



Update of Australia’s Critical Uses of Methyl Bromide

INTRODUCTION

In 2005, a strategy to provide for phase-out of critical uses of methyl bromide was developed in order to meet Australia’s international commitments under the Montreal Protocol on Substances that Deplete the Ozone Layer. This strategy is available at www.environment.gov.au/atmosphere/ozone/ods/methylbromide/pubs/critical-uses.pdf.

Since the publishing of the strategy, there has been a substantial reduction in the volume of methyl bromide used for critical uses, with only two industries remaining out of the five industries initially considered in the strategy (Table 1 and Figure 1).

This document is an update of the 2005 strategy and provides the current outlook for soil treatment for strawberry runner production and post harvest fumigation of rice, as at May 2009.

Table 1: Critical uses remaining in Australia

Year	Uses	Total tonnes ^{1,2}
2005	Pre-harvest (soil) uses (strawberry runners; strawberry fruit; and cut flowers) Post-harvest uses (almonds and packaged rice)	119 (147)
2006	Pre-harvest (soil) uses (strawberry runners and cut flowers) Post-harvest uses (almonds, packaged rice)	56 (75)
2007	Pre-harvest (soil) uses (strawberry runners; and cut flowers) Post-harvest uses (packaged rice)	45 (49)
2008	Pre-harvest (soil) uses (strawberry runners and cut flowers) Post-harvest uses (packaged rice)	41 (49)
2009	Pre-harvest (soil) uses (strawberry runners) Post-harvest uses (packaged rice)	n/a (38)
2010	Pre-harvest (soil) uses (strawberry runners) Post-harvest uses (packaged rice)	n/a (36)

1. Volumes given in parentheses are the volumes approved by the parties to the Montreal Protocol
2. n/a – not available

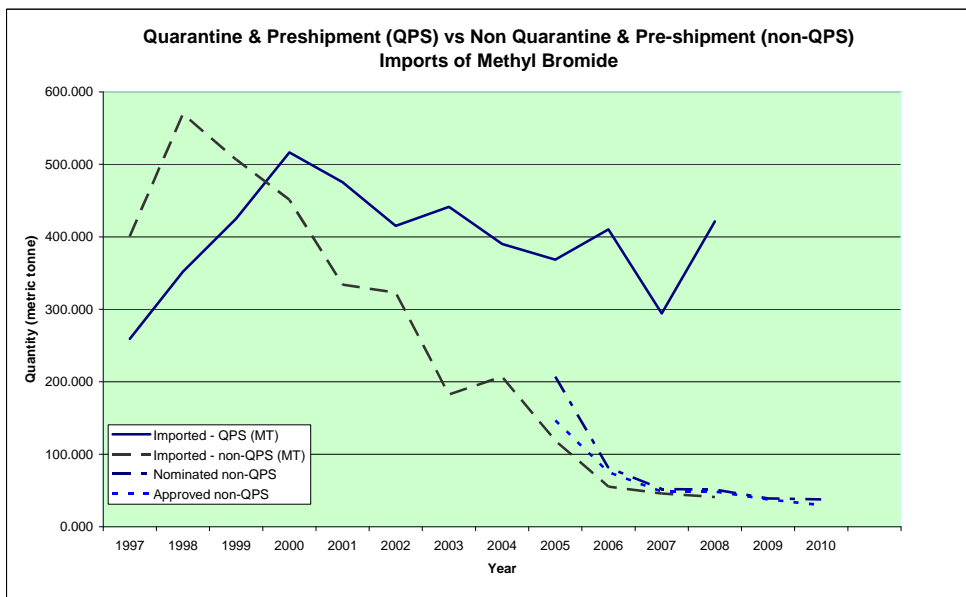


Figure 1: Decline in volume of methyl bromide used for non quarantine & pre-shipment (non-QPS) uses in Australia

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Regulatory context

The regulatory context relating to non quarantine and pre-shipment (non-QPS) uses remains largely unchanged since 2005. The primary mechanism for implementing controls on the import, and subsequent use, of methyl bromide for non-QPS purposes is the Ozone Protection and Synthetic Greenhouse Gas Management Regulations 1995. These Regulations are made under the *Ozone Protection and Synthetic Greenhouse Gas Management Act 1989* which gives effect to Australia's obligations under the Montreal Protocol.

These regulations provide a comprehensive system for the management of methyl bromide in Australia. The Regulations annually authorise non-QPS uses that have been approved by the Parties to the Montreal Protocol, together with individual approved users, approved suppliers and maximum quantities that can be supplied to each user. The Regulations put in place appropriate safeguards against methyl bromide being used for unauthorised non-QPS uses. The Regulations also provide for record keeping and/or reporting obligations for anyone selling and using methyl bromide. The Regulations create offence provisions for the illegal supply or use of methyl bromide.

