METHYL BROMIDE CRITICAL USE NOMINATION FOR POST HARVEST USE BY NPMA FOR FACILITIES AND COMMODITIES

FOR ADMINISTRATIVE PURPOSES ONLY: **DATE RECEIVED BY OZONE SECRETARIAT:** ***YEAR:*** ***CUN:***

NOMINATING PARTY:	The United States of America
BRIEF DESCRIPTIVE TITLE OF NOMINATION:	Methyl Bromide Critical Use Nomination for Post Harvest Use by NPMA for Facilities and Commodities.

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Following the requirements of Decision IX/6 paragraph (a)(1), the United States of America has determined that the specific use detailed in this Critical use Nomination is critical because the lack of availability of methyl bromide for this use would result in a significant market disruption.

X Yes ☐ No

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LIST OF DOCUMENTS SENT TO THE OZONE SECRETARIAT IN OFFICIAL NOMINATION PACKAGE

List all paper and electronic documents submitted by the Nominating Party to the Ozone Secretariat

1. PAPER DOCUMENTS: **Title of Paper Documents and Appendices**	**Number of Pages**	**Date Sent to Ozone Secretariat**

2. ELECTRONIC COPIES OF ALL PAPER DOCUMENTS: **Title of Electronic Files**	**Size of File (kb)**	**Date Sent to Ozone Secretariat**

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PART A: SUMMARY

1. NOMINATING PARTY

The United States of America (U. S.)

2. DESCRIPTIVE TITLE OF NOMINATION

Methyl Bromide Critical Use Nomination For Post-Harvest Use By NPMA For Facilities and Commodities

3. SITUATION OF NOMINATED METHYL BROMIDE USE

This sector includes commodities and food processing plants treated by National Pest Management Association members. Commodities included in this application are; processed foods (such as chips, crackers, cookies and pasta), spices and herbs, cocoa, dried milk, tea pellets, coffee beans, tomato and bell peppers, citrus and cassava. Methyl bromide is typically utilized in processed food and feed facilities as a space fumigant for treating the facility 1 to 3 times per year. As the need arises, methyl bromide is also used for trailer fumigations of product or packaging material. These facilities are under intense pressure from many insect pests as well as rodents.

4. METHYL BROMIDE NOMINATED FOR POST-HARVEST USE (COMMODITIES AND FACILITIES) NOT INCLUDED IN OTHER CHAPTERS

TABLE 4.1: METHYL BROMIDE NOMINATED FOR POST-HARVEST USE (COMMODITIES AND FACILITIES) NOT INCLUDED IN OTHER CHAPTERS

YEAR	NOMINATION AMOUNT (KG)	NOMINATION VOLUME (1000 M^3)
2006	**181,079**	**7,536**

5. BRIEF SUMMARY OF THE NEED FOR METHYL BROMIDE AS A CRITICAL USE

The US nomination is only for those uses where the alternatives are not suitable. In the U.S. there are a number of factors that make the potential alternatives to methyl bromide unsuitable for use on structures and commodities. These include:

- pest control efficacy of alternatives: the efficacy of alternatives may not be comparable to methyl bromide in some areas, making these alternatives technically and/or economically infeasible
- technical difficulties in adopting alternatives, for example heat may not be suitable for wood frame buildings or commodities with high oil content (development of rancidity)
- regulatory concerns, such as the adoption of a new fumigant such as sulfuryl fluoride that may not be registered in all states

COMMODITIES: Methyl Bromide fumigation for commodities occurs to ensure pest-free food and meet the strict requirements of the Food Sanitation Regulations. The uses listed in this chapter, processed foods (chips, cookies, crackers, pasta, etc.), spices and herbs, cocoa, dried milk, cheese, tea pellets, coffee beans, have no technically feasible alternative that can be used without incurring significant economic losses. Phosphine alone or combined with carbon dioxide is the only chemical alternative currently available for use on these commodities. Phosphine fumigations, however, take much longer than methyl bromide fumigations and are not a feasible alternative when rapid fumigations are needed. Harvest of commodities occurs in autumn, when temperatures are falling, making temperature-dependent phosphine fumigation less likely. These sectors are already using phosphine alone or in combination to the extent that their processing systems and marketing needs allow it. Any additional shifting from methyl bromide to the slower phosphine fumigation would result in disruption of commodity processing during peak production times, lost market windows, and substantial economic losses. In addition, adoption of not in kind alternatives, such as controlled atmospheres, cold, and carbon dioxide under pressure, would require major investments for appropriate treatment units and /or retrofitting of existing warehouses.

FACILITIES: Food processing facilities in the United States have reduced the number of methyl bromide fumigations by incorporating many of the alternatives identified by MBTOC. Most important have been implementing IPM strategies, especially sanitation, in all areas of a facility. Plants are now being monitored for pest populations, using visual inspections, pheromone traps, light traps and electrocution traps. When insect pests are found, plants will attempt to contain the infestation with treatments of low volatility pesticides applied to both surfaces and cracks and crevices. These techniques do not disinfest a facility but are critical in monitoring and managing pests.

Facilities in the United States also are using both phosphine and heat treatments to disinfest at least portions of their plants. Phosphine, both alone and in combination with carbon dioxide, is often used to treat incoming grain and some finished products. Unfortunately, phosphine is corrosive to copper, silver, gold and their alloys. These metals are critical components of both the computers that run the machines as well as some of the machines in the plants. Therefore, phosphine is not feasible in all areas of food processing facilities. Additionally, phosphine requires more time to kill insect pests than does methyl bromide, so plants will need to be shut down longer to achieve mortality, with associated economic losses from this downtime. There are also reports of stored product pests becoming resist to phosphine.

There are a number of limitations associated with the use of heat in this industry. Not all areas of a plant can be efficiently fumigated with heat. Some food substances, for instance cheeses will go rancid with heat treatments. Not all finished food products can be heated for the length of time heat is required for efficient kill of pests. In addition, geography of the United States plays a crucial role in the use of heat treatment. Food processing plants in the northern United States will experience winters with several weeks of sustaining temperatures of -32° to -35° C (-30° to -25° F). In these areas plants have heaters and the power plants have the capability to supply excess power as needed. However, the southern and parts of the western zones of the United States are geographically quite different. Winter temperatures there seldom reach –1.2° C (30° F) and when temperatures should fall that low, it is typically for only a few hours one night. Most winters some of these warmer areas of the U. S. don't freeze at all. Subsequently, these facilities do not have heaters, nor do the power plants have sufficient power to allow them to heat such large areas and sustain the temperatures necessary for a kill. Additionally, escaping insects can survive these outdoor temperatures and re-enter the facility after treatment, even when low volatility pesticides are used to treat the surfaces existing in the plant. Still, many southern and western facilities use heat treatments as a spot treatment whereas some northern facilities use heat treatments for all or parts of their plants.

By utilizing all these options, facilities in the U. S. have been able to reduce the number of methyl bromide fumigations from an average of 6 times a year to an average of two times in the south and west and once every 3 to 5 years in the north. The U.S. CUE nomination in this sector only includes a request for methyl bromide use where use of alternatives is limited for the reasons described above. There are many food processing facilities in the United States for which we are not requesting methyl bromide use because they have been able to successfully implement alternatives.

