OAR Box 1977

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Document Number:

16) VIII-A-6

Docket Number:

A-2000-24

A-2000-24- VIII-A-86
(OAR-2003-0001)

2003 NOMINATION FOR A CRITICAL USE EXEMPTION FOR POST-HARVEST/FOOD PROCESSING PLANTS FROM THE UNITED STATES OF AMERICA

1. Introduction

In consultation with the co-chair of Methyl Bromide Technical Options Committee (MBTOC), the United States (U. S.) has organized this version of its Critical Use Exemption Nomination in a manner that would enable a holistic review of relevant information by each individual sector team reviewing the nomination for a specific crop or use. As a consequence, this nomination for post- harvest/food processing plants, like the other nominations included in the U.S. request, includes general background information that the U. S. believes is critical to enabling review of our nomination in a manner that meets the requirements of the Parties' critical use decisions. With that understanding, the fully integrated U.S. nomination for food processing plants follows.

2. Background

In 1997, the Parties to the Montreal Protocol adjusted Article 2H of the Protocol, and agreed to accelerate the reduction in the controlled production and consumption of methyl bromide. This adjustment included a provision calling for a phaseout of methyl bromide by the year 2005 "save to the extent that the Parties decide to permit the level of production or consumption that is necessary to satisfy uses agreed by them to be critical uses." At the same time, the Parties adopted decision IX/6, the critical use exemption decision, which laid out the terms under which critical use exemptions under Article 2H would be granted.

3. Criteria for Critical Uses Under the Montreal Protocol

In crafting Decision IX/6 outlining the criteria for a critical use exemption, the Parties recognized the significant differences between methyl bromide uses and uses of other ozone-depleting chemicals previously given scrutiny under the Protocol's distinct and separate Essential Use exemption process. The United States believes that it is vitally important for the MBTOC to take into account the significant differences between the critical use exemption and the essential use exemption in the review of all methyl bromide critical use nominations.

During the debate leading up to the adoption of the critical use exemption Decision IX/6, an underlying theme voiced by many countries was that the Parties wanted to phase out methyl bromide, but not adversely affect agriculture. This theme was given life in various provisions of the critical use exemption, and in the differences in approach taken between the critical use exemption and the essential use exemption. Those differences are outlined below.

> *The Protocol's negotiated criteria for the critical use exemptions for methyl bromide are much different from the criteria negotiated for "essential uses" for other chemicals.*

Under the Essential Use provisions, in order to even be considered for an exemption, it was necessary for each proposed use to be "critical for health, safety or the functioning of society."

This high threshold differs significantly from the criteria established for the methyl bromide Critical Use exemption. Indeed, for methyl bromide, the Parties left it solely to the nominating governments to find that the absence of methyl bromide would create *a significant market disruption.*

For the U.S. nomination for post-harvest/food processing plants, following detailed technical and economic review, the U. S. has determined that some use of methyl bromide in food processing plants is critical to ensuring that there is no significant market disruption. The detailed analysis of technical and economic viability of the alternatives listed by TEAP for use in food processing plants is discussed later in this nomination, as is the basis for the U.S. estimate of the amount of methyl bromide needed within this sector.

> *In the case of methyl bromide, the Parties recognized many agricultural fumigants were inherently toxic, and therefore there was a strong desire not to replace one environmentally problematic chemical with another even more damaging.*

The critical use exemption language explicitly requires that an alternative should not only be technically and economically feasible, it must also be acceptable from the standpoint of human health and the environment. This is particularly important given the fact that most chemical alternatives to methyl bromide are toxic and pose some risk to human health or the environment; in some cases, a chemical alternative may pose risks even greater than methyl bromide.

> *In the case of methyl bromide, the Parties recognized that evaluating, commercializing and securing national approval of alternatives and substitutes is a lengthy process.*

In fact, even after an alternative is tested and found to work against some pests in a controlled setting, adequate testing in large-scale commercial operations in the many regions of the U.S. can take many years before the viability of the alternative can be adequately demonstrated. In addition, the process of securing national and sub-national approval of the use of alternatives requires extensive analysis of environmental consequences and risks to human health. The average time for the national review of scientific information in support of a new pesticide, starting from the date of submission to registration, is approximately 38 months. In most cases, the company submitting the information has spent approximately 7-10 years developing the toxicity data and other environmental data necessary to support the registration request.

> *The Parties to the Protocol recognized that unlike other chemicals controlled under the Montreal Protocol, the use of methyl bromide and available alternatives could be site specific and must take into account the particular needs of the user.*

The Essential Use exemption largely assumed that an alternative used in one place could, if approved by the government, be used everywhere. Parties clearly understood that this was not the case with methyl bromide because of the large number of variables involved, such as crop type, soil types, pest pressure and local climate. That is why the methyl bromide Critical Use exemption calls for an examination of the feasibility of the alternative *from the standpoint of the user*, and *in the context of the specific circumstances of the nomination*, including use and geographic location. In order to effectively implement this last, very important provision, we believe it is critical for MBTOC reviewers to understand the unique nature of U.S. agriculture, as well as U.S. efforts to minimize the use of methyl bromide, to research alternatives, and to register alternatives for methyl bromide.

4. U.S. Consideration/Preparation of the Critical Use Exemption for Processing Food Plants

Work on the U.S. critical use exemption process began in early 2001. At that time, the U.S. Environmental Protection Agency (U.S. EPA) initiated open meetings with stakeholders both to inform them of the Protocol requirements, and to understand the issues being faced in researching alternatives to methyl bromide. During those meetings, which were attended by State and association officials representing thousands of methyl bromide users, the provisions of the critical use exemption Decision IX/6 were reviewed in detail, and questions were taken. The feedback from these initial meetings led to efforts by the U. S. to have the Protocol Parties establish international norms for the details to be in submissions and to facilitate standardization for a fair and adequate review. These efforts culminated in decision XIII/11 which calls for specific information to be presented in the nomination.

Upon return from the Sri Lanka meeting of the Parties, the U.S. took a three track approach to the critical use process. First, we worked to develop a national application form that would ensure that we had the information necessary to answer all of the questions posed in decision XIII/11. At the same time, we initiated sector specific meetings. This included meetings with representatives of the food processing industry across the U. S. to discuss their specific issues, and to enable them to understand the newly detailed requirements of the critical use application. These sector meetings allowed us to fine tune the application so we could submit the required information to MBTOC in a meaningful fashion.

Finally, and concurrent with our preparation phase, we developed a plan to ensure a robust and timely review of any and all critical use applications we might receive. This involved the assembly of more than 45 PhDs and other qualified reviewers with expertise in both biological and economic issues. These experts were divided into interdisciplinary teams to enable primary and secondary reviewers for each application/crop. As a consequence, each nomination received by the U.S. was reviewed by two separate teams. In addition, the review of these interdisciplinary teams was put to a broader review of experts on all other sector teams to enable a third look at the information, and to ensure consistency in review between teams. The result was a thorough evaluation of the merits of each request. A substantial portion of requests did not meet the criteria of decision IX/6, and a strong case for those that did meet the criteria has been included.

Following our technical review, discussions were held with senior risk management personnel of the U.S. government to go over the recommendations and put together a draft package for submission to the parties. As a consequence of all of this work, it is safe to say that each of the sector specific nominations being submitted is the work of well over 150 experts both in and outside of the U.S. government.

5. Overview of Food Processing

5a. Food Processing Plants in the U.S.

Food processing is a US$500 billion global industry that involves the processing and packaging of meat, fish, fruits, vegetables, and specialty food and beverage products using technologies including canning, dehydration, freezing, and refrigeration. The U.S. portion of this global food processing industry is approximately US$130 billion (or 26 percent). In the U.S., there are approximately 17,000 food processing facilities. Food processing is a value-added activity that involves capital-intensive specialty equipment and facilities. For example, dog and cat food manufacturing requires machinery that renders grains, oilseed mill products, and meat byproducts. Rendered raw ingredients are later finished by extrusion (reconstituted and pressed into meat-like pieces), dried, and packed.

The four U.S. food processing sub-sectors in this first/initial U.S. nomination, rice milling, flour milling, pet food manufacturing, and bakeries, generate US$12.1 billion in annual sales revenue from 255 facilities. The four sub-sectors of this first U.S. critical use nomination for methyl bromide are only 2 percent of the U.S. food processing industry, by facility, or 9 percent, by sales revenue.

5b. U.S. Food Processing Practices

Food processing plants are highly variable depending upon the product manufactured (for example: flour, baked goods, cat food, dog treats). However, they all have three major components: the raw material receiving area, the production area and the warehouse (St. Car 2003). The receiving area contains the ingredients arriving from outside the plant and is generally a storage bin. For example, in flour mills this area will receive wheat; for pet food plants it will receive meat, meat by-products, as well as cereal grains. The receiving area has electronic equipment to monitor capacity and rate of use. The primary area where manufacturers still need methyl bromide fumigations is the production area. This is the site where the ingredients are combined and manufactured into a final product. The production area is congested with equipment, such as sifters, strainers, filters, magnets, metal detectors, mixers, ovens and extruders, all of which are highly technical and run by computers. The warehouse includes the packaging and storage areas of the finished product. Some warehouses also include trailers for transporting the final goods, which need to be pest free. Often, the warehouses are a corner of the production area and not an actual separate building. In addition to the processing facility there are concerns about pest infestation of packaged products. Processed foods are packaged in many types of materials including oxygen barrier bags; non-barrier packaging; shrink wrap; plastics, multi-layer thermal seal pouches and cans. Each of these packaging materials has different sensitivities with pest management treatments, including methyl bromide, and presents a different challenge for penetrating into the packaged food to kill the insects.

Food processing facilities are distributed throughout the U. S. and are thus subjected to very different weather conditions and pest pressures. In the southern portion of the U.S., there is often no heat source for the facilities as temperatures rarely will dip to freezing. Insect and other pest populations are very high in this geographical area as well. In the northern sections of the U.S., plants have heat sources, as the temperatures may be -23E C (-10E F) for several weeks. In addition, their pest pressures are lower as the severe temperatures help to keep populations low.

