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 FOREST SEEDLING NURSERIES Open Field

BRIEF DESCRIPTIVE TITLE OF NOMINATION:
Methyl Bromide Critical Use Nomination for Preplant Soil Use for Forest Seedling Nurseries in Open Fields or Protected Environments (Submitted in 2007 for 2009 Use Season)

CROP NAME (OPEN FIELD OR PROTECTED):
Forest Seedling Nurseries in Open Fields or Protected Environments

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	125.758

*This amount includes methyl bromide needed for research.

SUMMARY OF ANY SIGNIFICANT CHANGES SINCE SUBMISSION OF PREVIOUS NOMINATIONS

Research is ongoing to develop commercially feasible protocols for likely alternatives, such as 1,3-D and metam-sodium, use of low permeability films, and integrated methods with chemicals and non-chemicals. A recent study found that virtually impermeable film (VIF) with methyl bromide (methyl bromide) used at 168 kg/H provided comparable results to methyl bromide used at 392 kg/H with high density film (Enebak et al., 2006). Technical problems still exist when gluing VIF during broadcast applications.

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

For the 2009 season, methyl bromide is critical for forest seedling nurseries to produce plants free of diseases and nematodes to meet state and certification standards, as well as prospective buyer expectations. In addition to these certification-related pest control concerns, weed control is also essential to insure maximum production. The use protocols for the available alternatives have not been developed sufficiently to provide effective control of the key pests to depths of 1 m. In addition, there are few, if any, markets for plants that do not meet the certification standards, which mean that losses up to 100% are possible when inadequate pest control occurs.

Failure to adequately manage pests in transplants will jeopardize the viability of the planted forests.

The key alternatives appear to be 1,3-dichloropropene (1,3-D)/chloropicrin, 1,3-D/chloropicrin/metam-sodium, 1,3-D/metam-sodium, and dazomet as a follow-up application to 1,3-D/chloropicrin or chloropicrin. These chemicals, in addition to other strategies, such as use of low permeability tarps, may ultimately reduce or replace methyl bromide. A recent study found that dazomet resulted in reduced seedling growth (Enebak et al., 2006). In addition, problems of gluing VIF as well as cost and availability of the film make it technically and economically unfeasible for the near future. Enebak et al. (2006) found, however, that with VIF, use rates of methyl bromide could be reduced significantly. If technical and cost issues for VIF can be resolved, methyl bromide emissions and use rates can likely be reduced.

The certification requirements (e.g., CDFA, 2003; NCDA, undated) associated with the requesting states are strict (zero tolerance for any damaging diseases and plant-parasitic nematodes) in order to minimize the prospect of spreading these nematode and diseases to other states and countries where these plants are shipped. For example, "When nursery stock in the nursery is found by the inspector to be infested with any plant pest, the certificate may not be issued until the infested stock has been treated or destroyed to the extent that the salable stock to be covered by the certificate shall be apparently free of plant pests" (NCDA, undated). Research has been cited (e.g., Kabir et al., 2005) in this review that indicates potentially effective alternatives, but the need for methyl bromide for 2009 is critical until alternatives have been sufficiently tested for use in commercial strawberry nursery operations.

(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.

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

____________________________ ______________________________ _______________

Signature Name Date

Title: ____

CONTACT OR EXPERT(S) FOR FURTHER TECHNICAL DETAILS:

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

1. PAPER DOCUMENTS: **Title of paper documents and appendices**	**No. of pages**	**Date sent to Ozone Secretariat**
USA01 CUN09 SOIL _FOREST SEEDLING NURSERIES__ 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 _FOREST SEEDLING NURSERIES__ 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 Forest Seedling Nurseries in Open Field or Protected Environment

2. (Renomination Form 2.) DESCRIPTIVE TITLE OF NOMINATION:
Methyl Bromide Critical Use Nomination for Preplant Soil Use for Forest Seedling Nurseries in Open Fields or Protected Environments (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)***):**

Forest seedling nurseries in the U.S. supply conifer and hardwood seedlings that are used for reforestation, forest establishment, fiber production, and wildlife and conservation uses. In a survey conducted in 2001-2002 by the Southern Forest Nursery Management Cooperative, there were approximately 1.7 billion pine seedlings produced in the southern region of the U.S., which accounted for 80% of U. S. pine seedling production. Nurseries in the U.S. are located in eight climate zones (Zones 3 to 10) and have mostly light or medium soils. The majority of seedlings are species of conifers, especially pine. In addition, 30-60 species of hardwoods, such as oaks, hickory, poplars, and ash, are produced. Nurseries produce seedlings adapted to their respective regional conditions, with variables such as climate, elevation, and soil type. Forest seedling nurseries requesting critical use of methyl bromide include both public and private nursery operations.

Nurseries of this sector produce mostly conifer seedlings, which are typically grown for one or two years in seedling beds. After harvest, beds have one or two years of fallow or cover crops. Managers typically fumigate a particular conifer seedling bed with methyl bromide once every 3-4 years, i.e., one-quarter to one-third of the total nursery land is fumigated each year to produce two or three harvestable forest seedling crops per single bed fumigation. Effective fumigants, such as methyl bromide, permit less frequent bed fumigation per harvestable seedling crop. For hardwood seedlings, fumigation is usually provided prior to each seedling crop, as hardwood species are generally more prone to root rots and damping-off diseases than conifers, although the production volume of hardwoods is smaller than overall conifer production.

At the appropriate stage of maturity, forest seedlings are harvested in the nursery, packaged, and transported to the planting site. Seedlings are usually culled or sized during the harvesting process, with culled trees discarded. Nurseries that grade their seedlings may sell lower grade seedlings at a reduced price, or discard all but the highest grade seedlings. The impact of seedling quality, particularly seedling size, on the success of forest establishment cannot be overstated. The production of large and healthy planting stock is essential to the economic viability of reforestation processes. These typically include soil preparation at the planting site, transportation to the planting site, planting, and weed control after planting. The quality of seedlings is highly correlated with the success of the regeneration process and corresponding long-term economic and use benefits, where seedling quality results in greater survival rates and faster growth. Maintaining pest-free nursery soils is critical to producing healthy seedlings and the foundation for establishing economically viable forests.

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	**125.758**

*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.)*

Research to identify effective alternatives for the forest seedling nurseries is ongoing. Approximately half of the nurseries have transitioned to alternatives. The remaining nursery land continues to explore transition options. Research by this sector has been working to identify effective protocols for alternative treatments. Technical, economic, and regulatory consideration will require additional time to develop appropriate strategies for alternatives. Consequently, while research indicates the possibility of effective alternatives for this industry, the U.S. nomination reflects the continued need for some methyl bromide for the 2009 use season.

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

The U.S. nomination is for those nurseries where the alternatives are not effective against key pests when pressure is moderate to high. This comprises approximately 50% of forest seedling nurseries. The use of methyl bromide is considered critical where alternatives are not suitable because of regulatory, economic, or technical constraints. In addition, because of methyl bromide efficacy, two or three seedling crops can be grown with each methyl bromide application.

Effective fumigation is relied on to manage fungal pathogens (e.g., *Fusarium*, *Alternaria*, *Phytophthora*, *Pythium, Rhizoctonia*, *Cylindrocladium* spp., *Cylindrocarpon*, and *Macrophomina*), nematodes (e.g., *Circonemoides*, *Helicotylenchus*), and yellow and purple nutsedges (species of *Cyperus*) (Cram and Fraedrich, 1997). Nutsedges are generally considered among the major pests of forest seedling nurseries in the southeastern U.S. and the pests most difficult to manage.

Inconsistency in pest management performance by alternatives has been the primary concern for this sector, and the reason that methyl bromide is currently critical for maintaining high quality seedlings in nurseries with severe pest pressures. While direct yield losses, in terms of seedlings/hectare, were not large on average, intensive seedling production relies on the ability of nursery managers to meet quality, as well as yield, goals. In addition, economic issues such as increased application costs (e.g., costs associated with application of metam-sodium and a separate chloropicrin application) may have an impact on overall feasibility of these alternatives for the forest seedlings sector.

Research is ongoing to develop protocols for likely alternatives, such as 1,3-D and metam-sodium, use of low permeability films, and integrated methods with chemicals and non-chemicals. After study results are analyzed, the requesting consortia will develop timelines for transition from methyl bromide, most likely by implementing an integrated management strategy with a combination of chemical and non-chemical treatments. While field trials proceed, however, there is a critical need for methyl bromide for this sector for the 2009 use season.

TABLE A 2. EXECUTIVE SUMMARY*

Region		Southern Forest Nursery	International Paper	Weyer-haeuser (SE)	Weyer-haeuser (NW)	NE Forest & Conserv. Nursery	Michigan Seedling Assoc.	Sector Total
EPA Preliminary Value	kgs	246,032	7,468	17,962	16,491	29,250	6,908	324,111
EPA Amount of All Adjustments	kgs	(179,692)	(2,417)	(4,073)	(3,372)	(8,158)	(640)	(198,353)
Most Likely Impact Value for Treated Area	kgs	66,340	5,050	13,889	13,119	21,092	6,268	125,758
	ha	255	19	53	62	81	24	495
	Rate	260	260	260	211	260	260	254
Sector Research Amount (kgs)		-		2009 Total US Sector Nomination		125,758 *		

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

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

This sector is covered by certification standards as plant material is transported and transferred to various locations throughout the U.S. All states have strict certification standards and all nurseries have internal quality control standards as well. USDA-APHIS have guidelines for containment of sudden oak death (SOD) through movement of nursery material (USDA-APHIS, 2004). As examples, "All nursery stock shipped into Mississippi must carry on each container or bundle a valid nursery inspection tag (inspection certificate) of the State of origin. Containers should also be plainly marked with the names and addresses of shipper and consignee." (http://nationalplantboard.org/docs/mississippi.doc). Similarly, "Nursery stock entering the State of Alabama must be certified as being apparently free from plant pests. Certificate tags issued by the official certifying agency of the state of origin stating such must be firmly attached to each box, bundle or package of nursery stock moved into the state." (http://www.msapms.org/new/newsletters/Nursery%20and%20Nursery%20Stock%20Regulations_New.pdf). Other states have similar rules and regulations (e.g., Georgia, http://www.griffin.peachnet.edu/ga/gcia/ForestTrees.pdf).

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

Alternatives to methyl bromide for seedling production have shown inconsistent performance from season to season, for nurseries with moderate to high pest pressure (e.g., Fraedrich and Dwinell, 2003a, 2003b, 2003c; Carey, 2000, 1996, 1994; Weyerhaeuser, #8, 1992-95; Weyerhaeuser, #10, 1994-96). While chloropicrin, metam-sodium, dazomet, herbicides, and 1,3-D might be used to reduce pests, inconsistency in performance is the primary concern for this sector. For example, Fraedrich and Dwinell (2003b) found that dazomet had some efficacy against nutsedge in field trials one year in two southern nurseries. But in one of the nurseries in Georgia, nutsedge plant populations increased over the course of the summer. They cautioned that "…if dazomet is to be used for nutsedge control, additional efforts will be necessary to better define the optimal use conditions".

Research studies with soil amendments (Fraedrich and Dwinell, 1998; James et al., 1997, 2001; Lantz, 1997; Stone et al., 1998) resulted in reduction in populations of some pathogens, but the effects were variable depending on the nursery locations and species of seedlings. Furthermore, it was unclear if pathogen population size was correlated with disease incidence. More research is required before there can be commercial application of these methods as independent treatments.

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

Table A 3. Proportion of crop grown using methyl bromide.

