Methyl Bromide Critical Use Nomination for Preplant Soil Use for Sod Farms

For Administrative Purposes Only:	
Date received by Ozone Secretariat:	
YEAR:	***CUN:***

Nominating Party:	The United States of America
Brief Descriptive Title of Nomination:	Methyl Bromide Critical Use Nomination for Preplant Soil Use for Sod Farms (Prepared in 2005)

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

☐ Yes ☐ No

__________________ __________________ __________________
Signature Name Date

Title: ____________________________________

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

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

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

2. ELECTRONIC COPIES OF ALL PAPER DOCUMENTS: **Title of Electronic Files**	**Size of File (kb)**	**Date Sent to Ozone Secretariat**

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PART A: SUMMARY

1. NOMINATING PARTY

The United States of America (U.S.)

2. DESCRIPTIVE TITLE OF NOMINATION

Methyl Bromide Critical Use Nomination for Preplant Soil Use for Sod Farms (Prepared in 2005)

3. CROP AND SUMMARY OF CROP SYSTEM

The Turfgrass Producers International has requested methyl bromide (MB) as a critical use. This nomination includes use of MB in the production of turfgrass sod, grown primarily in California, Florida, Georgia, Alabama, and Texas. There are at least 1,143 turfgrass sod producers across the U.S. who farm approximately 132,000 hectares, with a wholesale product value of U.S. $670 million. On average, fumigation of the affected soil occurs once every three years. Sod fields have been flat fumigated with MB when first establishing new sod fields and as a pre-plant fumigation when pest pressures become so severe that effective pest management with alternatives is particularly difficult. Turfgrass yields average between 6,400 and 8,700 square meters per hectare per cutting. From planting to harvest, a sod crop takes between 9-12 months to reach maturity.

4. METHYL BROMIDE NOMINATED

TABLE 4.1: METHYL BROMIDE NOMINATED

YEAR	NOMINATION AMOUNT (KG)	NOMINATION AREA (HA)
2007	**78,040**	**254**

5. BRIEF SUMMARY OF THE NEED FOR METHYL BROMIDE AS A CRITICAL USE

The U. S. nomination is only for those areas where the alternatives are not effective against key pests when pressure is moderate to high. The use of MB is also considered critical only where alternatives are not suitable because of regulatory, economic, or technical constraints. Although alternative treatments can be foreseen as long-term solutions to MB use, transition from MB will depend on the development of application technologies to better deliver these alternatives to soils containing target pests. Alternative treatments may require more frequent applications and increase costs and environmental pesticide burden. Research is ongoing to develop protocols for likely alternatives.

A small percentage of total hectares for sod farms currently use MB. The use is primarily for approximately 1% of sod farm hectares that face pests that are difficult to manage. The little research that has been conducted to identify MB alternatives has found that metam-sodium and dazomet may be acceptable replacements for MB for many farms that currently use MB. This sector is still developing methods of applications that can make these alternatives more effective.

TABLE A.1: EXECUTIVE SUMMARY

TURF	**Turfgrass Producers International**
AMOUNT OF REQUEST* (KG)	
2007	**680,388**
AMOUNT OF NOMINATION (KG)	
2007	**76,112**

*See Appendix A for complete description of how the nominated amount was calculated.
**Golfcourse Superintendents Association are part of a supplemental request. They applied for a CUE in 2002 and 2004 but not 2003.

6. SUMMARIZE WHY KEY ALTERNATIVES ARE NOT FEASIBLE

Primary MB alternatives for sod production are metam-sodium and dazomet, often in combination with chloropicrin and in some cases depending on pests, 1,3-D. Research results (Unruh and Brecke, 2001; Unruh et al., 2002) suggest that these alternatives have the potential to be as effective as MB, although research in application technologies will continue and will permit development of more effective pest control methodologies.

7. (*i*) PROPORTION OF CROPS GROWN USING METHYL BROMIDE

TABLE 7.1: PROPORTION OF CROPS GROWN USING METHYL BROMIDE

REGION WHERE METHYL BROMIDE USE IS REQUESTED	TOTAL CROP AREA - 2001-2002 AVERAGE (HA)	PROPORTION OF TOTAL CROP AREA TREATED WITH METHYL BROMIDE (%)
Turfgrass Producers	1206	1 %

7. (*ii*) IF ONLY 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

Approximately 1% of the total land planted for turfgrass is treated with MB each year; the affected area averages one treatment every three years. MB is used only in the portion of the turfgrass area where pest problems cannot be acceptably controlled using alternative methods. For instance, some broadleaf weeds, such as ragweed, pigweed, and morning glory, may be controlled through continuous mowing to reduce seed production. Spot treatment with a nonselective herbicide, such as glyphosate, may be used to control competitive grasses that can be easily distinguished from the turfgrass crop. Relatively low pest pressures in most of the turfgrass sod production area make it possible for producers to use alternative pesticides (herbicides, fungicides, nematicides, and insecticides) and cultural practices.

7. (*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?

Advances in technologies that will improve efficacy (e.g., application methods, use of VIF) and may increase the area of production where alternatives can be used effectively. Research (e.g., Unruh and Brecke, 2001; Unruh et al, 2002) in turfgrass production indicates that fumigant efficacy (even MB) varies depending on location and pest pressure. It is likely that farms where nutsedge is a major pest will have the most difficult task finding an alternative.

