METHYL BROMIDE CRITICAL USE NOMINATION FOR POST HARVEST USE FOR COMMODITIES

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

NOMINATING PARTY: The United States of America

BRIEF DESCRIPTIVE TITLE OF NOMINATION: Methyl Bromide Critical Use Nomination for Post Harvest Use for Commodities

NOMINATING PARTY CONTACT DETAILS

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

X Yes ☐ No

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List of Documents Sent to the Ozone Secretariat in Official Nomination Package

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

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

2. Electronic Copies of All Paper Documents: **Title of Electronic Files**	**Size of File (kb)**	**Date Sent to Ozone Secretariat**

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PART A: SUMMARY

1. NOMINATING PARTY

The United States of America (U. S.)

2. DESCRIPTIVE TITLE OF NOMINATION:

Methyl Bromide Critical Use Nomination for Post Harvest Use for Commodities

3. SITUATION OF NOMINATED METHYL BROMIDE USE

This sector includes walnuts, pistachios, dried fruit (prunes, raisins, figs), and dates, which are under intense pressure from numerous insect pests. Methyl bromide is being used to treat these commodities in a very short period, during the peak production season and shortly after harvest, before they can be stored and/or shipped to prevent pests from infesting and degrading the commodity in storage. Most fumigations are made over a few weeks, during the peak production season when the bulk of the harvest is moving into the storage and shipping channels. These periods can be compressed when harvest occurs close to key market windows, such as holiday markets for certain types of dried fruits and nuts.

4. METHYL BROMIDE NOMINATED

TABLE 4.1: METHYL BROMIDE NOMINATED

YEAR	NOMINATION AMOUNT (KG)	VOLUME TREATED (1,000 M^3)
2006	**82,916**	**2,689**

The U. S. nomination is only for those facilities where the use of alternatives is not suitable. For U. S. commodities 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.
- 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). In other cases the character of the final product is changed, becoming cooked (toasted) rather than raw nuts, for example.
- Transition to newly available alternatives: Sulfuryl fluoride recently received a Federal registration for dried fruits and nuts; state registrations have not yet been issued. All of the dried fruit operations requesting methyl bromide are located in California, a state with a lengthy and rigorous registration process. Further, it will take some time for applicators to be trained in the use of this chemical and for its incorporation into a pest control program.
- Longer fumigations: 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 if the delay causes the producers to miss a market window. Longer fumigation periods may not be feasible in situation where there

is not excess fumigation capacity i.e. when facilities are in continuous use. In these situations longer fumigations for some products mean that others cannot be fumigated.

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)*

Methyl bromide is needed primarily to treat stored agricultural commodities in a very short period, during the peak production season, shortly after harvest before they can be stored and/or shipped. These treatments prevent field pests from infesting and degrading the commodity in storage. Fumigations must be made over a very short period, during the peak production season when the bulk of the harvest is moving into the storage and shipping channels. These periods can be compressed when harvest occurs close to key market windows, such as holiday markets for certain types of nuts.

The technical and economic feasibility analyses indicate that phosphine alone or combined with carbon dioxide (Eco2fume®) is the only chemical alternative currently available for use on in-shell walnuts, pistachios, dried fruit, and dates. Phosphine fumigation, however, takes longer than methyl bromide and is not a currently 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.

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. As with Eco2fume®, these alternatives could not be implemented in the short term without significant investment in new facilities. Estimated costs for treatment facilities are at least as great as building costs for Eco2fume, and do not include costs of land acquisition and development. The dried fruit and nut industries in the United States have reduced the number of methyl bromide fumigations by incorporating many of the alternatives identified by MBTOC, such as implementing IPM strategies, especially sanitation, in storage facilities. Pest populations are monitored 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.

Although, in time, the commodity industry will be able to gradually adopt alternatives as these become available, the sudden adoption of the next best alternative, phosphine alone or in combination, would adversely impact the industry's ability to rapidly process commodities during the peak harvest season and to access key market windows. That is, the industry would likely suffer significant economic losses if it were to fully replace methyl bromide with phosphine, mainly because of the cost of production delay. The estimated economic loss per 1000 m^3 ranges from $18,745 for dried fruit to $308,476 for pistachios. The estimated economic loss as a percentage of net revenue is greater than 100% for the CUE applicants in the commodity sector.

TABLE A.1: EXECUTIVE SUMMARY*

	Walnuts	*Pistachios*	*Dried Fruit*	*Dates*
Amount of Request				
2006 Kilograms	87,362	4,990	20,412	3,467
Application Rate (kg/m³)	60.87	21.0	24.0	21.0
Volume (1000 cubic meters)	1,435	238	850	167
2006 Nominated Amount (kg)	55,178	4,217	18,218	3,016
Marginal Strategy	Phosphine	Phosphine	Phosphine	Phosphine
Time Lost	84 DAYS PER YEAR	84 DAYS PER YEAR	84 DAYS PER YEAR	84 DAYS PER YEAR
Loss per 1000 m³	$97,121	$308,476	$18,745	$85,484
Loss per kg MB (US$/kg)	$978	$14,620	$781	$4,110
Loss as % of Gross Revenue (%)	28.06%	28.02%	28.33%	28.07%
Loss as % of Net Revenue (%)	561.24%	121.72%	130.38%	564.41%
Describe Economic Impacts	Economic losses are from additional production downtimes due to longer fumigation time from and capital expenditures required to adopt an alternative.			

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

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

TABLE 6.1: METHYL BROMIDE CONSUMPTION FOR THE PAST 5 YEARS AND THE AMOUNT REQUESTED IN THE YEAR(S) NOMINATED

For each year specify:	Historical Use[1]						Requested Use	
	1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2005**	**2006**
Amount of MB (kg)	88,094	92,006	104,588	91,334	102,616	76,400	125,953	116,230
Volume Treated (1000 m³)	2,223	3,285	3,125	2,428	2,718	1,548	2,829	2,690
Formulation of MB								
Dosage Rate (kg/1000 m³)	28.67	26.38	25.89	28.44	28.58	34.44	31.7	31.7
Actual (A) or Estimate (E)								

[1] Based on most current information.

