METHYL BROMIDE CRITICAL USE RENOMINATION FOR PREPLANT SOIL USE (OPEN FIELD OR PROTECTED ENVIRONMENT)

Executive Summary

The Orchard Replant sector comprises stone fruit, almond, and walnut orchards, and grape vineyards grown throughout California. Growers of these crops face a common threat—nematodes and a poorly understood disease complex called orchard replant "problem", or "disorder". The problem can be of varying severity depending on orchard location, crop, soil texture, soil moisture, or other factors. Orchards with replant problem have several visible effects, the first and most apparent is poor tree growth during the early years of establishment (rejection component) and in some cases a slow and detrimental decline in root health and plant growth caused primarily by pathogenic nematodes and fungi, which can lead to premature tree death. Interactions with environmental factors and damage by other pests (e.g., insects, nutrient deficiency or wind blow-down) are less well documented, but anything that limits early root growth can predispose the trees to greater damage from subsequent agents.

The U.S. Nomination for orchard replant is for a portion of the sites where alternatives are not suitable, either because of legal restrictions or physical features, such as unacceptable soil type or moisture. Methyl bromide continues to be a critical tool for some sites that are not amenable to other treatments. Orchard replant "problem" or "disorder" presents a challenge to growers when replanting orchards and vineyards, considering the long-term investment (typically fruit orchards and vineyards can produce for 20-25 years, walnut orchards can produce for 40 years, and almond orchards produce on average 25-30 years) that is necessary for fruit and nut orchard production. Many aspects of the etiology of this disease complex are currently unknown. Because of the perennial nature of orchards, fumigation of orchards occurs only once during the bearing life of the trees, and so the most efficient system to produce the healthiest trees is necessary to avoid early tree removal, added costs, and lost revenue due to necessity of planting and then replanting orchards if replant disorder is not initially addressed.

The nomination for methyl bromide for orchard replant, for use in 2010, has been reduced from previous years. Rate reductions were advised due to implementation of other measures, such as the use of herbicides, to replace some need for high rates of methyl bromide. In addition, a transition to alternatives has allowed an additional reduction in hectares requiring methyl bromide. USG has also adjusted the use rates to reflect the treated area use rates as opposed to whole field use rates. Research studies in California are examining methods to optimize fumigation for orchard replant to improve tree survival and orchard health. Research studies continue to explain the causes for replant disorder of these various orchard crops. Objectives of new research being conducted for this sector were outlined in reports to the 2007 Annual International Research Conference on Methyl Bromide Alternatives and Emissions Reductions (Browne et al., 2007; Kluepfel and Beede, 2007; McKenry et al., 2007; Coates et al., 2007; Wang et al., 2007).

NOMINATING PARTY:
The United States of America

NAME:
USA CUN09 SOIL ORCHARD REPLANT Open Field

BRIEF DESCRIPTIVE TITLE OF NOMINATION:
Methyl Bromide Critical Use Nomination for Preplant Soil Use for Orchard Replant in Open Fields (Submitted in 2008 for 2010 Use Season)

CROP NAME (OPEN FIELD OR PROTECTED):
Orchard Replant in Open Fields

QUANTITY OF METHYL BROMIDE REQUESTED IN EACH YEAR OF NOMINATION:

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

YEAR	NOMINATION AMOUNT (KILOGRAMS)
2010	**226,021**

SUMMARY OF ANY SIGNIFICANT CHANGES SINCE SUBMISSION OF PREVIOUS NOMINATIONS

The nomination for methyl bromide for orchard replant, for use in 2010, has been reduced from previous years. Rate reductions were advised due to implementation of other measures, such as the use of herbicides, to replace some need for high rates of methyl bromide. In addition, a transition to alternatives has allowed an additional reduction in hectares requiring methyl bromide. USG has also adjusted the use rates to reflect the treated area use rates as opposed to whole field use rates. Research studies in California have been examining methods to optimize fumigation for orchard replant to improve tree survival and orchard health. Research studies continue to attempt to explain the causes of replant disorder of these various orchard crops and define the best approach to managing key pest problems. Objectives of new research being conducted for this sector were outlined in reports to the 2007 Annual International Research Conference on Methyl Bromide Alternatives and Emissions Reductions (Browne et al., 2007; Kluepfel and Beede, 2007; McKenry et al., 2007; Coates et al., 2007; Wang et al., 2007).

Recent investigations with almond replant have identified a potential means of significantly reducing fumigant applications for replant by treating individual tree-planting holes or reduced strip area rather than broadcast or standard strip treatments (Browne et al., 2007; Browne et al., 2006; Coates et al., 2007). Currently, some individual holes are treated but on a smaller scale in orchards where trees that fail to survive or thrive the first year or so are replaced. Replanting an entire orchard with this method will involve some transitional time as scale-up techniques are developed. In experiments with chloropicrin, efficacy was equal or greater than with methyl bromide and efficacy with the use of 0.2 to 0.5 kg chloropicrin per hole (equal to 40 to 70 kg/ha) was at least equal to broadcast of 336 kg/ha. This is significant in particular since such high rates of broadcast chloropicrin are not allowed in California commercially. If efficacy can be attained with much reduced rates, a significant alternative to methyl bromide may be achieved. Browne et al. (2006) also found that the efficacy of 1,3-D for managing replant disorder to be at least equal to methyl bromide. These results are not ready for commercialization currently, as other crops must be tested and certain worker and technical issues must be resolved, but these are hopeful signs for the future.

Previous experience indicated that herbicides were not effective in killing remnant grape roots of old vineyards (McKenry, 1999). Newer work by McKenry et al. (2007) appears to have identified an effective application of an herbicide. McKenry et al. (2007) described a method of using a specific time of application of an herbicide, such as glyphosate, to kill roots of old vines before replanting with rootstocks of a different parentage. This system may help to reduce the "rejection component" of replant disorder and reduce the reliance on methyl bromide in some replant sites since a major reason for fumigation is to eliminate the nutrient source for pests from remnant roots of previous plantings. Grape roots in particular are difficult to kill when preparing for new plantings (McKenry et al., 2007; McKenry et al., 2006) and have resulted in higher rates for grape replant than other replant crops. Where nematodes are key pests, this method requires an additional application of a nematicide. Where 1,3-D is restricted, methyl bromide may be an important component.

Most new orchards and vineyards in California are planted on land previously planted to fruit trees, nut trees, or grapes. Results of a recent study of stone fruit orchard replant (McKenry et al., 2006) suggest that one full year of land fallow provided improvement in Nemaguard rootstock tree stands compared to orchards replanted with Nemaguard rootstock without fallow. However, new rootstocks are being sought to solve some ongoing problems of tree rejection associated with Nemaguard. Research in this sector is by slow nature, considering the perennial crops of interest. Nevertheless, the U.S. nomination reflects the reduction in methyl bromide use by this sector, which comprises a small portion of the fumigant requirements for orchard replant (see Table A.3).

REASONS WHY ALTERNATIVES TO METHYL BROMIDE ARE NOT TECHNICALLY AND ECONOMICALLY FEASIBLE

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

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

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

Research continues to identify the most effective alternatives for orchard replant (e.g., Browne et al., 2006; Coates et al., 2007; Caprile and McKenry, 2006; McKenry et al., 2007; McKenry et al., 2006). Only a small portion of orchard replant sites are being nominated for critical use of methyl bromide (see Table A.3). The best alternatives for orchard replant that have been identified are 1,3-D or 1,3-D with chloropicrin, and/or metam-sodium, especially in coarse-textured soils. Under some soil and moisture conditions (less than 12% to 1.5 meters) 1,3-D can be an effective management tool for replant problems. There is a critical need for methyl bromide in some orchards in California, either because of legally mandated township caps for 1,3-D, or because surface moisture requirements cannot be met (e.g., soils can not be adequately dried prior to use of 1,3-D).

NOMINATING PARTY CONTACT DETAILS:

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Following the requirements of Decision IX/6 paragraph (a)(1) The United States of America has determined that the specific use detailed in this Critical Use Nomination is critical because the lack of availability of methyl bromide for this use would result in a significant market disruption. ☐ Yes ☐ No

______________________ ______________________ __________

Signature Name Date

Title: ______________________________________

CONTACT OR EXPERT(S) FOR FURTHER TECHNICAL DETAILS:

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

1. PAPER DOCUMENTS: **Title of paper documents and appendices**	**No. of pages**	**Date sent to Ozone Secretariat**
USA CUN10 SOIL ORCHARD REPLANT Open Field		
2. ELECTRONIC COPIES OF ALL PAPER DOCUMENTS: ***Title of each electronic file (for naming convention see notes above)**	**No. of kilobytes**	**Date sent to Ozone Secretariat**
USA CUN10 SOIL ORCHARD REPLANT Open Field		

* Identical to paper documents

TABLE OF CONTENTS

TABLE OF TABLES

Part A: INTRODUCTION
Renomination Part A: SUMMARY INFORMATION

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

The United States of America (U.S.)
USA CUN10 SOIL Orchard Replant In Open Fields

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

Methyl Bromide Critical Use Nomination for Preplant Soil Use for Orchard Replant in Open Fields (Submitted in 2008 for 2010 Use Season)

3. CROP AND SUMMARY OF CROP SYSTEM (*e.g. open field (including tunnels added after treatment), permanent glasshouses (enclosed), open ended polyhouses, others (describe)***):**

The Orchard Replant sector comprises stone fruit, almond, and walnut orchards, and grape vineyards grown throughout California. Growers of these crops face a common threat—nematodes and a poorly understood disease complex called orchard replant “problem”, or “disorder”. The problem can be of varying severity depending on orchard location, crop, soil texture, soil moisture, or other factors. Orchards with replant problem have several visible effects, the first and most apparent is poor tree growth during the early years of establishment (rejection component) and in some cases a slow and detrimental decline in root health and plant growth caused primarily by pathogenic nematodes and fungi, which can lead to premature tree death. Interactions with environmental factors and damage by other pests (e.g., insects, nutrient deficiency or wind blow-down) are less well documented, but anything that limits early root growth can predispose the trees to greater damage from subsequent agents. Recent research (Browne et al., 2006) suggests that some replant problems may not be primarily a result of high nematode populations, but rather due to abiotic and biotic factors other than nematodes.

Typically, the first steps in the re-establishment of an orchard are the removal of old trees and “ripping” or deep tillage of the soil, followed by a fallow period or cover crop. The length of the fallow depends on soils, climate, and past pest problems, but is typically one to two years. Some replant has been done without a fallow, but McKenry (1999) found that at least a six month fallow was highly beneficial for long-term replant pest management. Fallow reduces “orchard rejection”, a component of the orchard replant problem when trees fail to survive due to an unknown cause (Caprile and McKenry, 2006; McKenry, 1999). Fallow may not be sufficient to reduce nematode infestation, but it generally improves tree growth. Fumigation should kill or reduce pests and remnant roots of previous plantings, especially for deep-rooted trees, that harbor pests.

Pre-plant fumigation occurs once in the life of the orchard. In the past both methyl bromide and 1,3-dichloropropene (1,3-D) have been the standards for orchard replant. For situations where moisture is greater than 12% at depths to 1.5 meters, 1,3-D is not regarded as effective. In these situations, methyl bromide is considered a critical tool to the long-term productivity of an orchard. Currently, research is identifying non-fumigation methods to kill remnant roots of outgoing orchard trees, which provide nutrients for soil-borne pests that may infest new tree plantings (e.g., McKenry et al., 2007; McKenry et al., 2006; Browne et al., 2006; Caprile and McKenry, 2006). Even difficult to kill grapevine roots were effectively treated with a specifically timed application of glyphosate (McKenry et al., 2007). This type of research, when tested on commercial orchards, may lead to a reduction in the use of fumigation for some replant sites.

4. AMOUNT OF METHYL BROMIDE NOMINATED (*give quantity requested (metric tonnes) and years of nomination*):

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

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

YEAR	NOMINATION AMOUNT (KILOGRAMS)
2010	**226,021**

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

The nomination for methyl bromide for orchard replant, for use in 2010, has been reduced from previous years. Rate reductions were advised due to implementation of other measures, such as the use of herbicides, to replace some need for high rates of methyl bromide. In addition, a transition to alternatives has allowed an additional reduction in hectares requiring methyl bromide. USG has also adjusted the use rates to reflect the treated area use rates as opposed to whole field use rates. Research studies in California are examining methods to optimize fumigation for orchard replant to improve tree survival and orchard health. Research studies continue to explain the causes for replant disorder of these various orchard crops. Objectives of new research being conducted for this sector were outlined in reports to the 2007 Annual International Research Conference on Methyl Bromide Alternatives and Emissions Reductions (Browne et al., 2007; Kluepfel and Beede, 2007; McKenry et al., 2007; Coates et al., 2007; Wang et al., 2007).