8. AMOUNT OF METHYL BROMIDE REQUESTED FOR CRITICAL USE

TABLE 8.1: AMOUNT OF METHYL BROMIDE REQUESTED FOR CRITICAL USE

REGION:	**Turfgrass Producers**
YEAR OF EXEMPTION REQUEST	**2007**
KILOGRAMS OF METHYL BROMIDE	680,400
USE: FLAT FUMIGATION OR STRIP/BED TREATMENT	Flat fumigation
FORMULATION *(ratio of methyl bromide/chloropicrin mixture)* TO BE USED FOR THE CRITICAL USE EXEMPTION (CUE)	98:2
TOTAL AREA TO BE TREATED WITH THE METHYL BROMIDE OR METHYL BROMIDE/CHLOROPICRIN FORMULATION *(ha)*	1416
APPLICATION RATE* *(kg/ha)* FOR THE **ACTIVE INGREDIENT**	480
DOSAGE RATE* *(g/m^2)* OF **ACTIVE INGREDIENT** USED TO CALCULATE REQUESTED KILOGRAMS OF METHYL BROMIDE	48.0

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

9. SUMMARIZE ASSUMPTIONS USED TO CALCULATE METHYL BROMIDE QUANTITY NOMINATED

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

- Hectares counted in more than one application or rotated within one year of an application to a crop that also uses MB were subtracted.
- Growth or increasing production (the amount of area requested by the applicant that is greater than that historically treated) was subtracted. The applicant included growth in the request and the growth amount was removed.
- Quarantine and pre-shipment (QPS) hectares is the area in the applicant's request subject to QPS treatments.
- Only the areas with moderate to heavy key pest pressure were included in the nomination.

10. SOD—KEY DISEASES AND WEEDS FOR WHICH METHYL BROMIDE IS REQUESTED AND SPECIFIC REASONS FOR THIS REQUEST

TABLE 10.1: SOD—KEY PESTS AND REASON FOR METHYL BROMIDE REQUEST

REGION WHERE METHYL BROMIDE USE IS REQUESTED	KEY PESTS AND WEED TO GENUS AND, IF KNOWN, TO SPECIES LEVEL	SPECIFIC REASONS WHY METHYL BROMIDE IS NEEDED
Throughout the United States	**Weeds:** nutsedge (*Cyperus* spp.); mainly off-type perennial grasses, crabgrass (*Digitaria spp*.); goosegrass (*Eleusine indica*); common bermudagrass (*Cynodon dactylon*) and turfgrass from the previous crop cycle. **Nematodes:** over 15 genera of parasitic nematodes, such as lance nematodes (*Hoplolaimus spp.*) and sting nematodes (*Belonolaimus longicaudatus*) **Insects:** white grubs (several species of soil-inhabiting scarabaeid beetle larvae)	Producers of turfgrass need to produce sod that is free of contamination with off-type perennial grasses, other weeds, pests, and diseases. For approximately 1% of the turfgrass sod growing area, this degree of pest control has been achieved through MB fumigation. However, dazomet and metam sodium with chloropicrin have looked as good (statistically) and nearly as good (numerically) in control of nutsedge and weedy grasses as MB at the high use rates for turf (560 kg/ha) (e.g., Unruh and Brecke, 2001; Unruh et al., 2002).

11. (*i*) SOD—CHARACTERISTICS OF CROPPING SYSTEM AND CLIMATE

TABLE 11.1: SOD—CHARACTERISTICS OF CROPPING SYSTEM

CHARACTERISTICS	U.S.
CROP TYPE: *(e.g. transplants, bulbs, trees or cuttings)*	Turfgrass sod grown from seeds or rhizomes
ANNUAL OR PERENNIAL CROP: *(# of years between replanting)*	Harvested annually
TYPICAL CROP ROTATION *(if any)* **AND USE OF METHYL BROMIDE FOR OTHER CROPS IN THE ROTATION:** *(if any)*	None
SOIL TYPES: *(Sand, loam, clay, etc.)*	Varies from clayish-loam to sandy-loam
FREQUENCY OF METHYL BROMIDE FUMIGATION: *(e.g. every two years)*	The area is treated with methyl bromide approximately once every 3 years. On average, 1% of the total turfgrass crop production area in the U.S. is fumigated in any one year.
OTHER RELEVANT FACTORS:	None identified.

TABLE 11.2 SOD—CHARACTERISTICS OF CLIMATE AND CROP SCHEDULE

	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	JAN	FEB
CLIMATIC ZONE	Range from temperate to subtropical (USDA Plant Hardiness Zones 5b through 11)											
SOIL TEMP. *(°C)*	Variable throughout the United States.											
RAINFALL *(mm)*												
OUTSIDE TEMP. *(°C)*												
FUMIGATION SCHEDULE[1]						x	x					
PLANTING SCHEDULE						x	x					
KEY MARKET WINDOW	Variable											

[1] On average, 1% of the area is fumigated once every three years.

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

None were identified as being relevant factors.

