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

NOMINATING PARTY:
The United States of America

NAME
USA CUN09 SOIL TOMATOES Open Field

BRIEF DESCRIPTIVE TITLE OF NOMINATION:
Methyl Bromide Critical Use Nomination for Pre-plant Soil Use for Tomato Grown in Open Fields (Submitted in 2007 for 2009 Use Season)

CROP NAME (OPEN FIELD OR PROTECTED):
Tomatoes Open Field

QUANTITY OF METHYL BROMIDE REQUESTED IN EACH YEAR OF NOMINATION:

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

YEAR	NOMINATION AMOUNT (METRIC TONNES)*
2009	**1,245.249**

*This amount includes methyl bromide needed for research.

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 MB 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 170 kg/ha (for areas where weeds were considered to be key pests) was used in calculating the amount of methyl bromide requested. For details of these changes please see Appendix A. 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 topographical features and seepage irrigation restrictions. For details on these changes in usage requirements, please see Appendix B.

Tomato growers in Maryland have requested methyl bromide. These growers have historically used methyl bromide in their tomato production, purchasing it from the stockpile since the 2005 ban. Maryland growers, in common with other tomato growers in the mid-Atlantic region, have production areas in with high water tables and in close proximity to environmentally sensitive estuaries. These factors make the use of 1,3-D limited.

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

Research results confirm that methyl bromide alternatives options provide inconsistent control of nutsedge weed species. Nutsedge is an extremely competitive weed in tomato production and can cause significant yield losses in the mid-Atlantic and Southeast. Methyl bromide alternatives also provide incomplete control of soil pathogens in the mid-Atlantic region and the state of Michigan.

- In addition, there is a regulatory prohibition on the use of 1,3-D where karst topographical features are present in the South-Eastern United States, including Florida.
- In Virginia and much of the mid-Atlantic, high water tables and the close proximity of production areas to environmentally sensitive estuaries makes the use of 1,3-D limited.
- In Michigan, 1,3-D can only be used when soil temperatures are higher than required for using methyl bromide, and this results in a planting/harvesting/marketing delay.
- In California, alternatives that must be applied with drip irrigation may not be suitable in areas with rolling or sloped topography due to uneven distribution of the fumigant**.**

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

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

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

NOMINATING PARTY CONTACT DETAILS:

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

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

_____________________________ _____________________________ _______________

Signature Name Date

Title: ____

CONTACT OR EXPERT(S) FOR FURTHER TECHNICAL DETAILS:

Contact/Expert Person:	Richard Keigwin
Title:	Division Director
Address:	Biological and Economic Analysis Division Office of Pesticide Programs U.S. Environmental Protection Agency 1200 Pennsylvania Avenue, N.W. Mailcode 7503P Washington, D.C. 20460 U.S.A.
Telephone:	(703) 308-8200
Fax:	(703) 308-7042
E-mail:	Keigwin.Richard@epa.gov

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

1. PAPER DOCUMENTS: **Title of paper documents and appendices**	**No. of pages**	**Date sent to Ozone Secretariat**
USA CUN09 SOIL TOMATOES Open Field		
2. ELECTRONIC COPIES OF ALL PAPER DOCUMENTS: ***Title of each electronic file (for naming convention see notes above)**	**No. of kilobytes**	**Date sent to Ozone Secretariat**
USA CUN09 SOIL TOMATOES Open Field		

* 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 TOMATOES Open Field

2. (Renomination Form 2.) DESCRIPTIVE TITLE OF NOMINATION:
Methyl Bromide Critical Use Nomination for Pre-plant Soil Use for Tomato Grown in Open Fields (Submitted in 2007 for 2009 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)*):
Tomato Crops Grown in Open Fields for Fruit in Michigan, Florida, the South-Eastern United States (Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee), and the Mid-Atlantic United States (Maryland, and Virginia). These crops are grown in open fields on plastic tarps, often followed by various other crops. Harvested fruit is destined for the fresh market**.**

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 (METRIC TONNES)*
2009	**1,245.249**

*This amount includes methyl bromide needed for research.

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

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 170 kg/ha (for areas where weeds were considered to be key pests) was used in calculating the amount of methyl bromide requested. For details of these changes please see Appendix A. 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 topographical features and seepage irrigation restrictions. For details on these changes in usage requirements, please see Appendix B.

Tomato growers in Maryland have requested methyl bromide. These growers have historically used methyl bromide in their tomato production, purchasing it from the stockpile since the 2005 ban. Maryland growers, in common with other tomato growers in the mid-Atlantic region, have production areas in with high water tables and in close proximity to environmentally sensitive estuaries. These factors make the use of 1,3-D limited.

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)**:**

Currently registered alternatives to methyl bromide do not consistently provide effective control of nutsedge weed species and more time is needed to evaluate relationship between fumigant alternatives, various mulches, and herbicide systems under different growing conditions.

The US nomination is only for those areas where the alternatives are not suitable. In US tomato production there are several factors that make the potential alternatives to methyl bromide unsuitable. These include:

- Pest control efficacy of alternatives: the efficacy of alternatives may not be comparable to methyl bromide in some areas, making these alternatives technically and/or economically infeasible for use in tomato 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, and in such cases the US is only nominating a CUE for tomato where the key pest pressure is moderate to high such as nutsedge in the Southeastern US.
- Regulatory constraints: e.g., telone use is limited in California due to townships caps and in Florida due to the presence of karst topographical features.
- In Virginia and much of the mid-Atlantic, high water tables and the close proximity of production areas to environmentally sensitive estuaries makes the use of 1,3-D limited.
- Delay in planting and harvesting: e.g., the plant-back interval for telone+chloropicrin is two weeks longer than methyl bromide+chloropicrin, and 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 key market windows, and adversely affect revenues through lower prices.
- Unsuitable topography: e.g., alternatives that must be applied with drip irrigation may not be suitable in areas with rolling or sloped topography due to uneven distribution of the fumigant.

TABLE A 2: EXECUTIVE SUMMARY FOR TOMATOES *

Region		Michigan Tomato	Maryland Tomatoes	Southeast Tomato Total	Georgia Tomato	Florida Tomato Total	Sector Total
EPA Preliminary Value	kgs	30,391	1,216	1,409,865	353,443	2,925,668	4,720,582
EPA Amount of All Adjustments	kgs	(4,718)	-	(1,134,255)	(286,127)	(2,055,735)	(3,480,835)
Most Likely Impact Value for Treated Area	kgs	25,672	1,216	275,610	67,316	869,933	1,239,748
	ha	147	8	1,575	385	4,971	7,085
	Rate	175	150	175	175	175	175
Sector Research Amount (kgs)		5,501	2009 Total US Sector Nomination			1,245,249	

* *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)**:**

Research results confirm that methyl bromide alternatives options provide inconsistent control of nutsedge weed species. Nutsedge is an extremely competitive weed in tomato and can cause significant yield losses in the Southeast. Methyl bromide alternatives also provide incomplete control of soil pathogens in Michigan and Virginia. In Delaware and Maryland the existence of highly aggressive race 2 *Fusarium oxysporum*, along with a high concentration of inoculum result in a much higher level of performance expected of alternatives.

In addition, there is a regulatory prohibition on the use of 1,3-D where karst topographical features are present in the South-Eastern United States, including Florida. In Virginia and much of the mid-Atlantic, high water tables and the close proximity of production areas to environmentally sensitive estuaries make the use of 1,3-D limited. In Michigan, 1,3-D can only be used when soil temperature are higher than required for using methyl bromide, and this results in a planting/harvesting/marketing delay. In California, alternatives that must be applied with drip irrigation may not be suitable in areas with rolling or sloped topography due to uneven distribution of the fumigant**.**

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 CROPS GROWN USING METHYL BROMIDE

REGION WHERE METHYL BROMIDE USE IS REQUESTED	TOTAL CROP AREA AVERAGE OF 2001 AND 2003 (HA)	PROPORTION OF REQUEST FOR METHYL BROMIDE IN 2003 (%)
Michigan Region	769	33
South-Eastern United States	28,646	100
NATIONAL TOTAL : *	51,506	57

(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 tomatoes may be grown without methyl bromide in all three regions is the absence of key target pests (i.e., nutsedge in the Southeast, soil pathogens in Michigan and the mid-Atlantic, and pathogens and nematodes in California).

- 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 Virginia and much of the mid-Atlantic, areas without high water tables and the close proximity of production to environmentally sensitive estuaries can use 1,3-D.
- In Delaware and Maryland areas without the existence of highly aggressive race 2 *Fusarium oxysporum* or high concentration of the inoculum could use some alternatives; providing they meet the criteria of water table and environmentally sensitive areas.
- In Michigan, the majority of tomato producing acres does not have *Phytopthora spp*., and do not use methyl bromide.

(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 hilly terrain, environmental sensitivity, cold soil temperatures, and heavy pest pressure preclude the use of fumigants that are employed when these conditions are not present.

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 4A: AMOUNT OF METHYL BROMIDE REQUESTED FOR CRITICAL USE – MICHIGAN, SOUTHEAST U.S., AND GEORGIA

REGION:	*Michigan*	*Southeast U.S***	*Georgia*
YEAR OF EXEMPTION NOMINATION	2009		
KILOGRAMS OF METHYL BROMIDE	See Appendix A	See Appendix A	See Appendix A
USE: BROADCAST OR STRIP/BED TREATMENT	Strip/Bed	Mostly Strip/Bed	Mostly Strip/Bed
FORMULATION *(ratio of methyl bromide/chloropicrin mixture)* TO BE USED FOR THE CUE	67/33	Mostly 67/33	Mostly 67/33
TOTAL AREA TO BE TREATED WITH THE METHYL BROMIDE OR METHYL BROMIDE/CHLOROPICRIN FORMULATION *(m^2 or ha)*	See Appendix A	See Appendix A	See Appendix A
DOSAGE RATE* *(g/m^2)* OF **ACTIVE INGREDIENT** USED TO CALCULATE REQUESTED KILOGRAMS OF METHYL BROMIDE	See Appendix A	See Appendix A	See Appendix A

**Only 36.7% percent of an hectare receives this amount of methyl bromide formulation*
***Includes Alabama, Arkansas, Kentucky, Louisiana, North Carolina, South Carolina, Tennessee, and Virginia.*

TABLE A 4B: AMOUNT OF METHYL BROMIDE REQUESTED FOR CRITICAL USE – FLORIDA

REGION:	*Florida – North Florida*	*Florida – Ruskin / Palmetto*	*Florida – Palm Beach*	*Florida - Southwest*	*Florida – Dade County*
YEAR OF EXEMPTION NOMINATION	2009				
KILOGRAMS OF METHYL BROMIDE	See Appendix A	See Appendix A	See Appendix A	See Appendix A	See Appendix A
USE: BROADCAST OR STRIP/BED TREATMENT	All Strip/Bed	All Strip/Bed	All Strip/Bed	All Strip/Bed	All Strip/Bed
FORMULATION *(ratio of methyl bromide/chloropicrin mixture)* TO BE USED FOR THE CUE	Mostly 67/33	Mostly 67/33	Mostly 67/33	Mostly 67/33	Mostly 67/33
TOTAL AREA TO BE TREATED WITH THE METHYL BROMIDE OR METHYL BROMIDE/CHLOROPICRIN FORMULATION *(m^2 or ha)*	See Appendix A	See Appendix A	See Appendix A	See Appendix A	See Appendix A
DOSAGE RATE* *(g/m^2)* OF **ACTIVE INGREDIENT** USED TO CALCULATE REQUESTED KILOGRAMS OF METHYL BROMIDE	See Appendix A	See Appendix A	See Appendix A	See Appendix A	See Appendix A

**Only 36.7% percent of a hectare receives this amount of methyl bromide formulation*
* 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 170 kg/ha (for areas where weeds were considered to be key pests) was used in calculating the amount of methyl bromide requested. For details of these changes please see Appendix A. 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 topographical features and seepage irrigation restrictions. For details on these changes in usage requirements, please see Appendix B.

Tomato growers in Maryland have requested methyl bromide. These growers have historically used methyl bromide in their tomato production, purchasing it from the stockpile since the 2005 ban. Maryland growers, in common with other tomato growers in the mid-Atlantic region, have production areas in with high water tables and in close proximity to environmentally sensitive estuaries. These factors make the use of 1,3-D limited.

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

QUANTITY REQUESTED FOR PREVIOUS NOMINATION YEAR:	1,552,655 kg
QUANTITY APPROVED BY PARTIES FOR PREVIOUS NOMINATION YEAR:	1,406,484 kg
QUANTITY (KG) REQUIRED FOR YEAR TO WHICH THIS REAPPLICATION REFERS:	1,245,249 kg
TREATED AREA (HA) REQUIRED FOR YEAR TO WHICH THIS REAPPLICATION REFERS	See Appendix A

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 1A MICHIGAN REGION: KEY DISEASES AND WEEDS AND REASON FOR METHYL BROMIDE REQUEST

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 NEEDED
Michigan Region	1. Crown, root and fruit rot caused by *Phytophthora capsici* 2. *Fusarium oxysporum* wilt	Methyl bromide is currently the only product that can control these soil-borne pathogens and allow Michigan growers to deliver their produce during premium priced early market windows. Other control measures have plant back restrictions that put Michigan tomatoes outside the premium priced fresh market. Resistant varieties have not been identified.

