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FINAL REPORT ON THE EVALUATION OF METHYL BROMIDE PROJECTS

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I. Executive Summary

1. The evaluation of methyl bromide (MB) projects comprised two stages, a Desk Study and a Field study, which considered in detail the four largest consuming sectors in Article 5 (A5) countries: horticulture (including strawberries and bananas), floriculture, tobacco and post-harvest uses. Field visits were conducted in thirteen countries in different regions and with differing levels of consumption. Reports of these field evaluations are available as individual country reports. The country case studies were summarized in four sub-sector papers which form the basis for the present synthesis report.

2. All but one of the countries visited during the Field Study have met the freeze in 2002 and will likely be in compliance with the 20% reduction of 2005. The projects have contributed significantly to this achievement. The planned phase-out was generally achieved in completed projects or is likely to be achieved in on-going projects albeit in many cases with some delays, due to various factors which show the complex character of this sector.

3. The fact that MB cannot be replaced by one in-kind alternative is clearly confirmed through this study. This implies that growers and other stakeholders need to change their approach to production and have to make important changes in process management. This relates mostly to IPM but also time management as alternatives often require longer exposure times than MB. Reluctance to management change is often the major reason for resistance to adoption of alternatives, even over economic matters.

4. Technology choice was found to be generally appropriate and, had been made as a result of demonstration trials, following discussion with key stakeholders and information on commercial adoption taking place in the same country or in similar regions and sectors. However, there are instances where advanced technologies have been implemented or equipment delivered without a solid examination of their technical or economic sustainability. Examples of this are steam for strawberries or tomatoes grown by small farmers or cooperatives, as well as CO₂ and high pressure chambers for post-harvest treatments, and electronic meters that cannot be calibrated in the country. This may be partly following suggestions by bilateral and implementing agencies and/or its consultants, but may have also been at the request from NOUs, farmers or processing companies who wanted advanced technologies. However, future maintenance needs and sustainability problems of such alternatives or equipment should be clearly analyzed and anticipated during project preparation.

5. The choice of the technologies promoted in the horticulture sector is generally considered adequate; these alternatives are being introduced as a result of demonstration projects or new practices which enjoy successful commercial adoption in industrial countries and are advocated by the bilateral and implementing agencies. Generally speaking, chemical alternatives are conventional, with few new compounds or technological breakthroughs in this area. Non-chemical alternatives are more controversial, particularly those involving high costs like grafted seedlings of vegetable crops and melons (according to latest data from the project in Guatemala, costs are coming down), biofumigation with manure in places where such material is rare, and soil steaming for small holders. Soil solarization is less expensive but its application engages the soil for relatively long periods of time. Low-cost practices such as sanitation, removal of crop

residues after harvesting, crop rotation, kill-off of harvested plants, removal of wild hosts and volunteer plants and others forming part of IPM programs should be strongly promoted.

6. Likewise, the choice of alternatives is generally adequate for the floriculture projects evaluated. Substrates, steam and alternative chemicals have been technically validated in many regions, climates and cropping systems around the world, many of them similar to those present in the countries where projects were evaluated. This is further supported by the fact that these alternatives are already in commercial use in various countries. A strong IPM approach reinforces success of these alternatives. Although results at the time of conducting the visits were often preliminary, general acceptance on the part of stakeholders concerning steam technology is high, particularly by larger companies. Adequate training in steaming methods, management and maintenance is essential for the success and sustainability of this alternative.

7. The tobacco sector is unique in that a specific alternative to MB has been found, the Floating Tray System or FTS. This alternative is more sustainable in the mid-term than the chemical alternatives, as it involves investment and infrastructure changes that make it very unlikely for growers to go back to conventional growing techniques involving MB use. This system may encounter economic constraints if the necessary supplies need to be imported. In some countries all inputs can now be locally sourced, while in others they are partially available or need to be wholly imported. Although having a suitable alternative in FTS the challenge remains in transferring this complex technology – many times to thousands of growers – within the timeframe of the MLF projects.

8. For the post-harvest sub-sector it can be safely stated that technical feasibility of MB alternatives does not require much more validation since the option range is comparatively small and extensive experience already exists. Experiences from other countries and regions are easily transferable, as treatments relate to a limited number of commodities and structures with similar features everywhere. Thus, there is no further need for demonstration projects but rather more intensive and thorough preparation of future investment projects in order to adjust them to local needs, management practices and constraints.

9. One constraint noted with respect to more modern chemical alternatives is lack of registration. This is particularly true for 1,3-dichloropropene and its different formulations with chloropicrin for soil uses and for sulfuryl fluoride for post-harvest uses. Missing market windows due to longer plant-back time needed with alternative fumigants was also reported as a constraint.

10. Economic feasibility of alternatives needs to be further validated, if possible at the commercial level. Although this kind of information is difficult to obtain, particularly for several cropping seasons, it is essential for commercial adoption to occur. The fact that some commercial adoption of alternatives has occurred in the countries visited offers a very good opportunity to document case studies that include economic information.

11. Involvement of key stakeholders from the beginning of the projects is an accepted principle but not always fully applied. Formal consultations and Government clearance are sometimes not enough to clarify all reservations and obstacles. Growers having strong influence over the sector, or a progressive attitude towards implementing alternatives; trade associations;

and institutions at the government level, e.g. extension services and research institutes need to be fully consulted about their preferences and constraints, and their views be taken into account in an open exchange during project preparation and implementation. Steering committees were found very useful, particularly when projects involve different sectors and regions within the same country, but are not in place in all countries.

