004 he is a full member of the International Academy of Refrigeration.

Pham Van Tho **Viet Nam (A5)**

Dr. Pham Van Tho, member of the RTOC, is a Deputy General of Department of Science and Technology at the Ministry of Fisheries, Vietnam. Tho is a full time official at the Ministry of Fisheries at Hanoi, Vietnam. The Ministry of Fisheries has an interest in the topics of the Montreal Protocol because there have been more than 400 exported seafood processing factories which use many technical equipments producing ODSs, therefore the Ministry of Fisheries have the demand to upgrade knowledge and experience on how to avoid the bad impact of ODSs on environment. Tho has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does consulting for organisations seeking to phase out ODSs. Tho's spouse/partner has no interest in matters related to the Protocol. Tho works frequently as a consultant to UN, UNEP, Implementing Agencies, Governments and companies on matters related to the Montreal Protocol.

Paulo Vodianitskaia **Brazil (A5)**

Paulo Vodianitskaia is the EHS Advisor for Whirlpool S.A. Paulo Vodianitskaia is a full time executive at the office located in Joinville, Brazil. Whirlpool S.A. has an interest in the topics of the Montreal Protocol because is a leading appliance manufacturer. Paulo Vodianitskaia has no proprietary interest alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does not do consulting for organisations seeking to phase out ODSs. Paulo Vodianitskaia's spouse has no interest in matters related to the Protocol. Paulo Vodianitskaia does not work as a consultant on matters related to the Montreal Protocol.

William F. Walter **USA (Non-A5)**

William F. Walter, member of the RTOC, is the Manager, Industry Relations at Carrier Corporation. William F. Walter is a full time manager with Carrier's Government and International Relations office in Syracuse, NY, USA. Carrier Corporation has an interest in the topics of the Montreal Protocol because it manufacturers heating, ventilation and air conditioning equipment. William F. Walter has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does not consult for organisations seeking to phase out ODSs. William F. Walter's spouse has no interest in matters related to the Protocol. William F. Walter has a B.S. and M.S. in Chemistry from the State University of New York and an MBA from Syracuse University. He has worked for Carrier Corporation since 1980.

Jianjun Zhang **China (A5)**

Jianjun Zhang, member of the RTOC, is a vice chief engineer at the Zhejiang Lantian Environmental Protection Hi-tech. Co., Ltd. Jianjun Zhang is a full time manager of R&D department at Zhejiang Lantian Environmental Protection Hi-tech. Co., Ltd, Hangzhou, Zhejiang, China. Zhejiang Lantian Environmental Protection Hi-tech. Co., Ltd has an interest in the topics of the Montreal Protocol because the company is a main manufacture of ODS alternatives in China. Jianjun Zhang has no proprietary interest alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does not consulting for organisations seeking to phase out ODSs. Jianjun Zhang's spouse has no interest in matters related to the Protocol. Jianjun Zhang works occasionally as a consultant to MLF and Chinese governments on matters related to the Montreal

Protocol. Jianjun Zhang has engaged on research and development of ODS alternatives for more than seventeen years. Jianjun Zhang received a master degree in 1991 and is now a professorial engineer in Chemical engineering. Jianjun Zhang had also experience studying and working in Hokkaido University, Japan and the Technology University of Delft, The Netherlands.

Attila Zoltan **Hungary (Non-A5)**

Mr. Attila Zoltan, member of the RTOC, is a Secretary General of the Hungarian Refrigeration and Air-conditioning Association (HRACA) since more than two years. Mr. Attila Zoltan is now a full time Secretary General at the HRACA Central Office, Budapest, Hungary, earlier he has been the President of the HRACA for 9 years. The HRACA has an interest in the topics of the Montreal Protocol because as the unique trade organisation in Hungary for refrigeration, air-conditioning and heat pump field since 1993 –as a partner of the Hungarian Ministry of Environment– one of it's main tasks to ensure, to spread the "good practice", the closed circuit service technology to handle and phase out ODSs (and newly the fluorine based GHGs too) through its member companies and certified personnel. HRACA is a member of the Air-conditioning and Refrigeration European Association (AREA) in order to gain the knowledge to fulfil its aims on the highest level. Mr. Attila Zoltan has no proprietary interest alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, but does consulting for organisations seeking to phase out ODSs. Mr. Attila Zoltan's spouse has no interest in matters related to the Protocol.

AIII.6a Disclosure of Interest Declarations MBTOC - Soils

Marten Barel **Netherlands (Non-A5)**

Mr. Marten Barel, a member of MBTOC since 2002, is a consultant. He has no proprietary interest in alternatives or substitutes to ODSs, and does not own stock in companies producing ODS or alternatives or substitutes to ODSs. Since 1999 he has worked as a consultant and trainer in MLF methyl bromide projects for GTZ, UNDP and UNIDO. For more than 30 years he has provided growers, fumigators and companies with specialist technical advice and training in methods of controlling soilborne pests and soil pasteurisation/ disinfestation techniques in nurseries and horticultural crop production. For 40 years (until 1999) he owned a fumigation / soil disinfestation company that used methyl bromide until it was phased-out in the early 1980s, and then developed alternatives to methyl bromide e.g. negative pressure steaming techniques. His social partner and children do not work for organisations which have an interest in the topics of the Montreal Protocol, and have no proprietary interest in alternatives or substitutes to ODSs, and do not own stock in companies producing ODS or alternatives or substitutes to ODSs. Travel to MBTOC meetings is currently funded by the Ministry of VROM in the Netherlands.

Antonio Bello **Spain (Non-A5)**

Dr Antonio Bello Pérez is a full time Research Professor at the Consejo Superior de Investigaciones Cientificas, Madrid, Spain. The institute has an interest in the topics of the Montreal Protocol because of the environmental impact of methyl bromide. Dr Bello Pérez has no proprietary interest alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consult for organizations seeking to phase out ODSs. He works occasionally as a consultant for UNEP, Implementing Agencies and Governments, on matters related to the Montreal Protocol. Travel to MBTOC meetings is paid by his institution, which in turn receives contributions for this travel from national projects.

Mohamed Besri (co-chair) **Morocco (A5)**

Prof. Mohamed Besri, is a full time Professor of Plant Pathology and Integrated Disease Management at the Hassan II Institute of Agronomy and Veterinary Medicine, Rabat, Morocco (HII IAVM). The HII IAVM has an interest in the topics of the Montreal Protocol because it houses specialists in Soil-borne Plant Pathogens and MLF projects (strawberries, bananas, cut flowers). It advises the Ministry of Agriculture on all aspects of alternatives to Methyl Bromide. Dr Besri has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs . Dr Besri works occasionally as a consultant to UNEP on matters related to the Montreal Protocol. Neither Dr Besri's spouse, business partner or dependant children living at same home work for or consults for any organization which has an interest in the topics of the Montreal Protocol, nor do any of them have any proprietary interest in alternatives or substitutes to ODSs, nor do any of them own stock in companies producing ODS or alternatives or substitutes to ODSs or consult for organizations seeking to phase out ODSs. Costs associated to travel, communication, and others related to participation in the TEAP, MBTOC, and relevant Montreal Protocol meetings, are paid by UNEP's Ozone Secretariat.

