METHYL BROMIDE CRITICAL USE NOMINATION
FOR POST HARVEST USE FOR NPMA

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 for NPMA (Submitted in 2006 for 2008 Use Season)

NOMINATING PARTY CONTACT DETAILS

Contact Person: John E. Thompson, Ph. D.
Title: International Affairs Officer
Address: Office of Environmental Policy
U.S. Department of State
2201 C Street N.W. Room 4325
Washington, DC 20520
U.S.A.
Telephone: (202) 647-9799
Fax: (202) 647-5947
E-mail: ThompsonJE2@state.gov

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.

☐ Yes ☐ No

Signature Name Date

Title:

CONTACT OR EXPERT(S) FOR FURTHER TECHNICAL DETAILS

Contact/Expert Person:	Richard Keigwin
Title:	Acting Division Director
Address:	Biological and Economic Analysis Division Office of Pesticide Programs U.S. Environmental Protection Agency Mail Code 7503C Washington, DC 20460 U.S.A.
Telephone:	(703) 308-8200
Fax:	(703) 308-8090
E-mail:	Keigwin.Richard@epa.gov

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 (Submitted in 2006 for 2008 Use Season)

3. SITUATION OF NOMINATED METHYL BROMIDE USE

This sector includes commodities and food processing plants treated by National Pest Management Association (NPMA) members and are not included in the Commodity or in the Food Facilities Chapters of the US nomination. Commodities included in this application are: processed foods (such as chips, crackers, cookies and pasta), spices and herbs, cocoa, and cheese processing plants. 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)
2008	**124,946**	**6,247**

** For details see Appendix A.*

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

The U. S. nomination is only for those facilities and commodities where the use of alternatives is not suitable. In U. S. food processing plants there are several factors that make the potential alternatives to methyl bromide unsuitable. These include:

- Pest control efficacy of alternatives: the efficacy of alternatives may not be comparable to methyl bromide, making these alternatives technically and/or economically infeasible.
- Geographic distribution of the facilities: some facilities are situated in areas where key pests usually occur at lower levels, such as those located in the northern part of the U. S. In such cases, the U. S. is only nominating a CUE for facilities where the key pest pressure is moderate to high.

- Age and type of facility: older food processing facilities, especially those constructed of wood, experience more frequent and severe pest infestations that must be controlled by fumigation.
- Constraints of the alternatives: some types of commodities (e.g., those containing high levels of fats and oils) prevent the use of heat as an alternative because of its effect on the final product (e.g., rancidity). Further, the corrosive nature of phosphine on certain metals prevents its use in mechanical and electrical areas of the facilities. Additionally, both phosphine and sulfuryl fluoride are temperature sensitive.
- Transition to newly available alternatives: Sulfuryl fluoride recently received a federal registration for portions of this sector. It will take some time for sulfuryl fluoride to be incorporated into a pest management program.
- Delay in plant operations: e.g., the use of some methyl bromide alternatives can add a delay to production by requiring additional time to complete the fumigation process. Production delays can result in significant economic impacts to the processors.

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, 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, has been 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. Recently sulfuryl fluoride was registered for many of these uses; however, the federal registration was July 2005, and each state needs to also register these new uses. It is unknown at this time what amounts of sulfuryl fluoride will be able to replace methyl bromide in this sector. In addition, sulfuryl fluoride is not registered by many foreign nations to which the U. S. exports. Also, 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 grains 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 need to be shut down longer to achieve maximum insect mortality, with associated economic losses from this downtime. There are also reports of stored product insects becoming resistant 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 treated 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 some plants have heaters and the power plants have the capability to supply excess power as needed. However, the southern zones and parts of the western zones of the United States are geographically quite different from the northern areas. Winter temperatures in the south and west seldom reach –1.2° C (30° F) and if temperatures fall that low, it is typically for only a few hours one night. Frequently winters in these warmer areas of the U. S. do not 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 in the plant and its perimeter. 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.

Newly registered for this sector is sulfuryl fluoride. Sulfuryl fluoride received a U. S. registration July 15th, 2005 for these use sites. All states, but California, have also registered these use sites. The industry will need time to incorporate this new alternative into their management plan. In addition, label language only allows for “incidental fumigation” for processed foods. Subsequently only minimal amounts of ingredients and products should be left in a facility during sulfuryl fluoride fumigations. Since many of these buildings have no way to separate products and ingredients from the equipment, this label restriction may be problematic.

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 2 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 U. S. for which we are not requesting methyl bromide use because they have been able to successfully implement alternatives. This U.S. CUE nomination in this sector includes a request for methyl bromide only where use of alternatives is limited for the reasons described above.