12. Interdisciplinary technical teams consisting of research and extension people specialized in plant pathology, weed control, crop production and application of pesticides were successful in sharing an integrative field approach with horticulture growers in Turkey and Peru. Bilateral and implementing agencies could promote Integrated Pest Management by supporting the establishment of such teams. In other cases, such as in the melon sector in Central America, producers are very reluctant to sharing their advanced information because of the intense competition and weak government extension services.

13. Phase-out projects and agreements foresee, in accordance with the Executive Committee guidelines for the MB sector, the development of policy measures (mainly import restrictions and bans) to use MB after completion of the phase-out. Although it is evident that governments are starting to develop regulations specifically dealing with MB imports, distribution and use, it appears at this time that political support through governmental regulations needs to be stronger in a number of countries.

14. MB consumption rates should be closely monitored within regions in order to prevent the growth of illegal commerce into countries that have already eliminated MB. The viability of promoting the prohibition of MB imports in non-consuming countries or agreeing on the implementation of accelerated phase-out schedules for low MB consumers surrounding former big MB users may create “buffer zones” that could help prevent illegal trade. UNEP CAP teams should explore the feasibility of regional agreements - for example between Central American countries, African countries or regions - in order to standardize regulations and to avoid or at least minimize illegal trade with MB. UNDP has recently suggested to UNEP CAP Africa that such a coordinated effort would be most beneficial to support the phase-out work underway in tobacco-producing countries in the sub-Saharan region.

15. Additional measures should be implemented by MB users and Government authorities in Art. 5 countries to reduce MB use and emissions, during the transition period until total phase-out, particularly in view of findings that MB prices remain generally competitive – if not lower – than those of alternatives which will likely extend the transition period:

- (a) Limiting maximum MB rates, lowering dosages, promoting and registering formulations with lower MB content, and encouraging restrictions for the use of small MB canisters;
- (b) Inform farmers about the possibility of using VIF as a transitional measure for reducing MB usage and emissions during the period when development of alternatives and commercial validation occurs, inter alia for applications for which currently no alternative exist.

16. The fact that agreements on MB phase-out include flexibility clauses that allow reacting to new experiences and developments has been beneficial in several projects. However, substantial changes of technology still require the approval of the Executive Committee.

17. Strong emphasis should continue to be given to awareness raising, information transfer and training, not only within one country and sector but also with other projects, regions and sectors. Ways to promote such horizontal experience-sharing could include for example developing an electronic network, organizing technical seminars, building a database with service and input suppliers all over the world and promoting field visits of technical teams and others. The useful joint website developed by UNEP and UNIDO with information on MB projects, events and other related issues, should be regularly up-dated; bilateral and the other implementing agencies should add their experiences in the implementation of MB projects to this web site.

18. Bilateral and implementing agencies should ensure that they receive half-yearly progress reports or, if more in tune with the crop cycle, yearly reports with substantial information on results obtained, problems encountered and lessons learnt. Report formats should facilitate quick and easy comparison between the original planning and actual outputs, achievement of objectives, milestones and impact of projects (see indicators in Annex II). It appears that in some projects regular reporting to the implementing agencies was incomplete, which makes proper project follow-up and evaluations very difficult.

II. Background, Scope and Approach

19. The evaluation of methyl bromide (MB) projects is part of the 2004 and 2005 Monitoring and Evaluation Work Programmes. It comprised two stages, a Desk Study and a Field study, which considered in detail the four largest consuming sectors in Article 5 (A5) countries: horticulture (including strawberries and bananas), floriculture, tobacco and post-harvest uses. The Desk Study (doc. UNEP/OzL.Pro/ExCom/43/8) was submitted to the 43rd Meeting of the Executive Committee in July 2004. The Field Study included visits and case studies in various countries. This Field Study's final report is submitted to the 46th Meeting of the Executive Committee in July 2005.

20. The Desk Study had identified relevant issues that needed further analysis during the field stage of the evaluation as follows:

- (a) Phase-out achieved and compliance with agreed schedules;
- (b) Sustainability of the phase-out achieved and commercial adoption constraints;
- (c) Impact of demonstration projects on effective technology transfer;
- (d) Format/Structure of the reports.

21. Field visits were conducted in thirteen countries in different regions and of different levels of consumption. They cover projects in four sub-sectors: (a) cut flowers, (b) horticulture,

(c) tobacco and (d) post-harvest. In some countries, the project activities in two or three sub-sectors were evaluated. The sample selected covers various types of projects in terms of size, year of approval, implementing agency, volume of funding, modality (traditional investment projects and multi-year agreements, with or without preceding demonstration project), completed and on-going, and is thus by and large representative of the various situations encountered (see Annex I, Table 1).

22. Reports of these field evaluations are available as individual country reports. Data collected during the second stage of the evaluation helped to get first-hand and up-to-date information about activities implemented by the projects and their results, in particular their contribution to the phase-out achieved and also with regard to implementation delays, their reasons and the actions taken to overcome them. The field visits lasted between three to five working days. Discussions were held with the National Ozone Units, Ministries of Agriculture, research institutions, importers of MB, farmers and their associations, extension services, exporters, fumigation companies, etc. Details about the persons interviewed are provided in the country reports.