TABLE A.1: EXECUTIVE SUMMARY*

		Processed Foods (chips, cookies, crackers, Pasta, etc)	Spices and Herbs	Cocoa	Dried Milk	Cheese processing Plants	Other Commodity[1]
AMOUNT OF REQUEST							
2005	Kilograms (kg)	94,226	10,936	89,022	1,320	3,856	4,794
2005	Application Rate (kg/1000m^3)	24.03	48.05	48.05	24.03	24.03	48.05
2005	Volume (1000m^3)	3921	228	1853	55	160	100
2006	Kilograms (kg)	93,442	9,938	85,393	503	3,856	4,905
2006	Application Rate (kg/1000m^3)	24.03	48.05	48.05	24.03	24.03	48.05
2006	Volume (1000m^3)	3,893	207	1,777	21	160	102
Nominated Amount							
2006 Nominated Amount (kg)		89,861	5,869	76,899	503	3,596	4,352
ECONOMICS							
Marginal Strategy		Unknown					
Time Lost		Not Provided by Applicant					
Loss per 1000 m^3							
Loss per kg MB (US$/kg)							
Loss as % of Gross Revenue (%)							
Loss as % of Net Revenue (%)							

*See Appendix B for complete description of how the nominated amount was calculated.

[1] Includes tea on pallets, coffee beans, tomatoes, bell peppers, citrus and cassava.

6. METHYL BROMIDE CONSUMPTION FOR PAST 5 YEARS AND AMOUNT REQUESTED IN THE YEAR(S) NOMINATED FOR POST HARVEST USE (COMMODITIES AND FACILITIES) NOT INCLUDED IN OTHER CHAPTERS

TABLE 6.1: METHYL BROMIDE CONSUMPTION FOR THE PAST 5 YEARS AND THE AMOUNT REQUESTED IN THE YEAR(S) NOMINATED FOR POST HARVEST USE (COMMODITES AND FACILITIES) NOT INCLUDED IN OTHER CHAPTERS*

	HISTORICAL USE						REQUESTED USE	
For each year specify:	**1997****	**1998****	**1999**	**2000**	**2001**	**2002**	**2005**	**2006**
Amount of MB (kg)			220,300	219,616	193149	217,636	204,153	198,037
Volume Treated (1000 m³)			7,020	8,037	6,791	8,293	8,497	8,245
Formulation of MB	The applicant did not provide any information on formulation						Unknown	
Dosage Rate (kg/1000 m³)			24.03	24.03	24.03	24.03	24.03	24.03
Actual (A) Estimate (E)	Unknown						Unknown	

*Based on most current information.
** No data from NPMA for 1997 & 1998.

7. LOCATION OF THE FACILITY OR FACILITIES WHERE THE PROPOSED CRITICAL USE OF METHYL BROMIDE WILL TAKE PLACE

This nomination package represents a wide variety of food processing and commodity facilities. The location of each facility where methyl bromide fumigations may take place was not requested by the U.S. Government in the forms filled out by the applicants. Therefore, we currently do not have a complete listing of the actual addresses for each facility.

TABLE A.2 2005 REQUEST - POST HARVEST USE (COMMODITIES AND FACILITIES) NOT INCLUDED IN OTHER CHAPTERS*

2005 Request - Post Harvest Use for Food Processing Plants (otherwise not included)		Processed Foods (chips, crackers, cookies, pasta)	Spices and Herbs	Cocoa	Dried Milk	Cheese Processing Plants	Other Commodity[1]
Applicant Request for 2005	Requested Kilograms (kg)	94,226	10,936	89,022	1,320	3,856	4,794
	Requested Application Rate (g/m^3)	24.03	48.05	48.05	24.03	24.03	48.05
	Requested Area (1000 m^3)	3,921	228	1853	55	160	100

[1] Includes tea on pallets, coffee beans, tomatoes, bell peppers, citrus and cassava.

*See Appendix B for complete description of how the nominated amount was calculated.

TABLE A.3 2006 NOMINATION – POST-HARVEST USE (COMMODITIES AND FACILITIES) NOT INCLUDED IN OTHER CHAPTERS*

2006 Nomination - Post Harvest Use for Food Processing Plants (otherwise not included)		**Processed Foods (chips, crackers, cookies, pasta)**	**Spices and Herbs**	**Cocoa**	**Dried Milk**	**Cheese Processing Plants**	**Other Commodity[1]**
Applicant Request for 2006	Requested Kilograms (kg)	93,442	9,938	85,393	503	3,856	4,905
	Requested Application Rate (g/m^3)	24.03	48.05	48.05	24.03	24.03	48.05
	Requested Area (1000 m^3)	3,893	207	1,777	21	160	102
CUE Nominated for 2006	Nominated Volume (1000 m^3)	3,893	207	1,777	21	160	102
	Nominated Application Rate (g/m^3)	24.03	48.05	48.05	24.03	24.03	48.05
	Nominated Kilograms (kg)	93,442	9,938	85,393	503	3,856	4,905

2006 Sector Nomination Totals	Overall Percent Reduction (%)	**9**
	Total 2006 U.S. Sector Nominated Kilograms (kg)	**181,079**

[1] Includes tea on pallets, coffee beans, tomatoes, bell peppers, citrus and cassava.

* See Appendix B for complete description of how the nominated amount was calculated.

PART B: SITUATION CHARACTERISTICS AND METHYL BROMIDE USE

8. KEY PESTS FOR WHICH METHYL BROMIDE IS REQUESTED:

TABLE 8.1: KEY PESTS FOR METHYL BROMIDE REQUEST: FACILITIES

GENUS AND SPECIES OF MAJOR PESTS FOR WHICH THE USE OF METHYL BROMIDE IS CRITICAL	COMMON NAME	SPECIFIC REASON WHY METHYL BROMIDE IS NEEDED
Tribolium confusum	Confused flour beetle	Pest status is due to health hazard: allergens; plus body parts, exuviae, and excretia violate FDA regulations[1]. Methyl bromide is needed because these insects can occur in areas with electronic equipment and materials that cannot tolerate high temperatures (i.e. cooking) so phosphine and heat are not completely adequate.
Tribolium castaneum	Red flour beetle	
Trogoderma variable	Warehouse beetle	Health hazard: choking and allergens; plus body parts, exuviae, and excretia violate FDA regulations. Methyl bromide is needed because these insects can occur in areas with electronic equipment and materials that cannot tolerate high temperatures (i.e. cooking) so phosphine and heat are not completely adequate.
Lasioderma serricorne	Cigarette beetle	Food contamination violates FDA regulations. Methyl bromide is needed because these insects can occur in areas with electronic equipment and materials that cannot tolerate high temperatures (i.e. cooking of some products; oils and butter go rancid with heat) so phosphine and heat are not completely adequate.
Sitophilus oryzae	Rice weevil	
Plodia interpunctella	Indianmeal moth	
Oryzaephilus mercator	Merchant grain beetle	
Cryptolestes pusillus	Flat grain beetle	

[1] FDA regulations can be found at: http://www.fda.gov/opacom/laws/fdcact/fdcact4.htm and http://www.cfsan.fda.gov/~dms/dalbook.html.