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

TABLE 12.1: SOD—HISTORIC PATTERN OF USE OF METHYL BROMIDE

FOR AS MANY YEARS AS POSSIBLE AS SHOWN SPECIFY:	1998	1999	2000	2001	2002	2003
AREA TREATED *(hectares)*	1,232	1,874	1,563	1,029	1382	648
AMOUNT OF MB ACTIVE INGREDIENT USED *(total kilograms)*	600,619	913,557	762,021	501,568	619,255	312,077
FORMULATIONS OF MB *(MB /chloropicrin)*	According to the applicant, the typical formulation used on turfgrass sod is 98:2.					
METHOD BY WHICH MB APPLIED *(e.g. injected at 25cm depth, hot gas)*	Liquid MB is shank injected into soil at a depth of 20-80 cm and covered with polyethylene tarpaulin.					
APPLICATION RATE FOR THE ACTIVE INGREDIENT IN kg/ha*	488	488	488	488	448	482
ACTUAL DOSAGE RATE FOR THE ACTIVE INGREDIENT *(g/m^2)**	48.8	48.8	48.8	48.8	44.8	48.2

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

PART C: SOD—TECHNICAL VALIDATION

13. SOD—REASON FOR ALTERNATIVES NOT BEING FEASIBLE

TABLE 13.1: SOD—REASON FOR ALTERNATIVES NOT BEING FEASIBLE

NAME OF ALTERNATIVE	TECHNICAL AND REGULATORY* REASONS FOR THE ALTERNATIVE NOT BEING FEASIBLE OR AVAILABLE	IS THE ALTERNATIVE CONSIDERED COST EFFECTIVE?
CHEMICAL ALTERNATIVES		
Dazomet	Research results indicated that most treatments (including MB) differed in efficacy depending on site location and specific weed pests that were evaluated (e.g., Unruh et al., 2002). In research trials, dazomet provided poor control of nutsedge in Jay, Florida, 44 weeks after treatment, compared to MB (89% vs. 57%, respectively). At the same site, dazomet provided equal control of weedy grasses and slightly better control of broadleaf weeds compared to MB, 44 weeks after treatment and 32 weeks after treatment, respectively (Unruh et al., 2002). MB fields may be planted within 48 hours after the plastic cover is removed, while, depending on soil temperature, a period of 14 to 21 days may be required for effective fumigation when dazomet is used to treat the soil. In situations of low pest pressure golfcourses may employ a marginal strategy without major economic dislocation if given a reasonable time frame for the transition.	Possibly
1,3-D and 1,3-D + Chloropicrin	Might be used if nematodes are a primary pest, or possibly in conjunction with dazomet or metam-sodium. Unruh and Brecke (2001) did not observe sufficient efficacy for managing weed pests.	Possibly
Metam-Sodium / Chloropicrin	Unruh and Brecke (2001) found that metam-sodium with chloropicrin provided comparable control (vs. MB) of weedy grasses and nutsedge at some locations in Florida but not in all. Efficacy varied for all treatments, including MB, depending on location.	Possibly

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

14. SOD—LIST AND DISCUSS WHY REGISTERED *(and Potential)* PESTICIDES ARE CONSIDERED NOT EFFECTIVE AS TECHNICAL ALTERNATIVES TO METHYL BROMIDE

TABLE 14.1: SOD—TECHNICALLY INFEASIBLE ALTERNATIVES DISCUSSION

NAME OF ALTERNATIVE	DISCUSSION
Selective Pre- or Post-Emergent Herbicides	Please refer to Item 13 above.

15. SOD—LIST PRESENT *(and Possible Future)* REGISTRATION STATUS OF ANY CURRENT AND POTENTIAL ALTERNATIVES

TABLE 15.1: SOD—PRESENT REGISTRATION STATUS OF ALTERNATIVES

NAME OF ALTERNATIVE	PRESENT REGISTRATION STATUS	REGISTRATION BEING CONSIDERED BY NATIONAL AUTHORITIES? (Y/N)	DATE OF POSSIBLE FUTURE REGISTRATION:
Iodomethane (Methyl Iodide)	Iodomethane is undergoing registration reviews in the U.S., but not for use on turfgrass	No	Unknown
Potassium Azide	The manufacturer has not requested registration in the U.S.	No	Unknown

16. SOD—STATE RELATIVE EFFECTIVENESS OF RELEVANT ALTERNATIVES COMPARED TO METHYL BROMIDE FOR THE SPECIFIC KEY TARGET PESTS AND WEEDS FOR WHICH IT IS BEING REQUESTED

TABLE 16.1: SOD—EFFECTIVENESS OF ALTERNATIVES – NUTSEDGE (*CYPERUS* SPP.) IN FLORIDA[1]

Treatment	Rates	Application Methods	% NusedgeControl[2]			
			Site 1		Site 2	
			6 WAT[3]	44 WAT[3]	3 WAT[3]	15 WAT[3]
Methyl Bromide + Chloropicrin	549 kg/ha + 11 kg/ha	Shank injected	100a	89a	100a	83a
1,3-D + oxadiazon	140 L/ha + 168 kg/ha	Shank injected + surface broadcast	0f	86ab	0c	74ab
Dazomet	392 kg/ha	Surface broadcast followed by rototill followed by soil seal	80abc	57de	78b	58bcd
Dazomet + Chloropicrin	392 +168 kg/ha	Surface broadcast followed by rototill followed by soil seal + shank injected	81ab	63bcd	81b	48cd
Dazomet + 1,3-D	392 kg/ha + 140 L/ha	Surface broadcast followed by rototill followed by soil seal + shank injected	51de	31f	76b	41d
Metam-sodium	748 L/ha	Surface spray followed by rototill followed by soil seal	43e	26f	71b	73ab
Metam-sodium + Chloropicrin	748 L/ha + 168 kg/ha	Surface spray followed by rototill followed by soil seal + shank injected	55cde	38ef	72b	76ab
Metam-sodium + Chloropicrin tarped	748 L/ha + 168 kg/ha	Surface spray followed by rototill + shank injected	64b-e	56de	100a	79ab
Metam-sodium + 1,3-D	748 + 140 L/ha	Surface spray followed by rototill + shank injected	69bcd	50def	87ab	70abc
Untreated Control			0f	0g	0c	0e
LSD (0.05)			25	24	17	23

