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

Executive summary

This renomination covers eggplant grown in the States of Florida, Georgia, and Michigan, for the fresh market. These crops are generally grown in open fields, on plastic tarps, and often followed by various other crops. Only areas where the use of alternative pest control chemicals is not feasible have been included in the calculation of nominated amounts and area to be treated. The applicants' requests have also been adjusted downward to account for the lower methyl bromide dose rates (see BUNNIE in Appendix A) for the southern regions of US eggplant production, since increased use of high barrier films in conjunction with lower rates has been reported there. For Michigan, the low dose rates requested by the applicants were incorporated into calculations.

In developing this renomination the USG examined several recent studies to determine whether yield losses and market window losses associated with the best available alternative could be altered from previous nominations.

In Michigan, methyl bromide is used primarily to control *Phytophthora capsici,* a soil pathogen that can destroy the entire harvest from affected areas if left uncontrolled. In Florida and Georgia the use of potential alternatives 1,3-dichloropropene (1,3-D) and metam sodium in the fall is impractical because of the long waiting periods for planting following application (28 days for 1,3-D and 21 days for metam sodium). Since the fall crop is dependent upon timely planting, the required waiting period would cost growers half the harvest season, thereby missing the higher market windows. Variations in soil temperatures or rainfall could also cause delays in fumigation events, since all fumigations must be completed by early May. In addition to potential economic disruptions, there is also a Federal label restriction of a 30.4 m buffer zone between treated fields and inhabited structures, which will reduce overall pest control in a field. In Michigan, no adoption of VIF is anticipated due to adverse local weather conditions (high winds), but a shift from a 67% methyl bromide formulation to a 50% formulation is expected by 2007.

In Florida and Georgia, methyl bromide is used mainly to control nutsedge, although it is also used to manage *Phytophthora* blight, southern blight, damping-off, and *Verticillium* wilt, and nematodes. Of the methyl bromide alternatives, only 1,3-D + chloropicrin is somewhat efficacious against *Phytophthora.*

In Florida, the best alternative, 1,3-D (Telone), may not be applied in areas overlying karst geology, which is common throughout the Southeastern States. There is also a 21-day planting delay (vs. 14 days for MB) due to regulatory restrictions for 1,3-D + chloropicrin. Outside karst areas, the best alternative at present is an application of Telone C-35 (1,3-D + 35% chloropicrin), at 35 gallons per acre, 3-5 weeks before transplanting, followed by an application of a herbicide mix of napropamide and trifluralin at the time of tarp laying.

A soil treatment recently developed by the University of Georgia is emerging as a promising methyl bromide replacement for Georgia's solanaceous spring crops, although not for the summer or fall crops. This treatment, known as UGA-3-WAY, consists of three successive soil fumigations, beginning with a1,3-D (Telone II) application, followed by a chloropicrin application, followed by a metam application. Further small plot and large-scale, on-farm research on various aspects is underway. Additional work is also planned for the next several years. Further research is needed to determine the efficacy of this alternative on other weed species. In addition, the economics of transitioning to this alternative, including the cost and durability of films and the modification of fumigation equipment, still needs to be worked out.

In conclusion, review of results from the latest relevant studies indicates that there has been no significant change in the availability of methyl bromide alternatives on eggplant. As indicated above, the UGA 3-WAY treatment has potential for the eggplant spring crop in Georgia, but still requires further validation before it is ready for widespread adoption in that State.

NOMINATING PARTY:

The United States of America

NAME

USA CUN09 SOIL EGGPLANT GROWN IN OPEN FIELDS

BRIEF DESCRIPTIVE TITLE OF NOMINATION:

Methyl Bromide Critical Use Nomination for Pre-plant Soil Use for Eggplants Grown in Open Fields (Submitted in 2008 for 2010 Use Season)

CROP NAME (OPEN FIELD OR PROTECTED):

Pre-plant Soil Use for Eggplant Grown 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	34,732

SUMMARY OF ANY SIGNIFICANT CHANGES SINCE SUBMISSION OF PREVIOUS NOMINATIONS:

A transition rate was applied based on the best estimate of yield losses and feasibility associated with likely methyl bromide alternatives and use of high barrier films that could be made by USG biologists and economists. In addition, lower methyl bromide dose rates were used in the calculations of the nomination (see BUNNIE in Appendix A) for the southern regions of US eggplant production, since increased use of high barrier films in conjunction with lower rates has been reported there. For Michigan and the mid-Atlantic regions, the low dose rates requested by the applicants were incorporated into calculations. Finally, the southern US applicants requests were adjusted to reflect the apparent technical feasibility of a three way combination of alternative fumigants (1,3 D followed by chloropicrin followed by metam-sodium) as a replacement for spring-time applications of methyl bromide + chloropicrin in those areas that do not face prohibition of 1,3 D due to karst topographical features.

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

The U.S. nomination is only for those areas where the alternatives are not suitable. In the U.S., Florida, Georgia, and Michigan are major eggplant producing states. In these States, factors that restrict the use of potential alternatives to methyl bromide include:

- Geographic distribution and regulatory constraints for alternatives. For example, in Florida and, to a lesser extent, in Georgia the use of 1,3-D is prohibited in areas overlying karst topographical features because of groundwater contamination concerns.

- Lower pest control efficacy of alternatives. In Florida and Georgia, where nutsedge is the main methyl bromide target pest, neither 1,3-D nor metam sodium, alone or in combination with chloropicrin, may adequately control moderate to high nutsedge populations. Furthermore, in some regions the efficacy of alternatives is not comparable to methyl bromide. In Michigan, where soil-borne pathogens are key methyl bromide target pests, neither 1,3-D nor metam sodium is effective against soil-borne fungi.

- Economic constraints. In Florida and Georgia, the use of products containing 1,3-D and metam sodium may be impractical in the fall because of the longer waiting periods for planting following application (28 and 21 days for 1,3-D and metam sodium, respectively, compared to 14 days for methyl bromide). In Michigan, waiting for soil temperatures to increase to levels necessary for the effective use of alternatives would represent an additional delay. Delays in planting and harvesting may result in the loss of market windows and reduction of revenues.

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

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

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

NOMINATING PARTY CONTACT DETAILS:

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

________________________ __________________________ _____________

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 CUN09 SOIL EGG PLANT GROWN IN OPEN FIELDS		
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 CUN09 SOIL EGGPLANT GROWN IN OPEN FIELDS		

* Identical to paper documents

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Part A: INTRODUCTION
Renomination Part A: SUMMARY INFORMATION

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

The United States of America
USA CUN09 Soil Eggplant Grown in Open Fields.

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

Methyl Bromide Critical Use Nomination for Preplant Soil Use for Eggplant Grown 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)*):

This is a request for eggplant grown in the States of Florida, Georgia, and Michigan. In Florida, eggplant is grown year-round, and often double cropped with pepper or cucumber following eggplant harvest. The crop that follows eggplant in a double cropping production system depends upon prevailing environmental and economic factors. Growers in Florida often plant eggplant as an extra crop, and grow okra, squash, or cucumbers after eggplant has been harvested. A spring crop of eggplant may follow as a second crop after a fall crop of pepper or tomato. Eggplant does best on well-drained, fertile, sandy-loam soils at a pH of 6.0-6.5. Poorly drained soils may result in slow plant growth, reduced root systems, and low yields. Eggplant requires a long, warm, frost-free growing season, usually of 14-16 weeks. Cold temperatures below 5^{o}C injure this crop. The best temperatures are 27-32^{o}C during the day and 21-32^{o}C during the night. Plant growth is curtailed at temperatures below 16^{o}C. Additionally, soil temperature below 16^{o}C restricts germination. However, most eggplant is started in the field from transplants. Methyl bromide is always used in the full-bed mulch process.

Until 1999, the chemical formulation primarily used was 98 percent methyl bromide and two percent chloropicrin. Since then, growers have shifted to formulations with lower concentrations of methyl bromide and higher amounts of chloropicrin due to the phase-out schedule of methyl bromide. At present, the standard formulation contains 50% methyl bromide in Florida and Michigan, and 57% in Georgia.

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	34,732

(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.)

A transition rate was applied based on the best estimate of yield losses and feasibility associated with likely methyl bromide alternatives that could be made by USG analysts. The nominated amount has also been adjusted to reflect the apparent technical feasibility of a 3 way combination of registered methyl bromide alternatives (1,3 D + chloropicrin followed by chloropicrin followed by metam-sodium) for spring-time fumigation of southeastern eggplant, but only in areas not affected by karst-related prohibitions on 1,3 D application.

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 US nomination is only for those areas where the alternatives are not suitable. There are several factors that make the potential alternatives to methyl bromide unsuitable in the U.S. eggplant production. These include:

- Efficacy of alternatives: the efficacy of alternatives may not be comparable to methyl bromide in some areas, making these alternatives technically and/or economically infeasible for use in eggplant production.

- Geographic distribution of key target pests: i.e., some alternatives may be comparable to methyl bromide as long as key pests occur at low pressure. The US is only nominating a CUE for eggplants where the key pest pressure is moderate to high, such as for nutsedge in the Southeastern US.

- Regulatory constraints: e.g., Telone use is limited in Florida and Georgia due to the presence of karst topographical features.

- Delay in planting and harvesting: e.g., the plant-back interval for Telone + chloropicrin is two weeks longer than methyl bromide + chloropicrin. In Michigan an additional delay would occur because soil temperature must be higher to fumigate with alternatives. Delays in planting and harvesting result in users missing major market windows, thus affecting revenues through lower prices.

- The best alternatives (e.g. 1,3-D + chloropicrin, metam sodium) are not as effective in controlling nutsedge and have a long waiting period for planting that would disrupt planting schedules and cause growers to miss key market windows. Furthermore, regulatory restrictions due to concerns over human exposure and ground water contamination, along with technical limitations, result in potential economic infeasibility of 1,3-D alone or in combination as a practical methyl bromide alternative. Major factors affecting the alternatives are a 28 day planting delay due both to label restrictions and low soil temperatures. In addition, a mandatory 30.4 m buffer zone is imposed for treated fields near the inhabited structures.

Michigan

In Michigan eggplant the key target pest is *Phytophthora capsici*. This soil pathogen can destroy the entire harvest from affected areas if left uncontrolled. In small plot trials with peppers and cucurbits conducted in Michigan (Hausbeck and Cortright, 2004), 1, 3 D + chloropicrin or metam-potassium provided a level of control comparable to methyl bromide. No trials were conducted with eggplants, but since both peppers and eggplant are solanaceous crops, these results likely apply to eggplant as well. *P. capsici* was recently found in irrigation water in Michigan (Gevens and Hausbeck 2003), increasing the likelihood of repeated re-infestation by this pathogen. It is not clear whether such small-scale results accurately reflect efficacy of methyl bromide alternatives in commercial pepper and eggplant production. These trials were conducted at a location where only cucurbits had been grown in the past. Other studies with these fumigants (described in the regional discussions later in this document) have not shown similarly promising results, suggesting that the pathogen in the Michigan study may not have adapted to solanaceous crops. Regrettably, fumigants in that study were applied in June, when soil temperatures are warmer than in April, when soil is usually fumigated, since growers plant according to premium market price windows. Given the lower dissipation of these fumigants at temperatures of about 4 ^{o}C, it is unlikely that similar results would be achieved if fumigations were timed more typically. Furthermore, regulatory restrictions (e.g., mandatory 30 m buffer zone for treated fields near inhabited structures) due to human exposure and ground water contamination concerns, along with technical and economic limitations, limit the feasibility of these fumigants as methyl bromide alternatives. Furthermore, variations in soil temperatures or rainfall could cause fumigation delays, since label restrictions and efficacy statements require that 1,3 D + chloropicrin and metam-sodium/potassium be used only above certain temperatures or when rain is not imminent. Label restrictions on these alternatives also require planting delays based on rates used. At higher rates delays can be as much as 2 weeks longer than for methyl bromide, which could disrupt the delivery schedule of fresh eggplant crops to wholesale buyers.