REGION WHERE METHYL BROMIDE USE IS REQUESTED	TOTAL CROP AREA 2001/2003 (HA)	PROPORTION OF TOTAL CROP AREA TREATED WITH METHYL BROMIDE (%)
Southern Forest Nursery Management Cooperative	Approx 1,090 ha bareroot pine; + 227 ha hardwood	50% (657 ha treated/1317 total ha)
International Paper	Not available	Not available
Weyerhaeuser-South	Not available	Not available
Weyerhaeuser-West	Not available	Not available
Northeastern Forest and Conservation Nursery Association	Not available	Not available
Michigan Seedling Association	Not available	Not available
NATIONAL TOTAL***:	51,506	2%

*Typically, only a fraction of a nursery's beds are fumigated in a given year.

**All nursery production qualifies for QPS use of methyl bromide in some states (e.g. Alabama) as determined by state regulations. Therefore, the amount of methyl bromide used for these beds are not included in the CUE request.

***National average may include states not requesting methyl bromide.

(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.

Pest-free standards for nursery stock make complete transition to alternatives difficult. However, this nomination applies to nurseries where alternatives are not effective. Alternatives such as metam-sodium, chloropicrin, dazomet are used in approximately half of nursery hectares. methyl bromide allows conifer seedling beds to be fumigated after two or three crops (as opposed to after every crop) because of the effectiveness of methyl bromide, which usually makes a second-year treatment unnecessary. With severe infestations of pests alternative products usually are applied more often, or several treatments with more than one alternative are used.

(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?

Once protocols have been tested sufficiently, confirming research results of effective alternatives, commercial nurseries will be able to expand the current use of alternatives to additional locations. Certification requirements make transitioning to alternatives more time consuming since long-term field trials have to be conducted. About half of the nurseries of this sector have been implementing alternative treatments including chemical and non-chemical methods (e.g., cover crop or fallow) that can reduce pest infestations. Strategies to replace methyl bromide by the remaining nurseries where methyl bromide is critical are being studied by all of the nurseries involved.

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

Table A 4. Amount of methyl bromide requested for critical use.

Region	**Southern Forest Nursery Management Cooperative**	**International Paper**	**Weyerhaeuser South**	**Weyerhaeuser West**	**Northeastern Forest & Conservation Nursery Assoc**	**Michigan Seedling Association**
YEAR OF EXEMPTION REQUEST—2009						
Quantity of methyl bromide nominated (metric tonnes)	See Appendix A	See Appendix A	See Appendix A	See Appendix A	See Appendix A	See Appendix A
Total crop area to be treated with the methyl bromide or methyl bromide/Pic formulation (m^2 or ha) (Note: ignore reductions for strip treatment)	See Appendix A	See Appendix A	See Appendix A	See Appendix A	See Appendix A	See Appendix A
Methyl bromide use: **broadacre or strip/bed** treatment?	Flat	Flat	Flat	Flat	Flat	Flat
Proportion of broadacre area which is treated in strips; e.g. 0.54, 0.67	None	None	None	None	None	None
Formulation (ratio of methyl bromide/Pic mixture) to be used for calculation of the CUE e.g. 98:2, 50:50	67:33	98:2	90:10	80:20	98:2 or 67:33	67:33
Application rate* (kg/ha) for the **formulation**	See Appendix A	See Appendix A	See Appendix A	See Appendix A	See Appendix A	See Appendix A
Dosage rate* (g/m^2) (i.e. actual rate of **formulation** applied to the area treated with methyl bromide/Pic only)	See Appendix A	See Appendix A	See Appendix A	See Appendix A	See Appendix A	See Appendix A

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

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.
- Only the hectares affected by one or more of the following impacts were included in the nominated amount: moderate to heavy key pest pressure, regulatory impacts, karst topographic 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 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 175 kg/ha (for areas where weeds were considered to be key pests) was used in calculating the amount of MB requested.

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

QUANTITY REQUESTED FOR PREVIOUS NOMINATION YEAR:	131,208 kg
QUANTITY APPROVED BY PARTIES FOR PREVIOUS NOMINATION YEAR:	131.208 kg
QUANTITY REQUIRED FOR YEAR TO WHICH THIS REAPPLICATION REFERS:	125,758 kg

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

Table B 1. Key diseases and weeds.

REGION WHERE METHYL BROMIDE USE IS REQUESTED	KEY DISEASE(S) AND WEED(S) TO SPECIES AND, IF KNOWN, TO LEVEL OF RACE	SPECIFIC REASONS WHY METHYL BROMIDE NEEDED (E.G. EFFECTIVE HERBICIDE AVAILABLE, BUT NOT REGISTERED FOR THIS CROP; MANDATORY REQUIREMENT TO MEET CERTIFICATION FOR DISEASE TOLERANCE; NO HOST RESISTANCE FOR A SPECIFIC RACE)
Southern Forest Nursery Management Cooperative	**Fungi** [100% at times]: *Fusarium*, *Macrophomina, Rhizoctonia*, *Pythium*, P*hytophthora*; **Weeds** [100% at times]: broadleaf, grasses, sedges **Nematodes** [100% at times]: *Circonemoides*, *Helicotylenchus*	For areas where pest pressure is high, methyl bromide provides sufficient protection for three successive seedling crops, with one fumigation treatment (one treatment every four years). Until protocols are developed to improve efficacy of alternative treatments, there may be a need to provide additional fumigation treatments, or use a combination of chemicals and other effective treatments that may increase costs, beyond what is feasible.
International Paper	**Fungi**: *Rhizoctonia* (root rot); **Weeds**: *Cyperus esculentus/rotundus* (purple/yellow nutsedge)	For areas where pest pressure is high, methyl bromide allows two successive seedling crops with one fumigation treatment (one treatment every four years). Alternative treatments may require more frequent fumigation due to reduced efficacy until protocols are developed to improve efficacy.
Weyerhaeuser-South	**Fungi**: *Fusarium*, *Pythium*, *Rhizoctonia*; **Weeds**: *Cyperus* (nutsedges)	Only #1 grade seedlings are sold; grade #2 and culls are discarded. In some nurseries (where infestation of fungal pathogens and nutsedges is severe), to economically manage the range of pests, methyl bromide is necessary since no alternatives currently provide both reliable control and economic sustainability for #1 grade seedlings.
Weyerhaeuser-West	**Fungi** [100% at times]: *Cylindrocarpon* (root rot); *Pythium* (damping-off, root rot), *Fusarium* (damping-off, root rot), *Phoma*, *Fusarium*, *Botrytis* (stem cankers); **Weeds**: *Cyperus* (yellow nutsedge) [100% at times]	Cylindrocarpon root rot is an increasingly important disease, with no registered chemicals. Applicant states that increased area reflects increased losses to the disease and necessity of continued production numbers. High pathogen populations and potential for contamination with *Phytophthora ramorum* (sudden oak death) leave little room for production variability.
Northeastern Forest & Conservation Nursery Association	**Fungi**: *Phytophthora* (damping-off, root rot) [80%], *Fusarium* (damping-off, root rot) [80%], *Cylindrocladium* [50%]; **Weeds**: *Cyperus* (yellow nutsedge) [40%], *Cirsium* (Canada thistle) [70%]	In humid, warm conditions damping-off is a significant problem; as with much of industry, weed problems, especially nutsedge and Canada thistle, are difficult to manage without methyl bromide.
Michigan Seedling Association	Primarily annual and perennial weeds (e.g., nutsedge, Canada thistle); also, fungal pathogens; nematodes	Nutsedge (50% of area), common groundsel (95% of area), hairy bittercress (60% of area), Canada thistle (25% of area), and mugwort (20% of area); Soil-borne diseases are also of concern; dazomet and metam-

REGION WHERE METHYL BROMIDE USE IS REQUESTED	KEY DISEASE(S) AND WEED(S) TO SPECIES AND, IF KNOWN, TO LEVEL OF RACE	SPECIFIC REASONS WHY METHYL BROMIDE NEEDED (E.G. EFFECTIVE HERBICIDE AVAILABLE, BUT NOT REGISTERED FOR THIS CROP; MANDATORY REQUIREMENT TO MEET CERTIFICATION FOR DISEASE TOLERANCE; NO HOST RESISTANCE FOR A SPECIFIC RACE)
		sodium are not reliable in this region because of cooler soil temperatures.

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

Table B 2. Cropping System and Climate – key characteristics.

CHARACTERISTICS	REGION WHERE METHYL BROMIDE IS REQUESTED					
	SOUTHERN FOREST NURSERY MANAGEMENT COOPERATIVE	INTERNATIONAL PAPER	WEYERHAEUSER SOUTH	WEYERHAEUSER WEST	NORTHEASTERN FOREST & CONSERVATION NURSERY ASSOC	MICHIGAN SEEDLING ASSOCIATION
CROP TYPE, E.G. TRANSPLANTS, BULBS, TREES OR CUTTINGS	Bare root forest seedlings (91-96% pine, 4-9% hardwood species)	Forest seedlings (pine species) and some hardwoods	Primarily loblolly pine; some hardwood species	Pine, Christmas trees, some hardwoods	Conifers (10-15 spp.)= 1-yr, 8%; 2-yr, 4%; 3-yr, 14%; hardwoods (30-50 spp.)= 1-yr, 55%; 2-yr, 9%; shrubs and forbs (>75 spp.)= 10%	Conifers, hardwoods
ANNUAL OR PERENNIAL CROP (STATE NUMBER OF YEARS BETWEEN REPLANTING)	**Conifers:** Typically grown for 1 year for each of 2 or 3 crops before fumigation on fourth year; **Hardwoods:** Prior to each crop	Typically grown for each of two years followed by two years of unfumigated cover crops before fumigation in the 4th year just before sowing the first seedling crop	Typically grown for 1 year	Typically 1 year seedling bed, 1 year transplant bed; transplants can be grown for 2, 3, or 4 years	Bareroot cuttings, and transplants, typically grown 1-3 years	Conifers: bareroot and transplants, typically 1, 2, or 3 years growth; Hardwood: 1-year (80%) and 2-year (20%)
'YPICAL CROP ROTATION (IF ANY) AND USE OF METHYL BROMIDE FOR OTHER CROPS IN THE ROTATION (IF ANY)	Cover crops include sorghum and corn	None	None	None	None	Crop grown on half the area. Land not in production are left fallow for 1-2 years, and planted with rye in Oct-Nov and Sudex in March-April.

Table B 2. Cropping System and Climate – key characteristics.

CHARACTERISTICS	REGION WHERE METHYL BROMIDE IS REQUESTED					
	SOUTHERN FOREST NURSERY MANAGEMENT COOPERATIVE	INTERNATIONAL PAPER	WEYERHAEUSER SOUTH	WEYERHAEUSER WEST	NORTHEASTERN FOREST & CONSERVATION NURSERY ASSOC	MICHIGAN SEEDLING ASSOCIATION
SOIL TYPES: (SAND LOAM, CLAY, ETC.)	Light (85%); medium (15%)	Light, medium, heavy	Light (62%); Medium (22%)	Light (60%), Medium (40%)	Light, Medium	Light
TYPICAL DATES OF PLANTING AND HARVEST	Planting: April-May of Year 2, 3, and 4; Harvest: Oct-Feb	Planting: April-May of Year 2, 3, and 4; Harvest: Oct-Feb	Planting: April-May of Year 2, 3, and 4; Harvest: Oct-Feb	Planting: April of Year 2; Harvest: Oct-Feb	Planting[a]: March-May, Oct-Dec Harvest: Fall or Spring	Planting: May (conifers, after Fall fumigation); Oct-Nov (hardwoods, after Fall fumigation) Harvest: varies
TYPICAL DATES OF METHYL BROMIDE FUMIGATION[b]	March of Year 1	Oct of Year 1	Oct of Year 1	March of Year 1	Sept of Year 1	May[c] (or, Aug-Sept)
FREQUENCY OF METHYL BROMIDE FUMIGATION (E.G. EVERY TWO YEARS)	Once in 3-4 years	Once in 4 years	Once in 4 years (conifers)	Once in 2 years	Once in 2 years; depending on species, can be once in 2-4 years	Every year on land in production (approximately half the land). Therefore, an average area of nursery is fumigated once in 2 years.
TYPICAL SOIL TEMPERATURE RANGE DURING METHYL BROMIDE FUMIGATION (E.G. 15-20°C)	Varies	Varies	Varies	Varies	Varies	Varies

Table B 2. Cropping System and Climate – key characteristics.