TABLE B 1B SOUTH-EASTERN AND MID-ATLANTIC UNITED STATES : KEY DISEASES AND WEEDS AND REASON FOR METHYL BROMIDE REQUEST

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 NEEDED
South-Eastern and Mid-Atlantic United States	1. Nutsedges (*Cyperus rotundus and C. esculentus*) 2. Root-Knot nematodes 3. *Phytophthora* Crown and Root Rot. *Fusarium* Wilt (*F. oxysporum*)	None of the listed MBTOC alternatives is effective in controlling the key pests in the South-Eastern and Mid-Atlantic United States.

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

TABLE B 2A MICHIGAN REGION: CHARACTERISTICS OF CROPPING SYSTEM

CHARACTERISTICS	MICHIGAN REGION
CROP TYPE: *(e.g. transplants, bulbs, trees or cuttings)*	Transplant tomatoes to produce fruit
ANNUAL OR PERENNIAL CROP: *(# of years between replanting)*	Annual
TYPICAL CROP ROTATION *(if any)* **AND USE OF METHYL BROMIDE FOR OTHER CROPS IN THE ROTATION:** *(if any)*	Squash, cucumber, eggplant and melons. All are susceptible to *Phytpphthora capsici*.
SOIL TYPES: *(Sand, loam, clay, etc.)*	Sandy to Loam
FREQUENCY OF METHYL BROMIDE FUMIGATION: *(e.g. every two years)*	Annual
OTHER RELEVANT FACTORS:	Low soil temperatures during late March do not allow effective soil fumigation with telone, telone+ chloropicrin or metam sodium for tomato planting in April.

TABLE B 3A MICHIGAN REGION: CHARACTERISTICS OF CLIMATE AND CROP SCHEDULE

	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	JAN	FEB
CLIMATIC ZONE *(Plant Hardiness Zone)*	5B											
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	17.7	20.6	20.9	18.1	8.0	2.4	-2.9	-8.0	-7.0
FUMIGATION SCHEDULE		X										
PLANTING SCHEDULE			X	X								
KEY MARKET WINDOW					X	X	X					

* HAUSBECK AND CORTRIGHT (2003).

** *DATA SOURCE* " http://www.crh.noaa.gov/grr/climate/f6/preliminary.php?site=LAN"

TABLE B 2B SOUTH-EASTERN AND MID-ATLANTIC UNITED STATES: CHARACTERISTICS OF CROPPING SYSTEM

CHARACTERISTICS	**SOUTH-EASTERN AND MID-ATLANTIC UNITED STATES**
CROP TYPE: *(e.g. transplants, bulbs, trees or cuttings)*	Transplant for tomato fruit production
ANNUAL OR PERENNIAL CROP: *(# of years between replanting)*	Annual
TYPICAL CROP ROTATION *(if any)* **AND USE OF METHYL BROMIDE FOR OTHER CROPS IN THE ROTATION:** *(if any)*	Tomato. Tomato-Cucumber or Squash or Watermelon or Cantaloupe. Tomato-Cucurbits.
SOIL TYPES: *(Sand, loam, clay, etc.)*	Sandy to loam, over karst topographical features in many areas
FREQUENCY OF METHYL BROMIDE FUMIGATION: *(e.g. every two years)*	Annual
OTHER RELEVANT FACTORS:	No other information provided.

TABLE B 3B SOUTH-EASTERN UNITED STATES: CHARACTERISTICS OF CLIMATE AND CROP SCHEDULE

	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	JAN	FEB
CLIMATIC ZONE *(Plant Hardiness Zone)*	6b, 7a, 7b, 8a, 8b, 9b, 10a, 10b											
SOIL TEMP. *(℃)* **	17-20	17-21	21-24	22-26	25-29	26-29	27-30	28-32	27-29	25-27	21-23	19-21
RAINFALL *(mm)**	51-203	51-203	51-203	51-203	102-203	102-203	51-203	51-203	25-102	25-102	25-102	25-102
OUTSIDE TEMP. *(℃)**	11-22	16-23	21-25	25-28	26-28	25-28	23-25	17-25	10-22	7-19	7-19	8-19
FUMIGATION SCHEDULE	X	X		X	X	X	X				X	X
PLANTING SCHEDULE	X	X	X		X					X	X	X
KEY MARKET WINDOW		X	X	X	X	X	X	X	X			

* *JACOB (1977). ** FLORIDA SOIL TEMPERATUTES SOURCE IS WWW.IMOK.UFL/EDU/WEATHER/ARCHIVES/200/CLIM00*

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

MICHIGAN REGION – 11.1 (*ii*) INDICATE IF ANY OF THE ABOVE CHARACTERISTICS IN 11. (*i*) PREVENT THE UPTAKE OF ANY RELEVANT ALTERNATIVES?

In Michigan, low soil temperatures during late March to early April make the use of in-kind (metam-sodium, 1,3-D + chloropicrin) fumigants impractical because soil temperatures may be below the labeled minimums or plant back restrictions may be too long (14 to 30 days) to allow April transplanting of tomato seedlings in the field.

SOUTH-EASTERN UNITED STATES – 11.2 (*ii*) INDICATE IF ANY OF THE ABOVE CHARACTERISTICS IN 11. (*i*) PREVENT THE UPTAKE OF ANY RELEVANT ALTERNATIVES?

In the Southeastern U.S., karst topographical features inhibit the use of all fumigants that contain 1,3-D in a significant portion of the tomato production areas.

MID-ATLANTIC UNITED STATES – 11.2 (*ii*) INDICATE IF ANY OF THE ABOVE CHARACTERISTICS IN 11. (*i*) PREVENT THE UPTAKE OF ANY RELEVANT ALTERNATIVES?

In Virginia and much of the mid-Atlantic, high water tables and the close proximity of production areas to environmentally sensitive estuaries makes the use of 1,3-D limited. In Delaware and Maryland the existence of highly aggressive race 2 *Fusarium oxysporum* , along with a high concentration of inoculum result in a much higher level of performance expected of alternatives.

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 MICHIGAN REGION : HISTORIC PATTERN OF USE OF METHYL BROMIDE

FOR AS MANY YEARS AS POSSIBLE AS SHOWN SPECIFY:	1999	2000	2001	2002	2003	2004	2005
AREA TREATED *(hectares)*	195	233	260	270	256	278	314
RATIO OF FLAT FUMIGATION METHYL BROMIDE USE TO STRIP/BED USE IF STRIP TREATMENT IS USED	100% strip	100% strip	100% strip	100% strip	100% strip	100% strip	100% strip
AMOUNT OF METHYL BROMIDE ACTIVE INGREDIENT USED *(total kg)*	23,493	28,003	31,235	32,461	30,781	33,430	37,697
FORMULATIONS OF METHYL BROMIDE *(methyl bromide /chloropicrin)*	67/33	67/33	67/33	67/33	67/33	67/33	67/33
METHOD BY WHICH METHYL BROMIDE APPLIED	Injected 20-25 cm	Injected 20-25 cm	Injected 20-25 cm	Injected 20-25 cm	Injected 20-25 cm	Injected 20-25 cm	Injected 20-25 cm
APPLICATION RATE OF ACTIVE INGREDIENT IN kg/ha*	120	120	120	120	120	120	120
ACTUAL DOSAGE RATE OF ACTIVE INGREDIENT *(g/m^2)**	12.0	12.0	12.0	12.0	12.0	12.0	12.0

**Only 36.7 percent land area is treated in the form of beds and therefore dosage rate (g/m^2) is higher.*

TABLE B 4B VIRGINIA: HISTORIC PATTERN OF USE OF METHYL BROMIDE

FOR AS MANY YEARS AS POSSIBLE AS SHOWN SPECIFY:	1999	2000	2001	2002	2003	2004	2005
AREA TREATED *(hectares)*	1,439	1,719	2,038	2,102	1,983	2,178	2,307
RATIO OF FLAT FUMIGATION USE TO STRIP/BED USE IF STRIP TREATMENT IS USED	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip
AMOUNT OF METHYL BROMIDE ACTIVE INGREDIENT USED *(total kg)*	242,014	288,961	342,711	353,325	333,390	366,253	387,821
FORMULATIONS OF METHYL BROMIDE (*methyl bromide /Chloropicrin)*	67/33	67/33	67/33	67/33	67/33	67/33	67/33
METHOD BY WHICH METHYL BROMIDE APPLIED	Mostly Injected at 25-30 cm depth	Mostly Injected at 25-30 cm depth	Mostly Injected at 25-30 cm depth	Mostly Injected at 25-30 cm depth	Mostly Injected at 25-30 cm depth	Mostly Injected at 25-30 cm depth	Mostly Injected at 25-30 cm depth
ACTUAL DOSAGE RATE OF ACTIVE INGREDIENT *(g/m^2)**	16.8	16.8	16.8	16.8	16.8	16.8	16.8

TABLE B 4C SOUTHEAST U.S.: HISTORIC PATTERN OF USE OF METHYL BROMIDE

FOR AS MANY YEARS AS POSSIBLE AS SHOWN SPECIFY:	1999	2000	2001	2002	2003	2004	2005
AREA TREATED *(hectares)*	5,564	5,816	6,052	5,947	6,131	6,252	6,376
RATIO OF FLAT FUMIGATION USE TO STRIP/BED USE IF STRIP TREATMENT IS USED	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip
AMOUNT OF METHYL BROMIDE ACTIVE INGREDIENT USED *(total kg)*	835,014	870,340	907,927	891,844	919,621	937,856	956,273
FORMULATIONS OF METHYL BROMIDE (*methyl bromide /Chloropicrin)*	67/33	67/33	67/33	67/33	67/33	67/33	67/33
METHOD BY WHICH METHYL BROMIDE APPLIED	Mostly Injected at 25-30 cm depth	Mostly Injected at 25-30 cm depth	Mostly Injected at 25-30 cm depth	Mostly Injected at 25-30 cm depth	Mostly Injected at 25-30 cm depth	Mostly Injected at 25-30 cm depth	Mostly Injected at 25-30 cm depth
ACTUAL DOSAGE RATE OF ACTIVE INGREDIENT *(g/m^2)**	15.0	15.0	15.0	15.0	15.0	15.0	15.0

**Includes Alabama, Arkansas, Kentucky, Louisiana, North Carolina, South Carolina, and Tennessee*

TABLE B 4D GEORGIA: HISTORIC PATTERN OF USE OF METHYL BROMIDE

FOR AS MANY YEARS AS POSSIBLE AS SHOWN SPECIFY:	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
AREA TREATED *(hectares)*	2,686	2,307	2,216	2,353	2,341	2,688	2,461
RATIO OF FLAT FUMIGATION USE TO STRIP/BED USE IF STRIP TREATMENT IS USED	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip
AMOUNT OF METHYL BROMIDE ACTIVE INGREDIENT USED *(total kg)*	512,423	354,727	332,778	353,443	351,620	403,710	369,611
FORMULATIONS OF METHYL BROMIDE (*methyl bromide /Chloropicrin)*	67/33	67/33	67/33	67/33	67/33	67/33	67/33
METHOD BY WHICH METHYL BROMIDE	Mostly Injected at 25-30 cm depth	Mostly Injected at 25-30 cm depth	Mostly Injected at 25-30 cm depth	Mostly Injected at 25-30 cm depth	Mostly Injected at 25-30 cm depth	Mostly Injected at 25-30 cm depth	Mostly Injected at 25-30 cm depth
ACTUAL DOSAGE RATE OF ACTIVE INGREDIENT *(g/m^2)**	19.1	15.4	15.0	15.0	15.0	15.0	15.0

TABLE B 4E FLORIDA – NORTH FLORIDA: HISTORIC PATTERN OF USE OF METHYL BROMIDE

FOR AS MANY YEARS AS POSSIBLE AS SHOWN SPECIFY:	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
AREA TREATED *(hectares)*	1,032	1,376	1,376	1,942	1,700	1,509	1,586
RATIO OF FLAT FUMIGATION USE TO STRIP/BED USE IF STRIP TREATMENT IS USED	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip
AMOUNT OF METHYL BROMIDE ACTIVE INGREDIENT USED *(total kg)*	199,690	246,754	246,754	348,359	335,295	291,740	243,535
FORMULATIONS OF METHYL BROMIDE (*methyl bromide /Chloropicrin)*	67/33	67/33	67/33	67/33	67/33	67/33	67/33
METHOD BY WHICH METHYL BROMIDE APPLIED	Injected at 25-30 cm depth	Injected at 25-30 cm depth	Injected at 25-30 cm depth	Injected at 25-30 cm depth	Injected at 25-30 cm depth	Injected at 25-30 cm depth	Injected at 25-30 cm depth
ACTUAL DOSAGE RATE OF ACTIVE INGREDIENT *(g/m^2)**	19.4	17.9	17.9	17.9	19.7	19.3	15.4