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)*

This nomination package represents four commodity sectors, all produced entirely in California: walnuts, pistachios, dried fruit (prunes, raisins, and figs), and dates. Walnuts are grown and processed primarily in the Sacramento and San Joaquin Valleys. Significant production also occurs in the coastal valleys in the counties of Santa Barbara, San Luis Obispo, Monterey, and San Benito.

Pistachios are grown mainly in the San Joaquin and Sacramento valleys. Kern County leads California in pistachio production with over 40 percent of the total crop. Other top producing counties include Madera, Kings, Fresno and Tulare. Pistachios are grown as far north as Shasta County and as far south as Riverside County.

The majority of California prunes are grown in the Sacramento Valley. Other production areas in the San Joaquin Valley include primarily Tulare and Fresno counties.

About 99% of California's raisin grape production is in the southern San Joaquin Valley region. Fresno County alone produces about 70% of California's raisins. Merced County is the only northern San Joaquin Valley County with any significant commercial production of raisins.

The San Joaquin Valley is the predominantly fig-producing area in California with Madera, Merced, and Fresno counties leading in production.

Most U.S. dates are grown in California’s Coachella Valley, Riverside and Imperial counties.

The location of each facility where methyl bromide fumigation may take place was not requested in the forms filled out by the applicants in the United States. Therefore, we currently do not have a complete listing of the addresses for each facility.

TABLE A.2: 2006 NOMINATION - POST HARVEST USE FOR COMMODITIES*

2006 NOMINATION - POST HARVEST USE FOR COMMODITIES		Walnuts	Pistachios	Dried Fruit	Dates
Applicant Request for 2006	**Requested Kilograms (kg)**	87,362	4,990	20,412	3,467
	Requested Application Rate (kg/1000 m³)	60.9	21.0	24.0	21.0
	Requested Volume (1000 m³)	1,435	238	850	167
CUE Nominated for 2006	**Nominated Volume (1000 m³)**	1,148	201	773	145
	Nominated Application Rate (kg/ 1000 m³)	48	21	24	21
	Nominated Kilograms (kg)	55,178	4,217	18,218	3,016

2006 NOMINATION TOTALS - POST HARVEST USE FOR COMMODITIES	
OVERALL REDUCTION (%)	29
2006 U.S. CUE NOMINATION (KG)	82,896
RESEARCH AMOUNT (KG)	20
Total 2006 U.S. Sector Nominated Kilograms (kg)	**82,916**

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

PART B: SITUATION CHARACTERISTICS AND METHYL BROMIDE USE

8. KEY PESTS FOR WHICH METHYL BROMIDE IS REQUESTED

TABLE 8.1: KEY PESTS FOR METHYL BROMIDE REQUEST

GENUS AND SPECIES FOR WHICH THE USE OF METHYL BROMIDE IS CRITICAL	COMMON NAME	SPECIFIC REASON WHY METHYL BROMIDE IS NEEDED
Cydia pomonella	Codling moth	MB is used mainly where rapid fumigations are needed to meet customer timelines during critical market windows and peak production periods. During peak production months, phosphine fumigation takes 3 times longer (6 days) than conventional MB fumigation (2 days) and up to 20 times longer than vacuum MB fumigation (7 hours). The required duration of phosphine fumigation increases as commodity temperature decreases, making its use impractical during the cold winter months. No technically or economically feasible alternatives exist at present during these critical periods.
Amyelois transitella	Navel orangeworm	
Plodia interpunctella	Indianmeal moth	
Tribolium castaneum	Red Flour Beetle	
Cadra figulilella	Raisin Moth	
Carpophilus sp.	Dried Fruit Beetle	
Ectomyelois ceratoniae	Carob pod moth	
Carpophilus spp., *Haptoncus* spp.	Nitidulid beetles	

TABLE B.1: KEY PESTS BY COMMODITY

COMMON NAME	WALNUTS	PISTACHIOS	DRIED FRUIT AS SPECIFIED	DATES
Codling moth	Common			
Navel orangeworm	Common			
Indianmeal moth	Common	Common	Common	
Red Flour Beetle	Minor	Common		
Warehouse Beetle		Minor		
Raisin Moth			Common	Minor
Dried Fruit Beetle			Common	
Carob pod moth				Common
Nitidulid beetles				Common

TABLE B.2: CHARACTERISTIC OF SECTOR

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Harvest Material In:	**Walnuts, Pistachios, Dried Fruit**								X	X	X	X	
	Dates	X								X	X	X	X
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

Critical methyl bromide fumigations occur during the peak harvest of the commodities. Other fumigations occur as indicated by monitoring throughout the year.

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

TABLE 9.1(a.): COMMODITIES

COMMODITY	MB DOSAGE *(Kg/1000 m^3)*	EXPOSURE TIME *(hours)*	TEMP. *(ºC)*	NUMBER OF FUMIGATIONS PER YEAR	PROPORTION OF PRODUCT TREATED AT THIS DOSE	FIXED (F) MOBILE (M) STACK (S)
Dried Fruit	24	24	Variable	3	100%	F, M
Pistachios	21	24	Variable	Variable 2-3 for some	100%	F, M
Walnuts	111	24	Variable	2.6	100%	F, M
Dates	21	24	Variable	1-2	100%	F, M

TABLE 9.1(b.): FIXED FACILITIES *(MB fumigation done mainly in vacuum chambers)*

COMMODITY	TYPE OF CONSTRUCTION AND APPROXIMATE AGE IN YEARS	VOLUME (m^3) OR RANGE	NUMBER OF FACILITIES (E.G. 5 SILOS)	GAS TIGHTNESS ESTIMATE
Dried Fruit	No information is available as to the type of construction, age, volume, number of facilities, and gas tightness of the diverse types of facilities in this sector.			
Pistachios				
Walnuts				
Dates				

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

Many of the MBTOC not-in-kind alternatives to methyl bromide are critical to monitoring and managing pest populations, but they are not designed to disinfest commodities for which there is a zero tolerance for insect infestations. The most critical of these for commodities in storage are: sanitation and IPM strategies. Sanitation is important and constantly addressed in management programs. 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 and thus 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. Although the U. S. Food and Drug Administration (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 commodity operations in the United States currently use both phosphine, alone and in combination whenever feasible. Phosphine fumigation has proven to be too slow for treating large commodity volumes that need to be processed rapidly. Although phosphine is more suitable for fumigating commodities in storage, where fumigation time is not a factor, its corrosive nature to certain metals limits its use in some processing plants, especially those outfitted with electronic sorting and processing control equipment.