No adoption of virtually impermeable film (VIF) is anticipated in Michigan due to adverse local conditions (high winds), which make it difficult to keep the mulch on the ground. Users of methyl bromide have shifted from the 67% formulation to a 50% formulation in 2007.

Florida and Georgia

Nutsedge is the weed that requires methyl bromide use in the Southeastern U.S., including Florida and Georgia. Methyl bromide is also used to manage *Phythophthora* blight, southern blight, damping-off, and *Verticillium* wilt, and nematodes in this region. Of the methyl bromide alternatives, only 1,3-D + chloropicrin has some efficacy against *Phytophthora.* However, 1,3-D cannot be applied in areas overlying karst topographical features, which are commonly found throughout the Southeast. Left uncontrolled, any of these pests could destroy the harvests from affected areas. The herbicide halosulfuron is effective against nutsedges, but can only be applied to row middles, not to raised beds, where nutsedge competition is intense (Florida CUE #03-0054).

Metam-sodium provides erratic, inconsistent control of nutsedges and nematodes, while 1,3-D + chloropicrin provides may adequately control nematodes and diseases (Eger 2000, Noling et al.

2000). However, where weed infestations are moderate to severe, metam-sodium may result in yield losses of up to 44 percent, compared to methyl bromide (Locascio et al. 1997). Metam-sodium also requires a planting delay of up to 30 days to avoid risk of phytotoxic injury to crops, compared to a 14-day delay for methyl bromide. Because of groundwater contamination concerns, 1,3-D + chloropicrin is not used in large portions of the southeastern U.S. where karst topographical features are common. In addition, there is a 28-day planting delay (14 days for methyl bromide) for 1,3-D + chloropicrin. Furthermore, any apparent technical feasibility of metam-sodium and 1,3 D + chloropicrin (and various combinations thereof) is based on small plot research trials carried out on crops other than eggplant.

Implications of methyl bromide loss for individual growers

If methyl bromide were to be unavailable for U.S. eggplant, growers in the regions cited in this nomination would have to discontinue growing this crop or suffer substantial losses. Growers would either leave agriculture entirely or switch to other crops that do not rely on pre-plant fumigation to control soil pests. The extent of this impact on the affected growers is debatable, but given the early state of commercial deployment of methyl bromide alternatives, it is possible that growers who currently use methyl bromide would face this outcome.

TABLE A 2: EXECUTIVE SUMMARY*

Region		Michigan Eggplant	Florida Eggplant	Georgia Eggplant	Sector Total or Average
EPA Preliminary Value	kgs	3,799	46,607	48,868	99,274
EPA Amount of All Adjustments	kgs	(1,057)	(27,764)	(35,721)	(64,541)
Most Likely Impact Value for Treated Area	kgs	2,742	18,843	13,147	34,732
	ha	18	114	80	213
	Rate	150	165	165	163
2010 Total US Sector Nomination					34,732

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

(ii) STATE WHETHER THE USE COVERED BY A CERTIFICIATION 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).*

Not used to meet 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)**:**

In the Southern U.S., mainly in Florida and Georgia, where nutsedge is a main methyl bromide target pest, neither 1,3-D or metam sodium, alone or in combination, may adequately control this weed. In karst topographical feature areas, which include 31 counties in Florida, Telone is highly restricted and metam sodium or metam potassium are the best alternatives available. However, further testing of these chemicals in large scale commercial fields is needed. In Florida and Georgia, farmers using 1,3-D and metam sodium in the fall would require longer waiting periods for planting. Applications of metam sodium or 1,3-D require waiting periods of 28 and 21 days, respectively, whereas only 14 days are needed for methyl bromide. Such delays could result in missed market windows. Metam sodium efficacy appears to decline where it is applied repeatedly due to enhanced degradation of its active ingredient, methyl isothiocyanate, by soil microorganisms (Ashley, et al., 1963; Ou et al., 1995; Verhagen et al., 1996; Gamlied et al., 2003).

In Michigan, soil-borne pathogens are the key methyl bromide target pests, and only 1,3-D + chloropicrin compares favorably with methyl bromide. However, potential delays of up to 28 days due to low soil temperature, along with label restrictions and mandatory 30 to 100 meter buffer zones due to human exposure concerns, limit the use of this alternative.

Iodomethane, a new methyl bromide alternative, was registered for one year in the U.S., in October, 2007. Iodomethane, however, is not registered for use on eggplant.

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.

7. (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 CROP GROWN USING METHYL BROMIDE

REGION WHERE METHYL BROMIDE USE IS REQUESTED	TOTAL CROP AREA (HA)**	PROPORTION OF TOTAL CROP AREA TREATED WITH METHYL BROMIDE (%)
Florida	647 (2001)	Not Available
Georgia	518 (2005)	Not Available
Michigan	84 (1997)	Not Available
National Total:*	**2,197 (2001)**	Not Available

*National total includes other regions not requesting methyl bromide
**Eggplant Statistics discontinued in 2002.
Sources: Florida: United States Department of Agriculture National Agricultural Statistics Service Vegetables 2002 Summary, January 2003 accessible online at: http://usda.mannlib.cornell.edu/usda/nass/VegeSumm//2000s/2003/VegeSumm-01-29-2003.pdf Michigan: accessible online at: http://www.hort.purdue.edu/newcrop/cropmap/michigan/michigantotals.html Georgia: The University of Georgia 2005 Georgia Farm Gate Value Report accessible online at: http://www.caed.uga.edu/publications/2006/pdf/AR-06-01.pdf

7. (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.

The primary reason that some eggplant may be grown without methyl bromide in all three regions is the absence of key target pests.

- In Florida, areas without karst topographical features and having low nutsedge pressure can successfully employ a fumigation system relying on 1,3-D and chloropicrin.
- In Georgia, eggplant fields that are not treated with methyl bromide are not infested with target weeds or pathogens.
- In Michigan, all eggplant acreage is treated with methyl bromide due to cool weather conditions and high pest pressure from diseases and weeds. The areas not treated apparently are not infected with target soil-borne pathogens. The applicant states that soil infestation is spreading in the region annually.

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?

No, areas that use methyl bromide do so because of environmental sensitivity and heavy pest pressure preclude the use of fumigants that are used when these conditions are not present. The primary reason that some eggplants may be grown without methyl bromide in all three regions is the absence of key target pests and constraints to use of alternatives (i.e., absence of nutsedge in the Florida and Georgia, soil pathogens and cold soil temperatures in Michigan, and karst topographic features in Georgia and Florida).

8. 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 NOMINATED FOR CRITICAL USE

REGION	Florida	Georgia	Michigan
YEAR OF EXEMPTION REQUEST	2009		
QUANTITY OF METHYL BROMIDE NOMINATED			
TOTAL CROP AREA TO BE TREATED WITH THE METHYL BROMIDE OR METHYL BROMIDE: CHLOROPICRIN FORMULATION (M^2 OR HA) (NOTE: IGNORE REDUCTIONS FOR STRIP TREATMENT)	See Appendix A	See Appendix A	See Appendix A
METHYL BROMIDE USE: BROADACRE OR STRIP/BED TREATMENT?	Strip	Strip/Bed	Strip/Bed

REGION	Florida	Georgia	Michigan
YEAR OF EXEMPTION REQUEST	2009		
PROPORTION OF BROADACRE AREA WHICH IS TREATED IN STRIPS; E.G. 0.54, 0.67	58%	58%	58%
FORMULATION (RATIO OF METHYL BROMIDECHLOROPICRIN MIXTURE) TO BE USED FOR CALCULATION OF THE CUE E.G. 98:2, 50:50	50/50	57/43	50/50
APPLICATION RATE* (KG/HA) FOR THE FORMULATION	See Appendix A	See Appendix A	See Appendix A
DOSAGE RATE* (G/M^2) (I.E. ACTUAL RATE OF FORMULATION APPLIED TO THE AREA TREATED WITH METHYL BROMIDECHLOROPICRIN ONLY)	See Appendix A	See Appendix A	See Appendix A

* Give here actual rate per treated area (e.g. the area directly treated under film) not rate per total area of field.

9. 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 acreage experiencing one or more of the following impacts were included in the nominated amount: moderate to heavy key pest pressure, regulatory impacts, karst topographical features, 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.

A transition rate was applied based on the best estimate of yield losses and feasibility associated with likely methyl bromide alternatives that could be made by USG biologists and economists. In addition, a dosage rate of 150 kg/ha (for areas where disease pathogens were considered to be key pests) and 175 kg/ha (for areas where weeds were considered to be key pests) was used in calculating the amount of methyl bromide requested. USG also refined the estimates of the proportion of crop acreage to which methyl bromide alternatives involving 1,3 D + chloropicrin could not be used due to Karst and seepage irrigation restrictions. For details on these changes in usage requirements, please see Appendix B.

(Renomination Form 17) RESULTANT CHANGES TO REQUESTED EXEMPTION QUANTITIES

QUANTITY (KILOGRAMS) REQUESTED FOR PREVIOUS NOMINATION YEAR:	62,789
QUANTITY (KILOGRAMS) APPROVED BY PARTIES FOR PREVIOUS NOMINATION YEAR:	48,691
QUANTITY (KILOGRAMS) REQUIRED FOR YEAR TO WHICH THIS REAPPLICATION REFERS:	34,732
TREATED AREA (HECTARES) REQUIRED FOR YEAR TO WHICH THIS REAPPLICATION REFERS:	213

Part B: CROP CHARACTERISTICS AND METHYL BROMIDE USE

10. 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 & WEEDS AND SPECIFIC REASONS WHY METHYL BROMIDE IS NEEDED

REGION WHERE METHYL BROMIDE USE IS REQUESTED	KEY DISEASE(S) AND WEED(S) TO GENUS AND, IF KNOWN, TO SPECIES LEVEL	SPECIFIC REASONS WHY METHYL BROMIDE IS NEEDED

Florida	Weeds: yellow & purple nutsedges (*Cyperus rotundus*, *C. esculentus*), nightshade (*Solanum* spp.), sweet clover (*Mellilotis spp.*), ragweed (*Ambrosia artemisifolia*) Plant diseases: phytophthora blight (*Phytophthora* spp.), Southern Blight (*Sclerotinia Rolfsii spp.)*, damping-off (*Rhizoctonia solani*, *Pythium* spp.), Verticillium Wilt (Verticillium Alboatrum spp.) Nematodes: root-knot nematodes (*Meloidogyne* spp.),	In the past, only methyl bromide has provided effective control of target pests in Florida, where pest pressures commonly exist at moderate to severe levels. Use of 1,3-D is restricted in key eggplant growing areas of Florida underlain by karst topographical features and sandy (porous) sub-soils, geological features that could lead to ground-water contamination. Products containing 1,3-D are prohibited in Dade County, where the entire vegetable growing area is affected (U.S. EPA, 2002, Noling, 2003). Metam-sodium has limited pest control capabilities as a stand-alone fumigant (Noling, 2003). Halosulfuron, which is effective against nutsedge, is only registered for use in row middles.
Georgia	Yellow and purple nutsedge (*Cyperus esculentus, C. rotundus*) *[100%];* crown and Root rot (*Phytophthora capsici*) *[40%];* plant-parasitic nematodes (*Meloidogyne incognita; Pratylenchus sp) [70%];* southern blight (*Sclerotium rolfsii*) *[70%];* Pythium root and collar rots (*P.irregulare, P. myriotylum, P. ultimum, P. aphanidermatum*) *[100%]*	In the past, only methyl bromide has provided effective control of target pests found in the southeast U.S. where pest pressures commonly exist at moderate to severe levels. Most, if not all of these States are limited in the use of 1,3-D because of underlying karst topographical features throughout the region. Halosulfuron, which is registered only for middle-of-row use, does not control nutsedge near pepper plants where most competition occurs. Metam-sodium has limited pest control capabilities as a stand-alone fumigant (Noling, 2003). Refer to Item 13 for additional detail.
Michigan	Crown and root rots caused by soil-borne fungus *Phytophthora capsici*.	Soil fumigation needs to be completed by the first week of May to allow growers to plant early and capture the early market for premium prices and to ensure demand for their crop during the entire growing season.