Almost all food processing plants in the U. S. operate 24 hours a day, 7 days a week, year round. Ten years ago nearly all plants fumigated with methyl bromide up to 4 times a year. In preparation for the loss of methyl bromide, the industry has been active in finding ways to reduce pests in the plants (these techniques will be described later). Currently, the southern plants fumigate with methyl bromide twice a year. Whereas, the northern plants have been able to extend their methyl bromide fumigations as far apart as once every 3 years.

5c. Other Issues Related to the U. S. Food Processing Industry

An emphasis in the U.S. on maintaining high quality food is codified in several health and consumer safety laws that are implemented by the U.S. Food and Drug Administration (U.S. FDA). This law, the Federal Food, Drug and Cosmetic Act (FFDCA 402), ensures human and animal foods are safe and properly labeled (Zimmerman, et al. 2003). The U. S. FDA defines when hazards and filth are unacceptable in human and animal foods (http://www.fda.gov/opacom/laws/fdcact/fdcact4.htm). U.S. FDA also establishes Defect Action Levels (DALs) which define how much filth is allowed in a food (Gecan 2003; http://www.cfsan.fda.gov/~dms/dalbook.html). Filth may include health hazards (for example setae, or barbed hairs, from dermestid beetle immatures are a choking hazard for children and pets) or contaminants that may render the food adulterated, but not actually hazardous. These contaminants include the body parts of pests (legs, wings, scales), as well as their excreta (feces, urine).

Consumers in the U.S. have very high expectations for their food products, including food for their pets. U. S. citizens tend to file lawsuits against manufacturers as a normal reaction to a perceived wrong. There are few barriers in the U. S. to filing these lawsuits and virtually no consequences to filing lawsuits under questionable grounds. There are also cases where people have "sabotaged" their own foods with maggots, roaches, even rats, in order to attempt to obtain monetary compensation. Manufacturers are very concerned about the negative publicity these lawsuits cause. In order to protect the reputation of their company as well as the future sales of their products, manufacturers strive to produce high quality foodstuffs. The food processing industry makes it a high priority to safeguard the healthfulness and cleanliness of their products.

6. Results of Review - Determined Need for Methyl Bromide in Food Processing Plants

6a. Target Pests Controlled with Methyl Bromide

Humans have much competition for their food. It has been estimated that arthropod pests account for 8 to 25 percent postharvest and structural losses in developed countries and as much as 75 percent in developing countries (Mason 2003).

Food processing plants are under pressure by insects, rodents and birds (applicants reported about 74 different arthropod pests, 5 rodent pests, and 3 bird pests). The primary reason for methyl bromide fumigations is insect pressure, not only insects in the ingredients and finished products, but also in the structure itself. The list of insects is too long for this summary, but a few of the main insects are: warehouse beetle (*Trogoderma variabile*); grain beetles, mainly sawtoothed (*Oryzaephilius surinamensis*) and merchant (*O. mercator*); and flour beetles (*Tribolium* spp.). Some insects feed within the grains (ex. weevils, lesser grain borers), meat products and by- products (ex. redlegged ham beetle, larder beetles), or are external feeders (ex. Indian meal moth, mealworms). In nature, these pests are scavengers, in other words, they eat dead animal and plant matter. Their ecological job is to help break down organic matter to release inorganic products for recycling in the environment. The food processing plant is analogous to a feast for these animals.

Food processing plants are also a changing, transient ecosystem. Therefore, for these animals to exploit this resource, they must have a high growth rate, a high reproduction rate, and must be generalist feeders (Sinha 1991). These characteristics allow for the pests to leave many offspring to take advantage of the varieties of materials in a food processing plant. It is these same characteristics that make managing them so challenging.

Not only do these insects eat the foodstuffs themselves, but they also leave cast skins, excreta, scales, webbing, body parts, etc. which adulterates the food. Moreover, some of these insects are health hazards. Warehouse beetles, the major pest for this sector, are dermestid beetles whose immatures have setae (barbed hairs) that are a choking hazard to small children and pets. Flour beetles secrete quinones which have been implicated as carcinogens. There is also the possibility of allergic reactions to arthropod fragments, excreta, pheromones. Cockroaches, ants and flies have been known to transport disease-causing bacteria, such as salmonella (Mason 2003).

6b. Technical and Economic Assessment of Alternatives

For the U.S. food processing industry, the MBTOC not in-kind alternatives to methyl bromide are critical for monitoring pest populations and managing those populations, but they do not disinfect food processing plants that have pests. In the U.S., phosphine is the only fumigant, other than methyl bromide, registered for disinfecting food processing plants. Both heat and phosphine can be used to disinfect infested food processing plants in some cases. Some facilities, probably due to construction, are unable to use heat or phosphine. Moreover, phosphine is a major concern because of its corrosive nature. Currently, there are plants in the U.S. that use both techniques and still need to fumigate with methyl bromide; even though they have been able to lengthen times between methyl bromide applications. The potential economic losses associated with the use of phosphine and heat treatment are large enough to substantively affect the profitability and competitiveness of entities within the food processing sector.

We begin our technical and economic assessment by presenting the not-in-kind (non-chemical) alternatives, and then describe the attributes of the in-kind (chemical) alternatives. The results of the U.S. interdisciplinary team review of the MBTOC listed alternatives are summarized in Table 1. However, this summary does not address fumigants which are not registered for disinfecting food processing plants in the U. S., such as: hydrogen cyanide, ethyl formate, sulfuryl fluoride, and controlled/modified atmospheres. Terms in **bold** are alternatives identified by the MBTOC for structures and flour mills. The only alternatives that are capable of disinfecting plants are heat and phosphine.

Table 1. Methyl Bromide Alternatives Identified by the Methyl Bromide Technical Options Committee (MBTOC) for Food Processing Plants

Methyl Bromide Alternatives	Assessment of Technical Feasibility	Assessment of Economic Feasibility
Biological Agents	No	No
Cold Treatments	No	No
Integrated Pest Management (IPM)	No	No
Electrocution	No	No
Contact Insecticides	No	No
Low Volatility Pesticides	No	No
Sanitation	No	No
Pest Exclusion	No	No
Physical Removal	No	No
Diatomaceous Earth	No	No
Heat Treatment	Yes*	No
Phosphine, alone	Yes*	No
Phosphine, in combination	Yes*	No

* Although these alternatives can control pests, practical implementation in many cases is complicated by corrosivity and damage to electronic equipment, building construction, pest resistance and regulatory limitations.

6c. Technical Feasibility of the "Not In Kind" Alternatives

Biological Agents, such as insects or pathogens. This is not an option for the food processing industry since the introduction of more insects, or pathogens, would contribute to contamination of the food. The FFDCA does not distinguish between body parts (legs, wings, etc) of beneficials from those of pests.

Cold Treatment. Insects can dramatically reduce their metabolism and acclimate to cold temperature. The U. S. does not have any food manufacturing plants that are air-tight enough to allow this to be feasible.

Integrated Pest Management (IPM). IPM is currently practiced in all the food processing facilities that submitted an application for critical use exemption. The IPM approach to pest control seeks to manage pests at economically tolerable levels by making use of all available chemical, cultural, biological, and mechanical pest control practices. The principles of IPM include other portions of the Not In Kind Alternatives, such as **pheromone traps, electrocution traps,** and light traps to monitor pest populations. When pests are found in traps, then **contact insecticides and low volatility pesticides** are applied in spot treatments for surfaces, cracks and crevices, or anywhere the pests may be hiding. These applications are intended to restrict pests from spreading throughout the facility to try to avoid a plant fumigation (Arthur and Phillips 2003). However, while IPM practices are used in the U.S. whenever feasible to reduce reliance on MBR, IPM is not designed to completely eliminate pests from any given facility nor to ensure that a facility remains free from infestation. Because of the zero tolerance for insects imposed by market demands and regulatory requirements, IPM is not an acceptable alternative to methyl bromide fumigation.

Sanitation, Pest Exclusion, Physical Removal, Diatomaceous Earth. 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). Part of sanitation involves quickly removing damaged and contaminated foods and packaging. Sanitation, pest exclusion, physical removal and diatomaceous earth cannot control pest populations below FDA's DALs.

Heat Treatment. If done correctly, heat of 60Eto 65E C (140Eto 150E F) for 12 hours will kill all stages of insects. Consequently, this is an option for a disinfectant in food processing plants. However, in the U. S., it takes 4 to 5 heat fumigations to equal one methyl bromide fumigation. Heat treatments in the northern areas of the U. S. take 2 to 3 days longer than a methyl bromide fumigation. It is critical to raise the temperature so as not to damage the building, as different components of these facilities (concrete, metals, wood, stone) all expand at different rates. All of these components contract at different rates, so the process of cooling the building is also critical.

Currently, many plants in the U. S., in preparing for the loss of methyl bromide, have made the conversion to utilize heat treatments. There are costs in retrofitting a plant for heat treatments. For instance sprinklers have to be replaced since they are set to go off at 55E C (130E F). Heat will also damage electrical insulation as well as computer components. So these items must be modified or replaced. Heat treatments in the southern U. S. is more of a problem since they do not have heaters at their plants to supply the energy needed for a treatment and consequently these plants must purchase their heat source elsewhere. However, by employing sanitation, IPM, and heat treatments, plants in the southern U. S. have been able to go from 4 methyl bromide fumigations per year to 2 fumigations per year and northern U. S. facilities have been able to reduce their methyl bromide fumigations to 1 fumigation per 3 years.

While heat may be useful in some plants, other food processing plants are unable to heat their building uniformly or maintain the proper temperature long enough for heat to be efficacious. In several cases, for instance a building 5 stories high, the upper level is too hot and the floor still has not reached proper temperature for control. Additionally, any fats, such as butter and oils, will become rancid from heat; and heat will also cook many substances (meats, some grains). Therefore, heat treatment is not a replacement for methyl bromide for all plants.

6d. Technical Feasibility of the "In Kind" Alternatives

Phosphine, alone. In the U.S., phosphine is the only fumigant other than methyl bromide registered for food manufacturing plants. It is the fumigant of choice to disinfect the commodities coming into most pet food processing plants.

While technically feasible, phosphine does require more time to kill insects than does methyl bromide. Further, some insect pests, such as lesser grain borers, flour beetles, flat grain beetles and sawtoothed grain beetles, have been found to be resistant to phosphine.