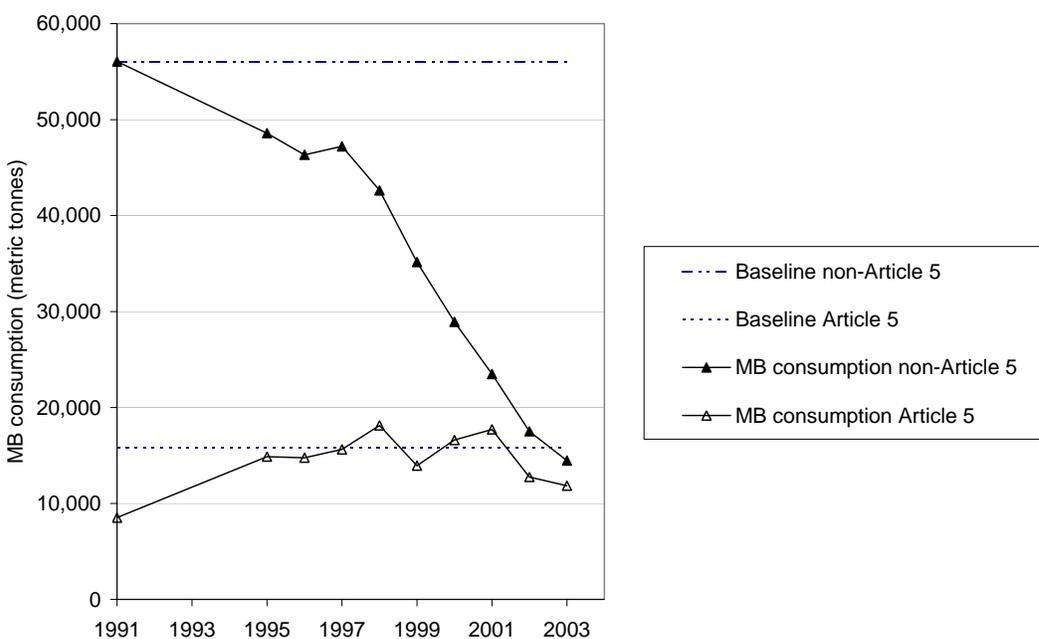
23. The country case studies were summarized in four sub-sector papers which form the basis for the present synthesis report. The country reports and sub-sector papers are available on request as hard copy and at the UNMFS Intranet website, 46th Meeting of the Executive Committee, Evaluation Document Library.

24. All draft country reports were circulated for comments to the countries and bilateral and implementing agencies concerned. The draft sub-sector papers and the present summary were sent to the bilateral and implementing agencies. Comments on the draft reports were received from Canada, Kenya, UNDP, UNEP and UNIDO, and were taken into account for finalizing the present document.

III. MB Consumption Trends in Article 5(1) Regions

25. The recent MBTOC progress report published by TEAP in May 2005 states that according to Ozone Secretariat data, MB consumption in Article 5(1) regions peaked at about 18,140 metric tonnes in 1998 and fell to about 11,858 metric tonnes in 2003.

Figure 2: Baselines and trends in reported MB consumption in non-Article 5(1) and Article 5(1) regions, 1991 – 2003 (metric tonnes)



Source: MBTOC estimates calculated from Ozone Secretariat data of April 2005.

26. Many Article 5 countries achieved considerable MB reductions by 2003:

- (a) Total Article 5(1) consumption in 2003 was 25% below the baseline;
- (b) 106 Article 5(1) Parties reported MB consumption between zero and 10 ODP tonnes in the most recent year (mainly 2003). Of these, 85 Parties reported zero MB consumption;
- (c) Many Article 5(1) countries are implementing MLF projects to reduce or totally phase-out MB. This includes 14 of the 15 largest MB consuming Article 5 countries (i.e. countries that consumed more than 300 metric tonnes in 2000). The exception is South Africa, which is currently preparing a GEF project for MB phase-out.

27. Ozone Secretariat data indicates that the vast majority of Article 5(1) countries that have ratified the Copenhagen Amendment achieved compliance with the freeze in 2002. However, in the first year of the freeze in 2002, 19 countries were in non-compliance, decreasing to 9 countries in 2003. Four are non-LVC countries while the rest are LVC countries. Twelve of the countries which were initially in non-compliance returned to compliance in the second year, while two countries which were initially in compliance came to be in non-compliance in the second year. More detailed data and an analysis of reasons for non-compliance are provided in the Desk Study on Non-Compliance with the Freeze in Consumption of CFCs, Halons, Methyl Bromide and Methyl Chloroform (doc. UNEP/OzL.Pro/ExCom/46/8).

28. The majority of Article 5(1) countries are on track for complying with the 20% reduction step in 2005, according to the MB consumption data reported for 2003. Analysis of the Ozone Secretariat data indicates that, by 2003, MB consumption in 113 Article 5(1) countries was less than 80% of the national baseline. The graph indicates that countries have achieved substantial reductions in advance of the 20% reduction step required in 2005. Only 24 Article 5(1) countries consumed more than 80% of their national baseline in 2003. 11 countries consumed between 50 – 80% of their baseline, 19 up to 50% and 83 reported zero consumption.

IV. Sustainability of the Phase-Out Achieved

29. The main objective of this evaluation was to assess the sustainability of the MB phase – out achieved. As identified in the desk study, four main aspects were considered:

(a) Technical

While the feasibility of the technical alternatives identified generally seems to be reasonably well established, their large scale application might reveal unforeseen difficulties. New alternatives that become available or new application methods that enhance their performance should also be considered for the investment projects – even during project implementation. In this context, the driving factors influencing the technology choice were analyzed.

(b) Economic/Commercial

Only if the alternatives are both technically feasible and economically viable their application by the farmers and other users will be maintained. Cost of MB and alternatives are compared in project documents to analyze incremental cost or savings. An attempt was made to identify both constraints and incentives to the adoption of proposed alternatives. One important aspect was to check the cost and availability of local materials and supplies, in view of the foreign exchange scarcity in many countries that often renders imported substitutes and materials more expensive and thus less sustainable than local ones. The contribution of awareness raising and training activities under the projects to the commercial adoption of alternatives was also analyzed.