TABLE 8.2: KEY PESTS FOR METHYL BROMIDE REQUEST: COMMODITIES

GENUS AND SPECIES FOR WHICH THE USE OF METHYL BROMIDE IS CRITICAL	COMMON NAME	SPECIFIC REASON WHY METHYL BROMIDE IS NEEDED
Cydia pomonella	Codling moth	MB is used mainly where rapid fumigations are needed to meet customer timelines during critical market windows and peak production periods. During peak production months, phosphine fumigation takes three times longer than conventional MB fumigation and 17 times longer than vacuum MB fumigation. The required duration of phosphine fumigation increases as commodity temperature decreases, making its use impractical during the cold winter months. No technically or economically feasible alternatives exist at present during these critical periods.
Amyelois transitella	Navel orangeworm	
Plodia interpunctella	Indianmeal moth	
Tribolium castaneum	Red Flour Beetle	
Cadra figulilella	Raisin Moth	
Carpophilus sp.	Dried Fruit Beetle	
Ectomyelois ceratoniae	Carob pod moth	
Carpophilus spp., *Haptoncus* spp.	Nitidulid beetles	

TABLE B.1: CHARACTERISTIC OF SECTOR - FACILITIES

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Harvest or Raw Material In	X	X	X	X	X	X	X	X	X	X	X	X
Fumigation Schedule (MB)*					X				X			
Retail Target Market Window	N/A											

* Plants in the southern United States may fumigate twice a year; plants in the northern United States may fumigate once every 3 years. However, fumigations may occur whenever a population explosion occurs.

TABLE B.2: CHARACTERISTIC OF SECTOR: COMMODITIES

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fumigation Schedule (MB): All Commodities	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Retail Target Market Window: All Commodities	**X**									**X**	**X**	**X**

Although fumigations may occur whenever a pest population explosion occurs, ideally food-processing plants will be fumigated with methyl bromide on 3-day holiday weekends just prior to the summer and at summer's end. This maximizes efficiency since the facilities are usually closed and workers are not present; and prior to very warm temperatures that increases insect pressure.

9. SUMMARY OF THE CIRCUMSTANCES IN WHICH THE METHYL BROMIDE IS CURRENTLY BEING USED

TABLE 9.1: (a) FOOD PROCESSING PLANTS

CUE	MB DOSAGE (*kg/1000m³*)	EXPOSURE TIME (*hours*)	TEMP (*°C*)	NUMBER OF FUMIGATIONS PER YEAR	PROPORTION OF FACILITY TREATED AT THIS DOSE	FIXED (F) MOBILE (M) STACK (S)
National Pest Management Association	Ave. 24-48	24 hrs		1-3	60-100%	F, M

TABLE 9.1: (b) FIXED FACILITIES

CUE	TYPE OF CONSTRUCTION AND APPROXIMATE AGE IN YEARS	VOLUME (1,000*m³*) OR RANGE	NUMBER OF FACILITIES	GASTIGHTNESS ESTIMATE
National Pest Management Association	5-10% 1-15 yrs old typically newer structures are tilt-up concrete construction. 80% 15-75 yrs old, combination of metal, wood, brick and concrete. 5-10% 75+ years old, combination of construction materials and methods.	Not available	Not available	Tilt-up concrete – good to medium Metal, wood, brick construction – medium to poor. Trailers/containers – good to poor, must be inspected prior to treatment.

10. List Alternative Techniques that are being Used to Control Key Target Pest Species in this Sector

Many of the MBTOC not in kind alternatives to methyl bromide are critical to monitoring pest populations and managing those populations, but they do not render a facility free of pests. . The most critical of these are: sanitation and IPM strategies. Sanitation is important and constantly addressed in management programs (Arthur and Phillips 2003). Cleaning and hygiene practices alone do not reduce pest populations, but reportedly improve the efficacy of insecticides or diatomaceous earth (Arthur and Phillips 2003). The principles of IPM are to utilize all available chemical, cultural, biological, and mechanical pest control practices. These include pheromone traps, electrocution traps, and light traps to monitor pest populations. If pests are found in traps, then contact insecticides and low volatility pesticides are applied in spot treatments for surfaces, cracks and crevices, or anywhere the pests may be hiding. These applications are intended to restrict pests from spreading throughout the facility to try to avoid a plant fumigation (Arthur and Phillips 2003). However, IPM is not designed to completely eliminate pests from any given facility or to ensure that a facility remains free from infestation. In addition a major problem is the infestation of equipment and bins where there are no legal pesticides for those use sites other than the fumigants. Although FDA allows minimal contamination of food products, there is a zero tolerance for insects imposed by market demands, therefore, neither sanitation nor IPM is acceptable as an alternative to methyl bromide fumigation; but these strategies are used to manage pest populations and extend the time between methyl bromide fumigations.

In addition to sanitation and IPM, most food processing manufacturers in the United States currently use both phosphine, alone and in combination with carbon dioxide, and heat to fumigate their facilities. Many of the facilities treat incoming grains and their storage facilities with phosphine, but the corrosive nature of phosphine limits its use throughout the entire plant, especially in areas with electronic components. Phosphine is problematic in that some stored product pests are already becoming resistant to this chemical. Some facilities, probably due to construction, are unable to use phosphine and/or heat. Facilities in the southern and western parts of the United States do not have heat sources on the premises thereby making heat fumigations impractical. Additionally, heat is a problem causing rancidity in butters and oils and denaturing proteins that may be used in the facility. Yet, there are plants in the U.S. that have incorporated both fumigation techniques and still need to fumigate with methyl bromide although they have been able to lengthen times between methyl bromide applications, thereby reducing the amount of methyl bromide used.

PART C: TECHNICAL VALIDATION

11. SUMMARIZE THE ALTERNATIVE(S) TESTED, STARTING WITH THE MOST PROMISING ALTERNATIVE(S)

Table 11.1: Summary of the Alternatives Tested

PEST	STUDY TYPE	RESULTS	CITATION
T. castaneum	Pilot feed and flour mills;	Insects contained in plastic boxes. Non-uniform heat. Number of hours to reach 50° C varied between the mills and within mills. 100% mortality at most locations of 50-60°C for 52 hrs. Old instars and pupae more heat tolerant	Mahroof, et al. 2003
T. castaneum	Lab	Mortality of each life stage increased with increase in temperature and exposure time. Young larvae most heat- tolerant and required 7.2 hr at >50°C.	Mahroof, et al. 2003
T. castaneum & T. confusum	Lab	Mortality increased as temperature increased and decreased as humidity increased. Mortality at one week was greater than initial mortality probably due to delayed effects of DE. *T. confusum* mortality lower than *T. castaneum.*	Arthur 2000
Rhyzopertha dominica; P. interpunctella; & T. castaneum	Lab	Initial investigation of volatiles from mountain sagebrush demonstrated some activity in against these insects in bioassays. No indication of whether this is really a potential alternative	Dunkel & Sears 1998
T. confusum	2nd & 3rd floors of a Pilot flour mill	Adult insects in open rings placed in mill. 100% mortality of beetles in 25 hr on the north end of the 3rd floor, but south end of 2nd floor had only 75% mortality with full DE and 50% mortality with partial DE after 64 hr.	Dowdy & Fields 2002
Ephestia kuehniella	Lab	Efficacy was influenced by age of the medium with DE when investigated under driest conditions (58% rh). But this is not a pest of concern in the U. S.	Nielsen 1998
T. castaneum & T. confusum	Lab	Field collected flour beetles demonstrated varying degrees of resistance to several pesticides: malathion, chlorpyrifos, dichlorvos, phosphine, but not to resmethrin. *T. castaneum* more resistant than *confusum*.	Zettler 1991
T. castaneum & T. confusum	Lab	Malathion-resistant flour beetles were susceptible to cyfluthrin treated steel panels. Longer residuals on unpainted panels than on painted panels	Arthur 1992