CHARACTERISTICS	REGION WHERE METHYL BROMIDE IS REQUESTED					
	SOUTHERN FOREST NURSERY MANAGEMENT COOPERATIVE	INTERNATIONAL PAPER	WEYERHAEUSER SOUTH	WEYERHAEUSER WEST	NORTHEASTERN FOREST & CONSERVATION NURSERY ASSOC	MICHIGAN SEEDLING ASSOCIATION
CLIMATIC ZONE (E.G. TEMPERATE, TROPICAL)	USDA zones 7a, 7b, 8a, 8b (nurseries in: Alabama, Arkansas, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia)	USDA zones 6b, 7a, 7b, 8a, 8b (Alabama, Arkansas, Georgia, South Carolina, Texas)	USDA zones 7b, 8a (includes Alabama, Arkansas, North Carolina, and South Carolina)	USDA zones 8a, 8b (includes Washington and western Oregon)	USDA zones 3a, 4b, 5a, 5b, 6a, 6b, 7a (includes state-owned nurseries in Illinois, Indiana, Kentucky, Maryland, Missouri, New Jersey, Ohio, Pennsylvania, West Virginia, and Wisconsin)	USDA zones 4b, 5a, 5b
ANNUAL AND SEASONAL RAINFALL (MM)	50-150 [d] (varies)	50-150 [d] (varies)	50-150 [d] (varies)	Varies	Varies	Varies
RANGE IN AVERAGE TEMPERATURE VARIATIONS IN MID WINTER AND MID SUMMER (E.G. MIN/MAX °C) (E.G. JAN 5-15°C, JULY 10-30°C	7-27 [d] (varies)	7-27 [d] (varies)	7-27 [d] (varies)	Varies	Varies	Varies
OTHER RELEVANT FACTORS:						

[a]Due to the large number of species and wide geographical area represented by the Northeastern consortium, seedlings can be planted at various times in the fall or spring. Generally, fumigation occurs once in two or three years, but beds for certain hardwood species may be treated every year.
[b] Fumigation generally occurs once in three or four years. According to this consortium, "The typical crop cycle would include a period of cover crop and fallow, nine to 24 months, after the second harvest (months 25-48). After the cover crop and/or fallow period, the area would be fumigated again and the crop cycle would continue."
[c] Fumigation schedules depend on growth as annual seedlings or additional bed requirements as transplants. Generally, fumigation occurs each year on the production land (half of the total nursery land)—therefore a particular parcel of land will receive fumigation once in two years.
[d] The rainfall and temperature data are for Alabama, which may be considered typical of the region.

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

Soil structure and texture can impact transition to alternatives (e.g., metam-sodium does not consistently dissipate in heavy soils due to low vapour pressure). Delay in planting can occur with some alternatives due to longer fumigation time required under tarp. Fumigation for conifer crops typically occurs once in a four-year cycle. Therefore, typically, two or three successive annual seedling crops are produced for each fumigation event. Alternatives may require fumigation (with 1,3-D + chloropicrin, for example) prior to each crop, which may increase the costs and environmental burden.

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 3A. SOUTHERN FOREST NURSERY MANAGEMENT COOPERATIVE - HISTORIC PATTERN OF USE OF METHYL BROMIDE

FOR AS MANY YEARS AS POSSIBLE AS SHOWN SPECIFY:	1999	2000[a]	2001[a]	2002[a]	2003[a]	2004[a]	2005[a]
AREA TREATED *(hectares)*	656	656	656	656	656	656	658
RATIO OF FLAT FUMIGATION METHYL BROMIDE USE TO STRIP/BED USE IF STRIP TREATMENT IS USED	not available	flat fumigation	flat fumigation	flat fumigation	flat fumigation	flat fumigation	flat fumigation
AMOUNT OF METHYL BROMIDE ACTIVE INGREDIENT USED *(total kilograms)*	246,032	246,032	246,032	246,032	246,032	246,032	246,032
FORMULATIONS OF METHYL BROMIDE *(methyl bromide:chloropicrin)*	98:2	98:2	98:2	98:2	98:2	98:2	98:2
METHOD BY WHICH METHYL BROMIDE APPLIED *)*	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp
APPLICATION RATE [ACTIVE INGREDIENT] (kg/ha*)	375	375	375	375	375	375	374
ACTUAL DOSAGE RATE [ACTIVE INGREDIENT] *(g/m^2)**	37.5	37.5	37.5	37.5	37.5	37.5	37.4

** For flat fumigation treatment application rate and dosage rate may be the same.*

[a]Data are based on a survey of consortium members in 2000. Consortium does not keep records of seedling production data but assumes that use rates and production information do not vary significantly from year to year.

TABLE B 3B. INTERNATIONAL PAPER - 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)*	185	121	115	101	130	131	62
RATIO OF FLAT FUMIGATION METHYL BROMIDE USE TO STRIP/BED USE IF STRIP TREATMENT IS USED	flat fumigation	flat fumigation	flat fumigation	flat fumigation	flat fumigation	flat fumigation	flat fumigation
AMOUNT OF METHYL BROMIDE ACTIVE INGREDIENT USED (kg)	68,975	43,646	38,666	34,853	49,942	50,253	23,913
FORMULATIONS OF METHYL BROMIDE *(methyl bromide:chloropicrin)*	98:2	98:2	98:2	98:2	98:2	98:2	98:2
METHOD BY WHICH METHYL BROMIDE APPLIED	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp
APPLICATION RATE [ACTIVE INGREDIENT] (kg/ha*)	374	362	338	344	384	384	384
ACTUAL DOSAGE RATE [ACTIVE INGREDIENT] *(g/m^2)**	37.4	36.2	33.8	34.4	38.4	38.4	38.4

** For flat fumigation treatment application rate and dosage rate may be the same.*

TABLE B 3C. WEYERHAEUSER-SOUTH - 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)*	72	66	61	64	66	72	61
RATIO OF FLAT FUMIGATION METHYL BROMIDE USE TO STRIP/BED USE IF STRIP TREATMENT IS USED	flat fumigation	flat fumigation	flat fumigation	flat fumigation	flat fumigation	flat fumigation	flat fumigation
AMOUNT OF METHYL BROMIDE ACTIVE INGREDIENT USED *(kg)*	29,649	21,516	21,709	24,231	26,079	29,803	24,340
FORMULATIONS OF METHYL BROMIDE *(methyl bromide:chloropicrin)*	98:2	90:10	90:10	90:10	98:2	98:2	98:2
METHOD BY WHICH METHYL BROMIDE APPLIED *)*	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp
APPLICATION RATE [ACTIVE INGREDIENT] (kg/ha*)	412	327	355	379	398	406	401
ACTUAL DOSAGE RATE [ACTIVE INGREDIENT] *(g/m^2)**	41.2	32.7	35.5	37.9	39.8	40.6	40.1

** For flat fumigation treatment application rate and dosage rate may be the same.*

TABLE B 3D. WEYERHAEUSER-WEST - 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)*	43	70	65	70	76	95	88
RATIO OF FLAT FUMIGATION METHYL BROMIDE USE TO STRIP/BED USE IF STRIP TREATMENT IS USED	flat fumigation	flat fumigation	flat fumigation	flat fumigation	flat fumigation	flat fumigation	flat fumigation
AMOUNT OF METHYL BROMIDE ACTIVE INGREDIENT USED *(total kilograms)*	11,360	17,864	17,125	14,647	16,935	19,122	18,370
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)*	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp
APPLICATION RATE [ACTIVE INGREDIENT] (kg/ha*)	262	255	263	210	224	201	208
ACTUAL DOSAGE RATE [ACTIVE INGREDIENT] *(g/m^2)**	26.2	25.5	26.3	21.0	22.4	20.1	20.8

** For flat fumigation treatment application rate and dosage rate may be the same.*

TABLE B 3E. NORTHEASTERN FOREST & CONSERVATION NURSERY ASSOCIATION - 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)*	91	87	80	72	87	78	69
RATIO OF FLAT FUMIGATION METHYL BROMIDE USE TO STRIP/BED USE IF STRIP TREATMENT IS USED	flat fumigation	flat fumigation	flat fumigation	flat fumigation	flat fumigation	flat fumigation	flat fumigation
AMOUNT OF METHYL BROMIDE ACTIVE INGREDIENT USED *(total kilograms)*	31,961	28,308	26,844	26,273	30,798	29,027	24,557
FORMULATIONS OF METHYL BROMIDE *(methyl bromide:chloropicrin)*	98:2	98:2	98:2	98:2	98:2	98:2	98:2
METHOD BY WHICH METHYL BROMIDE APPLIED *(e.g. injected at 25cm depth, hot gas)*	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp
APPLICATION RATE [ACTIVE INGREDIENT] (kg/ha*)	352	326	337	363	359	372	357
ACTUAL DOSAGE RATE [ACTIVE INGREDIENT] *(g/m^2)**	35.2	32.6	33.7	36.3	35.9	37.2	35.7

** For flat fumigation treatment application rate and dosage rate may be the same.*

TABLE B 3F. MICHIGAN SEEDLING ASSOCIATION - 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)*	46	51	34	35	26	26	26
RATIO OF FLAT FUMIGATION METHYL BROMIDE USE TO STRIP/BED USE IF STRIP TREATMENT IS USED	flat fumigation	flat fumigation	flat fumigation	flat fumigation	flat fumigation	flat fumigation	flat fumigation
AMOUNT OF METHYL BROMIDE ACTIVE INGREDIENT USED *(total kilograms)*	13,825	9,144	9689	9493	9420	9420	9147
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)*	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp	shank injected w/tarp
APPLICATION RATE [ACTIVE INGREDIENT] **(kg/ha*)**	302	178	285	270	364	364	353
ACTUAL DOSAGE RATE [ACTIVE INGREDIENT] *(g/m^2)**	30.2	17.8	28.5	27.0	36.4	36.4	35.3

** For flat fumigation treatment application rate and dosage rate may be the same.*

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

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

TABLE C 1. REASON FOR ALTERNATIVES NOT BEING FEASIBLE

Name of Alternative	TECHNICAL AND REGULATORY* REASONS FOR THE ALTERNATIVE NOT BEING FEASIBLE OR AVAILABLE	IS THE ALTERNATIVE CONSIDERED COST EFFECTIVE?
	CHEMICAL ALTERNATIVES	
Dazomet (400 kg/ha) or Metam-sodium (485 kg/ha)	Inconsistent results with weeds, especially w/moderate to high weed pressure. Does not consistently provide acceptable levels of nutsedge control, nor does it manage some diseases associated with fungal pathogens (root rot and damping-off pathogens). Most effective use will probably be incorporated with other methods, but protocols must be developed (Fraedrich and Dwinell, 2003b). Field trials show that seedling size (diameter and height) and root volume were inconsistent, non-uniform, and reduced with dazomet, leading to higher counts of Grade #2 seedlings and culls compared to greater numbers of Grade #1 seedlings with MB. Reduced efficacy requires production cycle compensation by increasing the frequency of fumigation or lengthening the fallow period in order to obtain better control of weeds and other pests. These strategies result in reduced seedling production. Damage to seedlings growing adjacent to beds being fumigated with dazomet or metam-sodium has resulted in significant loss of seedlings due to fumigant drift. Soil temperature requirements (above 4-6° C/ optimal 12-18° C) of dazomet or metam-sodium, due to vapor pressure properties, constrains use in some areas (north and west) (Landis and Campbell, 1989); (Fraedrich and Dwinell, 2003b; Campbell and Kelpsas, 1988; Carey, 1996; Carey, 1994; Enebak et al., 1990; Weyerhaeuser, #3, 1984-87; Weyerhaeuser, #4, 1985-87; Weyerhaeuser, #6, 1992; Weyerhaeuser, #7, 1994-96; Weyerhaeuser, #8, 1992-95; Weyerhaeuser, #9, 1994-95; Weyerhaeuser, #10, 1994-96; Darrow, 2002)	Where effective
	NON CHEMICAL ALTERNATIVES	

