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Minimising quarantine and pre-shipment (QPS) uses of methyl bromide

Tools for controlling, monitoring and reporting

United Nations Environment Programme

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Executive Summary

"Controlled uses of methyl bromide have been drastically reduced with immediate benefit to the ozone layer; but continued QPS uses prevent further benefits being realised. QPS uses of methyl bromide are major potential sources of ODS emissions if not appropriately managed."

The Montreal Protocol (Protocol) on Substances that Deplete the Ozone Layer came into effect in 1987. Protecting the ozone layer is extremely important as it prevents harmful ultraviolet (UV) rays from reaching the Earth's surface. Scientists have shown that without the Protocol, ozone layer destruction would have allowed UV radiation levels to increase to extremely high levels with disastrous effects on all forms of life. In 1992, the Protocol listed Methyl Bromide (MB) as an Ozone Depleting Substance (ODS). When emitted into the atmosphere the MB molecules break, releasing bromine, which aggressively destroys ozone.

Commercially, MB was used as a soil fumigant for many decades to control weeds, pests and pathogens that can attack many crops and cause severe losses. This fumigant was also used to disinfest food-processing and storage buildings, as well as commodities such as grains, beans and dried fruit. Since alternatives were available or under development for these uses, they were labelled as *controlled* under the Protocol and the Parties agreed to their phase-out, setting different timelines for developing countries that operate under Article 5 of the treaty ("A5 Parties") and developed countries ("non-A5 Parties"). A provision was left for *critical uses*, i.e. uses that were especially difficult to replace under strictly specific circumstances.

Methyl bromide has also been traditionally used as a treatment to control pests and pathogens of quarantine importance on various traded goods. These treatments are known as '*Quarantine and Pre-shipment*' (QPS) uses and can be performed by the exporting country at time of shipment or upon arrival by the importing country. As a QPS treatment, MB facilitates trade and also prevents accidental import of exotic pests. In 1992, the international community considered that there were no feasible alternatives for QPS treatments and that limiting use of MB would put international trade and the livelihood of many agricultural sectors at risk.

Such treatments were thus *exempted* from Protocol controls. Parties were nevertheless encouraged to minimise these QPS uses and to adopt alternative treatments whenever possible. As of 1 January only critical uses of MB are permitted in both A5 and non-A5 Parties. Developing country Parties have made great strides in phasing out controlled (i.e. non-QPS) uses of methyl bromide, thanks to the financial and technical assistance provided by the Protocol's Multilateral

Fund. As a result, MB use is now almost entirely for QPS.

QPS consumption[1] has remained relatively stable over the last 15 years at an approximate average of 11,000 metric tonnes per year. Data reported under the Protocol show that there is a general tendency for MB QPS consumption in A5-Parties to increase, whilst that of non-A5 Parties has decreased overall. The Asia-Pacific region is the largest consumer of MB for QPS purposes. The reported increases in A5 Parties may be linked to expanded international trade, however some Parties also raised the concern that MB imported for QPS purposes could be diverted into controlled uses. Establishment and enforcement of a reliable system to monitor actual consumption of MB is thus essential to ensure continued compliance with the Montreal Protocol. This requires in first instance a clear understanding of the differences between controlled and exempted uses as well as a robust legal framework, mechanisms to track MB uses, awareness raising, training and capacity building.

Most current QPS uses of MB are highly specialised, and have been used with very good success for a long time. Different species of pests and pathogens may be considered as quarantine pests by different countries and this will vary according to the particular situation of each country. Each country thus has a specific list of quarantine pests and requirements, which may encompass import permits, phytosanitary certificates, additional declarations and/or treatments and other relevant export information and documentation. There are cases where a pest that is common or endemic in one country is considered a quarantine pest in another.

Since 1992, several Decisions of the Montreal Protocol have concerned QPS uses of MB. Some of the issues raised by these Decisions include a request for clarification of the definitions of QPS, requirement of detailed evaluations of specific QPS uses of MB and their potential alternatives, and asking Parties to submit information on the details of QPS uses.

[1] The Protocol definition: Consumption = Production + Import – Export of controlled substances

The Parties to the Montreal Protocol are required to report by September 30 of each year on the production, import, export, consumption, feedstock uses and destruction of all ODS, including MB produced or consumed for QPS purposes. Presently, however, only total quantities of MB produced or consumed for QPS need to be reported. Parties are not required to report details on the MB- QPS application for different categories of use (i.e. commodities treated). With this limitation in data access and given the diversity of treatments involved, it is difficult to evaluate the QPS uses and to find or recommend alternatives for specific categories. It is also complex to monitor MB for QPS uses and to ensure accuracy in classification and exemptions.

The definition of 'quarantine' found in the Protocol follows closely the definition of quarantine used by the International Plant Protection Convention (IPPC). However, the concept of "Pre-shipment" is specific to the Montreal Protocol. The IPPC develops *International Standards for Phytosanitary Measures* (ISPMs), which are guidelines and recommendations recognised by the World Trade Organization. Some of these standards include procedures that can replace or avoid MB uses in quarantine (i.e. are suitable alternatives), whilst others seek to minimise MB use. The Protocol and the IPPC cooperate to ensure that their shared objectives are met and that the information on the existing alternatives for QPS purposes is shared among Parties.

MB uses for QPS are diverse. The Methyl Bromide Technical Options Committee (MBTOC), an advisory body of the Protocol, has estimated that there are five principal QPS applications of MB: Sawn timber and wood packaging material (ISPM-15); grains and similar foodstuffs; logs; pre-plant soil fumigation for production of propagation materials (considered a QPS use by one Party only); and fresh fruit and vegetables. In response to various Decisions of the Protocol, MBTOC estimated that it is feasible to replace 32–42% of the MB used for QPS with alternatives presently available across the four main categories of use.

Various A5 Parties have expressed concern over potential illegal trade and/or illegal uses of MB. To avoid this, Parties need to have reliable, use-specific, reporting and tracking processes on the use of MB produced, imported and or exported. Stakeholders in the public and private

sectors need to be adequately trained and sensitised. This is of paramount importance in sustaining the purpose and objectives of the Protocol for the management of the phase-out of MB.

Efficient tracking of MB for QPS applications requires close monitoring, timely information exchanges with trading partners, and a full understanding of both non-exempted and exempted uses. Some good examples of efficient tracking have been put in place in various countries for example Turkey, Malaysia, and Japan. The IPPC has developed a list of articles typically fumigated with MB for QPS purposes, which facilitates collection and reporting of MB usage data. Countries can make modifications of the IPPC guidelines in accordance to each Party's circumstances and may vary when the intended use is for either quarantine or for pre-shipment.

Some National Quarantine authorities have also developed local codes of practice or similar schemes to ensure best efficiency of methyl bromide treatments. For example, use of best management practices for QPS treatment of commodities minimises losses due to leakage prior to venting at the end of treatment, and maximises effectiveness of a particular dosage of methyl bromide.

Since agricultural products are potential carriers of quarantine pests and pathogens, expanding or maintaining their market access may be a complex process requiring substantial commitment to research and development. Typically, several years are needed to develop an effective disinfestation treatment that is acceptable to an importing country Thorough coordination between industry, packing houses, technical providers, fumigators, exporters, regulatory bodies and researchers is needed.

Contents

Foreword

The Montreal Protocol, through halting ozone layer depletion, could save an estimated $1.8 trillion in health care costs and almost $460 billion in avoided damages to agriculture, fisheries, and materials.

Since 1992, methyl bromide (MB) has been controlled as an ozone depleting substance (ODS) under the Montreal Protocol on Substances that Deplete the Ozone Layer. It is a commercial fumigant that was used worldwide for many decades to fumigate soil, to treat stored commodities, and to control a large variety of pests, pathogens and weeds. Under the Protocol, different phase out schedules for controlled uses of MB were agreed for developing countries that operate under Article 5 of the treaty ("A5 Parties") and developed countries ("non-A5 Parties"). Thanks to the financial and technical assistance provided by the Protocol's Multilateral Fund over the past two decades, by the deadline of 1 January 2015 virtually all A5 countries had successfully phased out their MB consumption for controlled uses by implementing alternative technologies and practices. The MB phase out is one of the Protocol's success stories.

However, methyl bromide continues to be used for Quarantine and Pre-shipment (QPS) applications, which are exempted uses under the Protocol and unaffected by the control measures. Quarantine and Pre-shipment is mainly used for the treatment of commodities in trade, to prevent the introduction and spread of plant pests and pathogens to environments where they are not yet present, thus avoiding huge economic and/or environmental consequences.[2] When the Protocol originally classified MB as an ODS more than twenty-four years ago, alternatives to QPS were not yet available. Nevertheless, even at that time Parties were encouraged whenever possible to minimise MB use and emissions, and to adopt alternatives.

Time has passed, and new technologies and practices to replace MB in QPS applications have been developed. Recent reports of the Protocol's MB Technical Options Committee (MBTOC) state that to date nearly 99% of the previously controlled uses of MB have been replaced by suitable non-ODS alternatives. As a result, the main MB use and resulting atmospheric emissions now come almost exclusively from QPS uses. An estimated 11,000 metric tonnes of MB are reported to be used annually in QPS applications.

Since MB use in QPS is exempted under the Protocol, there are no limits to imports, exports or use. Parties are however required to report on an annual basis the total aggregated national import, export and production

[2] http://ozone.unep.org/Publications/UNEP-Ozone-Secretariat-MP-Brochure.pdf

of MB in QPS applications but not the specific categories of use. This exempted unchecked use of MB in QPS application can encourage illegal trade (or use) and put at risk the phase-out of controlled use applications achieved to date.

This UNEP OzonAction publication is intended to help National Ozone Units understand why the close supervision of MB use in QPS applications is important for their countries continued compliance with the Montreal Protocol. It provides information about how to correctly identify MB QPS uses, data management, reporting, stakeholder engagements, and how to control and prevent potential illegal trade of this ODS. It will also be a useful reference tool for bio-security and plant quarantine officers, fumigating companies, and other stakeholders engaged in international trade. Using case study examples, the publication contains detailed guidelines and updated information including available MB alternatives for QPS applications.