TABLE B 4F FLORIDA – RUSKIN / PALMETTO: HISTORIC PATTERN OF USE OF METHYL BROMIDE

FOR AS MANY YEARS AS POSSIBLE AS SHOWN SPECIFY:	1999	2000	2001	2002	2003	2004	2005
AREA TREATED *(hectares)*	5,443	5,261	6,313	6,313	6,313	5,030	5,286
RATIO OF FLAT FUMIGATION USE TO STRIP/BED USE IF STRIP TREATMENT IS USED	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip
AMOUNT OF METHYL BROMIDE ACTIVE INGREDIENT USED *(total kg)*	1,009,806	887,226	990,645	948,189	1,089,709	850,841	811,762
FORMULATIONS OF METHYL BROMIDE (*methyl bromide /Chloropicrin)*	67/33	67/33	67/33	67/33	67/33	67/33	67/33
METHOD BY WHICH METHYL BROMIDE APPLIED	Injected at 25-30 cm depth	Injected at 25-30 cm depth	Injected at 25-30 cm depth	Injected at 25-30 cm depth	Injected at 25-30 cm depth	Injected at 25-30 cm depth	Injected at 25-30 cm depth
ACTUAL DOSAGE RATE OF ACTIVE INGREDIENT *(g/m^2)**	18.6	16.9	15.7	15.0	17.3	16.9	15.4

TABLE B 4G FLORIDA – PALM BEACH : HISTORIC PATTERN OF USE OF METHYL BROMIDE

FOR AS MANY YEARS AS POSSIBLE AS SHOWN SPECIFY:	1999	2000	2001	2002	2003	2004	2005
AREA TREATED *(hectares)*	2,044	2,843	2,843	2,843	2,843	2,335	2,455
RATIO OF FLAT FUMIGATION USE TO STRIP/BED USE IF STRIP TREATMENT IS USED	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip
AMOUNT OF METHYL BROMIDE ACTIVE INGREDIENT USED *(total kg)*	329,852	471,600	446,108	426,989	490,719	395,060	376,954
FORMULATIONS OF METHYL BROMIDE (*methyl bromide /Chloropicrin)*	67/33	67/33	67/33	67/33	67/33	67/33	67/33
METHOD BY WHICH METHYL BROMIDE APPLIED	Injected at 25-30 cm depth	Injected at 25-30 cm depth	Injected at 25-30 cm depth	Injected at 25-30 cm depth	Injected at 25-30 cm depth	Injected at 25-30 cm depth	Injected at 25-30 cm depth
ACTUAL DOSAGE RATE OF ACTIVE INGREDIENT *(g/m^2)**	16.1	16.6	15.7	15.0	17.3	16.9	15.4

TABLE B 4H FLORIDA – SOUTHWEST: HISTORIC PATTERN OF USE OF METHYL BROMIDE

FOR AS MANY YEARS AS POSSIBLE AS SHOWN SPECIFY:	1999	2000	2001	2002	2003	2004	2005
AREA TREATED *(hectares)*	7,345	8,529	8,529	8,529	8,529	7,212	7,582
RATIO OF FLAT FUMIGATION USE TO STRIP/BED USE IF STRIP TREATMENT IS USED	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip
AMOUNT OF METHYL BROMIDE ACTIVE INGREDIENT USED *(total kg)*	1,320,936	1,347,883	1,338,323	1,280,966	1,472,156	1,220,025	1,164,232
FORMULATIONS OF METHYL BROMIDE (*methyl bromide /Chloropicrin)*	67/33	67/33	67/33	67/33	67/33	67/33	67/33
METHOD BY WHICH METHYL BROMIDE APPLIED *(e.g. injected at 25cm depth, hot gas)*	Injected at 25-30 cm depth	Injected at 25-30 cm depth	Injected at 25-30 cm depth	Injected at 25-30 cm depth	Injected at 25-30 cm depth	Injected at 25-30 cm depth	Injected at 25-30 cm depth
ACTUAL DOSAGE RATE OF ACTIVE INGREDIENT *(g/m^2)**	18.0	15.8	15.7	15.0	17.3	16.9	15.4

TABLE B 4I FLORIDA : DADE COUNTY - HISTORIC PATTERN OF USE OF METHYL BROMIDE

FOR AS MANY YEARS AS POSSIBLE AS SHOWN SPECIFY:	1999	2000	2001	2002	2003	2004	2005
AREA TREATED *(hectares)*	1,700	1,700	1,603	1,481	1,481	1,315	1,381
RATIO OF FLAT FUMIGATION USE TO STRIP/BED USE IF STRIP TREATMENT IS USED	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip	Approx. 50% strip
AMOUNT OF METHYL BROMIDE ACTIVE INGREDIENT USED *(total kg)*	283,858	283,858	251,471	222,460	255,663	226,121	212,091
FORMULATIONS OF METHYL BROMIDE (*methyl bromide /Chloropicrin)*	67/33	67/33	67/33	67/33	67/33	67/33	67/33
METHOD BY WHICH METHYL BROMIDE APPLIED	Injected at 25-30 cm depth	Injected at 25-30 cm depth	Injected at 25-30 cm depth	Injected at 25-30 cm depth	Injected at 25-30 cm depth	Injected at 25-30 cm depth	Injected at 25-30 cm depth
ACTUAL DOSAGE RATE OF ACTIVE INGREDIENT *(g/m^2)**	16.7	16.7	15.7	15.0	17.3	17.2	15.4

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 1A MICHIGAN REGION: REASON FOR ALTERNATIVES NOT BEING FEASIBLE

NAME OF ALTERNATIVE	TECHNICAL AND REGULATORY* REASONS FOR THE ALTERNATIVE NOT BEING FEASIBLE OR AVAILABLE + CITATIONS**
CHEMICAL ALTERNATIVES	
1,3-D	It is not effective against fungal plant pathogens.
Metam sodium	Metam sodium is effective against soil fungi. However, Michigan soil temperatures during April are too low to use this fumigant for an early fresh market tomato crop. Product label states that tomatoes cannot be transplanted to the field for up to 21 days after fumigation. Technically, it is methyl bromide alternative, but economically it is not a viable alternative.
Chloropicrin	Chloropicrin is ineffective as a soil fumigant when applied alone.
NON CHEMICAL ALTERNATIVES	
Soil solarization	Michigan is a northern state with cold weather conditions and therefore it is not a viable option.
Steam	While steam has been used effectively against fungal pests in protected production systems, such as greenhouses, there is no evidence that it would be effective in the open tomato fields. Any such system would also require large amounts of energy and water to provide sufficient steam necessary to pasteurize soil down to the rooting depth of field crops (at least 20-50 cm).
Biological Control	Biological control agents are not technically feasible alternatives to methyl bromide because they alone cannot control the soil pathogens and/or nematodes. While biological control may have utility as part of plant pathogen management strategy, it can not be a methyl bromide alternative

NAME OF ALTERNATIVE	TECHNICAL AND REGULATORY* REASONS FOR THE ALTERNATIVE NOT BEING FEASIBLE OR AVAILABLE + CITATIONS**
Cover crops and mulching	There is no evidence that these practices effectively substitute for the control methyl bromide provides against fungal pathogens and nematodes.
Crop rotation and fallow land	The land is very expensive and there are not enough hectares in tomato growing areas to rotate. The fungal pathogen survive for many years in soil and therefore crop rotation and fallow are not a viable options (Lamour and Hausbeck, 2003*)
Endophytes	No information is available on tomato endophytes that will control fungal and plant pathogens.
Flooding/Water management	Flooding is not technically feasible because it does not suppress fungal plant pathogens and nematodes.
Grafting/resistant rootstock/plant breeding/soilless culture/organic production/substrates/plug plants.	There are no studies documenting the commercial availability of resistant rootstock immune to the fungal pathogens listed as target pests. Grafting and plant breeding are thus also rendered technically infeasible as methyl bromide alternatives for control of fungal pathogens and nematodes.
COMBINATIONS OF ALTERNATIVES	
1,3-D + chloropicrin	1,3-D is effective against nematodes. Chloropicrin is effective against fungal plant pathogens. Their combination is a technically feasible alternative, but Michigan's low soil temperature does not allow soil fumigation during April months for early fresh market tomato crop. See paragraph below.
Metam sodium + crop rotation	Same as for metam sodium.

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

The proposal by MBTOC to obviate the use of methyl bromide in Michigan by applying some alternative (specifically a combination of 1,3-D and chloropicrin) in the autumn preceeding crop planting will not work on tomatoes. In Michigan, the predominant agricultural treatment that uses methyl bromide is one where methyl bromide is applied in strips of raised beds. Areas between the raised beds are not treated. In addition to the risk that the harsh winter conditions (prolonged periods of below freezing weather with snow, sleet, and high winds) will tear the plastic barrier, there is significant risk of flooding and concomitant recontamination of the treated areas. The length and severity of the winter means 4-5 months of precipitation is 'stored' in frozen form and released over the short period of thaw in the spring. This thaw-based flooding can be exacerbated by heavy rainfalls (in excess of 25 mm/event) that occur throughout the spring and summer in Michigan. Because phytophthora and verticillium are endemic in the areas of Michigan for which methyl bromide is being requested, flooding will transfer spores from the untreated to treated areas, resulting in additional infected plants and severe crop losses.

TABLE C 1B SOUTH-EASTERN AND MID-ATLANTIC UNITED STATES: 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 dichloropropene (Telone)	Effective against nematodes, but not against fungal plant pathogens and nutsedge weeds. *South-Eastern*: Approximately 40% of tomato land has Karst topographical features. Growers with Karst topographical features cannot use 1,3-D because of underground water contamination. *Mid-Atlantic*: High water tables and the close proximity of production areas to environmentally sensitive estuaries makes the use of 1,3-D limited
Metam sodium/potassium	Metam (sodium or potassium) will control many weeds, but control of nutsedge is very inconsistent, and this fumigant is not very effective against soil nematodes.
Chloropicrin	Chloropicrin controls soil fungi, but may also stimulate nutsedge weed growth, and therefore it is not a viable option. It occasionally controls nutsedge as noted in the literature. Again, the issue is its inability to get consistent control (Santos et al, 2006; Culpepper, 2004).
NON CHEMICAL ALTERNATIVES	
Soil solarization	For nutsedge control in the mid-Atlantic and southeastern U.S. states, solarization is unlikely to be technically feasible as a methyl bromide alternative. Research indicates that the lethal temperature for nutsedge tubers is 50°C or higher (Chase et al. 1999). While this may be achieved for some portion of the autumn cropping in southern growing regions, it is very unlikely for any portion of the spring crops. Trials conducted in mid-summer in Georgia resulted in maximal soil temperatures of 43°C at 5 cm depth, not high enough to destroy nutsedge tubers, and tubers lodged deeper in the soil would be completely unaffected.
Steam	Steam is not a technically feasible alternative for open field tomato production because it requires sustained heat over a required period of time (UNEP 1998). While steam has been used effectively against fungal pests in protected production systems, such as greenhouses, there is no evidence that it would be effective in tomato fields. Any such system would also require large amounts of energy and water to provide sufficient steam necessary to pasteurize soil down to the rooting depth of field crops (at least 20-50 cm).
Biological Control	Biological control agents are not technically feasible alternatives to methyl bromide because they alone cannot control the soil pathogens, nematodes and nutsedges.
Cover crops and mulching	Cover crops and mulches appear to reduce weed population, but not nutsedges (Burgos and Talbert 1996). Mulching has also been shown to be ineffective in controlling nutsedges, since these plants are able to penetrate through both organic and plastic mulches (Munn 1992, Patterson 1998).