Through monitoring sales and use of methyl bromide and the introduction of strict liability penalties as a deterrent for non-compliance, the Australian Government is able to ensure that non-QPS quantities imported in to Australia are only sold to approved persons.

Transition plan for packaged rice

The Australian Rice Growers Cooperative (ARGC) is pursuing phosphine fumigation in sealed silos as the most suitable alternative to methyl bromide fumigation. This requires substantial infrastructure development, costed at \$47 million. Under the transition plan, new silos for phosphine would be constructed over three years at the main mill site in Leeton. The plan's delivery within the specified timeframe is dependent upon the ARGC's capacity to source sufficient infrastructure development capital, which is derived from revenue raised from satisfactory rice crop harvest yields.

Unfortunately, drought continues to affect rice crop harvest yields: for 2008 only around 15,000 tonnes (down from an average 1,200,000 tonnes) was harvested while the estimated crop yield in 2009 is 70,000 to 75,000 tonnes and still well below average. Two of the three milling sites remain closed in 2009 with 180 staff made redundant in 2008.

Table 2: Revised illustrative ARGC phosphine transition plan¹

Year	Amount of Methyl Bromide (Tonne)	Reduction (from 9.2 Tonne)
2008	9.20	0% (0%)
2009	7.82	15% (15%)
2010	6.65	15% (18%)
2011	5.66	15% (38%)
2012	5.27	7% (43%)
2013 ²	5.27	0% (43%)
2014	2.64	50% (71%)
2015	1.80	32% (80%)

1. Based on pre-drought yields. 2. As an example only, 2013 is shown with no reduction under a scenario of no capital investment because of poor yields due to drought.

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The ARGC will reduce the volume of methyl bromide by 15 per cent to 7.82 tonnes and 6.65 tonnes in 2009 and 2010, respectively, as required by the Parties to the Montreal Protocol, and is proposing a further 15% reduction in 2011 in accordance with their revised phosphine transition plan given in Table 2. The schedule could potentially be delayed if crop yields remain below average as sufficient investment capital may not be available (as illustrated in Table 2 by the year 2013).

The most promising alternative to methyl bromide and phosphine continues to be sulfuryl fluoride. Sulfuryl fluoride was registered in Australia in late 2007 although issues concerning whether the label would allow its use for packaged rice still need to be resolved. Trials were not conducted in 2008 but are now organised for 2009 through to 2011 as shown in Table 3. Should trials of sulfuryl fluoride prove successful and labelling issues resolved, the ARGC will review its phosphine transition plan to determine any capabilities for adopting sulfuryl fluoride ahead of phosphine. If sulfuryl fluoride can be used, ARGC is proposing the transition plan as given in Table 3.

Table 3: ARGC proposed sulfuryl fluoride trial and transition plan (pending trial success)

Year	Activity	Amount of Methyl Bromide Required (Tonnes)
2009	Trials	7.82
2010	Trials	6.65
2011	Trials/Transition	5.66
2012	Transition	0

The ARGC has implemented recapture and destruction technology developed by Nordiko Quarantine Systems at one site. The Nordiko system was reviewed by the Technology and Economic Assessment Panel (a subsidiary of the Montreal Protocol) which found that the system met the efficacy criteria for destruction. The scrubbing equipment was installed in early November 2006 and trials and monitoring have indicated that 90 to 95 per cent of the methyl bromide left after fumigation (around 80 per cent of the gas introduced) is being captured and destroyed¹. The site at which these facilities has been installed accounts for approximately 50 per cent of all non-QPS methyl bromide use (under non-drought conditions) and as such reduce ARGC's emissions of total non-QPS methyl bromide by 45 to 50%. In years of lower production such as 2008 and 2009 in which two mill sites were closed, the site would account for all production and would therefore reduce emissions by around 55-65%.

Australian rice growers have also adopted a vast array of Quality Assurance programs to improve product quality and avoid unforeseen increases in methyl bromide use. Specifically, Australian rice growers have employed Good Manufacturing Practices (GMPs), Hazard Analysis and Critical Control Point (HACCP) systems, Master Cleaning Schedules and Integrated Pest Management (IPM) including chemical treatment, onto all ARGC sites, including all facets of the supply chain. Recently Australian rice growers implemented American Institute of Baking (AIB) accreditation with all mills now certified to this standard. These programs contribute to overall insect control throughout the entire ARGC supply chain.

ARGC also bases methyl bromide requirements on 20g/m³ as recommended by MBTOC. This represents a reduction from a historical rate of 48g/m³ and hence a substantial reduction in ARGC's methyl bromide emissions.

¹ ie, of the introduced volume, around 80% is left and of that 80%, 90-95% is recaptured (ie 72-76% of total volume introduced).