Aocheng Cao **China (A5)**

Prof. Dr. Aocheng Cao is a Research Professor at the Institute of Plant Protection, Chinese Academy of Agricultural Sciences focusing on research in pesticide sciences. The Chinese Academy of Agricultural Sciences, a non-profit organization, is interested in the topics of the Montreal Protocol because soil pathogens and nematodes are important pests in China and alternatives to methyl bromide are urgently needed. Dr Cao has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or their alternatives or substitutes and does not consult for organizations seeking to phase-out ODSs. His spouse also works for the Chinese Academy of Agricultural Sciences, which has an interest in the topics of the Montreal

Protocol as it conducts research on pest control, but has no proprietary interest in alternatives or substitutes to ODSs, nor does she own stock in companies producing ODS or their alternatives or substitutes or perform consultancy for organizations seeking to phase out ODSs. Expenses related to Dr Cao's attendance to MBTOC meetings are paid by UNEP.

Peter Caulkins **USA (Non-A5)**

Dr Peter Caulkins is the Associate Director in the Special Review and Reregistration Division in the Office of Pesticide Programs in the U.S.EPA. The U.S. EPA has sole authority for the regulation of all pesticide use in the U.S. and therefore has a strong interest in the Montreal Protocol's phase-out of methyl bromide. Neither Dr Caulkins nor his wife or their son have any proprietary interests in ODSs or their alternatives, own no stock in either ODS companies or companies providing alternatives and do not do any consulting for organizations seeking to phase out ODSs. Travel to MBTOC meetings is paid for by EPA.

Fabio Chaverri **Costa Rica (A5)**

Mr Fabio Chaverri is a professor at the Universidad Nacional de Costa Rica where he works as a full time researcher on pesticide alternatives at the IRET (Central American Research Centre on Toxic Substances). The IRET has an interest in the topics of the Montreal Protocol since its main objective is to implement alternatives for toxic substances with a strong environmental or human health impact, such as ODSs. Mr Chaverri has no proprietary interest on alternatives or substitutes to ODSs, does not own stock in companies producing ODS or their alternatives or substitutes and does not consult for organizations seeking to phase out ODSs. He occasionally works as a consultant for UNDP and UNEP, governments and companies on matters related to the Montreal Protocol. His spouse does not work for or consult for any organization with has an interest in the topics of the Montreal Protocol and has no proprietary interest on alternatives or substitutes to ODSs, nor does she own stock in companies producing ODS or their alternatives or substitutes or consult for organizations seeking to phase out ODSs . Mr Chaverri's travel expenses to cover attendance to MBTOC meetings is paid by UNEP.

Ariane Elmas **Lebanon (A5)**

Ms Ariane Elmas was formerly the project manager of a "Trade and Environment" project funded by UNEP, managed by UNDP and implemented by the Ministry of Environment in Lebanon. This project published a report on the effects of trade liberalization in Lebanon with special focus on products where methyl bromide is used and includes an annual profitability analysis and a cost benefit analysis comparing the Methyl Bromide alternatives used for each crop. Ms Elmas, is an economist and is currently the Project Manager at the UNDP in Lebanon. The UNDP has an interest in the topics of the Montreal Protocol because it is one of its implementing agencies and as such manages the MB phase out project implemented in Lebanon under the coordination of the Ministry of the Environment. Neither Ms Elmas, nor her spouse or their dependant children have any proprietary interest in alternatives or substitutes to ODSs, own stock in companies producing ODS or their alternatives or substitutes or consult for organizations seeking to phase out ODSs. Expenses related to Ms Elmas' attendance to MBTOC meetings is paid by UNEP.

Abraham Gamliel **Israel (Non-A5)**

Dr Abraham Gamliel is a full time senior researcher on methods and technologies for pest control and pesticide application at the Ministry of Agriculture, Agricultural Research Organization, Volcani Center, Bet Dagan, Israel .He is also an adjunct professor at the Hebrew University of Jerusalem, Faculty of Agriculture, Rehovot, Israel. ARO Volcani Center has an interest in the topics of the Montreal Protocol because it is the research and development institute for solving the farmer's problem and for developing environmentally safe crop production. Dr Gamliel has no proprietary interest alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, and does not consult for organizations seeking to phase out ODSs. He works occasionally as a consultant for the Government, on matters related to the Montreal Protocol. Neither his spouse nor their children work for or consult for organizations having an interest in the topics of the Montreal Protocol nor do they have a proprietary interest in alternatives or substitutes to ODS, own stock in companies producing ODS or their alternatives or substitutes. Dr Gamliel's travel expenses to attend MBTOC meetings are paid by the Ministry of Agriculture of Israel.

Saad Hafez **USA (Non-A5)**

Prof. Dr. Saad L. Hafez is a full Professor of Nematology at the University of Idaho, working at the Parma Research and Extension Center. The University of Idaho has an interest in the topics of the Montreal Protocol as it conducts research on methyl bromide alternatives for nematode control. Dr Hafez has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or their alternatives or substitutes and does not consult for organizations seeking to phase out ODSs. Dr. Hafez occasionally works as a consultant for UNDP, UNEP, and UNIDO, Governments, companies and others on projects relating to Methyl Bromide alternatives. Dr. Hafez's spouse children do not work for or consult for any organization with an interest in the topics of the Montreal Protocol. His spouse and their dependant children have no proprietary interest in alternatives or substitutes to ODSs, do not own stock in companies producing ODS or alternatives or substitutes to ODSs and do not consult for organizations seeking to phase out ODSs. Costs of travel to enable Dr Hafez to attend MBTOC meetings are paid by the University of Idaho.

George Lazarovits **Canada (Non-A5)**

Dr George Lazarovits is a research scientist at the Southern Crop Protection and Food Research Center of Agriculture and Agrifood Canada (AAFC). He is employed as a fulltime research scientist to investigate aspects of plant pathology involved with management of soilborne plant pathogens. AAFC has an interest in the topics of the Montreal Protocol because Canada has a vested interest in eliminating ozone- depleting substances such as methyl bromide, which are still being used by Canadian growers and Industries. AAFC, in collaboration with Environment Canada, is charged with overseeing the phase-out of ozone depleting products. Dr Lazarovits has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or those manufacturing alternatives or substitutes to ODSs and does not act as consultant for organizations seeking to phase out ODSs, other than non profit government agencies charged with enforcing the regulations of the Montreal Protocol. He is involved in advising as a consultant to Environment Canada (EC) on matters related to the Montreal Protocol*,* including evaluation of critical use nominations submitted to them by Canadian growers or Industries seeking exemptions for use of MB under CUE. Such nominations, if approved by EC, are eventually adjudicated by members of MBTOC. Dr Lazarovits' spouse has no involvement whatsoever with any issues or has any interest in the topics of the Montreal Protocol or any proprietary interest in alternatives or substitutes to ODSs. She does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consult for organizations seeking to phase out ODSs. They have no dependent children living with them and their children have no involvement in any businesses dealing with issues that are in any way related to the Montreal Protocol. Travel to MBTOC meetings is paid for by AACF, and occasionally Environment Canada, from A Base budgets.