TABLE A.1: EXECUTIVE SUMMARY* *

	Processed Foods (chips, cookies, crackers, Pasta, etc)	Spices and Herbs	Cocoa	Cheese Processing Plants
AMOUNT OF REQUEST (KG)				
2008	**93,319**	**10,800**	**79,950**	**3,856**
NOMINATED AMOUNT (KG)				
2008	**64,627**	**4,064**	**53,255**	**3,000**

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

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* (PROCESSED FOODS)

	HISTORICAL USE*						REQUESTED USE
For each year specify:	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2008**
Amount of MB (kg)	116,143	105,640	88,663	91,058	132,076	108,404	93,319
Volume Treated (1000 m³)	4,834	4,397	3,690	3,790	5,497	4,512	3,884
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	12.03	24.03	24.03
Actual (A) Estimate (E)	Unknown						Unknown

*Based on most current information.

TABLE 6.2: 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* (SPICES AND HERBS)

	HISTORICAL USE*						REQUESTED USE
For each year specify:	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2008**
Amount of MB (kg)	10,651	894	2,101	9,637	4,286	4,153	10,800
Volume Treated (1000 m³)	443	37	87	401	178	173	449
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	24.03
Actual (A) Estimate (E)	Unknown						Unknown

*Based on most current information.

TABLE 6.3: 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* (COCOA)

	HISTORICAL USE*						REQUESTED USE
For each year specify:	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2008**
Amount of MB (kg)	31,844	75,348	62,935	90,863	20,172	21,175	79,950
Volume Treated (1000 m³)	1,325	3,136	2,619	3,782	840	915	3,327
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	24.03
Actual (A) Estimate (E)	Unknown						Unknown

*Based on most current information.

TABLE 6.4: 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* (CHEESE PROCESSING PLANTS)

	HISTORICAL USE*						REQUESTED USE
For each year specify:	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2008**
Amount of MB (kg)	5,059	4,895	3,829	3,362	3,856	3,856	3,856
Volume Treated (1000 m³)	211	204	159	140	160	160	160
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	24.03
Actual (A) Estimate (E)	Unknown						Unknown

*Based on most current information.

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

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. However, location information has previously been submitted to MBTOC, which is also included in this document as Appendix B.

In addition, a full list of all processing plants that apply any registered pesticide in the U.S. is available from the U.S. Department of Labor, Occupational Safety and Health Administration website located at http://www.osha.gov/pls/imis/sicsearch.html. EPA's Facility Registry System is publicly available and is located at http://www.epa.gov/enviro/html/fii/ez.html.

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	Health hazard: 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. Sulfuryl fluoride was registered for some of these uses, requires high concentration to kill all life stages, requires higher concentrations as temperature decreases; experience needed to incorporate into best management plan
Tribolium castaneum	Red flour beetle	
Trogoderma variable	Warehouse beetle	Health hazard: choking and 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. Sulfuryl fluoride was registered for some of these uses, requires high concentration to kill all life stages, requires higher concentrations as temperature decreases; experience needed to incorporate into best management plan
Lasioderma serricorne	Cigarette beetle	Health hazard: body parts, exuviae, and excretia violate FDA regulations[1].
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.cfsan.fda.gov/~dms/dalbook.html and http://www.fda.gov/opacom/laws/fdcact/fdcact4.htm.

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	Health hazard: body parts, exuviae, and excretia violate FDA regulations[1]
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	

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

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 (*ºC*)	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 (Bell 2000). 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.

Cocoa Beans

An automatic detention is mandated by US FDA for cocoa beans; however it is not for a quarantine pest, nor is methyl bromide the specified fumigant. Therefore, USG does not think this meets the QPS exemption requirements. US FDA orders detention of adulterated beans and then leaves it to the owner to propose a remediation method. There does not yet appear to be other feasible fumigation treatments at this time.

Cocoa beans are typically fumigated with methyl bromide twice. The beans are usually infested with pests while in the hold of a ship; therefore, the beans are always fumigated when they come off the ship. Then the cocoa beans are usually fumigated at least one more time just before they go to the chocolate manufacturing facility. The primary difficulty is the warehousing. Most warehouses at the docks are old, constantly being reinfested with pests from the ships coming into port, and loaded to the rafters with cocoa beans. Although all the warehouses are certified by the Cocoa Merchants' Association, this certification does not mean that a warehouse has separate staging areas for new product or that the newly arriving product is sufficiently sealed off from existing (stored) product so as to eliminate the possibility of reinfestation.

Although phosphine is labeled for cocoa beans, there are label restrictions that limit its use in these warehouse situations. Phosphine label instructions do not permit use of a warehouse while beans are under gas. The exposure period for phosphine is generally 72 hours, plus 1-2 days for aeration, which shuts down a warehouse for 5 days or so. When methyl bromide is used, the fumigation is on Friday night, aeration begins Saturday night and the warehouse is open again on Monday morning. If phosphine were used for fumigation, shipments of beans could not go in or out for periods of 5 days at a time as the warehouse would be closed for this entire period. In addition, the industry would be limited in colder weather, as phosphine cannot be used at temperatures below 40° F, and requires longer fumigation time at lower temperatures.