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

Please see Table 12.1.

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

NAME OF ALTERNATIVE	TECHNICAL REASON FOR THE ALTERNATIVE NOT BEING USED
Contact and low volatility insecticides	Not registered in the U.S. for use on stored commodities. The only insecticides registered for use in storage facilities are for crack and crevice treatment. These fogs, mists, and aerosols are effective only against exposed insects in the facilities and are not designed to penetrate the walnut shell or any kind of bulk commodity (Zettler, 2002).
Ethyl or methyl formate	Not registered in the U.S. for use on stored commodities.
Ethylene oxide	Not registered in the U.S. for use on stored commodities.
Phosphine alone or in combination	In general, phosphine alone or in combination is not suitable to replace methyl bromide when rapid fumigations are needed to meet customer timelines. The delay would disrupt processing of dried fruit and nuts, increasing production costs and interfering with access to the holiday market. Furthermore, phosphine is corrosive to some metals in electric and electronic equipment in processing plants. 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). For walnuts sold as in-shell (approximately 25% of the California production) phosphine fumigation takes too long during the peak production period, when large volumes of walnuts are processed and shipped rapidly. In some cases, however, phosphine has already replaced MB fumigation whenever feasible. For walnuts sold as shelled product, phosphine combined with carbon dioxide (Eco2fume®) is being used for in-storage fumigation by approximately 50% of the industry since 2001. The remaining 50% lack large storage facilities that can be sealed and left for at least five days, the time required to fully disinfest the commodity (California Walnut Commission & Walnut Marketing Board, 2003).
Propylene oxide	Propylene oxide (PPO) was recently labeled for use on in-shell nuts in California. Because PPO is a volatile, flammable liquid that must be used under vacuum conditions for safety, several years of commercial-scale testing will probably be necessary before this technique is perfected for commercial use. Furthermore, adoption for use on in-shell nuts will be limited by the need to use expensive vacuum chambers. At present, PPO is already being used by the walnut industry to sterilize approximately 20% of bulk shelled walnuts sold for dairy and bakery ingredients, targeting primarily mold and bacteria, and secondarily insects (California Walnut Commission &

NAME OF ALTERNATIVE	TECHNICAL REASON FOR THE ALTERNATIVE NOT BEING USED
	Walnut Marketing Board, 2003). PPO is not labeled for use on dried fruits.
Sulfuryl fluoride	Sulfuryl fluoride was recently registered in United States for use on dried fruit and nuts on January 23, 2004. The use of this chemical and its accompanying interactive computerized program will require training and licensing of applicators by the manufacturer. In addition, each state must also register this product. Research to date has shown that this sulfuryl fluoride is effective against the adult, pupal, and larval stages of target insects, but less effective against the egg stage (Fields and White, 2002, Schneider et al. 2003). The efficacy of this chemical remains to be demonstrated in the field. It may take up to 5 years to validate its use as a methyl bromide replacement and for the necessary industry conversion (See Section 17.2.1.).
Biological Agents	The only biological agent available for use in commodities is the granulosis virus, which acts specifically against Indian meal moth larvae (Johnson et al., 1998, Vail et al., 1991, Vail et al., 2002). No effective biological agents are available for use against other commodity pests. The U.S. Food and Drug Administration does not allow the use of predatory or parasitic insects in commodity storage areas.
Cold Treatment	This technique is unfeasible for use on a commercial scale, especially during harvest when large volumes need to be processed rapidly. Longer treatment times would also interfere with meeting the demands of critical European markets by delaying shipments by 1-3 weeks. For example, at 0^{o}C to 10^{o}C a 4-week exposure time is needed to control the Indian meal moth in stored walnuts (Johnson et al., 1997). Although it has been demonstrated that at -10^{o}C to -18^{o}C several insect pests of dates can be controlled in a few hours, (Donahaye et al., 1991, 1995), the slow rate of cold penetration and daily introduction of fresh commodities would interfere with the ability to maintain a constant low temperature throughout storage areas. In California, the grower cooperative Diamond Walnuts (representing approximately 50% of the walnuts grown in that state) alone processes about 3,630 metric tons per day at its Stockton plant during the peak harvest season in September (California Walnut Commission & Walnut Marketing Board, 2003). The longer treatment would also affect the industry's ability to take advantage of national and international market windows. Furthermore, the cost of retrofitting storage facilities and the energy cost required to rapidly cool large volumes of walnuts would be prohibitive.
Controlled/Modified Atmospheres	Exposure to low oxygen or high carbon dioxide has been shown to effectively control pests of stored dried fruit and nuts in laboratory studies. However, this approach would require a minimum of 2-5 days, depending on temperature (Calderon and Barkai-Golan, 1990, Soderstrom and Brandl, 1984, Tarr et al., 1996), and would not be feasible when commodity needs to be moved rapidly during peak production periods and to meet international market demands. In California, the grower cooperative Diamond Walnuts (representing approximately 50% of the walnuts grown in that state) alone processes about 3,630 metric tons per day at its Stockton plant. Moreover, adopting this alternative would require considerable expenditures for special treatment facilities and retrofitting existing structures.
Cultural practices and Integrated Pest Management	IPM, which includes cultural practices, is designed to manage pests at low population levels, not to completely eliminate them or prevent infestations.
Heat Treatment	This approach is not feasible for treating commercial-scale commodity volumes. Under laboratory conditions, brief exposure of commodities to high temperatures may eliminate insects without adversely affecting product quality**.** 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 walnuts in order to achieve total insect control. Furthermore, walnut quality may be adversely affected by exposure to heat, causing rancidity in walnut kernel oils (California Walnut Commission & Walnut Marketing Board, 2003). According to the California Dried Plum Board (2003), an attempt to use heat treatment commercially with prunes in California not only failed to control target pests, but resulted in several tons of prunes being damaged from heat exposure.