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

TABLE B 2A: FLORIDA - CHARACTERISTICS OF CROPPING SYSTEM

CHARACTERISTICS	FLORIDA
CROP TYPE:	Vegetable crop for fresh market
ANNUAL OR PERENNIAL CROP:	Annual
TYPICAL CROP ROTATION AND USE OF METHYL BROMIDE FOR OTHER CROPS IN THE ROTATION:	Peppers, cucurbits
SOIL TYPES:	Sandy and sandy-loam soils
FREQUENCY OF METHYL BROMIDE FUMIGATION:	Annually
OTHER RELEVANT FACTORS:	Double-cropped with cucurbit; may be preceded by pepper.

TABLE B 3A-1: FLORIDA - CHARACTERISTICS OF CLIMATE AND CROP SCHEDULE - NOT DOUBLE-CROPPED

MONTH	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb
CLIMATIC ZONE	Zones: 9a, 10a, 10b - In 1997, 80% of the state's eggplant production was in the southeast; remainder of about 20% distributed in the rest of the state, mostly in the central and northern regions.											
RAINFALL *(mm)*	65.5	50.0	72.5	134.1	175.8	193.3	152.7	65.0	42.7	158.8	62.0	66.8
OUTSIDE TEMP.*(℃)*	19.4	22.1	25.3	27.6	28.2	28.2	27.3	24.1	19.2	17.3	16.0	16.9
FUMIGATION SCHEDULE[A]				X	X	X	X	X	X	X	X	
PLANTING SCHEDULE[B]					**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**
KEY HARVEST WINDOW[C]	**E**	**E**	**E**	**E**	**E**				**E**	**E**	**E**	**E**

[A]Non-double cropped, earliest start date: June 15.
[B] For Non-Double cropped eggplant production, planting eggplants is usually initiated around July 1; shaded cells represent variation in transplanting dates
[C]For Non-Double Cropped Eggplants; Harvest Period usually begins as early as Nov. 1, may continue until July 31, depending on when planted and weather conditions.

TABLE B 3A-2: FLORIDA - CHARACTERISTICS OF CLIMATE AND CROP SCHEDULE - DOUBLE-CROPPED

MONTH	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb
CLIMATIC ZONE	Zones 9a, 10a, 10b - In 1997, 80% of the state's eggplant production was in the southeast; remainder of about 20% distributed in the rest of the state, mostly in the central and northern regions.											
RAINFALL *(mm)*	65.5	50.0	72.5	134.1	175.8	193.3	152.7	65.0	42.7	158.8	62.0	66.8
OUTSIDE TEMP.*(℃)*	19.4	22.1	25.3	27.6	28.2	28.2	27.3	24.1	19.2	17.3	16.0	16.9
FUMIGATION SCHEDULE[A]				**X**	**X**	**X**	**X**					
PLANTING SCHEDULE[B]					**E**	**E**	**E**	**E**				**2C**
KEY HARVEST WINDOW[F]	E	E	2C	2C	2C				E	E	E	E

[A] Double-cropped; assumed to be with cucurbits; earliest start date is June 15.
[B] For Double-Cropped eggplant production, planting (**E**) is typically initiated on July 1; variance can be until October 1. The second crop of cucurbits transplants would typically be initiated around Feb 1, and may vary until end of Feb, or 1st part of March.
[C] For Double Cropped Eggplants, Harvest Period usually begins as early as Nov. 15 (**E**), may continue until April 15, depending on when planted and weather conditions; Harvesting of second crop (**2C**) may start around May 1 and continue until mid-July

TABLE B 2B: GEORGIA - CHARACTERISTICS OF CROPPING SYSTEM

CHARACTERISTICS	GEORGIA
CROP TYPE:	Vegetable crop for the fresh market
ANNUAL OR PERENNIAL CROP:	Annual; generally 1 year
TYPICAL CROP ROTATION AND USE OF METHYL BROMIDE FOR OTHER CROPS IN THE ROTATION:	Eggplants, followed by a cucurbit crop (cucumbers, or squash) or pepper.
SOIL TYPES:	Sandy loam; clay loam
FREQUENCY OF METHYL BROMIDE FUMIGATION:	1 time per year; (either in spring or fall)
OTHER RELEVANT FACTORS:	The grower may complete two, three or even four crops in one fumigation cycle.

TABLE B 3B: GEORGIA - CHARACTERISTICS OF CLIMATE AND CROP SCHEDULE

MONTH	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb
CLIMATIC ZONE "PLANT HARDINESS ZONE"	Climate zones 7a, 7b, 8a, and 8b noted in the application. Zone 7a: -15.0 to –17.7 °C (0 to 5 °F): Oklahoma City, OK; South Boston, VA Zone 7b: -12.3 to 14.9 °C (5 to 10 °F); Griffin, GA Zone 8a: -9.5 to -12.2 ° C (10 to 15 °F); Tifton, GA Zone 8b: -6.7 to –9.4 °C (15 to 20 °F); Austin, TX; Gainesville, FL Portions of GA fall into all four of these zones.											
SOIL TEMP. (℃)	17.8	22.5	27.1	29.9	31.0	30.4	27.9	23.3	12.2	12.2	10.6	13.1
RAINFALL (mm)	127	97	89	114	142	122	86	58	58	114	114	107
AMBIENT TEMP. (℃)	21.0	25.4	29.3	31.9	32.6	32.5	30.7	26.3	21.0	17.3	16.4	17.8
FUMIGATION SCHEDULE[A]					▶◀							
PLANTING SCHEDULE[A,B]	⇉⇇				▶◀							
KEY HARVEST (MARKET) WINDOW[A,B]			⇉		⇇			▶	◀			

Shaded areas represent typical duration of activity. Darker shaded areas represent duration of activities for the second crop.

[A] Methyl bromide applied either in the spring or fall allows the grower to economically produce at least two crops (sometimes 3 or 4), the second crop usually cucumbers, from one fumigation event.

[B] Two crops are represented from one fumigation event.

▶= initiation of fumigation or planting and/or harvest of first crop; ◀ = termination of fumigation or planting and/or harvest of first crop. ⇉ = initiation of planting and/or harvest of second crop; ⇇ = termination of planting and/or harvest of second crop.

TABLE B 2C: MICHIGAN - CHARACTERISTICS OF CROPPING SYSTEM

CHARACTERISTICS	MICHIGAN
CROP TYPE:	Vegetable crop for the fresh market
ANNUAL OR PERENNIAL CROP:	Annual -- generally 1 year
TYPICAL CROP ROTATION AND USE OF METHYL BROMIDE FOR OTHER CROPS IN THE ROTATION:	Rotation sequence commonly followed by a pepper or cucurbit crop
SOIL TYPES:	Sandy loam, clayish loam
FREQUENCY OF METHYL BROMIDE FUMIGATION:	1 time every 2 years
OTHER RELEVANT FACTORS:	Michigan's diversified vegetable crop production is designed to meet key late spring and summer market demands in Midwestern states.

TABLE B 3C: MICHIGAN - CHARACTERISTICS OF CLIMATE AND CROP SCHEDULE

MONTH	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb
CLIMATIC ZONE "PLANT HARDINESS ZONE"	Generally characterized as 5b according to the USDA Hardiness Zone Map, with annual minimum temperature ranges (average) as –23.4 to –26.1 °C (-15 to –10 °F). Example cities: Columbia, Missouri and Mansfield, Pennsylvania.											
SOIL TEMP. (℃)	<10	10 - 15	15-20	20-25	20-25	20-25	20	10-15	<10	<10	<10	<10
RAINFALL (mm)	40	72	101	48	47	32	17	31	36	20	6	8
OUTSIDE TEMP. (℃)	0.2	7.4	12.1	17.5	20.6	20.9	18.1	8	2.4	-2.9	-8	-7
FUMIGATION SCHEDULE		▶◀										
PLANTING SCHEDULE			▶◀									
KEY HARVEST (MARKET) WINDOW					▶			◀				

Shaded areas represent typical duration of activity; ▶ = typical initiation of activity, ◀ = typical termination of activity.

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

In **Florida**, karst topographical features are prevalent and this severely limits the use of 1,3-D in that State. There are also restrictions on 1,3 D use in areas in Florida that cannot support seepage irrigation. There are no atypical characteristics identified in the nomination which might prevent the utility of Devrinol™ (napropamide) or trifluralin for nutsedge control and for control of broad-leaved weed species, such as morningglory. The herbicide halosulfuron has label limitations such as reduced effectiveness if rain events follow within 4 hours of application and plant-back restrictions (0 to 36 months) (U.S. EPA, CUN 2003/050).

In **Georgia**, nearly all the vegetable production occurs on Coastal Plain Soils, which are subject to high temperatures and excess heat. In addition to weeds, soil-borne fungal pathogens and plant-parasitic nematodes are endemic to the region, and nearly all production areas have severe infestations, thereby necessitating annual treatment with a soil fumigant. To a lesser extent Georgia also faces limitations on use of 1,3 D due to karst topographical features.

Michigan experiences heavy rainfall events across the state at any given moment during the growing season. Heavy rain (over 25 mm) can trigger rapid root and crown rot development and promote dissemination of *Phytophthora capsici* via irrigation sources. Generally, there is no difference in the amount of infection depending on soil type or production area. The pathogen is widespread and indigenous on almost all soil types in Michigan (Cortwright, 2003; Gevens and Hausbeck, 2003). Soil fumigation needs to be completed by the first week of May to allow growers to plant early and capture the early market (July-September). Significant rainfall events (>25.4 mm) or cold soil temperatures (<4.4 °C) could delay fumigation and planting. Cold soil temperatures often occur in early spring (March – April) in this region (Schaetzl and Tomczak 2001). Finally, lighter soil types may make drip application difficult (Cortright, 2003).