Name of Alternative	TECHNICAL AND REGULATORY* REASONS FOR THE ALTERNATIVE NOT BEING FEASIBLE OR AVAILABLE	IS THE ALTERNATIVE CONSIDERED COST EFFECTIVE?
Containerized production	Containerization of nursery production would (1) require a large capital investment by all participants in the sector, (2) increase seedling production costs by 300 to 600%, (3) reduce reforestation rates as public nurseries opt out of reforestation as expenditures go up. (see Section 18 and Appendix B.). Some nurseries with specialized markets have a portion of their production in containers (Barnett and McGilvrary, 1997; Darrow, 2002; Lowerts, 2003).	Not cost effective for the complex production systems; may be effective for a small portion of the industry's needs
Virtually Impermeable Film (VIF)	There remain some technical and availability concerns. However, manufacturers believe problems can be resolved (Rimini and Wigley, 2004). Ongoing studies may help assess the use of VIF with methyl bromide and chemical alternatives. (Carey and Godbehere, 2004).	Unclear availability and technical feasibility; not allowed in California

Name of Alternative	TECHNICAL AND REGULATORY* REASONS FOR THE ALTERNATIVE NOT BEING FEASIBLE OR AVAILABLE	IS THE ALTERNATIVE CONSIDERED COST EFFECTIVE?
Solarization	Many nurseries are not able to generate acceptable heat to allow spring planting; most effective time for solarization is not compatible with timing for production; uses solar radiation to heat soil under clear plastic, and under certain conditions in some locations in the summer, soil can be heated to as high as 60 C to a depth of 7.5 cm. Effective solarization would likely require several months of covered bed treatments, to heat soil to a sufficient depth (25-30 cm) in order to affect soil-borne pathogens. Seeds of some weed species are resistant even to higher temperatures obtained with solarization. Nutsedges, *Fusarium* spp., *Macrophomina* spp. are not controlled, or unpredictably controlled, by solarization (Elmore et al., 1997). Therefore, this alternative is not considered technically feasible. Conceivably, solarization could be optimized for efficacy and incorporated into an integrated pest management (IPM) program that would help reduce chemical use for bed preparation, but because of intensive scheduling of seedling production, solarization is inadequate as a sole replacement for MB in the forest seedling industry even in the southern U. S. (Weyerhaeuser, #8, 1992-95)	Only where feasible—of limited scale
Biofumigation	This is a process where mustard species (*Brassica* spp.) are grown and ultimately disked into soils. A bioactive breakdown product of some of these species is MITC. However, this alternative is not considered feasible due to the difficulty in obtaining sufficient biomass to produce effective amounts of MITC to manage diseases and weeds under nursery conditions. 11,500 kg per ha of *Brassica* plants—an amount that is considered very high production—is equivalent to approximately 25 kg dazomet, an amount significantly less than effective fumigation rates. In addition, increased *Fusarium* populations due to favorable conditions provided by *Brassica* plants have been reported to increase seedling diseases after biofumigation treatments. While some Petri dish studies (e.g., Charron and Sams, 2003) have indicated a reduction in growth of some fungal pathogens limited field studies have been conducted to verify effects.	Not able to provide sufficient biomass
Flooding/Water management	Nursery beds generally are designed and graded for good drainage to prevent standing water. Flooding could increase incidence of *Phytophthora* and *Pythium*, which cause important damping-off and root rot diseases. Therefore, this alternative is not considered technically feasible.	No
General Integrated Pest Management (IPM)	Nurseries currently use IPM techniques, but these measures do not provide adequate weed and disease control. Therefore, this alternative is not considered technically feasible.	Generally used by nurseries for pest management
Plowing/Tillage	Nursery beds, especially medium type soils with higher clay or organic matter than light soil beds, are susceptible to damage to soil structure and development of an impermeable "plow pan" layer. Increased plowing can result in less productive seedling beds, therefore, this alternative is not considered feasible.	No

Name of Alternative	TECHNICAL AND REGULATORY* REASONS FOR THE ALTERNATIVE NOT BEING FEASIBLE OR AVAILABLE	IS THE ALTERNATIVE CONSIDERED COST EFFECTIVE?
Physical Removal/ Sanitation	Appropriate sanitation practices are already followed by nurseries, as this improves productivity. Weed control by mechanical means would not be technically feasible for large-scale nursery seedling production.	No
Organic Amendments/ Compost	Not acceptably effective alone in weed management; often cover crops are already used for beds not in current production, as part of general IPM program; can be issue with weed introduction by plant-based mulches (James et al., 1997; James et al., 2001; Stone et al., 1998). Most nurseries employ various soil amendments to enhance seedling growth and quality, but these measures do not provide adequate weed and disease control, therefore, this alternative is not considered feasible.	No
COMBINATIONS OF ALTERNATIVES		
Chloropicrin (340 kg/ha)	A good fungicide, but not acceptably effective with moderate or high weed pressure, some reports of enhanced weed seed germination (Carey, 2000; Carey, 1996; Enebak et al., 1990; Weyerhaeuser, #7, 1994-96; Weyerhaeuser, #10, 1994-96). Weed pressure will likely increase overtime.	
Metam-sodium (485 kg/ha) + chloropicrin (115 kg/ha)	Can be effective against weeds and fungi, especially with low to moderate pressure and light soils (Carey, 2000; Carey, 1996; Carey, 1994; Weyerhaeuser, #10, 1994-96). There is a history of outgassing problems and significant seedling damage.	
1,3-D (260 kg/ha) + chloropicrin (140 kg/ha)	A good nematicide, requires light soils with optimal moisture content. Not sufficiently effective against weeds, especially with even moderate weed pressure; may have legal restrictions on use (Carey, 1996; Carey, 1994; Weyerhaeuser, #7, 1994-96; Weyerhaeuser, #10, 1994-96)	
Herbicides	Research will help to identify herbicides (e.g., glyphosate) that can effectively reduce high populations of nutsedge with consistent and reliable activity, most likely as part of an integrated program of alternatives (e.g., Fraedrich and Dwinell, 2003c).	

** 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 2. TECHNICALLY INFEASIBLE ALTERNATIVES DISCUSSION

NAME OF ALTERNATIVE	DISCUSSION
Chloropicrin (340 kg/ha)	A good fungicide, but not acceptably effective with moderate or high weed pressure, some reports of enhanced weed seed germination (Carey, 2000; Carey, 1996; Enebak et al., 1990; Weyerhaeuser, #7, 1994-96; Weyerhaeuser, #10, 1994-96). Weed pressure will likely increase overtime.
Metam-sodium (485 kg/ha) + chloropicrin (115 kg/ha)	Can be effective against weeds and fungi, especially with low to moderate pressure and light soils (Carey, 2000; Carey, 1996; Carey, 1994; Weyerhaeuser, #10, 1994-96). There is a history of outgassing problems and significant seedling damage.
1,3-D (260 kg/ha) + chloropicrin (140 kg/ha)	A good nematicide, requires light soils with optimal moisture content. Not sufficiently effective against weeds, especially with even moderate weed pressure; may have legal restrictions on use (Carey, 1996; Carey, 1994; Weyerhaeuser, #7, 1994-96; Weyerhaeuser, #10, 1994-96)
Herbicides	Research will help to identify herbicides (e.g., glyphosate) that can effectively reduce high populations of nutsedge with consistent and reliable activity, most likely as part of an integrated program of alternatives (e.g., Fraedrich and Dwinell, 2003c).

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.*)

TABLE 15.1. EFFECTIVENESS OF ALTERNATIVES – KEY WEEDS

Treatment	# Trials	Yield	Quality	Relative Quality	Weed Severity	Weed Incidence	Citation
[Chem. trts w/tarp] [1] Control (no fumigation) [2] Chloropicrin (340 kg/ha) [3] Chloropicrin (340 kg/ha) + metam sodium (320 kg/ha)	1 (W/ Loblolly pine)	Average Total Yield (per m^2) [1] 193b [2] 236a [3] 236a	Average Grade #1 Yield (per m^2) [1] 6b [2] 19ab [3] 45a	Quality (% Grade #1 compared to total) [1] 3% [2] 8% [3] 19%	(# Nutsedge rhizomes per m^2) [1] 91a [2] 43b [3] 5b	No MB trt	Carey, 2000
[Chem. trts w/tarp] [1] Control (no fumigation) [2] Chloropicrin (285 kg/ha) [3] Chloropicrin (285 kg/ha) + metam sodium (240 kg/ha)	1 (W/ Loblolly pine)	Average Total Yield (per m^2) [1] 150b [2] 214ab [3] 246a	Average Grade #1 Yield (per m^2) [1] 8b [2] 15ab [3] 53a	Quality (% Grade #1 compared to total) [1] 5% [2] 7% [3] 22%	(Nutsedge dry wt, kg/ha) [1] 551a [2] 40b [3] 11b	No MB trt	Carey, 2000
[Chem. trts w/tarp] [1] Control (no fumigation) [2] Chloropicrin (340 kg/ha) [3] Chloropicrin (340 kg/ha) + metam sodium (320 kg/ha) [4] MB (385 kg/ha) + Pic (8 kg/ha)	1 (W/ Loblolly pine)	Average Total Yield (per m^2) [1] 150b [2] 193a [3] 204a [4] 204a	Average Grade #1 Yield (per m^2) [1] 27b [2] 114ab [3] 150a [4] 131a	Quality (% Grade #1 compared to total) [1] 18% [2] 59% [3] 74% [4] 64%	Not reported	Not reported	Carey, 2000
[Chem. trts w/tarp] [1] Control (no fumigation) [2] Chloropicrin (340 kg/ha) [3] Chloropicrin (340 kg/ha) + metam sodium (320 kg/ha) [4] MB (385 kg/ha) + Pic (8 kg/ha)	1 (W/ Slash pine)	Average Total Yield (per m^2) [1] 107a [2] 150a [3] 150a [4] 129a	Average Grade #1 Yield (per m^2) [1] 63b [2] 109ab [3] 136a [4] 109ab	Quality (% Grade #1 compared to total) [1] 59% [2] 73% [3] 91% [4] 84%	Not reported	Not reported	Carey, 2000