Phosphine is also very corrosive to metals, especially copper and its alloys, bronze and brass. These metals are critical components of the electronics that run all the manufacturing equipment. In addition some of the equipment itself (for example: motors, mixers, etc.) also have metal parts that contain copper.

Phosphine, in combination. There is some indication that reduced concentrations of phosphine in combination with carbon dioxide and heat may be able to extend the life of the metals. However, additional research is needed on the effectiveness of this combination and its effects on the rate of metal corrosion. Additionally the same problems concerning heat treatments will also be a concern in combination with phosphine and carbon dioxide. Carbon dioxide will have little effect in most of the food processing plants since the facilities in the U.S. are not airtight. Also, using lower concentrations of phosphine with resistance in the pest populations will select for the resistant insects much quicker, and therefore, is not recommended.

6e. Economic Feasibility

The economic assessment of feasibility for post-harvest/food processing plant uses of methyl bromide included an evaluation of economic losses due to three major economic measures, with the first measure being sub-divided further into three contributing factors:

(1) absolute losses per facility are an aggregate of potential economic losses from:
(1a) direct pest control costs, because alternatives to methyl bromide tend to be more expensive, not only in terms of the price of the fumigant or treatment type, but also for the increased labor time required for longer, or an increased number of, treatments.

(1b) capital expenditures, which are often large amounts required to adopt an alternative, such as investments to retrofit a facility to make it suitable for heat treatment.

(1c) production delays, which are often related to additional production downtime for the use of alternatives. Many facilities are operating at or near production capacity in "just-in-time" environments. Alternatives that take longer than methyl bromide or require more frequent application can result in manufacturing slowdowns, shutdowns, or shipping delays. Slowing down production will result in additional costs incurred throughout channels of distribution.

(2) Economic loss as a percent of net revenue. This measure is calculated by dividing the absolute loss by the net revenue.

(3) Economic loss per kilogram of methyl bromide requested. This measure is calculated by dividing the loss per facility by the kilograms active ingredient requested per facility.

These measures represent different ways to assess the economic feasibility of methyl bromide alternatives for methyl bromide use in food processing facilities. Because producers (suppliers) represent an integral part of any definition of a market, we interpret the threshold of significant market disruption to be met if there is a significant impact on commodity suppliers using methyl bromide. The economic measures provide the basis for making that determination.

Following the U.S. technical and economic review, discussions were held with senior risk management personal in the U.S. government to decide the recommendations and put together a draft package for submission to the Parties. As a consequence of all of this work, it is safe to say that the nomination being submitted with this overview is the work of well over 60 experts both in and outside of government.

Technically feasible alternatives to methyl bromide in food processing are heat treatment, phosphine alone, and phosphine in combination. Implementation of these alternatives has substantial implications for this sector of applicants. Significant financial impacts likely will result from increased operating costs for materials and labor, capital expenditures, and increased production downtime. In rice milling and flour milling in part, the plants operate on small profit margins. For example the last new flour mill built in the U.S. went bankrupt in part because it could not pass along the start up costs to consumers. Therefore, any additional costs associated with construction or retrofitting of the facility cannot be passed along to the customer.

Heat

Heat is already being used in plants that can be heated efficiently. Some plants in food processing sector have already modified their plants for heat fumigation. These plants make constant spot heat treatments, which can be accomplished often in different parts of the plant during working hours. However, there are also old plants that need to make their facilities amenable to heat treatment and require additional production downtime for the use of alternatives. The food processing sector comprises a wide range of products and production processes. Heat treatment cannot be economically feasible for some plants while it has been used by other plants. Therefore, methyl bromide requests are only for those plants where alternatives are not technically feasible and/or not economically feasible.

The potential economic losses associated with the use of heat treatment mostly arise from the cost of production delay and capital expenditures to make the facility amenable to heat treatment. Table 2 provides a summary of the estimated economic losses associated with heat treatment. The estimated economic loss as a percentage of net revenue ranges from 10 percent to 41 percent. The industries that currently use methyl bromide for structural fumigation are, in general, subject to limited pricing power because 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 carry large debt loads, potentially making new capital investment difficult. Rice millers, flour millers, and bakers in part operate with low profit margins. The potential magnitude of economic losses associated with not having methyl bromide could cause bankruptcies and therefore market disruption.

Table 2. Summary of Financial and Economic Impacts for Food Processing Sector for Heat Treatment.

Economic Loss Measure[1]		Rice Milling (representative size : 10 million cf[2])	**Bakery (representative size : 5 million cf)**	**Dog and Cat Food (representative size : 1 million cf)**	**Flour milling (representative size : 1.2 million cf)**
Absolute loss per representative facility (Total = a+b+c)		$665,000	$1,229,000	$360,000	$341,000
	a) Direct pest control costs	$20,000	$68,000	$25,000	$45,000
	b) Capital expenditures	$250,000	$1,120,000	$145,000	$175,000
	c) Production delays	$413,000	$41,000	$142,000	166,000
Economic loss as a percentage of net revenue		41%	27%	10%	25%
Economic loss as per pound of Methyl bromide requested		$32	$197	$264	$273

1 Heat treatment is assumed to provide the same level of product protection as methyl bromide and thus, economic impacts are computed as the cost change of switching to the alternatives.
2 cubic feet

Phosphine alone. Phosphine, alone is more costly than heat treatment due to capital expenditure for accelerated replacement of plant and equipment due to corrosive nature of phosphine. A dog and cat food manufacturing facility showed that the required capital expenditure for phosphine, alone was over US$700,000 per year (while implementation of heat treatment would require a capital investment of US$100,000 per year.)

Phosphine in combination. Phosphine in combination is likely to be even more costly than phosphine, alone because implementation of this treatment also require retrofitting the facility for heat.

7. Critical Use Exemption Nomination for Food Processing Plants

As noted above, this nomination is for a critical use exemption for methyl bromide for rice millers, flour millers, pet foods, and bakeries in the U. S. The total nomination is for 612,576 kg (1,335,000 lbs) of methyl bromide, which could be used to treat 26.5 million cu m (936,000 1,000 cu ft), representing an average application rate of 0.022 kg/cu m (1.5 lbs/1,000 cu ft) The average application rates for all of these facilities conform to standard practices.

The U.S. interdisciplinary review team found a critical need for methyl bromide for rice millers, flour millers, pet foods, and bakeries in the U.S. The alternatives identified by MBTOC were, as reviewed above, regarded by reviewers in most cases as technically infeasible and in all others economically infeasible for acceptable management of the pest complex in these types of food processing plants throughout the U.S.

Tables 3, 4, 5, and 6 summarize the critical use exemption actual amount requested from the food processing sectors.

Table 3. Summary of Methyl Bromide Use & Requests by the Rice Milling Sector.

	1997	1998	1999	2000	2001	2005	2006	2007
kgs	186,880	151,953	168,746	171,911	142,881	202,756	202,756	202,756
1,000 cubic meters	5,692	4,531	5,125	5,229	4,587	6,173	6,173	6,173
rate (kg/cu m)	0.0328	0.0335	0.0329	0.0329	0.0311	0.0328	0.0328	0.0328

Historic methyl bromide use in the rice milling sector has slowly declined since 1997, with the exception of an increase between 1998-1999. However, the industry is expecting to grow in the coming years, and food safety standards are increasingly high in the United States and worldwide.

A representative user of the U.S. rice milling industry processes rice for both domestic and export markets. Facilities are very large, and many U.S. rice mills are located in warm climates that are conducive to insect production; pest pressure is very high. In addition, many domestic and export customers require rice to be fumigated with methyl bromide prior to shipment.

Table 4. Summary of Methyl Bromide Use & Requests by the Bakeries Sector.

	1997	1998	1999	2000	2001	2005	2006	2007
kgs	39,236	39,009	34,019	31,570	34,019	14,742	14,742	14,742
1,000 cubic meters	1,982	1,982	1,699	1,586	1,699	736	736	736
rate (kg/cu m)	0.0198	0.0197	0.0200	0.0199	0.0200	0.0200	0.0200	0.0200

The bakery sector in the United States works with insect sensitive ingredients which are typically stored on site in silos / bins in large expansive rooms. Due to the dusting nature of flour and other dry ingredients, it is extremely difficult to maintain control of all life forms of insects in environment. This is a requirement for compliance with government food regulations. In these situations, methyl bromide is now the only suitable tool for structural fumigations which provides control against infestation risks. However, this sector has attempted to reduce reliance on methyl bromide by switching to heat treatments in those plants where heat has proven to be a viable option. This U.S. critical use exemption nomination is for continued methyl bromide use in the bakery facilities where heat cannot be implemented because of the building structures.

Table 5. Summary of Methyl Bromide Use & Requests by the Pet Food Sector.

	1997	1998	1999	2000	2001	2005	2006	2007
kgs	43,386	43,887	43,001	45,200	48,264	48,081	48,081	48,081
1,000 cubic meters	1,992	2,015	1,974	2,075	2,216	2,209	2,209	2,209
rate (kg/cu m)	0.0218	0.0218	0.0218	0.0218	0.0218	0.0218	0.0218	0.0218

The United States pet food industry has slightly increased methyl bromide use since 1997; however, as many facilities are represented with this application, there is considerable variability in the number of plants fumigated during a particular year, and the frequency of fumigation of any one plant. The amount of methyl bromide used from one year to the next varies with the ability to schedule "downtime" in the production schedule for fumigation, pest introductions through contaminated ingredients, plant closures, partial fumigations when possible, and cost-cutting measures.

A representative plant has an average production capacity is 381,024 kilograms per day, and plant age ranges from 3 to 30 years; the average facility age is 18.5 years. Typically, plants run three shifts, 5.5 days per week, although some are operative 24 hours per day, 7 days per week. The average warehouse inventory is 1,360,800 kgs of finished product on the floor, and the average value of the finished product is US$600,000. Larger plants have a larger value, as they tend to produce high-value treats and biscuits. The average raw material and ingredient value of inventory available is 907,200 kgs; this figure includes bulk grains, animal protein, liquid and dry flavorings, vitamins, minerals, and other micro ingredients. The value of daily production averages US$100,000 and is closer to $290,000 for larger facilities.