Sulfuryl fluoride received a federal registration for this use July 2005. Time is needed to collect data at cocoa bean fumigations to determine the effectiveness of this chemical in commercial settings.

Herbs and Spices

The request for methyl bromide is for the facilities where spices are blended into packages (such as for pizza mixes) that are then added to pre-packaged goods. These facilities are similar to grain mills in that there are silos, mixing areas, packaging areas, etc. Infestation in herb and spice blending facilities is not localized to machinery that can be spot heat treated. These facilities utilize methyl bromide to target pests present in inaccessible areas of the structure, not the ingredients or finished products that may be stored on-site.

Fumigants of choice for treating spice commodities are ETO, PPO, and phosphine; however, a very small percentage of spices are fumigated with methyl bromide. The majority of spice commodity fumigations with methyl bromide are for quarantine or pre-shipment requirement. Facilities that have an occasional need for fumigation can not justify the cost associated with vacuum chambers or irradiation methods (example: occasional trailer fumigation every few years) and are using methyl bromide due to time constraints associated with phosphine. Time constraints for one company are due to demurrage fees of $200/day associated with overseas containers.

Sulfuryl fluoride for this use site was registered in July 2005. The industry is learning how to incorporate this newly registered alternative into their pest management plan. The industry is waiting for their trade partners to also register sulfuryl fluoride for this site to fully utilize the potential of this alternative, since many of these commodities are exported.

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.

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. To implement these alternatives would require new construction of all facilities.
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 and some of the equipment itself (for example: motors, mixers, etc.). In addition, phosphine 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. This alternative has already been implemented in areas without sensitive metals.
Phosphine, in combination	No	
Sulfuryl fluoride	Yes	Recently registered in United States for uses in this sector on July 14, 2005. The use of this chemical requires training of applicators by registrant, and each state must register this product as well. Efficacy of this chemical remains to be demonstrated in the field, but appears to be promising. Does require high concentrations of product as temperature decreases and to kill eggs. May take up to 5 years before we know if it will replace methyl bromide and for industry conversion.
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 for products and ingredients.
Cold Treatment	No	Does not disinfest facilities. Most of these IPM strategies are currently practiced and widely implemented with the beneficial result of lengthening time between fumigations. Facilities use sanitation and cleaning to maintain their plants. They monitor populations with pheromone traps. They try to limit incoming pests with electrocution traps by entrances/exits. When populations are discovered, they use physical removal and contact insecticides and low volatility pesticides. Facilities maintain rodenticide bait stations around their perimeter. These IPM strategies are not a replacement for methyl bromide, but do lengthen time between fumigations.
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	--
Sulfuryl Fluoride				
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, as heat is a poor penetrator of packaging, boxes, and commodities. Most insects do not survive more than 12 hours when exposed to 45^{o}C or more than 5 minutes when exposed to 50^{o}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	No indication was given by the applicant as to a timetable to solve identified problems.

3		fumigant has also been reported for several stored product pests. Also, not suitable to replace methyl bromide when rapid fumigations are needed to meet 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.
5	Sulfuryl Fluoride	Federal Registration very recent: July 14, 2005; not enough information available by applicant to assess.	

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 and other commodities on July 15, 2005. California registered sulfuryl fluoride in May 2005 for use in mills, tree nuts and dried fruits. (see Section 17.2.1).

For further details regarding the transition plans for this sector please consult the national management strategy.

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.

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:

1 2000: Phosphine in combination to control stored product insect pests
2 2001: Indianmeal Moth Granulosis Virus to control Indianmeal moth in stored grains
3 2004: Sulfuryl fluoride registered as a post-harvest fumigant for grains and flour mills, but not for the commodities included in this chapter. This product is not registered in the state of New York at the time of preparation of this document.
4 2005. Sulfuryl fluoride registered as a post-harvest fumigant for a number of these use sites. Needs to be registered by individual states.

18. ADDITIONAL COMMENTS

Pheromone Traps

"One misconception about pheromone traps is that a pest population can be controlled by deploying these traps—that is not true for most situations. Traps usually attract only a small percentage of the population that is within the effective range of the trap. Also, female-produced sex pheromones attract only males; the females that lay eggs and perpetuate the infestation are not affected. Since males of the many insect species will mate with multiple females, any males that are not trapped can easily contribute to the production of a subsequent generation of pests. New methods are being researched for using pheromones in pest suppression, but current uses of pheromone traps are best used only for monitoring purposes." (Arthur and Phillips 2003)

Sulfuryl Fluoride

There are some industry concerns regarding sulfuryl fluoride. Primarily that it is temperature dependent and that higher concentrations are necessary to kill eggs of insect pests. The post harvest industry is very concerned about the price of sulfuryl fluoride at these concentrations required to control all life stages of pests, especially when temperatures are low.