TABLE 15.1. EFFECTIVENESS OF ALTERNATIVES – KEY WEEDS							
Treatment	**# Trials**	**Yield**	**Quality**	**Relative Quality**	**Weed Severity**	**Weed Incidence**	**Citation**
"Heavy" soil (57% silt, 14% clay, 29% sand) [Chem. trts w/tarp] [1] Control (no fumigation) [2] Chloropicrin (285 kg/ha) [3] Metam sodium (455 kg/ha) [4] Chloropicrin (130 kg/ha) + metam sodium (455 kg/ha) [5] 1,3-D (240 kg/ha) + Pic (100 kg/ha) [6] Dazomet (285 kg/ha) [7] MB (265 kg/ha)+Pic(130kg/ha)	1 (w/ Loblolly pine	Average Total Yield (per m^2) [1] 194 [2] 181 [3] 204 [4] 192 [5] 238 [6] 214 [7] 188 [LSD, 0.05=20]	Average Grade #1 Yield (per m^2) [1] 41 [2] 31 [3] 35 [4] 31 [5] 28 [6] 25 [7] 23 [LSD, 0.05=40]	Quality (% Grade #1 compared to total) [1] 21% [2] 17% [3] 17% [4] 16% [5] 12% [6] 12% [7] 12%	(# Total weeds/ m^2; 53 days after treatment) [1] 37 [2] 16 [3] 25 [4] 7 [5] 12 [6] 12 [7] 6 [LSD, 0.05=14]	(% Coverage of weeds per plot (30 m^2); 53 days after treatment) [1] 39%a [2] 14%bc [3] 25%ab [4] 11%bc [5] 21%bc [6] 22%bc [7] 6%c	Carey, 1996
[Chem. trts w/tarp] [1] Control (no fumigation) [2] 1,3-D (240 kg/ha) + chloropicrin (100 kg/ha) [3] Metam sodium (455 kg/ha) [4] Chloropicrin (130 kg/ha) + metam sodium (455 kg/ha) [5] Dazomet (340 kg/ha) [6] Dazomet (170 kg/ha) +Pic (130kg/ha) [7] MB (265 kg/ha)+Pic(130kg/ha)	Not reported	Not reported	Not reported	Not reported	(# *Nutsedge* /m^2; 7 months after treatment) [1] 85abc [2] 5c [3] 27bc [4] 15bc [5] 98abc [6] 127abc [7] 1c [LSD, 0.05=38]	(% Coverage of *weeds* per plot (175 m^2)7 months after treatment) [1] 100%a [2] 35%c [3] 36%c [4] 38%c [5] 95%a [6] 46%c [7] 29%c [LSD, 0.05=16]	Carey, 1994
[1] Metam-sodium (485 kg/ha) [2] MB (235 kg/ha) + chloropicrin (115 kg/ha) [spring trt] [3] MB (235 kg/ha) + chloropicrin (115 kg/ha) [fall trt]	1 (1st year Ponderosa pine)	Average Total Yield (per m^2) [1] 245/m^2 [2] 221/m^2 [3] 208/m^2	Not reported	Not reported	Not reported	Not reported	Weyer-haeuser #2, 1980
[1] MB (235 kg/ha) + chloropicrin (115 kg/ha) [2] Metam-sodium (485 kg/ha) [3] Dazomet (400 kg/ha)	1 (2nd year crop Douglas fir)	(# Of packable seedlings relative to MB trt) [2] –54/m^2 [3] –5/m^2	Loss (based on 480 seedlings/m^2 w/MB): [2] 11% [3] 1%	Consortium (CUE 03-0021) Comment: "Height, caliper, shoot weight were greater w/ MBC treated soil"	Not reported	Not reported	Weyer-haeuser #4, 1985-1987

TABLE 15.1. EFFECTIVENESS OF ALTERNATIVES – KEY WEEDS

Treatment	# Trials	Yield	Quality	Relative Quality	Weed Severity	Weed Incidence	Citation
[1] MB (235 kg/ha) + chloropicrin (115 kg/ha) [2] Dazomet (285 kg/ha) [3] Dazomet (400 kg/ha) [4] Control	1 (2nd year crop w/ Douglas fir)	(# Of packable seedlings relative to MB trt) [2] –88/m² [3] –13/m² [4] –75/m²	Loss (based on 480 seedlings/m² w/MB): [2] 18% [3] 3% [4] 16%	Consortium (CUE 03-0021) Comment: "Seedling size not significantly different between MBC and dazomet at 285 kg/ha; size reduced w/ dazomet at 400 kg/ha (toxicity?")	Not reported	Not reported	Weyer-haeuser #5, 1985-1987
[1] MB (400 kg/ha) + chloropicrin (10 kg/ha) [2] Metam sodium (485 kg/ha) [3] Dazomet (400 kg/ha) [4] Control	1 (1st year crop w/ loblolly pine)	(# Of packable seedlings relative to MB trt) [2] –27/m² [3] –13/m² [4] –27/m²	Loss (based on 480 seedlings/m² w/MB): [2] 6% [3] 3% [4] 6%	Consortium (CUE 03-0021) Comment: "Seedling height averaged 5 cm shorter for dazomet and 10 cm shorter for metam sodium and control." "Caliper (diameter) was reduced by 1 mm in metam sodium and control seedlings."	Not reported	Not reported	Weyer-haeuser #6, 1992
[1] MB (390 kg/ha) + chloropicrin (8 kg/ha) [tarped] [2] MB (300 kg/ha) + chloropicrin (100 kg/ha)) [tarped] [3] Dazomet (400 kg/ha) [tarped] [4] Dazomet (400 kg/ha) [un-tarped] [5] Pic-chlor (400 kg/ha) [tarped] [6] Chloropicrin (340 kg/ha) [tarped] [7] Control	1 (1st and 2nd year crops w/loblolly pine)	(# Of packable seedlings relative to MB trt) **1st year crop:** [1] =[2] [3] –64/m² [4] –99/m² [5] +11/m² [6] +19/m² [7] –88/m² **2nd year crop:** [1] =[2] [3] –83/m² [4] –59/m² [5] –59/m² [6] –19/m² [7] Not reported	Loss (based on 480 seedlings/m² w/MB): **1st year crop:** [1] =[2] [3] 13% [4] 21% [5] 2% gain [6] 4% gain [7] 18% **2nd year crop:** [1] =[2] [3] 17% [4] 12% [5] 12% [6] 4% [7] Not reported	Consortium (CUE 03-0021) Comment: [1st year crop reduction with dazomet due to stunting, and reduced root volume] [2nd year crop yield reduction due to stunting, and reduced root volume]	Not reported	Not reported	Weyer-haeuser #7, 1994-1996

TABLE 15.1. EFFECTIVENESS OF ALTERNATIVES – KEY WEEDS

Treatment	# Trials	Yield	Quality	Relative Quality	Weed Severity	Weed Incidence	Citation
[1] MB (390 kg/ha) + chloropicrin (8 kg/ha) [tarped] [2] Dazomet (400 kg/ha) [tarped] [3] Dazomet (400 kg/ha) [tarped & solarized 3 mo.] [4] Solarization [tarped, solar. 3 mo] [5] Control	1 (1st and 2nd year crops w/loblolly pine) (bare fallow from harvest Feb., 1992 through fumigation and tarp (3 mo.) summer 1992	(# Of packable seedlings relative to MB trt) **1st year crop:** [2] –8/m^2 [3] –5/m^2 [4] –11/m^2 [5] = [1] **2nd year crop:** [2] –8/m^2 [3] –5/m^2 [4] –11/m^2 [5] +19/m^2	Loss (based on 480 seedlings/m^2 w/MB): **1st year crop:** [2] 2% [3] 1% [4] 2% [5] no loss **2nd year crop:** [2] 2% [3] 1% [4] 2% [5] 4% gain	[# weeds/m^2 May, 1993; dominant species: *Amaranthaceae* spp., *Mollugo verticillata, Euphorbia supine*] [1] 31b [2] 25b [3] 35b [4] 54ab [5] 104a	[# weeds/m^2 June, 1993; dominant species: *Euphorbia supine, Digitaria ciliaris, Digitaria ischaemun*] [1] 13b [2] 10b [3] 17b [4] 28a [5] 36a	Not reported	Weyer-haeuser #8, 1992-1995
[1] MB (400 kg/ha) + chloropicrin (8 kg/ha) [tarped] [2] Dazomet (400 kg/ha) [tarped] [3] Dazomet (400 kg/ha) [un-tarped] [4] Control	1 (1st year crop w/loblolly pine)	(# Of packable seedlings relative to MB trt) [2] –19/m^2 [3] –35/m^2 [4] –5/m^2	Loss (based on 480 seedlings/m^2 w/MB): [2] 4% [3] 7% [4] 1%	Consortium (CUE 03-0021)Comment: Short trees and poor root structure were main cull factors	Not reported	Not reported	Weyer-haeuser #9, 1994-1995
[1] MB (400 kg/ha) + chloropicrin (8 kg/ha) [2] 1,3-D (260 kg/ha) + chloropicrin (140 kg/ha) [3] Chloropicrin (130 kg/ha) + metam sodium (240 kg/ha) [tarped] [4] Dazomet (400 kg/ha)[tarped] [5] Dazomet (400 kg/ha)[untarped] [6] Chloropicrin (340 kg/ha) [tarped] [7] Control	1 (1st and 2nd year crops w/loblolly pine)	(# Of packable seedlings relative to MB trt [1]) **1st year crop:** [2] –40/m^2 [3] –8/m^2 [4] +3/m^2 [5] –29/m^2 [6] –13/m^2 [7] –46/m^2 **2nd year crop:** [2] –3/m^2 [3] –3/m^2 [4] +3/m^2 [5] Not reported [6] +3/m^2 [7] Not reported	Loss (based on 480 seedlings/m^2 w/MB): **1st year crop:** [2] 8% [3] 2% [4] no loss [5] 6% [6] 3% [7] 10% **2nd year crop:** [2] No loss [3] No loss [4] No loss [5] Not reported [6] No loss [7] Not reported	**1st year crop:** Culls were short with small diameters **2nd year crop:** Study was suspended due to high nutsedge populations	Not reported	Not reported	Weyer-haeuser #10, 1994-1996

TABLE 15.2: EFFECTIVENESS OF ALTERNATIVES – KEY DISEASES

Research Results for Disease (*Fusarium, Pythium, Rhizoctonia*) Management with Methyl Bromide (MB) and/or Alternatives

Treatment	**# Trials**	**Yield**	**Percent Survival**	**Average Yield Post Emergence (per m^2)**	Percent Healthy Root Tips (1 year old seedlings)	**Stand density, seedlings/m^2 (fumigation Sept. 1986, seeding Oct., 1986)**		**Citation Number**
						May 1987	**Sept 1987**	
[1] Control (no fumigation) [2] Chloropicrin (196 kg/ha) [3] MB (392 kg/ha] [4] MB (263 kg/ha) + chloropicrin (65 kg/ha) [5] MB (130 kg/ha) + chloropicrin (131 kg/ha) [6] Dazomet (280 kg/ha) [7] Captan (6 kg/ha) [soil drench] [8] Thiram (38 g/kg seed) [seed trt.] [9] Captan (6 kg/ha) [soil drench] + thiram (38 g/kg seed) [seed trt.] [10] Silica sand (overlay seeds)	6 reps (w/white pine in WI)	[Yield per m^2 at seedling emergence, based on survival from damping-off diseases, calculated rate of 720 seedlings/ m^2 at seeding rate of 14 g seed/ m^2] [1] 496b [2] 550a [3] 570a [4] 566a [5] 564a [6] 522ab [7] 474b [8] 404c [9] 408c [10] 366c	Percent survival from damping-off at seedling emergence [1] 69%ab [2] 76%a [3] 79%a [4] 79%a [5] 78%a [6] 73%a [7] 66%ab [8] 57%c [9] 57%c [10] 51%c	[Yield per m^2 after seedling emergence based on survival from damping-off diseases at cotyledon or primary needle stage] [1] 592d [2] 702a [3] 694ab [4] 710a [5] 682abc [6] 686ab [7] 580d [8] 646c [9] 670abc [10] 662bc	[1] 20%c [2] 55%ab [3] 68%a [4] 72%a [5] 76 %a [6] 31%bc [7] 8%c [8] 18%c [9] 16%c [10] 38%bc	[1] 464 [2] 464 [3] 464 [4] 464 [5] 464 [6] 464 [7] 320 [8] 360 [9] 360 [10] 320	[1] 110 [2] 464 [3] 464 [4] 464 [5] 464 [6] 250 [7] 106 [8] 106 [9] 106 [10] 80	Enebak et al., 1990
[1] Control (no fumigation) [2] MB (266 kg/ha) + chloropicrin (130 kg/ha) [3] Metam sodium (485 kg/ha) [4] Dazomet (400 kg/ha)	4 reps (w/ pon-derosa pine in Pacific NW)	[% Mortality due to *Pythium*, and *Fusarium*, during 1st growing season] [1] 25%a [2] 12%b [3] 8%b [4] 10%b	[# Of seedlings after 1st growing season] (per m^2) [1] 150a [2] 300b [3] 343b [4] 300b					Campbell and Kelpsas, 1988
[1] Control (no fumigation) [2] MB (266 kg/ha) + chloropicrin (130 kg/ha) [3] MB (580 kg/ha) + chloropicrin (285 kg/ha) [4] Dazomet (400 kg/ha)	1 (with Douglas fir)	**1st crop year**: Seedlings/m^2 [1] 429 [2] 482 [3] 455 [4] 469						Weyer-haeuser #3, 1984-1987