Table 6. Summary of Methyl Bromide Use & Requests by the Flour Milling Sector.

	1997	1998	1999	2000	2001	2005	2006	2007
kgs	—	453,592	430,912	385,553	340,194	340,194	328,854	317,514
1,000 cubic meters	---	16,991	16,991	16,991	16,991	16,991	16,991	16,991
rate (kg/cu m)	---	0.0267	0.0254	0.0227	0.0200	0.0200	0.0194	0.0187

A representative flour mill produces approximately 362,880 kgs of processed grain products every day. The industry has reduced its application rate consistently, as shown in the above table, and has decreased from the traditional 4-5 treatments per year down to 2-3 treatments per year. In addition, the industry optimizes fumigation with improved techniques, which has helped to reduce the both the application rate and the total amount of methyl bromide used. Augmenting the methyl bromide fumigation with carbon dioxide has also improved the effectiveness of fewer methyl bromide fumigations.

The U.S. nomination has been determined based first on consideration of the requests we received and an evaluation of the supporting material. This evaluation, which resulted in a reduction in the amount being nominated, included careful examination of issues including the area infested with the key target (economically significant) pests for which methyl bromide is required, the extent of regulatory constraints on the use of registered alternatives, and historic use rates, among other factors.

Table 7. Methyl Bromide CUE Nomination for Post-Harvest/Food Processing Plants

Year	Total Request by Applicants (kilograms)	U.S. Sector Nomination (kilograms)
2005	612,576	536,328

8. Availability of Methyl Bromide From Recycled or Stockpiled Sources

In accordance with the criteria of the critical use exemption, the Parties must discuss the potential that the continued need for methyl bromide can be met from recycled or stockpiled sources. With regard to recycling of methyl bromide, it is fair to say that the U.S. concurs with earlier TEAP conclusions that recycling of methyl bromide used in food processing facilities is not currently feasible. Facilities in the U. S. are very large and not able to be sealed tightly enough to allow methyl bromide to be captured and recycled. The U.S. has been investigating the level of the existing stockpile, and we believe that whatever stock pile may now exist will likely be fully depleted by 2005 when the need for the critical use exemption will start.

9. Minimizing Use/Emissions of Methyl Bromide in the U. S.

In accordance with the criteria of the critical use exemption, we will now describe ways in which we strive to minimize use and emissions of methyl bromide. While each sector based nomination includes information on this topic, we thought it would be useful to provide some general information that is applicable to most methyl bromide uses in the country

The use of methyl bromide in the United States is minimized in several ways. First, because of its toxicity, methyl bromide is regulated as a restricted use pesticide in the United States. As a consequence, methyl bromide can only be used by certified applicators who are trained at handling these hazardous pesticides. In practice, this means that methyl bromide is applied by a limited number of very experienced applicators with the knowledge and expertise to minimize dosage to the lowest level possible to achieve the needed results. 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 above) so the use of methyl bromide could be reduced. Ten years ago the plants were fumigated with methyl bromide up to 4 times a year. Currently, the southern plants fumigate with methyl bromide twice a year (typically on 3-day weekends). Whereas, the northern plants have been able to extend their methyl bromide fumigations as far apart as once every 3 to 5 years.

In terms of compliance, in general, the United States has used a combination of tight production and import controls, and the related market impacts to ensure compliance with the Protocol requirements on methyl bromide. Indeed, over the last – years, the price of methyl bromide has increased substantially. As Chart 1 in Appendix D demonstrates, the application of these policies has led to a more rapid U.S. phasedown in methyl bromide consumption than required under the Protocol. This accelerated phasedown on the consumption side may also have enabled methyl bromide production to be stockpiled to some extent to help mitigate the potentially significant impacts associated with the Protocol's 2003 and 2004 70% reduction. We are currently uncertain as to the exact quantity of existing stocks going into the 2003 season that may be stockpiled in the U.S. We currently believe that the limited existing stocks are likely to be depleted during 2003 and 2004. This factor is reflected in our requests for 2005 and beyond.

At the same time we have made efforts to reduce emissions and use of methyl bromide, we have also made strong efforts to find alternatives to methyl bromide. The section that follows discusses those efforts.

10. U.S. Efforts to Find, Register and Commercialize Alternatives to Methyl Bromide

Over the past ten years, the United States has committed significant financial and technical resources to the goal of seeking alternatives to methyl bromide that are technically and economically feasible to provide pest protection for a wide variety of crops, soils, and pests, while also being acceptable in terms of human health and environmental impacts. The U.S. pesticide registration program has established a rigorous process to ensure that pesticides registered for use in the United States do no present an unreasonable risk of health or environmental harm. Within the program, we have given the highest priority to rapidly reviewing methyl bromide alternatives, while maintaining our high domestic standard of environmental protection. A number of alternatives have already been registered for use, and several additional promising alternatives are under review at this time. Our research efforts to find new alternatives to methyl bromide and move them quickly toward registration and commercialization have allowed us to make great progress over the last decade in phasing out many uses of methyl bromide. However, these efforts have not provided effective alternatives for all crops, soil types and pest pressures, and we have accordingly submitted a critical use nomination to address these limited additional needs.

Research Program

When the United Nations, in 1992, identified methyl bromide as a chemical that contributes to the depletion of the ozone layer and the Clean Air Act committed the U.S. to phase out the use of methyl bromide, the U.S. Department of Agriculture (USDA) initiated a research program to find viable alternatives. Finding alternatives for agricultural uses is extremely complicated compared to replacements for other, industrially used ozone-depleting substances because many factors affect the efficacy such as: crop type, climate, soil type, and target pests, which change from region to region and among localities within a region.

Through 2002, the USDA Agricultural Research Service (ARS) alone has spent US$135.5 million to implement an aggressive research program to find alternatives to methyl bromide (see Table 1 below). Through the Cooperative Research, Education and Extension Service, USDA has provided an additional $11.4m since 1993 to state universities for alternatives research and outreach. This federally supported research is a supplement to extensive sector specific private sector efforts, and that all of this research is very well considered. Specifically, the phaseout challenges brought together agricultural and forestry leaders from private industry, academia, state governments, and the federal government to assess the problem, formulate priorities, and implement research directed at providing solutions under the USDA's Methyl Bromide Alternatives program. The ARS within USDA has 22 national programs, one of which is the Methyl Bromide Alternatives program (Select Methyl Bromide Alternatives at this web site: http://www.nps.ars.usda.gov). The resulting research program has taken into account these inputs, as well as the extensive private sector research and trial demonstrations of alternatives to methyl bromide. While research has been undertaken in all sectors, federal government efforts have been based on the input of experts as well as the fact that nearly 80 percent of preplant methyl bromide soil fumigation is used in a limited number of crops. Accordingly, much of the federal government pre-plant efforts have focused on strawberries, tomatoes, ornamentals, peppers and nursery crops, (forest, ornamental, strawberry, pepper, tree, and vine), with special emphasis on tomatoes in Florida and strawberries in California as model crops.

Table 1: Methyl Bromide Alternatives Research Funding History

Year	Expenditures by the U.S. Department of Agriculture (US$ Million)
1993	$7.255
1994	$8.453
1995	$13.139
1996	$13.702
1997	$14.580
1998	$14.571
1999	$14.380
2000	$14.855
2001	$16.681
2002	$17.880

The USDA/ARS strategy for evaluating possible alternatives is to first test the approaches in controlled experiments to determine efficacy, then testing those that are effective in field plots. The impact of the variables that affect efficacy is addressed by conducting field trials at multiple locations with different crops and against various diseases and pests. Alternatives that are effective in field plots are then tested in field scale validations, frequently by growers in their own fields. University scientists are also participants in this research. Research teams that include ARS and university scientists, extension personnel, and grower representatives meet periodically to evaluate research results and plan future trials.

Research results submitted with the CUE request packages (including published, peer-reviewed studies by (primarily) university researchers, university extension reports, and unpublished studies) include trials conducted to assess the effectiveness of the most likely chemical and non-chemical alternatives to methyl bromide, including some potential alternatives that are not currently included in the MBTOC list.

As demonstrated by the table above, U.S. efforts to research alternatives for methyl bromide have been substantial, and they have been growing in size as the phaseout has approached. The United States is committed to sustaining these research efforts in the future to continue to aggressively search for technically and economically feasible alternatives to methyl bromide. We are also committed to continuing to share our research, and enable a global sharing of experience. 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 post-harvest food processing sector has invested substantial time and funding into research and development of technically and economically feasible alternatives to methyl bromide. Past and current research focuses on the biology and ecology of the pests, primarily insect pests. To implement non-chemical controls and reduce methyl bromide use requires a thorough understanding of the pests in order to exploit their weaknesses. Some of these investigations have studied the effects of temperature and humidity on the fecundity, development, and longevity of a specific species. Other studies have been to determine the structural preferences and micro habitat requirements of a species. Studies of factors affecting population growth (interactions within and among species) have been conducted. However, with 74 different arthropod pests, 5 rodent pests, and 3 bird pests there is still much research that needs to be done.

IPM and sanitation methods are also under investigation. This includes food plant design and engineering modifications for pest exclusion. Another area of study is insect-resistant packaging. In fact, new research is demonstrating a potential to incorporate chemical repellents into packaging materials (Arthur and Phillips 2003). Further studies with pheromones and trapping strategies are helping to improve IPM in food processing plants.

The number of available insecticides that can be used in and around food plants, processing mills, and food warehouses in the U. S. has declined in recent years. Sulfuryl fluoride is toxic to stored- product pests but requires long exposures to kill insect eggs (Arthur and Phillips 2003). The research and development of chemical alternatives to be used by this sector is a critical need in the U. S.

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

> **Biology and Management of Food Pests (Oct 2002- Sep 2007)** to: examine the reproductive biology and behavior of storage weevils, Indian meal 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 Postharvest and Quarantine Pests (Jul 2000 - Dec 2004)** to: develop quarantine/postharvest 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 non-chemical methodologies which will yield integrated pest control management programs; and develop methods to detect insect infestations.