Nahum Marbán-Mendoza **Mexico (A5)**

Dr Nahum Marbán-Mendoza is a full-time professor of Integrated Pest Management and Plant Nematology at the Universidad Autónoma de Chapingo in the graduate programme of crop protection. He has over 25 years experience in the research and development of non-chemical alternatives to control plant parasitic nematodes associated with different crops in Central America and Mexico. Dr Marbán-Mendoza was MBTOC co-chair from 2002 to 2005. He has also assisted implementing agencies of the Montreal Protocol (UNEP, UNIDO) with methyl bromide phase-out programs in Mexico and Guatemala; occasionally he receives funds for wages and travel. Neither Dr Marbán nor his spouse or their daughter have ever had proprietary interest or owned stocks in a company producing ODS or their alternatives or substitutes, nor have they ever consulted for organizations seeking to phase out ODSs Costs related to Dr Marbán's participation in MBTOC activities are paid by UNEP.

Melanie K. Miller **Belgium (Non-A5)**

Dr Melanie Miller, a member of MBTOC since 1993, is a consultant on methyl bromide and alternative technologies. She has no proprietary interest in alternatives or substitutes to ODSs, and does not own stock in companies producing ODS or alternatives. She has authored a large number of papers and publications about methyl bromide alternatives for UNEP and other government bodies. She is a reviewer of project proposals for MLF and GEF methyl bromide projects, and has provided technical assistance to many methyl bromide projects in Article 5 countries. She was a sector expert in the World Bank's Ozone Operations Review Group (OORG) from 1999, member/adviser of the TEAP Economic Options Committee (EOC) Task Force on Methyl Bromide in 1996-1998, and analysed data for the TEAP Task Force reports on MLF replenishment in 2002 and 2005. Her spouse is an international expert on technical and legal aspects of the Montreal Protocol and currently works as a consultant. Her spouse has no proprietary interest in alternatives or substitutes to ODSs, and does not own stock in companies producing ODS or alternatives. The cost of travel to MBTOC meetings is paid from her own personal funds and sometimes by UNEP, at least in part.

Andrea Minuto **Italy (Non-A5)**

Dr Andrea Minuto is a full time assistant professor at the University of Torino (c/o Agroinnova) in Italy. Agroinnova has an interest in the topics of the Montreal Protocol because of the research conducted on soilborne pest and disease management. Dr Minuto has no proprietary interest in alternatives or substitutes to ODSs, and does not own stock in companies producing ODS or their alternatives or substitutes. He does consulting (as Agroinnova) for organizations seeking to phase out ODSs and also works occasionally as a consultant for Implementing Agencies and Governments on matters related to the Montreal Protocol. His spouse does not work or consul for organizations which have an interest in the topics of the Montreal Protocol or organizations seeking phase-out of ODS, nor does she have any proprietary interest in alternatives or substitutes to ODSs, or own stock in companies producing ODS or their alternatives or substitutes. Travel to MBTOC meetings is paid by Agroinnova, which receives contributions from the Italian Ministry of Environment, Territory and Sea.

Kazufumi Nishi **Japan (Non-A5)**

Dr Kazufumi Nishi is a Chief Researcher at the National Institute of Vegetable and Tea Science of Japan (NIVTS). He conducts research on plant disease control techniques, particularly physical control methods. Dr. Nishi has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consult for organizations seeking to phase out ODSs. Travel to MBTOC meetings is paid by the International Department at MAFF.

Marta Pizano (co-chair) **Colombia (A5)**

Ms Marta Pizano is a consultant on methyl bromide alternatives, particularly for cut flower production, and has actively promoted methyl bromide alternatives among growers in many countries. She is a regular consultant for

the Montreal Protocol Multilateral Fund (MLF) and its implementing agencies. In this capacity, she has contributed to the methyl bromide phase-out programs in nearly twenty Article 5 countries around the world, assisting growers with the adoption of sustainable alternatives and the implementation of IPM programs. She is a frequent speaker at national and international methyl bromide conferences and has authored numerous articles and publications on alternatives to this fumigant. She has been a member of MBTOC since 1998 and a co-chair since 2005. Neither Ms Pizano nor her husband or their children own stock or have proprietary interest in companies producing ODS or their alternatives or substitutes. Costs associated to travel, communication, and others related to participation in the TEAP, MBTOC, and relevant Montreal Protocol meetings, are paid by UNEP's Ozone Secretariat.

Ian Porter (co-chair) **Australia (Non-A5)**

Dr Ian Porter is the Statewide Leader of Plant Pathology with the Victorian Department of Primary Industries (DPI). DPI has an interest in developing sustainable control measures for plant pathogens and biosecurity. He is a member of a number of National Committees regulating ODS, has led the Australian research program on methyl bromide alternatives for soils and has 26 years experience in researching sustainable methods for soil disinfestation of plant pathogens with over 200 research publications. He has been a member of MBTOC since 1997, Soils sub committee chair since 2001 and MBTOC Co-chair since 2005. Neither Dr Ian Porter, wife or children have any proprietary interest in alternatives or substitutes to ODSs, nor own stock in companies producing ODS or alternatives or substitutes to ODSs. Dr Porter is presently assisting national research agencies in Australia develop national priorities for IPM and soil health. He has acted occasionally as a key consultant for UNEP and UNIDO in developing programmes to assist China, Mexico and CEIT countries to replace methyl bromide. The Victorian DPI has in the past made in-kind contributions to attend MBTOC and UNEP meetings, but provides no support at present. In 2007, Dr Porter funds his own participation. The Australian Federal Government Research Fund and funds obtained through the Ozone Secretariat have provided support to finance travel and expenses for MBTOC activities.

James D. Schaub **USA (Non-A5)**

Dr. James D. Schaub is an economist and Director of the Office of Risk Assessment and Cost-benefit Analysis, Office of the Chief Economist, United States Department of Agriculture (USDA). Dr. Schaub is employed full time within the Office of the Chief Economist, USDA in Washington D.C. The USDA has an interest in the topics of the Montreal Protocol because of its interest in environmentally sound agricultural production systems and the protection stored commodities. Further, USDA is responsible for protection of animal and plant health from quarantine pests. Dr. Schaub has no proprietary interests in alternatives or substitute ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consult for organizations seeking to phase out ODSs. He does not work as a consultant to any organization on matters related to the Montreal Protocol. Neither his spouse nor dependant children living at same home work for or consult for any organization which has an interest in the topics of the Montreal Protocol, nor do any of them have any proprietary interest in alternatives or substitutes to ODSs, nor do any of them own stock in companies producing ODS or alternatives or substitutes to ODSs or consult for organizations seeking to phase out ODSs. Travel to MBTOC meetings is paid by Office of the Chief Economist, USDA.