Name of Alternative	**Technical Reason for the Alternative Not Being Used**
High pressure carbon dioxide	High-pressure carbon dioxide for commodity treatment requires the availability of small fumigation chambers designed to withstand the required high pressures. The small size of these units would limit the amounts of walnuts that could be treated at any one time, delaying the process and causing critical market windows to be missed. This technique is, therefore, not suitable for use on a commercial scale in U.S. warehouses, where large volumes of walnuts must be processed within relatively short periods. Furthermore, these chambers are not readily available, and the cost of building a large number of them would be prohibitive (Zettler, 2002).
Irradiation	Although rapid and effective, irradiation may result in living insects 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 affects walnut oils, causing changes in flavor, lowering kernel quality, and shortening walnut shelf life. Irradiation would, furthermore, require major capital expenditures. Moreover, irradiated food is not widely accepted by consumers, adding another element of uncertainty to this method's adoption (California Walnut Commission & Walnut Marketing Board, 2003).
Pest Resistant Packaging	This measure only prevents reinfestation of finished product, and is not designed to control infestations in bulk commodity storage (Johnson and Marcotte, 1999).
Physical removal/ Cleaning/Sanitation	This technique is widely used as an IPM component in all dried fruit and nut operations, but by itself not designed to disinfest a commodity.

Table 12.2: Commodity Processing Plants – Comparison of Alternatives to Methyl Bromide Fumigation

Fumigant	Preparation Time (hr)	Fumigation Time (hrs)	Dissipation Time (hrs)	Total Time (hrs)	Number of Alternative Applications to One MB Application
Methyl Bromide	24	24	4	52	--
Methyl Bromide (in vacuum chamber)	1	4	2	7 [1]	--
Phosphine alone or in combination with CO_2	24	72 - 96	48	144 - 168	2.7 - 3.2 (MB under normal pressure) 20.6 - 24 (MB + low pressure)

[1] During the 3-4 week peak harvest season, many commodity processing plants operate 24 hours a day. Since it takes approximately 7 hours to fumigate a given lot with MB under vacuum, these plants can fumigate 3.4 lots per day per fumigation chamber, thus keeping up with the incoming harvested commodities.

PART D: EMISSION CONTROL

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, monitoring systems and other activities that are in place to minimize dosage and emissions)*

The dried fruit and nut industries in the United States have reduced the number of methyl bromide fumigations by incorporating many of the alternatives identified by MBTOC, such as implementing IPM strategies, especially sanitation, in storage facilities. Pest populations are monitored 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. Furthermore, the phosphine + CO_2 (Eco2fume®) combination is already being used to fumigate a substantial proportion of dried fruit and nuts in storage.

PART E: ECONOMIC ASSESSMENT

14. COSTS OF ALTERNATIVES COMPARED TO METHYL BROMIDE OVER 3-YEAR PERIOD

(Provide an analysis of how these costs were estimated as a separate attachment):

TABLE 14.1 COSTS OF ALTERNATIVES COMPARED TO METHYL BROMIDE OVER A 3-YEAR PERIOD FOR WALNUTS

MB AND ALTERNATIVES	COST IN CURRENT YEAR (US$)	COST ONE YEAR AGO (US$)	COST 2 YEARS AGO (US$)
WALNUTS			
Methyl Bromide	1 ($1.311 per 1000 m^3)	1 ($1.311 per 1000 m^3)	1 ($1.311 per 1000 m^3)
Phosphine	46 ($61,277 per 1000 m^3)	46 ($61,277 per 1000 m^3)	46 ($61,277 per 1000 m^3)
Pistachios			
Methyl Bromide	1 ($448 per 1000 m^3)	1 ($448 per 1000 m^3)	1 ($448 per 1000 m^3)
Phosphine	496 ($222,385 per 1000 m^3)	496 ($222,385 per 1000 m^3)	496 ($222,385 per 1000 m^3)
Dried Fruits			
Methyl Bromide	1 ($480 per 1000 m^3)	1 ($480 per 1000 m^3)	1 ($480 per 1000 m^3)
Phosphine	29 ($13,796 per 1000 m^3)	29 ($13,796 per 1000 m^3)	29 ($13,796 per 1000 m^3)
Dates			
Methyl Bromide	1 ($445 per 1000 m^3)	1 ($445 per 1000 m^3)	1 ($445 per 1000 m^3)
Phosphine	139 ($61,832 per 1000 m^3)	139 ($61,832 per 1000 m^3)	139 ($61,832 per 1000 m^3)

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	PHOSPHINE	**Economic losses from additional production downtimes due to longer fumigation time and from capital expenditures required to adopt an alternative.**	**Economic losses due to downtime with phosphine are persistent.**

Economic costs in the post-harvest uses of the commodity sector can be characterized as arising from three contributing factors. First, direct pest control costs increase 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 the 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. Economic cost per 1000 m^3 was calculated as the additional costs of methyl bromide if methyl bromide users had to replace methyl bromide with phosphine.

The four economic measures in Table E.1 were used to quantify the economic impacts to post-harvesting uses for commodity. The four economic measures are not independent in such a way that they can be calculated from the same financial data. The measures are, however, supplementary to each other in evaluating the CUE applicant's economic viability. These measures represent different ways to assess the economic feasibility of methyl bromide alternatives for methyl bromide users.