NAME OF ALTERNATIVE	TECHNICAL AND REGULATORY* REASONS FOR THE ALTERNATIVE NOT BEING FEASIBLE OR AVAILABLE
Crop rotation and fallow land	It is not a technically or economically (cannot afford to take land out of production) feasible alternative to methyl bromide because it does not, by itself, provide adequate control of fungi and/or nutsedges. Crops available for rotation to growers are also susceptible to fungi, while fallow land can still harbor fungal oospores. The nutsedge tubers provide new plants with larger energy reserves than the annual weeds that can be frequently controlled by crop rotations and fallow land. Furthermore, nutsedge plants can produce tubers within 8 weeks after emergence. This enhances their survival across different cropping regimes that can disrupt other plants that rely on a longer undisturbed growing period to produce seeds to propagate the next generation.
Endophytes	This is not a technically viable option because it has never been shown to work against the key pests in tomato or similar crops.
Flooding/Water management	Flooding has never been shown to control nutsedge species. Nutsedges are much more tolerant of watery conditions than many other weed pests. For example, Horowitz (1972) showed that submerging nutsedge in flowing or stagnant water (for 8 days and 4 weeks, respectively) did not affect the sprouting capacity of tubers. There are also serious practical obstacles to implementing flood management approaches in field production these areas of the U.S. Droughts are common in many parts of these regions, and the soil composition may not support flooding and still remain productive.
Grafting/resistant rootstock/plant breeding/soil-less culture/organic production/substrates/plug plants.	These technologies have never been shown to control listed key pests under field conditions. Resistant root stock or cultivars may control one pest, but not the other. It is almost impossible to breed or genetically engineer tomato cultivars that has all agronomic characters and is resistant to all key pests. This has no effect on managing nutsedge weeds.
COMBINATIONS OF ALTERNATIVES	
1,3 D + chloropicrin+ a herbicide (such as napropamide + s-metolachlor + halosulfuron)	A combination of fumigants and herbicide partners is the most promising alternative for the control of all key pests in the regions. The executive summary of dozens of research trials show that the growers may harvest tomato yield that is equal or nearly equal to yields obtained using methyl bromide and chloropicrin. With this combination, in areas where it can be used, growers may lose an average between 0 and 6.2% yield (Santos et al, 2006; Chellemi *et al*., 2001).

NAME OF ALTERNATIVE	TECHNICAL AND REGULATORY* REASONS FOR THE ALTERNATIVE NOT BEING FEASIBLE OR AVAILABLE
Metam sodium + Chloropicrin	Although this combination may be more effective than metam sodium alone in controlling fungal pests, it would not prevent yield losses caused by nutsedges and some species of nematodes. This mixture along with an herbicide (for controlling nutsedge weeds) may be a viable methyl bromide alternative in the South-Eastern and mid-Atlantic United States, where growers cannot use telone due to karst topographical features and shallow water tables, respectively. Further studies need to be undertaken to ascertain whether or not it is technically and economically viable.
1,3-D + Chloropicrin	This combination is effective against nematodes and fungal plant pathogens, but not against nutsedge and other weeds. Southeast; Approximately 40 and 8.0% of tomato land in Florida and Georgia, respectively, has karst topographical features. Growers in these areas cannot use telone because of state regulations and underground water contamination issues. Mid-Atlantic; high water tables and the close proximity of production areas to environmentally sensitive estuaries makes the use of 1,3-D limited
1,3-D + metam sodium + herbicide (such as napropamide + s-metolachlor + halosulfuron)	This mixture could provide reasonable control of pests when weed pressure is low to moderate, land does not have karst topographical features or high water tables in close proximity to environmentally sensitive estuaries. Growers will need to use one of the newly registered herbicides if they use this combination, although they will be constrained by certain limitations (described below).
Metam sodium + Crop rotation	Same as metam sodium.
Fumigant combination + herbicide partners	Current research suggests that in areas of low pest pressure this combination may be suitable for some growers as an alternative for methyl bromide. In these situations growers may employ a marginal strategy without major economic dislocation if given a reasonable time frame for the transition.

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

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)*:

TABLE C 2A MICHIGAN REGION: TECHNICALLY INFEASIBLE ALTERNATIVES DISCUSSION

NAME OF ALTERNATIVE	DISCUSSION
None	Other than those options discussed above, there are no alternatives that may control the key pest. Registered fungicides (such as azoxystrobin, mefenoxam and mancozeb) may control aerial infections of *Phytophthora capsici*, but are not effective against crown and root rot phase of this pathogen. Soil fumigation with methyl bromide kills soil-borne primary inoculum of this pest and therefore fungicide use is also reduced (Lamour and Hausbeck, 2003*)

TABLE C 2B SOUTH-EASTERN UNITED STATES: TECHNICALLY INFEASIBLE ALTERNATIVES DISCUSSION

NAME OF ALTERNATIVE	DISCUSSION
Glyphosate	It is a non-selective herbicide that can be applied to row middles only, since direct application to the rows would cause injury to the tomato crop. It does not provide residual control. As a post-emergence treatment, glyphosate will not provide season long control of yellow and/or purple nutsedge in tomatoes.
Paraquat	It is a non-selective herbicide that will not control nutsedge in the plant rows. It does not provide residual control. Repetitive applications are required to achieve fair control of annual weeds in the row middle (Culpepper, 2003). It may also be applied prior to crop emergence. Direct application to the rows would cause injury to the tomato crop. For perennial weeds, such as nutsedge, it will burn down the top portion of the plant, but would not affect tuber viability, allowing the weed to grow again. Thus, paraquat cannot provide season long. control. In addition, nightshade in fruit and vegetable fields in Florida .has demonstrated resistance to Paraquat.

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.*):

MICHIGAN REGION

It is key in the consideration of any research conducted for tomato production in Michigan that it be understood that law precludes early season applications due to the cold or frozen soils. In 2003, the applicant submitted the results of one small scale field trial on the efficacy of methyl bromide alternatives in controlling *Phytophthora capsici* and its effect on tomato yield (Hausbeck and Cortwright, 2003). This study focused on tomato and a number of vegetable crops (cucurbits, winter squash, and melons). As of July 2003, results showed that methyl bromide+ chloropicrin (67/33, shank injected @ 390 Kg/Hectare), metam sodium (drip applied) @ 355 KG ai/ha), 1, 3-D+chloropicrin (65/35, shank injected @ 150 liters/ha) resulted in 0, 12.9, 6.4 percent plant loss. Untreated control suffered 7.1% plant loss. The fields were treated on May 15 and 16, 2003, and the weather was unusually cooler than normal during May and early June of the year 2003. Results were inconclusive. The state expert claims that the growers may suffer 6.4 and 12.9 percent yield losses using 1, 3-D + chloropicrin and metam sodium if fields are fumigated in early May instead of April (using methyl bromide + chloropicrin). In addition, growers may also experience revenue losses if they miss early tomato market when prices are higher.

This study was repeated during the 2004-growing season. However, this study does not represent the typical Michigan conditions because due to the cool wet weather the plots were not treated until June 8 when the soil was warm enough for the alternatives to be effective. Results show that yields from tomato plots treated with metam potassium (K-Pam), alone or in combination with chloropicrin, and from plots treated with 1,3-D + chloropicrin (Telone C35) are not significantly different from yields from plots treated with methyl bromide + chloropicrin or from yields from untreated control plots (Hausbeck and Cartright, 2004). As for the 2003 trial discussed above, results of the 2004 study are still inconclusive, probably because of the occurrence of low pest pressure in the study area.

TABLE C 3 MICHIGAN REGION : Evaluation of Fumigants for Managing *Phytophthora* Crown and Fruit Rot of Solanaceous and Cucurbit Crops 2004

Alternative & Rate	Plant Loss (%)	Marketable Yield Loss*
MeBr 67:33 350 lb/A)	4.6 %	0%
Telone C-35 shank (392 gal/A)	15.3 %	30%
Chloropicrin shank (344 lb/A) plus Metam potassium drip (174 lb/A)	0.60%	-23%
Chloropicrin shank (344 lb/A) plus Metam potassium drip (348 lb/A)	0.40%	-12%
Chloropicrin 99% shank (25 gal)	24.30%	11%
Metam potassium drip (348 lb/A)	1.70%	-17%
Metam potassium drip (174 lb/A)	2.10%	7%

* Negative number indicates an increase in yield

Footnote. Due to a wet spring the treatments were applied later than typical for Michigan on June 8, 2004. From Hausbeck and Cortright, 2004.

SOUTH-EASTERN AND MID-ATLANTIC REGION

Marketable yield loss estimates using methyl bromide+ chloropicrin as standard were obtained from the average of the spring and fall, 2003, data found in table 2 of Santos et al. (2006). Data was taken from these harvest dates since the pest pressure was the highest of all three-harvest times in the study.

Telone C35/17 (1,3 D + 35 %/17% chloropicrin) plus pebulate herbicide has been found to be the best alternative to methyl bromide in controlling listed key pests under Florida growing conditions (Gilreath and Santos, 2005; Gilreath and Santos, 2005; Locascio *et al*, 2000, Chellemi *et al*., 2001). Pebulate is no longer registered in the U.S., however, so another herbicide would have to be substituted into the fumigation mixture. The results of many trials show that growers may harvest tomato yields that are nearly equal to yields obtained using methyl bromide and chloropicrin. Assuming that an herbicide is used that is as effective as pebulate, growers using a 1,3-D + chloropicrin + herbicide mixture may suffer an average of 0 to 27 percent yield losses (Santos *et al*, 2006; Chellemi *et al*., 2001). As the United States has consistently stated, our experience in that a 20% yield loss will force growers to no longer produce a crop. However, in areas of low to moderate pest pressure, information suggests that some growers may employ a marginal strategy without major economic dislocation if given a reasonable time frame for the transition. The assessment of need was adjusted to account for this. The crop experts were unable to provide yield loss estimate without 2-3 years of field trials and maintain that more time is needed to evaluate various methyl bromide fumigant alternatives, mulches and herbicides systems to study their effects on tomato yields.

In Delaware and Maryland the existence of highly aggressive race 2 *Fusarium oxysporum* , along with a high concentration of inoculum give a much higher level of performance required of alternatives (Zhou and Everts, 2003).

TABLE C 4 SOUTH-EASTERN U.S. ALTERNATIVES: SOUTH-EASTERN US FRESH MARKET TOMATO FUMIGATION TRIAL

Treatment	Fusarium Wilt[†] Incidence (19 WAT)	Diseased Plants[†] *Ralstonia solanacearum (19 WAT)*	Cyperus spp. [‡] (plants/m^2) (17 WAT)	Marketable[§] Yield Loss Using MeBr+ Pic as Standard
Me Br + Pic (67:33) (400 kg/ha)	3.8%	0%	11.5	0%
1,3-D + Pic (65:35) & napropamide+halosulfuron (330L/ha, 2.3kg +71g/ha)	5.0%	0%	11.5	0-4%
1,3-D + Pic (65:35) & metolachlor & trifloxysulfuron (330L/ha, 840g+5.3g/ha)	2.5%	0%	12.5	0-7%
Pic & MNa (170kg/ha & 710 L/ha)	0%	2.5*	3.5	0-2%

Footnote: Santos, M.S., JP Gilreath, TN Motis, JW Noling, JP Jones, and JA Norton. 2006
WAT=Weeks After Treatment
*Within column data is significantly different from methyl bromide +Pic (P=0.05)
[†]Data was obtained from Table 1, Spring 2003 since this part of the study was the only one to evaluate both *Fusarium* and *Ralstonia*.
[‡]Data was obtained from Table 4, Spring 2004 since the pest pressure was the highest of all three-harvest times.
[§]Yield data presented was for spring and fall 2003

TABLE C 5 SOUTH-EASTERN U.S. ALTERNATIVES: EFFICACY OF METHYL BROMIDE ALTERNATIVES FOR VERTICILLIUM AND WEED MANAGEMENT IN TOMATOES

Treatment	*Verticillium dahliae Infected (%) 2004*	Weeds per meter[2] (Aug 19, 2004)	Marketable Yield Loss 2003
MeBr 67:33 (268 + 132 lb/A)	29	0	0%
Telone C-35 shank (35 gal/A)	17.4	5.8	4%
Telone InLine C-35 drip (35 gal/A)	-	-	13%
Chloropicrin 99% (150 gal)	24.2	26.5	14%
Metam sodium drip (75 gal/A)	-	-	8%
Metam sodium spray/till (75 gal/A)	-	-	15%
Tri chlor EC (200 lb/A)		-	22%

Footnote: Louws, F.J., L.M. Ferguson, K. Ivors, J. Driver, K. Jennings, D. Milks, P.B. Shoemaker & D.W. Monks. 2004

TABLE C 6 SOUTH-EASTERN U.S. ALTERNATIVES: METHYL BROMIDE ALTERNATIVES IN TOMATO PRODUCTION SYSTEMS IN NORTH CAROLINA

Treatment	*Verticillium dahliae Rating* (July 7, 2002)	Marketable Yield Loss
MeBr 67:33 (268 + 132 lb/A)	4.9bc	0%
Telone C-35 shank (35 gal/A)	10.6 bc	-3%
Telone InLine C-35 drip (35 gal/A)	24.6 ab	5%
Chloropicrin shank (15 gal)	0 c	-4%
Metam sodium drip (75 gal/A)	13.4 abc	2%
Metam sodium spray/till (75 gal/A)	9.3 bc	5%
Tri chlor EC (200 lb/A)	17.6 abc	9%
Tri chlor EC (200 lb/A) 1 week delay Metam (75 gal/A)	15.1	7%

Footnote: Louws, F.J., L.M. Ferguson, N.P. Lynch, & P. B. Shoemaker. 2002

Recent research has suggested that metham sodium, with and without chloropicrin can provide yields that are not significantly different than methyl bromide plus chloropicrin treated fields. However, under heavy rainfall years (in June through July of 2004 in North Carolina rain fell for 41 of 61 days) 1,3 D/chloropicrin combinations have not shown effective control in fields where heavy nutsedge pressure is present. Combinations including trifluralin have shown stunting in tomato especially during years of above average rainfall on the production areas of the Southeastern US.

