

## METHYL BROMIDE – IS PHASE-OUT ON SCHEDULE?

Robert Taylor of the Natural Resources Institute, University of Greenwich in the UK provides an update on how things are progressing under the Montreal Protocol

### Introduction

It is now more than seven years since methyl bromide, a fumigant used worldwide, was identified as an ozone-depleting substance under the provisions of the Montreal Protocol Agreement. During those seven years control programmes for the chemical have been agreed for both developed and developing countries, the last major review occurring in 1997 (Taylor, 1997). As agreed under the Protocol, stepped reductions in the use of methyl bromide have already taken place on schedule in developed countries. There has been no requirement yet under the control

### “USA and the EU have fallen in line with the Montreal Protocol phase-out target of 2005”

programme for reductions in use of the fumigant in developing countries. Most countries using methyl bromide have ratified the agreement on phase-out, but some have yet to do so, the most significant of these being China where recently there has been significantly increased use of the chemical. Concurrent with internationally agreed control programmes, several countries took unilateral decisions to phase out methyl bromide earlier than 2005 as required under the Protocol. The most important of these countries was the USA, which uses about 40% of the annual global consumption of methyl bromide and where, under the Clean Air Act, use and manufacture of the chemical was due to cease from January 2001. In November 1998, however, due probably to the lack of suitable alternatives, the US Congress signed legislation to extend the use of methyl bromide until 2005. This effectively caused the USA to fall into line with countries following the Montreal Protocol Agreement. It is worth noting that the decision to extend usage was taken in the country that to date has put by far the greatest effort and funding into research on alternatives to methyl bromide.

In July 1998 the European Commission adopted proposals for a new Regulation to accelerate the phase-out of methyl bromide with production and use to cease from January 2001, except for certain critical exemptions. However, the 2001 phase-out date was rejected and the new EC Regulation, which is unlikely to come into force until 2001, will be broadly in line with the Montreal Protocol control programme for the fumigant. The rejection of an early phase-out in Europe may well have been influenced by the decision taken earlier in the year by the US Congress.

**Table 1. Some of the alternatives to current uses of methyl bromide**

chloropicrin – with or without metham-sodium/dazomet
phosphine – with or without CO <sub>2</sub>
sulfuryl fluoride
carbonyl sulfide
cyanogen
methyl iodide
controlled atmosphere (nitrogen/CO <sub>2</sub> )
IPM

### What are the alternatives to methyl bromide?

The latest information on alternatives to methyl bromide is to be found in the 1998 Report of the Methyl Bromide Technical Options Committee (MBOC, 1998). Excluding uses for quarantine and pre-shipment treatments of commodities not presently controlled under the Protocol, the report indicates that alternatives exist for 95% of the current uses of methyl bromide (Table 1). However, the report stresses that significant effort is required to transfer

### “alternatives exist, but much field use evaluation is needed”

these alternatives to a wider field use. For the treatment of soil, integrated pest management strategies, which may include the use of chemicals, are recommended as the best alternative approach to the use of methyl bromide. Chemicals alone, such as chloropicrin, or in combination with MITC (methyl isothiocyanate) generators (metham sodium and dazomet) are effective in certain situations. It has been stressed repeatedly that before alternatives to methyl bromide for soil treatment are widely adopted they must undergo local evaluation because of the wide variations existing between different countries in relation to soil type, climate, and pest complex.

Adopting alternatives to methyl bromide for disinfecting durable commodities, or buildings, does not present the same need for local evaluation because treatment techniques for these uses are almost always universal in their application. Long before environmental concerns were raised over methyl bromide, phosphine was being adopted worldwide as the major fumigant for durable commodities. This adoption has continued to the extent that methyl

bromide is now little used for treating durable commodities, except where time is a constraint. The major disadvantage of phosphine is the much longer exposure time required for effective control of insect pests. Phosphine, in combination with carbon dioxide (ECO<sub>2</sub>FUME®) and heat, has been evaluated for the disinfection of buildings in North America (Mueller, 1996). ECO<sub>2</sub>FUME® has very recently been registered in the USA for non-food applications. In the most modern food-processing facilities, and in flour mills, IPM systems involving improved cleaning and inspection programmes are already in operation in Europe and North America. This has resulted in fumigation being unnecessary or an infrequent requirement, but in older facilities, where effective cleaning is difficult, fumigation continues to be necessary. Controlled atmospheres employing nitrogen or carbon dioxide, and also the control of humidity/temperature regimes (Thermo Lignum® system), have effectively replaced methyl bromide for the control of pests damaging museum specimens and other valuable artifacts (Kidd, 1999).