In keeping with the objective of the Protocol, we hope that the information contained can support in reducing the demand use of MB in QPS applications, and ultimately to protect our common global property – the Earth's ozone layer.

Shamila Nair-Bedouelle
Head of UNEP OzonAction

Methyl bromide cylinders

Part 1 – Understanding Quarantine and Pre-Shipment (QPS) uses of methyl bromide under the Montreal Protocol

1.1. The Montreal Protocol and methyl bromide

The Montreal Protocol (Protocol) on substances that deplete the ozone layer came into effect in 1987. Parties to this universally ratified environmental agreement committed to:

> *"…take appropriate measures to protect human health and the environment against adverse effects resulting or likely to result from human activities which modify or are likely to modify the ozone layer…"*

Protecting the ozone layer is extremely important as it prevents harmful ultra violet (UV) rays from reaching the Earth's surface. Scientists have shown that without the Protocol, ozone layer destruction would have allowed UV radiation levels to increase to extremely high levels with disastrous effects on all forms of life from the microscopic marine phytoplankton's to human beings. The risk includes melanoma and non-melanoma skin cancers, more eye cataracts, weakened immune systems, reduced plant yields, damage to ocean ecosystems and reduced fishing yields, adverse effects on animals, and adverse effects on animals.

The Protocol is a living international agreement. In addition to the long list of Ozone Depleting Substances (ODS) listed when it came into effect in 1987, in 1992 Methyl Bromide (MB) was listed as an ODS. Scientists found that when emitted to the atmosphere the MB molecules break, releasing bromine, which aggressively destroys ozone. MB - CH_3Br - has high ozone depleting potential (ODP) of O.6. HCFC-22 (Chlorodifluoromethane) for example, has an ODP of 0.055.

Commercially, MB has been used as a fumigant for more than 70 years to control weeds, pests and pathogens present in soils, which can attack many crops and cause diseases that often lead to severe losses.

MB has also been used to disinfest food-processing buildings (mills, warehouses, ship-holds and containers) and stored durable commodities such as grain and beans (including rice, wheat, maize, coffee and cocoa), dried fruit and other dried foodstuffs.

All of these uses were controlled under the Protocol and the Parties agreed to phase them out, setting different timelines for A5 and non-A5 Parties [3].

As a QPS treatment, MB plays two different roles: it facilitates trade and it also prevents accidental import of exotic pests that could have a severe impact on other agricultural crops and native plants. Globally, MB is a well-established and accepted treatment for *quarantine and pre-shipment* (QPS) for control of a diverse range of pests and diseases affecting many commodities in trade, including timber, wooden packaging and various perishables such as fruits, vegetables and cut flowers.

In 1992 the international community considered that there were no feasible alternatives for such treatments. As a result, the lack of MB would put international trade and the livelihood of many agricultural sectors at risk. Methyl Bromide used for QPS purposes was thus exempted from Protocol Controls, but Parties were nevertheless encouraged to minimise its use for QPS and to adopt alternative treatments whenever possible.

The dual use of MB under the Montreal Protocol – controlled and exempted – poses challenges for governments, fumigators, international agencies and others. The Protocol has specific interpretation for the controlled and exempted use of MB, including reporting obligations. The purpose of this handbook is to provide clear guidelines and updated information in reference to,

- The Montreal Protocol rules for identification of QPS uses of MB (clear differentiation from controlled uses)
- Reporting requirements under the Protocol and suggested ways to record and report on QPS uses of MB
- Data management, reporting, including monitor QPS applications and to avoid illegal use/ trade
- Actions and tools to minimise MB use for QPS purposes
- Alternatives to MB for the main categories of QPS presently using MB
- Sources of information and relevant international linkages

[3] Article 2 of the Protocol details the control measures for all Parties. Article 5 defines the special situation of developing countries. Parties to the Montreal Protocol are generally classified as Article 5 (A5) or Non-Article 5 (Non-A5) in relation to their consumption of ODS. In general, A5 Parties are developing countries whilst non-A5s are developed

1.2. Methyl bromide uses under the Montreal Protocol

1.2.1. Methyl bromide definitions under the Montreal Protocol

Controlled uses

Methyl bromide was in the past used extensively for controlling a wide range of pests and pathogens present in soils, in post-harvest storage of commodities and in buildings or structures. Since alternatives were considered to be available for such applications, they were classified under the Protocol as *controlled uses.*

The Parties established a phase-out deadline of January 1st, 2005 for non-A5 Parties to phase-out controlled uses of MB, and of 1st January 2015 for A-5 Parties (see Table 1).

Critical uses

The Montreal Protocol has a provision for ***'Critical Uses'***. This classification applies for those specific circumstances of a sector or region where alternatives to methyl bromide were not available from a technical or economic standpoint and thus replacement of MB was more difficult. They are granted annually by the Parties under this provision on a case-to-case country basis, and based on recommendations made by the Protocol's Methyl Bromide Technical Options Committee (MBTOC). The requests are annual and need to be submitted individually by each interested Party.

Exempted QPS uses

In 1992, when MB was classified as an ODS, the Parties considered there were no alternatives to MB for a wide range of QPS

Table 1. Montreal Protocol control schedule for methyl bromide (Freezes and reductions refer to baseline levels)*

Non- Article 5 countries	Article 5 countries
▪ 25% reduction in production and consumption by 1 January 1999, according to 1991 baseline ▪ 50% reduction by 1 January 2001 ▪ 70% reduction by 1 January 2003 ▪ 100% phase-out by 1 January 2005 with a provision for CUE**	▪ Freeze in production and use on the basis of average levels for 1995-1998 (baseline) by 1 January 2002 ▪ 20% cut in production and use according to the 1995-98 baseline as of 1 January 2005 ▪ Phase-out by 1 January 2015 with a provision for CUE**

* *As per MOP VII (Annex III). ** Critical Use Exemptions*

treatments carried out with this fumigant. For that reason, Article 2H of the Protocol specifically excludes QPS uses of MB from control measures. These QPS uses are thus known under the Protocol as ***exempted uses*** of MB

Methyl bromide has also been used for many decades as a phytosanitary treatment to control pests and pathogens of quarantine importance on various traded goods including perishable commodities such as food, fresh fruit and vegetables and durable commodities such as grain and pulses, wood products, cotton and other materials. Such goods and their packaging can carry unwanted, exotic pests or pathogens, which can be introduced or spread into a given country or territory, often with serious impacts on the environment, the country's economy and even human health. To minimise these risks, governments implement national and international phytosanitary treatment standards. Very often, the treatment of choice is methyl bromide fumigation.

These treatments are known as ***'Quarantine and Pre-shipment'*** uses of methyl bromide. Treatment may be done before exporting the traded goods by the exporting country or upon arrival by the importing country.

1.2.2. Trends in methyl bromide consumption for QPS purposes

Because phase-out of controlled (non-QPS) uses of methyl bromide is so far advanced – as of 1st January 2015 only critical uses are permitted in both A5 and non-A5 Parties – **global MB use is now almost entirely for QPS**. In 2014, QPS consumption was about eight times larger than consumption allowed for all Parties under the critical use exemption. MB emissions from QPS uses are thus the major contributor to present degradation of the ozone layer by MB and thus further gains in ozone repair can only be achieved by phasing out QPS uses.

Global consumption

Based on data submitted by Parties to the Ozone Secretariat, QPS consumption has remained relatively stable over the last 15 years at an approximate average of 11,000 metric tonnes, with variations from year to year as seen in Fig 1. It is important to note that some Parties state that what they report to the Secretariat are consumption estimates, as they do not keep strict records. This is particularly true of categories of use, since the Protocol only requires reporting total consumption, not by category type.

A consumption peak is observed around 2006 especially in non-A5 Parties, which could coincide with entrance into force of the ISPM-15 standard as well as other factors.

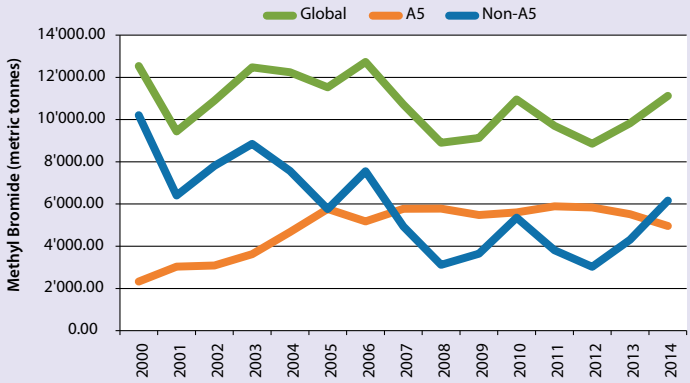
Fig. 1 shows that although overall consumption has remained relatively stable, the proportions used by A5/ non-A5 Parties have changed and there is a tendency for increase in consumption in A5 Parties.

Regional Consumption

The Asia Pacific region is by far the largest consumer of MB for QPS purposes, with an increase in consumption up until 2005 (Figure 2). Once again this may be due to ISPM-15, but also other factors such as increased trade. High consumers in the region include Indonesia, India, Vietnam, China, the Republic of Korea and Thailand. In recent years, some of these countries have reduced their MB consumption for QPS uses, for example Thailand.

Latin America is the second largest consuming region, with higher MB use for example in Mexico, Chile and Argentina. Consumption in Central America, particularly Nicaragua, has increased substantially in recent years.

FIGURE 1. GLOBAL CONSUMPTION TRENDS FOR MB USED FOR QPS PURPOSES 2000-2014



Source: Ozone Secretariat Data Access Centre, April 2016

As explained later in this document, QPS treatments with MB are strongly influenced by importing country requirements.

In non-Article 5 regions, four countries account for over 80% of total consumption of MB for QPS: The United States, Australia, New Zealand and Japan.