Other Florida research (Gilreath et al 2005) evaluated methyl bromide in combination with high barrier films for pepper production. In that study where there was high *Cyperus spp.* pressure there were no significant difference in yield between any of the rates of methyl bromide with the different types of films. However, the non-significant difference between treatment 2 and 3 is a 22% reduction in yield. Also, while not significant the difference between treatment 2 and 5 and 6 are equal to 17 and 14% yield losses, respectively. The data does go on to show that there are trends toward no difference in yield between treatment 2 and 4 (LDPE versus VIFP at one quarter the rate). This type of inconsistency suggests that the inclusion of non-treated or control plot data may result in a reduction in the robustness of the test when the pest pressure is high relative to any of the tested treatments.

In another study by Chellemi (2005) the interaction of solarization followed by treatment with a fumigant was studied. There is a complication in interpreting the results of this research due to the fact that the research was conducted on the same plots in 2001 and 2002, but the analysis was reported as being conducted as a fixed effects model with no repeated analysis. For this reason the ideal portion of the analysis to use to evaluate solarization followed by fumigation is the contrasts conducted using single degree of freedom tests. In the Chellemi (2005) study the interaction of solarization followed by treatment with a fumigant was not found to be significant for tomato or pepper yield ($P=0.46$ and $P=0.55$, respectively). However, the level of *Cyperus* spp. was reduced by the interaction of solarization followed by fumigation ($P=0.14$). The results of this analysis may have come from the much higher levels of control in those plots receiving fumigation when compared to those receiving solarization only. This resulted in a larger difference in densities of Cyperus spp. between the two types of treatments. This study does point out the need for more research the interactions of an integrated pest control approach.

TABLE C 7 SOUTH-EASTERN U.S. ALTERNATIVES: PEPPER YIELDS ARE NOT SIGNIFICANTLY DIFFERENT BUT PERCENT YIELD LOSS CAN BE LARGE

	Treatment	Use Rate kg/ha	Yield t/ha	% Change
1	Untreated		9.5	-31%
2	MeBr + Pic LDPE	392	13.8	0%
3	MeBr + Pic VIFP	196	10.8	-22%
4	MeBr + Pic VIFP	98	13.6	1%
5	MeBr + Pic VIFV	196	11.4	-17%
6	MeBr + Pic VIFV	98	11.9	-14%

Footnote: From Gilreath et al. 2005. Crop Protection 24: 285-287.
LDPE is low density polyethylene, VIFP and VIFV are virtually impermeable film by Plastopil and Vikase respectively.

Another study by Gilreath, et al. (2005) looks at nematode and *Cyperus* control in bell pepper (*Capsicum annum*). In that study the authors state "For bell pepper yield, the application of metam sodium and metam sodium + chloropicrin provided similar fruit weight as for methy bromide + chloropicrin in two of the three seasons." However, in that one year (Fall 2002) the yields went from 18.8 t/ha for methyl bromide + chloropicrin to 13.7 t/ha for metam sodium + chloropicrin. In a different study evaluating nematode populations and tomato yields, Gilreath et al (2006) found that the most efficacious treatment was Telone C35, chloropicrin, Pebulate+trifluralin. As discussed above, this treatment is problematic on more than one level. Overall the level of yield loss could have severe economic impacts for a grower. Because of the inconsistency of some of the alternative treatments, the U.S. does not consider them to be a replacement for methyl bromide.

Several members of MBTOC and the USG were recently able to tour field research sites in Florida and Georgia including the plots of Dr. Gilreath. During those discussions and in his recent research publications (Gilreath et al 2005 and Gilreath et al in press) the improved pest control when using Virtually Impermeable Film (VIF) or metalized films (using an aluminum layer such as Canslit) was described. Dr. Gilreath and other researchers were contacted on the topics of low permeability barrier films, and newer application techniques. Based on their input it appears that VIF films have still not been widely adopted because of problems in: laying the films, inelasticity and the resultant difficulty in conforming to the bed shape, problems with linear shear, and the fact that embossed films are not available. The current versions of metalized films are being widely tested by several researchers and growers and they have the potential to reduce fumigant use rates with better laying and bedshape conforming characteristics. It is anticipated that the results of many of these research plots and growers field tests will be available next year. These metalized films pose several questions for adoption: the fate of the aluminum coating if it "flakes off" on the soil during removal and the photostability of the coating during multiple crop cycles as is common in the southeastern U.S. While all of these results are promising there are only a few researchers that have multi-year trials with these films and new or modified application equipment. Many growers are said to be testing the new films, reduced rates of methyl bromide, and other alternatives. Without multi-year trials under a range of environmental conditions the consistency, feasibility, and adaptability cannot be assessed.

When evaluating research that MBTOC cites (Gilreath et al 2003) at the Bradenton site the untreated control has 53 nutsedge (*Cyperus rotundus*) plants per square yard while the Immokalee site has less than one plant per square yard. The current standard that the US recommends for moderate nutsedge pressure is 5 to 30 plants per square yard. At the Bradenton site the nutsedge control was not significantly different between Methyl bromide:chloropicrin (350 lb per acre) versus 1,3-D-35% chloropicrin /trifluralin/napropamide/chloropicrin (28 gal/0.5 lb/2 lb/125 lb) but had 39% more nutsedge plants and a 17% reduction in yield. When comparing the same treatments at the second site at Immokalee which had low nutsedge pressure (< 1 plant per square yard) and no significant difference in *Fusarium*, or nematodes such as *Meloidogyne spp, Belonolainus spp. and Tylenchorhynchus spp.* still had a 12.5% reduction in yield compared to methyl bromide.

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*):

There are a number of possibilities, including both chemical and non-chemical alternatives, which are being investigated for use as possible methyl bromide replacements. These range from methyl iodide, which has some potential to become a drop-in replacement for methyl bromide in pre-plant uses, 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.

In Michigan the critical use exemption application states that 1,3-D + chloropicrin, metam-sodium, methyl iodide, sodium azide, and furfural will continue to be under investigation as methyl bromide alternatives. Some of these alternatives are currently unregistered for use on tomato, and there are presently no commercial entities pursuing registration in the United States. The timeline for developing the above-mentioned methyl bromide alternatives in Michigan is as follows:
2003 – 2005: Test for efficacy (particularly against the more prevalent *Phytophthora*)
2005 – 2007: Establish on-farm demonstration plots for effective methyl bromide alternatives
2008 – 2010: Work with growers to implement commercial use of effective alternatives.

Research is also under way to optimize the use of a 50 % methyl bromide: 50 % chloropicrin formulation to replace the currently used 67:33 formulation. In addition, field research is being conducted to optimize a combination of crop rotation, raised crop beds, black plastic and foliar fungicides. Use of virtually impermeable film (VIF) will also be investigated as a replacement for the currently used low density polyethylene (LDPE), however, the lack of infrastructure to recycle VIF remains an obstacle.

In the Southeast, a combination of 1,3 D + chloropicrin + pebulate appeared to be the best alternative in controlling key pests in tomato fields. Since pebulate herbicide is no longer available then the growers will have to substitute another herbicide for postemergence application, listed in tables C 2a and C 3 (such as halosulfuron, rimsulfuron or trifloxysulfuron to achieve similar pest control). To date, preliminary evaluations of furfural have demonstrated poor control of nutsedge. Florida and Georgia state expert claim the yield losses using a combination of 1,3 D + chloropicrin + herbicides will be higher than 6.2% yield losses because pebulate is no longer registered and other herbicides have limitations. The crop experts were unable to provide yield loss estimate without 2-3 years of field trials. The experts claim that more time is needed to evaluate various methyl bromide fumigant alternatives, mulches and herbicides systems to study their effects on tomato yields.

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.

Methyl iodide: Only has an 'experimental use permit' that allows field trials on about 2,000 acres (combined) of several crops (none of which are cucurbits). Under development for future registration submission

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.

Muscador albus Strain QST 20779. Registered but no commercially available formulation.

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):

- Tomatoes are grown in fields. In south-eastern U.S., it is neither technically feasible nor economically viable to grow tomatoes in soil-less culture or in containers.

- Tomatoes are grown in fields. In Michigan, it is neither technically feasible nor economically viable to grow tomatoes in soil-less culture or in containers.

(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 currently technically and economically feasible

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

Not currently technically and economically feasible

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.

TABLE C 8 MICHIGAN REGION: PRESENT REGISTRATION STATUS OF ALTERNATIVES

NAME OF ALTERNATIVE	PRESENT REGISTRATION STATUS	REGISTRATION BEING CONSIDERED BY NATIONAL AUTHORITIES? (Y/N)	DATE OF POSSIBLE FUTURE REGISTRATION:
Methyl Iodide	Not registered.	Yes	Unknown
Sodium azide	Not registered. No registration package has been received.	No	Unknown
Furfural	Not registered. Registration package has been received.	Yes	Unknown
Propargyl Bromide	Not registered. No registration package has been received.	No	Unknown
Muscador albus Strain QST 20799	Registration package has been received.	Yes	Registered but not yet for sale in the U.S.

TABLE C 9 SOUTH-EASTERN UNITED STATES: PRESENT REGISTRATION STATUS OF ALTERNATIVES

NAME OF ALTERNATIVE	PRESENT REGISTRATION STATUS	REGISTRATION BEING CONSIDERED BY NATIONAL AUTHORITIES? (Y/N)	DATE OF POSSIBLE FUTURE REGISTRATION:
Halosulfuron-methyl	There are a number of restrictions limiting the potential to use this herbicide in tomatoes in the Southeast (see additional notes below). Among these are potential crop injury and plant back restrictions for rotational crops. Efficacy is lowered in rainy conditions (which are common in this region). Need more time to experiment under field conditions	Yes	Recently registered
Pebulate	For nutsedges: Was registered for use in tomatoes only, but its registration expired in December, 2002 (the manufacturer went out of business)	No	No longer registered
S-metolachlor	For nutsedges: Not registered in some states of concern. It is effective against yellow nutsedge and not effective against purple nutsedge (Culpepper, 2004).	Yes	Already registered
Terbacil	For nutsedges: Registered only in strawberries. The manufacturer claims that it is partially effective against yellow nutsedge and does not control purple nutsedge.	No	Unlikely due to phytotoxicity
Rimsulfuron	Registered for use on tomatoes. The product label states that it is partially effective against nutsedges.	Y	Already registered
Trifloxysulfuron	For nutsedges: Newly Registrated for use in tomato. Efficacy needs to be tested under large scale field trials. Labeled for use in Florida only. It provides good postemergence control of nutsedge but rotational restrictions may limit its large scale adoption.	Y	Already registered
Methyl Iodide	Not yet registered in the United States	Y	Unknown
Sodium azide	Not registered. No registration package has been received.	No	Unknown
Furfural	Not registered. Registration package has been received.	Yes	Unknown
Propargyl Bromide	Not registered. No registration package has been received.	No	Unknown
Muscadore albus Strain QST 20799	Registration package has been received.	Yes	Registered but not yet for sale in the U.S.

Additional notes on specific herbicides listed:

Halosulfuron-methyl

In December 2002, halosulfuron-methyl (Sandea®) was registered for weed control (including nutsedge) in tomatoes, peppers, eggplant, and cucurbits

Halosulfuron-methyl has a number of limitations which may affect its widespread adoption, that include: (1) phyto-toxicity with moderate rainfall immediately after application; (2) cool temperatures, (3) susceptible varieties, and (4) plant back restrictions. Specifically:

- Rainfall or sprinkler irrigation greater than 2.5 cm, soon after a pre-emergent application of halosulfuron-methyl, may cause crop injury. Sudden storms with greater than 2.5 cm of rainfall are common in Florida and other areas of the southeastern United States. In addition, rainfall within four hours after a post-emergence application of halosulfuron-methyl may reduce effectiveness and cause crop injury.
- Under cool temperatures that can delay early seedling emergence or growth, halosulfuron methyl can cause injury or crop failure. This is especially likely to occur during the first planting of the season. In addition, not all hybrids/varieties of tomatoes have been tested for sensitivity to halosulfuron-methyl. Halosulfuron may also delay maturity of treated crops.
- Halosulfuron methyl plant back restrictions are up to 36 months. Many of the vegetable crops fall within the 4 to 12 month range, although some are longer. There are label limitations for halosulfuron methyl. As per product label, halosulfuron methyl should not be applied if the crop or target weeds are under stress due to drought, water saturated soils, low fertility, or other poor growing conditions. This herbicide can not be applied to soil that has been treated with organophosphate insecticides. Foliar applications of organophosphate insecticides may not be made within 21 days before or 7 days after halosulfuron methyl application.
  Note: All the limitations above are listed in the US registration label for halosulfuron, which in turn is based on proprietary data submitted to EPA by the registrant company.