Recent investigations with almond replant have identified a potential means of significantly reducing fumigant applications for replant by treating individual tree-planting holes rather than broadcast or strip treat the entire orchard sites (Browne et al., 2006; Coates et al., 2007). Currently, some individual holes are treated but on a smaller scale in orchards where trees that fail to survive or thrive the first year or so are replaced. Replanting an entire orchard with this method will involve some transitional time as scale-up techniques are developed. In experiments with chloropicrin, efficacy was equal or greater than with methyl bromide and efficacy with the use of 0.2 to 0.5 kg chloropicrin per hole (equal to 40 to 70 kg/ha) was at least equal to broadcast of 336 kg/ha. This is significant in particular since such high rates of broadcast chloropicrin are not allowed in California commercially. If efficacy can be attained with much reduced rates, a significant alternative to methyl bromide may be achieved. Browne et al. (2006) also found that the efficacy of 1,3-D for managing replant disorder to be at least equal to methyl bromide. These results are not ready for commercialization currently, as other crops must be tested and certain worker and technical issues must be resolved, but these are hopeful signs for the future.

McKenry et al. (2007) described a method of using a specific time of application of an herbicide, such as glyphosate, to kill roots of old vines before replanting with rootstocks of a different parentage. This system may help to reduce the "rejection component" of replant disorder where it is present and reduce the reliance on methyl bromide in some replant sites since a major reason for fumigation is to eliminate the nutrient source for pests from remnant roots of previous plantings. Grape roots in particular are difficult to kill when preparing for new plantings (McKenry et al., 2007; McKenry et al., 2006).

Most new orchards and vineyards in California are planted on land previously planted to fruit trees, nut trees, or grapes. Results of a recent study of stone fruit orchard replant (McKenry et al., 2006) suggest that one full year of land fallow provided improvement in Nemaguard rootstock tree stands compared to orchards replanted with Nemaguard rootstock without fallow. However, new rootstocks are being sought to solve some ongoing problems of tree rejection associated with Nemaguard. The U.S. nomination reflects the reduction in methyl bromide use by this sector, which comprises a small portion of the fumigant requirements for orchard replant (see Table A.3).

5. (i) BRIEF SUMMARY OF THE NEED FOR METHYL BROMIDE AS A CRITICAL USE (e.g. no registered pesticides or alternative processes for the particular circumstance, plantback period too long, lack of accessibility to glasshouse, unusual pests)**:**

The U.S. Nomination for orchard replant is for a portion of the sites where alternatives are not suitable, either because of legal restrictions or physical features, such as unacceptable soil type or moisture. McKenry et al. (2007, 2006) and Caprile and McKenry (2006) have reported on methods that can help to replant many orchard sites without methyl bromide. However, methyl bromide continues to be a critical tool for some sites that are not amenable to other treatments (see Table A.3, below). For most sites, growers currently use alternative measures to manage orchard replant disorder (Browne et al., 2002; Caprile and McKenry, 2006; McKenry, 1999).

Orchard replant "problem" or "disorder" presents a challenge to growers when replanting orchards and vineyards, considering the long-term investment (typically fruit orchards and vineyards can produce for 20-25 years, walnut orchards can produce for 40 years, and almond orchards produce on average 25-30 years) that is necessary for fruit and nut orchard production. Many aspects of the etiology of this disease complex are currently unknown. Because of the perennial nature of orchards, fumigation of orchards occurs only once during the bearing life of the trees, and so the most efficient system to produce the healthiest trees is necessary to avoid early tree removal, added costs, and lost revenue due to necessity of planting and then replanting orchards if replant disorder is not initially addressed.

Replant disorder is complicated by environmental conditions or stress, such that management can be effective in some areas, but not in others. Effective fumigation prior to replanting orchards can reduce pest populations by 99.9% in the top 1.5 meters, by effectively killing remnant roots from previous orchard trees. A developing method being studied (e.g., Browne et al., 2007) to replant entire orchards by treating individual holes, rather than broadcast or strip, should significantly reduce fumigant use. This method may require a period of transition as worker and technical issues are resolved.

Prior to 1990, 1,3-D was considered at least as effective as, and more economical than, methyl bromide for treatment of replant problem (McKenry, 1999). However, due to environmental and health concerns, 1,3-D was banned, and methyl bromide became the predominant treatment for orchard replant. With the re-labeling of 1,3-D in the mid-1990s there were new restrictions on its use and application, including township caps and rate reductions in California. Each township is allowed a maximum of approximately 41,000 kg per year, in a township of approximately 9300 ha; at 225 kg/ha, 180 ha can be treated with 1,3-D per township. The reduced rates were considered ineffective for some severe replant situations (reduced to 325 kg/ha from 427 kg/ha).

TABLE A 2: EXECUTIVE SUMMARY*

Region		CA G&TFL - Stone Fruit	CA G&TFL - Raisin Grape	CA Walnut Commission	Almond Hullers & Processors	CA Wine Grapes Replant	Sector Total or Average
EPA Preliminary Value	kgs	667,926	165,561	113,398	45,359	91,988	1,084,233
EPA Amount of All Adjustments	kgs	(514,593)	(156,306)	(91,143)	(26,472)	(69,698)	(858,212)
Most Likely Impact Value for Treated Area	kgs	153,333	9,255	22,255	18,887	22,290	226,021
	ha	752	37	109	93	88	1,078
	Rate	204	252	204	204	252	210
2010 Total US Sector Nomination							226,021

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

(ii) STATE WHETHER THE USE COVERED BY A CERTIFICATION STANDARD.

(*Please provide a copy of the certification standard and give basis of standard (e.g. industry standard, federal legislation etc.). Is methyl bromide-based treatment required exclusively to meet the standard or are alternative treatments permitted? Is there a minimum use rate for methyl bromide? Provide data which shows that alternatives can or cannot achieve disease tolerances or other measures that form the basis of the certification standard).*

Use of methyl bromide for orchard replant is not covered by a certification standard.

6. SUMMARISE WHY KEY ALTERNATIVES ARE NOT FEASIBLE *(Summary should address why the two to three best identified alternatives are not suitable, < 200 words)*:

Only a small portion of orchard replant sites are being nominated for critical use of methyl bromide (see Table A.3). The best alternatives for orchard replant that have been identified are 1,3-D or 1,3-D with chloropicrin, and/or metam-sodium, especially in light soils (e.g., Caprile and McKenry, 2006). Under some soil and moisture conditions (high moisture at surface and less than 12% at depths to 1.5 meters) 1,3-D can be an effective management tool for replant problems. However, for 2010, there is a critical need for methyl bromide in some orchards in California where alternatives cannot be used, either because of legally mandated township caps for 1,3-D, local permit requirements for chloropicrin, buffer zone limitations, or surface moisture requirements cannot be met. Soils must have surface application of water for 1,3-D application, but soils up to 1.5 m may not have greater than 12% moisture. If rain is absent, growers without sprinklers have difficulty applying water for 1,3-D application.

The recent Federal registration of Iodomethane has not been used to adjust the amount of methyl bromide requested in this CUE. Although iodomethane has been registered at the federal level for the period of October 1, 2007 to October 1, 2008 only certain crops are included in this registration, specifically: Strawberry, Pepper, Tomato, Ornamentals, Nurseries, Trees and Vines.

At present state registrations are in place for 18 states, many of which do not request methyl bromide under the CUE process. These states are: Delaware, Georgia, Kentucky, Louisiana, Maine, Michigan, Mississippi, Missouri, New Mexico, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, Tennessee, Texas, Utah, and Virginia. Neither Florida not California, the two states that are the major users of methyl bromide have registered iodomethane.

Given the limited crops, the time-limited Federal registration (it is valid for one year only, October 2007 to October 2008), and the lack of State registrations in the major methyl bromide-using States, EPA feels that it is appropriate not to include iodomethane as a methyl bromide substitute at this time.

In addition, several other factors work to limit the adoption of iodomethane as a replacement for methyl bromide in the short run. These range from more extensive regulatory constraints vis a vis methyl bromide to the normal process of technology adoption which is not instantaneous.

Like methyl bromide, iodomethane is a restricted use pesticide. In addition to pesticide applicator training, however, a license to apply iodomethane also requires company-provided training. Once training has been provided, iodomethane application must be under the direct (observed) supervision of these trained personnel. We do not believe that classes can be organized and a sufficient number of individuals trained across registered uses so that large-scale adoption of iodomethane can occur in the short-run.

Iodomethane has other restrictions as well. Unlike the case with methyl bromide, the application area must be surrounded by a scalable buffer that increases in size as the field size and or the application rate increases. The buffer can be as much as 490 feet (150 meters) for a 40 acre (16 hectare) field. There are other restrictions as well. For example iodomethane cannot be used within 0.25 miles (over 400 meters) from a ‘sensitive’ occupied site such as a school or nursing home.

Furthermore, very few growers have experience using iodomethane. They will not have had experience selecting a dose and determining which cultural practices are necessary to obtain the best results for the iodomethane application. This will cause them to be reluctant to subject a significant portion of their crop to the experiment of iodomethane.

Although the company producing iodomethane does market other chemicals, it is the understanding of the USG that the company plans to develop a new distribution network. This network is not yet established and is yet another reason why growers may be reluctant to experiment with iodomethane in 2008.

Taking all of these factors into account, along with the limited time horizon of the registration, EPA believes that the appropriate method for addressing the registration of iodomethane is to reduce that amount of iodomethane allocated in the case that the registration is renewed and to adjust the reductions as other States register this compound.

This is the procedure followed for the 2008 allocation year.

(i) PROPORTION OF CROP GROWN USING METHYL BROMIDE *(provide local data as well as national figures. Crop should be defined carefully so that it refers specifically to that which uses or used methyl bromide. For instance processing tomato crops should be distinguished from round tomatoes destined for the fresh market)***:**

TABLE A.3. PROPORTION OF CROPS GROWN USING METHYL BROMIDE

REGION WHERE METHYL BROMIDE USE IS REQUESTED	AVERAGE TOTAL REPLANT AREA IN 2001 AND 2002 (HA) [AREA OF MEBR USE/TOTAL AREA REPLANTED PER YEAR]	PROPORTION OF TOTAL REPLANT AREA TREATED WITH METHYL BROMIDE PER 2001/2002 YEAR (%)
STONE FRUIT	5,587 (2005 est.) (93,117 ha total x 6%)	20% (1,116/5,587)
RAISIN & TABLE GRAPES	4,219 (2005 est.) (14,065 ha total x 3%)	2% (82/4,219)
WINE GRAPES	4,676 (2005 est.) (total 66,802 ha total x 7% replanted)	9% (421/4,676) (based on 2005 request—reported CDPR data may not be accurate)
WALNUTS	1851 (83,806 ha total bearing) (810 ha requested) 75% of replant may be strip treated—50% of this use methyl bromide; 12.5% of replant use no fumigation	37%
ALMONDS	6,119 (202,429 ha total x 3%) replanted)	4% (266/6,119) (65% may be strip treated)
NATIONAL TOTAL:	**Not available**	**Not available**

(ii) IF PART OF THE CROP AREA IS TREATED WITH METHYL BROMIDE, INDICATE THE REASON WHY METHYL BROMIDE IS NOT USED IN THE OTHER AREA, AND IDENTIFY WHAT ALTERNATIVE STRATEGIES ARE USED TO CONTROL THE TARGET PATHOGENS AND WEEDS WITHOUT METHYL BROMIDE THERE.

See Question 6.

(iii) WOULD IT BE FEASIBLE TO EXPAND THE USE OF THESE METHODS TO COVER AT LEAST PART OF THE CROP THAT HAS REQUESTED USE OF METHYL BROMIDE? WHAT CHANGES WOULD BE NECESSARY TO ENABLE THIS?

When protocols have been tested in commercial orchards confirming research results of effective alternatives in situations where currently only methyl bromide is effective. For example, Browne et al. (2006) have been testing a method of applying fumigants on a per hole basis rather than strip or broadcast applied. Results of these tests show that fumigant use could be significantly reduced if the methods can be "scaled-up" for commercial use. Studies to reduce or eliminate methyl bromide are ongoing throughout the industry (e.g., Browne et al., 2006; McKenry et al., 2007; McKenry et al., 2006; Caprile and McKenry, 2006; Coates et al., 2007).