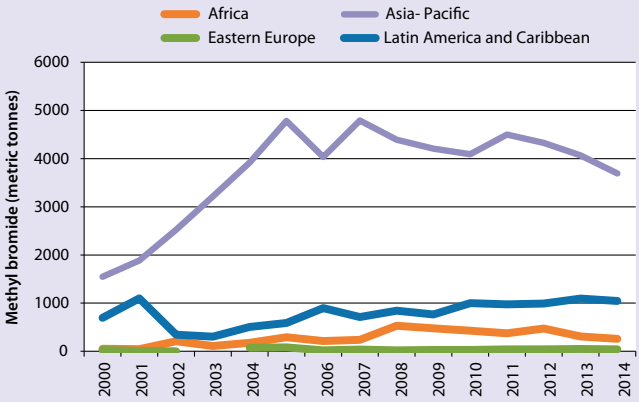
All member states of the EU banned MB uses (for both controlled and exempted uses) in 2010, however treatment is still required for some imported goods (as an example, the US is required to treat oak wood exports to Europe against oak wilt fungus with high rates of MB).

Increases may be linked to expanded international trade – for example, many A5 countries have increased exports of different products, and treatments are likely to be needed more frequently.

However, some Parties also raise the concern that MB imported for QPS purposes may actually be used for controlled uses, which is an illegal use.

Accurate monitoring of production and importation amounts of MB is clearly needed. This should include a clear distinction between amounts used for controlled and exempted uses as well as a

FIGURE 2. MB CONSUMPTION FOR QPS PURPOSES IN ARTICLE 5 REGIONS 2000-2014



Source: Ozone Secretariat Data Access Centre, April 2016

robust legal framework and mechanisms to track MB uses.

1.2.3. Methyl bromide production for QPS uses

Since 1999, seven Parties have reported production of MB for QPS purposes, but three of these report zero production since 2006: India, Ukraine and France.

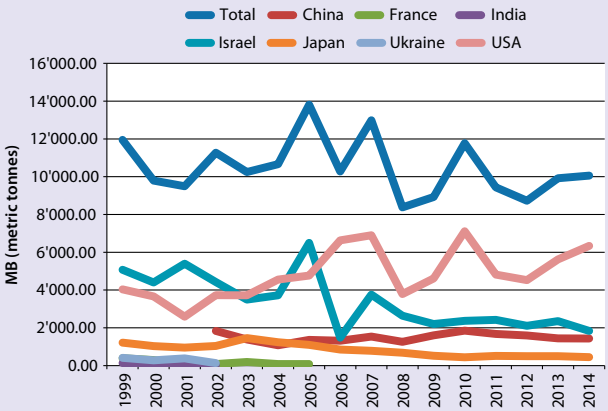
Presently, three non-A5 Parties (USA, Israel and Japan) and one A-5 Party (China) report MB production for QPS; individual production trends in these Parties together with the global trend appear in Figure 3.

1.3. QPS definitions used by the Montreal Protocol

In order to comply with Montreal Protocol provisions, a clear understanding of the nature and scope of QPS uses is essential. Below are the most relevant definitions.

Quarantine applications, of methyl bromide, are treatments to prevent the introduction, establishment and/or spread of quarantine pests or pathogens, or to ensure their official control,

FIGURE 3. TRENDS IN MB PRODUCTION FOR QPS PURPOSES 1999-2014



Source: Ozone Secretariat Data Access Centre, April 2016

Official control is that performed by, or authorised by, a national plant, animal or environmental protection or health authority (for example the NPPO, or quarantine/ phytosanitary officials).

Quarantine pests are pests (or pathogens) of potential importance to the areas endangered thereby and not yet present there, or present but not widely distributed and being officially controlled. Each country keeps its own official list of quarantine pests, which is regularly updated by the NPPO.

Pre-shipment applications are those treatments applied directly preceeding and in relation to export, either to meet the phytosanitary or sanitary requirements of the importing country or to meet existing phytosanitary or sanitary requirements of the exporting country. Such requirements must be in place before 7 December 1995, otherwise they do not comply with the definition of pre-shipment.

It is important to note that the definition of '*Pre-shipment*' is unique to the Montreal Protocol (it is found in Decisions VII/5 and XI/12).

Decision XI/12 of the Montreal Protocol states that pre-shipment applications are

> ***"…those non-quarantine applications applied within 21 days prior to export to meet the official requirements of the importing country or existing official requirements of the exporting country".***

Sawn wood treated with methyl bromide in Central America.

TABLE 2: COMPARATIVE GUIDE FOR EXEMPTED (QPS) USES, CONTROLLED USES AND CRITICAL USE EXEMPTIONS (CUE)

Type of treatment	Classifies as QPS	Classifies as controlled use	Allowed under CUE
Treatment is against a pest or pathogen that is officially controlled in the destination country	Yes, export quarantine	–	
Treatment is against a pest or pathogen that is officially controlled in the country importing the goods	Yes, import quarantine	–	n/a
Treatment is against a pest or pathogen that is not under official control	–	Controlled use (not presently allowed)	Allowed as CUE if granted by Parties
Treatment applied 21 days or less before export and required by exporting country or importing country authorities	Pre-shipment treatment	–	–
Requirement for treatment in place before 7 December 1995 (as per MOP VII, 1995)	Pre-shipment treatment	–	–
MB fumigation requests received by third parties such as companies, banks (letter of credit) or other commercial entities with no official control requirement		This is a controlled (non-exempted) use and is not presently allowed	

Heat treated wood pallets, New Zealand.

©Ken Glassey

Part 2 - QPS treatments with methyl bromide and related Montreal Protocol Decisions

2.1. Methyl bromide as a treatment for QPS

Most current QPS uses of MB are highly specialised, and have been used for a long time with very good success in avoiding and controlling the introduction of foreign, invasive pests and pathogens into environments where these are not present and where they pose very serious threats to specific productive sectors, including forests, croplands etc.

2.1.1. Examples of QPS treatments

Some classic examples of QPS uses appear in the Table 1 below:

Treatment of goods or commodity treatments are mostly associated with international trade where an importing country imposes regulations on the exporter or supplier.

In other instances, the importing countries prefer to treat products upon arrival, (post-entry quarantine) and MB (or sometimes an effective alternative treatment) is used as a mandatory treatment against a quarantine pest or in response to either pests found during inspection. This latter case should also be in response to the presence of a quarantine pest. The importing country usually determines which treatments are required, allowed or not allowed.

2.1.2. Key quarantine pests controlled with MB

Different species of pests and pathogens may be considered as quarantine pests by different countries and this will vary according to the particular situation of each country.

Table 1. Examples of QPS treatments with MB

Quarantine treatment	Pre-shipment treatment
▪ Fumigation on cut flowers found to be infested with quarantine pests upon arrival to the importing country ▪ Fumigation of fruit prior to export, to comply with official requirements of an importing country for controlling an officially listed quarantine pest ▪ Fumigation of logs to control or eradicate quarantine pests	▪ Fumigation of grain up to 21 days before export to meet requirements from an importing country (i.e. grain that is free of pests commonly infesting stored grain)

Each country keeps its own *official list of quarantine pests*. There are cases where a pest that is common or endemic in one country is considered a quarantine pest in another.

Table 2 below includes some common or frequent organisms that are classified as quarantine pests in many countries.

2.2. Decisions of the Montreal Protocol relating to QPS

Since 1992, several Decisions adopted by the Parties to the Montreal Protocol have dealt with exempted uses of MB for QPS. Among others, they request (i) clarification of the definitions of quarantine and pre-shipment, (ii) TEAP/MBTOC to conduct detailed evaluations on specific QPS uses of MB and their potential alternatives, or (iii) Parties to submit information on the details of QPS uses.

The most relevant Decisions taken by the Parties of the Montreal Protocol that deal with QPS uses are presented in Table 3, together with a brief summary of their scope and content.

Table 2. Main target pests of plant quarantine significance in the major classes of MB use for QPS

Treated commodity or situation	Main target quarantine pests
Whole logs, with bark	Different species of bark beetles, woodborers, *Sirex* spp., pinewood nematodes (*Bursaphelenchus xilophylus*), fungi (oak wilt, *Ceratocystis ulmi*).
Wood packaging materials	Many species of bark beetles, woodborers, *Sirex* spp., pinewood nematodes (*Bursaphelenchus xylophilus*).
Grain and similar foodstuffs	Trogoderma spp., particularly the Khapra beetle, T. granarium; *Prostephanus truncatus*; *Sitophilus granarius*; cotton bollworm, various snails.
Fresh fruit and vegetables	Many species of fruit flies, thrips, aphids, scale insects and other sucking bugs, various Lepidoptera (moths) and Coleoptera (beetles), different species of mites. Some of these may not be quarantine pests themselves, but act as vectors of quarantine viruses

Source: MBTOC Assessment Report, 2014

Khapra beetle, *Trogoderma graniarum.*

Emerald ash borer, *Agrilus plannipenis.*

Longhorn beetle.

Giant African snail, *Achatina fulica.*

TABLE 3. KEY DECISIONS OF THE MONTREAL PROTOCOL THAT ARE RELEVANT TO QPS USES OF MB (OZONE SECRETARIAT WEBSITE)

Decision No. and year	Issue addressed	General description
VII/5 1995	Definitions	Definition of "quarantine" and "pre-shipment"
IX/28 1997	Reporting ODS production and consumption	Approved official forms for reporting production and consumption of ODS including methyl bromide for QPS applications
XVI/10 2002	Reporting of information relating to QPS uses of MB	Requests Parties to submit information on QPS uses of MB. Requires TEAP to report on such data by commodity and application, providing a global use pattern overview, and including available information on potential alternatives for those uses identified from submitted data
XX/6 2008	Actions by Parties to reduce MB use for QPS purposes and related emissions	Requests TEAP, in consultation with IPPC[4] to review all relevant, current information on MB uses for QPS and related emissions; to assess trends in the major uses; available alternatives; other mitigation options and barriers to the adoption of alternatives. An to estimate possible replaceable proportion of MB used for QPS
XXI/10 2009	QPS uses of MB and their alternatives; QPS Management Strategies	Requests TEAP to assess technical and economic feasibility of alternatives for sawn timber and Wood Packaging Materials (WPM) (ISPM 15*); grains and similar foodstuffs; pre-plant soil use; logs. Current availability and market penetration rate; regulatory requirements for the implementation of alternatives; update estimated replaceable quantities of MB used for QPS purposes for A5 and non-A5 parties; and describe of a draft methodology for assessing the technical and economical feasibility of alternatives, the impact of their implementation and the impacts of restricting the quantities of MB produced and consumed for QPS.