TABLE 11.2: SUMMARY OF REVIEW OR POSITION PAPERS CONCERNING ALTERNATIVES FOR STORED PRODUCT PESTS

SYNOPSIS OF REVIEW OR POSITION PAPERS	CITATION
Review of methyl bromide alternatives for stored product insects: Heat: gradients in buildings, insect refugia, rate can be problematic due to structures, some equipment heat sensitive, plastics warp, dust explosions, sugar, oils, butter & adhesives removed, not all food products can be heated; phosphine: activity slow, flammability above concentrations of 1.8% by volume, corrosion of copper, silver, and gold, no data for in combination with CO2 and heat; modified atmospheres: activity slow, requires air-tight structures; sulfuryl fluoride[1]: no food tolerances in the U. S., no registration for this use.	Fields & White 2002
Cites studies on: the development of resistance to phosphine in stored product pests; interaction of time, temperature and concentration of performance of phosphine; sulfuryl fluoride's difficulty in killing egg stage; Tables comparing phosphine to methyl bromide (Table 1, Appendix A)	Bell 2000
Theoretical paper based on a few lab studies and small field crop trials indicating that traps currently used for monitoring pest populations could be used to reduce those populations. No studies on a commercial scale or food processing/storage facility were present.	Cox 2004
Mostly lab studies on assorted stored product pests indicate that IGRs, especially methoprene and diflubenzuron, may play a role in controlling these insects	Oberlander, et al. 1997
A simulation model in Denmark suggests that increase temperatures inside mills drives moth outbreaks and if mills were cooled to outdoor temperatures, moth outbreaks would be less frequent.	Skovgard, et al. 1999
Investigations into chemical control strategies should include a thorough examination of physical, biological and environmental factors that can affect pesticide toxicity. These include: application rate, formulation, timing, surface substrate, and target pest. WP formulation of cyfluthrin applied to concrete lasted longer than the EC formulation. *T. confusum* was more susceptible than *T. castaneum* to WP.	Zettler & Arthur 2000

[1]At the time of this review, sulfuryl fluoride had not been registered in the United States for any food uses. The new registration does not include the commodities within this sector.

12. SUMMARIZE TECHNICAL REASONS, IF ANY, FOR EACH ALTERNATIVE NOT BEING FEASIBLE OR AVAILABLE FOR YOUR CIRCUMSTANCES: (*For economic constraints, see Question 15*):

TABLE 12.1: SUMMARY OF TECHNICAL REASON FOR EACH ALTERNATIVE NOT BEING FEASIBLE OR AVAILABLE

IN KIND ALTERNATIVES	TECHNICAL FEASIBILITY	COMMENTS
Carbon Dioxide (high pressure)	No	Facilities in the United States are not airtight enough for modified atmospheres or carbon dioxide to be effective primarily because most are more than 25 years old and are not subsidized by the federal government. Downtime required for CO_2 alone is much longer, at 6-12 days.
Controlled & Modified Atmospheres	No	
Ethyl/Methyl Formate	No	Not registered in United States (last product cancelled in Oct. 1989)
Hydrogen Cyanide	No	Not registered in United States (last product cancelled in Feb. 1988)
Phosphine, alone	No	Although does kill insects, it is corrosive to metals, especially copper and its alloys, bronze and brass. These metals are important components of the electronics that run the manufacturing equipment. In addition some of the equipment itself (for example: motors, mixers, etc.) also have metal parts that contain copper. In addition it requires longer application time. This alternative is already being used in the areas without electronics and where temperatures are not a factor. Resistance to this fumigant has also been reported for several stored product pests.
Phosphine, in combination	No	
Sulfuryl fluoride	No	United States recent registration does not include these uses
NOT IN KIND ALTERNATIVE	**TECHNICAL FEASIBILITY**	**COMMENTS**
Heat Treatment	No	Sufficiently high temperature will kill insects given enough time; but heat sources are not readily available in all areas of United States (such as those in the south where hot weather is the norm and no heaters are available); and heat requires longer time of exposure. In areas that can use heat, it is being used. It is not feasible in remaining plants or areas of a plant.
Cold Treatment	No	Does not completely disinfest facility;
Contact Insecticides	No	
Cultural Practices	No	
Electrocution	No	
Inert Dust	No	
Pest Exclusion/Physical Removal	No	
Pesticides of Low Volatility	No	
Pheromones	No	
Physical Removal/Cleaning /Sanitation	No	
Rodenticide	No	

Table 12.2: Comparison of Alternatives to Methyl Bromide Fumigation

FUMIGANT	PREPARATION TIME (HR)	FUMIGATION TIME (HRS)	DISSIPATION TIME (HRS)	MINIMUM NUMBER OF APPLICATIONS TO ONE MB APPLICATION
Methyl Bromide	24	24	24	--
Phosphine, alone	24	48-72	24	0-2
Phosphine + CO2	24	48-72	24	3-4
Heat	36	48-52	24	3-4

PART D: EMISSION CONTROL

13. How Has This Sector Reduced the Use and Emissions of Methyl Bromide in the Situation of the Nomination?

Using sanitation, IPM, i.e. the “not-in-kind” alternatives the industry has been able to reduce methyl bromide use by extending the time between fumigations. Plants in the southern United States used to fumigate with methyl bromide as much as 4-6 times a year. The use of IPM strategies and more stringent sanitation methods have allowed these facilities to reduce the number of methyl bromide fumigations to twice a year. These fumigations are typically at the beginning of the summer and at the end of the summer.

In the northern regions of the United States, IPM strategies and sanitation methods have enabled some of these facilities to fumigate with methyl bromide once every 3 years, and a few facilities have gone without a methyl bromide fumigation for almost 5 years. The facilities in the northern United States have been able to exploit heat treatments more extensively than their southern counterparts, as well as opening up facilities during extremely cold weather for extensive cleaning with low volatility pesticides (organophosphates, pyrethroids, insect growth regulators, botanicals) at the perimeters to kill pests within the facilities.

The use of methyl bromide in food processing plants in the U. S. is minimized in several ways. In preparation for the loss of methyl bromide, the food processing industry has been active in finding ways to reduce pests in the plants (these techniques were described in Table 12.1).

PART E: ECONOMIC ASSESSMENT

14. Costs of Alternatives Compared to Methyl Bromide Over 3-Year Period

No data are available.