12. 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 4a: FLORIDA - 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)*	728	728	647	647	567	304
AMOUNT OF METHYL BROMIDE ACTIVE INGREDIENT USED *(total kilograms)*	114,623	114,623	101,888	100,284	86,899	46,463
FORMULATIONS OF METHYL BROMIDE *(Methyl Bromide/ Chloropicrin)*	67:33	67:33	67:33	67:33	67:33	67:33
METHOD BY WHICH METHYL BROMIDE APPLIED	Injected 25-30 cm depth	Injected 25-30 cm depth	Injected 25-30 cm depth	Injected 25-30 cm depth	Injected 25-30 cm depth	Injected 25-30 cm depth
ACTUAL DOSAGE RATE FOR THE ACTIVE INGREDIENT *(g/m^2)**	16.5	16.5	16.5	16.5	16.5	16.5

TABLE B 4b: GEORGIA - 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)*	315	321	346	291	350	419
AMOUNT OF METHYL BROMIDE ACTIVE INGREDIENT USED *(total kilograms)*	47,288	48,139	51,968	43,763	52,515	62,907
FORMULATIONS OF METHYL BROMIDE *(Methyl Bromide/ Chloropicrin)*	67:33	67:33	67:33	67:33	67:33	67:33
METHOD BY WHICH METHYL BROMIDE APPLIED	Injected, 20.3 to 30.5 cm, under tarp	Injected, 20.3 to 30.5 cm, under tarp	Injected, 20.3 to 30.5 cm, under tarp	Injected, 20.3 to 30.5 cm, under tarp	Injected, 20.3 to 30.5 cm, under tarp	Injected, 20.3 to 30.5 cm, under tarp
ACTUAL DOSAGE RATE FOR THE ACTIVE INGREDIENT *(g/m^2)**	16.5	16.5	16.5	16.5	16.5	16.5

TABLE B 4c: MICHIGAN - 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)*	32	34	32	35	39	34
AMOUNT OF METHYL BROMIDE ACTIVE INGREDIENT USED *(total kilograms)*	3,905	4,057	3,848	4,179	4,712	4,063
FORMULATIONS OF METHYL BROMIDE *(Methyl Bromide/ Chloropicrin)*	67:33 or 50:50	67:33 or 50:50	67:33 or 50:50	67:33 or 50:50	67:33 or 50:50	67:33 or 50:50
METHOD BY WHICH METHYL BROMIDE APPLIED	Injected 20-25 cm strip treatment	Injected 20-25 cm strip treatment	Injected 20-25 cm strip treatment	Injected 20-25 cm strip treatment	Injected 20-25 cm strip treatment	Injected 20-25 cm strip treatment
ACTUAL DOSAGE RATE FOR THE ACTIVE INGREDIENT *(g/m^2)**	12.1 or 9.0	12.1 or 9.0	12.0 or 9.0	12.0 or 9.0	12.0 or 9.0	15.0

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

13. 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
CHEMICAL ALTERNATIVES	
1,3 –D (Telone™)	Limestone channels potentially leading to groundwater (karst topographical features) underlies a portion of **Florida** production areas. Label restriction states that these products cannot be used where karst topographical features exists or where seepage irrigation is not possible in Florida. In **Georgia**, about 8 % of the production area is estimated to be affected by the karst restriction. Telone is not labeled for use in Dade County in Florida. See Appendices for details on the extent of karst. By itself, Telone may not adequately control nutsedge. Up to 2 applications of Telone II, in-line, or EC formulations may be needed to manage moderate to severe pest population levels. Also, there is a 28-day waiting period at the time of application until planting, which could cause loss of over half of the harvest season and the higher-end market windows to be missed. These are plantings made in July and harvested in the fall (Georgia CUE # 03-0049; Kelley, 2003). This only applies to light to moderate infestations (for which the US does not request a CUE) and only with Telone C-35. **In Michigan:** 1,3-D is inconsistently effective against soil-borne fungi. In a study conducted in Oceana County, Michigan, yields from pepper plots treated with 1,3-D+chloropicrin were comparable to yields from plots treated with methyl bromide + chloropicrin (Hausbeck and Cortright, 2004). These results were from fumigation conducted in June and need further validation under cooler conditions and on a larger scale. There is also a Federal label restriction of a 30.4 m buffer zone between treated fields and inhabited structures, which will reduce overall pest control in a field. Also, a 28-day waiting period for planting may be disruptive to timely eggplant production and marketing.
Halosulfuron	Registered for use on eggplant (Dec. 2002, US EPA, Aug. 2003); use restricted to the row middle only; potential crop injury; severe plant back restrictions from 3 to 36 months for most vegetables; severe restrictions when used in pest management strategy that includes soil-applied organophosphates.

NAME OF ALTERNATIVE	TECHNICAL AND REGULATORY* REASONS FOR THE ALTERNATIVE NOT BEING FEASIBLE OR AVAILABLE
Metam-sodium (Vapam™)	Does not work under high weed pest pressure and has only limited utility as a complementary treatment with other fumigants and herbicides (Noling, 2003). Considered as best available alternative for Dade County only (Aerts, 2003). Also, there is a 21-day waiting period at the time of application until planting (40% of harvest season missed), which may cause part of the higher-end market windows to be missed. This crop is planted in July and harvested in the fall. Beginning the application cycle earlier is not an option, since crops from the previous fumigation cycle must be terminated and cleaned up prior to metam application (Georgia CUE # 03-0049; Kelley, 2003). Repeated applications of MITC (the breakdown product of metam sodium) are known to enhance its biodegradation as a result of adapted microorganisms (Duncan and Yates, 2003). **For Michigan:** Poor fumigant with erratic results and inconsistent distribution in soil profiles; does not control *Phytophthora* (California Pepper Commission, CUE 02-0017; CUE03-0017). Repeated applications of MITC (the breakdown product of metam sodium) are known to enhance its biodegradation as a result of adapted microorganisms (Duncan and Yates, 2003). Phytotoxicity has been reported with this fumigant. 21-day day waiting period for planting may be disruptive to timely eggplant production and marketing. In a study conducted in Oceana County, Michigan by Hausbeck and Cortright (2004), yields from pepper plots treated with metam potassium (K-Pam) were comparable to yields from plots treated with methyl bromide + chloropicrin. However, this trial was conducted under optimally warm conditions inf June, and need to be validated under cooler conditions and on a larger scale.
Napropamide (Devrinol™)	Weak in terms of nutsedge efficacy; does not control established weeds (CUE 03-0017); waste of money (Noling, 2003).
Trifluralin	Aids in control of annual grasses; does not manage broadleaf weeds. May cause excessive crop stress leading to reductions in stands and yields.
Chloropicrin	Does not distribute evenly throughout the soil profile when used by itself, resulting in poor efficacy. Does not control *Phytophthora capsici* when used at maximum label rates. (California Pepper Commission, CUE 02-0017; CUE03-0017). Not effective as a stand-alone product against weeds such as nutsedge.
NON CHEMICAL ALTERNATIVES	
Solarization	Weed density (yellow and purple nutsedge was greater in the solarized treatments compared to the methyl bromide treatment. Worked for the 1st year in FL peppers; if pest threshold is low (Chellemi, et al., 1997)
Myrothecium verrucaria (Ditera™)	Biological nematicide; registered on broad range of crops, field efficacy is untested
COMBINATION OF ALTERNATIVES	
1,3-D + chloropicrin (Telone II or Telone C-35) + Devrinol + trifluralin	Strategy involves applying 1,3-D Flat Fumigation, followed by chloropicrin 3-4 wks post fumigation + both herbicides before laying plastic. Chloropicrin may not be efficacious in managing white mold (*Sclerotium rolfsii*). Producers in Dade County are prohibited from using Telone products.
Solarization + 1,3-D	May work in areas with low weed, pest or disease pressure. Eliminated root galling and high density of root-knot nematodes. (Chellemi, D.O., et al. 1997. Application of soil solarization to Fall Production of cucurbits and pepper. Proc. Fla. State Hort. 110:333-336.)
Solarization + biocontrol fungus, *Gliocladium virens*	Ristaino, J.B., Perry, K.B. and R. D. Lumsden. 1996. Soil solarization and *Gliocladium virens* reduce the incidence of southern blight (*Sclerotium rolfsii*) in bell pepper in the field. Biocon.Sci. and Tech. 6:583-593.

NAME OF ALTERNATIVE	TECHNICAL AND REGULATORY* REASONS FOR THE ALTERNATIVE NOT BEING FEASIBLE OR AVAILABLE
1,3-D followed by chloropicrin	Culpepper and Langston (2004) tested the effectiveness of several soil fumigant combinations against nutsedges and nematodes on peppers in Tifton, **Georgia.** Results show that 1,3-D followed by chloropicrin was significantly less effective than methyl bromide against purple and yellow nutsedge, but as effective as methyl bromide against soil nematodes. This combination, however, performed as well as methyl bromide in terms of spring and fall crop yield. This promising treatment requires further testing and validation in commercial fields. **For Michigan**: The 28-day waiting period for planting caused by low soil temperatures could disrupt the eggplant production and marketing timing. Regulatory restrictions due to concerns over human exposure and ground water contamination, along with technical limitations, result in potential economic infeasibility of this formulation as a practical methyl bromide alternative. In a study conducted in Oceana County, Michigan by Hausbeck and Cortright (2004), yields from pepper plots treated with 1,3-D+chloropicrin were comparable to yields from plots treated with methyl bromide + chloropicrin. These results, however, were from fumigation conducted under the optimally warm conditions of June, and require further validation in cooler conditions and at larger scales.
1,3-D + chloropicrin (Telone C35) followed by chloropicrin	Culpepper and Langston (2004) tested the effectiveness of several soil fumigant combinations against nutsedges and nematodes affecting peppers in Tifton, Georgia. In this study, 1,3-D + chloropicrin, followed by more chloropicrin was more effective than methyl bromide against yellow nutsedge, but less effective against purple nutsedge. This treatment performed as well as methyl bromide in terms of spring crop yield, but poorly in terms of fall yield. This combination does not appear to show promise as a methyl bromide alternative.
1,3-D + chloropicrin (Telone C35) followed by metam sodium	Culpepper and Langston (2004) tested the effectiveness of several soil fumigant combinations against nutsedges and nematodes affecting peppers in Tifton, Georgia. In this study, 1,3-D + chloropicrin, followed by metam sodium, was 36% less effective than methyl bromide against purple nutsedge, but as effective as methyl bromide against yellow nutsedge and soil nematodes. In terms of spring and fall crop yield, this treatment performed as well as methyl bromide. This combination is promising and will require further testing and validation in commercial fields.
UGA3-WAY Treatment	A soil treatment recently developed by the University of Georgia is a promising methyl bromide replacement for Georgia's eggplant crop grown in the spring, although not for the summer or fall crops. This treatment, known as **UGA-3-WAY**, consists of three successive soil fumigations, beginning with a1,3-D (Telone II) application, followed by a chloropicrin application, followed by a metam application (Culpepper, 2007a). This treatment has been used to accelerate transition away from methyl bromide. See appendix A for details.
Metam Sodium/Crop Rotation	The limitations of metam-sodium/potassium were discussed above. A 4-5 year rotation cycle is necessary to reduce inoculum levels. The economic threshold of *Phytophthora capsici* is presumed to be 1 oospore/ft^2 (Michigan CUE 03-0061). Because of high land costs, very few crops are of high enough economic value to be rotated with eggplants. Also, 21-day day waiting period for planting after metam sodium fumigation may be disruptive to timely eggplant production and marketing.
Metam Sodium/Furfural (Multigard™)	Results of a 2003 small plot study demonstrated practically equivalent soil pest control of target pests (plot vigor) and slightly lesser yields than methyl bromide (Hausbeck and Cortright, 2004). However, furfural is not registered for use on eggplant by the U.S.EPA.

Add more rows if necessary

* Regulatory reasons include local restrictions (e.g. occupational health and safety, local environmental regulations) and lack of registration.

** Citations should be recorded by a number only, to indicate citations listed in Question 22.

14. 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)***:**

The U.S. EPA only considered those technically feasible registered alternatives which are relevant for managing severe pathogen and pest pressures.

Paraquat and glyphosate will suppress (but not control) emerged nutsedge, but cannot be used on crop rows because of potential crop injury (SE Pepper Consortium CUE for 2004).

Summer or fall fumigation with products containing 1,3-D and metam sodium (Vapam and/or K-pam) is unfeasible because of the waiting periods required for planting following treatment (28 days for 1,3-D and 21 days for metam sodium). Such delays would cause reduction in yields and market windows missed. Since the fall crop is dependent upon timely planting, a long waiting period would cost growers half of the harvest season, thereby missing the higher market windows (Kelley, 2003).

While fungicides are available for use when pathogens infect aerial portions of crops, methyl bromide is not used in such events, but rather to keep newly new transplants from being infected. Potential yield losses to *Phytophthora capsici* affect up to 10% of the production area, especially if plants are infected early in the growing season. This situation is exacerbated by the widespread occurrence of indigenous populations of *P. capsici* (Michigan CUE #03-0061; Gevens and Hausbeck, 2003); rainfall events greater than 254 mm, which trigger rapid disease development; metalaxyl and mefenoxam-insensitivity reported for *Phytophthora* spp. in several vegetable production areas (Lamour and Hausbeck, 2003; Parra and Ristaino, 1998), and planting restrictions for alternative fumigants (e.g. 1,3-D + chloropicrin and metam-sodium).