[1] Modified from Unruh and Brecke (2001) and Unruh et al. (2002)
[2] Numbers followed by the same letter(s) are not significantly different.
[3] Number of weeks after treatment

TABLE 16.2: SOD—EFFECTIVENESS OF ALTERNATIVES – WEEDY GRASSES[1] IN FLORIDA [2]

Treatment	Rates	Application Methods	% Weed Control[3]			
			Site 1		Site 2	
			6 WAT[3]	44 WAT[3]	3 WAT[3]	15 WAT[3]
Methyl Bromide + Chloropicrin	549 kg/ha + 11 kg/ha	Shank injected	100a	98a	100a	74ab
1,3-D + oxadiazon	140 L/ha + 168 kg/ha	Shank injected + surface broadcast	0b	53b	13c	71ab
Dazomet	392 kg/ha	Surface broadcast followed by rototill followed by soil seal	98a	93a	83b	44cd
Dazomet + Chloropicrin	392 +168 kg/ha	Surface broadcast followed by rototill followed by soil seal + shank injected	96a	93a	91ab	38d
Dazomet + 1,3-D	392 kg/ha + 140 L/ha	Surface broadcast followed by rototill followed by soil seal + shank injected	100a	95a	90ab	54bcd
Metam-sodium	748 L/ha	Surface spray followed by rototill followed by soil seal	98a	88a	87b	65abc
Metam-sodium + Chloropicrin	748 L/ha + 168 kg/ha	Surface spray followed by rototill followed by soil seal + shank injected	100a	89a	92a	69abc
Metam-sodium + Chloropicrin tarped	748 L/ha + 168 kg/ha	Surface spray followed by rototill + shank injected	100a	94a	100a	70abc
Metam-sodium + 1,3-D	748 + 140 L/ha	Surface spray followed by rototill + shank injected	96a	94a	95ab	59a-d
Untreated Control			0b	0c	0c	0d
LSD (0.05)			35	13	13	27

[1] Grass species include coastal bermudagrass at Site 1 and alexandergrass, broadleaf signalgrass, and common bermudagrass at Site 2.
[2] Modified from Unruh and Brecke (2001) and Unruh et al. (2002)
[3] Numbers followed by the same letter(s) are not significantly different.
[4] Number of weeks after treatment

TABLE C.1: SOD—ALTERNATIVES YIELD LOSS DATA SUMMARY

ALTERNATIVE	LIST TYPE OF PEST	RANGE OF QUALITY LOSS	BEST ESTIMATE OF QUALITY LOSS[1]
Dazomet, alone or in combination with chloropicrin	Weeds, primarily off-type perennial grasses; secondarily, nutsedge, nematodes and insects	Unable to determine since research shows variability even among MB treatments, depending on location of trials and pest type	Unable to determine since research shows variability even among MB treatments, depending on location of trials and pest type
Metam sodium, alone or in combination with chloropicrin			
OVERALL LOSS ESTIMATE FOR ALL ALTERNATIVES TO PESTS			Unable to determine since research shows variability even among MB treatments, depending on location of trials and pest type

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.

17. ARE THERE ANY OTHER POTENTIAL ALTERNATIVES UNDER DEVELOPMENT WHICH ARE BEING CONSIDERED TO REPLACE METHYL BROMIDE?

Metam-sodium and dazomet, possibly in conjunction with chloropicrin, are likely effective alternatives to MB for turfgrass sod production. Covering plots treated with metam sodium + chloropicrin with plastic tarpaulin increased the nutsedge control effectiveness of this combination in southern Florida, although not in a western Florida site (Unruh et al., 2002). However, MB was also variable in its efficacy depending on the location and specific pests.

18. ARE THERE TECHNOLOGIES BEING USED TO PRODUCE THE CROP WHICH AVOID THE NEED FOR METHYL BROMIDE

The turfgrass producers claim that the reduction in MB, for 2003, was a result of increased use of metam-sodium. However, they claim a loss of quality as a result. Research indicates that metam-sodium and dazomet, and chloropicrin combinations have the potential to reduce the use of MB in many situations.

SUMMARY OF TECHNICAL FEASIBILITY

Research indicates that metam sodium and dazomet are the best available alternatives for MB in turfgrass sod production. Metam sodium and dazomet applied alone, or in conjunction with chloropicrin, can provide good control of wild and off-type perennial grasses and broad leaf weeds, but typically, fair to poor control of nutsedge (Unruh and Brecke, 2001). In research trials (e.g., Unruh and Brecke, 2001; Unruh et al., 2002) all of the fumigants that were tested, including MB, had variable efficacy depending on the location of the field trials. These studies indicated that in some locations metam-sodium + chloropicrin, under polyvinyl tarp, can be as effective as MB for controlling some target weeds. For areas with nutsedge infestations, efficacy of MB varied depending on location, and was superior in one trial in Florida and comparable to metam-sodium in another (Unruh et al., 2002). Farms with severe nutsedge infestations are most at risk for pest management problems when using dazomet or metam-sodium.