(c) Institutional

Institutional arrangements made for project implementation, like creating farmers' cooperatives, or marketing agreements, as well as involving extension services and government sponsored research, training and public awareness support activities can directly influence the sustainability of the alternatives implemented. Issues addressed include the role of stakeholders in project preparation, in the selecting, testing, demonstration and validation of alternatives, and the dissemination of information on results and experiences. As much as feasible, the reports also analyzed national systems for technology diffusion (research and extension services, their capabilities, collaboration, involvement and support to the project) and technology adoption (target clientele, their capabilities, education and expertise, organization).

(d) Political

Without limiting the supply of MB via effective import controls and worldwide reduction of MB production, there is a risk of users returning to MB use. This includes analysis of regional trade policies and illegal trade. In the majority of projects, no progress was reported on establishing controls on MB use and imports, and registration of alternative chemicals. Commercial/ official recognition of ODS-free status through eco-labels that may support replacement of MB was also considered.

30. On the basis of the above considerations, an interview checklist was developed and used during the missions related to each sub-sector. Consultants included specific questions relating to the different sectors as appropriate, e.g. sourcing of certain materials or equipment, environmental aspects relating to a particular alternative and others. The standard form of this questionnaire is shown in Annex III.

31. Technical and economical feasibility of alternatives may vary by sector. For this reason, these topics are dealt with in some detail, making reference to specific issues applying to each of the sectors involved. Influence of institutional and political matters on the sustainability of phase-out on the other hand, tend to apply to the country or region in general, and are thus grouped together for analysis.

V. Main Findings

V.1 Technical Sustainability of Alternatives

32. Technical validation of alternatives was generally appropriate for all the sub-sectors considered. It was noted that the flexibility clause in phase-out agreements, which permits the promotion of new alternatives or new application methods in investment projects as required, helped some projects to adapt to new circumstances.

33. There is an evident reluctance of MB users to change to alternatives which is noted in all sectors. The fact that MB cannot be replaced by one sole and equally effective alternative implies that growers and other stakeholders have to change their approach to production and process management. This relates mostly to IPM but also time management as alternatives generally require longer exposure times than MB. Reluctance to change is often the main constraint to adoption of alternatives, even over economic matters.

34. In the horticulture sector, the choice of technologies promoted through the projects is generally adequate. In most cases, these alternatives are being introduced following demonstration projects, supplemented sometimes by new practices advocated by the implementing agencies. Chemical alternatives are usually conventional as there are very few new compounds or technological breakthroughs in this area, but as such they are well trialled. Non-chemical alternatives are more controversial, particularly those involving high costs like grafted seedlings of vegetable crops and melons, biofumigation with manure in places where such material is rare and soil steaming which involves increasing costs in view of the high oil prices. The development of the demanding grafted seedlings technology is underway in the melon sector of Guatemala. Costs are coming down with increased production of seedlings and,

after initial reluctance, most large farms are testing them now while growers in Costa Rica refuse it so far for cost reasons. In Honduras, during the crop season 2004/2005, 170 ha of watermelon and 50 ha of melon, were planted with grafted seedlings. It is a technology worthwhile of further development, and the results of the on-going testing should be widely disseminated. Turkey and Morocco are using grafted seedlings already for tomatoes, peppers, watermelons, melons and eggplant.

35. The tobacco sector is probably unique in that a specific alternative to MB has been found, the Floating Tray System or FTS. This alternative is more sustainable in the mid-term than the chemical alternatives, as it involves investment and infrastructure changes that make it very unlikely for growers to go back to conventional growing techniques involving MB use. Although some technical problems can arise, (e.g. development and spread of seedling diseases as a result of high plant density and high moisture conditions in FTS), growers have adopted necessary measures to control them (bleach disinfectants, steam, copper oxychloride, boiling water, etc). IPM practices on the other hand could be improved. Stakeholders in some large sectors such as Brazil are also aware of the potential pollution of water bodies arising from water disposal from the pools and are taking pertinent measures, but this was less well handled in tobacco sectors in other countries visited. The same was true for the disposal of old and broken polystyrene trays.

36. In the flower sector, the choice of alternatives is generally adequate for the floriculture sectors involved. Substrates, steam and alternative chemicals have been technically validated in many regions and are used regularly on a commercial scale in various climates and cropping systems around the world, many of them similar to those present in the countries where projects were evaluated. Alternative chemicals are mostly metham sodium, dazomet and 1,3 – dichloropropene + chloropicrin. Although successful results have been obtained, efficiency and consistency of performance in these fumigants, particularly metham sodium, are influenced by the application method and soil conditions (e.g. humidity and temperature).

37. Technically speaking, steam is probably the best alternative to methyl bromide in the flower sector, proving equally effective. Its utilization is not new to the industry; pasteurization has been used in greenhouses for many decades. However, many variables influence the success and the cost-effectiveness of steam, both technically and economically, including appropriate IPM programs and careful maintenance of the boilers. Although results at the time of conducting the visits were often preliminary, general acceptance on the part of stakeholders concerning steam technology is high, particularly by larger companies. Adequate training in steaming methods, management and maintenance is essential for the success and sustainability of this alternative.

38. Production in substrates is a definite trend in the international floriculture sector – both in developed and developing countries. Although initial investment associated with substrate infrastructure is usually high, it can be compensated through increased yields and better quality of product, conditions which were confirmed by the grower involved with substrates in Ecuador. Substrate production does, however, pose new challenges associated with water and nutrition management, pest and disease control and the environment; to avoid soil and ground water contamination the nutrient solution should be re-circulated. These factors often make substrates a good option for more technically competitive or progressive growers only.