7. AMOUNT OF METHYL BROMIDE REQUESTED FOR CRITICAL USE (*Duplicate table if a number of different methyl bromide formulations are being requested and/or the request is for more than one specified region*):

TABLE A.4. AMOUNT OF METHYL BROMIDE REQUESTED FOR CRITICAL USE

REGION	Stone Fruit	Raisin & Table Grapes	Wine Grapes	Walnuts	Almonds
YEAR OF EXEMPTION REQUEST	**2010**	**2010**	**2010**	**2010**	**2010**
QUANTITY OF METHYL BROMIDE NOMINATED (METRIC TONNES)	See Appendix A				
TOTAL CROP AREA TO BE TREATED WITH THE METHYL BROMIDE OR METHYL BROMIDE/PIC FORMULATION (HA) (NOTE: IGNORE REDUCTIONS FOR STRIP TREATMENT)	See Appendix A				
METHYL BROMIDE USE: **BROADACRE OR STRIP/BED** TREATMENT[a]?	Many orchards treated by strip fumigation	Strip or broadcast fumigation	Usually strip fumigation	Many orchards treated by strip fumigation—75% of replant may be strip fumigated	Many orchards treated by strip fumigation
PROPORTION OF BROADACRE AREA WHICH IS TREATED IN STRIPS; E.G. 0.54, 0.67	65% of area is treated	65% of area is treated	65% of area is treated	65% of area is treated	65% of area is treated
FORMULATION (RATIO OF METHYL BROMIDE/PIC MIXTURE) TO BE USED FOR CALCULATION OF THE CUE E.G. 98:2, 50:50	67:33	67:33	67:33	67:33	67:33
APPLICATION RATE* (KG/HA) FOR THE FORMULATION	See Appendix A				
DOSAGE RATE* **(G/M^2)** (I.E. ACTUAL RATE OF FORMULATION APPLIED TO THE AREA TREATED WITH METHYL BROMIDE/PIC ONLY)	See Appendix A				

[a] Various methods are used depending on the particular location, fumigation can be flat fumigation, strip, or even "by the hole" (for individual tree replacement; methyl bromide is the only product that has acceptable technology for hole application—approximately 0.5 kg/tree). Strip fumigation would comprise approximately 65% of the total area that is actually fumigated.

8. SUMMARISE ASSUMPTIONS USED TO CALCULATE METHYL BROMIDE QUANTITY NOMINATED FOR EACH REGION *(include any available data on historical levels of use):*

The amount of methyl bromide nominated by the U.S. was calculated as follows:

- The percent of regional hectares in the applicant's request was divided by the total area planted in that crop in the region covered by the request. Values greater than 100 percent are due to the inclusion of additional varieties in the applicant's request that were not included in the USDA National Agricultural Statistics Service surveys of the crop.
- Hectares counted in more than one application or rotated within one year of an application to a crop that also uses methyl bromide were subtracted. There was no double counting in this sector.
- Growth or increasing production (the amount of area requested by the applicant that is greater than that historically treated) was subtracted. The applicant that included growth in their request had the growth amount removed.
- Quarantine and pre-shipment (QPS) hectares is the area in the applicant's request subject to QPS treatments. Not applicable in this sector.
- Only the hectares affected by one or more of the following impacts were included in the nominated amount: moderate to heavy key pest pressure, regulatory impacts, buffer zones, unsuitable terrain, and cold soil temperatures.

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

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

(Renomination Form 16.) CHANGES IN USAGE REQUIREMENTS

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

The nomination for methyl bromide for orchard replant, for use in 2010, has been reduced from previous years. Rate reductions were advised due to implementation of other measures, such as the use of herbicides, to replace some need for high rates of methyl bromide. USG has also adjusted the use rates to reflect the treated area use rates as opposed to whole field use rates. For details on these changes in usage requirements, please see Appendix A.

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

QUANTITY REQUESTED FOR PREVIOUS NOMINATION YEAR:	**314,007 kg**
QUANTITY APPROVED BY PARTIES FOR PREVIOUS NOMINATION YEAR:	**292,756 kg**
QUANTITY REQUIRED FOR YEAR TO WHICH THIS REAPPLICATION REFERS:	**226,021 kg**

Part B: CROP CHARACTERISTICS AND METHYL BROMIDE USE

9. KEY DISEASES AND WEEDS FOR WHICH METHYL BROMIDE IS REQUESTED AND SPECIFIC REASON FOR THIS REQUEST IN EACH REGION (*List only those target weeds and pests for which methyl bromide is the only feasible alternative and for which CUE is being requested*):

TABLE B 1. KEY DISEASES AND WEEDS AND REASON FOR METHYL BROMIDE REQUEST

REGION WHERE METHYL BROMIDE USE IS REQUESTED	KEY DISEASE(S) AND WEED(S) TO SPECIES AND, IF KNOWN, TO LEVEL OF RACE	SPECIFIC REASONS WHY METHYL BROMIDE NEEDED
STONE FRUIT	Interactions between pests and environmental factors. **Nematodes (Primary pests):** *Meloidogyne* (root knot); *Mesocriconema* (ring); *Xiphinema* (dagger); *Pratylenchus* (root lesion); and *Tylenchulus* (citrus) **Pathogens:** *Armellaria*, *Phytophthora*, and various fungi, depending on orchard location and conditions that are thought to contribute to orchard replant disorder. **Insect:** *Pollyphylla decemlineata* (Tenlined June beetle)	Methyl bromide is considered critical for approximately 20% of replant needs (Table A.3). For the best alternative, 1,3-D, soils must have surface application of water for 1,3-D application, but soils up to 1.5 m may not have greater than 12% moisture. If rain is absent, growers without sprinklers have difficulty applying pre-treatment of water for 1,3-D application (methyl bromide does not have a water pre-treatment requirement). For situations where moisture is greater than 12% at depths to 1.5 meters, 1,3-D is not regarded as effective at available rates. In these situations, methyl bromide is considered a critical tool to the long-term productivity of an orchard. In addition, township caps for 1,3-D, permit restrictions for chloropicrin, and buffer zones all restrict the transition or effectiveness of alternatives. Economic costs of long-term fallow in some locations increases the demand for chemical fumigation. Where there are restrictions of alternatives, methyl bromide is considered critical.
RAISIN & TABLE GRAPES	Interactions between various pathogens and environmental factors. **Nematodes (Primary pests and virus vectors):** *Meloidogyne* (root knot); *Mesocriconema* (ring); *Xiphinema* (dagger); *Pratylenchus* (root lesion); and *Tylenchulus* (citrus) **Pathogens:** *Armellaria*, *Phytophthora*, and various fungi, depending on orchard location and conditions that are thought to contribute to orchard replant disorder. **Insect:** At some sites *Pollyphylla decemlineata* (Tenlined June beetle)	Methyl bromide is considered critical for approximately 2% of replant needs (Table A.3). For the best alternative, 1,3-D, soils must have surface application of water for 1,3-D application, but soils up to 1.5 m may not have greater than 12% moisture. If rain is absent, growers without sprinklers have difficulty applying pre-treatment of water for 1,3-D application (methyl bromide does not have a water pre-treatment requirement). For situations where moisture is greater than 12% at depths to 1.5 meters, 1,3-D is not regarded as effective at available rates. In these situations, methyl bromide is considered a critical tool to the long-term productivity of an orchard. In addition, township caps for 1,3-D, permit restrictions for chloropicrin, and buffer zones all restrict the transition or effectiveness of alternatives. Economic costs of long-term fallow in some locations increases the demand for chemical fumigation. Where there are restrictions of alternatives, methyl bromide is considered critical. Some research suggests that the benefits of long term fallow had diminished after four seasons (Schneider et al., 2004), as well as increased costs of non-production.
WINE GRAPES	Replant problem is a disease complex comprised of interactions between various pathogens and environmental factors.	Methyl bromide is considered critical for approximately 9% of replant needs (Table A.3). For the best alternative, 1,3-D, soils must have surface application of water for 1,3-D application, but soils up to 1.5 m may not have greater than

REGION WHERE METHYL BROMIDE USE IS REQUESTED	KEY DISEASE(S) AND WEED(S) TO SPECIES AND, IF KNOWN, TO LEVEL OF RACE	SPECIFIC REASONS WHY METHYL BROMIDE NEEDED
	Nematodes (Primary pests): *Meloidogyne* (root knot); *Mesocriconema* (ring); *Xiphinema* (dagger); *Pratylenchus* (root lesion); and *Tylenchulus* (citrus) **Pathogens:** *Armellaria*, *Phytophthora*, and various fungi, depending on orchard location and conditions that are thought to contribute to orchard replant disorder. **Insect:** At some sites *Pollyphylla decemlineata* (Tenlined June beetle)	12% moisture. If rain is absent, growers without sprinklers have difficulty applying pre-treatment of water for 1,3-D application (methyl bromide does not have a water pre-treatment requirement). For situations where moisture is greater than 12% at depths to 1.5 meters, 1,3-D is not regarded as effective at available rates. In these situations, methyl bromide is considered a critical tool to the long-term productivity of an orchard. In addition, township caps for 1,3-D, permit restrictions for chloropicrin, and buffer zones all restrict the transition or effectiveness of alternatives. Economic costs of long-term fallow in some locations increases the demand for chemical fumigation. Where there are restrictions of alternatives, methyl bromide is considered critical. Some research suggests that the benefits of long term fallow had diminished after four seasons (Schneider et al., 2004), as well as increased costs of non-production.
WALNUTS	Interactions of pests and environment, primarily **Nematodes:** (in ~85% of orchards) *Pratylenchus vulnus*, *Mesocriconema xenoplax*, *Meloidogyne* spp.	Methyl bromide is considered critical for approximately 37% of replant needs (Table A.3). Township caps and unacceptable soil moisture (>12% at depths to 1.5 m in medium and heavy soils) limit 1,3-D use to approximately 30% of orchard land with light soils. Strategies that include multiple techniques, such as use of herbicides and fallow and nematicides, have the potential to reduce pest problems in orchard replant. However, these combination techniques must first be tested and proven so as not to compromise orchard productivity.
ALMONDS	Replant problem (affects ~25% of total growing area) is a disease complex comprising an interaction of pests (primarily nematodes) and environmental factors. Nematodes (affects 35-50% of total growing area): *Meloidogyne incognita* (root knot), *Pratylenchus vulnus* (root lesion), *Mesocriconema xenoplax* (ring), *Xiphinema americanum* (dagger); Bacteria: *Pseudomonas syringae* (canker) (affects 15% of total growing area); Fungi: Armillaria mellea (oak root fungus) (affects 5% of total growing area)	Methyl bromide is considered critical for approximately 4% of replant needs (Table A.3). Many new almond orchards were planted between 1979 and 1982. These orchards will soon need to be replanted as the life of the orchard is reaching its maximum (25-30 years). In addition, the worldwide demand for almonds is increasing (California produces 80% of the world's almonds). Because little virgin land is available, replant problems will occur in locations previously planted with almonds. Because of township caps (30% of area) and water moisture issues (65% of area), the best alternative, 1,3-D, is not available or effective as a replacement in many situations. Therefore, methyl bromide is considered critical for a portion of replant sites. Research is making progress in identifying the most effective alternatives (e.g., Browne et al., 2006; Coates et al., 2007; Lampinen et al., 2004; Browne et al., 2004), but these must be adapted to commercial production.