Net revenue is calculated as gross revenue minus operating costs. This is a good measure as to the direct losses of income that may be suffered by the users. It should be noted that net revenue does not represent net income to the users. Net income, which indicates profitability of an operation of an enterprise, is gross revenue minus the sum of operating and fixed costs. Net income should be smaller than the net revenue measured in this analysis. We did not include fixed costs because it is often difficult to measure and verify.

A separate analysis was conducted for each sub-sector (described below), and in each case the least cost alternative fumigation system, based on phosphine, was found to be no economically feasible. Production downtime was estimated on average at 84 days per year and total capital expenditures for accelerated replacement of plant and equipment due to corrosive nature of phosphine was assumed to be $1,076 per 1000 m^3 with 10-years lifespan with 10% interest rate from the data provided by the CUE applicants for post-harvesting uses. The potential economic losses associated with the use of phosphine mainly originate from the cost of production delay. The estimated economic loss per 1000 m^3 ranges from $13,436 for dried fruit to $222,051 for pistachio. The estimated economic losses as a percentage of gross revenue ranges from 19% to 22% and the estimated economic loss as a percentage of net revenue are over 100% for all the CUE applicants in the commodity sector, which results in negative profit margins with use of phosphine. The industries that use methyl bromide for commodity 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, companies of this type generally managed by producers' associations and therefore, making new capital investment is often difficult. The results suggest that phosphine is not economically viable as an alternative for methyl bromide.

Walnuts

The United States walnut industry operates almost exclusively in California, where approximately 5,300 growers and 51 processors are located. Over the past five years, growers have produced an average of 265,000 tons of walnuts per year on 80,940 hectares in California. The largest processor is the Diamond Cooperative facility in Stockton, California, through which 50 percent of all harvested walnuts in California pass. The other 50 independent handlers operate much smaller facilities that process the remaining 50 percent of California walnuts. Sales to Europe accounts for one-fifth of all revenue. Both production and sales peak in the fall in anticipation of the holiday season in December. Fumigation of walnuts takes place during the entire year, but fumigation capacity is primarily a limiting factor immediately after harvest. Approximately 25 percent of walnuts are sold in the shell, and these are usually packed and shipped to European market within a couple of days of the initial fumigation treatment. The remaining 75 percent of walnuts are processed further to create a variety of packaged shelled products. These walnuts must be fumigated before they put in long-term storage or continue in the processing chain due to the key pests. The U.S. walnut industry already has replaced methyl bromide 70 percent with Eco2fume for in-storage fumigation. Diamond Cooperative has completely converted to using Eco2fume for in-storage fumigation.

The primary scenario for this analysis is based on the Diamond Cooperative facility for processing walnuts in the shell as the representative user using the existing phosphine capacity to treat all walnuts. Given the existing capacity of 1500 tons per day of processing walnuts in the shell, having to rely on phosphine alone would require an additional five days to treat walnuts in the shell. At the processing rate of one lot every five days with phosphine compared with 7-hour turn-around time currently achieved with methyl bromide under vacuum, the processing walnuts in the shell would be only 5 percent or fumigation chamber capacity would need to be expanded to approximately 20 times the existing capacity.

Alternatively, all the walnuts could be stored and processed. However, prices paid to growers would be reduced by the increased supply that would be forced onto the domestic market. Given that the nature of the demand for walnuts is inelastic, the impact of this increase is estimated to results in a decrease of 18% to the growers. In addition to the price effect, there are increased costs from using phosphine. Additional expenditures are required to adopt phosphine for accelerated replacement of plant and electronic equipment due to the corrosive nature of phosphine (\$215 per 1000 m^3). The net effect of price decreases and cost increases represents 19% of gross revenues and 346% of net revenues. This can also be expressed as a loss of \$59,966 per 1000 m^3, and \$604 per kilogram of methyl bromide.

Another scenario could represent the cost of building additional fumigation chambers, so that the same amount of commodity could be fumigated during the critical time period, and avoid commodity loss and price declines from missing key market windows. In case of the Diamond plant, it is estimated that a tank farm of ten 1-million pound capacity silos would be required to support substitution of phosphine for on-receipt fumigation of in-shell walnuts alone. The costs of these silos and fumigation chambers were not estimated due to lack of information, but the Diamond Cooperative indicates that there is no space for such a tank farm at the Diamond Cooperative facility, so an offsite location would have to be found; hence there would be the associated costs of land acquisition and development. An environmental impact study would also be required. The Diamond Cooperative estimates that at least three to five years would be required for permitting and development of an offsite fumigation facility.

Pistachios

The United States pistachio industry operates almost exclusively in California. In 2001 approximately 730,000 tons of pistachios were produced in California on 315,588 hectares, where there are approximately 500 growers and 21 processors. Methyl bromide is used in the pistachio industry in post-harvesting storage, among other uses. The industry has already 95% replaced methyl bromide with phosphine in processing pistachios. After the pistachios are dried, phosphine is used in the storage facility. Once fumigation with phosphine is complete, the pistachios enter a sorting facility. The processors use methyl bromide during peak periods, when high volumes of pistachios are processed and need to enter the market quickly, such as holiday season. Fumigation of pistachios takes place during the entire year, but fumigation capacity is primarily a limiting factor immediately after harvest.

The primary scenario for this analysis is based on the Paramount, which is processing 60% of the total U.S. pistachio production, as the representative user using the existing phosphine capacity to treat all pistachios. Given the existing capacity of 200 tons per day of processing pistachio, U.S. EPA reviewers estimated that having to rely on phosphine alone would require an additional 84 days to treat pistachios. In addition to the production loss, there are increased costs from using phosphine. Additional expenditures are required to adopt phosphine for accelerated replacement of plant and electronic equipment due to the corrosive nature of phosphine (\$215 per 1000 m^3). The net effect of production loss and cost increases represents 20% of gross revenues and 403% of net revenues. This can also be expressed as a loss of \$222,051 per 1000 m^3, and \$10,574 per kilogram of methyl bromide.