39. In the post-harvest sector, technology choice was driven by different considerations in the countries that were studied. The extent to which such choice matched the real needs varied from country to country so that technical sustainability was assessed for each country separately. The Iranian project for example, benefited from an easy to use, comparatively safe, inexpensive and effective technology (fumigation with solid phosphine formulations). However, technical sustainability is severely endangered by an unnecessary restriction to a formulation (tablets) that is not ideal for the purpose of treating dried fruits due to difficulty of handling, residual powders and a very long waiting period. Formulations such as plates or chains of sachets are more appropriate for this use. Expensive electronic gas detectors have been purchased that need yearly calibration which cannot be done in the country so that they show erroneous records by now. Simple and inexpensive gas measuring pumps with tubes would have been a better option inspite of the significant cost for tubes in case of frequent fumigations. In addition, important framework conditions such as occupational safety have been neglected by the project.

40. The technology choice in Kenya seems to have been driven by solutions at hand provided by foreign consultants rather than by real and expressed needs in the country. This is apparently why reliable MB alternatives like phosphine were not taken into consideration and why technical sustainability is not presently evident. Syria adopted well known technologies, already trialled in many countries (bag stack fumigation with solid phosphine formulations), which are a wise choice for low priced commodities such as cereals. Success will depend on creating the minimum technical and institutional environment (e.g. occupational safety and solid training in application techniques) in which this technology can perform well. The technology choice of the project in Turkey was at the same time pragmatic (phosphine fumigation, Volcani cubes) and sophisticated (pressure chambers for CO₂ treatment). This broad range of alternatives for different purposes and circumstances provides a good technological basis for the dried fig industry, where sustainability probably will not be a problem. It should be kept in mind, however, that pressure chambers require a high initial investment and can only be considered as an alternative for a few companies big enough to afford them.

V.2 Economic Sustainability of Alternatives

41. Cost analyses and comparison of alternatives are presented in all project proposals. In most projects, however, no thorough economic feasibility studies of alternatives have been conducted during project implementation. Such studies should include both costs of alternatives as well as yields and quality obtained in several cropping seasons, in comparison with MB. Although this kind of information is reportedly difficult to obtain through projects as it is often considered as sensitive by private users competing against each other, it is most important for commercial adoption to occur. Bilateral and implementing agencies may wish to conduct such studies through cooperative/ progressive growers.

42. Fluctuating prices of MB are clearly influencing economic feasibility of alternatives. In countries like Iran and Turkey, MB prices have climbed making alternatives much more attractive to users (e.g. phosphine for post/harvest fumigation of cereals in Iran). However, in Ecuador MB is an inexpensive fumigant and treatment costs are lower than those of other fumigants and non-chemical alternatives. In other countries, prices of MB are comparable to those of chemical alternatives, as was reported in Costa Rica, for example.

43. One constraint noted with respect to chemical alternatives is lack of registration. This is particularly true for 1,3-dichloropropene and its different formulations with chloropicrin, which has proven to be an efficient alternative to MB in many crops, situations and regions. This fumigant is not registered in Ecuador, Kenya or Peru (in Peru additionally, metham sodium and dazomet are not registered at present). In the post-harvest sub-sector, this is true for sylfuryl fluoride, an alternative fumigant presently registered in some EU countries for treatment of empty structures and dried fruit. However, this gas requires high technical and safety standards and does not seem to be appropriate for some countries, e.g. Iran whilst it could be well suited for example for Turkey. However, the manufacturer is reluctant to apply for registration.

44. In the horticulture sector, economic viability of alternatives was partially analysed by the demonstration projects. The introduction of grafted seedlings, particularly when applied to melons, is still controversial. Grafting is well received in Romania and is being tested in Turkey. Grafted melon seedlings are promoted by the project in Guatemala despite growers' reluctance in view of their high cost, which is also the reason for which Costa Rican growers refuse to try this alternative. Grafted seedlings are still more expensive than conventional ones but gradually they become economically feasible when compared to methyl bromide treated conventional seedlings. Further reducing the cultivation costs of grafted plants is a feasible technical challenge undertaken by growers in Guatemala. Although grafted melon may pose problems of scion/rootstock physiological incompatibility, it is a technology of proven potential and a way to reduce inoculum pressure in the case of monoculture (melons).

45. The FTS system adopted by the tobacco sector may encounter economic constraints if the necessary supplies need to be imported. Only in Brazil, due to its developed industrial sector, all inputs needed for the widespread adoption of FTS are nationally made and available at reasonable costs to the growers. In Croatia and Macedonia there is local production of trays and substrates respectively, but the rest of the key inputs need to be imported. In Malawi every input needs to be imported at high costs to the growers. Interestingly, a result derived from the technology change in the case of Brazil is the creation of new jobs for manufacturing the inputs for the FTS (trays, specific tools like seeding or clipping devices, substrates, pelleted seeds, etc.).

46. With respect to alternatives for the flower sector, cost is the main constraint for the adoption of steam. In some countries, availability of (locally) less expensive fuel sources like natural gas and diesel oil make this alternative feasible as long as adequate technical precautions are taken. In particular, costs associated with steaming may be reduced through IPM, which helps maintain disease incidence at the lowest possible level. Another constraint can be maintenance, particularly when there is no local manufacturing or servicing of boilers, but this is apparently being addressed through the projects, even through locally manufactured boilers in some countries. Steam represents benefits when compared to fumigants, in that no waiting period is required before replanting. In some cases, this can add a substantial amount of flowers during the production cycle.

47. Locally sourced substrates are usually less expensive than imported ones. However, substrates like coconut coir or coconut peat are presently imported to many countries including Ecuador and are still economically feasible. Cleanliness and high quality are two important parameters to consider when using substrates and they may not always be present in local materials, although in a number of countries local substrate production research and testing is

underway. In Kenya, for example, pumice stone, readily available in the Rift Valley in Kenya, is under trial as a potential substrate for cut flower production. In Malawi, tobacco growers, in partnership with the Agricultural Research and Extension Trust (ARET), the body managing the technical implementation of the investment project, are using a variety of products as substrate including: ground nut (peanut) husks, rice husks, coffee husks, macadamia nut shells, even coal waste left behind after the curing process. ARET is producing a substrate 'recipe' book that will allow growers to produce their own substrate under the proper conditions.