S-metolachlor

It was registered for use in tomatoes in April 2003. However, it is not registered in states of concern, and does not control purple nutsedge or nightshade species. Further, it does not provide commercially acceptable weed control in plasticulture systems.

Rimsulfuron

There is evidence that rimsulfuron only provides suppressive control of yellow nutsedge (40 to 70 percent control) (Nelson *et al*, 2002). In addition, the label warns against tank mixing with organophosphate insecticides because injury to the crop may occur. Also, for most of the vegetable crops besides tomatoes there is a 12-month plant back restriction. This plant back restriction can seriously compromise the rotational interval needed for second crop production and IPM programs.

(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.

In studies discussed by MBTOC (Locascio et al, 2000) where pest control by alternatives was equal or better than that of methyl bromide; these studies were conducted with pebulate in each treatment mix, which the United States concedes is a very good alternative, however, it is no longer registered in this country. The likelihood of pebulate being registered in the near future is very low.

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 TO MINIMIZE METHYL BROMIDE USE AND EMISSIONS

TECHNIQUE OR STEP TAKEN	VIF OR HIGH BARRIER FILMS	METHYL BROMIDE DOSAGE REDUCTION	INCREASED % CHLOROPICRIN IN METHYL BROMIDE FORMULATION	LESS FREQUENT APPLICATION	DEEP INJECTION
WHAT USE/EMISSION REDUCTION METHODS ARE PRESENTLY ADOPTED?	Began research during 2003	Already using 67:33 with the potential to use lower ratios in the future. Between 1997 and 2002, the US has achieved a 27 % reduction in use rates.	Already using 67:33 with the potential to use lower ratios in the future	The US anticipates that the decreasing supply of methyl bromide will motivate growers to try less frequent applications.	Not feasible. With deep injection the fumigant is delivered below the root zone where the heaviest pest infestation is located.
WHAT FURTHER USE/EMISSION REDUCTION STEPS WILL BE TAKEN FOR THE METHYL BROMIDE USED FOR CRITICAL USES?	Began research during 2003	Already using 67:33 with the potential to use lower ratios in the future	Already using 67:33 with the potential to use lower ratios in the future	Not applicable	Not applicable
OTHER MEASURES *(please describe)*	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

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

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

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

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

Techniques to minimize emission include the use of low-permeability films, the application of water seals, and the "top dressing" application of fertilizer. In California, however, there is a performance standard for films that require a minimum level of permeability to methyl bromide to protect workers so low barrier films cannot be used with methyl bromide.

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

(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 growing of tomato 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 November in Orlando, Florida) 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 in Table D 1.

Part E: ECONOMIC ASSESSMENT

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

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

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

The following economic analysis is organized by methyl bromide critical use application regions.

Reader, 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.

Summary of Economic Feasibility

The economic analysis of the tomato application compared data on yields, crop prices, revenues and costs using methyl bromide and using alternative pest control regimens in order to estimate the loss of methyl bromide availability. The alternatives identified as technically feasible - in cases of low pest infestation – for different regions by the U.S. are: (a) 1,3-Dichloropropene and Chloropicrin; (b) Metam sodium; and (c) Chloropicrin. Changes in pest control costs for tomatoes are less than 4 percent of total variable costs therefore they would have little impact on any of the economic measures used in the analysis.

The economic factors that really drives the feasibility analysis for fresh market tomato uses of methyl bromide are: (1) yield losses, referring to reductions in the quantity produced, (2) increased production costs, which may be due to the higher-cost of using an alternative, additional pest control requirements, and/or resulting shifts in other production or harvesting practices (3) quality losses, which generally affect the quantity and price received for the goods, and (4) missed market windows due to plant back time restrictions, which also affect the quantity and price received for the goods.

The economic reviewers then analyzed crop budgets for pre-plant sectors to determine the likely economic impact if methyl bromide were unavailable. Various measures were used to quantify the impacts, including the following:

(1) **Loss per Hectare.** For crops, this measure is closely tied to income. It is relatively easy to measure, but may be difficult to interpret in isolation.

(2) **Loss per Kilogram of Methyl Bromide**. This measure indicates the value of methyl bromide to crop production.

(3) **Loss as a Percentage of Gross Revenue.** This measure has the advantage that gross revenues are usually easy to measure, at least over some unit, *e.g.*, a hectare of land or a storage operation. However, high value commodities or crops may provide high revenues but may also entail high costs. Losses of even a small percentage of gross revenues could have important impacts on the profitability of the activity.

(4) **Loss as a Percentage of Net Operating Revenue**. We define net cash revenues as gross revenues minus operating costs. This is a very good indicator as to the direct losses of income that may be suffered by the owners or operators of an enterprise. However, operating costs can often be difficult to measure and verify.

(5) **Operating Profit Margin**. We define operating profit margin to be net operating revenue divided by gross revenue per hectare. This measure would provide the best indication of the total impact of the loss of methyl bromide to an enterprise. Again, operating costs may be difficult to measure and fixed costs even more difficult, therefore fixed costs were not included in the analysis.

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

Michigan

We conclude that, at present, no economically feasible alternatives to methyl bromide exist for use in Michigan tomato production. Three factors have proven most important in our conclusion. These are yield loss, quality loss, and missed market windows.

Our analysis of this effect is based on the fact that prices farmers receive for their tomatoes 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 tomatoes 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, tomato growers manage their production systems with the goal of harvesting the largest possible quantity of tomatoes when the prices are at their highs. The ability to sell produce at these higher prices makes a significant contribution toward the profitability of tomato operations.

To describe these conditions in Michigan tomato production, we used daily tomato sales data from the U.S. Department of Agriculture for the previous year to gauge the impact of early season price fluctuations on gross revenues. Though data availability is limiting, we assume that if tomato growers adjust the timing of their production system, as required when using 1,3-D + Chloropicrin or Metam-Sodium or Chloropicrin, that they will, over the course of the growing season, accumulate gross revenues reduced by approximately 16%. We reduced the season average price by 16% in our analysis of the alternatives to reflect this. Based on currently available information, we believe 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.

TABLE E.1MICHIGAN: ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

MICHIGAN	METHYL BROMIDE	1,3-D + PIC	METAM SODIUM	CHLOROPICRIN
PRODUCTION LOSS (%)	0%	6%	13%	6%
PRODUCTION PER HECTARE	5,123	4,795	4,462	4,795
* PRICE PER UNIT (US$)	$ 11	$ 9	$ 9	$ 9
= GROSS REVENUE PER HECTARE (US$)	$ 55,178	$ 43,383	$ 40,370	$ 43,383
- OPERATING COSTS PER HECTARE (US$)**	$ 32,038	$ 30,869	$ 29,790	$ 31,283
= NET REVENUE PER HECTARE (US$)	$ 23,140	$ 12,514	$ 10,581	$ 12,100
FIVE LOSS MEASURES *				
1. LOSS PER HECTARE (US$)	$ -	$ 10,626	$ 12,560	$ 11,041
2. LOSS PER KILOGRAM OF METHYL BROMIDE (US$)	$ -	$ 122	$ 144	$ 127
3. LOSS AS A PERCENTAGE OF GROSS REVENUE (%)	0%	19%	23%	20%
4. LOSS AS A PERCENTAGE OF NET OPERATING REVENUE (%)	0%	46%	54%	48%
5. OPERATING PROFIT MARGIN (%)	42%	29%	26%	28%

**Note that the measures in the tables below must be interpreted carefully. Operating costs do not include fixed costs and net revenue equals gross revenue minus operating costs.

Eastern US

We conclude that, at present, no economically feasible alternatives to methyl bromide exist for use in Southeastern US tomato production. Two factors have proven most important in our conclusion. These are yield loss and missed market windows.

Our analysis of this effect is based on the fact that prices farmers receive for their tomatoes 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 tomatoes 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, tomato growers manage their production systems with the goal of harvesting the largest possible quantity of tomatoes when the prices are at their highs. The ability to sell produce at these higher prices makes a significant contribution toward the profitability of tomato operations.

To describe these conditions in Eastern US tomato production, we used weekly tomato sales data from the U.S. Department of Agriculture for the previous three years to gauge the impact of early season price fluctuations on gross revenues. Though data availability is limiting, we assume that if tomato 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, accumulate gross revenues reduced by approximately 15%. We reduced the season average price by 15% in our analysis of the alternatives to reflect this. Based on currently available information, we believe 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 Eastern US.

TABLE E.2 EASTERN US: ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

EASTERN US (EXCEPT FLORIDA)*	METHYL BROMIDE	1,3-D + PIC
PRODUCTION LOSS (%)	0%	1.75%
PRODUCTION PER HECTARE	4,403	4,326
* PRICE PER UNIT (US$)	$ 7	$ 6
= GROSS REVENUE PER HECTARE (US$)	$ 32,711	$ 27,382
- OPERATING COSTS PER HECTARE (US$)**	$ 27,581	$ 27,711
= NET REVENUE PER HECTARE (US$)	$ 5,130	$ (329)
FIVE LOSS MEASURES *		
1. LOSS PER HECTARE (US$)	$ -	$ 5,460
2. LOSS PER KILOGRAM OF METHYL BROMIDE (US$)	$ -	$ 63
3. LOSS AS A PERCENTAGE OF GROSS REVENUE (%)	0%	17%
4. LOSS AS A PERCENTAGE OF NET OPERATING REVENUE (%)	0%	106%
5. OPERATING PROFIT MARGIN (%)	16%	-1%

* Includes: South-Eastern United States (Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee), and the Mid-Atlantic United States (Maryland, and Virginia).
**Note that the measures in the tables below must be interpreted carefully. Operating costs do not include fixed costs and net revenue equals gross revenue minus operating costs.

Florida

We conclude that, at present, no economically feasible alternatives to methyl bromide exist for use in Florida tomato production. Two factors have proven most important in our conclusion. These are yield loss and missed market windows.

Our analysis of this effect is based on the fact that prices farmers receive for their tomatoes 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 tomatoes 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, tomato growers manage their production systems with the goal of harvesting the largest possible quantity of tomatoes when the prices are at their highs. The ability to sell produce at these higher prices makes a significant contribution toward the profitability of tomato operations.

To describe these conditions in Florida tomato production, we used weekly tomato sales data from the U.S. Department of Agriculture for the previous three years to gauge the impact of early season price fluctuations on gross revenues. Though data availability is limiting, we assume that if tomato 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, accumulate gross revenues reduced by approximately 15%. We reduced the season average price by 15% in our analysis of the alternatives to reflect this. Based on currently available information, we believe 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 Florida.

TABLE E.3 FLORIDA: ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

FLORIDA	METHYL BROMIDE	1,3-D + PIC
PRODUCTION LOSS (%)	0%	1.75%
PRODUCTION PER HECTARE	3,492	3,431
* PRICE PER UNIT (US$)	$ 10	$ 9
= GROSS REVENUE PER HECTARE (US$)	$ 36,007	$ 30,141
- OPERATING COSTS PER HECTARE (US$)**	$ 23,237	$ 23,966
= NET REVENUE PER HECTARE (US$)	$ 12,770	$ 6,175
FIVE LOSS MEASURES *		
1. LOSS PER HECTARE (US$)	$ -	$ 6,595
2. LOSS PER KILOGRAM OF METHYL BROMIDE (US$)	$ -	$ 76
3. LOSS AS A PERCENTAGE OF GROSS REVENUE (%)	0%	18%
4. LOSS AS A PERCENTAGE OF NET OPERATING REVENUE (%)	0%	52%
5. OPERATING PROFIT MARGIN (%)	35%	20%

**Note that the measures in the tables below must be interpreted carefully. Operating costs do not include fixed costs and net revenue equals gross revenue minus operating costs.

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

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

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

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

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

Renomination Form Part C: TRANSITION ACTIONS

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

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

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

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

(i) DESCRIPTION AND IMPLEMENTATION STATUS:

See question 15 above. Many research projects are ongoing and considerable funding is 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 above.

(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 15 million kilograms of methyl bromide were requested by methyl bromide users across all sectors. USG carefully scrutinized requests and made subtractions to ensure that no growth, double counting, inappropriate use rates on a treated hectare basis was incorporated into the final request. Use when the requestor qualified under some other provision (QPS, for example) was also removed and appropriate transition given yields obtained by alternatives and the associated cost differentials 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 MBAO, and through the land grant university system

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

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

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

(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

Chellemi, D., Botts, D.A. and Noling, J.W. 2001. Field scale demonstration/validation studies of methyl bromide in plastic mulch culture in Florida, USDA ARS specific co-operative agreement SCA # 58-6617-6-013, Executive Summary (1996-2001) submitted to the US-EPA.