10. (i) CHARACTERISTICS OF CROPPING SYSTEM AND CLIMATE (Place major attention on the key characteristics that affect the uptake of alternatives):

TABLE B.2 CHARACTERISTICS OF CROPPING SYSTEM AND CLIMATE

CHARACTERISTICS	REGION WHERE METHYL BROMIDE IS REQUESTED				
	STONE FRUIT	RAISIN & TABLE GRAPES	WINE GRAPES	WALNUTS	ALMONDS
CROP TYPE, E.G. TRANSPLANTS, BULBS, TREES OR CUTTINGS	Stone fruit trees for production	Raisin and table grapes	Wine grapes	English walnuts on black/Paradox rootstocks	Almond trees
ANNUAL OR PERENNIAL CROP (STATE NUMBER OF YEARS BETWEEN REPLANTING)	Perennial				
TYPICATYPICAL CROP ROTATION (IF ANY) AND USE OF METHYL BROMIDE FOR OTHER CROPS IN THE ROTATION (IF ANY)	May fallow one season with fumigation in the middle	May fallow one season with fumigation in the middle	May fallow one season with fumigation in the middle	May fallow one season with fumigation in the middle	May fallow one season with fumigation in the middle
SOIL S SOIL TYPES: (SAND LOAM, CLAY, ETC.)	Various (light, medium, heavy)	Various (light, medium, heavy)	Various (light, medium, heavy)	Light (30%), medium (40%), heavy (30%)	Various (light, medium, heavy)
TYPICAL DATES OF PLANTING AND HARVEST	Spring or Fall				
TYPICAL DATES OF METHYL BROMIDE FUMIGATION	Spring or Fall				
FREQUENCY OF METHYL BROMIDE FUMIGATION (E.G. EVERY TWO YEARS)	Once in life of orchard				
TYPICAL SOIL TEMPERATURE RANGE DURING METHYL BROMIDE FUMIGATION (E.G. 15-20°C)	Various				
CLIMATIC ZONE (E.G. TEMPERATE, TROPICAL)	USDA plant hardiness zones 9a, 9b				
ANNUAL AND SEASONAL RAINFALL (MM)	0-72*--Most rain Oct-April				
RANGE IN AVERAGE TEMPERATURE VARIATIONS IN MID WINTER AND MID SUMMER (E.G. MIN/MAX °C) (E.G. JAN 5-15°C, JULY 10-30°C	10-30°C * depending on month				
OTHER RELEVANT FACTORS:	None identified				

*For Fresno, California

(ii) INDICATE IF ANY OF THE ABOVE CHARACTERISTICS IN 11.(i) PREVENT THE UPTAKE OF ANY RELEVANT ALTERNATIVES?

Soil structure and texture can impact transition to alternatives (e.g., metam-sodium does not consistently dissipate in heavy soils due to low vapour pressure and therefore remnant roots are not killed). Single hole applications to replace dead or damaged trees may be technically difficult or impossible or ineffective with some alternatives.

11. HISTORIC PATTERN OF USE OF METHYL BROMIDE, AND/OR MIXTURES CONTAINING METHYL BROMIDE, FOR WHICH AN EXEMPTION IS REQUESTED

(*Add separate table for each major region specified in Question 8*):

TABLE B.3A. STONE FRUIT-- HISTORIC PATTERN OF USE OF METHYL BROMIDE

FOR AS MANY YEARS AS POSSIBLE AS SHOWN SPECIFY:	2001	2002	2003	2004	2005	2006
AREA TREATED *(hectares)*	1,063	1,182	1,619	1,722	1,722	1,722
RATIO OF FLAT FUMIGATION[a] METHYL BROMIDE USE TO STRIP/BED USE IF STRIP TREATMENT IS USED	strip—65% of area is treated	strip—65% of area is treated	strip—65% of area is treated	strip—65% of area is treated	strip—65% of area is treated	strip—65% of area is treated
AMOUNT OF METHYL BROMIDE ACTIVE INGREDIENT USED *(total kg)*	387,354	430,754	589,670	667,926	667,926	667,926
FORMULATIONS OF METHYL BROMIDE *(methyl bromide /pic)*	98:2	98:2	98:2	98:2	98:2	98:2
METHOD BY WHICH METHYL BROMIDE APPLIED	Shank injected	Shank injected	Shank injected	Shank injected	Shank injected	Shank injected
APPLICATION RATE OF ACTIVE INGREDIENT **(kg/ha)***	364	364	364	388	388	388
ACTUAL DOSAGE RATE OF ACTIVE INGREDIENT *(g/m^2)**	36.4	36.4	36.4	38.8	38.8	38.8

* *For Flat Fumigation treatment application rate and dosage rate may be the same.*

[a] Various methods are used depending on the particular location, fumigation can be Flat Fumigation, strip, or even "by the hole" (for individual tree replacement; MeBr is the only product that has acceptable technology for hole application—approximately 0.5 kg/tree).

TABLE B.3B. RAISIN AND TABLE GRAPES-- HISTORIC PATTERN OF USE OF METHYL BROMIDE

FOR AS MANY YEARS AS POSSIBLE AS SHOWN SPECIFY:	2001	2002	2003	2004	2005	2006
AREA TREATED *(hectares)*	67	97	123	1,245	1,245	1,245
RATIO OF FLAT FUMIGATION METHYL BROMIDE USE TO STRIP/BED USE IF STRIP TREATMENT IS USED	Flat Fumigation	Flat Fumigation	Flat Fumigation	Flat Fumigation	Flat Fumigation	Flat Fumigation
AMOUNT OF METHYL BROMIDE ACTIVE INGREDIENT USED *(total kg)*	18,248	20,175	34,618	309,460	309,460	309,460
FORMULATIONS OF METHYL BROMIDE *(methyl bromide /pic)*	98:2	98:2	98:2	98:2	98:2	98:2
METHOD BY WHICH METHYL BROMIDE APPLIED	Shank injected	Shank injected	Shank injected	Shank injected	Shank injected	Shank injected
APPLICATION RATE OF ACTIVE INGREDIENT **(kg/ha)***	271	208	280	249	249	249
ACTUAL DOSAGE RATE OF ACTIVE INGREDIENT *(g/m^2)**	27.1	21.0	28.0	24.9	24.9	24.9

* *For Flat Fumigation treatment application rate and dosage rate may be the same.*

Table B.3c. Wine Grapes-- Historic Pattern of Use of Methyl Bromide

For as many years as possible as shown specify:	2001	2002	2003	2004	2005	2006
Area Treated *(hectares)*	429	92	123	42	274	274
Ratio of Flat Fumigation methyl bromide use to strip/bed use if strip treatment is used	Strip (65% of a hectare is treated)	Strip (65% of a hectare is treated)	Strip (65% of a hectare is treated)	Strip (65% of a hectare is treated)	Strip (65% of a hectare is treated)	Strip (65% of a hectare is treated)
Amount of methyl bromide active ingredient used *(total kg)*	164,563	35,687	53,572	14,196	91,988	91,988
formulations of methyl bromide *(methyl bromide /chloropicrin)*	98:2	98:2	98:2	98:2	67:33	67:33
Method by which methyl bromide applied	Shank injected	Shank injected	Shank injected	Shank injected	Shank injected	Shank injected
Application rate of active ingredient (kg/ha)*	384	387	435	339	336	336
Actual dosage rate of active ingredient *(g/m^2)**	38.4	38.7	43.5	33.9	33.6	33.6

** For Flat Fumigation treatment application rate and dosage rate may be the same.*
Source of CA Usage data until 2004 was T. Trout, USDA, ARS , CA Fumigant Use 2005.

Table B.3d. Walnuts -- Historic Pattern of Use of Methyl Bromide

For as many years as possible as shown specify:	2001	2002	2003	2004	2005	2006
Area Treated *(hectares)*	139	201	180	182	182	182
Ratio of Flat Fumigation methyl bromide use to strip/bed use if strip treatment is used	~75% replant is strip treatment	~75% replant is strip treatment	~75% replant is strip treatment	~75% replant is strip treatment	~75% replant is strip treatment	~75% replant is strip treatment
Amount of methyl bromide active ingredient used *(total kg)*	24,308	59,589	33,074	39,164	39,164	39,164
formulations of methyl bromide *(methyl bromide /chloropicrin)*	98:2	98:2	98:2	98:2	98:2	98:2
Method by which methyl bromide applied	shank injected	shank injected	shank injected	shank injected	shank injected	shank injected
Application rate of active ingredient (kg/ha)*	175	296	184	215	215	215
Actual dosage rate of active ingredient *(g/m^2)**	17.5	29.6	18.4	21.5	21.5	21.5

** For Flat Fumigation treatment application rate and dosage rate may be the same.*

TABLE B.3E. ALMONDS -- HISTORIC PATTERN OF USE OF METHYL BROMIDE**

FOR AS MANY YEARS AS POSSIBLE AS SHOWN SPECIFY:	2001	2002	2003	2004 [a]	2005 [c]	2006 [d]
AREA TREATED *(hectares)*	496	819	278	211	2,207 [c]	2,749 [d]
RATIO OF FLAT FUMIGATION[b] METHYL BROMIDE USE TO STRIP/BED USE IF STRIP TREATMENT IS USED	Strip treatment (65% of hectare treated)	Strip treatment (65% of hectare treated)	Strip treatment (65% of hectare treated)	Strip treatment (65% of hectare treated)	Strip treatment (65% of hectare treated)	Strip treatment (65% of hectare treated)
AMOUNT OF METHYL BROMIDE ACTIVE INGREDIENT USED *(total kg)*	174,502	217,032	85,375	64,088	27,581 [c]	78,715 [d]
FORMULATIONS OF METHYL BROMIDE *(methyl bromide /chloropicrin)*	98:2	98:2	98:2	98:2	98:2	98:2
METHOD BY WHICH METHYL BROMIDE APPLIED	shank injected	Shank injected	Shank injected	Shank injected	Shank injected	Shank injected
APPLICATION RATE OF ACTIVE INGREDIENT (kg/ha)*	352	265	307	304	12 [c]	29 [d]
ACTUAL DOSAGE RATE OF ACTIVE INGREDIENT *(g/m^2)**	35.2	26.5	30.7	30.4	1.2 [c]	2.9 [d]

** For Flat Fumigation treatment application rate and dosage rate may be the same.*

[a] Data from preliminary estimates by California Department of Pesticide Regulation.

[b] Various methods are used depending on the particular situation; fumigation can be flat fumigation, strip, or even "by the hole" (for individual tree replacement; MeBr is the only product that has acceptable technology for hole application—approximately 0.5 kg/tree).

[c] 2005 acreage includes all almond acres treated regardless of rate plus 4 applications to pre-plant soil situations. Thus, the acreage data includes holes, strip and broadcast treatment. Tree hole data shows up both as "acres", where one can't tell exactly what surface area was treated as well as "U" for miscellaneous unit (which for MeBr is tree holes when accompanied by acres planted) in the California Department of Pesticide Use Data (CALPIP). Thus, it is not possible to estimate the exact acreage treated from the DPR data.

[d] 2006 acreage data from CA PUR includes all acres listed under "almond", 50% of the acres listed under "uncultivated ag land" and "soil fumigation/pre-plant". Total acreage is the amount of land to be planted or planted. It is always difficult to assess how many acres come from individual hole treatments (Cal-PIP had 4380 A but not clear when only 1 or 2 trees in an A were treated or a whole acre with 90- 120 holes.

**The number of acres treated with methyl bromide for replant of almond orchards will depend on the number of acres to be planted with almonds, the cost and whether replant situation. A look at the historical planting volumes indicates that 2002 was one of the lowest in 15 years (see planting data in sheet 2CC). Planting rates depend on the predicted market, on the age of orchards, and on the availability of trees to plant. It is anticipated that from 2005 on there will be a high demand to replant almond orchards, because 16 percent of the total 2002 almond acres were planted between 1979 and 1982. These orchards are reaching their 25 year lifespan with growers having to decide whether to replant them to almonds. With current demand for almonds it is likely they will be replanted to almonds. In addition, due to low almond prices in 2000/2001 there was a low ability to finance replanting in 2001 and 2002. The increased planting and use of methyl bromide indicates that with improved prices growers are working to replant their old orchards. Also, there is less "virgin" ground available for almond plantings in the Central Valley so the need for soil fumigants will be increasing overall.

Part C: TECHNICAL VALIDATION
Renomination Form Part D: REGISTRATION OF ALTERNATIVES

12. REASON FOR ALTERNATIVES NOT BEING FEASIBLE (*Provide detailed information on a minimum of the best two or three alternatives as identified and evaluated by the Party, and summary response data where available for other alternatives (for assistance on potential alternatives refer to MBTOC Assessment reports, available at http://www.unep.org/ozone/teap/MBTOC , other published literature on methyl bromide alternatives and Ozone Secretariat alternatives when available)*:

TABLE C 1. REASON FOR ALTERNATIVES NOT BEING FEASIBLE

NAME OF ALTERNATIVE	TECHNICAL AND REGULATORY* REASONS FOR THE ALTERNATIVE NOT BEING FEASIBLE OR AVAILABLE	IS THE ALTERNATIVE CONSIDERED COST EFFECTIVE?
CHEMICAL ALTERNATIVES		
Chloropicrin	Has activity as a fungicide and may be useful if fungi are significant causal agents of replant disorder (Trout et al., 2002). Some research suggests that phytotoxicity problems may occur at rates that are effective against pests (Browne et al., 2002). However, Browne et al. (2006) found that chloropicrin was effective for almond replant, but at high rates in broadcast treatments. In experimental plots, spot treatments (individual holes) rates of 0.2 to 0.5 kg chloropicrin per hole were at least as effective as methyl bromide. Technical issues remain with individual treatments including high labor costs. Use of high rates of chloropicrin are limited since County Agricultural Commissioners limit use permits and will do so at least until federal and state risk assessments are completed.	Possibly
1,3-dichloropropene (1,3-D)	Some orchards fall in areas with township cap restrictions on use of 1,3-D. May be effective where township caps do not apply and where soil moisture and texture are such that 1,3-D can penetrate to remnant tree roots of previous orchard. Comparative yield with 1,3-D were valued at 5585 kg/ha versus 8903 kg/ha with methyl bromide (Duncan et al, 2003). At US$0.30 per kg peaches, this represents a significant economic impact.	Possibly
Metam-sodium	May be effective in killing root tissue near soil surface, but will not kill roots below 75 cm when metam-sodium is applied at label rates; not an effective nematicide since it can not reach deep areas of soil; generally not effective in areas where water percolation is a problem (e.g., clay soils). However, in the future, new delivery systems could increase effectiveness of this compound to make it a more acceptable alternative to MeBr (where soil conditions are amenable to its use). Increasing the time in which material can diffuse throughout the target area will improve efficacy (McKenry, 1999); generally not effective in areas where water percolation is a problem (e.g., clay soils). Comparative yield with metam-sodium were valued at 6880 kg/ha versus 8903 kg/ha with methyl bromide (Duncan et al, 2003). At US$0.30 per kg peaches, this represents a significant economic impact.	Yes, in some sites.