48. With respect to the post-harvest sector, conventional wisdom says that use of solid phosphine formulations is a feasible option from the economic point of view and experiences in the visited countries seem to confirm this. Alternatives that require high investment on the other hand, such as fumigation or pressure chambers will not be taken up quickly, but may be interesting options for companies which have sufficient funds and look for solutions with a longer perspective. Pressure chambers, for example can be used to treat organic products and may be helpful to enter new markets.

V.3 Institutional Sustainability

49. The institutional sustainability of the evaluated projects depends to a large extent on intensive training of trainers and broad dissemination of project results. All project plans include efforts to raise awareness and diffuse alternatives. Workshops, seminars, publications and campaigns have generally been set forth to support these efforts. However, results are very heterogeneous and seem directly influenced by the organization and importance of the sector involved within the country. Bilateral and implementing agencies are encouraged to follow-up closely on this point, together with NOUs and counterpart agencies.

50. It seems particularly important to involve key or strategic stakeholders from different fronts in order to generate sufficient response. In Article 5 countries extension services are often weak or non-existent, but involving local universities and research centers proves useful. Larger or more frequent MB users and their associations if they exist should always be included and consulted. The creation of multidisciplinary teams – regional if needed – brings positive results. These teams should include Government agencies and the NOU, the counterpart agency, academic/research institutions, extension services, trade associations, direct MB users (growers) and others if appropriate. This was not always the case, however, as for example in Costa Rica where key stakeholders joined only at the investment stage, and in one of the projects in Ecuador, where the trade association has remained relatively uninvolved with project activities in the past. In the melon sector in Central America, producers are very reluctant to sharing their advanced information because of the intense competition and weak government extension services.

51. The most important contribution that projects can make towards institutional sustainability is solid training of trainers who can provide continuity and multiply the knowledge received. The need for robust training programs and appropriate technology transfer is further reinforced by the fact that actual achievements of training activities, which are a substantial component of all projects evaluated often fall below expectations. A major consequence of delays and deficits in training is the fact that MB users are insufficiently prepared to apply alternatives. As stated above, the message that a single, in kind alternative to MB does not exist

needs to be disseminated as much as possible and training plays a major role in getting this point across.

52. A Steering Committee, including representatives of the different kinds of stakeholders involved can be very efficient for achieving project goals. This can be particularly useful in cases where the sectors involved in the project are diverse and located in different regions within the country. Farmer or trade associations are helpful in the technology diffusion process and efforts should be made to involve them directly into the decision making process of the project.

53. Interdisciplinary technical teams consisting of research and extension people specialized in plant pathology, weed control, crop production and application of pesticides were successful in sharing an integrative field approach with horticulture growers in Turkey and Peru. Bilateral and implementing agencies could promote Integrated Pest Management by supporting the establishment of such teams.

V.4 Political Sustainability

54. Political sustainability is a prerequisite for investment projects. MB is subject to controls and regulations common to imports of all pesticides, generally issued by agricultural and environmental authorities. Specific regulations concerning MB import, distribution and use are presently in place in some countries whereas in others they are projected. Some regulations are specific for MB while others impose controls on all ODS. It was also noted that in some cases insufficient knowledge about the existence of regulations was present, particularly at the grower level but sometimes even across Government agencies. Strengthening communication efforts in this sense appears necessary. Although this pre-requisite should be fulfilled at the latest by the end of the projects or agreements, the Executive Committee and the bilateral and implementing agencies may wish to encourage countries to develop regulations as soon as possible during project implementation, since restrictions on MB use clearly encourages the adoption of alternatives.

55. No specific regulations concerning MB formulations, dosages, or application methods were found. Dosage rates of MB tend to vary widely both within and across sectors. The formulation most frequently used is 98:2 (MB/ Pic); formulations with higher chloropicrin content, e.g. 67:33 were found only in Costa Rica, where registration has been put forward by the melon sector. Although initializing registration usually lies outside the scope of action of Governments and is a commercial matter mostly in the hands of private companies, the respective authorities could facilitate and speed the legal registration procedure once such companies make an application.

56. Disposable canisters of MB (usually about 454 gr) were found in some countries (Costa Rica) but not in others (Ecuador, Kenya). Some countries no longer permit their use, e.g. Kenya, on safety grounds. Though requiring very little technology and investment, the system is a relatively inefficient way of applying methyl bromide. However, application of many in-kind (fumigant) alternatives tends to be more difficult than the use of small disposable cans of methyl bromide, and the development of a direct and simple replacement for small scale use presents a challenge. The Executive Committee may wish to encourage countries to limit or restrict the use of small MB cans in their regulations.

57. Although Virtually Impermeable Film or VIF, which allows for reduced dosages of MB and minimizes emissions, was never approved as part of a project, as it is a transitory solution. It was found to be in use some countries, e.g. Guatemala, but not in others. As it contributes to phase-out, it could nevertheless be encouraged by bilateral and implementing agencies by informing farmers about the possibility of using VIF as a transitional measure for reducing MB usage and emissions during the period when development of alternatives and commercial validation occurs, inter alia for applications for which currently no alternative exist.