PART D: EMISSION CONTROL

19. TECHNIQUES THAT HAVE AND WILL BE USED TO MINIMIZE METHYL BROMIDE USE AND EMISSIONS IN THE PARTICULAR USE

TABLE 19.1: 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
WHAT USE/EMISSION REDUCTION METHODS ARE PRESENTLY ADOPTED?	Research to examine tarps is ongoing and appears to improve efficacy (e.g., Landschoot and Park, 2004; Park and Landschoot, 2003)	None identified; industry traditionally has had a high use rate of MB	None identified; industry traditionally has had a high use rate of MB	For sod farms, used once in 3 years.
WHAT FURTHER USE/EMISSION REDUCTION STEPS WILL BE TAKEN FOR THE METHYL BROMIDE USED FOR CRITICAL USES?	Research to examine tarps is ongoing and appears to improve efficacy (e.g., Landschoot and Park, 2004; Park and Landschoot, 2003)	None identified; industry traditionally has had a high use rate of MB	None identified; industry traditionally has had a high use rate of MB	For sod farms, used once in 3 years.
OTHER MEASURES *(please describe)*				

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

The requesting consortia identified future plans for examining high density polyethylene as a means to minimize MB emissions.

PART E: ECONOMIC ASSESSMENT

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

TABLE 21.1: COSTS OF ALTERNATIVES COMPARED TO METHYL BROMIDE OVER 3-YEAR PERIOD

ALTERNATIVE	YIELD/QUALITY*	COST IN YEAR 1 *(U.S.$/ha)*	COST IN YEAR 2 *(U.S.$/ha)*	COST IN YEAR 3 *(U.S.$/ha)*
Methyl Bromide	100%	$1,235	$1,235	$1,235
Dazomet	75%	$2,964	$2,964	$2,964

** As percentage of typical or 3-year average yield and quality, compared to methyl bromide.*

22. GROSS AND NET REVENUE

TABLE 22.1: YEAR 1 GROSS AND NET REVENUE

YEAR 1		
ALTERNATIVES *(as shown in question 21)*	GROSS REVENUE FOR LAST REPORTED YEAR *(U.S.$/ha)*	NET REVENUE FOR LAST REPORTED YEAR *(U.S.$/ha)*
Methyl Bromide	$19,619	$10,327
Dazomet	$14,714	$3,693

TABLE 22.2: YEAR 2 GROSS AND NET REVENUE

YEAR 2		
ALTERNATIVES *(as shown in question 21)*	GROSS REVENUE FOR LAST REPORTED YEAR *(U.S.$/ha)*	NET REVENUE FOR LAST REPORTED YEAR *(U.S.$/ha)*
Methyl Bromide	$19,619	$10,327
Dazomet	$14,714	$3,693

TABLE 22.3: YEAR 3 GROSS AND NET REVENUE

YEAR 3		
ALTERNATIVES *(as shown in question 21)*	GROSS REVENUE FOR LAST REPORTED YEAR *(U.S.$/ha)*	NET REVENUE FOR LAST REPORTED YEAR *(U.S.$/ha)*
Methyl Bromide	$19,619	$10,327
Dazomet	$14,714	$3,693

MEASURES OF ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

TABLE E.1: ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

REGION A	METHYL BROMIDE	DAZOMET
YIELD/QUALITY LOSS (%)	0	25%
YIELD PER HECTARE (IN HA/HA)	1	Not Available
* PRICE PER UNIT (U.S.$)	$19,619	Not Available
= GROSS REVENUE PER HECTARE (U.S.$)	$19,619	$14,714
- OPERATING COSTS PER HECTARE (U.S.$)	$9,292	$11,021
= NET REVENUE PER HECTARE (U.S.$)	$10,327	$3,693
LOSS MEASURES		
1. LOSS PER HECTARE (U.S.$)	$0	$6,634
2. LOSS PER KILOGRAM OF METHYL BROMIDE (U.S.$)	$0	$13.82
3. LOSS AS A PERCENTAGE OF GROSS REVENUE (%)	0%	33.81%
4. LOSS AS A PERCENTAGE OF NET REVENUE (%)	0%	64.24%

SUMMARY OF ECONOMIC FEASIBILITY

The primary economic loss that would be expected in sod turfgrass is price reduction associated with the inability to market sod as certified, which results in up to a 75% reduction in gross revenue. The small proportion of turf production represented by this nomination is intended for sod growers producing certified sod.

In addition to price reductions from downgraded quality, there are also expected to be some losses from off-type grasses rendering some areas simply unharvestable, either from the presence of off-type grasses, or the required destruction of all grass in a particular area (to prevent the spreading of off-types). The losses are much smaller than the impact of not being able to certify the sod.

The CUE reviewers analyzed crop budgets data for sod turfgrass to determine the likely economic impact if methyl bromide were not available. The four economic measures in Table E.1 were used to quantify the economic impacts to pre-plant uses for sod turfgrass. The four economic measures are not independent in such a way that they can be calculated from the same crop budget data. The measures are, however, supplementary to each other in evaluating the CUE applicant's economic viability. These measures represent different ways to assess the economic feasibility of methyl bromide alternatives for methyl bromide users.

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

As stated earlier in the application, the price of non-certified sod is 75% lower than the price of certified sod. For production areas that would otherwise fumigate with methyl bromide, it is possible that some areas will be able to continue producing certified seed for a limited time, as long as they do not attempt to change variety or species. But, as mentioned earlier in the application, changing variety or species is one primary reason for needed to control off-types of grass.

To reflect a lower bound on impacts, under the assumption that some areas covered by the nomination would delay their shift in grass type, or delay their control of other key pests, the economic analysis used 25% as the yield/price effect. It is important to recognize that in some areas, the loss could be as high as 75%. Using the lower bound, we estimate that a representative grower would suffer $6,634 loss per hectare per year due to inferior product and a lower proportion of harvestable acreage, and an increase of fumigation costs with dazomet (TPI, 2003). The loss as a percentage of gross revenue was estimated at 33.81% and the loss as a percentage of net revenue at 64.24%. These changes are estimated to have a significant economic impact to the sod industry. The results suggest that dazomet is not economically viable as an alternative for methyl bromide.