Name of Alternative	Technical and regulatory* reasons for the alternative not being feasible or available	Is the alternative considered cost effective?
Dazomet	This alternative has been examined by researchers and is inconsistent in field trials. This product requires that there be uniform saturation of the granules to ensure that the product will perform consistently. This is not feasible in a typical orchard situation. "Before this product is practical, the granule dissolution rate must be known and predictable or there must be a formulation providing slow release of MITC over a known period of time" (McKenry, 1999). Nematode control after 1 year was 75% compared to 99% control with metam-sodium drench (McKenry, 1999).	Possibly
Nematicides	Other nematicides (besides 1,3-D) have limited use due to their lack of performance or due to regulatory and registration issues. Some products have been tested (McKenry et al., 2007 but only on experimental basis (organophosphate chemical is not registered and unlikely to be allowed). Products tested, or being tested, include: 30 products such as walnut tea, nicotinamide insecticide (Admire), Integrate (mineral extraction), Oxycom (peroxyacetic acide).	Possibly
NON CHEMICAL ALTERNATIVES		
Fallow	Generally fallow is not sufficient alone for high pest pressure areas, but is frequently done for one to two years regardless of fumigant that follows (Caprile and McKenry, 2006; McKenry, 1999; McKenry et al., 1995. Some fallow along with nematode tolerant rootstock peach seedlings have looked promising in research trials (e.g., Browne, 2003, 2004; McKenry, 1999).	Possibly
Rootstock	Genetic factors are known for *Prunus* spp. that confer some tolerance for orchard replant problems—for example, in one study an orchard with Marianna 2624 Plum rootstock was not as sensitive as an orchard with Nemaguard peach rootstock (McKenry, 1999). This is in spite of the resistance of Nemaguard to reproduction of root knot nematodes—however, feeding on Nemaguard roots were aided by reproduction on remnant roots causing significant replant problem. Rootstocks for all of the commodities in this sector are subject to differential effects from soil and other environmental factors, as well as the array of pests that comprise individual orchards. Consequently, rootstock can only be considered a component of an overall orchard management plan, and not a solution to the replant problem. However, short term fallow along with nematode tolerant rootstock peach seedlings have looked promising in research trials (e.g., Browne, 2003, 2004) although disease problems (e.g., *Armellaria*) were not considered in the studies. McKenry et al. (2006) have studied alternatives to fumigation for stone fruit and found that a one year fallow can reduce rejection of trees in replanted soil when Nemaguard rootstock is used in stone fruit plantings. However, new non-Nemaguard stock is being sought to successfully manage not only tree rejection but also infestation by several nematode species. In experiments with grapes, McKenry et al. (2007) found that planting a grape rootstock of a different origin reduces the rejection component.	Yes, where applicable; not stand alone when high pest pressure

NAME OF ALTERNATIVE	TECHNICAL AND REGULATORY* REASONS FOR THE ALTERNATIVE NOT BEING FEASIBLE OR AVAILABLE	IS THE ALTERNATIVE CONSIDERED COST EFFECTIVE?
Biofumigation, solarization, steam, biological control, cover crops and mulching, Crop rotation / fallow, crop residue and compost, substrate/plug plants, plowing/tillage, resistant cultivars, grafting/resistant rootstock, physical removal, organic amendments/compost, general IPM	Each of the not in kind alternatives were listed as options for replacement of methyl bromide. Many of these alternatives are currently being employed with current replant practices (Caprile and McKenry, 2006). Drenovsky et al. (2005) found that black polyethylene promotes greater growth (trunk diameter) in the year following planting probably due to increased soil temperature. This work is continuing. Alternatives such as biofumigation, solarization, and steam generally are not feasible due to planting times, failure to kill remnant roots, one time fumigation requirement per orchard (steam treatment), or inability to attain sufficient biomass of plant material (biofumigation). Biological control may have promise but research has not identified agents that can be used on a commercial scale or that work consistently well. The University of California is investigating biological control of major fungal pathogens, but this work is still in the early stages of research. As such, MeBr is currently considered critical to the industry.	Depending on location of replant site, these methods might assist acceptably in pest management procedures.
COMBINATIONS OF ALTERNATIVES		
1,3-D + chloropicrin	Effective against nematodes, fungi, and to kill remnant roots when 1,3-D is used in orchards with light soils; generally not feasible in medium or heavy soils where moisture excesses frequently occur at depths greater than 1 m; subject to township caps and specific moisture requirements. Promising results from research trials indicated that efficacy may be improved by refining application protocols and use rates (see e.g., Browne et al., 2003, 2004). Efficacy may be improved by incorporating fallow if economically feasible.	In situations where pathogens and nematodes are key pests, if no legal Restrictions apply and where soil type is amenable
1,3-D + chloropicrin + metam-sodium		
1,3-D + metam-sodium		

13. LIST AND DISCUSS WHY REGISTERED PESTICIDES AND HERBICIDES ARE CONSIDERED NOT EFFECTIVE AS TECHNICAL ALTERNATIVES TO METHYL BROMIDE (*Provide information on a minimum of two best alternatives and summary response data where available for other alternatives)*:

Only a small portion of orchard replant sites are being nominated for critical use of methyl bromide (see Table A.3). The best alternatives for orchard replant that have been identified are 1,3-D or 1,3-D with chloropicrin, and/or metam-sodium, especially in light soils. Under some soil and moisture conditions (high moisture at surface and less than 12% at depths to 1.5 meters) 1,3-D can be an effective management tool for replant problems. However, there is a critical need for methyl bromide in some orchards in California, either because of legally mandated township caps for 1,3-D or chloropicrin, or because surface moisture requirements cannot be met due to heavy soils (e.g., soils can not be adequately dried prior to use of 1,3-D).

Herbicides currently are used for killing remnant roots of previous orchard plants. For example, research with walnuts (McKenry, 1999) suggested that herbicide treatment followed by 18 months fallow can result in root knot nematode control of 97% compared to untreated plots. However, this effect only lasted 6 months, not long enough to achieve acceptable establishment of new orchard. While previous studies indicated that herbicides were not able to kill grapevine roots (McKenry, 1999), newer work by McKenry et al. (2007) appears to have identified an effective application of glyphosate. This method will be tested commercially. In stone fruit, the use of glyphosate on old *Prunus* trunks and a 1-year fallow reduced Nemaguard-rootstock tree rejection during the first year in replanted soil (McKenry et al., 2006). In an earlier report on plums, remnant roots were killed after 18 months but endoparasitic nematodes were not significantly reduced (McKenry et al., 1995). The current nomination reflects a reduction in use rates based on adopting alternatives for some sites.

14. STATE RELATIVE EFFECTIVENESS OF RELEVANT ALTERNATIVES COMPARED TO METHYL BROMIDE FOR THE SPECIFIC KEY TARGET PESTS AND WEEDS FOR WHICH IT IS BEING REQUESTED (*Use the same regions as in Section 10 and provide a separate table for each target pest or disease for which methyl bromide is considered critical. Provide information in relation to a minimum of the best two or three alternatives.*)

TABLE C 2A. STONE FRUIT - EFFECTIVENESS OF ALTERNATIVES – REPLANT DISORDER

KEY PEST: REPLANT DISORDER	AVERAGE DISEASE % OR RATING AND YIELDS IN PAST 3~5 YEARS				
METHYL BROMIDE FORMULATIONS AND ALTERNATIVES	# OF TRIALS	DISEASE (% OR RATING)	# OF TRIALS	ACTUAL YIELDS (T/HA)	CITATION
[1] Untreated [2] MB (449 kg/ha) [3] 1,3-D (392 kg/ha) [4] Metam-sodium (358 kg/ha) [5] Polyethylene mulch [6] Sodium tetrathiocarbonate (113 L/ha) [7] Compost + microbial inoc. (5 appl/season) [8] Compost + kelp + humic acid (5 appl/season) [9] Compost + calcium (5 appl/season)	**Orchard replant, 4 reps** [1] n/a [2] preplant [3] preplant [4] preplant [5] postplant [6] postplant [7] postplant [8] postplant [9] pre- & postplant	**Trunk dia. ,1st year (cm)** [1] 11.2b [2] 15.8a [3] 12.8ab [4] 14.0ab [5] 13ab [6] 11.4b [7] 10.8b [8] 10.8b [9] 11.8b	4 reps each	**Pruning mass, 2nd year (kg/tree)** [1] 1.8b [2] 6.4a [3] 3.6b [4] 3.8b [5] 2.8b [6] 1.6b [7] 1.8b [8] 1.7b [9] 2b	Drenovsky et al., 2005
[1] MB (400 kg/ha) [2] 1,3-D (350 kg/ha) + metam-sodium (125 kg/ha) [3] 1 year fallow (non-fumigated) [4] non-fumigated	Peach, fumigation Fall, 1997; Replant, Spring, 1998; 4 reps, **research plots**	**Trunk diameter** (mm for MB trt; and % of MB value); Aug. 2002: [1] 114a [2] 92%ab [3] 86%bc [4] 81%c	Same	**Market Yield** (kg/tree MB trt; and % of MB value); Aug. 2002: [1] 38a [2] 100%a [3] 93%a [4] 86%a	Trout et al., 2002
[1] MB (400 kg/ha) [2] 1,3-D (260 kg/ha) + chloropicrin (150 kg/ha) + metam-sodium (63 kg/ha) [3] 1 year fallow (non-fumigated) [4] non-fumigated	Peach, fumigation Fall, 1998; Replant, Spring, 1999; 4 reps, **research plots**	**Trunk diameter** (mm for MB trt; and % of MB value); Aug. 2002: [1] 94.1a [2] 102%a [3] 89%b [4] 82%b	Same	**Market Yield** (kg/tree MB trt; and % of MB value); July, 2002: [1] 30ab [2] 109%a [3] 87%bc [4] 75%c	Trout et al., 2002

TABLE C.2B. RAISIN & TABLE GRAPES - EFFECTIVENESS OF ALTERNATIVES – REPLANT DISORDER (NEMATODES)