19. CITATIONS

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APPENDIX A. 2008 METHYL BROMIDE USAGE NEWER NUMERICAL INDEX

2008 Methyl Bromide Usage Newer Numerical Index - BUNNI							Post Harvest Use NPMA	
January 24, 2006	Region		Processed Foods	Spices and Herbs	Cocoa	Cheese Processing Plants	Sector Total or Average	Notes
Dichotomous Variables	Currently Use Alternatives?		Yes	Yes	Yes	Yes		
	Pest-free Requirements?		Yes	Yes	Yes	Yes		
Other Issues	Frequency of Treatment of Product		1	1	2	1		
	Quarantine & Pre-Shipment Removed?		Yes	Yes	Yes	Yes		
Most Likely Combined Impacts (%)	Regulatory Issues (%)		0%	0%	0%	0%		
	Key Pest Distribution (%)		100%	100%	100%	100%		
	Total Combined Impacts (%)		**100%**	**100%**	**100%**	**100%**		
Most Likely Baseline Transition	(%) Able to Transition		84%	84%	84%	0%		
	Minimum # of Years Required		5	5	5	5		
	(%) Able to Transition per Year		**17%**	**17%**	**17%**	**0%**		
EPA Adjusted Use Rate (kg/1000m3)			20	20	20	20		
2008 Applicant Requested Usage	*Amount - Pounds*	*Pounds*	*205,734*	*23,809*	*176,259*	*8,500*	*414,302*	
	Volume - 1000ft^3		*137,156*	*15,873*	*117,506*	*5,667*	*276,201*	
	Rate (lb/1000ft^3)		*1.50*	*1.50*	*1.50*	*1.50*	*2*	
	Amount - Kilograms	Metric	**93,319**	**10,800**	**79,950**	**3,856**	**187,924**	
	Volume - 1000m^3		3,884	449	3,327	160	7,821	
	Rate (kg/1000m^3)		24	24	24	24	24	
EPA Preliminary Value		**kgs**	**93,319**	**9,938**	**79,950**	**3,856**	**187,062**	
EPA Baseline Adjusted Value has been adjusted for:			MBTOC Adjustments, QPS, Double Counting, Growth, Use Rate, Miscellaneous Adjustments, and Combined Impacts					
EPA Baseline Adjusted Value		kgs	77,676	4,885	64,009	3,000	149,570	
EPA Transition Amount		kgs	(13,050)	(821)	(10,753)	-	(24,624)	
Most Likely Impact Value (kgs)		kgs	**64,627**	**4,064**	**53,255**	**3,000**	**124,946**	
		1000m^3	**3,231**	**203**	**2,663**	**150**	**6,247**	
		Rate	**20**	**20**	**20**	**20**	**20**	
Sector Research Amount (kgs)			**-**	**2008 Total US Sector Nomination**		**124,946**		

1 Pound = 0.453592 kgs | 1000 cubic feet= 0.028316847 1000 cubic meters

1 lb/1000 ft^3 = 0.0624 kg/1000 m^3 | (ounces/1000 ft^3 ~ kg/1000 m^3)

Footnotes for Appendix A:

Values may not sum exactly due to rounding.

1. **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.
2. **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.
3. **Pest-free Requirements** - 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.
4. **Other Issues**.- Other issues is a short reminder of other elements of an application that were checked
5. **Frequency of Treatment of Product** – This indicates how often methyl bromide is applied in the sector. Frequency varies from multiple times per year to once in several decades.
6. **Quarantine and Pre-Shipment Removed?** – This indicates whether the Quarantine and pre-shipment (QPS) hectares subject to QPS treatments were removed from the nomination.
7. **Most Likely Combined Impacts (%)** – 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.
8. **Regulatory Issues (%)** - Regulatory issues (%) is the percent (%) of the requested area where alternatives cannot be legally used (e.g., township caps) pursuant to state and local limits on their use.

9. **Key Pest Distribution (%)** - 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.
10. **Total 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).
11. **Most Likely Baseline Transition** – Most Likely Baseline Transition amount was determined by the DELPHI process and was calculated by determining the maximum share of industry that can transition to existing alternatives.
12. **(%) Able to Transition** – Maximum share of industry that can transition
13. **Minimum # of Years Required** – The minimum number of years required to achieve maximum transition.
14. **(%) Able to Transition per Year** – The Percent Able to Transition per Year is the percent able to transition divided by the number of years to achieve maximum transition.
15. **EPA Adjusted Use Rate** - Use rate is the lower of requested use rate for 2008 or the historic average use rate or is determined by MBTOC recommended use rate reductions.
16. **2008 Amount of Request** – The 2008 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 1,000 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 US nomination.
17. **EPA Preliminary Value** – The EPA Preliminary Value is the lowest of the requested amount from 2005 through 2008 with MBTOC accepted adjustments (where necessary) included in the preliminary value.
18. **EPA Baseline Adjusted Value** – The EPA Baseline Adjusted Value has been adjusted for MBTOC adjustments, QPS, Double Counting, Growth, Use Rate/ Strip Treatment, Miscellaneous adjustments, and Combined Impacts.
19. **EPA Transition Amount** – The EPA Transition Amount is calculated by removing previous transition amounts since transition was introduced in 2007 and removing the amount of the percent (%) Able to Transition per Year multiplied by the EPA Baseline Adjusted Value.
20. **Most Likely Impact Value** – The qualified amount of the initial request after all adjustments have been made given in total kilograms of nomination, total volume of nomination, and final use rate of nomination.
21. **Sector Research Amount** – The total U.S. amount of methyl bromide needed for research purposes in each sector.
22. **Total US Sector Nomination** - Total U.S. sector nomination is the most likely estimate of the amount needed in that sector.