Part F. Future Plans

23. What Actions Will Be Taken to Rapidly Develop and Deploy Alternatives for This Crop?

Metam-sodium and dazomet already are used in the sod turfgrass production industry. It has not been determined how the 1% of total sod farm hectares that use MB can further reduce its use.

24. How Do You Plan to Minimize the Use of Methyl Bromide for the Critical Use in the Future?

According to the Critical Use Exemption request, studies of high density polyethylene will be evaluated. The consortium will create a timeline for a transition from MB to alternatives.

25. Additional Comments on the Nomination?

26. CITATIONS

Dunn, R. A. and Crow, W. T. 2001. Soil fumigation before planting turf. University of Florida IFAS Extension Publication ENY-26. http://edis.ifas.ufl.edu/IN095.

Unruh, J. B. and B. J. Brecke. 2001. *Seeking Alternatives for Methyl Bromide*. Golf Course Management. 69(3): 65-72. http://www.gcsaa.org/gcm/2001/mar01/pdfs/03seeking.pdf

Unruh, J. B., B. J. Brecke, J. A. Dusky and J. S. Godbehere. 2002. *Fumigant Alternatives for Replacement of Methyl Bromide in Turfgrass*. Weed Technology, 16:379-387, pp 379-387. http://www.pw.ucr.edu/textfiles/methyl%20bromide-1.pdf

APPENDIX A. 2007 Methyl Bromide Usage Numerical Index (BUNI).

Methyl Bromide Critical Use Exemption Process
2007 Methyl Bromide Usage Numerical Index (BUNI)

Date: 1/28/2005
Sector: TURF

Average Hectares in the US: 131,971
% of Average Hectares Requested: 1%

2007 Amount of Request				2001 & 2002 Average Use*			Quarantine and Pre-Shipment	Regional Hectares**			Research Amount (kgs)
REGION	Kilograms (kgs)	Hectares (ha)	Use Rate (kg/ha)	Kilograms (kgs)	Hectares (ha)	Use Rate (kg/ha)		2001 & 2002 Average	% of 2001 & 2002 Average	Requested %	
Turfgrass Producers International	680,388	1,416	480	388,041	821	473	0%	Not Available			1,928
TOTAL OR AVERAGE	680,388	1,416	480	388,041	821	473	0%				

2007 Nomination Options	Subtractions from Requested Amounts (kgs)					Combined Impacts Adjustment (kgs)		Adoption / Transition Adjustment (kgs)		MOST LIKELY IMPACT VALUE		
REGION	2007 Request	(-) Double Counting	(-) Growth	(-) Use Rate Adjustment	(-) QPS	HIGH	LOW	HIGH	LOW	Kilograms (kgs)	Hectares (ha)	Use Rate (kg/ha)
Turfgrass Producers International	680,388	-	292,347	141,573	-	123,234	71,476	112,143	65,043	76,112	254	300
Nomination Amount	680,388	680,388	388,041	246,468	246,468	123,234	71,476	112,143	65,043	76,112	254	300
% Reduction from Initial Request	0%	0%	43%	64%	64%	82%	89%	84%	90%	89%	82%	38%

Adjustments to Requested Amounts	Use Rate (kg/ha)		(%) Karst (Telone)		(%) 100 ft Buffer Zones		(%) Key Pest Distribution		Regulatory Issues (%)		Unsuitable Terrain (%)		Cold Soil Temp (%)		Combined Impacts (%)		% Adopt New Fumigants	
REGION	Low	EPA	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	HIGH	LOW	% adopt	% per year
Turfgrass Producers International	473	300	0	0	0	0	50	29	0	0	0	0	0	0	50%	29%	75%	9%

Other Considerations	Dichotomous Variables (Y/N)					Other Issues			Economic Analysis					
REGION	Strip Bed Treatment	Currently Use Alternatives?	Research/ Transition Plans	Tarps / Deep Injection Used	Pest-free Cert. Requirement	Change from Prior CUE Request (+/-)	Verified Historic MeBr Use / State	Frequency of Treatment	Loss per Hectare (US$/ha)	Loss per Kilogram of MeBr (US$/kg)	Loss as a % of Gross Revenue	Loss as a % of Net Revenue	Quality/ Time/ Market Window/ Yield Loss (%)	Marginal Strategy
Turfgrass Producers International	No	Yes	Yes	Tarp	Yes	0	No	1 / 3 years	$ 6,634	$ 14	34%	64%	25%	Dazomet

Conversion Units:
1 Pound = 0.453592 Kilograms   1 Acre = 0.404686 Hectare

Most Likely Impact Value: High 24% Low 77%

Turfgrass Producers International - In 2003 the 2002 year was reported as 605,200 lb., 1513 acres & 400 lb/acre. In 2004 the 2002 year was reported as 1,365,200 lb., 3413 acres, 400 lb/acre. No explanation for increase so old numbers were used.

Pest distribution estimated using tomato pest distribution (similar geographic distribution) due to lack of information provided by applicant.

Footnotes for Appendix A:

Values may not sum exactly due to rounding.