58. Regional agreements to reinforce MB phase-out strategies and avoid illegal trade of this fumigant were not apparent in any of the projects evaluated and may not be feasible in the short-term in view of the intense competition between neighbouring countries producing for the same export markets. Preoccupation with the possibility of diverting use of MB imported for QPS uses to soil uses was expressed by two of the countries visited, Ecuador and Peru. It cannot be excluded that illegal import can be an issue, especially for countries with frontiers that are not easy to control (which is the case of most countries visited). Governments should pay attention to this risk in order to ensure sustainability of national phase-out policies. The NOU in Guatemala has stated that they link up to an evolving regional computerized monitoring system of MB trade. UNDP has raised the issue of regional cooperation in the LAC region with other implementing agencies implementing investment projects in Latin America and has proposed a similar approach to the UNEP CAP ROLAC team as suggested to UNEP CAP Africa for the tobacco-producing countries in the sub-Saharan region. UNDP advised UNEP that liaison with the Southern and Eastern Africa Regulatory Commission on the Harmonization of Pesticides (SEARCH), and a strategic approach linked to further customs training planned for countries in the region under RMPs and RMP Updates (and taking into consideration Decision 45/54), would be supportive of policy efforts underway in phase-out projects in the region.

59. In the tobacco sector, the viability of promoting a “commitment to protect the ozone layer” with the world tobacco industry in order to agree on a global MB phase-out schedule could be explored. The tobacco sector is highly globalized: a few multinational companies concentrate a very high proportion of tobacco production and commerce in the world. Such an agreement could avoid the risk of increasing MB use in new tobacco growing areas like Vietnam, Thailand, Zambia, Tanzania, South Africa, Uganda and Mozambique, and in traditional grower countries which do not have a phase-out project for MB use in tobacco yet (e.g. India, Indonesia, and Turkey). In this sector, it is important to note that MB has been phased out from non-A5 tobacco producing countries (no Critical Use Exemptions have been requested), and good progress has been made in most A5 producing countries. The biggest international tobacco buying companies are imposing on their partners in each country the application of “Good Agriculture Practices Guidelines”, showing that they are already committed to the goal of eliminating MB. No resistance will probably be found to promote such an agreement.

VI. Impact of Demonstration Projects on Effective Technology Transfer

60. The logic of the technology-transfer process indicates that successful alternatives tested during demonstration projects would be selected for phase-out projects. In effect, this has generally been the case and successful alternatives identified during the demonstration stage have been selected whilst those appearing to be not effective have been eliminated. Throughout the Field Study several success stories were found in this respect. In some cases, no demonstration project was implemented, only an investment one; alternatives selected were those proving appropriate for similar sectors, conditions and circumstances in other projects and countries. This approach, coupled with the flexibility existing in investment projects for change or adaptation of newly available technologies or alternatives, was generally successful.

61. Both demonstration and investment projects address the same technology development continuum. They both deal with certain overlapping aspects of the generation, diffusion and adoption of new methyl bromide substituting technologies. Best diffusion occurs when research and extension collaborate on technology generation and diffusion in the framework of adaptive research and development plots. Besides the development of technologies per se, the projects play a unique role in the constitution of a sustainable research and extension base in the project countries. These capabilities will enable the countries to cope in the future with the new technical problems arising from the large-scale adoption of alternative technologies in the field. Adaptive research and development are not only a way to screen, fine-tune, monitor and recommend new alternatives. They act as training sites for young researchers and extension staff who could acquire first-hand field experience and gain subsequently their clientele's trust.

62. In spite of the above, a smooth and fruitful transition between demonstration and investment projects was not always apparent. Some reasons for this include too long a period elapsing between the demonstration and the investment project which made project teams completely different and experience gained lost; change of agencies between the two stages and lack of adequate follow-up between them; and failure in involving key stakeholders from the start of the demonstration stage.

VII. Implementation Delays

63. The last column in Table 1 in Annex I shows implementation delays. For individual projects and annual tranches of multi-year agreements, the approved duration is compared to the actual duration, and the resulting differences show the delays for both the completed and the on-going projects for which the delays can further increase. The figures are based on the 2004 progress reports of the bilateral and implementing agencies.

64. Twenty-one of the 26 projects evaluated for the various applications of soil fumigation present delays as follows: 15 are or were delayed between 0 and 12 months; 3 between 13 and 24 months; and 3 presented delays of over two years. However, two projects were finished before the end of their periods and three more, which are presently ongoing will also probably finish ahead of time. See Table 1 in Annex I for more details.

65. Of the 7 post-harvest projects evaluated, one was cancelled and the other six show delays with respect of the original expected date of completion. Delays range between 13 and 70 months with an average of 26.5 months.

66. Reasons for project delays differ in each case. Among these are most important

- (a) Difficulties in finding a suitable counterpart institution for the project (Syria, Ecuador);
- (b) Difficulties in contracting consultants and/or sourcing and receiving equipment or supplies, the latter of which sometimes have been delivered with substantial delays (Croatia, Iran, Syria, Turkey);
- (c) Insufficient involvement of strategic stakeholders in the project, which delayed approval from the productive sectors implicated (Costa Rica, Guatemala, Iran, Kenya, Syria);
- (d) Inadequate transition between demonstration and investment projects, brought about by changes in project teams, fragmented communication between teams (Costa Rica, Kenya);
- (e) Insufficient reporting and follow-up (Iran);
- (f) Absence of a demonstration project before the investment project, which made training on new alternatives for the tobacco sector more difficult and did not allow for adequate co-ordination between the institutions involved (Malawi, Peru).

VIII. Environmental Issues

67. To a larger or lesser extent, the sectors involved in the Field Study destine some production to exports and are thus subject to international quality and production requirements imposed by consumers in developed countries. For this reason several environmental programs and eco-labels have been developed, which may support replacement of MB. Examples of these programs are the Dutch MPS flower label with members in many countries including Kenya, Costa Rica and Ecuador, the German Flower Label program with members mostly in Ecuador and EUREPGAP, which mostly applies to fruits and vegetables but now contains a specific chapter on flowers and is starting to become active in Africa and Latin America. In general, these labels encourage reducing pesticide usage and some specifically prohibit using MB.