** ISPM-15 is a standard that regulates the treatment of Wood Packaging Materials (WPM) for controlling quarantine pests that may be disseminated in such materials.*

[4] IPPC: International Plant Protection Convention. See Part 3 for more information

Decision No. and year	Issue addressed	General description
XXIII/5 2011	QPS categories of use; procedures for data collection on QPS consumption per category of use	Invites Parties in a position to do so to report on the amount of MB used to comply with phytosanitary requirements of destination countries, and on phytosanitary requirements for imported commodities that must be met with MB. And requested TEAP/MBTOC to summarise article 7 data on QPS and provide regional analysis; provide guidance on procedures and methods for data collection on MB use for QPS; and prepare a concise report based on responses received. The Decision further requested Parties to comply with the reporting requirements of Article 7 and to provide data on the amount of methyl bromide used for quarantine and pre-shipment applications annually and invited Parties in a position to do so, on a voluntary basis, to supplement such data by reporting to the Secretariat information on methyl bromide uses recorded and collated pursuant to the recommendation of the Commission on Phytosanitary Measures.
XXIV/15 2012	Reporting categories of QPS use. Establishing data collection procedures	Emphasises the importance of reporting the production and consumption of MB for QPS and asked Parties who had not yet established procedures for data collection on MB use for QPS or wishing to improve existing procedures, to consider elements identified as essential in the TEAP 2012 Progress Report http://ozone.unep.org/sites/ozone/files/dec24-15%284%29-example_data_reporting_forms.pdf

Log fumigation with MB in Japan, a quarantine treatment.

2.2.1. Reporting obligations

Article 7 of the Montreal Protocol requires Parties to report annually to the Ozone Secretariat data on production, consumption, feedstock uses and destruction of all ODS by September 30 of each year (information collated for the preceding year). This includes MB produced or consumed for QPS purposes.

In 1997, Decision IX/28 approved official forms for ODS reporting, including data on QPS. The Beijing Amendment (Article 7(3)) further requires annual data on amounts used for QPS.

QPS data remained confidential until 2008 when the Parties allowed this information to become public under Decision XX/6.

In 2012, Decision XXIV/15 further emphasised the importance of reporting MB data for QPS, and asked Parties who had not yet established procedures for data collection on QPS uses or wishing to improve their already existing procedures, to consider elements which were identified as essential in the TEAP 2012 Progress Report[5].

2.2.2. MB reporting as related to categories of use

Presently Parties are only required to report total quantities of MB produced or consumed ((import-export)+ production) for QPS, and reporting specific quantities for each use categories is **not** required. That is, Parties are only required to report on total QPS use per reporting year and not on specific QPS use of methyl bromide.

Given the diversity of treatments involved however, this makes it difficult to evaluate QPS uses and find or recommend alternatives for specific categories.

It is also complex to monitor MB when used for QPS applications. Strict monitoring and reporting is necessary to ensure that uses are non- wrongly classified and therefore erroneously exempted as being QPS.

Furniture fumigation with MB in Australia.

[5] http://ozone.unep.org/sites/ozone/files/dec24-15%284%29-example_data_reporting_forms.pdf

In an attempt to better characterise QPS uses, Decision XXIV/15 (2012) asked Parties who had not yet established procedures for data collection on QPS uses of MB or wishing to improve their already existing procedures, to consider elements highlighted by TEAP/MBTOC in its 2012 Progress Report. Suggested reporting procedures can be downloaded from the Ozone Secretariat website[6].

Further, Decision XX/6 encouraged Parties to submit a Management Strategy to the Ozone Secretariat aimed to replace or when not possible reduce amounts of MB intended for QPS applications. The European Union (EU) for example, submitted a useful strategy, which is also posted at the Ozone Secretariat website[7].

Available resources for A-5 Parties

Montreal Protocol Multilateral Fund
The Multilateral Fund (MLF) was established by a Decision of the Second Meeting of the Parties to the Montreal Protocol (London, June 1990) and began its operation in 1991. Its main objective is to assist developing country parties to the Montreal Protocol with compliance to provisions agreed by the Parties with respect to the phase-out of the various ODS, including methyl bromide.

The MLF primarily works towards this objective with four United Nations Agencies known as *Implementing Agencies:* UNEP (United Nations Environment Programme), UNIDO (United Nations Industrial Development Organization), UNDP (United Nations Development Programme) and the World Bank (WB). Assistance has also been provided by means of bi-lateral agreements between a given Party and the MLF, often together with one of the implementing agencies.

Assistance has taken many forms – from information dissemination and training to specialised publications and various types of projects, aimed at trialling alternatives to replace an ODS or towards achieving its complete phase-out.

[6] See for example http://ozone.unep.org/sites/ozone/files/dec24-15%284%29-example_data_reporting_forms.pdf

[7] See http://ozone.unep.org/Exemption_Information/Quarantinne_and_preshipment/Dec_xx-6_Strategy_to_reduce_emmission_of_mbr_for_QPS-European_Commission-07072010.pdf

Although the MLF provides economic and technical assistance only for phasing-out controlled uses of methyl bromide, implementing agencies have also assisted Parties with reporting QPS uses of MB for example:

- UNEP's Ozonaction Programme: UNEP, in its capacity as an implementing agency of the Multilateral Fund for the Implementation of the Montreal Protocol, and through its Compliance Assistance Programme (CAP), enables countries to make informed decisions about compliance management, non-ODS alternative technologies, capacity building, policies and legislation development and in communication and awareness. National Ozone Units can contact CAP Regional Network coordinators (RNCs) on information and guidance. UNEP OzonAction has published various reports, guidebooks and other communication and awareness raising information on methyl bromide[8].
- United Nations Industrial Development Organisation (UNIDO) has developed a logbook format for licensed fumigators to fill whenever applying a QPS treatment, and which can be shared with the NOU every 3-4 months, for reviewing and consolidating data. The logbook form guides relevant authorities on the collection of information on methyl bromide consumption for QPS purposes. The UNIDO Logbook is available for download and UNIDO welcomes countries to use it and adopt it to their needs[9].
- The World Bank (WB) has published on work done to evaluate the potential impact on the trade of various exports from East Asia (i.e. rice from Thailand, coffee from Vietnam) if the Parties to the Montreal Protocol were to agree on restrictions to QPS uses of MB[10].

[8] See http://www.unep.org/ozonaction/Topics/MethylBromide/tabid/6221/Default.aspx.

[9] See http://www.unido.org/en/what-we-do/environment/safeguarding-the-environment/emerging-compliance-regimes/phase-out-of-methyl-bromide/unido-toolkit.html

[10] World Bank 2011. Implications of Possible Restrictions on Methyl Bromide Use for Quarantine and Preshipment (QPS) Uses : East Asia Case Study Analysis. Fifteenth Annual Financial Agent Workshop, 1 April 2011, Washington DC, USA.http://siteresources.worldbank.org/EXTTMP/Resources/30_DK_MB_QPS_FutureRestrictionsImpactAnalysis.pdf

- United Nations Development Organization (UNDP): As an Implementing Agency, UNDP has not actively dealt with QPS uses of MB. However, they implemented successful demonstration and investment projects for the phase-out of controlled uses in various countries. To be highlighted are: the phase-out of MB in Costa Rica, historically one of the highest MB users with a baseline of 570 metric tonnes and MB phase-out in Malawi, which was achieved in 2004, well in advance of the A-5 phase-out deadline and involved the tobacco sector. Both countries presently report zero consumption of MB for QPS.

Direct links to the information described above can be found in the checklist below.

Stack of wooden pallets under MB fumigation to comply with ISPM 15 in the Philippines.

SUMMARY – REPORTING OBLIGATIONS WITH RESPECT TO QPS AND SOURCES OF INFORMATION

Decision/ Article *	Reporting obligation or suggestion	RELATED AND USEFUL information
Article 7	Parties are required to report production, import and export of ODS covered in the Protocol and the amendments ratified by that Party	(Ozone Secretariat) publication on data management Ozone Secretariat publication on Methyl Bromide Ozone Secretariat website http://ozone.unep.org/sites/ozone/files/dec24-15%284%29-example_data_reporting_forms.pdf
Dec. XX/6	National Management Strategy	EC Management Strategy: http://ozone.unep.org/Exemption_Information/Quarantinne_and_preshipment/Dec_xx-6_Strategy_to_reduce_emmission_of_mbr_for_QPS-European_Commission-07072010.pdf
Dec. XXI/10	QPS uses and their alternatives	TEAP reports: http://ozone.unep.org/en/Assessment_Panels/TEAP/Reports/TEAP_Reports/teap-qpstf-october2009.pdf
Dec. XXIV/15	Suggested data reporting forms	Ozone Secretariat website: http://ozone.unep.org/sites/ozone/files/dec24-15%284%29-example_data_reporting_forms.pdf TEAP reports: http://ozone.unep.org/en/Assessment_Panels/TEAP/Reports/TEAP_Reports/TEAP_Progress_Report_May_2013.pdf
Other	UNIDO toolkit and logbook	UNIDO toolkit for MB: http://www.unido.org/en/what-we-do/environment/safeguarding-the-environment/emerging-compliance-regimes/phase-out-of-methyl-bromide/unido-toolkit.html.
	MBTOC Assessment Reports	http://ozone.unep.org/en/assessment-panels/documents?field_committee_target_id=383&field_subsidiary_body_target_id=391&field_publication_date_value%5Bvalue%5D%5Byear%5D=&title=Assessment

** Decisions of the Montreal Protocol can be found on the Ozone Secretariat website at the following link: http://ozone.unep.org/en/handbook-montreal-protocol-substances-deplete-ozone-layer/63*

2.3. The International Plant Protection Convention and QPS

The International Plant Protection Convention (IPPC) is an international agreement operating under Food and Agriculture Organization of the United Nations (FAO) whose main goal is to protect cultivated and wild plants by preventing the introduction and spread of pests and pathogens (see https://www.ippc.int/en/). It is governed by the Commission on Phytosanitary Measures (CPM) that works in co-operation with national and regional plant protection organisations operating within the framework of the IPPC, for example National Plant Protection Organizations (NPPOs).