Sulfuryl fluoride has been used for many years in the USA to control termites in buildings and has now almost entirely replaced methyl bromide in that country for the fumigation of dwellings. Evaluation of this chemical is in progress in the USA, and elsewhere, for possible wider applications, including the disinfection of flour mills and also timber (Williams and Schneider, 1999). The potential of sulfuryl fluoride to replace methyl bromide for treating food commodities is also being explored (Schneider and Williams, 1999). Several other chemicals are also being investigated as potential alternative commodity fumigants including carbonyl sulphide, cyanogen and methyl iodide. However, the long period required in order to obtain registration remains a constraint even if field trials should demonstrate any of these chemicals to be effective as commodity fumigants.

**Where are the real difficulties likely to be in finding replacements?**

Although replacements for many of the uses of methyl bromide have been identified, there are situations where alternatives are not available, or the particular situation does not allow easy substitution. Table 2 summarises commodities and situations for which no alternative to methyl bromide fumigation has been identified.

**Quarantine and pre-shipment fumigation of commodities**

There are currently no controls on methyl bromide when used for quarantine and pre-shipment purposes because it is widely recognised that restrictions here could pose a threat to international trade. The use of alternative fumigants such as phosphine is likely to result in unacceptable delays and disruption at ports. Concern has been expressed recently, however, regarding the increasing amount of methyl bromide being used for these purposes and consequently excluded from controls. It was reported in 1999 that quarantine and pre-shipment uses now account for 22 percent of global consumption of the fumigant (TEAP, 1999). Although fumigation employed for quarantine purposes is widely understood to be essential to protect local agriculture from exotic pests, and includes almost all treatments of perishable commodities, those undertaken for pre-shipment purposes (mostly of durable commodities) are less clearly defined. As a consequence, it was agreed at the latest meeting of Parties to the Montreal Protocol in December 1999 that the definition of pre-shipment application of methyl bromide should be clarified. In future it will apply only to single treatments conducted prior to export and being required by official agencies of the exporting or importing country (Anon., 1999). In addition, to qualify as a pre-shipment application the fumigation must take place within 21 days of shipment of the commodity. This new agreement is seen as a first step towards closing a loophole that has permitted unlimited use of methyl bromide in particular circumstances. Many of the fumigations previously regarded as pre-shipment treatments were required for commercial/contractual purposes only, and not officially required. Such treatments will no longer be excluded from controls on use of the fumigant.

**The situation in developing countries**

Methyl bromide will not be phased out in developing countries until 2015 under the so-called ‘10-year grace period’ agreed by the Parties to the Montreal Protocol. At an early stage in the development of control programmes for the fumigant it was realised that developing countries would need assistance to enable compliance with phase-out schedules, and a Multilateral Fund was established to support such assistance. The Fund is operated through four Implementing Agencies (three from the United Nations plus the World Bank) with the purposes of disseminating

**Table 2. Commodities and situations where alternatives to fumigation with methyl bromide are not presently available**

Commodities	Other situations
Fresh chestnuts	Flour mills and food processing facilities where IPM systems have failed
Fresh walnuts for immediate sale	Cheese stores containing organophosphate-resistant mites
Oak logs contaminated with oak wilt fungus	Aircraft where hydrogen cyanide is not available, chiefly for the control of rodents
Cotton containing pink bollworm	Military equipment contaminated with soil
Alfalfa and some other seeds containing seed-borne nematodes	Quarantine and pre-shipment treatment of durable and perishable commodities (see next section)

information, including the latest technology, and establishing projects that demonstrate alternative technologies to methyl bromide fumigation. These projects should lead to the countrywide adoption of alternative technologies. Projects are now well established both for soil fumigation

### “there is much concern about the increasing use of methyl bromide in China for soil fumigation”

and for commodity disinfestation in a number of countries. Several developing countries have indicated that projects in progress may result in reductions in the use of methyl bromide, if not total phase-out, in advance of 2015.