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*):

According to one applicant "an IPM system using true fallow, pathogen resistant cover crops, increased supplemental organic matter applications, increased herbicide and insecticide use, and annual chloropicrin and Telone fumigation for bareroot pine production" are the likely alternatives that could replace methyl bromide. Combinations of chemicals, such as chloropicrin, metam-sodium, or 1,3-D appear to be effective for some nurseries in reducing pest infestations, including some weed problems (e.g., Carey, 2000; Carey, 1996; Carey, 1994; Weyerhaeuser, #8, 1992-95; Weyerhaeuser, #10, 1994-96). Combinations of these compounds and application techniques (such as deep injection) to achieve the same pest control efficiencies as methyl bromide are being studied along with integrating non-chemical treatments, such as bed-fallow or cover crops. So far, none have proven cost effective and have generally resulted in an increased input of pesticides. Because of their physical limitations (e.g., low vapor pressure of metam-sodium), these products are frequently not used by nursery managers due to their lack of consistency. Conclusions based on individual research trials may be skewed since large-scale production may result in greater differences between treatments due to scale-up and different pest pressure. In addition, economic issues may have an impact on overall acceptability of these alternatives for the forest seedling nursery sector.

The use of metam without tarping is not feasible due to crop injury and worker exposure. It might appear appropriate, then, to tarp the material to prevent out-gassing problems. However, the application of metam followed by chloropicrin under flat-tarping, considering the large number of hectares treated each year, is not practical or cost effective, and currently, not technically feasible (personal communication, International Paper [Region B]; Southern Forest Nursery Management Cooperative [Region A]). A three-step process would be required, first application of metam, then chloropicrin, and finally, application of the tarp. Incorporation of metam using a rotovator is an extremely slow process, and the area to be treated within a given treatment window (determined by weather: temperature, moisture, wind) is limited. This window of application is generally 4-6 weeks, and even under the best application methods, this treatment takes four times as long to apply as the typical methyl bromide treatment. Therefore, to treat the necessary hectares each year would require a four-fold increase in labor and additional available equipment in order to apply metam, chloropicrin and cover with tarp. According to the label, and depending on soil and weather conditions, there would be a two to six week delay before planting after application of metam, chloropicrin and tarp-covering. This would affect market production costs.

The equipment needed to treat the area in spring and fall would not be available without the purchase of four additional applicator units and would greatly increase the cost to growers, as would the "set-up" time for the treatment with additional machinery. In order for tarps to be placed on the treated metam areas, workers must return into the treated area to lay down tarps after chloropicrin has been injected into the soil. In this case, out-gassing occurs, and workers must wear personal protection equipment that is not practical given the temperatures that normally occur at the time of application. Nursery growers of these regions are currently using high density films to decrease emissions of methyl bromide, but have found that for current production VIF is not an option due to excessive costs and technical difficulties of gluing during application. Nursery members of the Southern Forest Nursery Cooperative, among others, are experimenting with VIF, but are not able to adopt this technology for the 2008 season.

The use of low permeability films may offer a means of reducing methyl bromide use rates while maintaining efficacy and production goals (Carey and Godbehere, 2004). However, in the U.S. availability of VIF appears limited. Other low permeability films, such as metalized films, may have a place in these nurseries. Research is being conducted to determine if this type of film is feasible in the U. S. (e.g., does it hold up physically in field conditions? can it be glued to acceptable specifications?; is the cost acceptable?). VIF manufacturers believe that technical problems will be solved (Rimini and Wigley, 2004). However, the efficacy of VIF for U. S. agriculture may be different than that for Europe (Federal Register, 1998). There has been research examining the effects of certain fertilizer salts (e.g., ammonium thiosulfate, see Gan and Yates, 1998), which may act as barriers to volatile compounds (e.g., 1,3-D, methyl bromide) when applied to the soil surface, thus reducing emissions and improving efficacy, although this method is in the beginning stages of testing.

A major limitation with respect to ongoing research is the general lack of information to accurately assess pest control in large scale, compared to small research trials. Topics, such as outgassing damage as a result of metam-sodium applications and application of VIF and associated costs, are being studied. Technical difficulties in extrapolating research scale plots to "real world" applications make it difficult to transition away from methyl bromide and calculate implementation timelines, since production consistency is frequently compromised. As discussed in Section 23 below, considerable research dollars have been spent on research of methyl bromide alternatives. A combination of methods can conceivably be used to reduce methyl bromide, but this will require several seasons of testing and analyses.

In research plots, the reduction of methyl bromide from 98:2 to 65:35 or 50:50, increased periods of cover crop growth, use of herbicides (Fraedrich and Dwinell, 2003c), and an increased use of mechanical cultivation might reduce pest populations, and the overall use of methyl bromide. However, nursery managers are unlikely to adopt the use of glyphosate immediately, since it kills both hardwoods and conifers. Experiments have indicated that some soil amendments can reduce possible adverse growth effects of some alternatives (e.g., dazomet). Work in Wisconsin (Enebak et al., 1990; Iver, undated) suggested that white pine seedlings subjected to dazomet, but supplied with various nutrients, could reduce chlorosis sometimes observed in dazomet treated beds. Large scale trials will be necessary to confirm this effect. For disease control, studies (James et al., 1997) comparing cultivation practices, such as till vs. no-till and organic amendments indicate that effects vary according to the species grown, thus each nursery may have to consider alternatives with species and local environment in mind, unlike the more consistent effects of methyl bromide fumigation. Promising results in disease management have been observed (Lantz, 1997; Stone et al., 1998) with organic amendments, but successful weed management has not been adequately achieved.

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):

Containerization is used for seedling production in a limited capacity throughout the forest nursery sector. One Michigan grower (CUE 04-0039) produces greenhouse-grown plug plants, which are grown for 1-2 years, then planted in beds for an additional 1-3 years. Containers can also be for special circumstances where species survival or an genetic value of the planting stock make them economically feasible. Recent surveys indicate that of the 1.2 billion seedlings grown in the southeastern U. S. in the 2002-2003 season, fewer than 5% were produced in containers (McNabb and VandersSchaaf, 2003). An estimate can be made that less than 10% of the national forest seedling production is containerized. Container production is used for specialty purposes, for example, to reforest mine-spoil sites which are extremely harsh edaphic environments requiring a soil plug system to obtain adequate seedling survival (Lowerts, 2003).

A large investment would be necessary to shift the national production to containerization, as well as a shift for many nurseries in the well established protocols of growing seedlings. According to Darrow (2002) the transition from bed to container production would require additional capital and operating costs. Investment would be necessary for the purchases of greenhouses, container filling and sowing machines, containers, outdoor holding areas, fertigation systems, and new seedling transport systems both in the nursery and in the field. Not all sectors of seedling production would have this capital available to them. It is likely that smaller bareroot operations would close and many state-run nurseries would opt to close rather than budget state funds for such a significant capital outlay. Seedling prices could increase by up to six times current prices. A typical one year old bareroot seedling currently sells for $0.04 each, while the typical container seedling of the same species *begins* at $0.12 each. In addition to an increase in seedling costs, there are significant cost increases associated with transportation and planting container stock. Fewer container plants can be transported per truck and fewer seedlings can be carried by individual tree planters. More trucks and more fuel are needed to get seedlings to the planting site and more labor and time are needed to plant a given area. One study found that daily production decreased from 9.7 ha per day with bareroot seedlings to 7.3 ha per day with containerized seedlings, a decrease of 25%, without increasing planting crew size (Lowerts, 2003).

The result of containerization would be a significant increase in reforestation costs and a decrease in the rate of reforestation. According to the U. S. Forest Service, 48% of all reforestation in the U. S. is done on non-industrial private lands, an additional 42% is done on industrial lands, and 10% on government lands (Moulton and Hernandez, 2000). Non-industrial forest owners are sensitive to reforestation costs, decreasing their investment in direct proportion to increasing costs (Hardie and Parks, 1991; Royer, 1987). A reduction in reforestation efforts could have serious long-term negative impacts on the sustainability of the forest economy. Industrial owners will also be negatively impacted by increased reforestation costs as raw material costs increase (typically about 40-60% of the cost of final fiber products), impacting the competitiveness of their industry.

Conclusion: The infrastructure investment necessary for containerization is enormous and would probably force many nurseries out of business. Seedling production costs would increase, resulting in seedling price increases of over 250%. New transportation and planting systems would have to be adopted. Reforestation costs would go up significantly and probably result in fewer non-industrial forest owners reforesting after harvest. The potential long-term effect of these changes on the forestry economy is enormous. Overall, containerization would result in a significant increase in seedling production, transportation, and planting costs and would most likely decrease reforestation rates.

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

Please see Section 17(i), above.

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

Please see Section 17(i), above.

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.

TABLE C4. 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 (MeI) (Iodomethane)	Not registered for use in U.S. Research label has been granted for small plots (approximately 1 ha). Formulation being considered is 50:50 (chloropicrin). Risk assessment for chloropicrin will have to be finalized prior to registration of MeI.	Yes	Unknown

NAME OF ALTERNATIVE	PRESENT REGISTRATION STATUS	REGISTRATION BEING CONSIDERED BY NATIONAL AUTHORITIES? (Y/N)	DATE OF POSSIBLE FUTURE REGISTRATION:
Sodium Azide	Not registered in U. S. No registration package has been received.	No	Unknown
Propargyl bromide	Not registered in U. S. No registration package has been received.	No	Unknown

(Renomination Form 12.) DELAYS IN REGISTRATION
Where significant delays or obstacles have been encountered to the anticipated registration of an alternative, the exemption holder should identify the scope for any new/alternative efforts that could be undertaken to maintain the momentum of transition efforts, and identify a time frame for undertaking such efforts.

Iodomethane has been delayed in registration and it is unknown when that may occur or when the registrant will support the registration for this sector. 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 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.

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 MINIMISE METHYL BROMIDE USE AND EMISSIONS IN THE PARTICULAR USE.