15. Summarize Economic Reasons, if any, for each Alternative NOT being Feasible or Available for your Circumstances

Table 15.1. Summary of Economic Reasons for each Alternative NOT being Feasible or Available

No.	Methyl Bromide Alternative	Economic Reason (if any) for the Alternative not Being Available	Estimated Month/Year when the Economic Constraint COULD be Solved
1	Heat Treatment	Under laboratory conditions, brief exposure of commodities to high temperatures may eliminate insects without adversely affecting product quality. Sufficiently high temperature will kill insects given enough time; but heat sources are not readily available in all areas of United States (such as those in the south where hot weather is the norm and no heaters are available); and heat requires longer time of exposure. In areas that can use heat, it is being used. It is not feasible in remaining plants or areas of a plant. Also, this approach is not feasible for treating commercial-scale commodity volumes. Most insects do not survive more than 12 hours when exposed to 45°C or more than 5 minutes when exposed to 50°C (Fields, 1992). However, the effectiveness of this approach has not been tested with large volumes of commodities. Substitution of heat treatments where high temperatures are not already used for other applications would require extensive retrofitting of existing facilities, as well as heat delivery systems capable of rapidly and uniformly heating large volumes of commodities in order to achieve total insect control. Furthermore, cheese quality may be adversely affected by exposure to heat.	No indication was given by the applicant as to a timetable to solve identified problems.
2	Phosphine alone or in combination	Although does kill insects, it is corrosive to metals, especially copper and its alloys, bronze and brass. These metals are important components of the electronics that run the manufacturing equipment. In addition some of the equipment itself (for example: motors, mixers, etc.) also have metal parts that contain copper. In addition it requires longer application time. This alternative is already being used in the areas without electronics and where temperatures are not a factor. Resistance to this fumigant has also been reported for several stored product pests. Also, not suitable to replace methyl bromide when rapid fumigations are needed to meet	No indication was given by the applicant as to a timetable to solve identified problems.

No.	Methyl Bromide Alternative	Economic Reason (if any) for the Alternative not Being Available	Estimated Month/Year when the Economic Constraint could be Solved
		customer timelines. Furthermore, cheese makers claim that phosphine causes damage to the cheese, "melting of the cheese" and may cause acid residue, acrid off-odors and affect flavor. Phosphine fumigation takes 3-10 days, depending on temperature, compared to 1 day for MB (Hartsell et al., 1991, Zettler, 2002, Soderstrom et al., 1984, phosphine labels). An additional 2 days are needed for outgassing phosphine. Phosphine fumigation is least feasible during the colder winter months when, according to label directions, the minimum exposure periods increases to 8-10 days (plus two days for aeration) when commodity temperature decreases to 5^oC - $12\,^oC$. Phosphine is not used when commodity temperature drops below 5^oC (Phosphine and Eco2fume® labels).	
3	Irradiation	Although rapid and effective, irradiation may result in living insect left in the treated product. Treated insects are sterilized and stop feeding, but are not immediately killed. The high dosages necessary to cause immediate mortality in target insects may reduce product quality. Irradiation requires major capital expenditures and irradiated food are not widely accepted by consumers.	No indication was given by the applicant as to a timetable to solve identified problems.
4	Carbon Dioxide (high pressure)	Facilities in the United States are not airtight enough for modified atmospheres or carbon dioxide to be effective primarily because most are more than 25 years old.	No indication was given by the applicant as to a timetable to solve identified problems.

Commodities and facilities listed in this chapter were requested by the National Pest Management Association which represents members that provide fumigation services to food processing and storage facilities. The economic impacts on the facility from using the next best alternative could not be assessed since the applicant is not the end-user. However, the uses included in this chapter are those with no technically and economically feasible alternative. In general, economic impacts to the commodity and food processing sector can be characterized as arising from three contributing factors. First, the direct pest control costs increased in most cases because phosphine is more expensive due to increased labor time required for longer treatment time and increased number of treatments. Second, capital expenditures may be required to adopt phosphine for accelerated replacement of plant and equipment due to corrosive nature of phosphine. Finally, additional production downtimes for the use of alternatives are unavoidable. Many facilities operate at or near full production capacity and alternatives that take longer than methyl bromide or require more frequent application can result in manufacturing slowdowns, shutdowns, and shipping delays. Slowing down production would result in additional costs to the methyl bromide users.

The industries that use methyl bromide for commodity and facility fumigation are, in general, subject to limited pricing power, changing market conditions, and government regulations. Companies within these industries operate in a highly competitive global marketplace characterized by high sales volume, low profit margins, and rapid turnover of inventories. In addition, producers' associations generally manage companies of this type, and, therefore, making new capital investment is often difficult.

MEASURES OF ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

No information available.

PART F: FUTURE PLANS

16. PROVIDE A DETAILED PLAN DESCRIBING HOW THE USE AND EMISSIONS OF METHYL BROMIDE WILL BE MINIMIZED IN THE FUTURE FOR THE NOMINATED USE.

The industry is committed to studying how to improve insect control with IPM strategies and sanitation and to further reduce the number of methyl bromide fumigations. They are also continuing to pursue research of heat treatments to maximize efficiency. The United States government is supporting research in this sector (see Section 17.1) and the United States Environmental Protection Agency (EPA or Agency) has made registering methyl bromide alternatives a priority (see Section 17.2). EPA registered sulfuryl fluoride for some commodities and some mills on January 23, 2004 (see Section 17.2.1).

17. PROVIDE A DETAILED PLAN DESCRIBING WHAT ACTIONS WILL BE UNDERTAKEN TO RAPIDLY DEVELOP AND DEPLOY ALTERNATIVES FOR THIS USE:

17.1. Research

The number of available insecticides that can be used in and around food plants, processing mills, and food warehouses in the U. S. has declined in recent years. The research and development of chemical alternatives to be used by this sector is a critical need in the U. S. The post-harvest food-processing sector has invested substantial time and funding into research and development of technically and economically feasible alternatives to methyl bromide. Past and current research focuses on the biology and ecology of the pests, primarily insect pests. To implement non-chemical controls and reduce methyl bromide use requires a thorough understanding of the pests in order to exploit their weaknesses. Some of these investigations have studied the effects of temperature and humidity on the fecundity, development, and longevity of a specific species. Other studies have been to determine the structural preferences and microhabitat requirements of a species. Studies of factors affecting population growth (interactions within and among species) have been conducted. However, there is still much research that needs to be done.

IPM and sanitation methods are also under investigation. Studies have focused on food plant design, engineering modifications for pest exclusion, and insect-resistant packaging. New research is demonstrating a potential to incorporate chemical repellents into packaging materials (Arthur and Phillips 2003). Further studies with pheromones and trapping strategies are helping to improve IPM in food processing plants.

The USDA is continuing to fund research projects for post-harvest/food processing plants. Such activities include:

> Biology and Management of Food Pests (Oct 2002- Sep 2007) to: examine the reproductive biology and behavior of storage weevils, Indianmeal moth, and red and confused flour beetles; determine the influence of temperature on the population growth, mating and development of storage pests, specifically storage weevils, Indianmeal moth, and red and confused flour beetles; examine the use of CO_2 concentrations within a grain mass to predict storage weevils and flour beetle population growth; and examine the use of alternative fumigants on insect mortality (ozone, sagebrush, Profume®).
>
> Chemically Based Alternatives to Methyl Bromide for Post harvest and Quarantine Pests (Jul 2000 - Dec 2004) to: develop quarantine/post harvest control strategies using chemicals to reduce arthropod pests in durable and perishable commodities; develop new fumigants and/or strategies to reduce methyl bromide use; develop technology and equipment to reduce methyl bromide emissions to the atmosphere; develop system approaches for control using chemicals combined with nonchemical methodologies which will yield integrated pest control management programs; and develop methods to detect insect infestations.