APPENDIX B. METHYL BROMIDE FACILITIES DATA

CUE Applicant	Facility ID	Size of Facility	Historic Usage									
			1999		2000		2001		2002		2003	
			Rate (lbs ai/1,000ft^3)	Frequency (X/yr)	Rate (lbs ai/1,000ft^3)	Frequency (X/yr)	Rate (lbs ai/1,000ft^3)	Frequency (X/yr)	Rate (lbs ai/1,000ft^3)	Frequency (X/yr)	Rate (lbs ai/1,000ft^3)	Frequency (X/yr)
NCHA	MP18	52,000	3	4	3	4	4	5	3	4	13	14
NCHA	MP19	--	0.5	8	0.5	5	0.5	6	0.5	6	0.5	3
NCHA	MP20	50,000 - 100,000	--	--	--	--	--	--	--	--	--	--
NCHA	MP21	10,000 - 50,000	1.5	4	1.5	4	1.5	3	1.5	3	1.5	3
NCHA	MP22	50,000 - 100,000	3	4	3	4	3	4	3	3	3	3
NCHA	MP23	176,200	8	400lbs	4	200lbs	8	400lbs	8	400lbs	6	300lbs
PFI	PFI1	>500,000	1.5	2	1.5	2	1.5	2	1.5	2	1.5	2
PFI	PFI2	--	--	20	--	20	--	15	--	10	--	5
PFI	PFI3	>500,000	--	--	1.5	1	--	--	1.5	1	--	--
PFI	PFI4	1,000 - 5,000	--	--	--	--	--	--	--	--	--	--
PFI	PFI5	>500,000	1	1	1	1	0	0	1	1	1	1
PFI	PFI6	>500,000	1	2	1	2	1.25	1	1.25	1	1	1
PFI	PFI7	>500,000	1-2	1	0	0	1-2	1	1-2	1	1-2	1
PFI	PFI8	3,000,000	1	1	1.25	1	1.25	1	1	1	1	1
PFI	PFI9	>500,000	1	1	1	1	1	1	1	1	1	1
PFI	PFI10	>500,000	1	1	1	1	1	1	1	1	1	1
PFI	PFI11	700,000	0	0	0	0	0	0	0	0	0	0
PFI	PFI12	>500,000	0	0	0	0	0	0	0	0	0	0
PFI	PFI13	100,000 - 500,000	--	0	--	0	--	0	--	0	--	0
PFI	PFI14	7,000,000+	0	1	0	0	1	1	0	0	1	1
PFI	PFI15	1,750,000cu ft	0	1	0	0	1	1	0	0	1	1
PFI	PFI16	>500,000	1	1	1	1	0	0	1	1	1	1
PFI	PFI17	>500,000	1.5	0	2	1	0	0	2	1	2	1
PFI	PFI18	100,000 - 500,000	--	0	--	0	--	0	--	0	--	0
PFI	PFI19	>500,000	1	1	0	0	1	1	1	1	1	1
PFI	PFI20	3,500,000 cu ft	1	1	0.8	1	0.8	1	0	0	0	0
PFI	PFI21	3,000,000 cu ft	1	1	0	0	0	0	1	1	1-1.5	1
PFI	PFI22	>500,000	1	1	0	0	0	0	0	0	1	1