1. **Average Hectares in the US** – Average Hectares in the US is the average of 2001 and 2002 total hectares in the US in this crop when available. These figures were obtained from the USDA National Agricultural Statistics Service.
2. **% of Average Hectares Requested** - Percent (%) of Average Hectares Requested is the total area in the sector's request divided by the Average Hectares in the US. Note, however, that the NASS categories do not always correspond one to one with the sector nominations in the U.S. CUE nomination (e.g., roma and cherry tomatoes were included in the applicant's request, but were not included in NASS surveys). Values greater than 100 percent are due to the inclusion of these varieties in the U.S. CUE request that were not included in the USDA NASS: nevertheless, these numbers are often instructive in assessing the requested coverage of applications received from growers.
3. **2007 Amount of Request** – The 2007 amount of request is the actual amount requested by applicants given in total pounds active ingredient of methyl bromide, total acres of methyl bromide use, and application rate in pounds active ingredient of methyl bromide per acre. U.S. units of measure were used to describe the initial request and then were converted to metric units to calculate the amount of the US nomination.
4. **2001 & 2002 Average Use** – The 2001 & 2002 Average Use is the average of the 2001 and 2002 historical usage figures provided by the applicants given in total pounds active ingredient of methyl bromide, total acres of methyl bromide use, and application rate in pounds active ingredient of methyl bromide per acre. Adjustments are made when necessary due in part to unavailable 2002 estimates in which case only the 2001 average use figure is used.
5. **Quarantine and Pre-Shipment** – Quarantine and pre-shipment (QPS) hectares is the percentage (%) of the applicant's request subject to QPS treatments.
6. **Regional Hectares, 2001 & 2002 Average Hectares** – Regional Hectares, 2001 & 2002 Average Hectares is the 2001 and 2002 average estimate of hectares within the defined region. These figures are taken from various sources to ensure an accurate estimate. The sources are from the USDA National Agricultural Statistics Service and from other governmental sources such as the Georgia Acreage estimates.
7. **Regional Hectares, Requested Acreage %** - Regional Hectares, Requested Acreage % is the area in the applicant's request divided by the total area planted in that crop in the region covered by the request as found in the USDA National Agricultural Statistics Service (NASS). Note, however, that the NASS categories do not always correspond one to one with the sector nominations in the U.S. CUE nomination (e.g., roma and cherry tomatoes were included in the applicant's request, but were not included in NASS surveys). Values greater than 100 percent are due to the inclusion of these varieties in the U.S. CUE request that were not included in the USDA NASS: nevertheless, these numbers are often instructive in assessing the requested coverage of applications received from growers.
8. **2007 Nomination Options** – 2007 Nomination Options are the options of the inclusion of various factors used to adjust the initial applicant request into the nomination figure.
9. **Subtractions from Requested Amounts** – Subtractions from Requested Amounts are the elements that were subtracted from the initial request amount.
    10. **Subtractions from Requested Amounts, 2007 Request** – Subtractions from Requested Amounts, 2007 Request is the starting point for all calculations. This is the amount of the applicant request in kilograms.
    11. **Subtractions from Requested Amounts, Double Counting** - Subtractions from Requested Amounts, Double Counting is the estimate measured in kilograms in situations where an applicant has made a request for a CUE with an individual application while their consortium has also made a request for a CUE on their behalf in the consortium application. In these cases the double counting is removed from the consortium application and the individual application takes precedence.
    12. **Subtractions from Requested Amounts, Growth or 2002 CUE Comparison** - Subtractions from Requested Amounts, Growth or 2002 CUE Comparison is the greatest reduction of the estimate measured in kilograms of either the difference in the amount of methyl bromide requested by the applicant that is greater than that historically used or treated at a higher use rate or the difference in the 2007 request from an applicant's 2002 CUE application compared with the 2007 request from the applicant's 2003 CUE application.
    13. **Subtractions from Requested Amounts, QPS** - Subtractions from Requested Amounts, QPS is the estimate measured in kilograms of the request subject to QPS treatments. This subtraction estimate is calculated as the 2007 Request minus Double Counting, minus Growth or 2002 CUE Comparison then

multiplied by the percentage subject to QPS treatments. *Subtraction from Requested Amounts, QPS = (2007 Request – Double Counting – Growth)*(QPS %)*

14. **<u>Subtraction from Requested Amounts, Use Rate Difference</u>** – Subtractions from requested amounts, use rate difference is the estimate measured in kilograms of the lower of the historic use rate or the requested use rate. The subtraction estimate is calculated as the 2007 Request minus Double Counting, minus Growth or 2002 CUE Comparison, minus the QPS amount, if applicable, minus the difference between the requested use rate and the lowest use rate applied to the remaining hectares.