Because of label-mandated planting delays of up to 30 days for 1,3-D or metam-sodium/ potassium + chloropicrin, growers who plant eggplant early in the season would face losses of their target markets if forced to use these options, even if pests were adequately controlled. For these growers, fumigation must be completed by the first week of May in order to plant early and capture the early market (July - September) along with its premium prices, as well as to ensure demand for their crop during the entire growing season, especially during the mid and late season. According to the applicant, Michigan's diversified vegetable crop industry is designed to meet market demands in the late spring and through summer for the Midwest, thus requiring carefully-timed planting and harvesting schedules.

15. 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.*):

A: KEY PATHOGENS: *Phytophthora capsici*, *Pythium* spp. and nematodes (*Meloidogyne* spp.)

Summary of studies relevant to key pathogens

Hausbeck and Cortright (2004) conducted a small-plot field trial on several vegetables, including eggplant, at Michigan State University. Results, submitted with the 2007 CUE request, indicate that 1,3 D + 35 % chloropicrin treatments (shank-injected at 56.7 liters/ha) for control of *Phytophthora* and *Fusarium* resulted in a 44% yield loss, compared to methyl bromide plots. Chloropicrin plots alone (shank-injected at 233.6 l/ha) showed a 15.5% loss compared to methyl bromide plots. Metam-potassium + chloropicrin plots showed yields similar to those treated with methyl bromide. Metam-sodium was not tested, but can be assumed to be equivalent to metam-potassium since the active ingredient is the same. Even large differences in average yields across various treatments were often not statistically significant. To date, no new data have been generated to complement this work, though further research is planned (see Section 17 below).

In studies with other vegetable crops, fumigation with 1, 3 D + chloropicrin has generally provided better control of fungi than metam-sodium , though still not as good as control with methyl bromide. For example, in a study using a bell pepper - squash rotation in small plots, Webster et al. (2001) found significantly lower fungal populations with 1,3 D + 35 % chloropicrin (drip applied, 146 kg/ha of 1,3 D), as compared to the untreated control. However, methyl bromide (440 kg/ha, shank-injected) reduced fungal populations even more. *P. capsici* was not present in test plots, though *Fusarium* spp. were. However, as compared to the methyl bromide standard treatment plots, squash fruit weight was 63 % lower in the 1,3 D plots. The proportion of marketable squash fruit in the 1,3 D plots was 30 % lower than that in the methyl bromide plots. In another study, conducted on tomatoes, Gilreath et al. (1994) found that metam-sodium treatments did not match methyl bromide in terms of plant vigor at the end of the season. *Fusarium* (but not *P. capsici*) was one of several pests present.

These studies indicate that, while the Michigan trials show promise for metam-sodium/potassium + chloropicrin, there is inconsistency in efficacy and protection from yield losses. However, the trials were conducted in June, and it is unclear whether these results would hold if fumigation were done under cooler spring temperatures. Further, no large scale field trials have yet been performed to demonstrate consistent pest control similar to that provided by methyl bromide.

Culpepper and Langston (2004) compared the effectiveness of several soil fumigants on nematodes affecting peppers in Tifton, Georgia. Since eggplants were not included in these tests, data from peppers are again used to "bridge" a discussion. Results show that 1,3-D followed by chloropicrin was as effective as methyl bromide against nematodes. Spring and fall crop yield in these plots were similar to yield in methyl bromide plots.

Root knot nematodes *Meloidogyne* spp., also affect Georgia eggplants. Their damage to the root may facilitate plant invasion by fungal pathogens, which can lead to wilt, loss of plant vigor, and yield losses. Fumigant alternatives such as metam-sodium have proven inconsistent (Noling, 2003; FFVA, 2002).

Diseases caused by soil-borne fungi, (e.g., *Phytophthora* spp., *Pythium* spp. and *Sclerotium rolfsii*) are endemic in many vegetable production areas in Georgia. Fungicides such as chlorothalonil and azoxystrobilurin are only used prophylactically and may not offer sufficient plant protection. Resistance of *Phytophthora* spp. to metalaxyl and mefenoxam has been reported in tomato and pepper (Lamour and Hausbeck, 2003)

The use of 1,3-D and metam sodium in the fall is impractical because of the long waiting periods for planting following application under plastic mulch. For 1,3-D there is a 28 day waiting period; for metam sodium, there is a 21-day waiting period. Such delays would cost growers at least half of the harvest season, thereby missing the higher market windows. Thus, since the fall crop is dependent upon timely planting, the required waiting period would cost growers at least half of the harvest season, thereby missing the higher market windows (Kelley, 2003).

B: KEY WEEDs: Nutsedges

TABLE C 2: DATA ON TRIALS OF FUMIGANT ALTERNATIVES TO METHYL BROMIDE FOR POLYETHYLENE-MULCHED TOMATO (LOCASCIO ET AL. 1997)

Chemicals	Rate (kg/ha)	Average Nutsedge Density (#/m^2)	Average Marketable Yield (ton/ha)	% Yield Loss (compared to methyl bromide)
Untreated (control)	-	300 [ab]	20.1 [a]	59.1
methyl bromide + Pic (67-33), chisel-injected	390 kg	90 [c]	49.1 [b]	---
1,3 D + Pic (83-17), chisel-injected	327 l	340 [a]	34.6 [c]	29.5
Metam Na, Flat Fumigation	300 l	320 [a]	22.6 [a]	54.0
Metam Na, drip irrigated	300 l	220 [b]	32.3 [c]	34.2

Add more rows if necessary
** Citations should be recorded by a number only, to indicate citations listed in Question 22.

Narrative description of studies relevant to target weeds

For nutsedge pests, which are widespread in all requesting regions except Michigan, growers do not have technically feasible alternatives to methyl bromide use at planting. Metam-sodium and 1,3 D + chloropicrin have shown some efficacy in small-plot trials in other vegetable crops (e.g, tomato). However, metam sodium use may result in a 44% yield loss, while use of 1,3 D may result in a 29% loss. These fumigants often provide less control of nutsedges than methyl bromide. Furthermore, there is evidence that both 1,3 D and methyl isothiocynate levels decline more rapidly due to enhanced degradation of these chemicals by soil microorganisms, thus further compromising efficacy, in areas where these are repeatedly applied (Smelt et al., 1989; Ou et al., 1995; Gamliel et al., 2003; Dungan and Yates, 2003).

Results from small plot studies conducted in Tifton, Georgia, by Culpepper and Langston (2004) show that 1,3-D followed by chloropicrin was significantly less effective than methyl bromide against both purple and yellow nutsedge, although this treatment performed as well as methyl bromide relative to spring and fall crop yield. 1,3-D + chloropicrin, followed by more chloropicrin was more effective than methyl bromide against yellow nutsedge, but less effective against purple nutsedge. This treatment performed as well as methyl bromide in terms of spring yield, but poorly in terms of fall yield. 1,3-D + chloropicrin, followed by metam sodium was 36% less effective than methyl bromide for purple nutsedge control, but as effective as methyl bromide against yellow nutsedge. However, test plots were small, and it is unclear if these results will hold in commercial fields, considering the variable results reported elsewhere for these alternatives. The nutsedge populations in this study were dominated by yellow nutsedge (90% of the total). It is not clear if populations where purple nutsedge is dominant would be controlled as effectively, since other studies have shown that purple nutsedge is a hardier species.

In Florida, the best currently available alternative for eggplant production (which cannot be used in areas containing karst topographical features) is an application of Telone C-35 (1,3-D + 35% chloropicrin), at 35 gallons per acre, 3-5 weeks before transplanting, followed by an application of a herbicide mix of napropamide and trifluralin to the top of the raised bed at the time of tarp laying (Noling and Botts, 2007).

A soil treatment recently developed by the University of Georgia appears to be promising as a methyl bromide replacement for Georgia's eggplant spring crop, although not for the summer or fall crops. This treatment, known as **UGA 3-WAY**, consists of three successive soil fumigations, beginning with a1,3-D (Telone II) application, followed by a chloropicrin application, followed by a metam application (Culpepper, 2007a).

In 2006, Culpepper *et al*. (2007a) tested the effectiveness of fall applications of methyl bromide alternatives, including the UGA 3 WAY treatment, on nutsedges infesting the spring bell pepper crop in TyTy, Georgia. Results of this small-plot study show that the UGA 3-WAY alternative (see above) performed as well as the standard methyl bromide application. Similarly, reducing the standard rates of methyl bromide by 50%, from 392 kg/ha under standard LDPE film to 196 kg/ha under metalized film, also provided excellent purple nutsedge control. Pepper yields were comparable in all treated plots.

In a related small plot trial, conducted by Culpepper (2007b) in Echols County, Georgia, during the spring of 2006, excellent purple nutsedge control was achieved with 484 kg of methyl bromide/ha under standard film and 336 kg of methyl bromide/ha under metalized film. However, further reducing the methyl bromide rate by 50% to 224 kg/ha, under metalized film, resulted in poor nutsedge control. Soil fumigation took place in February. Culpepper concludes that, based on research conducted over the past three years with methyl bromide applied under metalized film, a 33% reduction of the standard 67:33 formulation is possible in fields heavily infested with weeds, and a 40% reduction in fields with light weed infestations, whereas reducing the methyl bromide rate by 50% would be unsustainable for weed control.

Results from a trial conducted during the fall of 2007 in Georgia show that the 3-WAY approach provided very poor nutsedge control

However, the use of the GA 3-WAY alternative treatment appears to affect the size composition of the harvested peppers, producing more of the largest (jumbo) peppers, but less of some of the smaller ones, with a net decrease in total pepper volume harvested, suggesting that further studies are needed to further elucidate the economic consequences of shifting to this alternative. (Culpeper, *et al.,* 2007b).

Although these results are promising, results from small plot research need to be verified at the commercial level, in on-farm trials. Furthermore, most research in Georgia has so far focused on nutsedge. Additional work is needed to determine the efficacy of alternatives on other weed species, such as morning glory and pigweed. Finally, the economics of transitioning to alternatives has not been fully worked out, including the cost and durability of films and the modification of fumigation equipment.

16. 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*):

Several chemical and non-chemical methods are being investigated for use as possible methyl bromide replacements, ranging from iodomethane, which has potential to become a drop-in replacement for some crops, to radio waves which may one day be used to sterilize the soil.

Until a chemical is registered, and only after efficacy against key pests is demonstrated in repeated trials at commercial scales, does the USG consider that a chemical or technology is a bona fide replacement for methyl bromide.

Iodomethane: On October 5, 2007, the U.S. EPA approved the registration of this soil fumigant for one year under highly restrictive provisions governing its use. However, it is not approved for use on eggplant.

Propargyl bromide: Under proprietary development for future registration submission.

Sodium azide: Under proprietary development for future registration submission.

Furfural: registered for greenhouse ornamentals only. Under proprietary development for other registration submission.

DMDS (dimethyl disulfide): Under proprietary development for future registration submission.

17. (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):

No. Areas where methyl bromide is not used in this region do not face moderate to severe populations of the key pests.

(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 feasible for large production and/or limited resources.

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

No studies have been done to demonstrate technical and economic feasibility of such systems in open field eggplant crops in the US. None appear to be planned by US researchers for the near future.

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.

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

(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.

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

(Renomination Form 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 US 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 next SIP (for June, 2007) to meet the new lower ozone standards.