PFI	PFI23	100,000 - 500,000	--	--	5lb/42 35	1	5lb/42 35	1	5lb/42 35	1	5lb/42 35	1
PFI	PFI24	100,000 - 500,000	0	0	1	1	0	0	0	0	0	0
PFI	PFI25	>500,000	1	1	1	1	1	1	1	1	1	1
PFI	PFI26	2,120,000	1	1	1	1	1	1	1	1	1	1
PFI	PFI27	1,100,000	1	1	1	1	1	1	1	1	1	1
PFI	PFI28	>500,000	1	1	1	1	0	0	1	1	1	1
PFI	PFI29	18.3 million ft^3	--	--	--	--	--	--	--	--	1	1 trailer
PFI	PFI30	2.5 million ft^3	--	0	1	1	1	1	1	1	--	01
PFI	PFI31	18.3 million ft^3	1.5	45 trailers	1.4	45 trailers	1.5	38 trailers	1.5	16 trailers	1.5	25 trailers
PFI	PFI32	1.4 million ft^3	1	1	1	1	1	1	1	1	1	1
PFI	PFI33	23.6 million ft^3 planned	--	--	--	--	--	--	--	--	--	--
PFI	PFI34	23.6 million ft^3 planned	--	--	--	--	--	--	--	--	--	--
PFI	PFI35	11.2 million ft^3	1	1	1	1	1	1	1	1	1	1
PFI	PFI36	8.2 million ft^3	--	--	--	Once, all warehous es	1.5 lbs	Twice (trailers)	0 lbs	--	1.5 lbs	Twice (trailers)
PFI	PFI37	6.9 million ft^3	--	0	1	1	1	1	1	1	1	1
PFI	PFI38	>500,000	--	0	--	0	1	1	--	0	--	0
PFI	PFI39	>500,000	1.5	1	1.5	1.5	1.5	1	1	1	1	2
PFI	PFI40	>500,000	1	1	1.5	1	1	1	1	1	0	0
PFI	PFI41	>500,000	1.5	1	0	0	0	0	0	0	1	0
PFI	PFI42	240,000ft^2; 4,800,000ft^3	--	--	--	--	--	--	1.0#/t^3	1	1.0#/ft^3	1
PFI	PFI43	7 million ft^3	--	--	--	--	--	--	--	--	--	--
PFI	PFI44	>500,000	1.5	1	1.5	1	1.5	1	1.5	1	1.5	1
PFI	PFI45	100,000 - 500,000	0	0	0	0	0	0	0	0	5	1
PFI	PFI46	5,000 - 10,000	0	0	0	0	0	0	0	0	0	0
PFI	PFI47	10,000 - 50,000	0	0	0	0	0	0	0	0	0	0
PFI	PFI48	>500,000	1	1	0	0	1	1	1	1	1	1
PFI	PFI49	>500,000	0	0	0	0	0	0	0	0	0	0
PFI	PFI50	>500,000	0	0	0	0	0	0	0	0	0	0
PFI	PFI51	100,000 - 500,000	--	--	1.3	1	1	1	1.3	1	--	--
PFI	PFI52	100,000 - 500,000	--	NA	--	NA	--	0	--	0	--	0
Rice	1	>500,000	1	2	1	2	1	2	1	2	1	2

Millers												
Rice Millers	2	>500,000	1	2	1	2	1	2	1	2	1	2
Rice Millers	3	>500,000	1.5	1	1.5	2	1.5	2	1.5	2	1	2
Rice Millers	4	>500,000	1.5	2	1.5	2	1.5	2	1	2	1	2
Rice Millers	5	>500,000	1	2	1	2	1	2	1	2	1	2
Rice Millers	6	>500,000	0.5	1	0.5	1	0.5	1	0.5	1	0.5	1
Rice Millers	7	10,000-50,000	2	2	2	2	2	2	2	4	2	2
Rice Millers	8	5,000-10,000	1	5	1	5	1	5	1	5	1	5
Rice Millers	9	5,000-10,000	1	4	1	4	1	4	1	4	1	4
Rice Millers	10	--	1	1	1	1	1	1	1	1	1	1
Rice Millers	11	>500,000	3	2	3	2	3	2	3	2	3	2
Rice Millers	12	5,000-10,000	2.15	1	2.2	1	2.2	2	2.19	1	2	2
Rice Millers	13	50,000-100,000	1	9	1	9	1	9	1	9	1	9
Rice Millers	14	--	24,000 lbs.	2	24,000 lbs.	2	12,000 lbs.	1	12,0000 lbs.	1	12,0000lbs	1
Rice Millers	BR549	>500,000	0.5	1	0.5	1	0.5	1	0.5	1	0.5	1
NPMA	1	100,000-500,000	2	52	2	52	2	52	2	52	2	52
NPMA	2	>500,000	2	52	2	52	2	52	2	52	2	52
NPMA	3	>500,000	2	52	2	52	2	52	2	52	2	52
NPMA	4	100,000-500,000	2	52	2	52	2	52	2	52	2	52
NPMA	5	100,000-500,000	2	52	2	52	2	52	2	52	2	52
NPMA	6	50,000-100,000 (H2); 100,000-500,000 (H1)	2	52	2	52	2	52	2	52	2	52