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Several alternatives have been considered but were found to be neither economically or technically feasible:

- Residue problems have been experienced with ethyl formate, and the high flammability of this gas creates excessive fire risks. There are also doubts about ethyl formate's pest control efficacy for rice. The gas is registered in New South Wales for use on dried fruit only.
- Vapormate (ethyl formate:carbon dioxide 2%:98% mix) is currently only registered for adult stages of insects. Due to the reduced grain size and higher bulk density, movement of the gas is inhibited resulting in very low concentrations at the bag opening. Insect mortality rate observed during testing ranged between 0-100 per cent, confirming that all spaces in the bag were not reached using Vapormate.
- Carbonyl sulphide was found to be technically unfeasible. Sorption studies highlighted that significantly higher dosages were required for various rice commodities, as well as problems with organoleptic (taste and smell) perception due to residues.
- Cold disinfestation has also been considered. During the trial, it took three weeks to establish -20°C in 1 tonne bulkers. Costs associated with constructing sufficient cold storage facilities would require an expansion of warehouse space of up to 200 per cent. Such costs are expected to easily exceed \$100 million.
- Packaging alteration with oxygen scavenging has also been considered as an alternative for rice storage. It is not considered economically feasible due to substantial increases in operating costs (from \$8.88 million to \$31.11 million per year).

Strawberry runner production

Strawberry runner growers use methyl bromide as a soil fumigant. This minimises the risk of pest infestations and disease because methyl bromide creates a partially sterile soil matrix. Pests, weeds and pathogens in the soil are reduced to a very low level. Without this treatment, pest, weed and disease infestations can cause significant production and quality losses in fruit production.

In Queensland, the strawberry runner industry stopped using methyl bromide in 2008. The primary chemical alternative is Telone² (1,3-dichloropropene, Dow Agrosiences).

Victorian growers, represented by the Toolangi Certified Strawberry Runners Growers Cooperative (TCSRGC), have expressed concerns about the efficacy of Telone in their cooler and wetter climate. These concerns are based on trials carried out by the Victorian Department of Primary Industries (Vic DPI) over a number of years on Telone C-35 and fumigants such as chloropicrin and iodomethane, and combinations of these compounds. Vic DPI concluded that “in trials conducted in cold (<10 °C), wet and/or compacted soils, these fumigants [that is, Telone and chloropicrin] resulted in crop phytotoxicity; lower yields; and/or inferior pathogen, weed, and disease control compared with MB [methyl bromide]” (Mattner *et al* 2008)³.

This variability in plant growth and pest control could prevent runner crops grown in soils treated with Telone C-35 from meeting industry certification standards. Consequently, further research into improving the efficacy of Telone C-35 for cool climate applications is required, and the associated problems resolved, before Telone C-35 can be considered an acceptable alternative for use by the Victorian runner industry.

The chemical alternative of most interest to TCSRGC is iodomethane (IM; methyl iodide) which is being trialled under permit in commercial scale up trials. Registration of iodomethane products in Australia by Arysta LifeScience North America Corporation is currently under consideration by the Australian Pesticide and Veterinary Medicine Authority (APVMA). The products also contain chloropicrin (Pic).

Two formulations are being considered:

1. **Iodane 500 Soil Fumigant:** 500 g/kg chloropicrin (Pic) and 500g/kg iodomethane liquid fumigant product (Application Summary at www.apvma.gov.au/data_protection/39862.pdf).
2. **Iodane 330 Soil Fumigant** 670 g/kg chloropicrin and 330 g/kg iodomethane liquid fumigant product (Application Summary at www.apvma.gov.au/data_protection/39861.pdf).

Trials from 2007 indicate “Formulations of IM:Pic (30:70 and 50:50, 500 kg/ha) controlled weeds to the same levels as MB:Pic(50:50). IM:Pic (30:70 and 50:50, 500 kg / ha) also gave equivalent control of key strawberry pathogens to MB:Pic (50:50)” (Mann et al, 2007)⁴.

Projects to further assess and improve the comparative efficacy of iodomethane:chloropicrin (IM:Pic 50:50) are continuing in 3 commercial scale up trials over 2008-2009 and in associated small plot experiments. As an adjunct to the IM:Pic trials, the TCSRGC and other stakeholders are

² Also Telone C35, a mixture of 1,3-dichloropropene (615g/kg) and chloropicrin (345g/kg)

³ S. Mattner, I. J. Porter, R. Gounder, R. Mann, E. Williams, M. Milinkovic, I. Horner, E. Bigwood, P. Frase, and S. Coram. 2008. Breaking the critical-use barriers preventing Australian horticulture from phasing out methyl bromide. Horticulture Australia Project: BS04009, May 2008. Department of Primary Industries, Victoria.

