# METHYL BROMIDE CRITICAL USE RENOMINATION NOMINATION FOR STRUCTURES, COMMODITIES OR OBJECTS

## NOMINATING PARTY:
The United States of America

## NAME
USA CUN09 **POST HARVEST** **NATIONAL PEST MANAGEMENT ASSOCIATION (NPMA)**

## BRIEF DESCRIPTIVE TITLE OF NOMINATION:
Methyl Bromide Critical Use Nomination for Post Harvest Use by NPMA (Submitted in 2007 for 2009 Use Season)

## STRUCTURE, COMMODITY OR OBJECT TREATED:
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.

## QUANTITY OF METHYL BROMIDE REQUESTED IN EACH YEAR OF NOMINATION:

**TABLE COVER SHEET: QUANTITY OF METHYL BROMIDE REQUESTED IN EACH YEAR OF NOMINATION**

| YEAR | NOMINATION AMOUNT (METRIC TONNES)* |
|---|---|
| 2009 | 117.779 |

*This amount includes methyl bromide needed for research.

## SUMMARY OF ANY SIGNIFICANT CHANGES SINCE SUBMISSION OF PREVIOUS NOMINATIONS:

There are no significant changes in this sector since the previous nomination.

## REASON OR REASONS WHY ALTERNATIVES TO METHYL BROMIDE ARE NOT TECHNICALLY AND ECONOMICALLY FEASIBLE:

The U. S. nomination is only for those facilities and commodities where the use of alternatives is not suitable.

**<u>COMMODITIES:</u>** Methyl bromide fumigation for commodities occurs to ensure pest-free food and meet the strict requirements of the Food Sanitation Regulations. The commodities listed in this chapter (cocoa, cheese) have no technically feasible alternative that can be used without incurring significant economic losses. Sulfuryl fluoride and phosphine are the primary alternatives in these commodities. Phosphine fumigations take much longer than methyl bromide fumigations and are not a feasible alternative when rapid fumigations are needed; is corrosive to certain metals; and is limited by temperature. Sulfuryl fluoride was federally registered for these uses; however the state of California has not yet registered these uses. It is unknown at this time what amounts of sulfuryl fluoride will be able to replace methyl bromide in this sector. 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.

**<u>FACILITIES:</u>** 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 sulfuryl fluoride, 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 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 $^{o}$ to -35 $^{o}$ C (-30 $^{o}$ to -25$^{o}$ 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 $^{o}$ C (30 $^{o}$ 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.

*(Details on this page are requested under Decision Ex. I/4(7), for posting on the Ozone Secretariat website under Decision Ex. I/4(8))*

*This form is to be used by holders of single-year exemptions to reapply for a subsequent year's exemption (for example, a Party holding a single-year exemption for 2005 and/or 2006 seeking further exemptions for 2007). It does not replace the format for requesting a critical-use exemption for the first time.*

*In assessing nominations submitted in this format, TEAP and MBTOC will also refer to the original nomination on which the Party's first-year exemption was approved, as well as any supplementary information provided by the Party in relation to that original nomination. As this earlier information is retained by MBTOC, a Party need not re-submit that earlier information.*

**NOMINATING PARTY CONTACT DETAILS:**


| | |
|---|---|
| Contact Person: | Hodayah Finman |
| Title: | Foreign Affairs Officer |
| Address: | Office of Environmental Policy<br>U.S. Department of State<br>2201 C Street, N.W. Room 2658<br>Washington, D.C. 20520<br>U.S.A. |
| Telephone: | (202) 647-1123 |
| Fax: | (202) 647-5947 |
| E-mail: | finmanhh@state.gov |


Following the requirements of Decision IX/6 paragraph (a)(1) [*insert name of Party*] 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: | Division Director |
| Address: | Biological and Economic Analysis Division<br>Office of Pesticide Programs<br>U.S. Environmental Protection Agency<br>1200 Pennsylvania Avenue, N.W. Mailcode 7503P<br>Washington, D.C. 20460<br>U.S.A. |
| Telephone: | (703) 308-8200 |
| Fax: | (703) 308-7042 |
| E-mail: | Keigwin.Richard@epa.gov |


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

| **1. PAPER DOCUMENTS:**<br>**Title of paper documents and appendices** | **No. of pages** | **Date sent to Ozone Secretariat** |
|---|---|---|
| USA CUN09 Post Harvest National Pest management Association | | |
| | | |
| | | |
| | | |
| **2. ELECTRONIC COPIES OF ALL PAPER DOCUMENTS:**<br>***Title of each electronic file (for naming convention see notes above)** | **No. of kilobytes** | **Date sent to Ozone Secretariat** |
| USA CUN09 Post Harvest National Pest management Association | | |
| | | |
| | | |

# *TABLE OF CONTENTS*



## *TABLE OF TABLES*

## PART A: INTRODUCTION
## RENOMINATION PART A: SUMMARY INFORMATION

### 1. (Renomination Form 1.) NOMINATING PARTY AND NAME:

The United States of America
USA CUN09 POST HARVEST NATIONAL PEST MANAGEMENT ASSOCIATION (NPMA)

### 2. (Renomination Form 2.) DESCRIPTIVE TITLE OF NOMINATION:

Methyl Bromide Critical Use Nomination for Post Harvest Use By NPMA (Submitted in 2007 for 2009 Use Season)

### 3. SITUATION OF NOMINATED METHYL BROMIDE USE (*e.g. food processing structure, commodity (specify)*):

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 beans, 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. AMOUNT OF METHYL BROMIDE NOMINATED (*Give quantity requested and years of nomination*):

### (Renomination Form 3.) YEAR FOR WHICH EXEMPTION SOUGHT:

**TABLE A 1. QUANTITY OF METHYL BROMIDE REQUESTED IN EACH YEAR OF NOMINATION**

| YEAR | NOMINATION AMOUNT (METRIC TONNES)* |
|---|---|
| **2009** | **117.779** |

*This amount includes methyl bromide needed for research.