The rice milling industry has spent over US$500,000 on research to develop alternatives since 1992, and plans to use additional pesticides, such as carbonyl sulfide, carbon dioxide, phosphine, magnesium phosphide (magtoxin), and dichlorvos (vapona) over the next few years. Non-chemical methods used by this sub-sector, to reduce methyl bromide use, include heat and cold treatments, and many individual companies are involved in further research and testing of alternatives. Industry experts also recommend further studies on sulfuryl fluoride tolerances and combination treatments of heat/carbon dioxide/phosphine.

The bakery sector is implementing heat as an alternative at those facilities where heat is technically feasible. Currently, heat is being implemented at several facilities nationwide, but further trials are needed to determine the effects of heat on a long-term basis. However, older facilities with hardwood floors and plant electrical wiring systems are unsuitable for heat treatments. Other methods being used to reduce reliance on methyl bromide are: exclusion, cleaning, early detection, improved design of equipment, trapping, and other integrated pest management (IPM) approaches. Phosphine continues to be tested.

The flour milling industry is committed to IPM techniques in order to minimize reliance on any one tool. Many plants have reduced the amount of annual fumigations from 4-5 per year to 2-3 per year. Some of these facilities combine methyl bromide with carbon dioxide. Further, these applicants have authored three manuals on fumigation best practices, which are widely utilized throughout the industry. The industry continues to test high heat, phosphine, alone and in combination; and the combination of heat, phosphine, and carbon dioxide.

17.2. Registration

Since 1997, the United States EPA has made the registration of alternatives to methyl bromide a high registration priority. Because the EPA currently has more applications pending in its registration review queue than the resources to evaluate them, EPA prioritizes the applications. By virtue of being a top registration priority, methyl bromide alternatives enter the science review process as soon as U.S. EPA receives the application and supporting data rather than waiting in turn for the EPA to initiate its review.

As one incentive for the pesticide industry to develop alternatives to methyl bromide, the Agency has worked to reduce the burdens on data generation, to the extent feasible while still ensuring that the Agency's registration decisions meet the Federal statutory safety standards. Where appropriate from a scientific standpoint, the Agency has refined the data requirements for a given pesticide application, allowing a shortening of the research and development process for the methyl bromide alternative. Furthermore, Agency scientists routinely meet with prospective methyl bromide alternative applicants, counseling them through the preregistration process to increase the probability that the data is done right the first time and rework delays are minimized

The U.S. EPA has also co-chaired the USDA/EPA Methyl Bromide Alternatives Work Group since 1993 to help coordinate research, development and the registration of viable alternatives. This coordination has resulted in key registration issues (such as worker and bystander exposure through volatilization, township caps and drinking water concerns) being directly addressed through USDA's Agricultural Research Service's US$15 million per year research program conducted at more than 20 field evaluation facilities across the country. Also EPA's participation in the evaluation of research grant proposals each year for USDA's US$2.5 million per year methyl bromide alternatives research has further ensured close coordination between the U.S. government and the research community.

Since 1997, the U.S. EPA has registered the following chemical/use combinations as part of its commitment to expedite the review of methyl bromide alternatives:

- 2000: Phosphine in combination to control stored product insect pests
- 2001: Indianmeal Moth Granulosis Virus to control Indianmeal moth in stored grains
- 2004: Sulfuryl fluoride registered as a post-harvest fumigant for grains and flour mills, but not for the commodities included in this chapter.

18. ADDITIONAL COMMENTS

19. CITATIONS

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APPENDIX A

APPENDIX A - TABLE 1: EFFECT OF TEMPERATURE ON CONCENTRATION AND TIME THRESHOLDS FOR SOME PESTS OF STORED PRODUCTS. (FROM: BELL, C. H. 2000)

SPECIES	FUMIGANT	THRESHOLD (ºC OR TIME)	TEMPERATURE (ºC)	
			15	25
Sitophilus oryzae	Methyl Bromide	ºC (mg/l)	0.6-0.9	1.3-2.0
Tribolium confusum	Methyl Bromide	ºC (mg/l)	1.3-2.0	2.5-3.0
Tribolium castaneum	Methyl Bromide	ºC (mg/l)	1.3-2.0	3.0-3.5
Tribolium castaneum	Phosphine	ºC (mg/l)		0.005-0.0011
Tribolium castaneum	Phosphine	Time (h)		0.5-1.5

For phosphine relatively long exposure times are required for kill of all stages & time threshold is more important than the concentration for efficient fumigant action.

APPENDIX A - TABLE 2: CONCENTRATION-TIME PRODUCT RECOMMENDATIONS BY NATIONAL PEST MANAGEMENT ASSOCIATION

SPECIES	STAGE	TEMP (°C)	OUNCE-HOURS		MG/L	
			PHOSPHINE 72 HR	PHOSPHINE 144 HR	METHYL BROMIDE	SULFURYL FLUORIDE
Lasioderma serricorne	eggs	4.4			146.4	
	eggs	10	8.5	49.5	91.2	
	eggs	15.6	61.8	37.9	48	
	eggs	21.1	0.64	0.86	43.2	
	eggs	26.5				711.7
	larvae	4.4	6.9	1.2	379.2	
	larvae	10	3.7	0.86	206.4	
	larvae	15.6	0.94	0.72	132	
	larvae	21.1	0.5	0.43	120	
	larvae	26.5				55.9
	pupae	4.4	5.6	7.4	1046	
	pupae	10	5.6	4.6	324	
	pupae	15.6	5.2	1.3	124.8	
	pupae	21.1	0.58	0.3	108	
	adult	4.4	2.2	1.9	230.4	
	adult	10	1.8	1.1	105.6	
	adult	15.6	1	0.5	64.8	
	adult	21.1	0.36	0.3	57.6	
	adult	26.5				34.9
Sitophilus oryzae	adult	21	0.36		30	
Tribolium confusum	eggs	26.7				1124.8
	adult	4.4			209.3	178.2
	adult	15.6			92.8	97.6
	adult	25	0.48		64	55
	adult	26.7			74.2	76.5
Tribolium castaneum	adult	24	11.5		62	
Plodia interpunctella	eggs	15			53	
	eggs	20			29	
	eggs	25			22	
	eggs	30			21	
	larvae	15			34	
	larvae	20			31	
	larvae	25			24	
	larvae	30			25	
	pupae	15			64	
	pupae	20			50	
	pupae	25			43	
	pupae	30			35	

REMINDER
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APPENDIX B. 2006 Methyl Bromide Usage Numerical Index (BUNI).