Sally Schneider **USA (Non-A5)**

Dr. Sally Schneider is a National Program Leader at the United States Department of Agriculture. Dr. Schneider is a full time National Program Leader for Horticulture, Pathogens, and Germplasm at the Agricultural Research Service, Beltsville, Maryland, U.S.A. The Agricultural Research Service has an interest in the topics of the Montreal Protocol because they are the in-house research agency for the U.S. Department of Agriculture. Dr. Schneider has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consult for organizations seeking to phase out ODSs. Dr. Schneider does not work, occasionally or otherwise, as a consultant to UN, UNEP, MLF, Implementing Agencies, Governments, companies, etc. on matters related to the Montreal Protocol. Dr. Schneider does not have a spouse, business partner, social partner, or dependant children living in same home. Travel to MBTOC meetings is paid by United States Department of Agriculture.

Dr. J.L. (Stappies) Staphorst **South Africa (A5)**

Dr. J.L. (Stappies) Staphorst is a soil microbiologist at the Plant Protection Research Institute of the Agricultural Research Council of South Africa. Dr Staphorst is a full time senior researcher, advisor and mentor in the Plant Pathology and Microbiology Division of the Institute in Pretoria, South Africa. The Plant Protection Research Institute has an interest in the topics of the Montreal Protocol because it houses the specialist Soil-borne Plant Diseases Unit and forms part of the Public Support Services Division that advises the Department of Agriculture on all aspects of plant diseases, pests and pesticides. Dr Staphorst has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does no consulting for organizations seeking to phase out ODSs. Dr Staphorst works occasionally as a consultant to UNEP on matters related to the Montreal Protocol. His spouse has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does no consulting for organizations seeking to phase out ODSs. Travel to MBTOC meetings is paid by UNEP with logistical support from the Plant Protection Research Institute.

Akio Tateya **Japan (Non-A5)**

Mr. Akio Tateya is a Technical Adviser at Syngenta Japan K.K. a pesticide producing company, which does not produce substitutes to methyl bromide. He also a technical adviser for the Japan Fumigation Technology Association, a non-profit body that is financially supported by the Japanese Government and companies producing methyl bromide and its substitutes. He conducts work for Syngenta Japan K.K. on a contract basis for a consultancy fee; he acts as a nominal member and adviser of the Japan Fumigation Technology Association, for which he is not paid. He is also a member of the Japanese delegation attending the Meeting of the Parties and Open-ended Working Groups, acting as technical adviser on matters related to the Protocol. He has been occasionally asked to attend panels or meetings at the Ministry of Agriculture, Forestry and Fisheries. He has no proprietary or any other kind of interest in alternatives or substitutes to ODS, nor does he own any stocks in companies producing either ODS or their alternatives or substitutes and does not work for any organization seeking to phase out ODS. His spouse and children do not work for organizations with an interest in the Montreal Protocol. Travel expenses to enable attendance to MBTOC meetings and other meetings related to the Montreal Protocol are paid by the Japan Fumigation Technology Association. He receives no funding from the Japanese Government.

Alejandro Valeiro **Argentina (A5)**

Mr Alejandro Valeiro is the National Coordinator of the PROZONO Project (MLF/UNDP project ARG/02/G61) at the National Institute for Agricultural Technology (INTA) of Argentina, based at the Famaillá INTA´s Experimental Station in Tucumán Province, Argentina. The INTA has an interest in the topics of the Montreal Protocol because it is the national counterpart for implementing MLF methyl bromide phase-out projects, which are coordinated by the National Ozone Unit. Mr Valeiro has no proprietary interest on alternatives or substitutes to ODSs, does not own stock in companies producing ODS or their alternatives or substitutes and does not perform permanent consulting for organizations seeking to phase out ODSs. He works occasionally as a consultant to the MLF, Implementing Agencies, on matters related to the Montreal Protocol. Mr Valeiro's spouse consults for UNDP, which has an interest in the topics of the Montreal Protocol because it implements MLF projects in Argentina. Neither Mr Valeiro, nor his spouse or dependant children have proprietary interest in ODS or their alternatives or substitutes, and do not own stock in companies producing ODS alternatives or substitutes to ODSs. Travel to MBTOC meetings is paid by UNEP.

Nick Vink **South Africa (A5)**

Prof. Dr. Nick Vink is Chair of the Department of Agricultural Economics at the University of Stellenbosch, South Africa. He is a full time Professor at the University of Stellenbosch. The University has no interest in the topics of the Montreal Protocol. Dr Vink has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consult for organizations seeking to phase out ODSs. He does not work as a consultant to any organisation on matters related to the Montreal Protocol. Neither his spouse or dependant children work for or consult for any organization which has an interest in the topics of the Montreal Protocol, nor do they have any proprietary interest in alternatives or substitutes to ODSs, or own stock in companies producing ODS or their alternatives or substitutes. Travel to MBTOC meetings is paid by UNEP.

James Wells **USA (Non-A5)**

Mr. James Wells is the President of Environmental Solutions Group, LLC (ESG), a regulatory consulting firm in Sacramento, California. He was invited to join MBTOC in 1993 primarily because of his experience in pesticide regulatory programs, especially with methyl bromide and methyl bromide alternatives. He worked for the State of California pesticide regulatory program for 27 years and was the Director of the California Department of Pesticide Regulation from 1991 to 1999. Dr. Wells has no proprietary interest in alternatives or substitutes to ODSs and does not own stock in companies producing ODS or alternatives or substitutes to ODSs. He does not consult for organizations seeking to phase out ODSs. However, ESG consults with several agricultural organizations seeking Critical Use Exemptions for the use of methyl bromide. These organizations are; the California Strawberry Commission (CSC), the California Strawberry Nursery Association (CSNA), the Garden Rose Council (GRC) and the California Association of Garden and Nursery Centers (CANGC). Together with his staff he prepares and submits CUEs for the CSNA, GRC and CANGC to the USEPA. His spouse works for the California Department of Justice, which has no interest in the topics of the Montreal Protocol. She has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consult with organizations seeking to phase out ODSs. Travel to MBTOC meetings is paid by ESG.

AIII.6b Disclosure of Interest Declarations MBTOC - QSC

Jonathan Banks, **Australia (Non-A5)**

Dr. Jonathan Banks, Chair of TEAP's QPS Task Force, is a private consultant. He was a member of the 1992 Methyl Bromide Assessment and from 1993 to 1998 and 2001 to 2005 co-chaired the Methyl Bromide TOC. He worked as a Research Scientist with the Australian Commonwealth Scientific and Industrial Research Organization (CSIRO) from1972 to 1999 on grain storage technologies, including use of improved use of fumigants. He is co-inventor of carbonyl sulfide, an alternative fumigant to methyl bromide in some applications. Patent rights have been assigned to his employer, CSIRO. Dr Banks has no proprietary interest in alternatives or

substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs. He has stock in Brambles Ltd, a company that inter alia leases wooden pallets for freight. The pallets may or may not be treated with methyl bromide or alternatives. His spouse is co-owner of their commercial organic apple orchard. She has no financial interests relating to ozone-depleting substances. He has served on some national committees concerned with ODS and their control, and within the last 4 years has received contracts from UNEP, and other institutions and public companies related to methyl bromide alternatives and grain storage technology--including training in fumigation (methyl bromide and alternatives) and fumigation technology and recapture systems for methyl bromide. In 2005 and 2006 he received some support from UNEP for TEAP and MBTOC activities. Other funding for his MBTOC activities has been through grants or contracts from the Department of Environment and Heritage, Australia or from personal contributions.