KEY PEST: REPLANT DISORDER (NEMATODES)					
METHYL BROMIDE FORMULATIONS AND ALTERNATIVES *(include dosage rates and application method)*	**# OF TRIALS**	**DISEASE (% OR RATING)**			**CITATION**
[1] not fumigated [2] MB (455 kg/ha) [shanked, tarp] [3] metam-sodium (125 kg/ha) [microspray] [4] InLine + metam-sodium (125 kg/ha) [microspray] [5] chloropicrin (455 kg/ha) [drip] + metam-sodium (125 kg/ha) [microspray]	5 reps; grapes	*Meloidogyne* spp. (#/100 cc soil) (trial planted and sampled 2001) [1] 324a [2] 0c [3]290a [4] 0c [5] 8b	*Tylenchulus semipenetrans* (#/100 cc soil) (trial planted and sampled 2001) [1] 121a [2] 0c [3] 157a [4] 0c [5] 2bc		Schneider et al., 2002
[1] not fumigated [2] 1-year fallow [3] 1-year fallow + cover crop [4] MB (455 kg/ha) [shanked, tarp] [5] 1,3-D (352 kg/ha) [in 60 mm water] + metam-sodium (125 kg/ha) [microspray] [6] 1,3-D (352 kg/ha) [in 100 mm water] + metam-sodium (125 kg/ha) [microspray]	5 reps; grapes	*Meloidogyne* spp. per 100 cc soil (trial planted 1998, sampled 2001)			Schneider et al., 2002
		Thompson seedless rootstock	Teleki 5C rootstock	Harmony rootstock	
		[1] 144ab [2] 215a [3] 145ab [4] 1def [5] 0.2ef [6] 6cde	[1] 261a [2] 49b [3] 190a [4] 0.3c [5] 0.6c [6] 0.2c	[1] 0.8a [2] 0.0a [3] 0.1a [4] 0.0a [5] 0.0a [6] 0.0a	
[1] not fumigated [2] 1-year fallow [3] 1-year fallow + cover crop [4] MB (455 kg/ha) [shanked, tarp] [5] 1,3-D (352 kg/ha) [in 60 mm water] + metam-sodium (125 kg/ha) [microspray] [6] 1,3-D (352 kg/ha) [in 100 mm water] + metam-sodium (125 kg/ha) [microspray]	5 reps; grapes	*Tylenchulus semipenetrans* per 100 cc soil (trial planted 1998, sampled 2001)			Schneider et al., 2002
		Thompson seedless rootstock	Teleki 5C rootstock	Harmony rootstock	
		[1] 638a [2] 352a [3] 463a [4] 0.4c [5] 3c [6] 6b	[1] 301a [2] 434a [3] 342a [4] 4b [5] 1b [6] 3b	[1] 913a [2] 1123a [3] 723a [4] 2b [5] 6b [6] 7b	

TABLE C.2C. WINE GRAPES - EFFECTIVENESS OF ALTERNATIVES – REPLANT DISORDER (NEMATODES)

KEY PEST: REPLANT DISORDER (NEMATODES)					
METHYL BROMIDE FORMULATIONS AND ALTERNATIVES *(include dosage rates and application method)*	**# OF TRIALS**	**DISEASE (% OR RATING)**			**CITATION**
[1] not fumigated [2] MB (455 kg/ha) [shanked, tarp] [3] metam-sodium (125 kg/ha) [microspray] [4] InLine + metam-sodium (125 kg/ha) [microspray] [5] chloropicrin (455 kg/ha) [drip] + metam-sodium (125 kg/ha) [microspray]	5 reps; grapes	*Meloidogyne* spp. (#/100 cc soil) (trial planted and sampled 2001) [1] 324a [2] 0c [3]290a [4] 0c [5] 8b	*Tylenchulus semipenetrans* (#/100 cc soil) (trial planted and sampled 2001) [1] 121a [2] 0c [3] 157a [4] 0c [5] 2bc		Schneider et al., 2002
		Meloidogyne spp. per 100 cc soil (trial planted 1998, sampled 2001)			
		Thompson seedless rootstock	Teleki 5C rootstock	Harmony rootstock	
[1] not fumigated [2] 1-year fallow [3] 1-year fallow + cover crop [4] MB (455 kg/ha) [shanked, tarp] [5] 1,3-D (352 kg/ha) [in 60 mm water] + metam-sodium (125 kg/ha) [microspray] [6] 1,3-D (352 kg/ha) [in 100 mm water] + metam-sodium (125 kg/ha) [microspray]	5 reps; grapes	[1] 144ab [2] 215a [3] 145ab [4] 1def [5] 0.2ef [6] 6cde	[1] 261a [2] 49b [3] 190a [4] 0.3c [5] 0.6c [6] 0.2c	[1] 0.8a [2] 0.0a [3] 0.1a [4] 0.0a [5] 0.0a [6] 0.0a	Schneider et al., 2002
		Tylenchulus semipenetrans per 100 cc soil (trial planted 1998, sampled 2001)			
		Thompson seedless rootstock	Teleki 5C rootstock	Harmony rootstock	
[1] not fumigated [2] 1-year fallow [3] 1-year fallow + cover crop [4] MB (455 kg/ha) [shanked, tarp] [5] 1,3-D (352 kg/ha) [in 60 mm water] + metam-sodium (125 kg/ha) [microspray] [6] 1,3-D (352 kg/ha) [in 100 mm water] + metam-sodium (125 kg/ha) [microspray]	5 reps; grapes	[1] 638a [2] 352a [3] 463a [4] 0.4c [5] 3c [6] 6b	[1] 301a [2] 434a [3] 342a [4] 4b [5] 1b [6] 3b	[1] 913a [2] 1123a [3] 723a [4] 2b [5] 6b [6] 7b	Schneider et al., 2002

TABLE C.2D. ALMONDS - EFFECTIVENESS OF ALTERNATIVES – REPLANT DISORDER

KEY PEST: REPLANT DISORDER	AVERAGE DISEASE % OR RATING AND YIELDS IN PAST 3~5 YEARS				
METHYL BROMIDE FORMULATIONS AND ALTERNATIVES *(include dosage rates and application method)*	# OF TRIALS	DISEASE (% OR RATING)	# OF TRIALS	ACTUAL YIELDS (T/HA)	CITATION
fungal pathogens [1] MB (409 kg/ha) [2] chloropicrin (425 kg/ha) [3] 1,3-D (409 kg/ha) [4] non-fumigated	Almond (Marianna 2624 rootstock), 2001; 4 reps, research plots (19 m x 22 m), no tarp;	**Trunk diameter (mm)** (increase after 8 months post-fumigation) [1] 4b [2] 10c [3] 2a [4] 1a	same	**Trees (%) w/growth >1.5 m height (in 8 months):** [1] 21%a [2] 96%b [3] 1%a [4] 2%a	Browne et al., 2002
fungal pathogens [1] MB (0.34 kg/tree) + chloropicrin (0.11 kg/tree) [2] chloropicrin (0.45 kg/tree) [3] non-fumigated	Almond (Marianna 2624 rootstock), 2002; 4 reps, research plots (19 m x 22 m), no tarp;	**Trunk diameter (mm)** (increase after 8 months post-fumigation) [1] 15b [2] 14b [3] 4a	same	**Trees (%) w/growth >1.5 m height (in 8 months):** [1] 94% [2] 83% [3] 6%	Browne et al., 2002

TABLE C.2E. ALMONDS - ALMOND TREE REPLANT RESPONSES TO PREPLANT FUMIGATION TREATMENTS IN ORCHARD 1 (ALMOND AFTER ALMOND) AND ORCHARD 2 (ALMOND AFTER GRAPE).

Fumigant, rate	Plot area treated	Mulch system	Trunk circ. increase (% of control)[a]	2006 Yield (kg/tree)
Orchard 1: Almond after Almond (fumigants applied October 27, 2003)				
Control	None	None	0	4.09 de
Control	None	VIF row strip	-6	3.04 e
MB, 448 kg/ha	Broadcast (100%)	None	4	5.07 bcd
MB, 448 kg/ha	Row strip (38%)	None	-4	4.60 cde
MB, 448 kg/ha	Row strip (38%)	VIF row strip	-2	4.52 cde
Telone II, 380 kg/ha	Broadcast (100%)	None	11	5.68 abcd
Telone II, 380 kg/ha	Row strip (38%)	None	6	5.01 bcd
Telone II, 380 kg/ha	Row strip (38%)	VIF row strip	0	5.01 bcd
Telone C35, 600 kg/ha	Broadcast (100%)	None	16	6.97 a
Telone C35, 600 kg/ha	Row strip (38%)	None	27	6.73 a
IM:Pic (50:50), 448 kg/ha	Broadcast (100%)	None	29	7.19 a
IM:Pic (50:50), 448 kg/ha	Row strip (38%)	None	19	6.37 ab
Pic 448 kg/ha	Broadcast (100%)	None	17	5.92 abc
Pic, 448 kg/ha	Row strip (38%)	None	30	6.37 ab
Pic, 448 kg/ha	Rowstrip (38%)	VIF row strip	28	7.05 a
Orchard 1: Almond after Almond (fumigants applied November 10, 2003)				
Control	None	None	o	4.09 de
MB, 0.5 kg per tree site	Tree site[b]	None	0	5.05 bcd

Pic	Tree site[b]	None	-13	4.41 cde
Telone II	Tree site[b]	None	-11	4.57 cde
Orchard 2: Almond after Grape (fumigants applied November 11, 2003)				
Control	None	None	0	5.96 abc
Control	None	VIF row strip	-3	5.32 bcd
MB, 448 kg/ha	Broadcast (100%)	None	-5	6.72 ab
MB, 448 kg/ha	Row strip (38%)	None	-9	5.65 abcd
MB, 448 kg/ha	Row strip (23%)	None	-9	5.77 abc
MB, 448 kg/ha	Row strip (38%)	VIF row strip	-10	5.67 abcd
Telone II, 380 kg/ha	Broadcast (100%)	None	-5	4.29 cd
Telone II, 380 kg/ha	Row strip (38%)	None	-5	5.10 bcd
Telone II, 380 kg/ha	Row strip (38%)	VIF row strip	-8	4.02 d
Telone C35, 600 kg/ha	Row strip (38%)	None	-12	5.57 bcd
Telone C35, 600 kg/ha	Row strip (38%)	VIF	-10	5.17 bcd
IM:Pic (50:50), 448 kg/ha	Broadcast (100%)	None	-4	7.31 a
IM:Pic (50:50), 448 kg/ha	Row strip (38%)	None	-7	6.12 ab
Pic 448 kg/ha	Row strip (38%)	None	-5	5.33 bcd
Pic, 448 kg/ha	Row strip (23%)	None	-3	5.49 bcd
Pic, 448 kg/ha	Rowstrip (38%)	VIF row strip	-13	5.96 abc

From: Lampinen, B., Browne, Schneider, S., Shrestha, A., Holtz, B., and Simon, L. 2006. Alternative pre-plant soil fumigation treatments for deciduous tree crops. Annual International Research Conference on Methyl Bromide Alternatives (2006).
http://www.mbao.org/2006/06Proceedings/039LampinenBrownecsreesfumigantalternativesfordeciduousfinal.pdf

[a] From March 2003 to November 2005.

[b] Applied at depth of approximately 45 cm, one probe per tree site.

15. ARE THERE ANY OTHER POTENTIAL ALTERNATIVES UNDER DEVELOPMENT THAT THE PARTY IS AWARE OF WHICH ARE BEING CONSIDERED TO REPLACE METHYL BROMIDE? (*If so, please specify*):

The combination of 1,3-D with chloropicrin is the primary alternative to methyl bromide for orchards where conditions are amenable (light soils, moisture less than 12% at depths to 1.5 meters, high moisture above 30 cm) and allowed. Ongoing research studies (e.g., McKenry et al., 2007; McKenry et al., 2006; Caprile and McKenry, 2006; Browne et al., 2006; Lampinen et al., 2004; Browne et al., 2004) suggest that alternatives, including tolerant rootstocks, crop rotations, 1,3-D, chloropicrin, and VIF, can replace methyl bromide. Alternative strategies that are being investigated also include fallowing studies, generally with prior treatment with an herbicide to kill remnant roots from previous plantings (McKenry et al., 2007; McKenry et al., 2006), or cover crops, although nematode control has been short-lived (only up to 6 to 9 months) in some studies (McKenry, 1999). Rootstock with resistance to the primary nematode pests are being developed, but orchard replant disorder is caused by varying factors, including pathogens, that are different in different orchard locations and according to the crop grown (and crop grown prior to the orchard replant). In addition, regulatory constraints (e.g., 1,3-D, chloropicrin, and some low permeable films) may prevent uses in important areas.

16. (i) ARE THERE TECHNOLOGIES BEING USED TO PRODUCE THE CROP WITHOUT METHYL BROMIDE? (*e.g. soilless systems, plug plants, containerised plants.*

State proportion of crop already grown in such systems nationally and if any constraints exist to adoption of these systems to replace methyl bromide use. State whether such technologies could replace a proportion of proposed methyl bromide use):

A relatively small portion of orchard replant sites requires methyl bromide (see Table A.3). To reduce methyl bromide use further, growers have been switching from the traditional broadcast treatments to strip or single hole treatments. Single hole treatments may offer a significant reduction in fumigant use while maintaining efficacy (Browne et al., 2006; Coates et al., 2007). Fumigating narrower strips to reduce fumigant use is also being studied (Browne et al, 2007). Use of herbicides, such as glyphosate, can reduce remnant roots of previous plantings and reduce the nutrients used by problem nematodes (McKenry et al., 2007), but methods are only beginning commercial testing. In addition, in orchards not subject to restrictions, 1,3-D can be an effective alternative (Caprile and McKenry, 2006). Tests are being conducted to develop new delivery systems to target pests with alternatives such as metam-sodium and 1,3-D to depths where these compounds can more efficiently kill roots and nematodes that feed on roots.