Chellemi, D.O. & J. Mirusso. 2006. Optimizing Soil Disinfestation Procedures for Fresh Market Tomato and Pepper. Plant Disease vol. 90 n. 5. p. 668-674.

Baldwin, R.E. & C.M. Waldenmaier. 1991. Trellis Tomato Fumigation Trial 1991. Eastern Shore Agricultural Experiment Station. VA

Burnette, G. 2003. Personal communication, November 25, 2003.

Culpepper, Stanley. 2004. Faculty, University of Georgia, Athens, GA. Comments on methyl bromide Critical use nomination for preplant soil use for tomato grown in open fields.

Driver , J.G.,& F.J. Louws. 2000. Fumigants and varieties to manage southern bacterial wilt of tomato. North Carolina State University.

Florida. 2000. Florida soil temperatures. Web address: www.imok.ufl/edu/weather/archive/200/clim00

Gilreath, J.P., J.P. Jones, T.N. Motis, B.M. Santos, J.W. Noling, and E.R. Rosskopp. 2003. Evaluation of various chemical treatment for potential as methyl bromide replacemnts for disinfetation of soilborne pests in polyethylene-mulched tomato. Proc. Fla. State Hort. Soc. 116: 151-158.

Gilreath, J.P., T.N. Motis, and B.M. Santos. 2005. *Cyperus spp*. Control with reduced methyl bromide plus chloropicrin doses under virtually impermeable films in pepper. Crop Prot. 24: 285-287.

Gilreath, J.P. & B.M. Santos. 2005. Efficacy of 1,3-Dichloropropene Plus Chloropicrin in Combination with Herbicides on Purple Nutsedge (*Cyperus rotundus*) Control in Tomato. Weed Tech. 19: 101-104

Gilreath, J.P. & B.M. Santos. 2005. Purple Nutsedge (*Cyperus rotundus*) Control with Fumigation and Pebulate Combinations in Tomato. Weed Tech. 19:575-579

Gilreath, J.P. B.M. Santos, J.D. Busacca, J.E. Eger Jr., J.M. Mirusso, P.R. Gilreath. 2006. Validation Broadcast Application of Telone C-35 Complemented with Chloropicrin and Herbicides in Commercial Tomato Farms. Crop Prot. 25:79-82.

Gilreath, J.P. B.M. Santos, C.A. Chase, S.J. Locascio. 2006. Influence of Soil Fumigation on 2,4-D and Dicamba Carryover in Fresh Market Tomato. Crop Prot. 25:1095-1100.

Gilreath, J.P. B.M. Santos, T.M. Motis, J.W. Noling, and J.M. Mirusso. (2005) Methyl bromide alternatives for nematode and *Cyperus* control in bell pepper (*Capsicum annuum*). Crop Prot. 24: in press.

Hausbeck, M. and Cortright, B. 2003. Soil temperature data submitted to BEAD (OPP, US-EPA) in support of methyl bromide critical use exemption application.

Hausbeck, M.K. & B.D. Cortright. 2003. Alternatives for methyl bromide on cucurbit and Solanaceous crops. Unpublished.

Hausbeck, M.K. & B.D. Cortright. 2004. Evaluation of Fumigants for Managing Phytophthora Crown and Fruit Rot of Solanaceous and Cucurbit Crops; 2004. . Unpublished.

IR-4. 2003. IR-4 Project Annual Report 2003. Available online at http://ir4.rutgers.edu/annreport/report2003.pdf
Jacob, W. C. 1977. Range of mean outside temperature and rainfall in South-Eastern United States. Climatic Atlas of the United States. Published by the US Department of Commerce.

Lamour, H.H. and Hausbeck, M. 2003. Effect of crop rotation on the survival of *Phytophthora capsici* in Michigan. Plant Disease 87: 841-845.

Locasio, S.J., Gilreath, J.P., Dickson, D.W., Kucharek, T.A., Jones, J.P. and Noling, J.W. 1997. Fumigant alternatives to methyl bromide for polyethylene-mulched tomato. HortScience 32(7) 1208-1211.

Locasio, S.J. & Dickson, D.W. 2000. Broadcast vs In-Row Application of 1,3-D Plus Chloropicrin as an Alternative for Tomato Fumigants.

Louws, F.J., L.M. Ferguson, K. Ivors, J. Driver, K. Jennings, D. Milks, P.B. Shoemaker & D.W. Monks. 2004. Efficacy of methyl bromide alternatives for Verticillium and weed management in tomatoes. North Carolina State University.

Louws, F.J., L.M. Ferguson, N.P. Lynch, & P. B. Shoemaker. 2002. Methyl bromide alternatives in tomato production systems in North Carolina. North Carolina State University.

Morales, J.P., Santos, B.M., Stall, W.M. and Bewick. T.A. 1997. Effects of purple nutsedge (*Cyprus rotundus*) on tomato and bell pepper vegetative growth and fruit yield. Weed Science Technology 11: 672-676.

Minuto, A., A. Garibaldi, and M.L. Lodovica Gullino. 2003. Chemical Alternatives to Methyl Bromide in Italy: An Update. Proceedings of the MBAO.

Minuto, A. M.L. Gullino, F. Lamberti, T.D'Addabbo, E. Tescari, H. Ajwa, A. Garibaldi. 2006. Application of an Emulsifiable Mixture of 1,3-Dichloropropene and Chloropicrin Against Root Knot Nematodes and Soilborne Fungi for Greenhouse Tomatoes in Italy. 2006. Crop Prot. 25:1244-1252

Nelson, M., B. Olsen, B. Vander Mey, G, Lepeze, and L. Rodriguez, B. Johnson, W. Currey, J. Norton. 2001. Proceedings of the MBAO

Nelson, K.A. and Renner, K.A. 2002. Yellow nutsedge (*Cyprus esculentus*) control and tuber production with glyphosate and ALS-inhibiting herbicides. Weed Technology 16(3): 512-519.

Norton, J., Nelson, R.D., Nelson, M.D., Olson, B.O., Mey, B.V. and Lepez, G. 2000. Field evaluation of alternatives to methyl bromide for pre-plant soil fumigant in California tomatoes. USDA IR-4 methyl bromide alternatives program for minor crop. Report submitted to the US-EPA during 2003 in support of methyl bromide critical use exemption.

Santos, B.M., J.P. Gilreath, T.N. Motis, J.W. Noling, J.P. Jones, and J.A. Norton. 2006. Comparing Methyl Bromide Alternatives for Soilborne Disease, Nematode and Weed Management in Fresh Market Tomato. Crop Prot. 25:690-695.

Stall, W.M. and Morales-Payan, J.P. 2003. The critical period of nutsedge interference in tomato, Florida. Web address: http://www.imok.ufl.edu/liv/groups/ipm/weed_con/nutsedge.htm

Tostovrsnik, N.S., A.L. Shanks, I.J. Porter, S.W. Mattner, and R.W. 2005. Facilitating the Adoption of Alternatives to Methyl Bromide in Australian Horticulture. Proceedings of the MBAO

U.S. Environmental Protection Agency. 1998. Re-registration Eligibility Decision (RED) 1,3 dichloroprppene. Available at http://www.epa.gov/REDs/0328red.pdf

U.S. Environmental Protection Agency. 1998. Feasibility of using gas permeable tarps to reduce methyl bromide emissions associated with soil fumigation in the United States.

Zhou, X.G. & K.L. Everts. 2003. Races and Inoculum Density of Fusarium oxysporum f. sp. niveum in Commercial Watermelon Fields in Maryland and Delaware. Amer. Phytopath. Soc. V. 87 n. 6 692-698.

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

2008 Methyl Bromide Usage Newer Numerical Index - BUNNIE								Tomato	
December 18, 2006	Region		Michigan Tomato	Maryland Tomatoes	Southeast Tomato Total	Georgia Tomato	Florida Tomato Total	Sector Total	Notes
Marginal Strategy - Among Best Strategies & Economic Analysis (See Chapter)	Possible Regime		Telone+Pic+ herbicide	Metam+Pic+ herbicide	Metam+Pic+ herbicide	Telone+Pic+ herbicide	Telone+Pic+ herbicide		
	Loss Estimate (%) - Yield (Y), Quality (Q), Market Window (M)		22%, (6% Y + 16% MW)	21%, (6% Y + 15% MW)	21%, (6% Y + 15% MW)	21%, (6% Y + 15% MW)	21%, (6% Y + 15% MW)		
	Loss per Hectare (US$/ha)		$ 1,937	$ 5,374	$ 5,374	$ 4,533	$ 7,068		
	Loss per Kg of MeBr (US$/kg)		$ 16	$ 36	$ 36	$ 30	$ 46		
	Loss as a % of Gross Revenue		5%	17%	17%	11%	15%		
	Loss as a % of Net Op Revenue		42%	173%	173%	77%	40%		
Dichotomous Variables (Y/N)	Strip or Bed Treatment?		Strip	Strip	Strip	Strip	Strip		
	Currently Use Alternatives?		Yes	Yes	Yes	Yes	Yes		
	Tarps / Deep Injection Used?		Tarp	Tarp	Tarp	Tarp	Tarp		
Other Issues	Frequency of Treatment (x/ yr)		1x per year	1x per year	1x per year	1x per year	1x per year		
	Change in CUE Request		same	New	increase	same	decrease	decrease	
Most Likely Combined Impacts (%)	Florida Telone Restrictions (%)		0%	0%	6%	11%	54%		
	100 ft Buffer Zones (%)		0%	0%	0%	0%	0%		
	Key Pest Distribution (%)		100%	100%	36%	36%	36%		
	Regulatory Issues (%)		0%	0%	0%	0%	0%		
	Unsuitable Terrain (%)		0%	0%	0%	0%	0%		
	Cold Soil Temperature (%)		100%	0%	0%	0%	0%		
	Total Combined Impacts (%)		**100%**	**100%**	**39%**	**43%**	**70%**		
Most Likely Baseline Transition	(%) Able to Transition		0%	0%	64%	64%	64%		
	Minimum # of Years Required		0	0	7	7	7		
	(%) Able to Transition / Year		**0%**	**0%**	**9%**	**9%**	**9%**		
Joint Adjusted Use Rate		kg/ha	**175**	**150**	**187**	**186**	**183**		*
Joint Adjusted Dosage Rate		g/m2	17.5	15.0	18.7	18.6	18.3		
2008 Applicant Requested Usage	*Amount - Pounds*	*Pounds*	*67,000*	*2,680*	*3,288,720*	*779,210*	*6,450,000*	*10,587,610*	
	Area - Acres		*625*	*40*	*23,560*	*5,815*	*43,000*	*73,040*	
	Rate (lb/A)		*107.20*	*67.00*	*144.81*	*134.00*	*150.00*	*145*	
	Amount - Kilograms	Metric	**30,391**	**1,216**	**1,491,737**	**353,443**	**2,925,668**	**4,802,455**	
	Treated Area - Hectares		253	16	9,534	2,353	17,401	29,558	
	Rate (kg/ha)		120	75	162	150	168	162	
EPA Preliminary Value		kgs	**30,391**	**1,216**	**1,409,865**	**353,443**	**2,925,668**	**4,720,582**	
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	25,672	1,216	351,495	97,035	1,293,382	1,768,799	*
EPA Transition Amount		kgs	-	-	(81,281)	(29,719)	(423,449)	(534,448)	*
EPA Amount of All Adjustments		kgs	**(4,718)**	**-**	**(1,134,255)**	**(286,127)**	**(2,055,735)**	**(3,480,835)**	
Most Likely Impact Value for Treated Area		**kgs**	**25,672**	**1,216**	**275,610**	**67,316**	**869,933**	**1,239,748**	*
		ha	**147**	**8**	**1,575**	**385**	**4,971**	**7,085**	*
		Rate	**175**	**150**	**175**	**175**	**175**	**175**	*
Sector Research Amount (kgs)			**5,501**	**2008 Total US Sector Nomination**			**1,245,249**		*

1 Pound = 0.453592 kgs 1 Acre = 0.404686 0.404686 ha

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 (Apendix Table 1 and Appendix Figure 3).

Soil physiographic division characteristics used to estimate locations of karst topography may not define all karst features in Flordia 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 SLN restriction, then those map units were selected. Next, the "Acreage and Proportionate

[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

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.

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[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.