Methyl Bromide Critical Use Exemption Process **Date:** 2/26/04

2006 Bromide Usage Numerical Index (BUNI) **Sector:** POST HARVEST USE (NPMA)

Average Volume in the US:	N/A
% of Average Volume Requested:	N/A

	2006 Amount of Request			2001 & 2002 Average Use			Quarantine and Pre-Shipment	Regional Volume	
FOOD FACILITY TYPE	Kilograms (kgs)	Volume (1000m³)	Use Rate (kg/1000m³)	Kilograms (kgs)	Volume (1000m³)	Use Rate (kg/1000m³)		2001 & 2002 Average	% of Volume
Processed Foods	93,523	3,892	24	89,861	3,740	24	0%	N/A	N/A
Spices and Herbs	9,938	414	24	5,869	244	24	0%	N/A	N/A
Cocoa	85,393	3,554	24	76,899	3,200	24	0%	N/A	N/A
Dried Milk	503	21	24	643	27	24	0%	N/A	N/A
Cheese Processing Plants	3,856	160	24	3,596	150	24	0%	N/A	N/A
Other Commodity	4,905	204	24	4,352	181	24	0%	N/A	N/A
TOTAL OR AVERAGE	198,117	8,245	24.03	181,219	7,542	24.03	0%	N/A	N/A

2006 Nomination Options	Subtractions from Requested Amounts (kgs)					Combined Impacts Adjustment (kgs)		MOST LIKELY IMPACT VALUE			
FOOD FACILITY TYPE	2006 Request	(-) Double Counting	(-) Growth or 2002 CUE Comparison	(-) Use Rate Difference	(-) QPS	HIGH	LOW	Amount (kgs)	Volume (1000m³)	Use Rate (kg/1000m³)	% Reduction
Processed Foods	93,523	-	3,663	-	-	89,861	89,861	89,861	3,740	24	4%
Spices and Herbs	9,938	-	4,069	-	-	5,869	5,869	5,869	244	24	41%
Cocoa	85,393	-	8,494	-	-	76,899	76,899	76,899	3,200	24	10%
Dried Milk	503	-	-	-	-	503	503	503	21	24	0%
Cheese Processing Plants	3,856	-	260	-	-	3,596	3,596	3,596	150	24	7%
Other Commodity	4,905	-	553	-	-	4,352	4,352	4,352	181	24	11%
Nomination Amount	198,117	198,117	188,811	188,811	188,811	181,079	181,079	181,079	7,536	24	9%
% Reduction from Initial Request	0%	0%	5%	5%	5%	9%	9%	9%	9%		

Adjustments to Requested Amounts	Use Rate (kg/1000m³)		(%) Key Pest Distribution		(%) Adopt New Fumigants		(%) Combined Impacts		Time, Quality, or Product Loss	Marginal Strategy
FOOD FACILITY TYPE	2006	Low	High	Low	High	Low	HIGH	LOW		
Processed Foods	24	24	100%	100%	0%	0%	100%	100%		Heat
Spices and Herbs	24	24	100%	100%	0%	0%	100%	100%		Heat
Cocoa	24	24	100%	100%	0%	0%	100%	100%		Heat
Dried Milk	24	24	100%	100%	0%	0%	100%	100%		Heat
Cheese Processing Plants	24	24	100%	100%	0%	0%	100%	100%		Heat
Other Commodity	24	24	100%	100%	0%	0%	100%	100%		Heat

Other Considerations	Dichotomous Variables (Y/N)			Other Issues			Economic Analysis			
FOOD FACILITY TYPE	Currently Use Alternatives?	Research / Transition Plans	Pest-free Market Requirement	Change from Prior CUE Request (+/-)	Verified Historic MeBr Use / State	Frequency of Treatment /Yr	Loss per 1000 m³ (US$/1000m)	Loss per Kg of MeBr (US$/kg)	Loss as a % of Gross Revenue	Loss as a % of Net Revenue
Processed Foods	Y	Y	Y	0	N	2-3				
Spices and Herbs	Y	Y	Y	+	N	2				
Cocoa	Y	Y	Y	0	N	1/5 yr				
Dried Milk	Y	Y	Y	+	N	2				
Cheese Processing Plants	Y	Y	Y	0	N	1/5 yr				
Other Commodity	Y	Y	Y	-	N	2.5				

Conversion Units: 1 Pound = 0.453592 Kilograms 1,000 cu ft = 0.028316847 1,000 cubic meters

Footnotes for Appendix B:

Values may not sum exactly due to rounding.

1. **Average Volume in the U.S.** – Average Volume in the U.S. is the average of 2001 and 2002 total volume fumigated with methyl bromide in the U.S. in this sector (when available).
2. **% of Average Volume Requested** - Percent (%) of Average Volume Requested is the total volume in the sector's request divided by the Average Volume in the U.S. (when available).
3. **2006 Amount of Request** – The 2006 amount of request is the actual amount requested by applicants given in total pounds active ingredient of methyl bromide, total volume of methyl bromide use, and application rate in pounds active ingredient of methyl bromide per thousand cubic feet. U.S. units of measure were used to describe the initial request and then were converted to metric units to calculate the amount of the U.S. nomination.
4. **2001 & 2002 Average Use** – The 2001 & 2002 Average Use is the average of the 2001 and 2002 historical usage figures provided by the applicants given in kilograms active ingredient of methyl bromide, total volume of methyl bromide use, and application rate in kilograms active ingredient of methyl bromide per thousand cubic meters. Adjustments are made when necessary due in part to unavailable 2002 estimates in which case only the 2001 average use figure is used.
5. **Quarantine and Pre-Shipment** – Quarantine and pre-shipment (QPS) is the percentage (%) of the applicant's requested amount subject to QPS treatments.
6. **Regional Volume, 2001 & 2002 Average Volume** – Regional Volume, 2001 & 2002 Average Volume is the 2001 and 2002 average estimate of volume of methyl bromide used within the defined region (when available).
7. **Regional Volume, Requested Volume %** - Regional Volume, Requested Volume % is the volume in the applicant's request divided by the total volume fumigated with methyl bromide in the sector in the region covered by the request.
8. **2006 Nomination Options** – 2006 Nomination Options are the options of the inclusion of various factors used to adjust the initial applicant request into the nomination figure.
9. **Subtractions from Requested Amounts** – Subtractions from Requested Amounts are the elements that were subtracted from the initial request amount.
   10. **Subtractions from Requested Amounts, 2006 Request** – Subtractions from Requested Amounts, 2006 Request is the starting point for all calculations. This is the amount of the applicant request in kilograms.
   11. **Subtractions from Requested Amounts, Double Counting** - Subtractions from Requested Amounts, Double Counting is the estimate measured in kilograms in situations where an applicant has made a request for a CUE with an individual application while a consortium has also made a request for a CUE on their behalf in the consortium application. In these cases the double counting is removed from the consortium application and the individual application takes precedence.
   12. **Subtractions from Requested Amounts, Growth or 2002 CUE Comparison** - Subtractions from Requested Amounts, Growth or 2002 CUE Comparison is the greatest reduction of the estimate measured in kilograms of either the difference in the amount of methyl bromide requested by the applicant that is greater than that historically used or treated at a higher use rate or the difference in the 2006 request from an applicant's 2002 CUE application compared with the 2006 request from the applicant's 2003 CUE application.
   13. **Subtractions from Requested Amounts, QPS** - Subtractions from Requested Amounts, QPS is the estimate measured in kilograms of the request subject to QPS treatments. This subtraction estimate is calculated as the 2006 Request minus Double Counting, minus Growth or 2002 CUE Comparison then multiplied by the percentage subject to QPS treatments. *Subtraction from Requested Amounts, QPS = (2006 Request – Double Counting – Growth)*(QPS %)*
   14. **Subtraction from Requested Amounts, Use Rate Difference** – Subtractions from requested amounts, use rate difference is the estimate measured in kilograms of the lower of the historic use rate or the requested use rate. The subtraction estimate is calculated as the 2006 Request minus Double Counting, minus Growth or 2002 CUE Comparison, minus the QPS amount, if applicable, minus the difference between the requested use rate and the lowest use rate applied to the remaining hectares.
15. **Adjustments to Requested Amounts** – Adjustments to requested amounts were factors that reduced to total amount of methyl bromide requested by factoring in the specific situations were the applicant could use alternatives to methyl bromide. These are calculated as proportions of the total request. We have tried

to make the adjustment to the requested amounts in the most appropriate category when the adjustment could fall into more than one category.