McKenry (1999), Caprile and McKenry (2006), and McKenry et al. (2006, 2007) have outlined approaches that may help address methyl bromide alternatives for replant. These include use of herbicides to kill remnant roots, use of fallow, crop rotations, use of "virgin" soil as an amendment to possibly reduce replant problem, resistant rootstocks when available, irrigation regimes to improve consistency of metam-sodium, etc. Field studies on these perennial crops require considerable time to conduct and until replicated trials can be analyzed methyl bromide may be required in some sites.

(ii) IF SOILLESS SYSTEMS ARE CONSIDERED FEASIBLE, STATE PROPORTION OF CROP BEING PRODUCED IN SOILLESS SYSTEMS WITHIN REGION APPLYING FOR THE NOMINATION AND NATIONALLY:

Not applicable for this sector.

(iii) WHY ARE SOILESS SYSTEMS NOT A SUITABLE ALTERNATIVE TO PRODUCE THE CROP IN THE NOMINATION?

The nature of orchard replant makes soilless systems not applicable for this sector.

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

(Renomination Form 11.) PROGRESS IN REGISTRATION
Where the original nomination identified that an alternative's registration was pending, but it was anticipated that one would be subsequently registered, provide information on progress with

its registration. Where applicable, include any efforts by the Party to "fast track" or otherwise assist the registration of the alternative.

The U.S. government has no authority to compel registrations; it can only act on registrations requested by private entities. The timely submission of data to support a registration decision is at the sole discretion of the registrant.

TABLE C 3. RENOMINATION FORM PRESENT REGISTRATION STATUS OF ALTERNATIVES

NAME OF ALTERNATIVE	PRESENT REGISTRATION STATUS	REGISTRATION BEING CONSIDERED BY NATIONAL AUTHORITIES? (Y/N)	DATE OF POSSIBLE FUTURE REGISTRATION:
Methyl Iodide (Iodomethane)	Not registered for this sector in U.S.	Yes	Unknown

(Renomination Form 12.) DELAYS IN REGISTRATION

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

See above.

(Renomination Form 13.) DEREGISTRATION OF ALTERNATIVES

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

Six fumigants are undergoing a review of risks and benefits at present. A likely outcome of this review will be the imposition of additional restriction on the use of some or all of these chemicals. This process will not lead to proposed restrictions until 2008, at which point the process to modify labels will start. This process can take several years to complete. It is not possible to forecast the outcome of the soil fumigant analysis at this time.

An additional complication in forecasting changes in the registration of alternatives is that under the U.S. federal system individual states may impose restrictions above those imposed at the Federal level. Examples of these additional restrictions include the township caps on Telone® in California and the "SLN" (Special Local Needs) restrictions on the same chemical in 31 Florida counties.

In addition, the California Department of Pesticide Regulation (DPR) may impose use restrictions and water seal requirements on all soil fumigants to reduce their contributions to volatile organic compounds as part of the efforts to meet the Federal Clean Air Standards for ground level ozone. DPR plans to finalize regulations in the next 2-3 months to meet a deadline imposed by a lawsuit concerning compliance with the 1994 pesticide component of the State Implementation Plan (SIP) on ozone. They are also in the process of devising what measures will be included in the SIP (June, 2007) to meet the new lower ozone standards.

As an example, according to the California DPR (Segawa, 2007):

> The main SIP action is DPR's regulation to reduce volatile organic compound (VOC) emissions from field fumigations. This regulation includes requirements for use of methyl bromide, chloropicrin, 1,3-D, metam, dazomet, and sodium tetrathiocarbonate. The regulation achieves VOC reductions in two ways: changing application methods, and establishing fumigant emission limits.
>
> Beginning in 2008, the regulation requires applicators to use certain "low-emission" application methods within ozone nonattainment areas during May * Oct. The San Joaquin Valley where sweet potatoes are grown is one of the nonattainment areas affected. However, most sweet potato fumigations occur outside the May * Oct window. For sweet potato fumigations during May * Oct, applicators will most likely need to use post-application water treatments for metam or 1,3-D, or chemigate using drip irrigation systems. Methyl bromide sweet potato fumigations will probably be unchanged. Their current method is likely considered low-emission.
>
> If a certain emissions trigger is met, fumigant limits go into effect. San Joaquin Valley is almost certain to meet this trigger in 2009. The fumigant limit applies to the entire nonattainment area during May * Oct. DPR enforces the fumigant limit using allowances issued to growers. It's likely that fumigated acreage will be reduced beginning in 2009, but I'm not able to estimate what the reduction might be. The reduction will be proportional for all growers and crops. That is, everybody will be reduced the same percentage amount.
>
> The above description is the easy part. We're still in litigation regarding the needed fumigant reductions in Ventura. We also have major uncertainties what the fumigant reductions will look for 2010 and beyond in all nonattainment areas due to possible actions by EPA's air program.

Part D: EMISSION CONTROL
Renomination Form Part E: IMPLEMENTATION OF MBTOC/TEAP RECOMMENDATIONS

17. TECHNIQUES THAT HAVE AND WILL BE USED TO MINIMISE METHYL BROMIDE USE AND EMISSIONS IN THE PARTICULAR USE (*State % adoption or describe change*):

TABLE D 1. TECHNIQUES TO MINIMIZE METHYL BROMIDE USE AND EMISSIONS

TECHNIQUE OR STEP TAKEN	LOW PERMEABILITY BARRIER FILMS	METHYL BROMIDE DOSAGE REDUCTION	INCREASED % CHLOROPICRIN IN METHYL BROMIDE FORMULATION	DEEP INJECTION	LESS FREQUENT APPLICATION
WHAT USE/EMISSION REDUCTION METHODS ARE PRESENTLY ADOPTED?	Currently being tested	Reduced rates with other non-fumigant methods (e.g., herbicides, fallow)	Change from 98:2 to 67:33.	Deep injections are currently being used	Currently, only fumigated once in orchard life
WHAT FURTHER USE/EMISSION REDUCTION STEPS WILL BE TAKEN FOR THE METHYL BROMIDE USED FOR CRITICAL USES?	Research is underway to develop use in commercial production systems	Research to replant orchards per hole rather than broadcast or standard strips.	Not likely above 43% chloropicrin due to regulatory restrictions. If per hole treatment is adopted, chloropicrin alone has shown promise in research studies (e.g., Browne et al., 2006)	Per hole treatment can significantly reduce overall fumigant use.	Only fumigated once in orchard life
OTHER MEASURES (PLEASE DESCRIBE)	Research with water seals (e.g., Gao and Trout, 2005) indicate that water may be able to reduce emissions, alone or with tarps. Combination of methods using two or three chemicals and effective tarps (low permeability and/or various colors) and IPM methods (e.g., fallow, cover crop) is being studied to develop the most effective regimes for pest management.				

18. IF METHYL BROMIDE EMISSION REDUCTION TECHNIQUES ARE NOT BEING USED, OR ARE NOT PLANNED FOR THE CIRCUMSTANCES OF THE NOMINATION, STATE REASONS:

Techniques to minimize emission include developing methods to fumigate entire orchards per hole rather than strip or broadcast, the use of low-permeability films, the application of water seals, and the "top dressing" application of fertilizer. In California, however, there is a performance standard for films that require a minimum level of permeability to methyl bromide to protect workers so low barrier films cannot be used with methyl bromide.

The application of water seals is dependent on the availability of adequate supplies of water and a lack of restrictions on water use as well as irrigation systems that will allow the application of sufficient quantities of water to effect the seal.

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

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

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

(Renomination Form 14.) USE/EMISSION MINIMISATION MEASURES

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

In accordance with the criteria of the critical use exemption, each party is required to describe ways in which it attempts to minimize use and emissions of methyl bromide. The use of methyl bromide in the United States is minimized in several ways. Methyl bromide can only be used by certified applicators trained for handling these hazardous pesticides. In practice, this means that methyl bromide is applied by a limited number of experienced applicators with the knowledge and expertise to minimize dosage to the lowest level possible to achieve the needed results. In keeping with both local requirements to avoid "drift" of methyl bromide into inhabited areas, as well as to preserve methyl bromide and keep related emissions to the lowest level possible, methyl bromide application for tomatoes is most often machine injected into soil to specific depths.

Reduced methyl bromide concentrations in mixtures, cultural practices, and the extensive use of tarpaulins to cover land treated with methyl bromide has resulted in reduced emissions and an application rate that we believe is among the lowest in the world for the uses described in this nomination.

Part E: ECONOMIC ASSESSMENT
Renomination Form Part F: ECONOMIC ASSESSMENT

20. (Renomination Form 15.) ECONOMIC INFEASIBILITY OF ALTERNATIVES – METHODOLOGY *(MBTOC will assess economic infeasibility based on the methodology submitted by the nominating Party. Partial budget analysis showing per hectare gross and net returns for methyl bromide and the next best alternatives is a widely accepted approach. Analysis should be supported by discussions identifying what costs and revenues change and why. The following measures may be useful descriptors of the economic outcome using methyl bromide or alternatives. Parties may identify additional measures. Regardless of the measures used by the methodology, it is important to state why the Party has concluded that a particular level of the measure demonstrates a lack of economic feasibility):*

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

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

An economic analysis was not done for this sector because most of the losses cannot be quantified. The critical use nomination (CUN) for this sector does not include areas where soil conditions are ideal and township caps do not restrict the use of 1,3 D. This CUN only applies to areas where township caps or certain soil types do not permit the use or effective use of 1,3-D. In such areas there are no technically or economically feasible alternatives and tree losses are likely to be greater than 20% (McKenry, 1999). 1,3 D in combinations with chloropicrin or metam-sodium is economically feasible in ideal soil conditions when not restricted California township caps on 1,3 D. Where soil conditions permit the effective use of 1,3 D an estimated 5% tree loss is expected from the use of 1,3 D in various combinations with chloropicrin and metam sodium. A 5% tree loss is considered a moderate loss, making the treatment economically feasible, providing there are no other losses.

Where 1,3 D is not permitted there are no effective nematicides. Trees that survive are not likely to be as healthy and could suffer yield losses. If a nematode infestation causes the death of trees, then replacement trees would also suffer the same infestation unless there use of an effective nematicide, or possibly several years of fallow.

An economic analysis was not done because most of the losses cannot be quantified since there are no data to substantiate the magnitude of these losses. These losses include:

- Delayed planting
- Fallow
- Additional use of herbicides
- Tree loss

- Replant costs to replace tree losses
- Loss of trees replanted
- Yield loss of fruit or nuts
- Delayed achievement of full yield potential
- Earlier loss of productivity of whole orchard

A number of soil pathogens and nematodes, many still poorly understood, occur over the lifespan of an orchard. It is important that the grower be able to reduce the amount of inoculum in the soil to ensure that the young trees have the opportunity to get off to a vigorous start to ensure survival. 1,3 D, chloropicrin, and metam-sodium have shown promise on some soil types, but long-term research on tree survival and on yield impacts is incomplete. If the alternatives do not work as effectively as methyl bromide, then it is possible that other losses could occur, such as additional replanting, higher yield losses, and shorter lifespan of the whole orchard reducing the ability to amortize the initial investment costs.

Part F: NATIONAL MANAGEMENT STRATEGY FOR PHASE-OUT OF THIS NOMINATED CRITICAL USE
Renomination Form Part B: TRANSITION PLANS

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

21. DESCRIBE MANAGEMENT STRATEGIES THAT ARE IN PLACE OR PROPOSED TO PHASE OUT THE USE OF METHYL BROMIDE FOR THE NOMINATED CRITICAL USE, INCLUDING:

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

These issues are discussed in the US Management Plan for Methyl Bromide, submitted previously.

Renomination Form Part C: TRANSITION ACTIONS

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

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

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

(Renomination Form 6.) TRIALS OF ALTERNATIVES
Where available, attach copies of trial reports. Where possible, trials should be comparative, showing performance of alternative(s) against a methyl bromide-based standard.

See Section 15 above for selected trial results and citations.

(i) DESCRIPTION AND IMPLEMENTATION STATUS:

These issues are discussed in the US Management Plan for Methyl Bromide, submitted previously.

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

See Section 15 above for selected trial results and citations.

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

This nomination reflects the critical uses and required quantities of methyl bromide (see Appendix A).

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

The USG can authorize Experimental Use Permits (EUPs) for large scale field trials for methyl bromide alternatives, as has been done for methyl iodide. A recent change has been to allow the EUP for methyl iodide without the previously required destruction of the crop, thus encouraging more growers to participate in field trials. As with other activities connected with registration of a pesticide, the USG has no legal authority either to compel a registrant to seek a EUP or to require growers to participate.