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

18. 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 USED 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?	In 2006, high barrier films were used in over 50% of Florida's acreage. VUF adoption is not anticipated in Michigan due to its fragility under local weather conditions. Use of metalized film and VIF in Georgia is expected to increase to 20% and 15%, respectively, in 2011 in 2006.	Florida eggplant have growers transitioned from a 67% to a 50% formulation. Georgia growers have shifted from a 67% to a 57% formulation.. Michigan growers have shifted from a 67% to a 50% formulation.	It has increased from 33% to 50% in Florida and Michigan, and from 33% to 43% in Georgia..	Will not control pathogens in root zone.	No
WHAT FURTHER USE/EMISSION REDUCTION STEPS WILL BE TAKEN FOR THE METHYL BROMIDE USED FOR CRITICAL USES?	Use of high barrier films is expected to increase to over 60% of Florida's eggplant acreage in 2007.	Further reduction of methyl bromide use rate to 123 kg/ha is expected in Florida by 2007.	Research is underway to develop use of a 50 % methyl bromide formulation in Michigan commercial production systems.	Not feasible because fumigant would not be located in the area of heavy pest pressure.	The U.S. anticipates that the decreasing supply of methyl bromide will motivate growers to try less frequent applications.
OTHER MEASURES (PLEASE DESCRIBE)	Examination of promising but presently unregistered alternative fumigants and herbicides, alone or in combination with non-chemical methods, is planned in all regions. Measures adopted in Michigan will likely be used in the other regions when fungi are the only key pests involved				

Some studies in Florida have indicated that lower rates of methyl bromide + chloropicrin can be used under VIF or metalized films to effectively control key pests there (Gilreath et al. 2005, Culpepper's studies available at www.gaweed.com). Extension publications in Florida suggest that rates as low as 60 % of the standard 392 kg/ha of the 67:33 formulation of methyl bromide + chloropicrin is usable for the suite of key pests there (Noling and Botts 2007, Noling 2006), and this rate is likely to be feasible for the rest of the southeast as well (Culpepper, personal communication). Due to reduced availability of methyl bromide growers have been trying rates at such levels and even lower, but these are not controlled experiments.

19. 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 the use of low-permeability films, the application of water seals, and the "top dressing" application of fertilizer. 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. Therefore, these methods have been deemed currently infeasible for use in the acreage requesting methyl bromide in this nomination.

The Methyl Bromide Technical Options Committee and the Technology and Economic Assessment Panel may recommend 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 strives to minimize use and emissions of methyl bromide. The use of methyl bromide in the United States is minimized in several ways. First, because of its toxicity, methyl bromide has, for the last 40 years, been regulated as a restricted use pesticide in the United

States. As a consequence, methyl bromide can only be used by certified applicators who are trained at handling these hazardous pesticides. In practice, this means that methyl bromide is applied by a limited number of very experienced applicators with the knowledge and expertise to minimize dosage to the lowest level possible to achieve the needed results. 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.

As methyl bromide has become more scarce, users in the United States have, where possible, experimented with different mixes of methyl bromide and chloropicrin. Specifically, in the early 1990s, methyl bromide was typically sold and used in methyl bromide mixtures made up of 98% methyl bromide and 2% chloropicrin, with the chloropicrin being included solely to give the chemical a smell enabling those in the area to be alerted if there was a risk. However, with the outset of very significant controls on methyl bromide, users have been experimenting with significant increases in the level of chloropicrin and reductions in the level of methyl bromide. While these new mixtures have generally been effective at controlling target pests, at low to moderate levels of infestation, it must be stressed that the long term efficacy of these mixtures is unknown.

Tarpaulin (high density polyethylene) is also used to minimize use and emissions of methyl bromide. In addition, cultural practices are utilized by tomato growers.

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.

USDA has several grant programs that support research into overcoming obstacles that have prevented the implementation of methyl bromide alternatives. In addition, USEPA and USDA jointly fund an annual meeting on methyl bromide alternatives. At this year's meeting (held in San Diego, California) sessions were to assess and prioritize research needs and to develop a use/emission minimization agenda for methyl bromide alternatives research.

Additional specific measures are provided above in Table D 1.

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;

Economic data for the 2010 methyl bromide critical use renomination were taken from applications for methyl bromide critical use and were updated from previous nominations when newer information was available in the 2010 application. The following economic assessment is organized by methyl bromide critical use application. Expected impacts when using methyl bromide alternatives are given in tables E1 through E3 by geographic location.

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

TABLE E 1: FLORIDA - ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

FLORIDA EGGPLANT	METHYL BROMIDE	1,3-D + CHLOROPICRIN	METAM-SODIUM
YIELD LOSS (%)	0%	29%	44%
YIELD PER HECTARE	1,893	1,344	1,060
* PRICE PER UNIT (US$)	$11.33	$11.33	$11.33
= GROSS REVENUE PER HECTARE (US$)	$21,445.71	$15,227	$12,010
- OPERATING COSTS PER HECTARE (US$)	$14,951.49	$13,902	$13,186
= NET REVENUE PER HECTARE (US$)	$6,494.22	$1,325	$(1,178)
FIVE LOSS MEASURES *			
1. LOSS PER HECTARE (US$)	$0	$5,170	$7,671
2. LOSS PER KILOGRAM OF METHYL BROMIDE (US$)	$0	$34	$51
3. LOSS AS A PERCENTAGE OF GROSS REVENUE (%)	0%	24%	36%
4. LOSS AS A PERCENTAGE OF NET REVENUE (%)	0%	80%	118%
5. PROFIT MARGIN (%)	30%	9%	-10%

TABLE E 2: GEORGIA - ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

GEORGIA EGGPLANT	METHYL BROMIDE	1,3-D + CHLOROPICRIN	METAM-SODIUM
YIELD LOSS (%)	0%	29%	44%
YIELD PER HECTARE	6,023	4,276	3,373
* PRICE PER UNIT (US$)	$7	$7	$7
= GROSS REVENUE PER HECTARE (US$)	$42,359	$30,075	$23,721
- OPERATING COSTS PER HECTARE (US$)	$34,976	$30,289	$27,794
= NET REVENUE PER HECTARE (US$)	$7,383	$(214)	$(4,073)
FIVE LOSS MEASURES *			
1. LOSS PER HECTARE (US$)	$0	$7,598	$11,456
2. LOSS PER KILOGRAM OF METHYL BROMIDE (US$)	$0	$51	$76
3. LOSS AS A PERCENTAGE OF GROSS REVENUE (%)	0%	18%	27%
4. LOSS AS A PERCENTAGE OF NET REVENUE (%)	0%	103%	155%
5. PROFIT MARGIN (%)	17%	-1%	-17%

Note: Georgia eggplant revenue and cost measures were calculated using data from a two crop per growing season production system.

TABLE E 3: MICHIGAN - ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

MICHIGAN EGGPLANT	METHYL BROMIDE	1,3-D + CHLOROPICRIN
YIELD LOSS (%)	0%	6%
YIELD PER HECTARE	4,445	4,179
* PRICE PER UNIT (US$)	$8	$8
= GROSS REVENUE PER HECTARE (US$)	$37,475	$32,584
- OPERATING COSTS PER HECTARE (US$)	$26,981	$26,085
= NET REVENUE PER HECTARE (US$)	$10,494	$6,500
FIVE LOSS MEASURES *		
1. LOSS PER HECTARE (US$)	$0	$3,9974
2. LOSS PER KILOGRAM OF METHYL BROMIDE (US$)	$0	$33
3. LOSS AS A PERCENTAGE OF GROSS REVENUE (%)	0%	11%
4. LOSS AS A PERCENTAGE OF NET REVENUE (%)	0%	38%
5. PROFIT MARGIN (%)	28%	20%

Note: The unit price of eggplant was reduced by 7.5% in the analysis of economic feasibility of the alternatives to reflect price reduction that could occur if 1,3-D + chloropicrin were used in place of methyl bromide.

Summary of Economic Feasibility

There are currently few alternatives to methyl bromide for use in eggplant, and there are factors that limit existing alternatives' usability and efficacy. These include pest complex, climate, and regulatory restrictions. As shown above, the two most promising alternatives to methyl bromide in Florida and Georgia for control of nut-sedge in eggplant (1,3-D + chloropicrin and metam-sodium) are considered not technically feasible. This derives from regulatory restrictions and the magnitude of expected yield losses when they are used. Economic data representing the Florida and Georgia eggplant growing conditions are included in this section as a supplement to the biological review to illustrate the impacts of using methyl bromide alternatives, not to gauge them with respect to economic feasibility. However, in Michigan 1,3-D + chloropicrin is considered technically feasible.

Michigan

The US concludes that, at present, no economically feasible alternatives to methyl bromide exist for use in Michigan eggplant production. Yield losses and missed market windows are the factors that have proven most important in these conclusions, which are discussed individually below:

- Yield Loss: The US anticipates yield losses of 6% throughout Michigan eggplant production.

- Missed Market Windows: The US agrees with Michigan's assertion that growers will likely receive significantly lower prices for their produce if they switch to 1,3-D + chloropicrin. This is due to changes in the harvest schedule caused by the above described soil temperature complications and extended plant back intervals when using 1,3-D + chloropicrin.

  The analysis of this effect is based on the fact that prices farmers receive for their eggplants vary widely over the course of the growing season. Driving these fluctuations are the forces of supply and demand. Early in the growing season, when relatively few eggplants are harvested, the supply is at is lowest and the market price is at its highest.

As harvested quantities increase, the price declines. In order to maximize their revenues, eggplant growers manage their production systems with the goal of harvesting the largest possible quantity of eggplants when the prices are at their highs. The ability to sell produce at these higher prices makes a significant contribution toward the profitability of eggplant operations.

Specific data representing these market fluctuations are not available for Michigan eggplant. However, because of the similar production system and growing conditions, Michigan pepper price data was used to represent price fluctuations in Michigan eggplant and their impact on growers' gross revenues. Though data availability is limiting, it was assumed that if eggplant growers adjust the timing of their production system, as required when using 1,3-D + chloropicrin, that they will, over the course of the growing season, receive gross revenues reduced by approximately 7.5%. The season average price was reduced by 7.5% in analysis of the alternatives to reflect this. Based on currently available information, the US believes this reduction in gross revenues serves as a reasonable indicator of the typical effect of planting delays resulting when methyl bromide alternatives are used in Michigan eggplant production.

Florida
No technically (and thus economically) feasible alternatives to methyl bromide are presently available to the effected eggplant growers in area with karst topographic features. For spring – planted eggplant in non-karst areas the request for methyl bromide has been adjusted downwards by a 25%transition that has been applied in addition to the previous transition rate. For the remaining eggplant production the US concludes that use of methyl bromide is critical in Florida eggplant production.

Florida's application for methyl bromide critical use indicated that more than one crop is typically grown per growing season but did not provide specific production and sales data for this crop. As a result of this gap in data, economic assessment of Florida eggplant production was based on a single crop production system. This characterization of growing conditions could result in the critical need for methyl bromide appearing smaller than it actually is, because the value the second crop derives from methyl bromide is not included in the analysis.

Other potentially significant economic factors, such as price reductions due to missed market windows, were not analyzed for this region, as the case for critical use of methyl bromide is sufficiently strong based solely on yield loss.

Georgia
No technically (and thus economically) feasible alternatives to methyl bromide are presently available to the effected eggplant growers for the summer and fall eggplant crop and for eggplant grown in areas exhibiting karst topographic features. For spring –planted eggplant in non-karst areas the request for methyl bromide has been adjusted downwards by a 25%transition that has been applied in addition to the previous transition rate. For the remaining eggplant production the US concludes that use of methyl bromide is critical in Georgia eggplant production.

Other potentially significant economic factors, such as price reductions due to missed market windows, were not analyzed for this region, as the case for critical use of methyl bromide is sufficiently strong based solely on yield loss. Note that data describing Georgia eggplant production is based on double cropping production practices.

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

(i) DESCRIPTION AND IMPLEMENTATION STATUS:

See Question 15 for selected trial results and citations. Many research projects are ongoing and considerable funding are being used in this effort.

(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 Question 15 for selected trial results and citations. Many research projects are ongoing and considerable funding are being used in this effort.