The situation in China merits special mention because of the recent dramatic increase in the use of methyl bromide there, both for quarantine purposes and, more significantly, for soil disinfestation. During the period 1998-1999 a three-fold increase took place in the volume of the fumigant used to treat export wood packing materials because of the need to control the Asian Longhorned beetle, *Anoplophora glabripennis* (Yuejin, 2000). Before 1995, there had been very little use of methyl bromide for soil treatment in China, but the introduction of technology permitting local production of the chemical in small cans changed this situation. Individual farmers, growing horticultural crops in plastic greenhouses, were now able to fumigate the soil themselves and to continue crop production throughout the year. This new capability for soil fumigation is finding increasing favour among Chinese farmers, and it is predicted that there will be a 50% increase in the quantity of methyl bromide used to treat soil in China between 1998 and 2000 (Yuejin, 2000). If this increase continues, uncontrolled, the effect will be to partially negate the efforts of other countries to reduce methyl bromide usage.

### Sources of information on methyl bromide and alternatives

One of the most important scientific meetings covering research on alternatives to methyl bromide is the Annual International Research Conference held in the USA. At the 1999 conference in San Diego, in addition to the regular reporting of research findings, a special session organised by the United Nations Environment Programme was devoted to problems of methyl bromide replacement in developing countries. Presentations describing the progress of projects on methyl bromide replacement in several developing countries were given by representatives from the Implementing Agencies of the Multilateral Fund and also from a bilateral agency (Castella Lorenzo 1999; Barakat *et al.*, 1999). Another conference innovation during 1999 was a final summation on progress made to date in seeking alternatives to methyl bromide, and also what still needs to be achieved before phase-out of the chemical. For soil fumigation, it was recorded that many alternatives are available, but the chemical alternatives have rather limited use and they are not user-friendly. For post-harvest disinfestation it

was said that no ‘silver bullet’ alternative is available and although many alternatives have been researched most have disadvantages compared to methyl bromide. In addition, many alternatives are still only at the laboratory stage of development. By 2005 it was expected that there would be a wide gap between what will be needed in order to replace methyl bromide and what will be available.

### Conclusions

The phase-out programme for methyl bromide in developed countries is on schedule with the stepped reductions agreed under the Protocol already taking place. Alternative technologies to methyl bromide fumigation are, however, not readily available in all situations and this may result in the continued use of the chemical for some purposes, notably quarantine and pre-shipment treatments, for a considerable time. For developing countries the adoption of alternatives is expected to follow very much the same pattern as in developed countries, but over a longer time scale. The situation developing in China is, however, more difficult to predict with the potential for increased use of methyl bromide for soil fumigation being very great. It is hoped that a control programme for use of the fumigant in China can be agreed in the near future in order that the efforts of other countries to reduce methyl bromide usage will not be negated. Whether or not there really are sufficient alternatives to methyl bromide to enable phase out of all but the most critical uses by 2005 (for developed countries) is still unclear and there is some pessimism by those directly involved in researching replacements.

### Acknowledgement

This article is an output from a project funded by the UK Department for International Development (DFID) for the benefit of developing countries. The views expressed are not necessarily those of DFID.

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### New Californian restrictions on methyl bromide

On 16 January 2000 the California Department of Pesticide Regulation (DPR) released proposed regulations that will impose mandatory, statewide rules on the use of methyl bromide. The regulations include several new restrictions that will expand the nation's most comprehensive program for regulating the widely-used fumigant.

The proposed regulations will enhance protection for children in schools, establish minimum buffer zones around application sites, and set new limits on work hours for fumigation employees. The regulations would also require that neighbors be notified of a farmer's request to use methyl bromide, and establish the right for those neighbors to be later notified of the fumigation schedule.

The Department is moving forward on the regulations on an expedited schedule due to a court-imposed deadline – a San Francisco Superior Court judge last year ordered the Department to adopt by June 2000 more specific regulations on the field fumigation use of methyl bromide.

Those interested in more detail can obtain copies of the proposed regulations and related documents will be available on DPR's Web site <http://www.cdpr.ca.gov>, or by calling or writing to Fred Bundock, Department of Pesticide Regulation, 830 K Street, Sacramento CA 95814-3510, USA. Tel +1 (916) 324-4194.

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