The IPPC develops *International Standards for Phytosanitary Measures* (ISPMs), which are guidelines and recommendations recognised by the World Trade Organization Agreement on the Application of Sanitary and Phytosanitary Measures (the SPS Agreement).

In practice, the IPPC focuses primarily on quarantine issues related to plants and the control of regulated quarantine pests and regulated non-quarantine pests[11]. Some of these standards include procedures that can replace or avoid the use of MB for use in quarantine (i.e. are suitable alternatives), whilst others seek to minimise MB use.

The definition of 'quarantine' found in the Protocol follows closely the definition of quarantine used by the IPPC. It should be noted that the concept of "Pre-shipment" is specific to the Montreal Protocol and has no direct counterpart in the IPPC. It relates to control of non-quarantine pests affecting commodities in trade. Official phytosanitary bodies (NPPOs, plant quarantine officials and others) of the importing or the exporting countries involved in a trade relationship can require pre-shipment measures to be put in place.

The Montreal Protocol and the IPPC cooperate to ensure that their shared objectives are met and that the information on the existing alternatives for QPS purposes is shared among Parties.

Therefore, the reduction of MB-QPS mainly by adopting alternative technologies is of common interest to both the Montreal Protocol and the IPPC. To further pursue this common interest,

[11] Methyl Bromide: Quarantine and Pre-shipment Uses, Ozone Secretariat, UNEP, page 3

a Memorandum of Understanding (MOU) was signed between IPPC and UNEP (Ozone Secretariat) during the 24th Meeting of the Parties of the Montreal Protocol in November 2012.

The MOU aims to jointly promote a wider implementation of existing recommendations regarding methyl bromide as a quarantine treatment and support efforts to develop alternative treatments to replace it. The main goals of the MOU are to

- Strengthen the collection of information on how methyl bromide is currently used for quarantine purposes in order to identify opportunities for shifting to alternatives;
- Improve regional and international coordination regarding methyl bromide management;
- Encourage information exchange and cooperative research aimed at reducing emissions of methyl bromide and develop alternatives;
- Promote best fumigation practices and wider use of recovery and recycling technologies to minimise methyl bromide emissions.

2.3.1. IPPC standards related to methyl bromide

The main standard that is relevant to MB use is **ISPM-15**. This standard regulates the treatment of Wood Packaging Materials (WPM) for controlling quarantine pests that may be disseminated in such materials.

Methyl bromide is one of the treatments authorised by the IPPC to treat WPM in compliance with this standard, which seeks to avoid dispersal of quarantine pests that may be associated with forests. Presently however, ISPM-15 recommends heat treatment over MB fumigation, however it and provides equal acceptance of both treatments.

The IPPC's working groups continuously work on new standards and revise existing ones in consideration of alternatives that become certified and generally available around the world. Dielectric heating was recently approved as a treatment to comply with ISPM-15[12] and, additional alternatives, including, sulfuryl fluoride and microwave irradiation, are under evaluation and could be accepted under ISPM-15 in the future.

[12] Commission of Phytosanitary Measures, (CPM) of the IPPC, April 2013

In 2008, and mindful of the reduction of all uses of MB in the Montreal Protocol, the Parties to the IPPC adopted a recommendation that encouraged Parties to establish a strategy to reduce the use and emissions of MB used for phytosanitary treatments.

The IPPC guideline *"Replacement or reduction of the use of methyl bromide as a phytosanitary measure"*[13] recommends:

- Inspection-based fumigation instead of mandatory fumigation (i.e. detecting and identifying the quarantine pest of concern before applying the treatment, instead of applying it preventively)
- Avoiding unjustified re-fumigation with methyl bromide (i.e. re-fumigation should be used only when a quarantine pest situation is evident, not as a precautionary measure)
- Improving treatment facilities as appropriate to maximise efficiency of fumigation, thus reducing re-fumigation requirements
- Increasing exposure time with a view to reducing dosage, where technically feasible
- Avoiding MB application in situations where efficacy is doubtful or marginal
- Reassessing doses and exposure times with a view of reducing them
- Using optimal temperatures during fumigation (as sub-optimal temperatures may require higher dosages)
- Using treatment facilities of appropriate size
- Evaluating pest risk and treatment efficacy (through a pest risk analysis) to determine if a more appropriate dose or an alternative treatment are possible.

Heat treated Wood Pallets China.

[13] IPPC 2008. See https://www.ippc.int/en/core-activities/governance/cpm-recommendations/replacement-or-reduction-of-the-use-of-methyl-bromide-as-a-phytosanitary-measure/

2.4. QPS uses of MB

MB uses for QPS are diverse and comprise many products. The IPPC has compiled a list of the main uses. These, together with other additional categories considered to be QPS by some Parties appear in Table 4.

2.4.1. Main categories of use

In response to Decision XX/6 of the Montreal Protocol and later through surveys conducted when preparing its Assessment Reports, MBTOC has estimated that five principal applications consume nearly 80% of the global MB used for QPS as follows:

1) Sawn timber and wood packaging material (ISPM-15)
2) Grains and similar foodstuffs
3) Logs
4) Pre-plant soils use
5) Fresh fruit and vegetables

According to a survey conducted by MBTOC in 2012, the first four categories account for more than 80% by amount of the MB used for QPS in 2013. Pre-plant soils uses as a QPS treatment are only reported by one Party (USA) and refer to production of high health, plant propagation material (i.e. strawberry runners, forest and fruit tree seedlings, ornamental plant cuttings etc.)

Proportions of use for each of these categories is thus different for A5 and non-A5 Parties:

FIGURE 1. ESTIMATED CATEGORIES OF MB USE FOR QPS IN ARTICLE 5 PARTIES (2013)

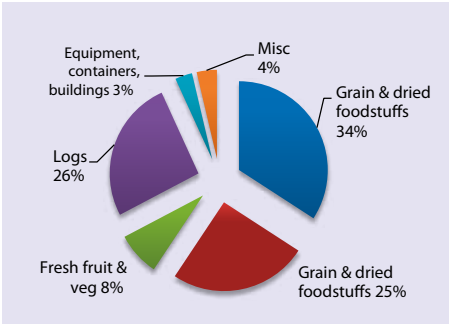
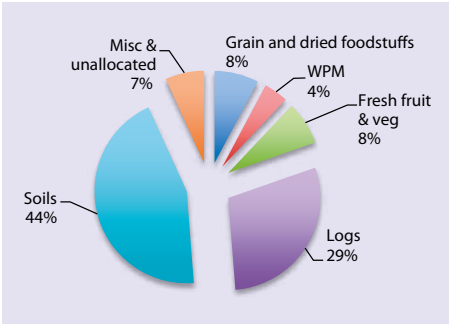


FIGURE 2. ESTIMATED CATEGORIES OF MB USE FOR QPS IN NON- ARTICLE 5 PARTIES (2013)



Source: 2014 MBTOC Assessment Report

TABLE 4: MAIN CATEGORIES OF MB USE FOR QPS PURPOSES

Category	Uses
Commodities	Bulbs, corms, tubers and rhizomes (intended for planting)
	Cut flowers and branches (including foliage)
	Fresh fruit and vegetables
	Grain, cereals and oil seeds for consumption including rice (not intended for planting)
	Dried foodstuffs (including herbs, dried fruit, coffee, cocoa)
	Nursery stock (plants intended for planting other than seed), and associated soil and other growing media
	Seeds (intended for planting)
	Soil and other growing media as a commodity, including soil exports and soil associated with living material such as nursery stock*
	Wood packaging materials
	Wood (including sawn wood and wood chips)
	Whole logs (with or without bark)
	Hay, straw, thatch grass, dried animal fodder (other than grains and cereals listed above)
	Cotton and other fibre crops and products
	Tree nuts (e.g. almonds, walnuts, hazelnuts)
Structures and equipment	Buildings with quarantine pests (including elevators, dwellings, factories, storage facilities)
	Equipment (including used machinery and vehicles) and empty shipping containers and reused packaging
Soil as agricultural land*	Pre-plant and disinfestation fumigation of agricultural land*
Miscellaneous small volume uses	Personal effects, furniture, air* and watercraft*, artefacts, hides, fur and skins

*Source: IPPC (2008) list of categories; *Not on IPPC (2008) list. Refers to pre-plant soil fumigation for production of plant propagation materials. This is a use that is classified as "QPS" by one Party to the Montreal Protocol (USA)*

© Ken Glassey

Debarked logs treated with fungicide.

© Marta Pizano

Heat treatment of wood pallets in China.

Part 3 – Alternatives to methyl bromide for QPS uses

3.1. QPS alternatives

Alternatives to MB need to be technically and economically feasible. In relation to QPS, this includes efficacy against the quarantine pests of concern, the infrastructural capacity of the country, end-use customer requirements, phytosanitary agreements, logistical requirements and regulatory approval for the use of the alternative. Installed capacity and having the required skills to implement such alternatives are also essential.

Methyl bromide is often the treatment of choice because it is the best known option (and thus well accepted by trade partners), is most easily at hand, facilities to conduct the treatment are readily available, and has proven to be the most effective.

In general, the adoption of alternatives to methyl bromide for QPS purposes has significant implications for international trade. Bilateral agreements between exporting and importing countries often need to be negotiated before an alternative to MB can be implemented successfully.

Such negotiations can be lengthy, allowing time for protocols to be developed and confidence that the selected alternatives will be completely effective. Specialised training may also be required.

In response to various Decisions of the Parties to the Montreal Protocol, TEAP through its MBTOC[14] has assessed the availability and market penetration of technically and economically feasible alternatives of the four largest consuming categories of methyl bromide for QPS. MBTOC estimates that it is feasible to replace 32–42% of the MB used for QPS with alternatives presently available across the four main categories of use.

3.1.1. Alternatives for sawn timber and wood packaging materials (ISPM-15)

ISPM-15 is a standard issued by the IPPC regulating the treatment of Wood Packaging Materials (WPM) for controlling quarantine pests that may be disseminated in them. The main alternatives for this category of QPS use are briefly described below.