Chris Bell **UK (Non-A5)**

Dr. Christopher Hugh Bell, is a Fellow at the Central Science Laboratory (CSL), Department of Environment, Food and Rural Affairs, at York, UK, where he led research into fumigation technology, including studies on methyl bromide and potential alternatives which were sponsored by UK government agencies and private companies, until his retirement in 2004. He is also a Regional Editor for the Journal of Stored Products Research for Europe and Africa, an Elsevier journal publishing original research addressing problems encountered in the storage of durable commodities. Dr. Bell has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, and does not represent organizations seeking to phase out ODSs. He works occasionally as a consultant to governments and companies on matters related to methyl bromide use or replacement, or the Montreal Protocol. Travel and subsistence to attend MBTOC meetings has been paid by the UK Department of Environment, Food and Rural Affairs (DEFRA), or by UNEP.

Fred Bergweff **Netherlands (Non-A5)**

Mr Fred Bergwerff is the General Manager for ECO2 B.V., a company that provides disinfestation services through controlled atmospheres technology and equipment, and related consulting services. He is employed in a full time capacity with responsibilities for joint-venture partnerships, technical assistance, training and promotion of good practices in the structural, commodity, quarantine and port disinfestation industries, particularly specialising in QPS and ISPM-15 treatments. ECO2 does not have a commercial relationship with any fumigant or pesticide manufacturers/registrants. ECO2 has been involved in research trials on MB alternatives and has assisted companies to adopt MB alternatives for structures, stored commodities and pre-shipment and quarantine treatments. ECO2 has an interest in the topics of the Montreal Protocol because of its expertise in disinfestation and pest control, particularly non-chemical treatments. Other than controlled atmospheres and the company ECO2 BV, Mr Bergwerff and his business partners in ECO2 have no proprietary interest in ODS or other alternatives to ODS, and do not own stock in companies that manufacture ODS or other alternatives to ODS. He carries out consulting work for organizations and companies that are seeking to phase out ODS. Mr Bergwerff's wife owns shares in ECO2, has no proprietary interest in ODS or other alternatives to ODS, and does not own stock in companies manufacturing ODS or other alternatives to ODS. Travel to MBTOC meetings is paid by ECO2, which receives no contribution for this travel from any other company or organisation.

Kathy M. Dalip **Belize (A5)**

Dr. Kathy M Dalip is an Entomologist at the Caribbean Agriculture Research and Development Institute (CARDI), which has headquarters in Trinidad and offices in twelve member countries. Kathy works full-time at the CARDI Belize Unit, Central Farm, Western Highway, Cayo District, Belize, Central America. Between 2000 and 2005, Kathy was stationed at the CARDI Jamaica Unit where she was a member of the Jamaica Methyl Bromide Working Group. Her work at CARDI is focused in the areas of integrated pest management (IPM) and organic agriculture. Hence, her emphasis is on finding non-chemical pest control options to improve production and economic feasibility for farmers. Kathy has no proprietary interest alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and has not done consulting for organizations seeking to phase out ODSs. Travel to MBTOC meetings is paid by for by the Ozone Secretariat of UNEP.

Ricardo T Deang **Philippines (A5)**

Dr Ricardo Deang is a retired Deputy Administrator for Pesticides of the Fertilizer and Pesticide Authority (FPA) – a government regulatory office for fertilizers and pesticides – since April 1996. He was responsible for registration, restriction, and banning of pesticides when imminent hazards are posed; and certification of pesticide applicators and fumigators. FPA has an interest in the topics of the Montreal Protocol because the Philippines is a signatory to the Montreal Protocol and the office restricts/monitors methyl bromide importation and use. Prior to this position Mr. Deang worked as a research entomologist on biological control. Currently Mr Deang is Chairman of the Board of a consultancy firm, Management and Executive Network, Inc. He has no proprietary interest on alternatives or substitute to ODSs, does not own stock in companies producing ODSs or alternatives or substitutes to ODSs and does not engage in consulting for organizations seeking to phase out ODSs. His wife and their children have no proprietary interest on alternatives or substitutes to ODSs, do not own stock in companies producing ODSs or alternatives or substitutes to ODSs and do not engage in consulting for organizations seeking to phase out ODSs. They have no interest in the topics of the Montreal Protocol. Travel to MBTOC meetings is paid by UNEP.

Patrick Ducom **France (non-A5)**

Dr. Jacques François Patrick Ducom, Agronomy Engineer, is a long standing MBTOC member and head of the Laboratoire National Denrées Stockées (LNDS), Plant Protection Service, Ministry of Agriculture, France. Dr Ducom is a full time researcher in fumigation LNDS. He works occasionally as a consultant for Implementing Agencies of the Multilateral Fund on matters related to the Montreal Protocol. Dr Ducom has no proprietary interest on alternatives or substitute to ODSs, does not own stock in companies producing ODSs or alternatives or substitutes to ODSs and does not engage in consulting for organizations seeking to phase out ODSs. Travel to MBTOC meetings is paid from the LNDS budget

Kenneth Glassey **New Zealand (Non-A5)**

Mr Kenneth Logan Glassey is a Senior Biosecurity Adviser at the Ministry of Agriculture and Forestry (MAF). Ken Glassey is a full time adviser on Phytosanitary Treatments and Treatment Operators at the Ministry of Agriculture and Forestry Head Office, Wellington, New Zealand. MAF has an interest in the topics of the Montreal Protocol because quarantine and preshipment treatments uses a significant amount of methyl bromide (218 tonnes in 2004). Current responsibilities cover researching, developing and reviewing New Zealand's import standards including operational standards such as treatments for imported commodities. This also involves monitoring quality and adequacy, initiating remedial action as necessary, and the provision of advice on the practical application and implications of such standards. Mr Glassey has been involved in QPS inspection and treatments for 20 years with particular expertise with forest produce, and worked in forest management for 11 years prior to that. Mr Glassey has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consult for organizations seeking to phase out ODSs. He does not work as a consultant to implementing agencies on matters related to the Montreal Protocol. Mr Glassey's partner living in same home does not work for or consults for any organization, which has an interest in the topics of the Montreal Protocol. She has no proprietary interest alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consult for organizations seeking to phase out ODSs. Travel to TEAP/TOC/TSB meetings is paid by MAF.