As noted in our previous nomination, the USG provides funding and other support for agricultural research, and in particular, for research into alternatives for methyl bromide. This support takes the form of direct research conducted by the Agricultural Research Service (ARS) of USDA, through grants by ARS and CSREES, by IR-4, the national USDA-funded project that facilitates research needed to support registration of pesticides for specialty crop vegetables, fruits and ornamentals, through funding of conferences such as MBAO, and through the land grant university system

The U.S. nomination for this sector reflects the commitment by this sector and the U.S. to reduce methyl bromide use to only the most critical needs. Support for research studies has been an important part of the commitment by growers and funding agencies to find effective alternatives. Most sites currently use alternatives for orchard replant (see Table A.3).

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

(i) DESCRIPTION AND IMPLEMENTATION STATUS:

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

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

See Section 21.

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

The U.S. nomination for this sector reflects the commitment by this sector and the U.S. to reduce methyl bromide use to only the most critical needs. See Appendix A.

(iv) ACTIONS TO ADDRESS ANY DELAYS/OBSTACLES:

Ongoing field trials require results to be validated for commercial application. For tree crops, long-term studies must be evaluated before results are known. Therefore, some period of time after publication of field trials is needed for commercial testing and implementation.

USG attempts to identify methyl bromide alternatives to move them forward in the registration queue. However, USG has no authority to compel registrations; it can only act on registrations requested by private entities. The timely submission of data to support a registration decision is at the sole discretion of the registrant.

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

(i) DESCRIPTION AND IMPLEMENTATION STATUS:

Please consult the U.S. National Management Strategy previously supplied to MBTOC (in 2006).

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

The U.S. nomination for this sector reflects the commitment by this sector and the U.S. to reduce methyl bromide use to only the most critical needs. See Appendix A.

(iii) ACTIONS TO ADDRESS ANY DELAYS/OBSTACLES:

USG attempts to identify methyl bromide alternatives to move them forward in the registration queue. However, USG has no authority to compel registrations; it can only act on registrations requested by private entities. The timely submission of data to support a registration decision is at the sole discretion of the registrant.

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

(Renomination Form 9.) CHANGES TO TRANSITION PROGRAM
If the transition program outlined in the Party's original nomination has been changed, provide information on the nature of those changes and the reasons for them. Where the changes are significant, attach a full description of the revised transition program.

See Appendix A.

(Renomination Form 10.) OTHER BROADER TRANSITION ACTIVITIES
Provide information in this section on any other transitional activities that are not addressed elsewhere. This section provides a nominating Party with the opportunity to report, where

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

These issues are discussed in the US Management Plan for Methyl Bromide, submitted previously.

Part G: CITATIONS

Browne, G., Lampinen, B., Holtz, B., Upadhyaya, S., Wang, D., Gao, S. Doll, D., Schmidt, L., Hanson, B., Goodell, N., McKenry, M., and Klonsky, K. 2007. Integrated pre-plant alternatives to methyl bromide for almonds and other stone fruits. http://www.mbao.org/2007/Proceedings/008BrowneGmbao2007.pdf

Browne, G. T., Connell, J. H., Schneider, S. M. 2006. Almond replant disease and its management with alternative pre-plant soil fumigation treatments and rootstocks. Plant Disease 90:869-876.

Browne, G., Connell, J., McLaughlin S., Lee, R., Schneider, S., and Trout, T. 2004. Potential of chemical and non-chemical approaches for managing *Prunus* replant disease. Annual International Research Conference on Methyl Bromide Alternatives (2004). http://mbao.org/

Browne, G., Trout, T., Becherer, H., McLaughlin, S., Lee, R., Gartung, J., Gillis, M., Schneider, S., and Bulluck, R. 2003. Pre-plant cropping and fallowing effects on severity of Prunus replant disease. Annual International Research Conference on Methyl Bromide Alternatives (2003). http://mbao.org/

Browne, G., Trout, T. and Bulluck, R. 2002. Cultural control and etiology of replant disease of *Prunus* spp. University of California, Sustainable Agriculture Research and Education Program. http://www.sarep.ucdavis.edu/grants/reports/mebr/browne/browne.html

Caprile, J. and McKenry, M. 2006. Orchard replant considerations. University of California Extension, Contra Costa County *Crop Currents*, Fall 2006, attached *in* University of California Extension *Tree Topics* Oct. 30, 2006, vol 31, issue 8. http://fruitsandnuts.ucdavis.edu/crops/CAPRILE_ORCHARD_REPLANT_CONSIDERATIONS_12_06.pdf

Coates, R., Shafii, M., Upadhyaya, S. K., and Browne, G. 2007. Tree planting site-specific fumigant application to control almond replant disease. Annual International Research Conference on Methyl Bromide Alternatives (2007). http://www.mbao.org/2007/Proceedings/009UpadhyayaSMBATreePlantingSite.pdf

Drenovsky, R. E., Duncan, R. A., and Scow, K. M. 2005. Soil sterilization and organic carbon, but not microbial inoculants, change microbial communities in replanted peach orchards. California Agriculture 59 (3):176-181. http://californiaagriculture.ucop.edu/0503JAS/pdfs/SoilSterilization.pdf

Duncan, R. A., McKenry, M., and Scow, K. 2003. Evaluation of pre- and post-plant treatments for replanted peach orchards. Annual International Research Conference on Methyl Bromide Alternatives (2003). http://mbao.org/

Gao, S. and Trout, T. 2005. Potential for using surface water applications to reduce fumigation emissions. Annual International Research Conference on Methyl Bromide Alternatives. http://www.mbao.org/2005/05Proceedings/109GaoS%20Extended%20abstract-Gao.pdf

Kluepfel, D. and Beede, B. 2007. Methyl bromide alternatives for use in walnut production systems. Annual International Research Conference on Methyl Bromide Alternatives (2007). http://www.mbao.org/2007/Proceedings/010KluepfelMethylbromidealterantives.pdf

Lampinen, B., Browne, Schneider, S., Shrestha, A., Holtz, B., and Simon, L. 2006. Alternative pre-plant soil fumigation treatments for deciduous tree crops. Annual International Research Conference on Methyl Bromide Alternatives (2006). http://www.mbao.org/2006/06Proceedings/039LampinenBrownecsreesfumigantalternativesfordeciduousfinal.pdf.

Lampinen, B., Browne, Schneider, S., Shrestha, A., Holtz, B., and Simon, L. 2004. Alternative pre-plant soil fumigation treatments for deciduous tree crops. Annual International Research Conference on Methyl Bromide Alternatives (2004). http://mbao.org/

McKenry, M., Buzo, T., and Kaku, S. 2007. Replanting vineyards without soil fumigation. . Annual International Research Conference on Methyl Bromide Alternatives (2007). http://www.mbao.org/2007/Proceedings/050McKenryMReplantVineyardsw-outsoifumigMBAO2007.pdf

McKenry, M., Buzo, T., and Kaku, S. 2006. Replanting stone fruit orchards without soil fumigation. Annual International Research Conference on Methyl Bromide Alternatives. http://www.mbao.org/2006/06Proceedings/028McKenrySummary2006.pdf.

McKenry, M. V. 1999. The replant problem and its management. Contractor for California Association of Nurseryman. Prepared for California Department of Pesticide Regulation. Catalina Publishing, Fresno, California, USA. (See CUE 03-0013, CUE 03-0014 request packages of California Grape and Tree Fruit League, and CUE 03-0029 request of California Walnut Commission.)

McKenry, M., Buzo, T., and Kaku, S. 1995. First-year evaluation of tree and vine growth and nematode development following 17 pre-plant treatments. *In:* University of California Plant Protection Quarterly. Vol. 5, No. 4. http://www.uckac.edu/ppq/PDF/95oct.pdf

Schneider, S., Trout. T., Browne, G., Ajwa, H., and Sims, J. 2004. Vineyard replant—performance of methyl bromide alternatives over time. Annual International Research Conference on Methyl Bromide Alternatives (2004). http://mbao.org/

Segawa, R. 2007. Personal communication email to N. Mallampalli, EPA.

Trout. T., Ajwa, H., Schneider, S., Gartung, J. 2002. Fumigation and fallowing effects on replant problems in California peach. Annual International Research Conference on Methyl Bromide Alternatives (2002). http://mbao.org/

Wang, D., Gao, S., Gerik, J., Hanson, B., Smith, C., Klonsky, K., Westerdahl, B., Vasquez, S., Browne, G., and Yates, S. 2007. Methyl bromide alternatives for vineyard replant—assessment

of control efficacy, fumigant movement, and crop response. Annual International Research Conference on Methyl Bromide Alternatives (2007).
http://www.mbao.org/2007/Proceedings/011WangDMBAO2007areawide.pdf

Appendix A: Methyl Bromide Usage Newer Numerical Index Extracted (BUNNIE)

2010 Methyl Bromide Usage Newer Numerical Index - BUNNIE							Orchard Replant		
January 23, 2008	Region		CA G&TFL - Stone Fruit	CA G&TFL - Raisin Grape	CA Walnut Commission	Almond Hullers & Processors	CA Wine Grapes Replant	Sector Total or Average	Notes
Dichotomous Variables	Strip or Bed Treatment?		Strip	Strip	Strip	Strip	Strip		
	Currently Use Alternatives?		Yes	Yes	Yes	Yes	Yes		
	Tarps / Deep Injection Used?		Deep	Deep	Deep	Deep	Deep		
	Pest-free Cert Requirements?		No	No	No	No	No		
Other Issues	Frequency of Treatment (x/ yr)		1x/ 22 years	1x/ 22 years	1x/ 40 years	1x/ 20 year	1x/ 25 years		*
	QPS Removed?		Yes	Yes	Yes	Yes	Yes		
Most Likely Combined Impacts (%)	Florida Telone Restrictions (%)		0%	0%	0%	0%	0%		
	100 ft Buffer Zones (%)		0%	0%	0%	0%	0%		
	Key Pest Distribution (%)		55%	48%	85%	46%	48%		
	Regulatory Issues (%)		3%	4%	6%	25%	4%		
	Unsuitable Terrain (%)		0%	0%	0%	0%	0%		
	Unsuitable Soil (%)		0%	0%	0%	0%	0%		
	Total Combined Impacts (%)		**56%**	**50%**	**86%**	**59%**	50%		
Most Likely Baseline Transition	(%) Able to Transition		0%	0%	0%	0%	0%		
	Minimum # of Years Required		0	0	0	0	0		
	(%) Able to Transition / Year		**0%**	**0%**	**0%**	**0%**	**0%**		
EPA Adjusted Use Rate (kg/ha)			**133**	**164**	**133**	**133**	**164**		
EPA Adjusted Strip Dosage Rate (g/m2)			20.4	25.2	20.4	20.4	25.2		
2010 Requested Usage	*Amount - Pounds*	*Pounds*	*1,472,526*	*682,243*	*250,000*	*100,000*	*202,800*	*2,707,569*	
	Area - Acres		*7,326*	*2,000*	*2,000*	*900*	*676*	*12,902*	
	Rate (lb/A)		*201.00*	*341.12*	*125.00*	*111.11*	*300.00*	*210*	
	Amount - Kilograms	Metric	**667,926**	**309,460**	**113,398**	**45,359**	**91,988**	**1,228,132**	
	Treated Area - Hectares		2,965	809	809	364	274	5,221	
	Rate (kg/ha)		225	382	140	125	336	235	
EPA Preliminary Value		kgs	**667,926**	**165,561**	**113,398**	**45,359**	**91,988**	**1,084,233**	
EPA Baseline Adjusted Value has been adjusted			MBTOC Adjustments, QPS, Double Counting, Growth, Use Rate/Strip						
EPA Baseline Adjusted Value		kgs	153,333	9,255	22,255	18,887	22,290	226,021	
EPA Transition Amount		kgs	-	-	-	-	-	-	
EPA Amount of All Adjustments		kgs	**(514,593)**	**(156,306)**	**(91,143)**	**(26,472)**	**(69,698)**	**(858,212)**	
Most Likely Impact Value for Treated Area		**kgs**	**153,333**	**9,255**	**22,255**	**18,887**	**22,290**	**226,021**	
		ha	**752**	**37**	**109**	**93**	**88**	**1,078**	
		Rate	**204**	**252**	**204**	**204**	**252**	**210**	
Sector Research Amount (kgs)			**-**	**2010 Total US Sector Nomination**			**226,021**		

1 Pound = 0.453592 kgs 1 Acre = 0.404686 ha