### (Renomination Form 4.) SUMMARY OF ANY SIGNIFICANT CHANGES SINCE SUBMISSION OF PREVIOUS NOMINATIONS (e.g. changes to requested exemption quantities, successful trialling or commercialisation of alternatives, etc.)

There have not been any significant changes since the previous nomination. Industries are testing alternatives (such as sulfuryl fluoride, heat, etc) and learning how to better incorporate these into their IPM strategies. Facilities are improving sealing during fumigations, and building improvements. Research is ongoing to solve pest problems in food processing facilities and mills. However, at the time of this nomination, there have not been any significant changes.

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

(Describe the particular aspects of the nominated use that make methyl bromide use critical, e.g.

lack of economic alternatives, unacceptable corrosion risk, lack of efficacy of alternatives under the particular circumstances of the nomination):

TABLE A 2. EXECUTIVE SUMMARY*

| Region | | Processed Foods | Spices and Herbs | Cocoa | Cheese Processing Plants | Sector Total |
|---|---|---|---|---|---|---|
| EPA Preliminary Value | kgs | 91,399 | 9,299 | 78,245 | 2,268 | 181,210 |
| EPA Amount of All Adjustments | kgs | (30,780) | (5,406) | (27,242) | (3) | (63,431) |
| Most Likely Impact Value (kgs) | kgs | 60,619 | 3,893 | 51,002 | 2,265 | 117,779 |
| | $1000m^3$ | 3,031 | 195 | 2,550 | 113 | 5,889 |
| | Rate | 20 | 20 | 20 | 20 | 20 |
| Sector Research Amount (kgs) | | - | 2009 Total US Sector Nomination | | 117,779 | |

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

## 6. METHYL BROMIDE CONSUMPTION FOR PAST 5 YEARS AND AMOUNT REQUIRED IN THE YEAR(S) NOMINATED:

TABLE A 3. METHYL BROMIDE CONSUMPTION AND HISTORIC AMOUNTS

Methyl Bromide Consumption and Historic Amounts NPMA

| MBR HISTORICAL USE (KILOGRAMS) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Applicant Name | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
| Processed Foods | 116,143 | 105,640 | 88,663 | 91,058 | 132,076 | 112,225 | 120,588 |
| Spices and Herbs | 10,651 | 894 | 2,101 | 9,637 | 4,286 | 7,462 | 7,330 |
| Cocoa | 31,844 | 75,348 | 62,935 | 90,863 | 20,172 | 21,938 | 21,816 |
| Dried Milk | 1,319 | 626 | 660 | 567 | 535 | 482 | 458 |
| Cheese Processing Plants | 5,059 | 4,895 | 3,829 | 3,362 | 3,856 | 2,268 | 2,163 |
| SECTOR TOTALS | 165,015.86 | 187,403.80 | 158,187.03 | 195,487.27 | 160,923.55 | 144,375.61 | 152,354.30 |

| VOLUME TREATED (1,000 CUBIC METERS) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Applicant Name | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
| Processed Foods | 4,834 | 4,397 | 3,690 | 3,790 | 5,497 | - | - |
| Spices and Herbs | 443 | 37 | 87 | 401 | 178 | - | - |
| Cocoa | 1,325 | 3,136 | 2,619 | 3,782 | 840 | - | - |
| Dried Milk | - | - | - | - | - | - | - |
| Cheese Processing Plants | 211 | 204 | 159 | 140 | 160 | 94 | 90 |
| SECTOR TOTALS | 6,812.86 | 7,773.43 | 6,556.09 | 8,112.32 | 6,675.17 | 94.39 | 90.01 |

| APPLICATION RATE (KGS/1,000 CUBIC METERS) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Applicant Name | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
| Processed Foods | 24.03 | 24.03 | 24.03 | 24.03 | 24.03 | unknown | unknown |
| Spices and Herbs | 24.03 | 24.03 | 24.03 | 24.03 | 24.03 | unknown | unknown |
| Cocoa | 24.03 | 24.03 | 24.03 | 24.03 | 24.03 | unknown | unknown |
| Dried Milk | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! | unknown | unknown |
| Cheese Processing Plants | 24.03 | 24.03 | 24.03 | 24.03 | 24.03 | 24.03 | 24.03 |
| SECTOR AVERAGE | 24.22 | 24.11 | 24.13 | 24.10 | 24.11 | 1,529.57 | 1,692.64 |

## 7. LOCATION OF THE FACILITY OR FACILITIES WHERE THE PROPOSED CRITICAL USE OF METHYL BROMIDE WILL TAKE PLACE (*Give name and physical address. Continue on separate sheet(s) as annex to this form if necessary. Number each address from one onwards*):

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. 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.

## **Renomination Form Part G:** CHANGES TO QUANTITY OF METHYL BROMIDE REQUESTED

*This section seeks information on any changes to the Party's requested exemption quantity.*

### (Renomination Form 16.) CHANGES IN USAGE REQUIREMENTS

*Provide information on the nature of changes in usage requirements, including whether it is a change in dosage rates, the number of hectares or cubic metres to which the methyl bromide is to be applied, and/or any other relevant factors causing the changes.*

There are no changes in the usage requirements in this sector since the last nomination.

### (Renomination Form 17.) RESULTANT CHANGES TO REQUESTED EXEMPTION QUANTITIES

**TABLE RENOMINATION FORM G 1. RESULTANT CHANGES TO REQUESTED EXEMPTION QUANTITIES**

| | |
|---|---|
| QUANTITY REQUESTED FOR PREVIOUS NOMINATION YEAR: | **124.946 MT** |
| QUANTITY APPROVED BY PARTIES FOR PREVIOUS NOMINATION YEAR: | **122.400 MT** |
| QUANTITY REQUIRED FOR YEAR TO WHICH THIS REAPPLICATION REFERS: | **117.779 MT** |

# PART B: SITUATION CHARACTERISTICS AND MB USE

## 8. KEY PESTS FOR WHICH METHYL BROMIDE IS REQUESTED:

**TABLE B 1A. KEY PESTS FOR WHICH METHYL BROMIDE IS REQUESTED: 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 B 1B: 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.