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

The bakery sector is implementing heat as an alternative at those facilities where heat is technically feasible. Currently, heat is being implemented at several facilities nationwide. Other methods being used to reduce reliance on methyl bromide are: exclusion, cleaning, early detection, improved design of equipment, trapping, and other integrated pest management (IPM) approaches, and plans to continue these efforts in the coming years. Heat treatment continues to be tested, but further trials are needed to determine the effects of heat on a long-term basis. Other conditions such as older buildings with hardwood floors, plant electrical wiring systems are not especially conducive to heat treatments. In addition to the possibility of heat, this sector is also extremely supportive of third-party research conducted by the USDA on sulfuryl fluoride.

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

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, which is pending registration in the United States; heat treatments; and various combinations of heat, phosphine, and carbon dioxide. Industry is supportive of and closely follows USDA research on these alternatives.

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

Registration Program

The United States has one of the most rigorous programs in the world for safeguarding human health and the environment from the risks posed by pesticides. While we are proud of our efforts in this regard, related safeguards do not come without a cost in terms of both money and time. Because the registration process is so rigorous, it can take a new pesticide several years (3-5) to get registered by EPA. It also takes a large number of years to perform, draft results and deliver the large number of health and safety studies that are required for registration.

U.S. registration decisions are often the basis for other countries' pesticide regulations, which means that the benefits from assuring human and environmental safety accrue globally. Few countries, particularly in the developing world, have the resources to conduct and review these studies nor the market power to leverage chemical companies to perform and submit the necessary data. In recognition of this factor the USDA has provided some funding to help enable registration, and the U.S. EPA has introduced an accelerated review process for chemicals that are potential alternatives to uses of methyl bromide. This has involved a significant commitment of resources, and has resulted in fast track review of methyl bromide alternatives, such as sulfuryl fluoride. However, much work remains to be done.

The U.S. Environmental Protection Agency regulates the use of pesticides under two major federal statutes: the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and the Federal Food, Drug, and Cosmetic Act (FFDCA), both significantly amended by the Food Quality Protection Act of 1996 (FQPA). Under FIFRA, EPA registers pesticides provided its use does not pose unreasonable risks to humans or the environment. Under FFDCA, the Agency is responsible for setting tolerances (maximum permissible residue levels) for any pesticide used on food or animal feed. With the passage of FQPA, the Agency is required to establish a single, health-based standard for pesticides used on food crops and to determine that establishment of a tolerance will result in a "reasonable certainty of no harm" from aggregate exposure to the pesticide.

The process by which EPA examines the ingredients of a pesticide to determine if they are safe is called the registration process. The Agency evaluates the pesticide to ensure that it will not have any adverse effects on humans, the environment, and non-target species. Applicants seeking pesticide registration are required to submit a wide range of health and ecological effects toxicity data, environmental fate, residue chemistry and worker/bystander exposure data and product chemistry data. A pesticide cannot be legally used in the U.S. if it has not been registered by EPA, unless it has an exemption from regulation under FIFRA.

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, 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 EPA to initiate its review. Once the review process begins, it takes an average of 38 months to complete the registration.

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

The U.S. EPA has also co-chaired the USDA/EPA Methyl Bromide Alternatives Work Group since 1993 to help coordinate research, development and the registration of viable alternatives. 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 groundwater concerns) being directly addressed through USDA's Agricultural Research Service's $13.5 million per year research program conducted at more than 20 field evaluation facilities across the country. Also EPA's participation in the evaluation of research grant proposals submitted to the USDA's Cooperative State Research, Education, and Extension Service methyl bromide alternatives research program of US$ 2.5 million per year has further ensured that critical registration issues are being addressed by the research community.

Since 1997, 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: Indian meal Moth Granulosis Virus to control Indian meal moth in stored grains

EPA is currently reviewing several additional applications for registration as methyl bromide alternatives, with several registration eligibility decisions expected in the next several years, including:

- Sulfuryl fluoride as a post-harvest fumigant for stored commodities

Again, while these activities appear promising, it must be noted that issues related to toxicity, ground water contamination, and the release of air pollutants may pose significant problems with respect to some alternatives that may lead to use restrictions since many of the growing regions are in sensitive areas such as those in close proximity to schools and homes. Ongoing research on alternate fumigants is evaluating ways to reduce emission under various application regimes and examining whether commonly used agrochemicals, such as fertilizers and nitrification inhibitors, could be used to rapidly degrade soil fumigants. For example, if registration of iodomethane or another alternative occurs in the near future, commercial availability and costs will be factors that must be taken into consideration.

It must be emphasized, however, that finding potential alternatives, and even 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.

11. Conclusion and Policy Issues Associated with the Nomination

In summary, a review of the critical use exemption criteria in Decision IX/6 demonstrates that the Parties clearly understood the many issues that make methyl bromide distinctly different from the industrial chemicals previously addressed by the Parties under the essential use process. It is now the challenge of the MBTOC, TEAP and the Parties to consider the national submission of critical use nominations in the context of that criteria, and the information requirements established under Decision XIII/11.

In accordance with those Decisions, we believe that the U.S. nomination contained in this document provides all of the information that has been requested by the Parties. On the basis of an exhaustive review of a large, multi-disciplinary team of sector experts, we have determined that the MBTOC listed potential alternatives for the post-harvest/ food processing sector are not currently technically or economically feasible from the standpoint of U. S. food processing manufacturers covered by this exemption nomination. Even the most promising of these alternatives is economically infeasible due to potential decreases in revenue and increases in production costs associated with adopting the alternatives.

In addition, we have demonstrated that we have and will continue to expend significant efforts to identify and commercialize alternatives to the use of methyl bromide in post-harvest/food processing plants. It must be stressed that the registration process, which is designed to ensure that new pesticides do not pose an unreasonable adverse effect to human health and the environment, is long and rigorous. The U.S. need for methyl bromide for food processing plants will be maintained for the period being requested.
In reviewing this nomination, we believe that it is important for the MBTOC, the TEAP and the Parties to understand some of the policy issues associated with our request. A discussion of those follows:

a. Request for Aggregate Exemption for All Covered Methyl Bromide Uses: As mandated by Decision XIII/11, the nomination information that is being submitted with this package includes information requested on historic use and estimated need in individual sectors. That said, we note our agreement with past MBTOC and TEAP statements which stress the dynamic nature of agricultural markets, uncertainty of specific production of any one crop in any specific year, the difficulty of projecting several years in advance what pest pressures might prevail on a certain crop, and, the difficulty of estimating what a particular market for a specific crop might look like in a future year. We also concur with the MBTOC's fear that countries that have taken significant efforts to reduce methyl bromide use and emissions through dilution with chloropicrin may be experiencing only short term efficacy in addressing pest problems. On the basis of those factors, we urge the MBTOC and the TEAP to follow the precedent established under the essential use exemption process for Metered Dose Inhalers (MDIs) in two key areas.

First, because of uncertainties in both markets and the future need for individual active moieties of drugs, the TEAP has never provided a tonnage limit for each of the large number of active moieties found in national requests for a CFC essential use exemption for MDIs, but has instead recommended an aggregate tonnage exemption for national use. This has been done with an understanding that the related country will ensure that the tonnage approved for an exemption will be used solely for the group of active moieties/MDIs that have been granted the exemption. We believe that the factors of agricultural uncertainty surrounding both pest pressures in future year crops, and efficacy of reduced methyl bromide application provide an even stronger impetus for using a similar approach here. The level of unpredictability in need leads to a second area of similarity with MDIs, the essential need for a review of the level of the request which takes into account the need for a margin of safety.

b. Recognition of Uncertainty in Allowing Margin for Safety: With MDIs, it was essential to address the possible change in patient needs over time, and in agriculture, this is essential to address the potential that the year being requested for could be a particularly bad year in terms of weather and pest pressure. In that regard, the TEAP's Chart 2 in Appendix D demonstrates the manner in which this need for a margin of safety was addressed in the MDI area. Specifically, Chart 2 in Appendix D tracks national CFC requests for MDIs compared with actual use of CFC for MDIs over a number of years.

Chart 2 in Appendix D demonstrates several things. First, despite the best efforts of many countries to predict future conditions, it shows that due to the acknowledged uncertainty of out-year need for MDIs, Parties had the tendency to request, the TEAP recommended, and the Parties approved national requests that turned out to include an appreciable margin of safety. In fact, this margin of safety was higher at the beginning – about 40% above usage – and then went down to 30% range after 4 years. Only after 5 years of experience did the request come down to about 10% above usage. While our experience with the Essential Use process has aided the U.S. in developing its Critical Use nomination, we ask the MBTOC, the TEAP and the Parties to recognize that the complexities of agriculture make it difficult to match our request exactly with expected usage when the nomination is made two to three years in advance of the time of actual use.

Chart 2 in Appendix D also demonstrates that, even though MDI requests included a significant margin of safety, the nominations were approved and the countries receiving the exemption for MDIs did not produce the full amount authorized when there was not a patient need. As a result, there was little or no environmental consequence of approving requests that included a margin of safety, and the practice can be seen as being normalized over time. In light of the similar significant uncertainty surrounding agriculture and the out year production of crops which use methyl bromide, we wish to urge the MBTOC and TEAP to take a similar, understanding approach for methyl bromide and uses found to otherwise meet the critical use criteria. We believe that this too would have no environmental consequence, and would be consistent with the Parties aim to phaseout methyl bromide while ensuring that agriculture itself is not phased out.

c. Duration of Nomination: It is important to note that while the request included for the use above appears to be for a single year, the entire U.S. request is actually for two years – 2005 and 2006. This multi-year request is consistent with the TEAP recognition that the calendar year does not, in most cases, correspond with the cropping year. This request takes into account the facts that registration and acceptance of new, efficacious alternatives can take a long time, and that alternatives must be tested in multiple cropping cycles in different geographic locations to determine efficacy and consistency before they can be considered to be widely available for use. Finally, the request for multiple years is consistent with the expectation of the Parties and the TEAP as evidenced in the Parties and MBTOC request for information on the duration of the requested exemption. As noted in the Executive Summary of the overall U.S. request, we are requesting that the exemption be granted in a lump sum of 9,920,965 kilograms for 2005 and 9,445,360 kilograms for 2006. While it is our hope that the registration and demonstration of new, cost effective alternatives will result in even speedier reductions on later years, the decrease in our request for 2006 is a demonstration of our commitment to work toward further reductions in our consumption of methyl bromide for critical uses. At this time, however, we have not believed it possible to provide a realistic assessment of exactly which uses would be reduced to account for the overall decrease.