(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.)*

During the preparation of this nomination the USG has accounted for all identifiable means to reduce the request. Specifically, approximately 13 million kilograms of methyl bromide were requested by methyl bromide users across all sectors. USG carefully scrutinized requests and made subtractions to ensure that no growth, double counting, inappropriate use rates on a treated hectare basis was incorporated into the final request. Use when the requestor qualified under some other provision (QPS, for example) was also removed and appropriate transition given yields obtained by alternatives and the associated cost differentials were factored in. As a result of all these changes, the USG is requesting roughly 1/3 of that amount.

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

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

The USG has the ability to 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 an EUP or to require growers to participate.

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

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

The USDA maintains an extensive technology transfer system, the Agricultural Extension Service. This Service is comprised of researchers at land grant universities 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.

(i) DESCRIPTION AND IMPLEMENTATION STATUS:

See above.

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

See Question 15 for selected trial results and citations. Many research projects are ongoing and considerable funding are being used in this effort.

(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 USG feels that no additional change in methyl bromide quantity requested is necessary. 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:

See above.

Ongoing field trials require results to be validated for commercial application. Therefore, some period of time after publication of field trials is needed for commercial testing and implementation.

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

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

(i) DESCRIPTION AND IMPLEMENTATION STATUS:

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

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

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

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

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

2010 Methyl Bromide Usage Newer Numerical Index - BUNNIE							Eggplant	
January 23, 2008		Region		Michigan Eggplant	Florida Eggplant	Georgia Eggplant	Sector Total or Average	Notes
Other Considerations	Marginal Strategy - Among Best Strategies & Economic Analysis (See Chapter)	Possible Regime		Telone+Pic	Telone+Pic	Telone+Pic		
		Loss Estimate (%) - Yield (Y), Quality (Q), Market Window (M), Time (T)		22% Y + T	29% Y + T	29% Y + T		
		Loss per Hectare (US$/ha)		$ 4,034	$ 5,252	$ 7,593		
		Loss per Kg of MeBr (US$/kg)		$ 34	$ 35	$ 51		
		Loss as a % of Gross Revenue		12%	24%	18%		
		Loss as a % of Net Op Revenue		39%	82%	72%		
	Dichotomous Variables (Y/N)	Strip or Bed Treatment?		Strip	Strip	Strip		
		Currently Use Alternatives?		Yes	Yes	Yes		
		Tarps / Deep Injection Used?		Tarp	Tarp	Tarp		
	Other Issues	Frequency of Treatment (x/ yr)		1x per year	1x per year	1x per year		
		Change in CUE Request		increase	decrease	same	decrease	
Most Likely Combined Impacts (%)		Florida Telone Restrictions (%)		0%	65%	8%		
		100 ft Buffer Zones (%)		0%	1%	0%		
		Key Pest Distribution (%)		75%	53%	53%		
		Regulatory Issues (%)		0%	0%	0%		
		Unsuitable Terrain (%)		0%	0%	0%		
		Cold Soil Temperature (%)		100%	0%	0%		
		Total Combined Impacts (%)		**100%**	**84%**	57%		
Most Likely Baseline Transition		(%) Able to Transition		0%	25%	25%		
		Minimum # of Years Required		0	7	7		
		(%) Able to Transition / Year		**0%**	**4%**	**4%**		
Joint Adjusted Use Rate			kg/ha	**150**	**165**	**165**		*
Joint Adjusted Dosage Rate			g/m2	15.0	16.5	16.5		
2010 US CUE Application Information		*Amount - Pounds*	Pounds	*10,000*	*102,751*	*107,736*	*220,487*	
		Area - Acres		*93*	*750*	*804*	*1,647*	
		Rate (lb/A)		*107.53*	*137.00*	*134.00*	*134*	
		Amount - Kilograms	Metric	**4,536**	**46,607**	**48,868**	**100,011**	
		Treated Area - Hectares		38	304	325	667	
		Rate (kg/ha)		121	154	150	150	
EPA Preliminary Value			kgs	**3,799**	**46,607**	**48,868**	**99,274**	
EPA Baseline Adjusted Value has been adjusted for:				Double Counting, Growth, EPA Use Rate Adjustment, Joint Use Rate Adjustment, and Combined Impacts				*
EPA Baseline Adjusted Value			kgs	2,742	24,247	17,356	44,345	*
EPA Transition Amount			kgs	-	(5,403)	(4,209)	(9,612)	*
EPA Amount of All Adjustments			kgs	**(1,057)**	**(27,764)**	**(35,721)**	**(64,541)**	
Most Likely Impact Value for Treated Area			kgs	**2,742**	**18,843**	**13,147**	**34,732**	*
			ha	**18**	**114**	**80**	**213**	
			Rate	**150**	**165**	**165**	**163**	*
Sector Research Amount (kgs)				**-**	**2010 Total US Sector Nomination**		**34,732**	

APPENDIX B FLORIDA TELONE® (1,3-D) REGULATORY RESTRICTIONS

BACKGROUND

Telone® (1,3-dichloropropene or 1,3-D) is a restricted use pesticide which is available for use by Florida fruit and vegetable growers through a special local need (SLN) registration. This registration includes specific use restrictions for certain Florida counties. In these counties, Telone® can only be used on soils having restrictive layers to downward water movement that support seepage irrigation. This is in addition to nationwide use restrictions that state that Telone® cannot be used within 100 feet of wells used for potable water or karst topographic features.

This document estimates the area in key Florida agricultural counties that cannot use Telone® based on karst and soil restrictions. The data sources and methods used to make these estimates are described below. Telone® use restrictions are an important consideration because Telone® is a potential replacement for methyl bromide. The agricultural counties considered in this analysis grow crops that have submitted methyl bromide critical use exemptions (CUE). These counties correspond to the counties listed as having additional use restrictions on the Telone® SLN label. Estimating the area not suitable for Telone® use is part of the analysis conducted by the United States to determine the amount of methyl bromide that has a critical need in Florida. Fumigation with 1,3-D is an alternative to fumigation with methyl bromide, and one that results in smaller yield loss differences with methyl bromide than some of the other alternatives.

CROP INFORMATION

Methyl bromide CUEs for 2008 were submitted for several field grown specialty crops grown in Florida, including strawberry, tomato, pepper, and eggplant. This analysis focuses on these crops because Telone® is a potential alternative to methyl bromide on these crops. County level acreage for these four crops was obtained from the Census of Agriculture (USDA, 2002). Table 1 presents the major producing counties in terms of harvested acres for each crop. Figure 1 illustrates the distribution of harvested acres for each crop by each county. Figure 2 is a map of Florida counties and also indicates which counties are the major producers of these four crops. The highlighted counties account for a significant portion, generally 90% or more, of the crops' acreages and were therefore selected for this analysis.

KARST RESTRICTION

Telone® is a restricted use pesticide that cannot be used within 100 feet of karst topological features. Soil physiographic divisions in Florida having karst characteristics were used to identify karst topography in Florida. Definitions of the physiographic divisions were obtained from Brooks (1981). These physiographic divisions are associated to the Physiographic Divisions Map of Florida. The Physiographic Divisions Map of Florida, originally created by Brooks (1981), was converted to a digital format by the United States Geologic Service (USGS) et al. (2000). It is a general reference map of Florida physiographic divisions (districts, subdistricts, subdivisions) defined by Brooks (1981). USG used this map in a geographic information system (GIS) to estimate the area within each county having karst features (Appendix Table 1 and Appendix Figure 3).

Soil physiographic division characteristics used to estimate locations of karst topography may not define all karst features in Florida due to the scale and uncertainties associated with the conversion of the map into a digital format. The scale issue means that small units of karst topographical features may not be included in the physiographic divisions map, thus the proportion of land area affected by karst features is likely to be under- rather than over-estimated. Because this map was produced before GIS mapping tools were available, it was not designed for GIS use. It was converted to digital format but when overlaid on newer and more accurate GIS maps of Florida; its land area differs by approximately 3%, although not every aspect differs by this amount. The physiographic divisions map is, however, the best available information on the physiographic divisions of Florida. Currently, USG is unable to account for the magnitude of the variability associated with this map. Therefore, Table Appendix B 1 provides our best estimates of the areas in Florida with karst topographical features.

SPECIAL LOCAL NEED RESTRICTION

In addition to the Telone® use restriction related to karst topography, certain Florida counties[1] have additional soil restrictions as stated on the Telone® supplemental label. Telone® can only be used on soils having restrictive layers to downward water movement that can support seepage irrigation in specified counties. Most strawberry, tomato, pepper, and eggplant are grown in counties that have this restrictive soil layer.

Soils potentially having these restrictive layers, such as argillic or spodic horizons, are of the following taxonomic soil orders: Alfisol, Ultisol, Mollisol, and Spodosol. Electronic soil survey data for each county were downloaded from the Soil Data Mart maintained by the USDA Natural Resource Conservation Service (NRCS). County soil surveys delineate soil map units containing multiple soil types. For this analysis, the map units containing at least 50 percent of the required soils were identified as locations that meet the label requirements. The remaining map units were considered to contain soils unsuitable for Telone® use.

Electronic soil survey data were used to quantify the area within each county not suitable for Telone® use based on the soil criteria of the Florida Special Local Need (SLN) registration. Tabular data of soil surveys for each county were used as follows. First, soils series (components of soil map units) that have at least one of the four above mentioned soil orders were identified using the "Taxonomic Classification of Soils" table of the soil survey. This step identified the soil series potentially having the required restrictive layers. Second, soil map units were selected in the "Component Legend" table of the soil survey if they contained the identified soil series. The "Component Legend" table provides the percentage of each soil component in a map unit. If at least 50 percent of the map unit contains the identified soils, soils meeting the

[1] These counties include Brevard, Broward, Charlotte, Citrus, Collier, Dade, De Soto, Glades, Hardee, Hendry, Hernando, Highlands, Hillsborough, Indian River, Lake, Lee, Manatee, Martin, Monroe, Okeechobee, Orange, Osceola, Palm Beach, Pasco, Pinellas, Polk, St. Lucie, Sarasota, Seminole, Sumter, and Volusia

SLN restriction, then those map units were selected. Next, the "Acreage and Proportionate Extent of Soils" table of the soil survey was used to calculate the total acreage of the suitable map units in a county. Finally, the area not represented by these suitable soils was calculated to estimate the area not suitable for Telone® use. The areas not meeting the SLN soil requirements are presented in Table 1.

CALCULATING THE AREA OF TELONE® RESTRICTION

The areas deemed unsuitable for Telone® use due to soil restrictions may not be additive to the karst areas because locations of restricted soils and karst topography may overlap. Further spatial analysis is required to determine the total area in a county not suitable for Telone® use. In using the available information to estimate areas, therefore, USG used two assumptions: the most restrictive (in the sense of allowing the greatest use of Telone®) is that areas of karst and areas where seepage irrigation is not feasible overlap to the greatest extent possible[2]; and the less restrictive, standard statistical assumption, that both areas of karst and areas lacking a restrictive layer (areas where seepage irrigation are not feasible) are identically and independently distributed[3].

The assumption that would have resulted in the lowest level of allowable Telone® use, that the areas of karst topography and the areas where seepage irrigation is not feasible are mutually exclusive, was not used to derive estimates for the purposes of these analyses.[4]

In all instances the agricultural areas were assumed to be identically and independently distributed across soil types within the county. To make any other assumption would require a survey of each county where any one of these crops is grown. Further, growers do move areas of cultivation and also rotate crops as a means of maintaining lower pest pressures so that from year to year the results may change.

CONCLUSION

It is important to note that soil orders are the broadest class in the soil taxonomic system. Therefore, this analysis aims to identify soils that potentially have the required restrictive layers. This leads to an underestimate rather than an overestimate of areas where seepage irrigation is not feasible. Further investigation such as onsite field testing and more detailed soil survey analysis may be required to more accurately determine if a soil is suitable for Telone® use. However, USG believes this analysis provides a more quantitative understanding of Telone® use restrictions in Florida than that previously used in the methyl bromide CUE process.