## 9. SUMMARY OF THE CIRCUMSTANCES IN WHICH THE METHYL BROMIDE IS CURRENTLY BEING USED (*Give ranges of dosage, exposure or temperatures, if appropriate*):

**TABLE B 2 A. COMMODITIES**

| 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 |

- Advise if this information is not available.
- ** Where only part of a structure is fumigated, count partial fumigations separately in this column

Add more rows if required

**TABLE B 2 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.<br><br>80% 15-75 yrs old, combination of metal, wood, brick and concrete.<br><br>5-10% 75+ years old, combination of construction materials and methods. | Not available | Not available | Tilt-up concrete – good to medium<br><br>Metal, wood, brick construction – medium to poor.<br><br>Trailers/containers – good to poor, must be inspected prior to treatment. |

*Give gastightness estimates where possible according to the following gastightness scale: 'A' - less than 25% gas loss within 24 hours or half loss time of pressure difference (e.g. 20 to 10 Pa ($t_{1/2}$)) greater than 1 minute; 'B' – 25-

50% gas loss within 24 hours or half loss time of pressure difference greater than 10 seconds; 'C' – 50-90% gas loss within 24 hours or half loss time of pressure difference 1-10 second: 'D'– more than 90% gas loss within 24 hours or a pressure half loss time of less than 1 second.

## 10. LIST ALTERNATIVE TECHNIQUES THAT ARE BEING USED TO CONTROL KEY TARGET PEST SPECIES IN THIS SECTOR (*Include main alternative techniques for situations similar to the nomination such as given in MBTOC and TEAP reports indexed at http://www.unep.org/ozone/teap/MBTOC*):

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 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 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. There remain facilities in the U.S. that have incorporated phosphine and heat fumigation techniques but 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. This past year many facilities tried sulfuryl fluoride. The industry is still learning how to incorporate sulfuryl fluoride in their pest management strategies.

**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. One fumigation company has reported some success with these sulfuryl fluoride applications; another company is still investigating it. However, the current label prohibits more than one application to cocoa beans.

**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 dried herbs and 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 RENOMINATION FORM PART D: REGISTRATION OF ALTERNATIVES

### 11. SUMMARISE THE ALTERNATIVE(S) TESTED, STARTING WITH THE MOST PROMISING:

See Part F, Renomination Form Part C.

**TABLE C 1. SUMMARY OF 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 C 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. SUMMARISE TECHNICAL REASONS, IF ANY, FOR EACH ALTERNATIVE NOT BEING FEASIBLE OR AVAILABLE FOR YOUR CIRCUMSTANCES (*For economic constraints, see Question 14*):

**TABLE C 3. TECHNICAL SUMMARY OF INFEASIBILITY OF ALTERNATIVES**

<table>
<tr><th>IN KIND ALTERNATIVES</th><th>TECHNICAL FEASIBILITY</th><th>COMMENTS</th></tr>
<tr><td>Carbon Dioxide (high pressure)</td><td>No</td><td rowspan="2">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.<br><br>To implement these alternatives would require new construction of all facilities.</td></tr>
<tr><td>Controlled & Modified Atmospheres</td><td>No</td></tr>
<tr><td>Ethyl/Methyl Formate</td><td>No</td><td>Not registered in United States (last product cancelled in Oct. 1989)</td></tr>
<tr><td>Hydrogen Cyanide</td><td>No</td><td>Not registered in United States (last product cancelled in Feb. 1988)</td></tr>
<tr><td>Phosphine, alone</td><td>No</td><td rowspan="2">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.<br><br>This alternative has already been implemented in areas without sensitive metals.</td></tr>
<tr><td>Phosphine, in combination</td><td>No</td></tr>
<tr><td>Sulfuryl fluoride</td><td>Yes</td><td>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.</td></tr>
</table>

| 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.<br><br>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 | |

*Progress in registration of a product will often be beyond the control of an individual exemption holder as the registration process may be undertaken by the manufacturer or supplier of the product. The speed with which registration applications are processed also can falls outside the exemption holder's control, resting with the nominating Party. Consequently, this section requests the nominating Party to report on any efforts it has taken to assist the registration process, but noting that the scope for expediting registration will vary from Party to Party.*

**(Renomination Form 11.) PROGRESS IN REGISTRATION**

*Where the original nomination identified that an alternative's registration was pending, but it was anticipated that one would be subsequently registered, provide information on progress with its registration. Where applicable, include any efforts by the Party to "fast track" or otherwise assist the registration of the alternative.*

The registration status of the alternatives to methyl bromide has not changed since the previous nomination.

Methyl bromide alternatives do have a fast track for registration in the U.S. EPA. However, before registering a new pesticide or *new use* for a registered pesticide, EPA must first ensure that the pesticide, when used according to label directions, can be used with a reasonable certainty of no harm to human health and without posing unreasonable risks to the environment. To make such determinations, EPA requires more than 100 different scientific studies and tests from applicants. Where pesticides may be used on food or feed crops, EPA also sets tolerances (maximum pesticide residue levels) for the amount of the pesticide that can legally remain in or on foods.

There is a registration decision expected soon on applying an insect growth regulator, methoprene, onto a plastic film used for coating food boxes to control pests after food has been processed. It is undergoing review within the EPA Office of Pesticide Programs.

USG has no legal authority to compel registrations; it can only act on registrations requested by private entities. The timely submission of data to support a registration decision is at the sole discretion of the registrant. Please see table above for additional detail.

**(Renomination Form 12.) DELAYS IN REGISTRATION**

*Where significant delays or obstacles have been encountered to the anticipated registration of an alternative, the exemption holder should identify the scope for any new/alternative efforts that could be undertaken to maintain the momentum of transition efforts, and identify a time frame for undertaking such efforts.*

Methyl bromide alternatives have a fast track for registration in the U.S. EPA. However, before registering a new pesticide or *new use* for a registered pesticide, EPA must first ensure that the pesticide, when used according to label directions, can be used with a reasonable certainty of no harm to human health and without posing unreasonable risks to the environment. To make such determinations, EPA requires more than 100 different scientific studies and tests from applicants. Where pesticides may be used on food or feed crops, EPA also sets tolerances (maximum pesticide residue levels) for the amount of the pesticide that can legally remain in or on foods.