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14. Appendices

Appendix A. List of Critical Use Exemption requests for the Food Processing Sector in the U.S.

CUE-02-0023, Rice Millers' Association

CUE-02-0026, Kraft Food North America, Inc.

CUE-02-0027, Pet Food Institute

CUE-02-0031, North American Millers Association

Appendix B: Spreadsheets Supporting Economic Analyses

This appendix presents the calculations, for each sector, that underlie the economic analysis presented in the main body of the nomination chapter. As noted in the nomination chapter, each sector is comprised of a number of applications from users of methyl bromide in the United States, primarily groups (or consortia) of users. The tables below contain the analysis that was done for each individual application, prior to combining them into a sector analysis. Each application was assigned a unique number (denoted as CUE #), and an analysis was done for each application for technically feasible alternatives. Some applications were further sub-divided into analyses for specific sub-regions or production systems. A baseline analysis was done to establish the outcome of treating with methyl bromide for each of these scenarios. Therefore, the rows of the tables correspond to the production scenarios, with each production scenario accounting for row and the alternative(s) accounting for additional rows.

The columns of the table correspond to the estimated impacts for each scenario. (The columns of the table are spread over several pages because they do not fit onto one page.) The impacts for the methyl bromide baseline are given as zero percent, and the impacts for the alternatives are given relative to this baseline. Loss estimates include analyses of yield and revenue losses, along with estimates of increased production costs. Losses are expressed as total losses, as well as per unit treated and per kilogram of methyl bromide. Impacts on profits are also provided.

After the estimates of economic impacts, the tables contain basic information about the production systems using methyl bromide. These columns include data on output price, output volume, and total revenue. There are also columns that include data on methyl bromide prices and amount used, along with data on the cost of alternatives, and amounts used. Additional columns describe estimates of other production (operating) costs, and fixed/overhead costs.

The columns near the end of the tables combine individual costs into an estimate of total production costs, and compare total costs to revenue in order to estimate profits. Finally, the last several columns contain the components of the loss estimates.

Food Plant/Structural (F/S) Part A											
Sector Summary of Economic Estimates					***Absolute Loss Per Representative Facility***						
CUE # 02-00	**Sector**	**Applicant**	**Alternative**	Technically Feasible?	Representative Facility Size	Direct Pest Control Costs ($USD)	Capital Expenditure ($USD)	Production Delays ($USD)	**Total** ($USD)	**Loss as a Percentage of Net Revenue**	**Loss as per Kilogra of MeBr Requeste** ($USD)
23	F/S	Rice Millers' Assn	methyl bromide		10 million cubic feet						
23	F/S	Rice Millers' Assn	Heat treatment	Y	10 million cubic feet	$20,000	$250,000	$413,000	$665,000	41%	$71
26	F/S	Kraft Foods	methyl bromide		5 million cubic feet						
26	F/S	Kraft Foods	Heat treatment	Y	5 million cubic feet	$68,000	$1,120,000	$41,000	$1,229,000	27%	$433
27	F/S	Pet Food Institute	methyl bromide		1 million cubic feet						
27	F/S	Pet Food Institute	Heat treatment	Y	1 million cubic feet	$25,000	$145,000	$142,000	$360,000	10%	$582
31	F/S	Flour Millers' Assn	methyl bromide		1.2 million cubic feet						
31	F/S	Flour Millers' Assn	Heat treatment	Y	1.2 million cubic feet	$45,000	$175,000	$166,000	$342,000	25%	$602

Food Plant/Structural (F/S) Part B															
Sector Summary of Economic Estimates					***MeBr or Alternative Costs***										
CUE # 02-00	**Sector**	**Applicant**	**Alternative**	Revenue per facility ($USD)	Kg ai that would be applied per facility	Units of product applied per facility	Unit	MeBr cost per facility ($USD)	MeBr cost per kgs ($USD)	Application & other costs ($USD)	Annual cost per facility ($USD)	Cost of Goods Sold ($USD)	Net Revenue ($USD)	Loss as a % of Net Revenue	Loss per kilograms of Methyl Bromide ($USD)
23	F/S	Rice Millers' Assn	methyl bromide	$27,300,000	9,320	9,320	kg ai	$27,961.36	$6.60	$347,039	$375,000	$25,304,370	$1,620,630	0%	$0
23	F/S	Rice Millers' Assn	Heat treatment	$27,300,000							$395,000	$25,304,370	$955,630	41%	$71
26	F/S	Kraft Foods	methyl bromide	$120,000,000	2,841	2,841	kg ai	$8,522.73	$6.60	$41,750	$68,000	$115,320,000	$4,612,000	0%	$0
26	F/S	Kraft Foods	Heat treatment	$120,000,000							$136,000	$115,320,000	$3,383,000	27%	$433
27	F/S	Pet Food Institute	methyl bromide	$16,300,000	618	618	kg ai	$1,854.55	$6.60	$18,145	$20,000	$12,714,000	$3,566,000	0%	$0
27	F/S	Pet Food Institute	Heat treatment	$16,300,000							$45,000	$12,714,000	$3,206,000	10%	$582
31	F/S	Flour Millers' Assn	methyl bromide	$48,800,000	568	568	kg ai	$1,704.55	$6.60	$43,295	$45,000	$38,064,000	$10,691,000	0%	$0
31	F/S	Flour Millers' Assn	Heat treatment	$48,800,000							$90,000	$38,064,000	$10,349,000	25%	$602

Appendix C: U.S. Technical and Economic Review Team Members

Christine M. Augustyniak (Technical Team Leader). Christine has been with the U.S. Environmental Protection Agency since 1985. She has held several senior positions, both technical and managerial, including Special Assistant to the Assistant Administrator for Prevention, Pesticides, and Toxic Substances, Chief of the Analytical Support Branch in EPA's office of Environmental Information and Deputy Director for the Environmental Assistance Division in the Office of Pollution Prevention and Toxics. She earned her Ph. D. (Economics) from The University of Michigan (Ann Arbor). Dr. Augustyniak is a 1975 graduate of Harvard University (Cambridge) *cum laude* (Economics). Prior to joining EPA, Dr. Augustyniak was a member of the economics faculty at the College of the Holy Cross (Worcester).

William John Chism (Lead Biologist). Bill has been with the U.S. Environmental Protection Agency since 2000. He evaluates the efficacy of pesticides for weed and insect control. He earned his Ph. D. (Weed Science) from Virginia Polytechnic Institute and State University (Blacksburg), a Master of Science (Plant Physiology) from The University of California (Riverside) and a Master of Science (Agriculture) from California Polytechnic State University (San Luis Obispo). Dr. Chism is a 1978 graduate of The University of California (Davis). For ten years prior to joining the EPA Dr. Chism held research scientist positions at several speciality chemical companies, conducting and evaluating research on pesticides.

Technical Team

Jonathan J. Becker (Biologist) Jonathan has been with the U.S. Environmental Protection Agency since 1997. He has held several technical positions and currently serves as a Senior Scientific Advisor within the Office of Pesticides Programs. In this position he leads the advancement of scientific methods and approaches related to the development of pesticides use information, the assessment of impacts of pesticides regulations, and the evaluation of the benefits from the use of pesticides. He earned his Ph. D. (Zoology) from The University of Florida (Gainesville) and a Masters of Science (Biology/Zoology) from Idaho State University (Pocatello). Dr. Becker is a graduate of Idaho State University. Prior to joining EPA, Dr. Becker worked as a senior environmental scientist with an environmental consulting firm located in Virginia.

Diane Brown-Rytlewski (Biologist) Diane is the Nursery and Landscape IPM Integrator at Michigan State University, a position she has held since 2000. She acts as liaison between industry and the university, facilitating research partnerships and cooperative relationships, developing outreach programs and resource materials to further the adoption of IPM. Ms. Rytlewski holds a Master of Science (Plant Pathology) and a Bachelor of Science (Entomology), both from the University of Wisconsin (Madison). She has over twenty year experience working in the horticulture field, including eight years as supervisor of the IPM program at the Chicago Botanic Garden.

Greg Browne (Biologist). Greg has been with the Agricultural Research Service of the U.S. Department of Agriculture since 1995. Located in the Department of Plant Pathology of the University of California (Davis), Greg does research on soilborne diseases of crop systems that currently use methyl bromide for disease control, with particular emphasis on diseases caused by *Phytophthora* species. He is the author of numerous articles on the use of alternatives to methyl bromide for the control of diseases in fruit and nut crops He earned his Ph. D. (Plant Pathology) from the University of California (Davis) and a Master of Science (Plant Pathology) from the same institution. Dr. Browne is a graduate of The University of California (Davis). Prior to joining USDA was a farm advisor in Kern County.

Nancy Burrelle (Biologist). Nancy Burelle is a Research Ecologist with USDA's Agricultural Research Service, currently working on preplant alternatives to methyl bromide. She earned both her Ph. D. and Master of Science degrees (both in Plant Pathology) from Auburn University (Auburn).

Linda Calvin (Economist). Linda Calvin is an agricultural economist with USDA's Economic Research Service, specializing in research on topics affecting fruit and vegetable markets. She earned her Ph. D. (Agricultural Economics) from The University of California (Berkeley).

Kitty F. Cardwell (Biologist). Kitty has been the National Program Leader in Plant Pathology for the U.S. Department of Agriculture Cooperative State Research, Extension and Education Service since 2001. In this role she administrates all federally funded research and extension related to plant pathology, of the Land Grant Universities throughout the U.S. She earned her Ph.D. (Phytopathology) from Texas A&M University (College Station). Dr. Cardwell is a 1976 graduate of The University of Texas (Austin) *cum laude* (Botany). For twelve years prior to joining USDA Dr. Cardwell managed multinational projects on crop disease mitigation and food safety with the International Institute of Tropical Agriculture in Cotonou, Bénin and Ibadan, Nigeria.

William Allen Carey (Biologist). Bill is a Research Fellow in pest management for southern forest nurseries , supporting the Auburn University Southern Forest Nursery Management Cooperative. He is the author of numerous articles on the use of alternative fumigants to methyl bromide in tree nursery applications. He earned his Ph. D. (Forest Pathology) from Duke University (Durham) and a Master of Science (Plant Pathology) from The University of Florida (Gainesville). Dr. Carey is a nationally recognized expert in the field of nursery pathology.