REFERENCES

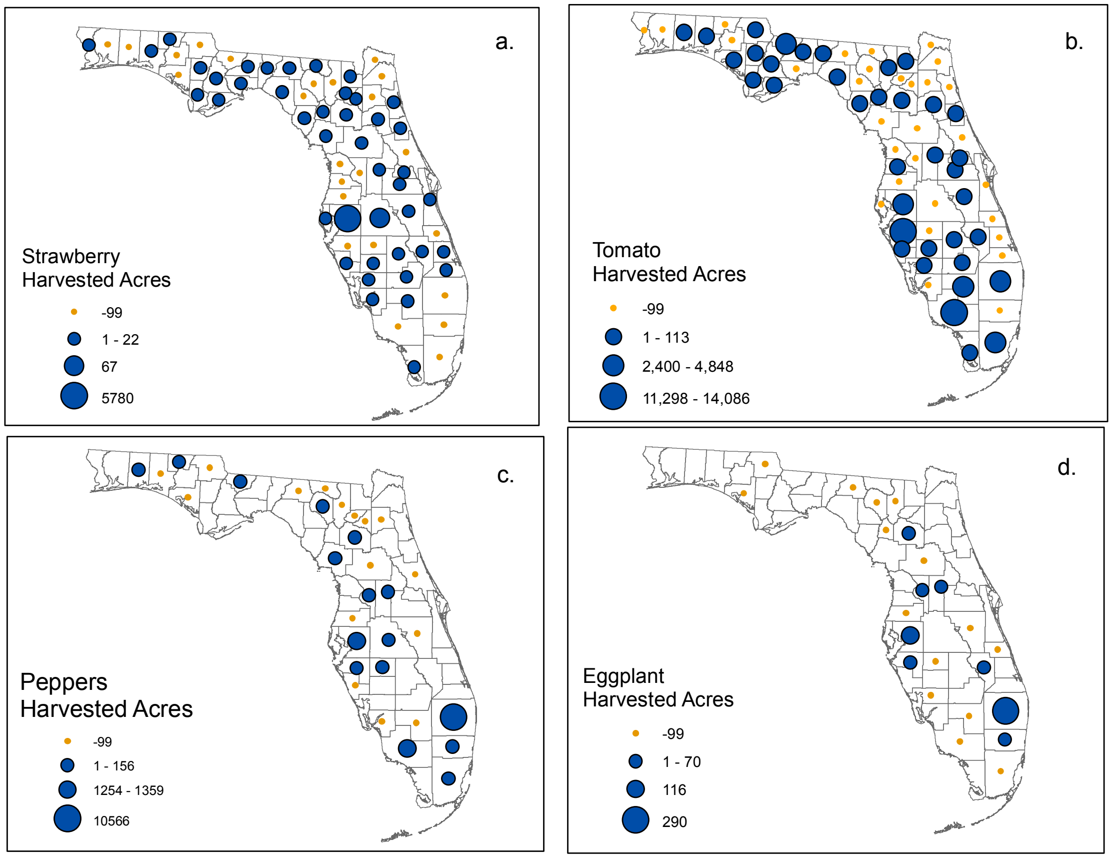
Brooks, H.K. 1981. Guide to the Physiographic Divisions of Florida. Institute of Food and Agricultural Sciences. Gainesville, Fla. University of Florida.

ESRI, 2005. ArcGIS 9.1 Data and Maps. Environmental Systems Research Institute.

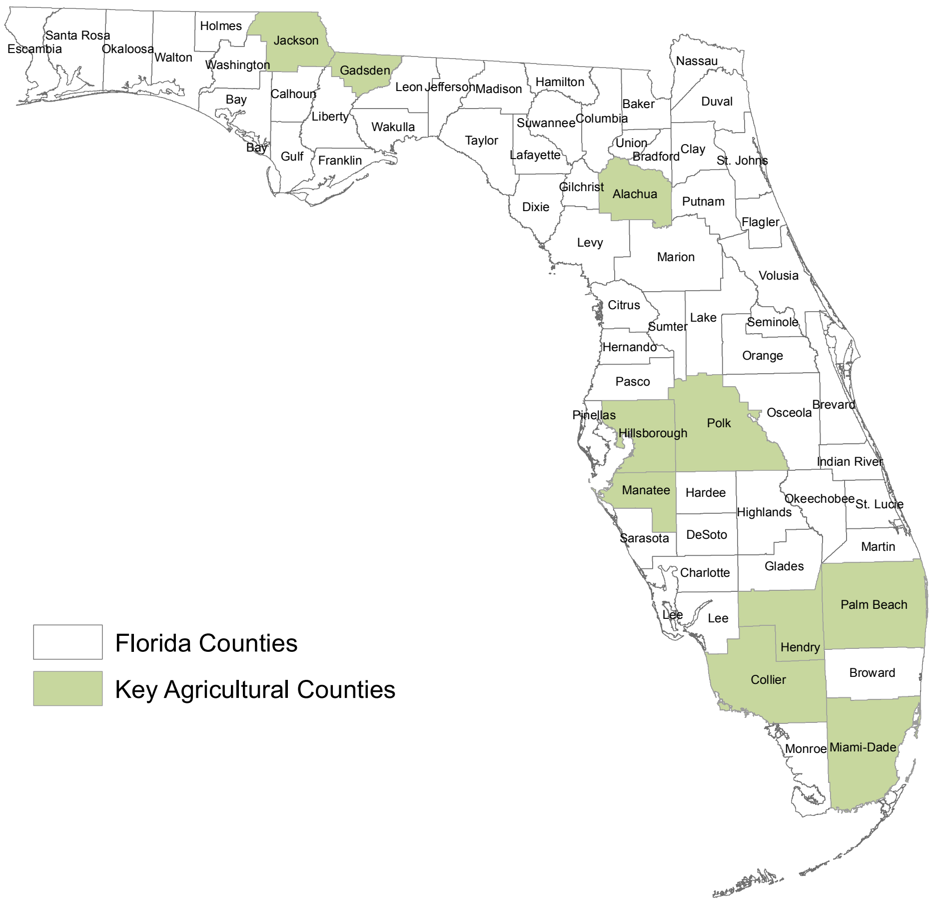
USDA Natural Resource Conservation Service (NRCS) Soil Data Mart. Online: http://soildatamart.nrcs.usda.gov/

USDA, 2002. Census of Agriculture. Online: http://www.nass.usda.gov/Census_of_Agriculture/index.asp

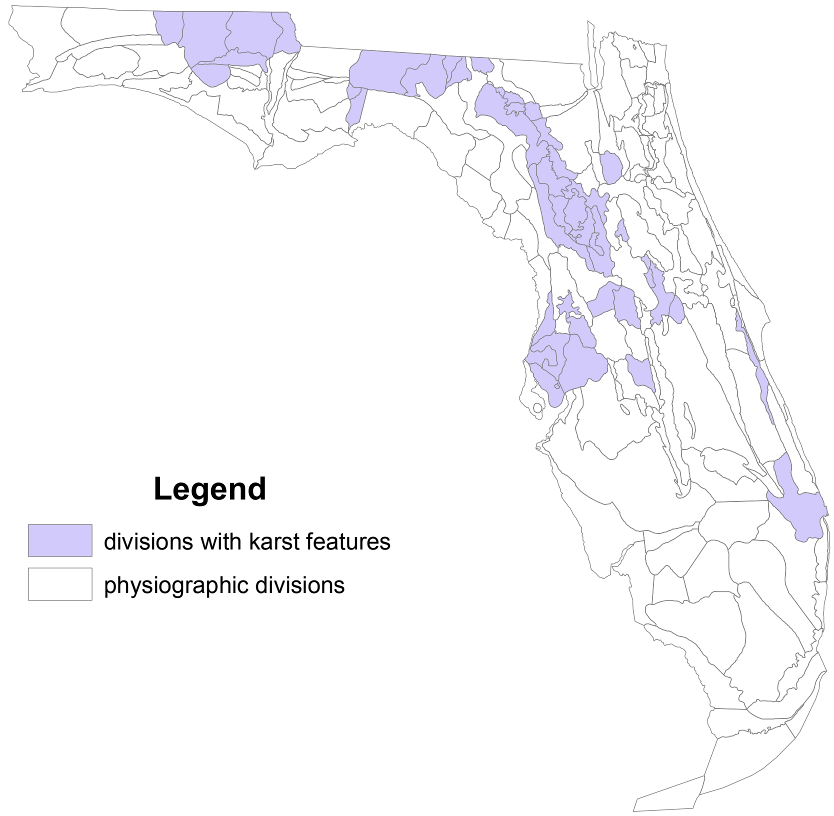
USGS, University of Florida, and St. Johns River Water Management District, 2000. Physiographic divisions map of Florida. Online: http://www.sjrwmd.com/programs/data.html



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).

APPENDIX C ADDRESSING MBTOC COMMENTS

As part of the 2006 MBTOC TEAP report, comments were directed to the Tomato (Field) sector of the United States Nomination. Below is the response to these comments.

MBTOC Comment: "*MBTOC considers several alternatives available for the nomination and that uptake of alternatives for this crop in regions with similar pests and climate has occurred within 4 years or less (eg Spain, Italy, Australia) (Leoni and Leda, 2004; Tostoyrsnik et al, 2005; Minuto et al, 2003).* "

United States Response: While it may seem as if this nomination is moving slower toward the "uptake of alternatives", in fact in comparison to others, including those cited by MBTOC, this sector has adapted well. This sector is at a point where only the most difficult to treat regions remain looking for alternatives. Areas with unique land characteristics, use restrictions, and those in close proximity to environmentally sensitive areas remain. During the same time that these sectors were struggling to adapt alternatives, other countries were trying to label mixtures that include methyl bromide; these efforts had occurred as recently as 2003 (Minuto et al, 2003).

As stated by MBTOC, other countries have been successful at rapidly reducing their dependence on methyl bromide by following a mandate that was imposed without regard to economic or efficacy considerations. The United States would like for MBTOC to conduct an economic feasibility assessment of the impact of those changes and describe how these mandated timelines will, or will not, impact United States tomato (field) production. At this time, for the United States to adopt this principle, some of the most productive tomato producing areas of the country would be lost.

The paper cited by MBTOC, Leoni and Leda, 2004, was of research conducted for greenhouse production and is not applicable to the United States Tomato (Field) nomination.

MBTOC Comment: *"In recent tomato trials conducted in Florida, 1,3-D/Pic 65:35 with and without LP barrier films, 1,3-D/Pic 65/35 and the herbicide combinations of either metolachlor & trifloxsulfuron or treflan and napropamide, and improved application of Pic with MNa provided similar yields as MB/Pic 67:33 in a number of consecutive trails over the spring and fall of 2003 and spring of 2004 (Santos et al, 2005). In further studies, (Locascio et al, 2000, Nelson et al, 2002, and Gilreath et al., 2005) similar pest and weed control and/or yields have been realized."*

United States Response: As presented in section 15 (also see the reproduced table below) the study by Santos, et al. (2006) demonstrated just how inconsistent pest control is with the alternatives. As stated in the comment from MBTOC, the alternatives were evaluated under a "*number of consecutive trails over the spring and fall of 2003 and spring of 2004 (Santos et al, 2005)."* The mean of the spring 2003, fall 2003, and spring 2004 yields for each treatment would lead one to believe that indeed there were no differences in treatments. However, when yields are viewed by treatments within each date of harvest, the differences in yields range from 0-7%

(see table 15.4 below). This inconsistency of the alternatives is currently a primary focus of producers and researchers in this field.

In the other studies mentioned by MBTOC, the paper by Locascio et al, 2000 was conducted with pebulate in each mix, which the United States concedes is a very good alternative, however, it is no longer registered in this country. In addition, while the United States commends Nelson et al, (2002) on their work, the lack of information on pest pressure makes the evaluation of this study most improbable. Equally as difficult is the comparison of the study by Gilreath et al. (2005) to the methyl bromide alternatives discussion. In this study there was no methyl bromide treatment standard for which to make comparisons.

TABLE APPENDIX C 1 SOUTH-EASTERN U.S. ALTERNATIVES: SOUTH-EASTERN US FRESH MARKET TOMATO FUMIGATION TRIAL

Treatment	Fusarium Wilt† Incidence (19 WAT)	Diseased Plants† *Ralstonia solanacearum (19 WAT)*	Cyperus spp. ‡ (plants/m^2) (17 WAT)	Marketable§ Yield Loss Using MeBr+ Pic as Standard
Me Br + Pic (67:33) (400 kg/ha)	3.8%	0%	11.5	0%
1,3-D + Pic (65:35) & napropamide+halosulfuron (330L/ha, 2.3kg +71g/ha)	5.0%	0%	11.5	0-4%
1,3-D + Pic (65:35) & metolachlor & trifloxysulfuron (330L/ha, 840g+5.3g/ha)	2.5%	0%	12.5	0-7%
Pic & MNa (170kg/ha & 710 L/ha)	0%	2.5*	3.5	0-2%

Footnote: Santos, M.S., JP Gilreath, TN Motis, JW Noling, JP Jones, and JA Norton. 2006
WAT=Weeks After Treatment
*Within column data is significantly different from MB+Pic (P=0.05)
†Data was obtained from Table 1, Spring 2003 since this part of the study was the only one to evaluate both *Fusarium* and *Ralstonia*.
‡Data was obtained from Table 4, Spring 2004 since the pest pressure was the highest of all three-harvest times.
§Yield data presented was for spring and fall 2003