[14] The Technical and Economic Assessment Panel (TEAP) of the Montreal Protocol is composed of five Technical Options Committees (TOC), one of which is the MBTOC (Methyl Bromide TOC), in charge of all issues relating to methyl bromide under the Protocol, including QPS.

TABLE 1. ALTERNATIVES THAT CAN POTENTIALLY REPLACE OR REDUCE MB USE FOR QPS PURPOSES

Treated item	Examples of potential alternatives to replace or reduce methyl bromide[15]
Bulbs, corms, tubers and rhizomes (intended for planting)	Hot water, pre-plant quarantine soil sterilization (steam or chemical), pesticide dip, or a combination of these treatments
Cut flowers and branches (including foliage)	Controlled atmospheres (CO_2, N_2) + combination treatment, hot water, irradiation, PH_3, PH3/CO_2 mixture, pyrethroids, ethyl formate
Fresh fruit and vegetables	Cold treatment, high-temperature forced air, hot water, irradiation, quick freeze, vapour heat treatment, chemical dip, PH3, combination of treatments, ethyl formate
Grain, cereals and oil seeds for consumption including rice (not intended for planting)	Heat treatment, irradiation, ethyl formate, carbonyl sulphide, PH3, PH3 + CO_2, sulfuryl fluoride, controlled atmospheres (CO_2, N_2)
Dried foodstuffs (including herbs, dried fruit, coffee, cocoa)	Heat treatment, carbon dioxide under high pressure, irradiation, ethyl formate, PH_3, PH_3 + CO_2, controlled atmosphere (CO_2, N_2), sulfuryl fluoride, propylene oxide
Nursery stock (plants intended for planting other than seed), and associated soil and other growing media	Hot water, soil sterilization (steam or chemical e.g. methyl isothiocyanate (MITC) fumigants), pesticides dip, PH_3, combination of any of these treatments
Seeds (intended for planting)	Hot water, pesticide dipping or dusting, phosphine, combination treatments
Wood packaging materials	Heat treatment (contained in Annex 1 of ISPM No. 15). Further alternative treatments may be added in the future.
Wood (including round wood, sawn wood, Wood chips)	Heat treatment, kiln-drying, removal of bark, microwave, irradiation, MITC/sulfuryl fluoride mixture, methyl iodide, chemical impregnation or immersion, PH_3, sulfuryl fluoride
Whole logs (with or without bark)	Heat treatment, irradiation, removal of bark, PH_3, sulfuryl fluoride. MITC/sulfuryl fluoride mixture, methyl iodide.
Hay, straw, thatch grass, dried animal fodder (other than grains and cereals above)	Heat treatment, irradiation, high pressure + PH_3, PH_3, sulfuryl fluoride
Cotton and other fibre crops and products	Heat treatment, compression, irradiation, phosphine, sulfuryl fluoride CO_2
Tree nuts (almonds, walnuts, hazelnuts. other)	Carbon dioxide under high pressure, controlled atmosphere (CO_2, N_2), heat treatment, irradiation, ethylene oxide, ethyl formate, phosphine, phosphine + carbon dioxide, propylene oxide, sulfuryl fluoride
Buildings with quarantine pests (including elevators, dwellings, factories, storage facilities)	Controlled atmosphere (CO_2, N_2), heat treatment, pesticide spray or fogging, PH_3, sulfuryl fluoride
Equipment (including used agricultural machinery and vehicles), empty shipping containers and reused packaging	Controlled atmosphere (CO_2, N_2), heat treatment, steam, hot water, pesticide spray or fogging, PH_3, sulfuryl fluoride
Personal effects, furniture, crafts, artefacts, hides, fur and skins	Controlled atmospheres (CO_2, N_2), heat treatment, irradiation, ethylene oxide, pesticide spray or fogging, PH_3, sulfuryl fluoride

[15] These examples are generally applicable and likely to meet current standards for treatment or disinfestation. Some alternatives may not be appropriate on particular commodities or in specific situations. (Source: MBTOC 2014 Assessment Report)

Heat treatment

Heat is the only alternative to MB approved, accepted internationally and actually encouraged for compliance with ISPM-15. Kiln drying and more recently dielectric heating (e.g. microwave) are accepted as heat treatments. A core temperature of at least 56°C must be maintained for at least 30 minutes for kiln drying. The profile of the wood must be heated to achieve a minimum 60°C for one continuous minute for dielectric heating.

Heat treatments to meet ISPM-15 are in use in many countries around the world. In general, they require more infrastructure and quality control than for methyl bromide fumigation, but are often found to be cost effective and practical. Heat has been in use in many A5 countries for many years (e.g. Morocco, Colombia, Argentina, Mexico, Ecuador, China)[16].

Chemical alternatives

Often the wood packaging material needing treatment to meet the requirements of ISPM-15 already contains goods and such goods are likely to be damaged by heat, fumigation is preferred over heat.

The only officially recognised chemical option under ISPM-15 at present is methyl bromide, but sulfuryl fluoride and phosphine, continue to be under consideration by IPPC bodies.

Some National Plant Protection Organizations recognise other treatments for wood packaging material and similar products and are able to use them through bilateral agreements with partner countries interested in a specific trade.

Heat treatment of wood packaging material in Taiwan.

[16] Source: MBTOC 2014 Assessment Report

TABLE 2. SUMMARY – ALTERNATIVES FOR WOOD PACKAGING MATERIAL (ISPM-15)

Alternative	Market penetration	Remarks
Heat	In use in many countries, including A5 Parties, economically feasible	Only alternative to MB approved by IPPC to comply with ISPM-15, includes kiln drying and dielectric heating (microwaves)
Non-wood pallets	In use in various countries, particularly EU, Australia, NZ, USA, also some A5 countries	Cost may be a constraint in A5 countries, however there may be added benefits (i.e. forest preservation)
Alternative fumigants	Unknown	Sulfuryl fluoride and phosphine under consideration by IPPC

Alternatives to wood pallets

Alternatives to wooden pallets, which do not carry quarantine pests, are exempt from the requirements of ISPM-15.

For example, plastic pallets (often made from recycled plastic) are commercially available and are used by many companies in the EU, the US and other countries. Cardboard pallets are used in Australia, the EU, Kenya, New Zealand, the US and others. This option can nevertheless be more expensive and require additional facilities such as for plastic recycling, which may not always be available (or affordable).

3.1.2. Alternatives for grains and dried foodstuffs

Although sometimes aimed at controlling quarantine pests (i.e. the Khapra beetle), exempted treatments of grain and dried foodstuffs generally fall under the definition of pre-shipment uses. Alternatives thus will need to be selected on the basis of the target pests to be controlled (whether cosmopolitan or quarantine). In some cases, Government authorities will specifically require treatment with MB.

Alternatives for pre-shipment uses

Cereal grains in storage (for example rice, maize and wheat) frequently become infested by various kinds of cosmopolitan pests, which make them unacceptable for export and in consequence a pre-shipment treatment with MB is conducted, however alternative treatments are now widely available and in use.

The choice of treatment will depend on whether national authorities officially require methyl bromide or if very rapid treatment is absolutely essential since

alternatives tend to be slower acting than methyl bromide.

Phosphine fumigation is in widespread use for controlling cosmopolitan pests in both bagged and bulk grain consignments. Since resistance to phosphine may arise, combinations with CO_2, cold or heat are implemented, together with best application practices, to reduce this risk.

The use of controlled atmosphere technologies is expanding at present and there appears to be potential for much more widespread adoption.

Sulfuryl fluoride fumigation is restricted by the availability and registration of the fumigant to only a few countries at this time. In particular, registration is very limited in A5 countries.

Direct treatment of grain with pesticides (i.e. insecticides) will also yield pest-free grain that meets inspection standards. A holding period is sometimes necessary before inspection to allow for action of the pesticide on the pests, but some fast acting pesticides for direct application are available, for example dichlorvos and cypermethrin. This may be practically difficult however in some cases, for example rice, as sometimes residues are

Apples treated with phosphine + cold.

Trials with QPS fumigant alternatives in Japan (SF + MITC).

left on the grain, which may hamper its commercial value.

Although heat is technically feasible, its use is restricted by the high cost of treating facilities able to heat grain moving at fast handling speeds, such as when loading or discharging silos, ship holds or other enclosures. It is however an option for small-scale disinfestation facilities for bulk grain, operating at a relatively slow speed.

Quarantine

In some cases, it may be necessary to treat grain consignments to control quarantine pests, notably the Khapra beetle (*Trogoderma granarium*) and *Prostephanus* species, contaminants such as specific snails (e.g. *Cochlicella* spp.) or seed-borne diseases such as Karnal bunt (*Tilletia indica*).

Silo fumigation with phosphine.

In particular, many countries have strict quarantine regulations on grain and other durables originating from countries where Khapra beetle occurs. Typically, only MB treatment is specified against this quarantine pest for stored product disinfestation, using double normal dosages and often with extended exposure period.

Heat treatment is a good alternative to methyl bromide for controlling many stored product pests, including Khapra beetle. Despite its tolerance to temperatures of about 41°C, Khapra beetle is quite susceptible to higher temperatures.

In the past, *T. granarium* was quite susceptible to phosphine and this was a good potential alternative to methyl bromide against this pest. However, with the frequent development phosphine resistance by *T. granarium* in the Indian subcontinent, phosphine is not currently considered an option for controlling this pest.

Table 3. Summary – MB alternatives for grains and dried foodstuffs

Alternative	Market penetration	Remarks
Phosphine – PH_3	High. In wide use around the world.	Development of resistant pests is of concern. Slower speed action can be compensated with in-transit treatments (in suitable ship holds)
Controlled atmospheres	Implemented in many non A5 countries and increasingly used in A5 countries	Good potential, can be combined with PH_3 to improve efficacy and reduce time
Sulfuryl fluoride, cyanogen, carbonyl sulfide, ethyl formate	Not registered in many countries, which limits their adoption	Efficient where registered

3.1.3. Alternatives for logs

Methyl bromide is the most widely used fumigant for treating exported logs, however it does have some limitations including limited penetration especially wet timber (green logs).