15. **<u>Adjustments to Requested Amounts</u>** – Adjustments to requested amounts were factors that reduced to total amount of methyl bromide requested by factoring in the specific situations were the applicant could use alternatives to methyl bromide. These are calculated as proportions of the total request. We have tried to make the adjustment to the requested amounts in the most appropriate category when the adjustment could fall into more than one category.
    16. **<u>(%) Karst topography</u>** – Percent karst topography is the proportion of the land area in a nomination that is characterized by karst formations. In these areas, the groundwater can easily become contaminated by pesticides or their residues. Regulations are often in place to control the use of pesticide of concern. Dade County, Florida, has a ban on the use of 1,3D due to its karst topography.
    17. **<u>(%) 100 ft Buffer Zones</u>** – Percentage of the acreage of a field where certain alternatives to methyl bromide cannot be used due the requirement that a 100 foot buffer be maintained between the application site and any inhabited structure.
    18. **<u>(%) Key Pest Impacts</u>** - Percent (%) of the requested area with moderate to severe pest problems. Key pests are those that are not adequately controlled by MB alternatives. For example, the key pest in Michigan peppers, *Phytophthora* spp. infests approximately 30% of the vegetable growing area. In southern states the key pest in peppers is nutsedge.
    19. **<u>Regulatory Issues (%)</u>** - Regulatory issues (%) is the percent (%) of the requested area where alternatives cannot be legally used (e.g., township caps) pursuant to state and local limits on their use.
    20. **<u>Unsuitable Terrain (%)</u>** – Unsuitable terrain (%) is the percent (%) of the requested area where alternatives cannot be used due to soil type (e.g., heavy clay soils may not show adequate performance) or terrain configuration, such as hilly terrain. Where the use of alternatives poses application and coverage problems.
    21. **<u>Cold Soil Temperatures</u>** – Cold soil temperatures is the proportion of the requested acreage where soil temperatures remain too low to enable the use of methyl bromide alternatives and still have sufficient time to produce the normal (one or two) number of crops per season or to allow harvest sufficiently early to obtain the high prices prevailing in the local market at the beginning of the season.
    22. **<u>Combined Impacts (%)</u>** - Total combined impacts are the percent (%) of the requested area where alternatives cannot be used due to key pest, regulatory, soil impacts, temperature, etc. In each case the total area impacted is the conjoined area that is impacted by any individual impact. The effects were assumed to be independently distributed unless contrary evidence was available (e.g., affects are known to be mutually exclusive). For example, if 50% of the requested area had moderate to severe key pest pressure and 50% of the requested area had karst topography, then 75% of the area was assumed to require methyl bromide rather than the alternative. This was calculated as follows: 50% affected by key pests and an additional 25% (50% of 50%) affected by karst topography.

23. **<u>Qualifying Area</u>** - Qualifying area (ha) is calculated by multiplying the adjusted hectares by the combined impacts.
24. **<u>Use Rate</u>** - Use rate is the lower of requested use rate for 2007 or the historic average use rate.
25. **<u>CUE Nominated amount</u>** - CUE nominated amount is calculated by multiplying the qualifying area by the use rate.
26. **<u>Percent Reduction</u>** - Percent reduction from initial request is the percentage of the initial request that did not qualify for the CUE nomination.
27. **<u>Sum of CUE Nominations in Sector</u>** - Self-explanatory.
28. **<u>Total US Sector Nomination</u>** - Total U.S. sector nomination is the most likely estimate of the amount needed in that sector.
29. **<u>Dichotomous Variables</u>** – dichotomous variables are those which take one of two values, for example, 0 or 1, yes or no. These variables were used to categorize the uses during the preparation of the nomination.
    30. **<u>Strip Bed Treatment</u>** – Strip bed treatment is 'yes' if the applicant uses such treatment, no otherwise.
    31. **<u>Currently Use Alternatives</u>** – Currently use alternatives is 'yes' if the applicant uses alternatives for some portion of pesticide use on the crop for which an application to use methyl bromide is made.

32. **Research/ Transition Plans** – Research/ Transition Plans is 'yes' when the applicant has indicated that there is research underway to test alternatives or if applicant has a plan to transition to alternatives.
33. **Tarps/ Deep Injection Used** – Because all pre-plant methyl bromide use in the US is either with tarps or by deep injection, this variable takes on the value 'tarp' when tarps are used and 'deep' when deep injection is used.
34. **Pest-free cert. Required** - This variable is a 'yes' when the product must be certified as 'pest-free' in order to be sold

35. **Other Issues**.- Other issues is a short reminder of other elements of an application that were checked
36. **Change from Prior CUE Request**- This variable takes a '+' if the current request is larger than the previous request, a '0' if the current request is equal to the previous request, and a '-' if the current request is smaller that the previous request.
37. **Verified Historic Use/ State**- This item indicates whether the amounts requested by administrative area have been compared to records of historic use in that area.
38. **Frequency of Treatment** – This indicates how often methyl bromide is applied in the sector. Frequency varies from multiple times per year to once in several decades.

39. **Economic Analysis** – provides summary economic information for the applications.
40. **Loss per Hectare** – This measures the total loss per hectare when a specific alternative is used in place of methyl bromide. Loss comprises both the monetized value of yield loss (relative to yields obtained with methyl bromide) and any additional costs incurred through use of the alternative. It is measured in current US dollars.
41. **Loss per Kilogram of Methyl Bromide** – This measures the total loss per kilogram of methyl bromide when it is replaced with an alternative. Loss comprises both the monetized value of yield loss (relative to yields obtained with methyl bromide) and any additional costs incurred through use of the alternative. It is measured in current US dollars.
42. **Loss as a % of Gross revenue** – This measures the loss as a proportion of gross (total) revenue. Loss comprises both the monetized value of yield loss (relative to yields obtained with methyl bromide) and any additional costs incurred through use of the alternative. It is measured in current US dollars.
43. **Loss as a % of Net Operating Revenue** -This measures loss as a proportion of total revenue minus operating costs. Loss comprises both the monetized value of yield loss (relative to yields obtained with methyl bromide) and any additional costs incurred through use of the alternative. It is measured in current US dollars. This item is also called net cash returns.

44. **Quality/ Time/ Market Window/Yield Loss (%)** – When this measure is available it measures the sum of losses including quality losses, non-productive time, missed market windows and other yield losses when using the marginal strategy.
45. **Marginal Strategy** -This is the strategy that a particular methyl bromide user would use if not permitted to use methyl bromide.