Another scenario could represent the cost of building additional silos and fumigation chambers, so that the same amount of commodity could be fumigated with phosphine during the critical time period, and avoid commodity loss and price declines from missing key market windows. The costs of these silos and fumigation chambers were not estimated due to lack of information.

Dried Fruit

California produces 99 percent of the domestic supply and 70 percent of the world's supply of dried plums. California also produces 99 percent of the domestic raisin crop, and 40 percent of world raisin production. California is responsible for nearly all of domestic fig production and 20 percent of global supply. The industry has already replaced 50% methyl bromide with phosphine in processing dried fruits. Fumigation of pistachios takes place during the entire year. Phosphine cannot replace methyl bromide for the 5 coldest months when the temperature in the storage facilities is not high enough to make phosphine effective for controlling target pests.

The primary scenario for this analysis is based on the representative user using the existing phosphine capacity to treat all dried fruits. U.S. EPA reviewers estimated that having to rely on phosphine alone would require an additional 84 days to treat all dried fruits. In addition to the production loss, there are increased costs from using phosphine. Additional expenditures are required to adopt phosphine for accelerated replacement of plant and electronic equipment due to the corrosive nature of phosphine ($215 per 1000 m^3). The net effect of production loss and cost increases represents 22% of gross revenues and 335% of net revenues. This can also be expressed as a loss of $14,660 per 1000 m^3, and $610 per kilogram of methyl bromide.

Dates

California produces most of domestic supply of dates. The industry has not replaced methyl bromide with phosphine in processing dates. The processors use methyl bromide during peak periods, when high volumes of dates are processed and need to enter the market quickly, such as holiday season. Fumigation of dates takes place during the entire year, but fumigation capacity is primarily a limiting factor immediately after harvest.

The primary scenario for this analysis is based on the representative user using the existing capacity to treat all dates. U.S. EPA reviewers estimated that having to rely on phosphine alone would require an additional 84 days to treat all dates. In addition to the production loss, there are increased costs from using phosphine. Additional expenditures are required to adopt phosphine for accelerated replacement of plant and electronic equipment due to the corrosive nature of phosphine ($215 per 1000 m^3). The net effect of production loss and cost increases represents 20% of gross revenues and 404% of net revenues. This can also be expressed as a loss of $61,498 per 1000 m^3, and $2,957 per kilogram of methyl bromide.

Another scenario could represent the cost of building additional silos and fumigation chambers, so that the same amount of commodity could be fumigated during the critical time period, and avoid commodity loss and price declines from missing key market windows. The costs of these silos and fumigation chambers were not estimated due to lack of information.

MEASURES OF ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

TABLE E.1: ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES FOR WALNUT

Loss Measure	Methyl Bromide	Phosphine
Total Commodity Treated (kg/1000 m³)	**320,455 kg**	**320,455 kg**
Average Market Price (US$/kg)	**$1.08**	**$0.89**
Gross Revenue (US$/1000 m³)	**$346,091**	**$283,794**
Operating Cost (a+b) per 1000 m³	**$328,786**	**$328,673**
a) Cost of MB or Alternative	**$1,311**	**$983**
b) Other Operating Costs	**$327475**	**$327,690**
Net Revenue (US$/ha) (net of operating costs)	**$17,305**	**$(36,661)**
Loss measures		
Time Lost (days)	**0 DAYS**	**84 DAYS**
Loss per 1000 m³ (US$/1000 m³)	**$0**	**$59,966**
Loss per Kilogram MB (US$/kg)	**$0**	**$543**
Loss as a % of Gross Revenue (%)	**0%**	**11%**
Loss as a % of Net Revenue (%)	**0%**	**212%**

TABLE E.2: ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES FOR PISTACHIO

Loss Measure	Methyl Bromide	Phosphine
Total Commodity Treated (kg/1000 m^3)	511,628 kg	366,979 kg
Average Market Price (US$/kg)	$2.16	$2.16
Gross Revenue (US$/1000 m^3)	$1,100,930	$792,670
Operating Cost (a+b) per 1000 m^3	$1,045,883	$959,674
a) Cost of MB or Alternative	$448	$334
b) Other Operating Costs	$1,045,435	$959,340
Net Revenue (US$/ha) (net of operating costs)	$55,047	$(167,004)
Loss measures		
Time Lost (days)	0 DAYS	84 DAYS
Loss per 1000 m^3 (US$/1000 m^3)	$0	$222,051
Loss per Kilogram MB (US$/kg)	$0	$10,524
Loss as a % of Gross Revenue (%)	0%	28%
Loss as a % of Net Revenue (%)	0%	133%

TABLE E.3: ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES FOR DRIED FRUIT

Loss Measure	Methyl Bromide	Phosphine
Total Commodity Treated (kg/1000 m^3)	88,235 kg	63,529 kg
Average Market Price (US$/kg)	$0.75	$0.75
Gross Revenue (US$/1000 m^3)	$66,176	$47,647
Operating Cost (a+b) per 1000 m^3	$61,808	$57,939
a) Cost of MB or Alternative	$480	$360
b) Other Operating Costs	$61,328	$57,579
Net Revenue (US$/ha) (net of operating costs)	$4368	$(10,292)
Loss measures		
Time Lost (days)	0 DAYS	84 DAYS
Loss per 1000 m^3 (US$/1000 m^3)	$0	$13,436
Loss per Kilogram MB (US$/kg)	$0	$560
Loss as a % of Gross Revenue (%)	0%	28%
Loss as a % of Net Revenue (%)	0%	131%

TABLE E.4: ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES FOR DATE

Loss Measure	Methyl Bromide	Phosphine
Total Commodity Treated (kg/1000 m³)	**125,480 kg**	**90,605 kg**
Average Market Price (US$/kg)	**$2.42**	**$2.42**
Gross Revenue (US$/1000 m³)	**$304,533**	**$219,263**
Operating Cost (a+b) per 1000 m³	**$289,306**	**$265,534**
a) Cost of MB or Alternative	**$445**	**$334**
b) Other Operating Costs	**$288,861**	**$265,200**
Net Revenue (US$/ha) (net of operating costs)	**$15,227**	**$(46,271)**
Loss measures		
Time Lost (days)	**0 DAYS**	**84 DAYS**
Loss per 1000 m³ (US$/1000 m³)	**$0**	**$61,498**
Loss per Kilogram MB (US$/kg)	**$0**	**$2,957**
Loss as a % of Gross Revenue (%)	**0%**	**28%**
Loss as a % of Net Revenue (%)	**0%**	**404%**

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 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). U.S. EPA registered sulfuryl fluoride for some commodities on January 23, 2004 (see Section 17.2.1).