Treatment of logs may need to be rapid to avoid charges and congestion at ports associated with occupying restricted port area for the treatment. Many pests of quarantine significance, which attack green wood, do not re-infest dry and debarked wood, so de-barking may be an accepted option to avoid fumigation.

Significant savings of MB have been achieved by reducing the fumigation rate (dosage) for logs by identifying situations where excessive rates were previously used (MBTOC 2010 Assessment Report)

In-transit fumigation with phosphine of *Pinus radiata* logs exported from New Zealand to China was pioneered by New Zealand. It is now routinely used as a quarantine and pre-shipment measure, and unlike MB, this treatment can be applied in-transit below deck in the holds (about 2/3 of the cargo capacity only). Phosphine is more cost effective, and has partially replaced methyl bromide for this purpose.

Sulfuryl fluoride (SF) is a similar fumigant to MB except that the fumigation temperature or concentration usually needs to be higher to achieve the same level of pest mortality for all pest stages including eggs.

SF does however have some other environmental concerns as it is now reported to have a 20-year high global warming potential (GWP) of 6840[17].

Ethane dinitrile (EDN), also known as cyanide is now registered in Australia for the treatment of logs and timber and registration is also progressing in New Zealand, South East Asia, South Africa and Israel and being reviewed in a number of additional countries. However the controls on its use such as buffer zones, recapture and withholding period restrict its update. Currently only Malaysia accepts EDN as a quarantine treatment.

For many years, heat has been accepted as a quarantine treatment for logs and timber shipped to the USA and other countries. Steam heat is a more effective quarantine measure than dry heat. The general specification requires the wood to reach a core temperature of 71°C for 60 minutes. Kiln drying of timber to a moisture content of less than 20% using temperatures over 70°C is often a commercial requirement but has also been long accepted as a quarantine treatment by most importing countries.

Gamma irradiation is used in some countries, however, its practical application must overcome a number of hurdles, including the construction of large irradiating facilities to handle logs and bulk wood products and poor penetration into freshly cut logs, potential damage and dose-dependent degradation of wood products and very high dosages required to eliminate fungi.

Water soaking or immersion is a good control method for pests attacking logs. Immersion of some logs destined for plywood manufacture is a useful process as it improves the quality of the products. The storage of logs in water or under water spray has long been accepted as an effective treatment for terrestrial insects and fungi.

However, the large areas and water volumes required for soaking logs restrict the application of this quarantine treatment on a large scale.

For many years, bark removal has been a key strategy for reducing the risk of logs and sawn timber carrying certain insects and fungi of quarantine concern for many years. In fact, many countries importing logs require it; debarking however is costly and thus limited to high value timber.

[17] http://www.arb.ca.gov/cc/shortlived/2015appendixa.pdf

Table 4. Summary – alternatives for logs

Alternative	Market penetration	Remarks
Sawn timber (lumber)	Many Parties including A5	Process increases cost so feasible where there is demand for higher value products
Debarking	Some Parties, including A5	Acceptable if conducted as a component of an integrated system
Heat	Some Parties, including A5	Only justified for high-grade logs
Phosphine	Some Parties, including A5	May be applied in transit in suitable ship holds

3.1.4 Alternatives for pre-plant fumigation of nurseries

Pre-plant soil fumigation for production of high health, often certified plant propagation material (i.e. strawberry runners, forest and fruit tree seedlings, ornamental plant cuttings etc.) is considered a QPS treatment by only one Party (USA).

3.1.5. Alternatives for fresh fruit and vegetables

Although the vast majority of horticultural products globally are harvested and placed on the market without any postharvest treatment, some horticultural products require treatment for reducing the risk of accidentally transferring pests not present in an importing country.

Grain inspection , Central America.

Fumigation of cocoa beans with CO_2 Germany.

TABLE 5. SUMMARY – ALTERNATIVES FOR PRE-PLANT SOIL TREATMENT

Alternative	Market penetration	Remarks
Fumigants (1,3-Dichloropropene, Chloropicrin (Pic), Metham sodium (MS) and combinations)	High, in use as alternatives for many pre-plant soil (controlled) uses in A5 and non-A5 countries	The alternative must meet certification or other health standards and be accepted by regulatory authorities. May need inspection.
Substrates	Acceptable and in use in some countries both A5 and non-A5. Sometimes used only for part of the propagation process	May not be economically feasible.
Steam	In use around the world	Economic feasibility may be challenging

Forest nurseries in substrates, Chile.

These treatments may be applied either pre-shipment, in-transit or on arrival depending on the phytosanitary requirements of the importing country.

Postharvest insect control treatments applied to horticultural commodities may include physical treatments (such as cold, heat, controlled/modified atmospheres, removal, irradiation, radio/microwave frequencies, pressure/vacuum), or chemical fumigation treatments with either Generally Recognised As Safe (GRAS) compounds (i.e. ozone, ethyl formate), or higher risk fumigants (i.e. methyl bromide, phosphine, sulfuryl fluoride, carbonyl sulphide, cyanogen) or insecticidal dips.

A "systems approach" integrating pre-plant management activities and post-harvest processing to minimise the impact of insects from the field to the final packaging is widely used and well recognised in many countries. In fact the IPPC has developed standards to this respect - ISPM 14 (2002).

The alternative used to kill insects on horticultural products tends to be specific to individual crops, cultivars, pests, markets and even growing regions. In many cases, the approved treatments apply to a particular commodity with particular pest(s) from a particular country or region and a particular quarantine concern of the importing country.

Irradiation unit Philippines for fruit treatment, particularly mangoes.

Inspection of vegetables at a Japanese airport.

Part 4 – Tracking MB use

4.1. Tracking MB use

Various A5 Parties have expressed concern during Meetings of the Parties (MOP) and also in the course of work conducted by implementing agencies and the MLF, over potential illegal trade and/or illegal uses of MB. In particular, reference is made to the possible diversion of MB imported for QPS uses to non-exempted (non-QPS) applications, see for example MLF 2012 "Evaluation of methyl bromide projects in Africa MLF, 2012[18].

Presently, non-exempt uses can only be permitted under the 'Critical Use Exemption'. This approval is done through a complex process established under the Montreal Protocol requiring a detailed application whereby the applicant must demonstrate that no alternatives are available for a specific use. The application is evaluated by MBTOC, and based on the recommendations issued by the committee the Parties may allow continued use of MB for controlled uses.

Parties need to have reliable, use-specific, reporting and tracking processes on the use of MB produced, imported and/or exported. This is of paramount importance in sustaining the objectives of the Montreal Protocol for the management of the phase-out of methyl bromide.

Efficient tracking of MB use requires close monitoring and a full understanding of both non-exempted and exempted (QPS) uses. The IPPC has developed a list of articles, commodities and products typically fumigated with MB for QPS purposes, which facilitates collection and reporting of MB usage data as discussed in previous sections. Modifications may be made in accordance to each Party's circumstances and may vary when the intended use is for quarantine or for pre-shipment.

In accordance to Decisions adopted by the Parties to the Montreal Protocol, all Parties are required to have an import/export licensing systems for ODS. This will include MB, as listed under Annex E of the Protocol.

Specifically, Article 4B of the Montreal Protocol requires each Party, to establish a system for licensing the import and export of new, used, recycled and reclaimed substances in Annexes A, B, C and E of the Protocol and to report to the Secretariat within three months of the date of introducing that system. This is a

[18] http://www.multilateralfund.org/66/English/1/6615.pdf – http://www.multilateralfund.org/68/English/1/6811.pdf

mandatory compliance obligation of all Parties to the Protocol.

To ensure that methyl bromide when used, is only for QPS applications and for CUE (where approval is received from the MOP), the following guidelines are suggested for the strengthening of the ODS licensing systems and include:

- Each Party should have a list of pre-approved fumigators having the required skills to manage MB in QPS application. See for example the guidelines for Australia[19]
- Organise regular meetings with key stakeholders and work to agree on a voluntarily/annual allocation of quotas for QPS and non-QPS (where the latter should now be either zero or exclusively for Critical Use Exemptions if these have been requested and granted).

Flower inspection, Japan.

[19] http://www.agriculture.gov.au/import/arrival/treatments/treatments-fumigants

- Where practical, establishing special permits and only for registered importers of MB and for each treatment application (in addition to the licensing system). Avoid multi-year stockpiling of MB
- MB import permits should include information on specific uses for which the MB is imported and how and where it will be stored. This will help tracking categories of use and quantities applied and also avoiding stockpiling, reducing risks of diversion into unauthorised uses.
- Participating in iPIC (informal prior informed consent system) a voluntary agreement between countries to exchange information on import and export licenses prior to export. UNEP DTIE OzonAction has established an iPIC on line mechanism in which more than 100 countries presently participate. Many potential cases of illegal and unwanted trade in MB have been prevented through cross checking by importing and exporting countries prior to shipment (http://www.unep.org/ozonaction/InformationResources/iPIC-online).
- Ensuring coordination and joint work between the NOU and Customs authorities (as well as other relevant government agencies such as NPPO, environmental authorities, and industry representatives where appropriate). This should include correct classification based on: customs harmonised system (HS) codes and chemical names under which MB – or mixtures containing MB- may be traded. Care has to be taken that MB should be classified as a fumigant and not pesticides. (i.e. insecticides, fungicides)
- Establish and enforce penalties (fines) that are significant enough to deter potential smugglers from breaking the law.
- Adopt incentives to encourage use of alternatives
- Permit a specific formulation of MB for QPS purposes only. Generally, only formulations containing 100% MB are suitable for QPS applications; and these are not practical, or safe, for other uses. 100% MB can be provided in distinctive packaging (i.e. red cylinders) that is easy to spot by regulatory authorities.

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Methyl bromide recapture unit.

Part 5 – Initiatives, bilateral agreements

5.1. Initiatives, bilateral agreements

5.1.1. Best practice guidelines

Quarantine authorities from many countries (NPPOs) have developed codes of practice or similar schemes to ensure best efficiency of methyl bromide treatments, much along the lines of IPPC guidelines.