NPMA	7	50,000-100,000 (F1 & F2)	2	52	2	52	2	52	2	52	2	52
NPMA	8	100,000-500,000	2	52	2	52	2	52	2	52	2	52
NPMA	9	50,000-100,000	2	52	2	52	2	52	2	52	2	52
NPMA	10	>500,000	1	1	1	1	1	1	1	1	1	1
NPMA	11	>500,000	2004: Rate – 1-3#/1000 COFT, Frequency - 2				--	--	--	--	--	--
NPMA	12	--	--	--	--	--	3	2	3	2	3	2
NPMA	13	--	--	--	--	--	3	16	3	17	3	3
NPMA	14	>500,000	1	2	1	3	1	2	1	2	1	1
NPMA	15	50,000-100,000	6oz/1000 cu ft	2	6oz/1000 cu ft	2	6oz/1000 cu ft	1	6oz/1000 cu ft	2	6oz/1000 cu ft	3
NPMA	16	>500,000	1.5	1	--	--			--	--	1.5	1
NPMA	17	100,000-500,000	3	2	3	2	3	1	3	2	3	3
NPMA	18	100,000-500,000	3	1	--	--	3	1	3	1	--	--
NPMA	19	--	25.5	2	25.5	2	25.5	2	25.5	2	25.5	2
NPMA	20	>500,000	--	--	1	1	--	--	--	--	--	--
LifeLine Foods		>500,000	--	--	--	--	--	--	1,800	1	--	--
NAMA	1	>500,000	1.5	3-4	1.5	3-4	1.5	3-4	2	3-4	1.5	3-4
NAMA	2	>500,000	1	3	1	3	1	3	1	3	1	3
NAMA	3	>500,000	1.5oz	2	1.5oz	1	1.5oz	2	1.5oz	2	1.5oz	2
NAMA	4	>500,000	1	2	1	2	1	2	1	3	1	2
NAMA	5	1,000-5,000	--	--	--	--	--	--	--	--	--	--
NAMA	6	1,000-5,000	1.25	1	1.25	1	1.25	1	1	1	1.25	1
NAMA	7	1,000-5,000	--	--	--	--	--	--	--	--	1	1
NAMA	8	1,000-5,000	1.12	2	1.12	2	1.12	1	1	1	1.12	1
NAMA	9	>500,000	1.65	1	1.57	1	1.57	1	2	1	1.55	1
NAMA	10	>500,000	--	--	--	--	--	--	--	--	0.81	1
NAMA	11	0-1,000	1.25	2	1.25	2	1.25	1	1	1	1.25	1
NAMA	12	>500,000	0.75	1	0.75	1	0.75	1	1	1	0.75	1
NAMA	13	>500,000	0.5	1	0.75	1	1	1	0	0	0	0
NAMA	14	1,000-5,000	1.5-3	2	1.5-3	2	1.5-3	2	1.5-3	2	1.5-3	2
NAMA	15	885000	0.75	2	0.75	2	0.75	2	1	2	0.75	2
NAMA	16	>500,000	1.5	2	1.5	2	1.5	2	2	2	1.5	2
NAMA	17	>500,000	925	2	1050	2	1050	2	1,100	1	1100	1

NAMA	18	>500,000	3325	1	2800	1	3400	1	3,700	1	3500	1
NAMA	19	>500,000	1.25	3	1.25	3	1.25	2	1	2	1.25	2
NAMA	20	>500,000	1.25	3	1.25	3	1.25	2	1	2	1.25	3
NAMA	21	>500,000	1.8	2	1.8	2	1.8	2	2	2	1.8	2
NAMA	22	>500,000	1	4	1	3	1	4	1	3	1.3	2
NAMA	23	>500,000	1.5	2	1.5	2	1.5	2	2	2	1.5	2
NAMA	24	>500,000	1.5	2	1.5	2	1.5	2	2	2	1.5	2
NAMA	25	>500,000	1.5	2	1.5	2	1.5	2	2	2	1.5	2
NAMA	26	>500,000	1.8	3	1.8	3	1.8	3	2	3	1.8	3
NAMA	27	>500,000	1	3	1	3	1	3	1	3	1	3
NAMA	28	100,000-500,000	1	3	1.2	3	1.5	4	1	3	1.4	3
NAMA	29	>500,000	?	?	?	?	?	?	?	?	?	?
NAMA	30	>500,000	1	4	1	4	1	3	1	3	1	3
NAMA	31	>500,000	N/A		N/A		N/A		1-1.5	3	1-1.5	3
NAMA	32	>500,000	1.5	3-4	1.5	3-4	1.5	3-4	2	3-4	1.5	3-4
NAMA	33	>500,000	--	--	--	--	--	--	1-1.5	3-4	1-1.5	3-4
NAMA	34	565	1.85	3	1.94	3	1.77	3	2	3	2.12	3
NAMA	35	50,000-100,000	1	2	1	2	1	3	1	3	1	2
NAMA	37	>500,000	.5-.75	3	.5-.75	2	.5-.75	3	.5-.75	3	.5-.75	3
NAMA	38	10,000-50,000	1.25	3	1.25	3	1.25	3	1	3	1.25	3
NAMA	39	945591	0.75	2	0.75	2	0.75	2	1	2	0.75	2
NAMA	40	>500,000	0.5	3	0.5	3	0.5	3	1	3	0.5	3
NAMA	41	50,000-100,000	1.5	3	1.5	3	1.5	2	2	2	1.5	2
NAMA	42	>500,000	1	2	1	2	1	2	1	2	1	2
NAMA	43	100,000-500,000	1.25	2	1.25	2	1.25	2	1	2	1.25	2
NAMA	44	50,000-100,000	0.5	2	0.5	2	0.5	2	1	2	0.5	2
NAMA	45	1,000-5,000	1	2	1	2	1	2	1	2	1	2
NAMA	46	0-1,000	--	--	--	--	--	--	--	--	--	--
NAMA	47	1,000-5,000	.5-1	4	.5-1	4	.5-1	4	.5-1	4	.5-1	4
NAMA	48	5,000-10,000	1	3	1	2	1	2	1	2	1	2
NAMA	49	--	1.5	3	1.5	3	1.5	3	2	3	1.5	3
NAMA	50	1,000-5,000	--	--	--	--	1.5	2	1.5, 3	2	1.5	1
NAMA	51	0-1,000	1.5	3	1.5	2	1.5	3	2	2	1.3	3
NAMA	52	>500,000	1.8	2	1.8	2	1.8	1	2	2	1.8	2
NAMA	53	100,000-500,000	1.5	3	1.5	3	1.5	3	2	3	1.5	1