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

17.1 Research

The amount of methyl bromide requested for research purposes is considered critical for the development of effective alternatives. Without methyl bromide for use as a standard treatment, the research studies can never address the comparative performance of alternatives. This would be a serious impediment to the development of alternative strategies. The U.S. government estimates that commodities research will require 20 kg per year of methyl bromide for 2005 and 2006. This amount of methyl bromide is necessary to conduct research on alternatives and is in addition to the amounts requested in the submitted CUE applications. One example of this type of research is a study testing the comparative performance of several fumigants for penetration through packing material for control of the Indianmeal moth or confused flour beetle.

To date, the U.S. government has spent U. S.$135.5 million to implement an aggressive research program to find alternatives to methyl bromide under the USDA's Agricultural Research Service (ARS) Methyl Bromide Alternatives program (select Methyl Bromide Alternatives at this web site: http://www.nps.ars.usda.gov).

The post-harvest 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.

The USDA is continuing to fund research projects in post-harvest pest management. 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, Indian meal moth, and red and confused flour beetles; examine the use of CO2 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.

Propylene Oxide and Carbon Dioxide: A non-flammable 8% PPO and 92% CO_2 mixture is being tested for use as fumigant on dried fruit and nuts. Unlike 100% PPO, this mixture would not require the use of vacuum chambers (Griffith, 2004).

Overall, future research plans for this industry encompass testing alternatives that fumigate rapidly and achieve high mortality rates. So far the most promising of these are sulfuryl fluoride, and tolerances for its use were set on January 23, 2004 which will lead to its official registration; heat treatments; and various combinations of heat, phosphine, and carbon dioxide. Industry is supportive of and closely follows USDA research on these alternatives.

U. S. efforts to research alternatives for methyl bromide have been increasing as the phase-out has approached. The U. S. is committed to sustaining its research efforts into the future until technically and economically viable alternatives are found for each and every controlled use of methyl bromide. We are also committed to continuing to share our research. Toward that end, for the past several years, key U. S. government agencies have collaborated with industry to host an annual conference on alternatives to methyl bromide. This conference, the Methyl Bromide Alternatives Outreach (MBAO), has become the premier forum for researchers and others to discuss scientific findings and progress in this field.

The following are additional examples of research actions supported by the dried fruit and nuts industry in California, with funding levels in excess of U.S. $1,000,000, and implemented by USDA (California Dried Plum Board, 2003):

- Determination of seasonal prevalence and spatial variation of navel orangeworm.
- Development of pheromone-mediated mating disruption of navel orangeworm and attract-and-kill techniques for nitidulid beetles.
- Determination of the efficacy of propylene oxide: carbon dioxide mixtures against a variety of stored product insects.
- Determination of the loading of MB on activated carbon after repeated use and the effect of high moisture on the sorption process.
- Indianmeal moth granulovirus as an alternative to methyl bromide for protection of dried fruits and nuts.
- Low temperature studies for eggs of Indianmeal moth and navel orangeworm as a component of integrated post harvest systems.
- Optimization of Indianmeal moth trapping.
- Physical treatment for post harvest insects, aimed at determining heat tolerance of moths species, identifying stage and pests species most tolerant to vacuum, and describing response of cowpea weevil eggs to commercial cold storage temperatures.

In addition, the following study is being carried out by the Dried Fruit Association of California and Dow Chemical Company: Sulfuryl fluoride efficacy and residue studies on dry fruit, designed to determine this chemical's effectiveness against dried fruit pests and to develop data for its registration

17.2 Registration

While the U.S. government's role to find alternatives is primarily in the research arena, we know that research is only one step in the process. As a consequence, we have also invested significantly in efforts to register alternatives, as well as efforts to support technology transfer and education activities with the private sector.

Since 1997, the Agency has made the registration of alternatives to methyl bromide a high registration priority. Because the Agency currently has more applications pending in its review than the resources to evaluate them, U.S. EPA prioritizes the applications in its registration queue. 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 U.S. 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/U.S. EPA Methyl Bromide Alternatives Work Group since 1993 to help coordinate research, development and the registration of viable alternatives. The work group conducted six workshops in Florida and California (states with the highest use of methyl bromide) with growers and researchers to identify potential alternatives, critical issues, and grower needs covering the major methyl bromide dependent crops and post harvest uses.

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 U. S.$15 million per year research program conducted at more than 20 field evaluation facilities across the country. Also U.S. EPA's participation in the evaluation of research grant proposals each year for USDA's U. S.$2.5 million per year methyl bromide alternatives research has further ensured close coordination between the U.S. government and the research community.

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

- 2000: Phosphine in combination to control stored product insect pests
- 2001: Indianmeal Moth Granulosis Virus to control Indianmeal moth in stored grains

Sulfuryl Fluoride

On January 23, 2004, the U. S. EPA registered sulfuryl fluoride as a post-harvest fumigant for dried fruit and tree nuts. While registration for these uses will provide opportunities to reduce methyl bromide use, it must be emphasized that such replacement, if feasible, will only occur gradually over time.

Alternatives must be tested by users and found technically and economically feasible before widespread adoption will occur. As noted by TEAP, a specific alternative, once available may take up to 5 fumigation cycles of use before efficacy can be determined in the specific circumstance of the user. The registrant is requiring that applicators be trained by them before using sulfuryl fluoride (there is a 3-tiered certification system). It will take some time for potential applicators to be identified and to take this training before the product can begin testing in the specific circumstances of users.