TECHNIQUE OR STEP TAKEN	LOW PERMEABILITY BARRIER FILMS	METHYL BROMIDE DOSAGE REDUCTION	INCREASED % CHLOROPICRIN IN METHYL BROMIDE FORMULATION	DEEP INJECTION	LESS FREQUENT APPLICATION
WHAT USE/EMISSION REDUCTION METHODS ARE PRESENTLY ADOPTED?	Currently, most growers use HDPE tarps; VIF is restricted in California.	Between 1997 and 2002 the dosage rate of methyl bromide has dropped by one eighth.	May be feasible for some pests, if regulations allow a higher percentage of chloropicrin	Deep injections are currently being used to provide the deep-rooted plant optimal pest-free environment	For certification of nursery stock, fumigation must occur prior to every planting
WHAT FURTHER USE/EMISSION REDUCTION STEPS WILL BE TAKEN FOR THE METHYL BROMIDE USED FOR CRITICAL USES?	Research is underway to develop use in commercial production systems	Possible changeover from broadcast to raised bed band treatments,	May be feasible for some pests, if regulations allow a higher percentage of chloropicrin	Deep injections are currently being used to provide the deep-rooted plant optimal pest-free environment	For certification of nursery stock, fumigation must occur prior to every planting
OTHER MEASURES (PLEASE DESCRIBE)	Combination of methods using two or three chemicals and effective tarps (low permeability and/or various colors) and IPM methods are being studied to develop the most effective regimes for pest management.				

The Forest Seedlings sector has reduced its methyl bromide consumption through several techniques developed over the past several years. First, the sector has incorporated the use of high-density polyethylene (HDPE) tarp material that has helped increase fumigation efficiencies and reduced application rates. HDPE increases methyl bromide soil residence time, increasing efficiency and reducing application rates. VIF or other low permeable films are likely to be important means of further reducing emissions (e.g., Carey and Godbehere, 2004). Suppliers believe technical problems can be fixed (Rimini and Wigley, 2004), however, currently regulations prevent the use of VIF in California.

Second, methyl bromide fumigation in the forest seedlings sector increasingly has been made using deep injection that places the material deeper into the soil than previously. Deeper placement contributes to longer residence time in the soil and greater application efficiency. This has been accomplished at considerable capital investment on the part of applicators.

Third, forest seedlings nurseries have increased the percentage of chloropicrin in fumigation mixtures. While 98% methyl bromide and 2% chloropicrin was the most widely used compound a few years ago, a 66:33 formulation is now more common, especially in areas without heavy nutsedge infestations. Growers still applying 98:2 formulations, such as International Paper, are currently examining the effects of 66:33 in their nursery trials. Some efficiency in weed control has been sacrificed by this change in procedure, however, and higher concentrations of chloropicrin become increasingly less satisfactory as weed pressure, particularly nutsedge, increases. Some nurseries are investigating use of herbicides as an economic means of weed control (e.g., Fraedrich and Dwinell, 2003c; Northeastern Consortium request, Worksheet 4).

Fourth, forest seedlings nurseries routinely use IPM techniques to develop their fumigation strategies. Nurseries fumigate once every four years, growing two seedling crops and two cover crops following fumigation. Soil organic matter content, weed populations, and disease incidence are carefully monitored during the crop rotation to ensure the correct timing and rate of MB application. Monitoring pest populations is an integral part of an IPM approach and helps ensure MB efficiency.

Finally, the forest seedlings sector has devoted considerable resources to investigating methyl bromide alternatives and continues to search for methodologies to reduce methyl bromide use rates. The industry is committed to continuing research to address the issue of improved consistency (especially for nutsedge control) with available chemical alternatives and to test new products in order to determine efficacy and obtain the information necessary for U. S. registrations.

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

Methyl bromide emission reduction techniques are used or are being studied or planned by all nurseries. Emission reduction technologies are being addressed by the sector (e.g., VIF, reduced methyl bromide component of formulation, use of advanced delivery techniques to make alternative chemicals more effective at deeper soil levels). Approximately half of the nursery land is currently using alternatives. The use of methyl bromide for the remaining 50% is being addressed by research and field trials. The U.S. nomination reflects the continuing reduction in methyl bromide emissions by this sector.

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

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

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

(Renomination Form 14.) USE/EMISSION MINIMISATION MEASURES

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

In accordance with the criteria of the critical use exemption, each party is required to describe ways in which it strives to minimize use and emissions of methyl bromide. The use of methyl bromide in the United States is minimized in several ways. First, because of its toxicity, methyl bromide has, for the last 40 years, been regulated as a restricted use pesticide in the United States. As a consequence, methyl bromide can only be used by certified applicators that 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 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 above.

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.

TABLE E.1. SOUTHERN FOREST NURSERY MANAGEMENT COOPERATIVE - ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

REGION A - SOUTHERN FOREST NURSERY MANAGEMENT COOPERATIVE	Methyl Bromide	Dazomet	1,3-D + Chloropicrin	Metam-Sodium + Chloropicrin
YIELD LOSS (%)	*0%*	*5%*	*3%*	*3%*
Yield (seedling) per Hectare Pine	*779,617*	*740,636*	*756,228*	*756,228*
** Price per Unit (U.S. $/seedling)*	*$ 0.04*	*$ 0.04*	*$ 0.04*	*$ 0.04*
Gross Revenue per Proportion (88%)	***$ 27,443***	***$ 26,070***	***$ 26,619***	***$ 26,619***
Yield (seedling) per Hectare Longleaf Pine	*423,785*	*402,596*	*411,072*	*411,072*
** Price per Unit (U.S. $/seedling)*	*$ 0.06*	*$ 0.06*	*$ 0.06*	*$ 0.06*
Gross Revenue per Proportion (3%)	***$ 763***	***$ 725***	***$ 740***	***$ 740***
Yield (seedling) per Hectare Hardwood	*243,399*	*231,229*	*236,097*	*236,097*
** Price per Unit (U.S. $/seedling)*	*$ 0.25*	*$ 0.25*	*$ 0.25*	*$ 0.25*
Gross Revenue per Proportion (9%)	***$ 5,476***	***$ 5,203***	***$ 5,312***	***$ 5,312***
= Aggregate Gross Revenue per Hectare (U.S. $)	**$ 33,682**	**$ 31,998**	**$ 32,671**	**$ 32,671**
- Operating Costs per Hectare (U.S. $)	**$ 17,820**	**$ 20,750**	**$ 19,865**	**$ 20,258**
= Net Revenue per Hectare (U.S. $)	**$ 15,862**	**$ 11,247**	**$ 12,806**	**$ 12,413**
LOSS MEASURES				
1. Loss per Hectare (U.S. $)	**$ 0**	**$ 4,614**	**$ 3,055**	**$ 3,449**
2. Loss per Kilogram of MB (U.S. $)	**$ 0**	**$ 49.21**	**$ 32.59**	**$ 36.78**
3. Loss as a Percentage of Gross Revenue (%)	**0%**	**14%**	**9%**	**10%**
4. Loss as a Percentage of Net Revenue (%)	**0%**	**29%**	**19%**	**22%**

TABLE E 2. INTERNATIONAL PAPER: ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

REGION B - INTERNATIONAL PAPER	Methyl Bromide	Dazomet	1,3-D + Chloropicrin	Metam-Sodium + Chloropicrin
Yield Loss (%)	0%	5%	3%	3%
Yield (seedling) per Hectare	741,315	704,250	719,076	719,076
* Price per Unit (U.S. $/seedling)	$ 0.04	$ 0.04	$ 0.04	$ 0.04
= Gross Revenue per Hectare (U.S. $)	$ 31,096	$ 29,541	$ 30,163	$ 30,163
- Operating Costs per Hectare (U.S. $)	$ 15,740	$ 18,284	$ 18,343	$ 18,621
= Net Revenue per Hectare (U.S. $)	$ 15,356	$ 11,257	$ 11,820	$ 11,542
LOSS MEASURES				
1. Loss per Hectare (U.S. $)	$ 0	$ 4,099	$ 3,536	$ 3,814
2. Loss per Kilogram of MB (U.S. $)	$ 0	$ 78.97	$ 68.13	$ 73.49
3. Loss as a Percentage of Gross Revenue (%)	0%	13%	11%	12%
4. Loss as a Percentage of Net Revenue (%)	0%	27%	23%	25%

TABLE E.3: WEYERHAEUSER SOUTH - ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

REGION D - WEYERHAEUSER SOUTH	Methyl Bromide	Dazomet	1,3-D + Chloropicrin	Metam-Sodium + Chloropicrin
Yield Loss (%)	0%	5%	3%	3%
Yield (seedling) per Hectare	574,612	545,882	557,374	557,374
* Price per Unit (U.S. $/seedling)	$ 0.05	$ 0.05	$ 0.05	$ 0.05
= Gross Revenue per Hectare (U.S. $)	$ 26,719	$ 25,383	$ 25,918	$ 25,918
- Operating Costs per Hectare (U.S. $)	$ 16,960	$ 17,758	$ 17,736	$ 17,656
= Net Revenue per Hectare (U.S. $)	$ 9,759	$ 7,626	$ 8,182	$ 8,262
LOSS MEASURES				
1. Loss per Hectare (U.S. $)	$ 0	$ 2,134	$ 1,578	$ 1,497
2. Loss per Kilogram of Methyl Bromide (U.S. $)	$ 0	$ 25.38	$ 18.77	$ 17.81
3. Loss as a Percentage of Gross Revenue (%)	0%	8%	6%	6%
4. Loss as a Percentage of Net Revenue (%)	0%	22%	16%	15%

TABLE E.4: WEYERHAEUSER WEST - ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

REGION E - WEYERHAEUSER WEST	Methyl Bromide	Dazomet	1,3-D + Chloropicrin	Metam-Sodium + Chloropicrin
Yield Loss (%)	0%	5%	3%	3%
Yield (seedling) per Hectare	60,610	57,579	58,792	58,792
* Price per Unit (U.S. $/seedling)	$ 0.31	$ 0.31	$ 0.31	$ 0.31
= Gross Revenue per Hectare (U.S. $)	$ 18,759	$ 17,821	$ 18,196	$ 18,196
- Operating Costs per Hectare (U.S. $)	$ 10,187	$ 11,748	$ 11,748	$ 10,342
= Net Revenue per Hectare (U.S. $)	$ 8,571	$ 6,073	$ 6,448	$ 7,854
LOSS MEASURES				
1. Loss per Hectare (U.S. $)	$ 0	$ 2,499	$ 2,124	$ 718
2. Loss per Kilogram of Methyl Bromide (U.S. $)	$ 0	$ 28.52	$ 24.24	$ 8.19
3. Loss as a Percentage of Gross Revenue (%)	0%	13%	11%	4%
4. Loss as a Percentage of Net Revenue (%)	0%	29%	25%	8%

TABLE E.5: NORTHEASTERN FOREST & CONSERVATION NURSERY ASSOCIATION - ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