NAMA	54	>500,000	1	1	1	2	1	2	1	1	--	0
NAMA	55	>500,000	--	--	--	--	--	--	1,800lbs	1	--	--
NAMA	56	100,000-500,000	3	23	3	34	3	18	3	17	3	15
NAMA	57	>500,000	1	2	1	2	1	2	1	2	1	2
NAMA	58	10,000-50,000	1.25	4	1.25	4	1.25	4	1	3	1.25	3
NAMA	59	50,000-100,000										
NAMA	60	1,000-5,000	16	1	16	2	16	2	16	2	16	2
NAMA	61	>500,000	1.5	2	1.5	2	1.5	2	2	2	N/A	N/A
NAMA	62	>500,000		3		3		3		3		3
NAMA	63	1,000-5,000	1.5	2	1.5	2	1.5	2	2	2	1	2
NAMA	64		0.25	3	0.25	3	0.25	3	0	3	0.25	3
NAMA	65	>500,000	1.5	2	1.5	2	1.5	2	2	2	N/A	N/A
NAMA	66	1,000-5,000	1.5	2	1.5	2	1.5	2	2	2	1.5	2
NAMA	67	>500,000		3		4		3		3		3
NAMA	68	1,000-5,000	per label	3	per label	3	per label	3	per label	3	per label	3
NAMA	69	1,000-5,000	per label	3	per label	3	per label	3	per label	3	per label	3
NAMA	70	100,000-500,000	--	--	--	--	--	--	--	--	--	--
NAMA	71	>500,000	2	2	1.8	2	1.6	2	2	2	1.6	2
NAMA	72	100,000-500,000		N/A		N/A		N/A		N/A		N/A
NAMA	73	>500,000	1.5	2	1.5	2	1.5	2	2	2	1.5	2
NAMA	74	>500,000	1	4	1	3	1	3	1	3	1	3
NAMA	75	>500,000	1.5	3	1.5	3	1.5	3	2	2	1.5	2
NAMA	76	100,000-500,000	--	--	--	--	--	--	--	--	--	--
NAMA	77	>500,000	3	2	3	2	3	2	3	2	3	1
NAMA	78	100,000-500,000	1.25	1	1.25	1	1.25	1	1	1	1.25	1
NAMA	79	100,000-500,000	1.5	2	1.5	2	1.5	3	2	2	1.5	1
NAMA	80	100,000-500,000	1.5	2	1.5	2	1.5	1	2	2	1.5	1
NAMA	81	100,000-500,000	1.5	1	1.5	1	1.5	1	2	1	1.5	1
NAMA	82	100,000-500,000	1.5	2	1.5	2	1.5	2	2	2	1.5	2
NAMA	83	1,000-5,000	1.5	3	1.5	3	1.5	2	2	2	1.5	2
NAMA	84	10,000-50,000	0	0	1.5	3	1.5	4	2	6	1.5	4
NAMA	85	100,000-500,000	1	2	1	2	1	2	1	2	1	2
NAMA	86	100,000-500,000	1	2	1	2	1	2	1	2	1	2
NAMA	87	>500,000	0.75	2	0.75	2	0.75	2	1	2	0.75	2
NAMA	88	>500,000	1	2	1	2	1	2	1	2	1	2

NAMA	89	>500,000	0.75	2	0.75	2	0.75	2	1	2	0.75	2
NAMA	90	>500,000	0.6	2	0.6	2	0.6	2	1	2	0.6	2
NAMA	91	>500,000	1	1	1	1	1	1	1	1	1	1
NAMA	92	>500,000	1	2	1	2	1	2	1	2	1	2
NAMA	93	>500,000	1	1	1	1	1	1	1	1	1	1
NAMA	94	>500,000	1	2	1	2	1	2	1	2	1	2