16. **Use Rate kg/ 1000 m^3 2006** – Use rate in pounds per thousand cubic feet, 2006, is the use rate requested by the applicant as derived from the total volume to be fumigated divided by the total amount (in pounds) of methyl bromide requested.
17. **Use Rate kg/ 1000 m^3 low** – Use rate in pounds per thousand cubic feet, low, is the lowest historic use rate reported by the applicant. The use rate selected for determining the amount to nominate is the lower of this rate or the 2006 use rate (above).
18. **(%) Key Pest Impacts** - Percent (%) of the requested area with moderate to severe pest problems. Key pests are those that are not adequately controlled by MB alternatives. For structures/ food facilities and commodities, key pests are assumed to infest 100% of the volume for the specific uses requested in that 100% of the problem must be eradicated.
19. **Adopt New Fumigants (%)** – Adopt new fumigants (%) is the percent (%) of the requested volume where we expect alternatives could be adopted to replace methyl bromide during the year of the CUE request.
20. **Combined Impacts (%)** - Total combined impacts are the percent (%) of the requested area where alternatives cannot be used due to key pest, regulatory, and new fumigants. In each case the total area impacted is the conjoined area that is impacted by any individual impact. The effects were assumed to be independently distributed unless contrary evidence was available (e.g., affects are known to be mutually exclusive).

21. **Qualifying Volume** - Qualifying volume (1000 cubic meters) is calculated by multiplying the adjusted volume by the combined impacts.
22. **CUE Nominated amount** - CUE nominated amount is calculated by multiplying the qualifying volume by the use rate.
23. **Percent Reduction** - Percent reduction from initial request is the percentage of the initial request that did not qualify for the CUE nomination.
24. **Sum of CUE Nominations in Sector** - Self-explanatory.
25. **Total U.S. Sector Nomination** - Total U.S. sector nomination is the most likely estimate of the amount needed in that sector.
26. **Dichotomous Variables** – dichotomous variables are those which take one of two values, for example, 0 or 1, yes or no. These variables were used to categorize the uses during the preparation of the nomination.
    27. **Currently Use Alternatives** – Currently use alternatives is 'yes' if the applicant uses alternatives for some portion of pesticide use on the crop for which an application to use methyl bromide is made.
    28. **Research/ Transition Plans** – Research/ Transition Plans is 'yes' when the applicant has indicated that there is research underway to test alternatives or if applicant has a plan to transition to alternatives.
    29. **Pest-free Market. Required** - This variable is a 'yes' when the product must be pest-free in order to be sold either because of U.S. sanitary requirements or because of consumer acceptance.
30. **Other Issues**.- Other issues is a short reminder of other elements of an application that were checked
    31. **Change from Prior CUE Request**- This variable takes a '+' if the current request is larger than the previous request, a '0' if the current request is equal to the previous request, and a '-' if the current request is smaller that the previous request. If the applicant has not previously applied the word 'new' appears in this column.
    32. **Verified Historic Use/ State**- This item indicates whether the amounts requested by administrative area have been compared to records of historic use in that area.
    33. **Frequency of Treatment** – This indicates how often methyl bromide is applied in the sector. Frequency varies from multiple times per year to once in several decades.
34. **Economic Analysis** – provides summary economic information for the applications.
    35. **Loss per 1000 m^3** – This measures the total loss per 1000 m^3 of fumigation when a specific alternative is used in place of methyl bromide. Loss comprises both the monetized value of yield loss (relative to yields obtained with methyl bromide) and any additional costs incurred through use of the alternative, such as longer time spent in the fumigation chamber. It is measured in current U.S. dollars.
    36. **Loss per Kilogram of Methyl Bromide** – This measures the total loss per kilogram of methyl bromide when it is replaced with an alternative. Loss comprises both the monetized value of yield loss (relative to yields obtained with methyl bromide) and any additional costs incurred through use of the alternative. It is measured in current U.S. dollars.

37. **Loss as a % of Gross revenue** – This measures the loss as a proportion of gross (total) revenue. Loss comprises both the monetized value of yield loss (relative to yields obtained with methyl bromide) and any additional costs incurred through use of the alternative. It is measured in current U.S. dollars.
38. **Loss as a % of Net Operating Revenue** -This measures loss as a proportion of total revenue minus operating costs. Loss comprises both the monetized value of yield loss (relative to yields obtained with methyl bromide) and any additional costs incurred through use of the alternative. It is measured in current U.S. dollars. This item is also called net cash returns.
39. **Quality/ Time/ Market Window/Yield Loss (%)** – When this measure is available it measures the sum of losses including quality losses, non-productive time, missed market windows and other yield losses when using the marginal strategy.
40. **Marginal Strategy** -This is the strategy that a particular methyl bromide user would use if not permitted to use methyl bromide.

APPENDIX B. SUMMARY OF NEW APPLICANTS

A number of new groups applied for methyl bromide for 2005 during this application cycle, as shown in the table below. Although in most cases they represent additional amounts for sectors that were already well-characterized sectors, in a few cases they comprised new sectors. Examples of the former include significant additional country (cured, uncooked) ham production; some additional request for tobacco transplant trays, and very minor amounts for pepper and eggplant production in lieu of tomato production in Michigan.

For the latter, there are two large requests: cut flower and foliage production in Florida and California (‘Ornamentals’) and a group of structures and process foods that we have termed ‘Post-Harvest NPMA’ which includes processed (generally wheat-based foods), spices and herbs, cocoa, dried milk, cheeses and small amounts of other commodities. There was also a small amount requested for field-grown tobacco.

The details of the case that there are no alternatives which are both technically and economically feasible are presented in the appropriate sector chapters, as are the requested amounts, suitably adjusted to ensure that no double-counting, growth, etc. were included and that the amount was only sufficient to cover situations (key pests, regulatory requirements, etc.) where alternatives could not be used.

The amount requested by new applicants is approximately 2.5% of the 1991 U.S. baseline, or about 1,400,000 pounds of methyl bromide, divided 40% for pre-plant uses and 60% for post-harvest needs.

The methodology for deriving the nominated amount used estimates that would result in the lowest amount of methyl bromide requested from the range produced by the analysis to ensure that adequate amounts of methyl bromide were available for critical needs. We are requesting additional methyl bromide in the amount of about 500,000 Kg, or 2% or the 1991 U.S. baseline, to provide for the additional critical needs in the pre-plant and post-harvest sector.

Applicant Name	2005 U.S. CUE Nomination (lbs)
California Cut Flower Commission	400,000
National Country Ham Association	1,172
Wayco Ham Company	39
California Date Commission	5,319
National Pest Management Association	319,369
Michigan Pepper Growers	20,904
Michigan Eggplant Growers	6,968
Burley & Dark Tobacco Growers USA - Transplant Trays	2,254
Burley & Dark Tobacco Growers USA - Field Grown	28,980
Virginia Tobacco Growers - Transplant Trays	941
Michigan Herbaceous Perennials	4,200

Ozark Country Hams	240
Nahunta Pork Center	248
American Association of Meat Processors	296,800
Total lbs	**1,087,434**
Total kgs	**493,252**