**(Renomination Form 13.) DEREGISTRATION OF ALTERNATIVES**

*Describe new regulatory constraints that limit the availability of alternatives. For example, changes in buffer zones, new township caps, new safety requirements (affecting costs and feasibility), and new environmental restrictions such as to protect ground water or other natural resources. Where a potential alternative identified in the original nomination's transition plan has subsequently been deregistered, the nominating Party would report the deregistration, including reasons for it. The nominating Party would also report on the deregistration's impact (if any) on the exemption holder's transition plan and on the proposed new or alternative efforts that will be undertaken by the exemption holder to maintain the momentum of transition efforts.*

Methyl bromide use on structures, commodities, and post harvest treatments is undergoing reregistration in the US. The proposed mitigations for that reregistration include a fumigation management plan, treatment buffers to enhance worker safety and ventilation buffers to enhance bystander safety. The proposed buffers are based primarily on use rate, total amount of methyl bromide used, and the type and duration of aeration.

An additional complication in forecasting changes in the registration of alternatives is that under the US federal system individual states may impose restrictions above those imposed at the Federal level. Examples of these additional restrictions may include increasing buffer zones around facilities and chambers and requiring capture and destruction technology.

## PART D: EMISSION CONTROL
## RENOMINATION FORM PART E: IMPLEMENTATION OF MBTOC/TEAP RECOMMENDATIONS

**13. HOW HAS THIS SECTOR REDUCED THE USE AND EMISSIONS OF METHYL BROMIDE IN THE SITUATION OF THE NOMINATION? (***Describe procedures used to determine optimum methyl bromide dosages and exposures, improved sealing processes, (refer to gastightness standards given in Question 9(b) above) monitoring systems and other activities that are in place to minimise dosage and emissions***).**

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 C.12.1).

*The Methyl Bromide Technical Options Committee and the Technology and Economic Assessment Panel may recommended that a Party explore and, where appropriate, implement alternative systems for deployment of alternatives or reduction of methyl bromide emissions.*

*Where the exemptions granted by a previous Meeting of the Parties included conditions (for example, where the Parties approved a reduced quantity for a nomination), the exemption holder should report on progress in exploring or implementing recommendations.*

*Information on any trialling or other exploration of particular alternatives identified in TEAP recommendations should be addressed in Part C.*

**(Renomination Form 14.) USE/EMISSION MINIMISATION MEASURES**

*Where a condition requested the testing of an alternative or adoption of an emission or use minimisation measure, information is needed on the status of efforts to implement the recommendation. Information should also be provided on any resultant decrease in the* *exemption quantity arising if the recommendations have been successfully implemented. Information is required on what actions are being, or will be, undertaken to address any delays or obstacles that have prevented implementation.*

During the preparation of this nomination the USG has accounted for all identifiable means to reduce the request. Specifically, approximately 15 million kilograms of methyl bromide were requested by methyl bromide users across all sectors. USG carefully scrutinized requests and made subtractions to ensure that no growth, double counting, inappropriate use rates on a volume basis was incorporated into the final request. Use when the requestor qualified under some other provision (QPS, for example) was also removed and appropriate transition given yields obtained by alternatives and the associated cost differentials~~,~~ was factored in. As a result of all these changes, the USG is requesting roughly 1/3 of that amount.

The USG feels that no additional reduction in methyl bromide quantities is necessary, given the significant adjustments described above.

## PART E: ECONOMIC ASSESSMENT
## RENOMINATION FORM PART F: ECONOMIC ASSESSMENT

**14. (Renomination Form 15.) ECONOMIC INFEASIBILITY OF ALTERNATIVES – Methodology** *(MBTOC will assess economic infeasibility based on the methodology submitted by the nominating Party. Partial budget analysis showing the operations' gross and net returns for methyl bromide and next best alternatives is a widely accepted approach. Analyses should be supported by discussions identifying which costs and revenues change and why. The following measures may be useful descriptors of the economic outcome using methyl bromide or alternatives. Parties may identify additional measures. Regardless of the methodology used, this section should explain why the calculated measures with the alternative are levels that indicate the alternative is not economically feasible. In the case of culturally significant artifacts economic assessment may not be practical.):*

The following measures or indicators may be used as a guide for providing such a description:

- (a) The purchase cost per kilogram of methyl bromide and of the alternative;
- (b) Gross and net revenue with and without methyl bromide, and with the next best alternative;
- (c) Percentage change in gross revenues if alternatives are used;
- (d) Losses per cubic meter relative to methyl bromide if alternatives are used;
- (e) Losses per kilogram of methyl bromide requested if alternatives are used;
- (f) Losses as a percentage of net cash revenue if alternatives are used;
- (g) Percentage change in profit margin if alternatives are used.

**TABLE E 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. | No indication was given by the applicant as to a timetable to solve identified problems. |

| | | | |
|---|---|---|---|
| | | 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. | |
| **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 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.<br><br>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 $5^{o}C$ - $12\,^{o}C$. Phosphine is not used when commodity temperature drops below $5^{o}C$ (Phosphine and Eco2fume® labels). | No indication was given by the applicant as to a timetable to solve identified problems. |
| **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. For food-processing facilities where sulfuryl | |

| | | | |
|---|---|---|---|
| | | fluoride is technically feasible, it costs four to five times as much as methyl bromide for similar results. | |

Commodities and food-processing 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**

For commodities listed in this chapter, an economic analysis was not conducted because this sector did not have an alternative registered. For food-processing facilities listed in this chapter, annual costs of alternatives were compared to methyl bromide (Table 14.2). However, economic feasibility of such alternatives was not assessed due to the lack of revenue information which is necessary to quantify the economic impacts to food-processing facilities.