Margriet F. Caswell (Economist). Margriet has been with the USDA Economic Research Service since 1991. She has held both technical and managerial positions, and is now a Senior Research Economist in the Resource, Technology & Productivity Branch, Resource Economics Division. She earned her Ph.D. (Agricultural Economics) from the University of California (Berkeley). Dr. Caswell also received a Master of Science (Resource Economics) and Bachelor of Science (Natural Resource Management) from the University of Rhode Island (Kingston). Prior to joining USDA, Dr. Caswell was a member of both the Environmental Studies and Economics faculties at the University of California at Santa Barbara.

Tara Chand-Goyal (Biology). Tara has been with the U.S. Environmental Protection Agency since 1997. He serves in the Office of Pesticide Programs as a plant pathologist and specializes in analyzing the efficacy of pesticides with emphasis on risk reduction. He earned his Ph. D. (Mycology and Plant Pathology) from The Queen's University (Belfast) and a Master of Science (Plant Pathology and Mycology) from Punjab University (Ludhiana). Dr. Chand-Goyal is a graduate of Punjab University. Prior to joining EPA Dr. Chand-Goyal was a member of the faculty of The Oregon State University (Corvallis) and of The University of California (Riverside). His areas of research and publication include: the biology of viral, bacterial and fungal diseases of plants; biological control of plant diseases; and, genetic manipulation of microorganisms.

Daniel Chellemi (Biologist). Dan has been a research plant pathologist with the U.S. Department of Agriculture since 1997. His research speciality is the ecology, epidemiology, and management of soilborne plant pathogens. He earned his Ph.D. (Plant Pathology) from The University of California

(Davis) and a Master of Science (Plant Pathology) from The University of Hawaii (Manoa). Dr. Chellemi is a 1982 graduate of the University of Florida (Gainesville) with a degree in Plant Science. He is the author of numerous articles in the field of plant pathology. In 2000 Dr. Chellemi was awarded the ARS "Early Career Research Scientist if the Year". Prior to joining USDA, Dr. Chellemi was a member of the plant pathology department of The University of Florida (Gainesville).

Angel Chiri (Biologist). Angel has been with the U.S. Environmental Protection Agency since 1997. He serves in the Office of Pesticide Programs as an entomologist and specializes in analyzing the efficacy of pesticides with emphasis on benefits of pesticide use. He earned his Ph. D. (Entomology) from The University of California (Riverside) and a Master of Science (Biology/Entomology) from California State University (Long Beach). Dr. Chiri is a graduate of California State University (Los Angeles). Prior to joining EPA Dr. Chiri was a pest and pesticide management advisor for the U.S. Agency for International Development working mostly in Latin America on IPM issues.

Colwell Cook (Biologist). Colwell has been with the U.S. Environmental Protection Agency since 2000. She serves in the Office of Pesticide Programs as an entomologist and specializes in analyzing the efficacy of pesticides with emphasis on benefits of pesticide use. She earned her Ph. D. (Entomology) from Purdue University (West Lafayette) and has a Master of Science (Entomology) from Louisiana State University (Baton Rouge). Dr. Cook is a 1979 graduate of Clemson University. Prior to joining EPA Dr. Cook held several faculty positions at Wabash College (Crawfordsville) and University of Evansville (Evansville).

Julie B. Fairfax (Biologist). Julie has been with the U.S. Environmental Protection Agency since 1989. She currently serves as a senior biologist in the Biological and Economics Analysis Division, and has previously served as a Team Leader in other divisions within the Office of Pesticides Programs. She has held several technical positions specializing in the registration, re-registration, special review and regulation of fungicidal, antimicrobial, and wood preservative pesticides. Ms. Fairfax is a 1989 graduate of James Madison University (Harrisonburg, VA) where she earned her degree in Biology. Prior to joining EPA, Julie worked as a laboratory technician for the Virginia Poultry Industry.

John Faulkner (Economist) John has been with the U. S. Environmental Protection Agency since 1989. He serves in the Office of Pesticide Programs analyzing the costs imposed by the regulation of pesticides. He earned his Ph. D. (Economics) from the University of Colorado (Boulder) and holds a Master's of Business Administration from The University of Michigan (Ann Arbor). Dr. Faulkner is a 1965 graduate of the University of Colorado (Boulder). Prior to joining EPA was a member of the economics faculty of the Rochester Institute of Technology (Rochester), The University of Colorado (Boulder) and of the Colorado Mountain College (Aspen).

Clara Fuentes (Biologist). Clara has been with the U.S. Environmental Protection agency since 1999, working in the Philadelphia, Pennsylvania (Region III) office. She specializes in reviewing human health risk evaluations to pesticides exposures and supporting the state pesticide programs in Region III. She earned her Ph. D. (Entomology) from The University of Maryland (College Park) and a Master of Science (Zoology) from Iowa State University (Ames). Prior to joining EPA, Dr. Fuentes worked as a research assistant at U.S. Department of Agriculture, Agricultural Research Service (ARS) (Beltsville), Maryland, and as a faculty member of the Natural Sciences Department at InterAmerican University of Puerto Rico. Her research interest is in the area of Integrated Pest Management in agriculture.

James Gilreath (Biologist). Jim has been with the University of Florida Gulf Coast Research and Education Center since 1981. In this position his primary responsibilities are to plan, implement and publish the results of investigations in weed science in vegetable and ornamental crops. One main focus of the research is the evaluation and development of weed amangement programs for specific weed pests. He earned his Ph.D. (Horticulture) from The University of Florida (Gainesville) and a Master of Science, also in Horticulture, from Clemson University (Clemson). Dr. Gilreath is a 1974 graduate of Clemson University (Clemson) with a degree in Agronomy and Soils.

Arthur Grube (Economist). Arthur has been with the U.S. Environmental Protection Agency since 1987. He is now a Senior Economist in the Biological and Economics Analysis Division, Office of Pesticide Programs. He earned his Ph.D. (Economics) from North Carolina State University (Raleigh) and a Masters of Arts (Economics) also from North Carolina State University. Dr. Grube is a 1970 graduate of Simon Fraser University (Vancouver) where his Bachelor of Arts degree (Economics) was earned with honors. Prior to joining EPA Dr. Grube conducted work on the costs and benefits of pesticide use at the University of Illinois (Urbana). Dr. Grube has been a co-author of a number of journal articles in various areas of pesticide economics

LeRoy Hansen (Economist). LeRoy Hansen is currently employed as an Agricultural Economist for the USDA Economic Research Service, Resource Economics Division in the Resources and Environmental Policy Branch. He received his Ph.D. in resource economics from Iowa State University (Ames) in 1986. During his 16 years at USDA, Dr. Hansen has published USDA reports, spoken at profession meetings, and appeared in television and radio interviews.

Frank Hernandez (Economist). Frank has been with the U.S. Environmental Protection Agency since 1991. He is a staff economist at the Biological and Economic Analysis Division of the Office of Pesticide Programs. He holds degrees in Economics and Political Science from the City University of New York.

Arnet W. Jones (Biologist). Arnet has been with the U.S. Environmental Protection Agency since 1990. He has had several senior technical and management positions and currently serves as Chief of the Herbicide and Insecticide Branch, Biological and Economic Analysis Division, Office of Pesticide Programs. Prior to joining EPA he was Senior Agronomist at Development Assistance Corporation, a Washington, D.C. firm that specialized in international agricultural development. He holds a Master of Science (Agronomy) from the University of Maryland (College Park).

Hong-Jin Kim (Economist). Jin has been an economist at the National Center for Environmental Economics at the U.S. Environmental Protection Agency (EPA) since 1998. His primary areas of research interest include environmental cost accounting for private industries/ He earned his Ph.D. (Environmental and Resource Economics) from The University of California (Davis) and holds a Master of Science from the same institution. Dr. Kim is a 1987 graduate of Korea University (Seoul) with a Bachelor of Arts (Economics). Prior to joining the U.S. EPA, Dr. Kim was an assistant professor at the University of Alaska (Anchorage) and an economist at the California Energy Commissions. Dr. Kim is the author of numerous articles in the fields of resource and environmental economics.

James Leesch (Biologist). Jim has been a research entomologist with the Agricultural Resarch Service of the U.S. Department of Agriculture since 1971. His main area of interest is post-harvest commodity protection at the San Joaquin Valle. He earned his Ph.D. (Entomology/ Insect Toxicology) from The University of California (Riverside) Dr. Leesch received a B.A. degree in Chemistry from

Occidental College in Los Angeles, CA in 1965. He is currently a Research entomologist for the Agricultural Research Service (USDA) researching Agricultural Sciences Center in Parlier, CA. He joined ARS in June of 1971.

Sean Lennon (Biologist). Sean is a Biologist interning with the Office of Pesticide Programs of the U.S. Environmental Protection Agency. He will receive his M.S. in Plant and Environmental Science in December 2003 from Clemson University (Clemson). Mr. Lennon is a graduate of Georgia College & State University (Milledgeville) where he earned a Bachelor of Science (Biology). Sean is conducting research in Integrated Pest Management of Southeastern Peaches. He has eight years of experience in the commercial peach industry.

Nikhil Mallampalli (Biologist). Nikhil has been with the U.S. Environmental Protection Agency since 2001. He is an entomologist in the Herbicide and Insecticide Branch of the Biological and Economic Analysis Division. His primary duties include the assessment of pesticide efficacy in a variety of crops, and analysis of the impacts of risk mitigation on pest management. Dr. Mallampalli earned his Ph.D. (Entomology) from The University of Maryland (College Park) and holds a Master of Science (Entomology) from the samr institution. Prior to joining the EPA, he worked as a postdoctoral research fellow at Michigan State University (East Lansing) on IPM projects designed to reduce reliance on pesticides in small fruit production.