Mr Alfredo T. Gonzalez **Philippines (A5)**

Mr Gonzalez is president of Pestcon Pest Management and General Services, a company with an interest in the Montreal Protocol because it uses methyl bromide in the for Quarantine and pre-shipment treatments as well as ISPM 15 treatments for wood packaging materials. Mr Gonzalez, has no proprietary interest in alternatives or substitutes to ODSs, and does not own stock in companies producing ODS or alternatives or substitutes to ODSs. Presently he is the general consultant for the implementation of the Methyl Bromide Phase-out program in the Philippines for the Government of his country, under the Department of Natural Resources- Philippine Ozone Desk (DENR-POD) in cooperation with the Fertilizer and Pesticide Authority (FPA), which is directly related to the Montreal Protocol. Neither Mr Gonzalez's wife or their children have any proprietary interest in alternatives or substitutes in ODSs. Expenses related to Mr Gonzalez's attendance to MBTOC meetings are paid by UNEP.

Darka Hamel **Croatia (A5)**

Dr. Darka Hamel is an entomologist responsible the protection of stored products. Dr Hamel is a full time executive manager at the Institute for Plant Protection in Agriculture and Forestry of the Republic Croatia (PPI). The PPI has an interest in the topics of the Montreal Protocol because companies using methyl bromide for treatment in accordance with ISPM 15 are authorised to do so in accordance with the PPI recommendation. Dr. Hamel has no proprietary interest alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consulting for organizations seeking to phase out ODSs. Dr. Hamel works occasionally as a consultant to the Croatian Ministry of Agriculture, Forestry and Water Management or the Ministry for Environmental Protection and Physical Planning regarding legislation on matters related to the Montreal Protocol. Travel to MBTOC meetings is paid by UNEP.

Michelle Marcotte (co-chair) **Canada (Non-A5)**

Ms Michelle Marcotte was a member of the 1992 Methyl Bromide Assessment and subsequently a member of the Methyl Bromide Technical Options Committee between 1992 and 2005; she was confirmed as Co-Chair in 2005. Until 1993 she worked for MDS Nordion, a supplier of radiation processing equipment which is an alternative to the use of methyl bromide in some commodity and quarantine situations. Since then, Ms Marcotte, through Marcotte Consulting, has provided consulting services to governments and agri-food companies in eight countries on agri-environmental issues, food technology, regulatory affairs and radiation processing. Marcotte Consulting has an interest in the topics of the Montreal Protocol because of its long time market development work in food irradiation, an alternative to some methyl bromide uses, and because of its interest in food processing, food safety and trade. In the field of methyl bromide alternatives, Ms Marcotte has published case studies for pest control in food processing, for stored commodities, for alternatives for quarantine and for greenhouse use. She is a member of the Canada Industry-Government Methyl Bromide Working Group and the Canada-US Methyl Bromide Working Group; both organizations work to achieve phase out of methyl bromide in the agri-food sector. Marcotte has consulted to companies, industry associations, the International Atomic Energy Agency and US AID on irradiation as a methyl bromide alternative in food processing, quarantine and trade. She has also prepared consulting reports summarising research in methyl bromide alternatives and case studies on food processing for

US Environmental Protection Agency. Ms Marcotte has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs. Ms Marcotte's spouse works for United States Department of Agriculture managing research in methyl bromide alternatives and is a member of MBTOC. He does not have proprietary interest in alternatives or substitutes to ODS and does not own stock in companies producing ODS or alternatives or substitutes to ODSs. Ms Marcotte receives a consulting contract from the Government of Canada, Environment Canada. The funds for Ms Marcotte for travel to TEAP, MBTOC and Montreal Protocol meetings and to support her work on the MBTOC are provided by the Government of Canada, Environment Canada.

Takashi Misumi **Japan (Non-A5)**

Mr. Takashi Misumi, member of MBTOC since 2005 is a senior researcher at the Yokohama Plant Protection Station (YPPS). Mr. Misumi is a full time Researcher at the Quarantine Disinfestation Technology Section, Research Division of YPPS. He has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consult for organizations seeking to phase out ODSs. Neither his spouse nor their children work for organizations with has an interest in the topics of the Montreal Protocol. Expenses related to the attendance of MBTOC meetings are paid by International department of MAFF.

David M Okioga **Kenya (A5)**

Dr. David Okioga is a founding member of MBTOC, joining in 1992. He was MBTOC co-chair between 1997 and 2002. Dr Okioga was the Director, National Plant Quarantine Services of Kenya for sixteen years. He also served as the Coordinator in Agricultural Botany under the Kenya Agricultural Research Institute, Secretary to the Ministry of Agriculture on Plant Breeder's Rights, Member of the National Agricultural Research Centre, National Horticultural Research Centre, National Potato Research Centre, and the National Committee for the National Genebank. Dr. Okioga has undertaken a number of contracts from the African Unity (then Organization of the African Unity), FAO and UNEP. Some of these consultancies were related to crop protection, where methyl bromide was considered as the chemical of choice for soil fumigation, whereas others were on strengthening the Montreal Protocol policies on ODS phase out in the African region (including methyl bromide). In 1995, Dr. Okioga was appointed Coordinator, of the National Ozone Unit (NOU) of Kenya by the Ministry of Environment and Natural Resources, Kenya, in consultation with UNDP, a post that he still holds at present. Dr. Okioga's main responsibility is strengthening the government of Kenya in meeting the requirements of the Montreal Protocol and in phasing out of ODS in the country. Travel and expenses related to his attendance to MBTOC meetings are paid by UNEP.

Jordi Ruidavets **Spain (Non-A5)**

Dr. Jordi Riudavets is a Researcher at the Institute for Agrifood Research and Technology (IRTA) of Spain. He is a full time entomologist at the Crop Protection Division, with experience in the development and transfer of integrated pest management (IPM) programs for stored products and horticultural crops. The IRTA has an interest in the topics of the Montreal Protocol because is a state-owned company of the Catalan Government, and its activities are concerned with scientific research and technology transfer in the areas of agriculture, aquaculture and the agrifood industry. Dr. Riudavets has no proprietary interest alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consult for organizations seeking to phase out ODSs. He occasionally works as a consultant to the Spanish Government, food companies, pest control companies and private companies with interest in matters related to the Montreal Protocol. Travel to MBTOC meetings is paid by the Spanish Ministry of the Environment.

Christoph Reichmuth **Germany (Non-A5)**

Prof. Dr. Christoph Reichmuth is chemist and responsible for stored product protection. Dr Reichmuth is a full time director of the Institute for Stored Product Protection of the Federal Biological Research Centre for Agriculture and Forestry in Berlin, Germany, of the German Ministry for Nutrition, Agriculture and Consumer Protection, Germany. The Federal Ministry for Nutrition, Agriculture and Consumer Protection together with the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety has a pronounced interest to replace methyl bromide as quickly as possible, due to the strongly expressed political interest and public opinion in Germany. Dr Reichmuth has no proprietary interest, patent for production of phosphine from magnesium phosphide in a generator with the company Degesch Detia, Germany, patent for the treatment of stored products and organic materials (wood) with inert atmospheres with the company Buse, Germany, patent for pheromone traps for Lepidopteran pests with the Max-Planck-Society, Germany, at present there are no royalties paid from the patents to Dr Reichmuth. He gave and gives advice to private companies in Germany to obtain critical use exemptions for methyl bromide in helping to understand the English forms of UNEP/TEAP, he works occasionally as a consultant to UNIDO, supporting projects or parties to replace methyl bromide. Travel to MBTOC meetings or related meetings concerning the phase-out of methyl bromide are paid by the German Ministry for Nutrition, Agriculture and Consumer Protection or by the German Ministry for the Environment, Nature Conservation and Nuclear Safety.