**TABLE 14.2: ANNUAL COSTS OF ALTERNATIVES COMPARED TO METHYL BROMIDE***

| | Methyl Bromide | Sulfuryl Fluoride | Heat Treatment |
|---|---|---|---|
| Annual Cost per 1,000 $M^3$ | $420 | $2,100 | $804 |

*Costs in this table only include the cost of fumigation or heat treatment.

*Estimates of the cost of sulfuryl fluoride are based on information provided by the applicant that it is necessary to use sulfuryl fluoride at a rate, which costs up to five times as much as methyl bromide for similar results.

## PART F: NATIONAL MANAGEMENT STRATEGY FOR PHASE-OUT OF THIS NOMINATED CRITICAL USE
## RENOMINATION FORM PART B: TRANSITION PLANS

*Provision of a National Management Strategy for Phase-out of Methyl Bromide is a requirement under Decision Ex. I/4(3) for nominations after 2005. The time schedule for this Plan is different than for CUNs. Parties may wish to submit Section 21 separately to the nomination.*

### 15. DESCRIBE MANAGEMENT STRATEGIES THAT ARE IN PLACE OR PROPOSED TO ELIMINATE THE USE OF METHYL BROMIDE FOR THE NOMINATED CRITICAL USE, INCLUDING:

1. Measures to avoid any increase in methyl bromide consumption except for unforeseen circumstances;
2. Measures to encourage the use of alternatives through the use of expedited procedures, where possible, to develop, register and deploy technically and economically feasible alternatives;
3. Provision of information on the potential market penetration of newly deployed alternatives and alternatives which may be used in the near future, to bring forward the time when it is estimated that methyl bromide consumption for the nominated use can be reduced and/or ultimately eliminated;
4. Promotion of the implementation of measures which ensure that any emissions of methyl bromide are minimised;
5. Actions to show how the management strategy will be implemented to promote the phase-out of uses of methyl bromide as soon as technically and economically feasible alternatives are available, in particular describing the steps which the Party is taking in regard to subparagraph (b) (iii) of paragraph 1 of Decision IX/6 in respect of research programmes in non-Article 5 Parties and the adoption of alternatives by Article 5 Parties.

The U.S. has submitted the National Strategy Management Plan in accordance with Decision IX/6

## RENOMINATION FORM PART C: TRANSITION ACTIONS

*Responses should be consistent with information set out in the applicant's previously-approved nominations regarding their transition plans, and provide an update of progress in the implementation of those plans.*

*In developing recommendations on exemption nominations submitted in 2003 and 2004, the Technology and Economic Assessment Panel in some cases recommended that a Party should explore the use of particular alternatives not identified in a nomination' transition plans. Where the Party has subsequently taken steps to explore use of those alternatives, information should also be provided in this section on those steps taken.*

*Questions 5 - 9 should be completed where applicable to the nomination. Where a question is not applicable to the nomination, write "N/A".*

### (Renomination Form 6.) TRIALS OF ALTERNATIVES

*Where available, attach copies of trial reports. Where possible, trials should be comparative, showing performance of alternative(s) against a methyl bromide-based standard*

#### (i) DESCRIPTION AND IMPLEMENTATION STATUS:

In the literature described below, none of the alternatives were compared to a methyl bromide standard.

<u>IPM</u>

Research is continuing in the area of contour mapping to support pest management /IPM (Arbogast, et al. 2005; Nansen, et al., 2006). Spatial studies are important in monitoring pest populations.

Efficient insect detection of cereal grains is being studied (Neethirajan, et al., 2007).

Numerous articles on essential oils have been published recently (Lee 2002; Nansen and Phillips, 2003) and on other spot-treatments (Lee, et al., 2003; Leelaja, et al. In Press; Wang, et al., 2006). Hydroprene is receiving attention as well (Mohandass, et al. 2006a, 2006b).

<u>Alternative Fumigants</u>

Phosphine investigations continue. Collins, et al. (2005) conducted laboratory studies examining resistant and susceptible strains of the *Rhyzopertha dominica* to a range of phosphine concentrations and exposure periods.

Germinara, et al. (In Press) have begun preliminary investigations into the biological activity of proprionic acid on adults of *Sitophilus granarius* and *S. oryzae*.

Ozone as a fumigant in grain bins is being investigated (Kells, et al., 2001).

The registrant of sulfuryl fluoride is conducting more experiments through-out the U.S., but the experiments are not available at the time of this nomination.

Heat Treatments
Boina and Subramanyam,(2004) studied confused flour beetle life stages in the laboratory to a range of elevated temperatures.

Mahroof, et al., (2005) continues investigations of heat treatments and the red flour beetle.

**(ii) OUTCOMES OF TRIALS: (***Include any available data on outcomes from trials that are still underway. Where applicable, complete the table included at Appendix I identifying comparative disease ratings and yields with the use of methyl bromide formulations and alternatives.* )

IPM
Contour mapping in Indian meal moth illustrate that higher trap catches are nearer the source of infestations (Arbogast, et al., 2005).

Researchers are trying to develop efficient and fast insect detection techniques for grain. The potential of acoustic detection, carbon dioxide measurement, near-infrared spectroscopy, and soft X-ray methods have been discussed. Most were found to be cost prohibitive, and also the complexities of caibrating & operating the instruments presented problems to implementation (Neethirajan, et al., 2006).

The literature regarding essential oils are all in small areas and laboratory experiments, in addition, none have included economic analyses.

A review of hydroprene, an insect growth regulator, demonstrates that it works well on the immature stages of many of the stored product insects, but the efficacy depends upon the surface texture, temperature, and sanitation (Mohandass, et al. 2006a). In addition, mortality of Indian meal moth larvae is increased at higher temperatures Mohandass, et al., 2006b).

Alternative Fumigants
Collins, et al. (2205) with R. dominica, complete control can be expected in 5, 10, and 14 days depending on phosphine concentration.