Some good examples are found in sections in the United States Department of Agriculture Animal and Plant Health Inspection Service (USDA PPQ) manual of the USA, the Australia Quarantine and Inspection Service (AQIS) / Methyl Bromide Fumigation Standard of Australia, Approved Biosecurity Treatments of New Zealand and the Theory and Practice of Plant Quarantine Treatments from Japan. The FAO web-based document 'Guide to Fumigation under Gas-Proof Sheets' also provides instruction on use of MB for QPS treatments. They can be found at the links listed at the bottom of this page[20]:

Use of best management practices for QPS treatment of commodities minimises losses due to leakage prior to venting at the end of treatment, and maximises effectiveness of a particular dosage of methyl bromide.

Treatment of commodities for QPS purposes under best practice is typically carried out in well sealed enclosures designed to retain the fumigant gas at effective levels throughout the treatment. Appropriate sealing should minimise fumigant loss, caused by wind and temperature changes. There are standards available for sealing enclosures (freight containers, fumigation chambers, sheeted stacks, silo bins, sheds etc.) for fumigation with MB, which may vary with country regulations or codes of practice, but are usually based either on a pressure test or a gas retention test.

Application of audited best practice for QPS fumigations in several countries that trade with Australia under the AFAS (Australian Fumigation Accreditation Scheme) has avoided the use of substantial quantities of methyl

[20]
- USA - APHIS PPQ manuals – http://www.aphis.usda.gov/import_export/plants/manuals/index.shtml
- Australia – AQIS Import Conditions database http://www.aqis.gov.au/icon32/asp/ex_querycontent.asp
- New Zealand - Approved Biosecurity Treatments for Risk Goods Directed for Treatment - http://www.biosecurity.govt.nz/files/regs/stds/bnz-std-abtrt.pdf
- Japan - Theory and Practice of Plant Quarantine Treatments (revised edition 2002) (JFTA 2002)

bromide. It is estimated that AFAS countries (India, Indonesia, Malaysia, Vietnam and Thailand) have collectively reduced methyl bromide usage and this saving was achieved largely through avoiding repeated methyl fumigations after failures in the initial treatments were detected. Under this scheme, individual companies from participating countries obtain the accreditation and are listed officially as MB fumigation providers[21]. Other countries, including the Philippines and countries in Central America countries are also being trained under the AFAS scheme.

5.1.2. Bilateral agreements to ensure market access with MB alternatives

Since agricultural products are potential carriers of quarantine pests and pathogens, expanding or maintaining their market access may be a complex process requiring substantial commitment to research and development. Typically, several years are needed to develop an effective disinfestation treatment that is acceptable to an importing country and significant coordination between industry, packing houses, technical providers, fumigators, exporters, regulator bodies and researchers needs to be put in place.

Each importing country has its own quarantine pest list and phytosanitary requirements, which may consist of import permits, phytosanitary certificates, additional declarations and/or treatments and also any other relevant export information and documentation.

The National Plant Protection Organization (NPPO) of the individual exporting countries must negotiate with the importing country authorities to determine acceptable QPS treatments. Required information may include,

- Efficacy tests against a range of life stages of target pest/s which could be present on the exported commodity;
- Tolerance of the product to the selected treatment;
- Acceptability of the treatment by the target market (in particular when a Maximum Residue Limit (MRL) has been established);
- Registration/residue analysis (usually required for chemical treatments);
- Bilateral negotiation of the protocol chosen;
- Industry investment in treatment facilities, logistics and infrastructure;
- Commercialisation of the treatment among interested users

[21] http://www.daff.gov.au/aqis/import/general-info/pre-border/afas/providers

Some importing countries require more intensive and formal experimental (research) procedures to validate proposed treatments, which may include demonstration of Probit 9 (99.9967% pest mortality) level mortality.

Others use a "Systems Approach" that is based on quantitative pest risk analysis including mode and volume of trade and probabilities of infestation by the pest during each step of the harvesting, packing and shipping process. Further, the viability of the pest during these processes, as well as during palletisation and transport to the market and the probability of it establishing and spreading in the destination country are also taken into account.

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Recapture unit for MB.

Accessing and maintaining markets is a complex process requiring short- and long-term planning, good communication and information exchange and effective use of resources, but can be effectively done. Malaysia for example, has recently published the document *"Phytosanitary requirements for commodities granted market access for commodities granted market access through plant quarantine bilateral negotiation 2011"*[22] containing treatments accepted for exported fresh produce by different markets.

5.2. Additional sources of information

A wealth of information on alternatives to methyl bromide, including for QPS uses, has become available during the past two decades. Below are some useful resources on this topic.

[21] Malaysia Crop Protection and Plant Quarantine Division, Department of Agriculture www.doa.gov.my

Pre-shipment flower inspection Costa Rica, lowers risks of MB fumigation upon arrival.

The Protocol's Methyl Bromide Technical Options Committee (MBTOC) conducts very thorough work on methyl bromide use and its alternatives, for both controlled and exempted uses. Quadrennial Assessment Reports (most recent from 2014), yearly Progress Reports and other relevant publications can be accessed and downloaded at the Ozone Secretariat website:

http://ozone.unep.org/new_site/en/assessment_docs.php?committee_id=6&body_id=6&body_full=Methyl%20Bromide%20Technical%20Options%20Committee&body_acronym=MBTOC

UNEP's Ozonaction Programme also offers various reports and other kinds of information on methyl bromide, which can be accessed at: http://www.unep.org/ozonaction/Topics/MethylBromide/tabid/6221/Default.aspx.

Good covers are essential to minimise MB leakage and ensure efficient MB use.

A recent publication addresses the MB phase-out for controlled uses and its remaining challenges in A5 countries: http://www.unep.fr/ozonaction/information/mmcfiles/7674-e-Phasing_out_methyl_bromide_in_developing_countries.pdf

Assistance to A-5 Parties of the Montreal Protocol is provided through Methyl Bromide Officers in UNEP's Compliance Assistance Programme (CAP). Regional offices and contacts may be found at: http://www.unep.org/ozonaction/AboutTheBranch/StaffContacts/tabid/6190/Default.aspx

The Multilateral Fund for the Montreal Protocol offers reports on monitoring and evaluation activities conducted on ODS including MB. These can be consulted at: http://www.multilateralfund.org/Evaluation/evaluationlibrary/default.aspx

UNIDO has developed numerous informative materials, most recently a "Tool-kit for sustainable MB phase-out" https://www.unido.org/fileadmin/user_media_upgrade/What_we_do/Topics/Multilateral_environmental_agreements/UNIDO_TOOLKIT_for_sustainable_MB_phase-out_FIN__2_.pdf

The reader is further directed to the many scientific articles published every year reflecting studies conducted by many research teams around the world, as well as to workshops and scientific meetings periodically held in many countries (see for example www.mbao.org).

About the UNEP DTIE OzonAction Programme

Under the Montreal Protocol on Substances that Deplete the Ozone Layer, countries worldwide are taking specific, time-targeted actions to reduce and eliminate the production and consumption of man-made chemicals that destroy the stratospheric ozone layer, Earth's protective shield.

The objective of the Montreal Protocol is to phase out ozone depleting substances (ODS), which include CFCs, halons, methyl bromide, carbon tetrachloride, methyl chloroform, and HCFCs. One hundred ninety seven governments have joined this multilateral environmental agreement and are taking action.

The UNEP DTIE OzonAction Branch assists developing countries and countries with economies in transition (CEITs) to enable them to achieve and sustain compliance with the Montreal Protocol. With our programme's assistance, countries are able to make informed decisions about alternative technologies, ozone-friendly policies and enforcement activities.

OzonAction has two main areas of work:

- Assisting developing countries in UNEP's capacity as an Implementing Agency of the Multilateral Fund for the Implementation of the Montreal Protocol, through a Compliance Assistance Programme (CAP).
- Specific partnerships with bilateral agencies and Governments.

UNEP's partnerships under the Montreal Protocol contribute to the realisation of the Millennium Development Goals and implementation of the Bali Strategic Plan.

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About the UNEP Division of Technology, Industry and Economics

The UNEP Division of Technology, Industry and Economics (DTIE) helps governments, local authorities and decision-makers in business and industry to develop and implement policies and practices focusing on sustainable development.

The Division works to promote:

> sustainable consumption and production,
> the efficient use of renewable energy,
> adequate management of chemicals,
> the integration of environmental costs in development policies.

The Office of the Director, located in Paris, coordinates activities through:

> The International Environmental Technology Centre - IETC (Osaka, Shiga), which implements integrated waste, water and disaster management programmes, focusing in particular on Asia.
> Sustainable Consumption and Production (Paris), which promotes sustainable consumption and production patterns to contribute to human development through global markets.
> Chemicals (Geneva), which promotes sustainable development by catalysing global actions and building national capacities for the sound management of chemicals and the improvement of chemicals safety worldwide.
> Energy (Paris), which fosters energy and transport policies for sustainable development and encourages investment in renewable energy and energy efficiency.
> OzonAction (Paris), which supports the phase-out of ozone depleting substances in developing countries and countries with economies in transition to ensure implementation of the Montreal Protocol.
> Economics and Trade (Geneva), which helps countries to integrate environmental considerations into economic and trade policies, and works with the finance sector to incorporate sustainable development policies.

UNEP DTIE activities focus on raising awareness, improving the transfer of knowledge and information, fostering technological cooperation and partnerships, and implementing international conventions and agreements.

For more information
see **www.unep.org**

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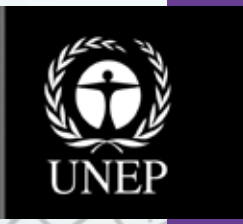

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Under the Montreal Protocol, 1 January 2015 was the deadline for phasing out of controlled uses of methyl bromide. The Protocol however exempts MB use for quarantine and pre-shipment (QPS) applications. Supporting MP compliance, this booklet delivers on the management of data reporting of MB in QPS applications and tracking MB use for this purpose. Detailed information on suitable alternatives to MB is included. It is a useful reference tool for National Ozone Units, bio-security and plant quarantine officers, fumigating companies, students and other stakeholders, promoting transition to more environmentally friendly alternatives.

DTI/2013/PA