⁴ R.C. Mann, S.W. Mattner, R.K. Gounder, and I.J. Porter. 2007. Annual International Research Conference on Methyl Bromide Alternatives and Emissions Reductions, San Diego, USA. “Iodomethane offers opportunities for methyl bromide phase out and soil disinfestation in Australia”. www.mbao.org/

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also researching the efficacy and plant yields for reduced application rate of MB:Pic formulations. These compare application rates of MB:Pic (50:50) @ 500kg/ha with 375kg/ha, (equivalent to 25g/m² to 18.75g/m²). Trials completed thus far indicate comparable efficacy and yield results for both dosage rates. Data sets from trials over two seasons, however, are needed to satisfy the minimum regulatory requirements. Any rate reduction will have to be approved by the APVMA in order to change the label rate. Industry considers that, subject to APVMA approval, this will result in a reduced requirement for methyl bromide in 2010 or 2011 if alternatives have not yet been made commercially available.

The use of IM:Pic also has implications for interstate market access and quarantine matters which require resolution. Arysta Life Sciences has confirmed its intention to pursue commercial development of IM:Pic, pending resolution of APVMA approval and interstate market access issues. It is anticipated that data from the second round of trials will provide supplementary information for APVMA. Arysta Life Sciences is currently working with the industry and key government agencies to address interstate market access issues, including preparation of a technical paper.

Results from previously conducted trials have suggested ethanedinitrile (EDN, Linde AG) may be a promising possible alternative to methyl bromide. An Application Summary for EDN in the product STERIGAS 1000 was lodged by Linde AG with the APVMA in September 2007 (www.apvma.gov.au/data_protection/37416.pdf).

A two-year research program (2007 -2009), managed and operated by VSICA and funded in collaboration with Horticulture Australia, is investigating the use of soil-less systems to produce strawberry runner foundation stock. The program aims to provide data for development of the biological, biosecurity, hygiene and economic protocols necessary to design a full-scale system at Toolangi. Design specifications are anticipated by 2009/10. Building the facility and commissioning of commercial production, anticipated by 2010/11, is subject to resolution of site issues with Victorian government. This system may prove suitable for foundation stock, given the relatively small numbers, but economic feasibility for commercial growers is still to be determined.

Given the progress on alternatives as discussed above, the TCSRGC believes that there is potential to completely phase out the industry's reliance on methyl bromide by 2016 or earlier if certain conditions can be met. This will require further planning with fumigation contractors, Arysta Life Sciences, the fruit industry and members of TCSRGC, and be based on a transition to IM:Pic and a reduction of MB:Pic application rates.

The transition to alternatives could be achieved either by a phased reduction process or a direct transition in a specified year. These are outlined below as options 1 and 2, respectively.

Option 1: Phased reduction would require transition to alternatives over a five year period commencing in 2012. Each successive year would see, on average, a 20 per cent decrease in the baseline volume of 29.79 tonnes, as the approved 2011 CUE volume.

Table 4: TCSRGC proposed methyl iodide transition plan (option 1)

Year	Anticipated quantity sought	Percentage reduction
2011	29.79	0
2012	23.832	20
2013	17.874	40
2014	11.916	60
2015	5.958	80
2016	0	100

This timeframe is indicative only and depends on the progression and resolution of associated issues mentioned above, as well those that pertain to application techniques and logistical issues (i.e. cost,

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supply and distribution). It is therefore not expected to be able to achieve reductions in nominated volumes before at least 2012.

Option 2: If proposed phased transition cannot be achieved because of difficult logistical issues but all other matters have been resolved (eg the IM:Pic products are registered), then the industry could potentially make a 100% transition to alternatives with a nil requirement for methyl bromide. As indicated above, approval of formulations of IM:Pic, by Australian authorities, is critical in any transition and this is not expected before at least 2012. The earliest a 100% transition could therefore commence would be 2013.

From a desktop perspective TCSRGC would prefer option 1 but this is likely not able to be achieved without detailed and costly planning that would be required to deal with complicated logistical problems. Major factors to resolve include:

- Contractor difficulties in fumigating appropriate land areas of TCSRGC members with either MB:Pic or the reduced rate formulation that equates to the allocation of the correct proportion of MB:Pic, and the alternative treatment, among members of TCSRGC.
- Segregating and labelling runners from the different fumigant treatments at each of the nine members of TCSRGC; and maintaining the segregation at central packing facilities.
- Ensuring consignments to national fruit industry clients comprise the correct proportion of runners grown in MB:Pic treated soil and soil treated with the alternative treatment.
- Client communications that explain the need for an equitable method of allocation of runners treated by MB:Pic and the approved alternative, and of how TCSRGC will calculate the variation in costs.
- Adjusting all of the issues referred to above over the phase out period.

TCSRGC will continue to try and resolve the above concerns but it remains that that the only practical solution might be to make a clean transition to the alternative treatment at a prescribed time when the new product has “passed” all regulatory, technical approvals and is commercially available.