Germinara, et al. (In Press) have begun preliminary investigations into the biological activity of proprionic acid on adults of Sitophilus granarius and S. oryzae. These laboratory studies demonstrated that proprionic acid was effective in killing adult weevils, and dose-dependent repellent effects.

Kells, et al. (2001) determined that ozone can be used as a fumigant in grain bins. In 8.9 tonnes of maize, with 50 ppm ozone for 3 days resulted in 92-100% mortality of adult red flour beetle, adult maize weevil and Indian meal moth larvae.

The sulfuryl fluoride registrant is conducting studies in different geographical locations with different stored products pests, but the results are not yet available.

Heat Treatments

Boina and Subramanyam,(2004) found that old larvae of confused flour beetles most resistant to elevated temperatures. In pupae & adults of red flour beetles, sublethal heat exposure resulted in impaired reproductive performance (Mahroof, et al. 2005)

**(iii) IMPACT ON CRITICAL USE NOMINATION/REQUIRED QUANTITIES:** *(For example, provide advice on any reductions to the required quantity resulting from successful results of trials.)*

The available literature does not compare potential replacements of methyl bromide with methyl bromide. In addition, few have information regarding costs. However, the industry is learning how to implement sulfuryl fluoride as well as heat. There have been a few instances of building damage from heat fumigations, as many heat companies are trying to match the down times of methyl bromide fumigations.

During the preparation of this nomination the USG has accounted for all identifiable means to reduce the request. Specifically, approximately 15 million kilograms of methyl bromide were requested by methyl bromide users across all sectors. USG carefully scrutinized requests and made subtractions to ensure that no growth, double counting, inappropriate use rates on a treated hectare basis was incorporated into the final request. Use when the requestor qualified under some other provision (QPS, for example) was also removed and appropriate transition given yields obtained by alternatives and the associated cost differentials~~,~~ was factored in. As a result of all these changes, the USG is requesting roughly 1/3 of that amount.

The USG feels that no additional reduction in methyl bromide quantities is necessary, given the significant adjustments described above.

**(iv) ACTIONS TO ADDRESS ANY DELAYS/OBSTACLES IN CONDUCTING OR FINALISING TRIALS:**

Research takes both time and money. In the U.S. much research is accomplished by university faculty members competing for grant money. In addition, the U.S. Department of Agriculture has an Agriculture Research Service that conducts research.
The 5-year accomplishments of this program are available at:
http://www.ars.usda.gov/SP2UserFiles/Program/308/NP308AccomplishmentReport.pdf

NPMA is also funding research to support these specific subsectors. They have hired scientists to study alternatives (primarily heat and sulfuryl fluoride) to methyl bromide for structures and cocoa beans. In addition, they are funding an agricultural economist to conduct a cost benefits analysis.

The USG has the ability to authorize Experimental Use Permits (EUPs) for large scale field trials for methyl bromide alternatives. As with other activities connected with registration of a pesticide, the USG has no legal authority either to compel a registrant to seek an EUP or to require growers to participate.

As noted in our previous nomination, the USG provides a great deal of funding and other support for agricultural research, and in particular, for research into alternatives for methyl bromide.

This support takes the form of direct research conducted by the Agricultural Research Service (ARS) of USDA, through grants by ARS and CSREES, by IR-4, the national USDA-funded project that facilitates research needed to support registration of pesticides for specialty crop vegetables, fruits and ornamentals, through funding of conferences such as MBAO, and through the land grant university system

### (Renomination Form 7.) TECHNOLOGY TRANSFER, SCALE-UP, REGULATORY APPROVAL FOR ALTERNATIVES

The USDA maintains an extensive technology transfer system, the Agricultural Extension Service. This Service is comprised of researchers at land grant universities, county extension agents, and private pest management consultants. In addition to these sources of assistance for technology transfer, there are trade organizations and grower groups, some of which are purely voluntary but most with some element of institutional compulsion, that exist to conduct research, provide marketing assistance, and to disseminate "best practices."

#### (i) DESCRIPTION AND IMPLEMENTATION STATUS:

Many of the USDA grants include technology transfer. Most of the recipients of grants typically accomplish this by extension education (publications,websites) and industry engagement via trade-shows and conferences. Several awardees will hold hands-on training and demonstrations.

See above.

#### (ii) OUTCOMES ACHIEVED TO DATE FROM TECHNOLOGY TRANSFER, SCALE-UP, REGULATORY APPROVAL:

See above.

#### (iii) IMPACT ON CRITICAL USE NOMINATION/REQUIRED QUANTITIES: (*For example, provide advice on any reductions to the required quantity resulting from successful progress in technology transfer, scale-up, and/or regulatory approval.*)

During the preparation of this nomination the USG has accounted for all identifiable means to reduce the request. Specifically, approximately 15 million kilograms of methyl bromide were requested by methyl bromide users across all sectors. USG carefully scrutinized requests and made subtractions to ensure that no growth, double counting, inappropriate use rates on a treated hectare basis was incorporated into the final request. Use when the requestor qualified under some other provision (QPS, for example) was also removed and appropriate transition given yields obtained by alternatives and the associated cost differentials~~,~~ was factored in. As a result of all these changes, the USG is requesting roughly 1/3 of that amount.

The USG feels that no additional reduction in methyl is necessary.

#### (iv) ACTIONS TO ADDRESS ANY DELAYS/OBSTACLES:

Research takes both time and money. The above experiments are continuing and require more time in order to complete. After the data are analyzed, the results will dictate what further actions will be needed. Any further investigations will need appropriate funding, most likely through competitive grants. In addition, extension education (publications, websites) and industry engagement via trade-shows and conferences, and other venues (like the Methyl Bromide Alternatives Outreach Annual Meetings) will be pursued. Some groups will hold hands-on training and demonstrations.

USG has no legal authority to compel registrations; it can only act on registrations requested by private entities. The timely submission of data to support a registration decision is at the sole discretion of the registrant. Please see table above for additional detail.