John Sansone **USA (Non-A5)**

Mr John Sansone is the President and General Manager for SCC Products. He is employed in a full time capacity with responsibilities for sales, training, stewardship and as a consultant for end users in the residential, commodity,

quarantine and port fumigation industries. SCC Products has a commercial relationship with several fumigant/pesticide manufacturers/registrants, some of which offer products which are considered alternatives to MB. SCC Products has been involved in research trials in the food processing and stored commodities sectors. The firm was instrumental in the transition to alternatives for the residential fumigation marketplace and currently is transitioning alternatives into the commodity fumigation market. It is also involved in the implementation of recapture equipment for commodity fumigation companies in California. SCC Products has an interest in the topics of the Montreal Protocol because of its relationship and expertise in many fumigation areas. Mr Sansone has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consult for organizations seeking to phase out ODSs. He does not work as a consultant to the UN, UNEP, MLF, Implementing Agencies, Governments, companies, etc. on matters related to the Montreal Protocol. Mr Sansone has no relatives or business partners that work for or consult for any organization with an interest in the topics of the Montreal Protocol nor does he have relatives or business partner having a proprietary interests in alternatives or substitutes to ODSs, or who own stock in companies producing ODS or alternatives or substitutes to ODSs or consult for organizations seeking to phase out ODSs. Travel to MBTOC meetings is paid by SCC Products, which receives no contribution for this travel from anyone.

Robert Taylor **UK (Non-A5)**

Mr Robert Taylor retired from the Natural Resources Institute (NRI) of the United Kingdom in 2001. The NRI was a government establishment involved in biological/agricultural research, development and training, primarily in relation to developing countries. In recent years the NRI has become part of the University of Greenwich. Crop protection in both the pre- and post-harvest stages has always been a major feature of NRI's research and development programmes. Pest management, including the use of fumigants, has always features strongly in such programmes. Mr Taylor has no proprietary interest in alternatives or substitutes to methyl bromide and does not own stock in companies consulting for organizations seeking to phase out the chemical. He works occasionally as a consultant to UN agencies including UNIDO and UNEP on matters relating to the Montreal Protocol. Mr Taylor has no relatives or business partners who work or consult for organizations, which have an interest in the topics of the Montreal Protocol, nor does he have relatives or business partners having proprietary interests in alternatives or substitutes to methyl bromide, or who own stock in companies producing alternatives or substitutes to methyl bromide, or who consult for companies seeking to phase out methyl bromide. Travel and subsistence for MBTOC meetings is paid for by the UK government and most recently by the Department for the Environment Farming and Rural Affairs and UNEP.

Ken Vick **USA (Non-A5)**

Dr Kenneth W. Vick is a Senior National Program Leader for methyl bromide alternatives research at the Agricultural Research Service (ARS), United States Department of Agriculture (USDA). As National Program Leader he helps lead the almost $20 million ARS research program to develop alternatives to the use of methyl bromide for soil and post-harvest applications. ARS has an interest in the topics of the Montreal Protocol because it was assigned lead responsibility for developing alternatives as the primary research arm of the USDA and because it was deemed to be of high priority by the United States Government. Dr Vick has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consult for any organization. His spouse, a MBTOC co-chair, consults for governments, NGOs and companies that have an interest in the phase out of methyl bromide because they are Parties to the Protocol or because they are investigating or developing food irradiation a methyl bromide alternative for some commodities and in some quarantine situation. She has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does consult for organizations seeking to phase out ODSs. Dr Vick's travel to MBTOC and Montreal Protocol meetings is paid by the USDA Agriculture Research Service.

Chris Watson **UK (Non-A5)**

Mr.Christopher Russell Watson is a MBTOC member since 1992. He works for Igrox Ltd in the UK as Chairman a part-time position since he is presently semi-retired. Mr Watson has been involved in the fumigation industry using both methyl bromide and other fumigants for 40 years. Together with his wife he formed Igrox Ltd in 1976, which is now one of the largest fumigation and pest control servicing companies in the UK. For the past 20 years he has been involved in working closely with government agencies in the UK to develop safe and efficient fumigation practices and procedures. Igrox Ltd has an interest in the topics of the Montreal Protocol because it supplies services and products that are alternatives to methyl bromide, as well as continuing to provide services using methyl bromide in situations where it is still necessary. Mr Watson owns stock in Igrox Ltd, and occasionally carries out consultancy work for agencies seeking to phase out ODS's which have included the UK government agencies as well as private companies. His spouse doesn't not own stocks in Igrox Ltd and has no proprietary interests in alternatives or substitutes for ODS's and does not consult for companies seeking to phase out ODS's. Travel to MBTOC meetings was subsidised by Igrox Ltd and the British Pest Control Association until 2005. Presently, Mr Watson covers travel expenses from his own personal funds with some assistance from the UK Government (DEFRA).

Mr Eduardo Willink **Argentina (A5)**

Mr Eduardo Willink is Director of Special Disciplines and Head of the Agricultural Zoology Department of the Estación Experimental Agroindustrial Obispo Colombrés Tucumán, Argentina. He is a full time researcher in entomology who leads a team of researchers working on quarantine treatments, systems approach and pest host status, and is a member of the Technical Panel on Phytosanitary Treatments within IPPC, FAO. The organization has an interest in the topics of the Montreal Protocol because its mission is to resolve regional agro-industrial problems with the least impact on the environment. Mr Willink has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs and does not consulting for organizations seeking to phase out ODSs. Neither his spouse or dependant children work for or consult for organizations with an interest in the topics of the Montreal Protocol, nor do they have any proprietary interest in alternatives or substitutes to ODSs, own stock in companies producing ODS or their alternatives or substitutes or consult for organizations seeking to phase out ODSs. Travel to TOC meetings is paid by UNEP.