REFERENCES

[2] In other words, if 20% of a county has karst topographical features and 30% lacks a restrictive layer so that seepage irrigation is not feasible, a total of 30%, the larger of the two numbers, of the county area cannot use telone®.
[3] Using the assumption of identical and independently distributed soil features, a county that had 20% of its area with karst topographical features and 30% lacking a restrictive layer, the total county area that could not use Telone® would be 44%, 30% and 20% of the remaining 70%.
[4] Using the assumption that the two restrictions are mutually exclusive, and in using the example of 20% karst and 30% lacking a restrictive layer, Telone® use would not be allowed in 50% of the are of the county.

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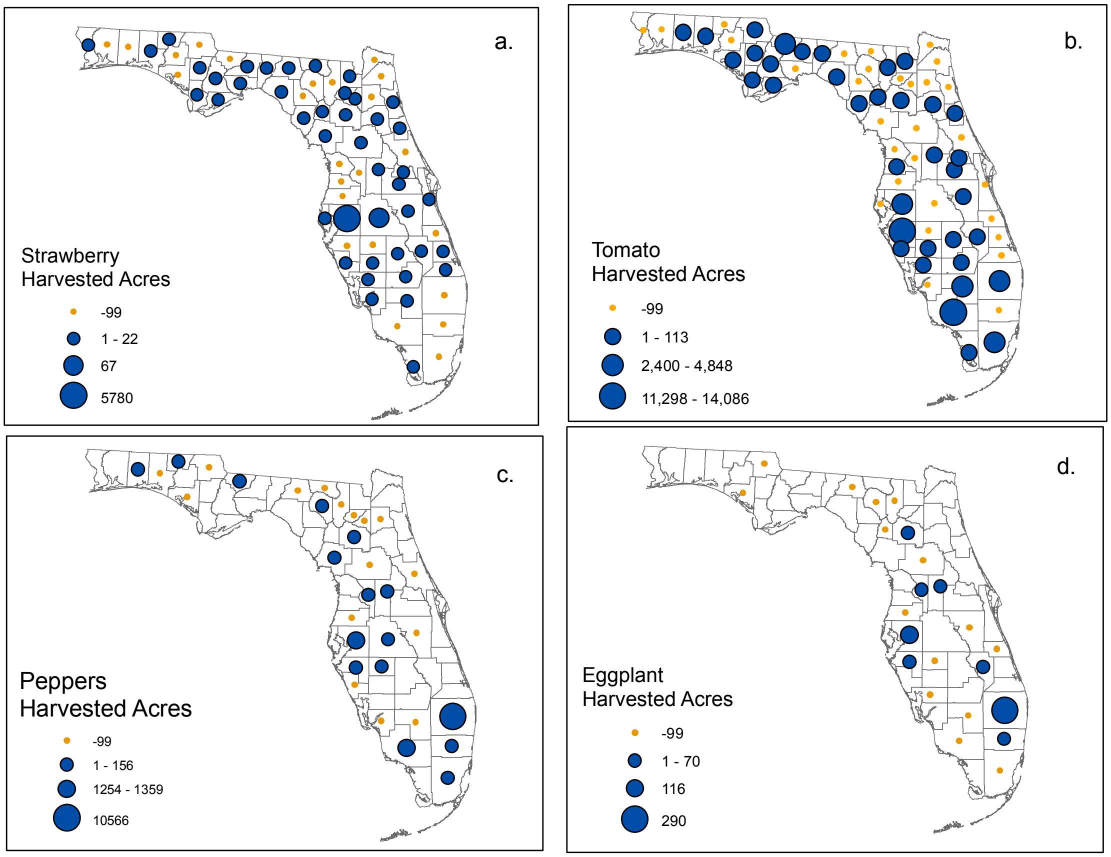
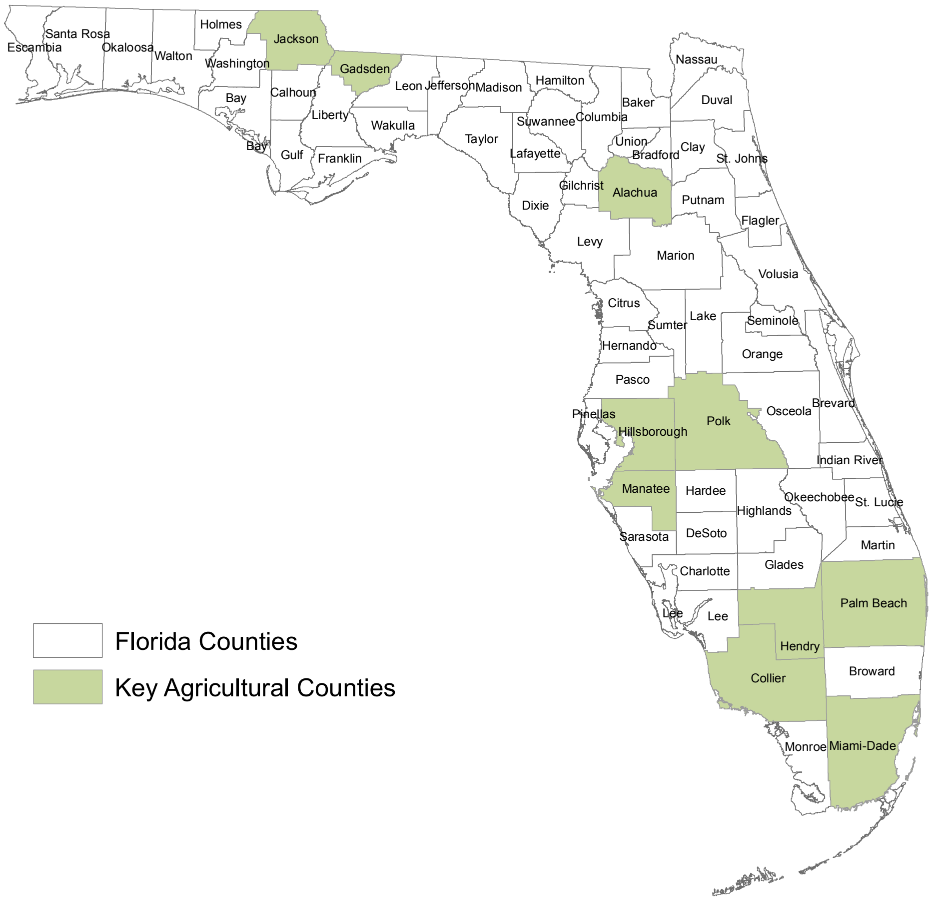
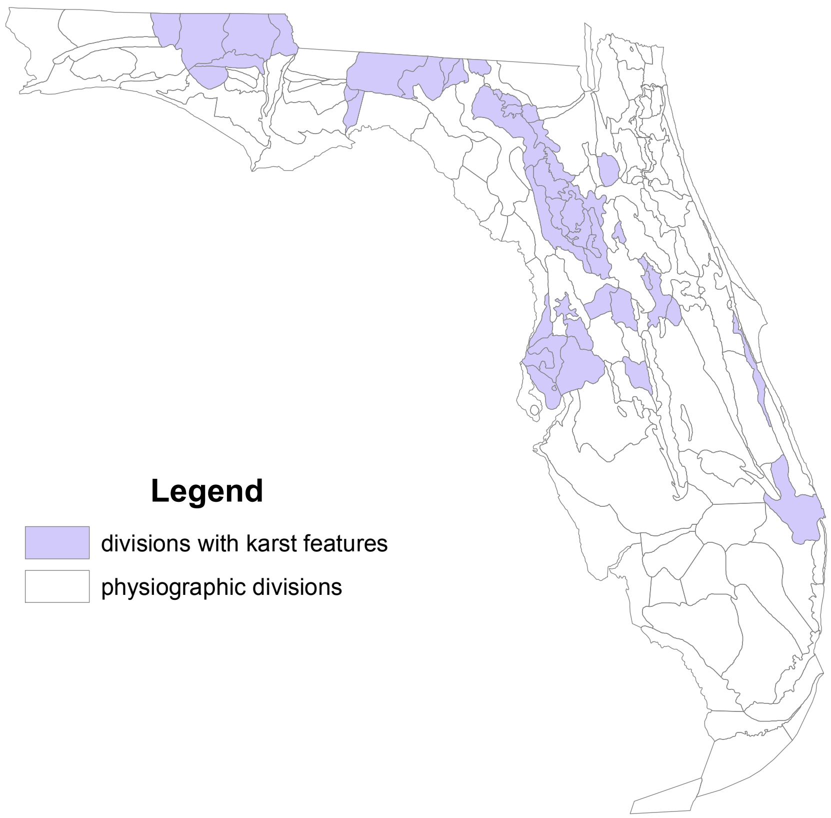


Appendix B, Figure 1. Acres Harvested for strawberry (a), tomatoes (b), pepper (c), and eggplant (d) in Florida. Data are from USDA Census of Agriculture, 2002. A county where a crop is grown but acreage is not reported is represented by -99. Florida map obtained from ESRI (2005).



Appendix B, Figure 2. Map of Florida counties. The highlighted **counties were selected for this analysis because these counties grow the bulk (generally 90% or more)of tomato, strawberry, pepper, and eggplant crops. Florida map obtained from ESRI (2005).**



Appendix B Figure 3. The Karst Area of Florida. The karst area is an estimate based on selected map divisions described to have karst feature in the Physiographic Divisions Map of Florida. The Physiographic Divisions Map of FL is a generalized map created by the USGS, University of Florida Institute of Food and Agricultural Sciences, and the St Johns River Water management District in 2000.

Appendix B Table 1. Major producing Florida counties in terms of acres harvested for strawberry, tomato, pepper, and eggplant, The areas in each county that are unsuitable for Telone® use based on soil and karst restrictions.

a. Strawberry

County[1]	Acres Harvested[2]	Karst Area[3] in County (%)	SLN Restriction of Unsuitable Soils[4] (%)
Hillsborough	5,780	50	35
Polk	67	9	55
Alachua	22	62	100*

b. Tomato

County[1]	Acres Harvested[2]	Karst Area[3] in County (%)	SLN Restriction of Unsuitable Soils[4] (%)
Collier	14,086	0	32
Manatee	11,298	0	23
Hillsborough	4,848	50	35
Hendry	4,805	0	27
Palm Beach	3,308	17	73
Miami-Dade	2,932	NA*	NA*
Gadsden	2,400	<1	100*
Jackson	113	93	100*

c. Pepper

County[1]	Acres Harvested[2]	Karst Area[3] in County (%)	SLN Restriction of Unsuitable Soils[4] (%)
Palm Beach	10,566	17	73
Hillsborough	1,359	50	35
Collier	1,254	0	32
Manatee	156	0	23

d. Eggplant

County[1]	Acres Harvested[2]	Karst Area[3] in County (%)	SLN Restriction of Unsuitable Soils[4] (%)
Palm Beach	290	17	73
Hillsborough	116	50	35
Manatee	70	0	23

1. Counties included in tables account for at least 80% of the acres harvested for each crop. The remaining acreage is scattered across other counties and no single county accounts for a significant portion.
2. Acres Harvested data are from USDA Census of Agriculture, 2002.
3. The percent Karst Area is an estimate based on selected map divisions described to have karst feature in the physiographic divisions map of Florida. The physiographic divisions map of FL is a generalized map created by the USGS, University of Florida Institute of Food and Agricultural Sciences, and the St Johns River Water management District in 2000.
4. County area based on soils not capable of supporting seepage irrigation as mandated by the SLN or special local need registration.

* Florida state agricultural experts informed US EPA that seepage irrigation is not used in the Northern Florida counties (S. Olson, personal communication via C. Augustyniak, Nov/Dec 2006). Additionally, Telone® cannot be used in Miami-Dade County and therefore, the karst and SLN area analyses were not conducted for this county (E. McAvoy, personal communication via C. Augustyniak, Nov/Dec, 2006).