### (Renomination Form 8.) COMMERCIAL SCALE-UP/DEPLOYMENT, MARKET PENETRATION OF ALTERNATIVES

#### (i) DESCRIPTION AND IMPLEMENTATION STATUS:

These issues are discussed in the National Management plan for methyl bromide submitted previously.

**(ii) IMPACT ON CRITICAL USE NOMINATION/REQUIRED QUANTITIES:** (*For example, provide advice on any reductions to the required quantity resulting from successful commercial scale-up/deployment and/or market penetration*.

The USG feels that no additional reduction in methyl bromide quantities is necessary

#### (iii) ACTIONS TO ADDRESS ANY DELAYS/OBSTACLES:

USG has no legal authority to compel registrations; it can only act on registrations requested by private entities. The timely submission of data to support a registration decision is at the sole discretion of the registrant. Please see table above for additional detail

The USDA maintains an extensive technology transfer system, the Agricultural Extension Service. This Service is comprised of researchers at land grant universities and county extension agents in addition to private pest management consultants. In addition to these sources of assistance for technology transfer, there are trade organizations and user groups, some of which are purely voluntary but most with some element of institutional compulsion, that exist to conduct research, provide marketing assistance, and to disseminate “best practices”.

### (Renomination Form 9.) CHANGES TO TRANSITION PROGRAM

*If the transition program outlined in the Party’s original nomination has been changed, provide information on the nature of those changes and the reasons for them. Where the changes are significant, attach a full description of the revised transition program.*

See Appendix A.

### (Renomination Form 10.) OTHER BROADER TRANSITION ACTIVITIES

*Provide information in this section on any other transitional activities that are not addressed elsewhere. This section provides a nominating Party with the opportunity to report, where applicable, on any additional activities which it may have undertaken to encourage a transition, but need not be restricted to the circumstances and activities of the individual nomination. Without prescribing specific activities that* *a nominating Party should address, and noting that individual Parties are best placed to identify the most appropriate approach to achieve a swift transition in their own circumstances, such activities could include market incentives, financial support to exemption holders, labelling, product prohibitions, public awareness and information campaigns, etc.*

These issues are discussed in the National Management plan for methyl bromide submitted previously.

## PART G: CITATIONS


Arbogast, R. T., Shahpar, R Chini, J. E. Mcgovern. 2005. Plodia interpunctella (Lepidoptera:Pyralidae): spatial relationship between trap catch and distance from a source of emerging adults. J Econ. Entomol. 98(2):326-333.

Arthur, F. H. 2000. Toxicity of diatomaceous earth to red flour beetles and confused flour beetles (Coleoptera: Tenebrionidae): Effects of temperature and relative humidity. J. Econ. Entomol. 93(2): 526-532.

Arthur, F. H. 1992. Cyfluthrin WP and EC formulations to control malathion-resistant red flour beetles and confused flour beetles (Coleoptera: Tenebrionidae): Effects of paint on residual activity. J. Entomol. Sci. 27(4):436-444.

Arthur, F. and T. W. Phillips. 2003. Stored-product insect pest management an d control, In: Food Plant Sanitation eds: Y. H. Hui, B. L. Bruinsma, J. R. Gorham, W. Nip, P. S. Tong, and P. Ventresca. Marcel Dekker, Inc., New York, pp. 341-358.

Bell, C. H. 2000. Fumigation in the 21st century. Crop Protection 19:563-569.

Boina, D. and B. Subramanyam. 2004. Relative susceptibility of Tribolium confusum life stages exposed to elevated temperatures. J. Econ. Entomol. 97(6):2168-2173.

Collins, P. J., G. J. Daglish, H. Pavic and R. A. Kopittke. 2005. Response of mixed-age cultures of phosphine-resistant and susceptible strains of lesser grain borer, Rhyzopertha dominica, to phosphine at a range of concentrations and exposure periods. J Stored Products Research 41(4): 373-385.

Cox, P.D. 2004. Potential for using semiochemicals to protect stored products from insect infestation. J Stored Prod. Res. 40:1-25.

Dowdy, A K.& P. G. Fields. 2002. Heat combined with diatomaceous earth to control the confused flour beetle (Coleoptera: Tenebrionidae) in a flour mill. J Stored Prod. Res. 38:11-22.

Dunkel, F. V. and L. J. Sears. 1998. Fumigant properties of physical preparations from Mountain big sagebrush, Artemisia tridentate Nutt. ssp. vaseyana (Rydb.) Beetle for stored grain insects. J. Stored Prod. Res. 34(4):307-321.

Fields, P. and N. D. G. White. 2002. Alternatives to methyl bromide treatments for stored-product and quarantine insects. Annual Review of Entomology 47:331-59.

Germinara, G. S., G. Rotundo, and A. De Cristofaro. In Press. Repellence and fumigant toxicity of propionic acid against adults of Sitophilus granarius (L.) and S. oryzae (L.). J Stored Products Research available online August 2006.

Hou, X., P. Fields, and W. Taylor. 2004. The effect of repellents on penetration into packaging by stored-product insects. J Stored Prod. Res. 40:47-54.

Kells, S. A., L. J. Mason, D. E. Maier, and C. P. Woloshuk. 2001. Efficacy and fumigation characteristics of ozone in stored maize. J Stored Products Research 37(4): 371-382.

Lee, Sung-Eun. 2002. Biochemical mechanisms conferring cross-resistance to fumigant toxicities of essential oils in a chlorpyrifos-methyl resistant strain of Oryzaephilus surinamensis L. (Coleoptera:Silvanidae). J Stored Products Research 38(2): 157-166.

Lee, S., C. J. Peterson, and J.R. Coats. 2003. Fumigation toxicity of monoterpenoids to several stored product insects. J Stored Products Research 39(1): 77-85.

Leelaja, B. C., Y. Rajashekar, P. V. Reddy, K. Begum, and S. Rajendran. In Press. Enhanced fumigant toxicity of allyl acetate to stored-product beetles in the presence of carbon dioxide. J Stored Products Research available online January 2006.