MBTOC – SUBCOMMITTEE SOILS						
Names	**Gender**	**Affiliation**	**Expertise**	**Length of service**	**Country**	**Article 5 status**
Co-Chairs						
1. Mohamed Besri	M	Institut Agronomique et Vétérinaire Hassan II (Academia)	Researcher, particularly MB alts for vegetables. Pathologist (PhD)	B	Morocco	A5
2. Marta Pizano	F	Consultant	Consultant, MB alts, particularly cut flower production and IPM. Pathologist (MSc)	B	Colombia	A5
3. Ian Porter	M	Department of Primary Industries (Government research)	Researcher, soils MB use and alts, particularly fungal pathogens and IPM. Pathologist (PhD)	B	Australia	Non-A5
Members						
4. Marten Barel	M	Consultant	Consultant, , specialist on soil fumigation, Substrates, Hydroponics, Steaming, Bio-fumigation and Solarization	D	Netherlands	Non-A5
5. Antonio Bello	M	Centro de Ciencias Medioambientales (Government research)	Non-chemical alternatives. Pathologist. (PhD, Prof.)	A	Spain	Non-A5
6. Aocheng Cao	M	Chinese Academy of Agricultural Sciences (Government research)	Researcher, soil alternatives, particularly in China (A5) context. Pathologist. (PhD)	C	China	A5
7. Peter Caulkins	M	Associate Director, Special Review & Re-registration Division US EPA	Registration of alternatives, regulatory issues (PhD)	D	US	Non-A5
8. Ariane Elmas	F	Totken Lebanon – consulting	Economics and trade	D	Lebanon	A5
9. Fabio Chaverri	M	IRET-Universidad Nacional (Academia)	Researcher, soil alternatives, including solarisation. Microbiologist.	C	Costa Rica	A5
10. Abraham Gamliel	M	Agricultural Research Organization, The Volcani Center, (Government Research)	Alternatives for soils, horticulture. Pathologist (PhD)	D	Israel	Non-A5
11. Saad Hafez	M	University of Idaho (Academia)	Soils alternatives, nematologist (PhD, Prof.)	C	US	Non-A5

12. George Lazarovits	M	Agriculture & Agri-food Canada (Government research)	Researcher, non chemical control of soilborne pathogens (PhD)	C	Canada	Non-A5
13. Nahum Marbán Mendoza	M	Universidad Autonoma de Chapingo (Academia)	Researcher, soils alternatives, particularly nematode problems (PhD, Prof.)	C	Mexico	A5
14. Melanie Miller	F	Consultant	Consultant in MB alternatives use and policy (PhD)	A	Belgium	Non-A5
15. Andrea Minuto	M	Agroinnova Universita Torino (Academia)	Researcher, MB and alternatives in soils. Pathologist (PhD)	D	Italy	Non-A5
16. Kazufumi Nishi	M	Nat Institute of Vegetables and Tea Science (Government research)	Nonchemical alts, particularly heat systems for soils (PhD)	D	Japan	Non-A5
17. James D. Schaub	M	United States Department of Agriculture (Government regulatory)	Agricultural economist (PhD)	C	US	Non-A5
18. Sally Schneider	F	United States Department of Agriculture (Government research)	Researcher in soils alts, particularly replant problems and propagative nursery material . Nematologist. PhD)	C	US	Non-A5
19. JL Staphorst	M	Plant Protection Research Institute (Parastatal research)	Soil Microbiologist (DSc)	B	South Africa	A5
20. Akio Tateya	M	Syngenta Japan K.K.	Application of MB and alts, particularly in Japan	A	Japan	Non-A5
21. Alejandro Valeiro	M	Instituto Nacional de Tecnología Agropecuaria (Government research)	Introduction/use of soils alts, including tobacco. Agronomist (MSc).	C	Argentina	A5
22. Nick Vink	M	University of Stellenbosch (Academia)	Agricultural economics (PhD, Prof.)	C	South Africa	A5
23. Jim Wells	M	Environmental Solutions Group, LLC (Consultant)	Registration and regulatory – MB and alternatives, soil uses	A	US	Non-A5
TOTALS	19 M 4 F			4A 4B 9C 6D		14 non-A5 9 A5

A >10 years, B 5-10, C 2-5, D <2 years membership

MBTOC SUBCOMMITTEE QUARANTINE, STRUCTURES AND COMMODITIES (QSC)						
Co-Chairs						
1. Michelle Marcotte	F	Consultant	Consultant, particularly food processing, regulations, structural and commodity treatments and irradiation	A	Canada	Non-A5
Members						
2. Jonathan Banks (Co-Chair Quarantine Task Force)	M	Consultant	Consultant, postharvest, particularly non-chemical and gas technologies (fumigants, CA) and QPS uses of MB. Entomologist (Ph. D.)	A	Australia	Non-A5
3. Chris Bell	M	Consultant, formerly Central Science Laboratory (Government research)	Postharvest technologies, particularly fumigants, phosphine; sulfuryl fluoride, controlled atmospheres and heat (Ph.D.)	B	UK	Non-A5
4. Fred Bergwerff	M	Eco2, Netherlands	Fumigator, specialist in non-MB systems, including heat.	D	Netherlands	Non-A5
5. Kathy Dalip	F	CABI	Quarantine entomologist (Ph. D.)	D	Jamaica	A5
6. Ricardo Deang	M	Consultant	Regulatory and registration. Entomologist (Ph. D.)	A	Philippines	A5
7. Patrick Ducom	M	Ministère de l'Agriculture (Government research)	Postharvest and structural alternatives	B	France	Non-A5
8. Ken Glassey	M	MAFF, New Zealand	Forester, government advisor on MB alternatives in forest products	D	New Zealand	Non-A5
9. Eduardo Gonzalez	M	Fumigator	Phosphine, QPS and non-QPS treatments. Structures, commodities.	D	Philippines	A5
10. Darka Hamel	F	Institute for Plant Protection in Agriculture and Forestry (Government)	Postharvest and structural treatments, regulations	D	Croatia	A5
11. Takashi Misumi	M	MAFF (Government research)	QPS expert	D	Japan	Non-A5
12. David Okioga	M	Ministry of Environment and Natural Resources (Government regulatory)	Postharvest and QPS MB alternatives (Ph. D.)	A	Kenya	A5
13. Christoph Reichmuth	M	BBAGermany (Government research)	Researcher, MB alternatives in postharvest/structures (Ph. D.)	B	Germany	A5

14. Jordi Riudavets	M	IRTA-Department of Plant Protection. (Government Research)	IPM for stored products and horticultural crops (Ph. D.)	D	Spain	Non-A5
15. John Sansone	M	SCC Products (Fumigator)	Fumigator, particular expertise in structures	A	US	Non-A5
16. Robert Taylor	M	Consultant	Postharvest technology, specifically A5 uses	A	UK	Non-A5
17. Ken Vick	M	United States Department of Agriculture (Government research)	Research in MB alternatives, incl. QPS. Entomologist (Ph. D.)	A	US	Non-A5
18. Chris Watson	M	IGROX Ltd (Fumigator)	Practical use of MB and alternatives including the use of phosphine, Sulfuryl Fluoride,CO2 and Heat Treatments for commodities(inc timber) and structures	A	UK	Non-A5
19. Eduardo Willink	M	Ministry of Agriculture	Quarantine entomologist (Ph. D.)	D	Argentina	A5
TOTALS	M =16 F =3		A= 8 B = 3 C = 0 D = 8		CEIT & A5=7	Non-A5=12

A >10 years, B 5-10, C 2-5, D <2 years membership