Region F - Northeastern Forest & Conservation Nursery Association	Methyl Bromide	Dazomet	1,3-D + Chloropicrin	Metam-Sodium + Chloropicrin
Yield Loss (%)	**0%**	**5%**	**3%**	**3%**
Yield per Hectare Conifer Seedling 1-0	247,105	234,750	239,692	239,692
** Price per Unit (U.S. $/seedling)*	$ 0.22	$ 0.22	$ 0.22	$ 0.22
Gross Revenue per Proportion (8%)	**$ 4,349**	**$ 4,132**	**$ 4,219**	**$ 4,219**
Yield per Hectare Conifer Seedling 2-0	247,105	234,750	239,692	239,692
** Price per Unit (U.S. $/seedling)*	$ 0.22	$ 0.22	$ 0.22	$ 0.22
Gross Revenue per Proportion (4%)	**$ 2,175**	**$ 2,066**	**$ 2,109**	**$ 2,109**
Yield per Hectare Conifer Seedling 3-0	135,908	129,112	131,831	131,831
** Price per Unit (U.S. $/seedling)*	$ 0.31	$ 0.31	$ 0.31	$ 0.31
Gross Revenue per Proportion (14%)	**$ 5,898**	**$ 5,603**	**$ 5,721**	**$ 5,721**
Yield per Hectare Deciduous Tree Seedling 1-0	185,329	176,062	179,769	179,769
** Price per Unit (U.S. $/seedling)*	$ 0.28	$ 0.28	$ 0.28	$ 0.28
Gross Revenue per Proportion (55%)	**$ 28,541**	**$ 27,114**	**$ 27,684**	**$ 27,684**
Yield per Hectare Deciduous Tree Seedling 2-0	123,553	117,375	119,846	119,846
** Price per Unit (U.S. $/seedling)*	$ 0.34	$ 0.34	$ 0.34	$ 0.34
Gross Revenue per Proportion (9%)	**$ 3,781**	**$ 3,592**	**$ 3,667**	**$ 3,667**
Yield per Hectare Deciduous. Shrub Seedling 1-0	154,441	146,719	149,808	149,808
** Price per Unit (U.S. $/seedling)*	$ 0.26	$ 0.26	$ 0.26	$ 0.26
Gross Revenue per Proportion (10%)	**$ 4,015**	**$ 3,815**	**$ 3,895**	**$ 3,895**
= Aggregate Gross Revenue per Hectare (U.S. $)	**$ 48,759**	**$ 46,321**	**$ 47,296**	**$ 47,296**
- Operating Costs per Hectare (U.S. $)	**$ 32,718**	**$ 38,747**	**$ 37,994**	**$ 37,994**
= Net Revenue per Hectare (U.S. $)	**$ 16,041**	**$ 7,574**	**$ 9,302**	**$ 9,302**
Loss Measures				
1. Loss per Hectare (U.S. $)	**$ 0**	**$ 8,467**	**$ 6,738**	**$ 6,738**
2. Loss per Kilogram of Methyl Bromide (U.S. $)	**$ 0**	**$ 49.38**	**$ 39.30**	**$ 39.30**
3. Loss as a Percentage of Gross Revenue (%)	**0%**	**17%**	**14%**	**14%**
4. Loss as a Percentage of Net Revenue (%)	**0%**	**53%**	**42%**	**42%**

TABLE E.6: MICHIGAN SEEDLING ASSOCIATION - ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

Region G - Michigan Seedling Association	Methyl Bromide	Dazomet	1,3-D + Chloropicrin	Metam-Sodium + Chloropicrin
Yield Loss (%)	**0%**	**5%**	**3%**	**3%**
Yield per Hectare Conifer Seedlings	1,070,789	1,017,250	1,038,665	1,038,665
** Price per Unit (U.S. $/seedling)*	$ 0.14	$ 0.14	$ 0.14	$ 0.14
Gross Revenue per Proportion (60%)	**$ 89,946**	**$ 85,449**	**$ 87,248**	**$ 87,248**
Yield per Hectare Conifer Transplants	74,132	70,425	71,908	71,908
** Price per Unit (U.S. $/ transplants)*	$ 0.60	$ 0.60	$ 0.60	$ 0.60
Gross Revenue per Proportion (10%)	**$ 4,448**	**$ 4,225**	**$ 4,314**	**$ 4,314**
Yield per Hectare Deciduous Transplants	329,474	313,000	319,589	319,589
** Price per Unit (U.S. $/ transplants)*	$ 0.50	$ 0.50	$ 0.50	$ 0.50
Gross Revenue per Proportion (30%)	**$ 49,421**	**$ 46,950**	**$ 47,938**	**$ 47,938**
= Aggregate Gross Revenue per Hectare (U.S. $)	**$ 143,815**	**$ 136,624**	**$ 139,501**	**$ 139,501**
- Operating Costs per Hectare (U.S. $)	**$ 94,908**	**$ 96,186**	**$ 96,394**	**$ 95,959**
= Net Revenue per Hectare (U.S. $)	**$ 48,907**	**$ 40,438**	**$ 43,107**	**$ 43,542**
Loss Measures				
1. Loss per Hectare (U.S. $)	**$ 0**	**$ 8,469**	**$ 5,800**	**$ 5,365**
2. Loss per Kilogram of Methyl Bromide (U.S. $)	**$ 0**	**$ 95.26**	**$ 65.24**	**$ 60.35**
3. Loss as a Percentage of Gross Revenue (%)	**0%**	**6%**	**4%**	**4%**
4. Loss as a Percentage of Net Revenue (%)	**0%**	**17%**	**12%**	**11%**

Summary of Economic Feasibility

An economic assessment was made for three technically feasible in-kind (chemical) alternatives for the forest seedlings sector: dazomet, 1-3 D + chloropicrin, and metam-sodium + chloropicrin. The economic assessment of feasibility for pre-plant uses of MB included an evaluation of economic losses from three basic sources: (1) yield losses, referring to reductions in the quantity produced, (2) quality losses, which generally affect the price received for the goods, and (3) 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.

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) Losses as a percent of gross revenues. 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.

(2) Absolute losses 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.

(3) Losses per kilogram of MB requested. This measure indicates the value of MB to crop production but is also useful for structural and post-harvest uses.

(4) Losses as a percent of net revenues. We define net 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.

These measures represent different ways to assess the economic feasibility of MB alternatives for MB users, who are forest seedling 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 MB. The economic measures provide the basis for making that determination.

Economic reviewers analyzed potential economic losses from using dazomet, 1-3 D + chloropicrin, and metam-sodium + chloropicrin because they are currently considered technically feasible alternatives for nursery seedlings production.

Total losses are similar for both 1-3-D + chloropicrin and metam-sodium + chloropicrin. Quantifiable losses originate from yield losses and cost increases. Dazomet has slightly higher yield losses than 1-3-D + chloropicrin, and metam-sodium + chloropicrin, but similar treatment costs. Indirect yield losses occurred due to lengthening of the production cycle, which resulted in less land in production and more in fallow or longer time for seedlings to reach appropriate size. Additional losses may also arise due to a shift from high quality Grade #1 seedlings to lower quality Grade #2, which causes a loss of about 30% of value, and more seedlings that must be culled. Unfortunately, data were lacking to measure this shift. Thus, total losses are underestimated.

Tables E.1 - E.8 provides a summary of the estimated economic losses. A measure of net revenue loss may not be completely accurate partly because many nurseries are publicly owned and seedling prices or production costs are subsidized. Although attempts were made to appropriately value the seedlings at a true market price, losses as a percentage of gross revenues and of net revenue should be viewed with caution. Direct yield losses are similar across the regions, mainly because the same studies were used to predict impacts. The range of losses in the studies is rather large because both dazomet and metam-sodium provide inconsistent pest control. Indirect losses arising from shifts in the production cycle were not quantified. In the Northern region this impact is expected to be more pronounced due to cooler temperatures and longer time required for production of a seedling crop. Changes in production costs arise due to differences between the costs of methyl bromide and the alternatives, shifts in the production cycle (increasing the frequency of fumigation or lengthening the fallow period) and additional expenses such as supplementary irrigation. These costs vary across regions and within the Western region, which is highly diverse, because of differences in pests, production systems and regional differences in costs of water and labor. Costs are higher in the South, in part because warmer temperatures increase pest pressure.

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

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

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

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

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

Renomination Form Part C: TRANSITION ACTIONS

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

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

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

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

See Section 15 above for selected trial results and citations.

(i) DESCRIPTION AND IMPLEMENTATION STATUS:

See answer to 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 Section 15 above for selected trial results and citations.

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

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

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

(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 previous item 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 for additional information.

(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

22. CITATIONS (*allocate a number to each reference, and use this number in the text*):

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

2009 Methyl Bromide Usage Newer Numerical Index - BUNNIE — **Forest Seedlings**

December 18, 2006	Region	Southern Forest Nursery	Interna-tional Paper	Weyer-haeuser (SE)	Weyer-haeuser (NW)	NE Forest & Conserv. Nursery	Michigan Seedling Assoc.	Sector Total	Notes
Dichotomous Variables	Strip or Bed Treatment?	Flat Fume	Flat Fume	Flat Fume	Flat Fume	Flat Fume	Flat Fume		
	Currently Use Alternatives?	Yes	Yes	Yes	Yes	Yes	Yes		
	Tarps / Deep Injection Used?	Tarp	Tarp	Tarp	Tarp	Tarp	Tarp		
	Pest-free Cert Requirements?	Yes	Yes	Yes	Yes	Yes	Yes		
Other Issues	Frequency of Treatment (x/ yr)	1x/4years	1x/4years	1x/4years	1x/3years	1x/1-3years	1x/3-4years		*
	QPS Removed?	Yes	Yes	Yes	Yes	Yes	Yes		
Most Likely Combined Impacts (%)	Florida Telone Restrictions (%)	0%	0%	0%	0%	0%	0%		
	100 ft Buffer Zones (%)	0%	0%	0%	0%	0%	0%		
	Key Pest Distribution (%)	100%	100%	100%	100%	100%	100%		
	Regulatory Issues (%)	0%	0%	0%	0%	0%	0%		
	Unsuitable Terrain (%)	0%	0%	0%	0%	0%	0%		
	Cold Soil Temperature (%)	0%	0%	0%	0%	0%	0%		
	Total Combined Impacts (%)	**100%**	**100%**	**100%**	**100%**	**100%**	100%		
Most Likely Baseline Transition	(%) Able to Transition	0%	0%	0%	0%	0%	0%		
	Minimum # of Years Required	0	0	0	0	0	0		
	(%) Able to Transition / Year	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**		
EPA Adjusted Use Rate (kg/ha)		**260**	**260**	**260**	**211**	**260**	**260**		
EPA Adjusted Strip Dosage Rate (g/m2)		26.0	26.0	26.0	21.1	26.0	26.0		
2009 Requested Usage	*Amount - Pounds* (Pounds)	*542,408*	*16,464*	*39,600*	*40,349*	*64,016*	*16,363*	*719,200*	
	Area - Acres (Pounds)	*1,621*	*48*	*132*	*170*	*199*	*64*	*2,234*	
	Rate (lb/A) (Pounds)	*334.61*	*343.00*	*300.00*	*236.79*	*321.69*	*255.67*	*322*	
	Amount - Kilograms (Metric)	**246,032**	**7,468**	**17,962**	**18,302**	**29,037**	**7,422**	**326,223**	
	Treated Area - Hectares (Metric)	656	19	53	69	81	26	904	
	Rate (kg/ha) (Metric)	375	384	336	265	361	287	361	
EPA Preliminary Value	**kgs**	**246,032**	**7,468**	**17,962**	**16,491**	**29,250**	**6,908**	**324,111**	
EPA Baseline Adjusted Value has been adjusted for:		MBTOC Adjustments, QPS, Double Counting, Growth, Use Rate/Strip Treatment, Miscellaneous, and Combined Impacts							
EPA Baseline Adjusted Value	kgs	66,340	5,050	13,889	13,119	21,092	6,268	125,758	
EPA Transition Amount	kgs	-	-	-	-	-	-	-	
EPA Amount of All Adjustments	kgs	**(179,692)**	**(2,417)**	**(4,073)**	**(3,372)**	**(8,158)**	**(640)**	**(198,353)**	
Most Likely Impact Value for Treated Area	**kgs**	**66,340**	**5,050**	**13,889**	**13,119**	**21,092**	**6,268**	**125,758**	
	ha	**255**	**19**	**53**	**62**	**81**	**24**	**495**	
	Rate	**260**	**260**	**260**	**211**	**260**	**260**	**254**	
Sector Research Amount (kgs)		**-**		**2009 Total US Sector Nomination**				**125,758**	

1 Pound = 0.453592 kgs 1 Acre = 0.404686