Mahroof, R., B. Subramanyam, and P. Flinn. 2005. Reproductive performance of Tribolium castaneum (Coleoptera: Tenebrionidae) exposed to minimum heat treatment temperature as pupae and adults. J. Econ. Entomol. 98(2):626-633.

Mahroof, R., Subramanyam, B. and Eustace, D. 2003. Temperature and relative humidity profiles during heat treatment of mills and its efficacy against Tribolium castaneum (Herbst) life stages. J. Stored Prod. Res. 39:555-569.

Mahroof, R., B. Subramanyam, J. E. Throne, and A. Menon. 2003. Time-mortality relationships for Tribolium castaneum (Coleoptera: Tenebrionidae) life stages exposed to elevated temperatures. J. Econ. Entomol. 96(4): 1345-1351.

Mohandass, S., F. H. Arthur, K. Y. Zhu, and J. E. Throne. 2006a. Hydroprene prolongs developmental time and increases mortality in wandering-phase Indianmeal moth (Lepidoptera:Pyralidae)larvae. J. Econ. Entomol. 99(4):1509-1519.

Mohandass, S. M., F. H. Arthur, K. Y. Zhu, and J. E. Throne. 2006b. Hydroprene: mode of action, current status in stored-product pest management, insect resistance, and future prospects. Crop Protection 25:902-909.

Mueller, D. K. 2002. Insect resistance testing. Fumigants and Pheromones 62:1-2.

Nansen, C., T. W. Phillips, P. K. Morton, and E. J. Bonjour. 2006. Spatial analysis of pheromone-baited trap captures form controlled releases of male Indianmeal moths. Environ. Entomol. 35(2):516-523.

Nansen, C. and T. W. Phillips. 2003. Ovipositional responses of the Indianmeal moth, Plodia interpunctella (Hubner) (Lepidoptera:Pyralidae) to oils. Annals Entomol. Soc. Amer. 96(4):524-531.

Neethirajan, S., C. Karunakaran, D. S. Jayas, and N. D. G. White. 2007. Detection techniques for stored-product insects in grain. Food Control 18(2):157-162.

Nielsen, P. S. 1998. The effect of a diatomaceous earth formulation on the larvae of Ephestia kuehniella Zeller. J Stored Prod. Res 34:113-121.

Oberlander, H., D. L. Silhacek, E. Shaaya, and I. Ishaaya. 1997. Current status and future perspectives of the use of insect growth regulators for the control of stored product insects. J Stored Prod. Res. 33:1-6.

Skovgard, H., N. Holst, and P. S. Nielsen. 1999. Simulation model of the Mediterranean flour moth (Lepidoptera: Pyralidae) in Danish flour mills. Environ. Entomol. 28(6):1060-1066.

Taylor, R.W.D. 1989. Phosphine, a major grain fumigant at risk. Int. Pest Control. 31:10-14.

Wang, J., F. Zhu, X. M. Zhou, C. Y. Niu, and C. L. Lei. 2006. Repellent and fumigant activity of essential oil from Artemisia vulgaris to Tribolium castaneum (Herbst) (Coleoptera: Tenebrionidae). J Stored Products Research 42(3): 339-347.

Zettler, J. L. 1991. Pesticide resistance in Tribolium castaneum and T. confusum (Coleoptera: Tenebrionidae) form flour mills in the United States. J. Econ. Entomol. 84(3):763-767.

Zettler, J. L. and F. H. Arthur. 2000. Chemical control of stored product insects with fumigants and residual treatments. Crop Protection 19:577-582.

# APPENDIX A 2009 METHYL BROMIDE USAGE NEWER NUMERICAL INDEX EXTRACTED (BUNNIE)

**2009 Methyl Bromide Usage Newer Numerical Index - BUNNIE** — **NPMA**

| December 18, 2006 | Region | | Processed Foods | Spices and Herbs | Cocoa | Cheese Processing Plants | Sector Total | Notes |
|---|---|---|---|---|---|---|---|---|
| Dichotomous Variables | Currently Use Alternatives? | | Yes | Yes | Yes | Yes | | |
| | Pest-free Requirements? | | Yes | Yes | Yes | Yes | | |
| Other Issues | Frequency of Treatment of Product | | 1x per year | 1x per year | 1x per year | 1x per year | | |
| | 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** | | |
| 2009 Applicant Requested Usage | *Amount - Pounds* | *Pounds* | *201,500* | *20,500* | *172,500* | *5,000* | *399,500* | |
| | *Volume - 1000ft$^3$* | | *161,200* | *16,400* | *138,000* | *4,000* | *319,600* | |
| | *Rate (lb/1000ft$^3$)* | | *1.25* | *1.25* | *1.25* | *1.25* | *1.25* | |
| | **Amount - Kilograms** | Metric | **91,399** | **9,299** | **78,245** | **2,268** | **181,210** | |
| | Volume - 1000m$^3$ | | 4,565 | 464 | 3,908 | 113 | 9,050 | |
| | Rate (kg/1000m$^3$) | | 20 | 20 | 20 | 20 | 20 | |
| **EPA Preliminary Value** | | **kgs** | **91,399** | **9,299** | **78,245** | **2,268** | **181,210** | |
| 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 | 91,294 | 5,862 | 76,810 | 2,265 | 176,232 | |
| EPA Transition Amount | | kgs | (30,675) | (1,970) | (25,808) | - | (58,453) | |
| **EPA Amount of All Adjustments** | | **kgs** | **(30,780)** | **(5,406)** | **(27,242)** | **(3)** | **(63,431)** | |
| **Most Likely Impact Value (kgs)** | | kgs | **60,619** | **3,893** | **51,002** | **2,265** | **117,779** | |
| | | 1000m$^3$ | **3,031** | **195** | **2,550** | **113** | **5,889** | |
| | | Rate | **20** | **20** | **20** | **20** | **20** | |
| **Sector Research Amount (kgs)** | | | **-** | **2009 Total US Sector Nomination** | | **117,779** | | |

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$^3$)