There are additional pesticide registration issues, however, that must be resolved before sulfuryl fluoride can be used in sectors for which the U. S. is nominating methyl bromide CUEs. Some states must also register sulfuryl fluoride. California needs to register this product through their regulatory process, and requires at least four months after receiving an application, as long as risk concerns do not appear in their assessments. At the time of this writing, however, California had not received an application from the sulfuryl fluoride registrant.

There are also data limitations preventing U.S. EPA, at this time, from estimating the degree to which sulfuryl fluoride might replace some methyl bromide use in fumigating dried fruits and nuts. We currently lack the information to evaluate sulfuryl fluoride's performance relative to methyl bromide. We have almost no relative product performance data (direct comparisons to methyl bromide), no experience in how well it performs in different facilities and climates over multiple years, no price data, and no information on what other costs might be associated with adopting sulfuryl fluoride. Lacking such information, we cannot reach science-based conclusions on the technical and economic feasibility of sulfuryl fluoride at this time.

For these reasons, and given the current state of data, U.S. EPA is refraining from speculating on the degree to which sulfuryl fluoride registrations might lead to amended CUE nominations. At the same time, U.S. EPA commits to carefully studying sulfuryl fluoride use during the next year, with the aim of identifying specific sectors where CUE requests can be modified, once we have (and have analyzed) the necessary data.

Finding potential and registering those alternatives, is not the end of the process. Alternatives must be tested by users and found technically and economically feasible before widespread adoption will occur. As noted by TEAP, a specific alternative, once available may take two or three cropping seasons of use before efficacy can be determined in the specific circumstance of the user. In an effort to speed adoption the U.S. government has also been involved in these steps by promoting technology transfer, experience transfer, and private sector training.

18. ADDITIONAL COMMENTS (*Add here any other information that may help clarify why a critical use is needed for the use being considered***):**

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APPENDIX A. 2006 Methyl Bromide Usage Numerical Index (BUNI).

Methyl Bromide Critical Use Exemption Process

2006 Methyl Bromide Usage Numerical Index (BUNI)

Date:	2/26/04	**Average Volume in the US:**	not available
Sector:	COMMODITIES	**% of Average Volume Requested:**	not available

	2006 Amount of Request			2001 & 2002 Average Use			Quarantine and Pre-Shipment	Regional Volume	
COMMODITY TYPE	Kilograms (kgs)	Volume (1000m^3)	Use Rate (kg/1000m^3)	Kilograms (kgs)	Volume (1000m^3)	Use Rate (kg/1000m^3)		2001 Volume	% of Volume
DRIED FRUIT	20,412	850	24.03	18,218	773	23.57	0%	not available	not available
PISTACHIOS	4,990	238	20.98	5,262	201	26.17	0%	not available	not available
WALNUTS	87,362	1,435	60.87	72,121	1,501	48.06	20%	not available	not available
DATES	3,467	167	20.82	3,016	145	20.82	0%	not available	not available
TOTAL OR AVERAGE	116,230	2,689	31.67	98,617	2,620	29.65	5%	not available	not available

2006 Nomination Options	Subtractions from Requested Amounts (kgs)					Combined Impacts Adjustment (kgs)		MOST LIKELY IMPACT VALUE			
COMMODITY TYPE	2006 Request	(-) Double Counting	(-) Growth or 2002 CUE Comparison	(-) Use Rate Difference	(-) QPS	HIGH	LOW	Amount (kgs)	Volume (1000m^3)	Use Rate (kg/1000m^3)	% Reduction
DRIED FRUIT	20,412	-	1,839	355	-	18,218	18,218	18,218	773	24	11%
PISTACHIOS	4,990	-	772	-	-	4,217	4,217	4,217	201	21	15%
WALNUTS	87,362	-	-	18,390	13,794	55,178	55,178	55,178	1,148	48	37%
DATES	3,467	-	452	-	-	3,016	3,016	3,016	145	21	13%
Nomination Amount	116,230	116,230	113,168	94,423	80,629	80,629	80,629	82,896	2,267	37	29%
% Reduction from Initial Request	0%	0%	3%	19%	31%	31%	31%	29%	16%		

ustments to Requested Amou	Use Rate (kg/1000m^3)		(%) Key Pest Distribution		(%) Adopt New Fumigants		(%) Combined Impacts		Time, Quality, or Product Loss	Marginal Strategy
COMMODITY TYPE	2006	Low	High	Low	High	Low	HIGH	LOW		
DRIED FRUIT	24	24	100	100	0	0	100%	100%	84 DAYS	Phosphine
PISTACHIOS	21	21	100	100	0	0	100%	100%	84 DAYS	Phosphine
WALNUTS	61	48	100	100	0	0	100%	100%	84 DAYS	Phosphine
DATES	21	21	100	100	0	0	100%	100%	84 DAYS	Phosphine

Other Considerations	Dichotomous Variables (Y/N)			Other Issues			Economic Analysis			
COMMODITY TYPE	Currently Use Alternatives?	Research / Transition Plans	Pest-free Market Requirement	Change from Prior CUE Request (+/-)	Verified Historic MeBr Use / State	Frequency of Treatment /Yr	Loss per 1000 m^3 (US$/1000m)	Loss per Kg of MeBr (US$/kg)	Loss as a % of Gross Revenue	Loss as a % of Net Revenue
DRIED FRUIT	Y	Y	Y	0	N	2/year	$ 13,436	$ 560	28%	131%
PISTACHIOS	Y	Y	Y	+	N	2/year	$ 222,051	$ 10,524	28%	133%
WALNUTS	Y	Y	Y	0	N	2/year	$ 96,793	$ 975	28%	559%
DATES	Y	Y	Y	new	N	2/year	$ 61,498	$ 2,957	28%	404%

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

Footnotes for Appendix A:

Values may not sum exactly due to rounding.

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

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

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

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

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

APPENDIX C. SUMMARY OF NEW APPLICANTS

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

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

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

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

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

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

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