Tom Melton (Biologist). Tom has been a member of the Plant Pathology faculty at North Carolina State University since 1987. Starting as an assistant professor and extension specialist, Tom has become the Philip Morris Professor at North Carolina State University. His primary responsibilities are to develop and disseminate disease management strategies for tobacco. Dr. Melton earned his Ph.D. (Plant Pathology) from The University of Illinois (Urbana-Champaign) and holds a Master of Science (Pest Management) degree from North Carolina State University (Raleigh). He is a 1978 graduate of Norht Carolina State University (Raleigh) Prior to joining the North Carolina State faculty,. Dr. Melton was a member of the faculty at The University of Illinois (Urbana- Champaign).

Richard Michell (Biologist). Rich has been with the U.S. Environmental Protection Agency since 1972. He is a nematologist/plant pathologist in the Herbicide and Insecticide Branch of the Biological and Economic Analysis Division. His primary duties include the assessment of pesticide efficacy in a variety of crops, with special emphasis on fungicide and nematicide use and the development of risk reduction options for fungicides and nematicides. Dr. Michell earned his Ph.D. (Plant Pathology/Nematology) from The University of Illinois (Urbana-Champaign) and holds a Master of Science degree (Plant Pathology/Nematology) from The University of Georgia (Athens).

Lorraine Mitchell (Economist). Lorraine has been an agricultural economist with the U.S. Department of Agriculture, Economic Research Service since 1998. She works on agricultural trade issues, particularly pertaining to consumer demand in the EU and emerging markets. Dr. Mitchell earned her Ph.D. (Economics) from The University of California (Berkeley). Prior to joining ERS, Dr. Mitchell was a member of the faculty of the School of International Service of The American University (Washington) and a research assistant at the World Bank.

Thuy Nguyen (Chemist). Thuy has been with the U.S. Environmental Protection Agency since 1997, as a chemist in the Office of Pesticides Program. She assesses and characterizes ecological risk of pesticides in the environment as a result of agricultural uses. She earned her degrees of Master of Science (Chemistry) from the University of Delaware and Bachelor of Science (Chemistry and Mathematics) from Mary Washington College (Fredericksburg, VA). Prior to joining the EPA, Ms

Nguyen held a research and development scientist position at Sun Oil company in Marcus Hook, PA, then managed the daily operation of several EPA certified laboratories for the analyses of pesticides and other organic compounds in air, water, and sediments.

Jack Norton(Biologist). Jack has worked for the U.S. Department of Agriculture Interregional research Project #4 (IR-4) as a consultant since 1998. The primary focus of his research is the investigation of potential methyl bromide replacement for registration on minor crops. He is an active member of the USDA/EPA Methyl Bromide Alternatives Working Group. Dr, Norton earned his Ph.D. (Horticulture) from Texas A&M University (College Station) and holds a Master of Science (Horticultural Science) from Oklahoma State University(Stillwater). He is a graduate of Oklahoma State University (Stillwater). Prior to joining the IR-4 program, Dr. Norton worked in the crop protection industry for 27 years where he was responsible for the development and registration of a number of important products.

Olga Odiott (Biologist) Olga has been with the U.S. Environmental Protection Agency since 1989. She has held several technical positions and currently serves as a Senior Biologist within the Office of Science Coordination and Policy. In this position she serves as Designated Federal Official and liaison on behalf of the Office of Pesticide Programs and the FIFRA Scientific Advisory Panel, an independent peer review body that provides advice to the Agency on issues concerning the impact of pesticides on health and the environment. She holds a Masters of Science (Plant Pathology) from the University of Puerto Rico (San Juan). Prior to joining EPA, Ms. Odiott worked for the U.S. Department of Agriculture.

Craig Osteen (Economist). Craig has been with the U.S. Department of Agriculture for over 20 years. He currently is with the Economic Research Service in the Production Management and Technology Branch, Resource Economics Division. He primary areas of interest relate to issues of pest control, including pesticide regulation, integrated pest management, and the methyl bromide phase out. Dr. Osteen earned his Ph.D. (Natural Resource Economics) from Michigan State University (East Lansing).

Elisa Rim (Economist). Elisa is an Agricultural Economist interning with the Office of Pesticide Programs of the U.S. Environmental Protection Agency. She earned her Master of Science (Agricultural Economics) from The Ohio State University (Columbus) and holds a Bachelor of Arts (Political Science) from the same institution. She has conducted research in environmental economics and developed a cost analysis optimization model for stream naturalization projects in northwest Ohio.

Erin Rosskopf (Biologist). Erin received her PhD from the Plant Pathology Department, University of Florida, Gainesville in 1997. She is currently a Research Microbiologist with the USDA, ARS and has served in this position for 5 years.

Carmen L. Sandretto (Agricultural Economist). Carmen has been with the Economic Research Service of the U.S. Department of Agriculture for over 30 years in a variety of assignments at several field locations, and since 1985 in Washington, DC. He has worked on a range of natural resource economics issues and in recent years on soil conservation and management, pesticide use and water quality, and small farm research studies. Mr. Sandretto holds a Master of Arts degree (Economics) from Harvard University (Cambridge) and a Master of Science (Agricultural Economics) from The University of Wisconsin (Madison). Mr Sandretto is a graduate of Michigan State University (East Lansing). Prior to serving in Washington, D.C. he was a member of the economics faculty at Michigan State University and at the University of New Hampshire (Durham).

Judith St. John (Biologist). Judy has been with the USDA's Agricultural Research Service since 1967. She currently serves as Associate Deputy Administrator and as such she is responsible for the Department's intramural research programs in the plant sciences, including those dealing with pre- and post-harvest alternatives to methyl bromide. Dr. St. John earned her Ph.D. (Plant Physiology) from The University of Florida (Gainesville).

James Throne (Biologist). Jim is a Research Entomologist with the U.S. Department of Agriculture's gricultural Research Service and Research Leader of the Biological Research Unit at the Grain Marketing and Production Research Center in Manhattan, Kansas. He conducts research in insect ecology and development of simulation models for improving integrated pest management systems for stored grain and processed cereal products. Other current areas of research include investigating seed resistance to stored-grain insect pests and use of near-infrared spectroscopy for detection of insect-infested grain. Jim has been with ARS since 1985. Dr. Throne earned his Ph.D. (Entomology) in 1983 from Cornell University (Ithaca) and earned a Master of Science Degree (Entomology) in 1978 from Washington State University (Pullman). Dr. throne is a 1976 graduate (Biology) of Southeastern Massachusetts University (N. Dartmouth).

Thomas J. Trout (Agricultural Engineer). Tom has been with the U.S. Department of Agriculture, Agricultural Research Service since 1982. He currently serves as research leader in the Water Management Research Laboratory in Fresno, CA. His present work includes studying factors that affect infiltration rates and water distribution uniformity under irrigation, determining crop water requirements, and developing alternatives to methyl bromide fumigation. Dr. Trout earned his Ph.D. (Agricultural Engineering) from Colorado State University (Fort Collins) and holds a Master of Science degree from the same institution, also in agricultural engineering. Dr. Trout is a 1972 graduate of Case Western Reserve University (Cleveland) with a degree in mechanical engineering. Prior to joining the ARS, Dr. trout was a member of the engineering faculty of Colorado State University (Fort Collins). He is the author of numerous publications on the subject of methyl bromide alternatives.

J. Bryan Unruh (Biologist). Bryan is Associate Professor of Environmental Horticulture at The University of Florida (Milton) and an extension specialist in turfgrass. He leads the statewide turfgrass extension design team. Dr. Unruh earned his Ph.D. (Horticulture) from Iowa State University (Ames) and holds a Master of Science degree (Horticulture) from Kansas State University (Manhattan). He is a 1989 graduate of Kansas State University.

David Widawsky (Chief, Economic Analysis Branch). David has been with the U.S. Environmental Protection Agency since 1998. He has also served as an economist and a team leader. As branch chief, David is responsible for directing a staff of economists to conduct economic analyses in support of pesticide regulatory decisions. He earned his Ph.D. (Development and Applied Economics) from Stanford University (Palo Alto), and a Master of Science (Agricultural Economics) from Colorado State University (Fort Collins). Dr. Widawsky is a 1987 graduate (Plant and Soil Biology, Agricultural Economics) of the University of California (Berkeley). Prior to joining EPA, Dr. Widawsky conducted research on the economics of integrated pest management in Asian rice production, while serving as an agricultural economist at the International Rice Research Institute (IRRI) in the Philippines.

TJ Wyatt (Economist). TJ has been with the U. S. Environmental Protection Agency since 2001. He serves in the Office of Pesticide Programs analyzing the costs and benefits of pesticide regulation. His other main area of research is farmer decision-making, especially pertaining to issues of soil fertility and soil conservation and of pesticide choice. Dr. Wyatt earned his Ph.D. (Agricultural Economics) from The University of California (Davis). Dr. Wyatt holds a Master of Science (International Agricultural Development) from the same institution. He is a 1985 graduate of The University of Wyoming (Laramie). Prior to joining the EPA, he worked at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and was based at the Sahelian Center in Niamey, Niger.

Leonard Yourman (Biologist). Leonard is a plant pathologist with the Biological and Economic Analysis Division of the U. S. Environmental Protection Agency. He currently conducts assessments of pesticide use as they relate to crop diseases. He earned his Ph. D. (Plant Pathology) from Clemson University (Clemson) and holds a Master of Science (Horticulture/ Plant Breeding) from Texas A&M University (College Station). Dr. Yourman is a graduate (English Literature) of The George Washington University (Washington, DC). . Prior to joining EPA, he conducted research on biological control of invasive plants with USDA at the Foreign Disease Weed Science Research Unit (Ft. Detrick, MD). He has also conducted research on biological control of post harvest diseases of apples and pears at the USDA Appalachian Fruit Research Station (Kearneysville, WV). Research at Clemson University concerned the molecular characterization of fungicide resistance in populations of the fungal plant pathogen *Botrytis cinerea.*

Istanbul Yusuf (Economist). Istanbul has been with the U. S. Environmental Protection Agency since 1998. She serves in the Office of Pesticide Programs analyzing the costs imposed by the regulation of pesticides. She earned her Masters degree in Economics from American University (Washington). Ms Yusuf is a 1987 graduate of Westfield State College (Westfield) with a Bachelor of Arts in Business Administration. Prior to joining EPA Istanbul worked for an International Trading Company in McLean, Virginia.

Appendix D: CHARTS

Charts 1 and 2 attached as separate electronic file.