68. In the tobacco sector, no attempts envisaging implementation of labelling and/or certification systems were detected in the countries visited. Notwithstanding, it is important to remark that the biggest international tobacco buying companies (very much present in Brazil and entering the market in Malawi, Croatia and Macedonia) are recently imposing on their partners in each country the application of “Good Agriculture Practices Guidelines” (GAP) that exclude the use of MB. In Malawi, the national stakeholders are looking to solicit the recognition of the

tobacco buying companies active in Malawi for the efforts made to eliminate MB use and thereby support the GAP Guidelines of the buyers.

69. In the post-harvest sector, there were reports of importers who have expressed concern related to MB application and requested commodities that had not been subject to this type of treatment. Exporters have to be prepared to a growing demand from industrialized countries for food and feed which is free of MB. Only technologies that can comply with existing and possible future standards of food and feed safety are really sustainable from the economic point of view.

IX. Format/Structure of the Reports

70. One of the main problems encountered during the desk phase of the evaluation were weaknesses in the appraisal, reporting and monitoring system of the projects; in some cases, no regular progress reports were available in the projects. Bilateral and implementing agencies should insist on receiving such half-yearly reports with substantial information as indicated in Annex II of this report. The Secretariat might work with them on a standard outline which could serve also for the annual reporting under MB phase-out agreements.

71. It is expected from a reliable reporting system on the progress of MB replacement projects to reveal early on deficiencies in project implementation or deviations from objectives and time frame, or sustainability problems. To this end, the reporting system should encompass the project's activities, mechanisms and outcomes in both qualitative and quantitative terms. The results should address the choice of alternative technologies and trials conducted, diffusion and training, commercial adoption and any constraints encountered. Reports should also address the technical, economic, institutional and political sustainability of alternatives selected.

ANNEX I

As of May 23, 2005

Countries Visited During the Field Study and Main Characteristics of the Projects Evaluated

Soil Fumigation

Country	Project Number	Status	Region	Main alternatives chosen	MB Baseline	Approved Phase-Out (ODP Tonnes)	Actual Phased Out (ODP Tonnes)	Total Phase-Out Approved For Multi-Year Agreements Projects (ODP Tonnes)	Implementing Agency	Funds Approved (US\$)	Funds Returned (US\$)	Funds Disbursed (US\$)	Approved Duration (Months)	Actual Duration (Months)
SUB-SECTOR HORTICULTURE														
Costa Rica	COS/FUM/27/DEM/14	Completed	LAC	Metam sodium, 1,3-D/Pic solarization	342.5	0.0	0.0	N/A	UNDP	180,500	0	180,500	19	34
	COS/FUM/35/INV/25*	Ongoing				84.4	84.0	426.9	UNDP	1,211,321	0	913,588	12	44
	COS/FUM/43/INV/33*	Ongoing				130.8	0.0		UNDP	1,938,114	0	0	17	17
Guatemala	GUA/FUM/22/DEM/15	Completed	LAC	Grafted melon seedlings, metam sodium, telone	400.7	0.0	0.0	N/A	UNIDO	440,000	-58,383	381,617	25	31
	GUA/FUM/38/INV/29	Ongoing	502.6			296.6	N/A	UNIDO	3,257,377	0	2,143,381	73	74	
Kenya	KEN/FUM/39/INV/33*	Ongoing	AFR	IPM, steaming	217.5	5.0	8.0	34.0	Germany	287,247	0	171,606	12	24
	KEN/FUM/42/INV/35*	Ongoing				12.0		Germany	172,347	0	0	24	24	
Peru	PER/FUM/31/INV/28	Completed	LAC	Solarization, biofumigation, crop rotation for onions, paprika and potatoes, dazomet	1.3	4.0	4.0	N/A	UNDP	209,770	0	209,762	38	54
Romania	ROM/FUM/34/INV/19**	Ongoing	EUR	Metam sodium, grafted seedlings	111.5	93.9	93.9	N/A	Italy	630,517	0	325,528	50	54
Turkey	TUR/FUM/25/DEM/46	Completed	EUR	Solarization, metam sodium	479.7	0.0	0.0	N/A	UNIDO	314,600	-9,808	304,792	25	35
	TUR/FUM/29/INV/56	Completed				50.0	50.0	N/A	IBRD	366,440	0	366,440	38	45
	TUR/FUM/35/INV/74*	Completed				29.2	29.2	292.2	UNIDO	1,000,000	0	383,034	12	24
	TUR/FUM/41/INV/82*	Ongoing				58.0	40.0		UNIDO	1,000,000	0	0	24	37
SUB-SECTOR FLORICULTURE														
Costa Rica	COS/FUM/27/DEM/15	Completed	LAC	Steam, Alt. Chemicals Biopesticides, Substrates	342.5	0	0	N/A	UNDP	193,500	-117	193,383	34	14
	Additional Projects included in Horticulture													
Ecuador	ECU/FUM/38/INV/31	Ongoing	LAC	Substrates, Steam, Alt. Chemicals	66.2	37.2	37.2	N/A	IBRD	597,945	0	597,945	37	26
	ECU/FUM/26/TAS/23	Ongoing				15.0	0.0	N/A	IBRD	244,244	0	97,303	85	81
Kenya	KEN/FUM/24/DEM/17	Completed	AFR	Steam, Substrates with biocontrols	217.5	0.0	0.0	N/A	UNIDO	328,900	-3,475	325,425	25	61
	KEN/FUM/38/INV/31*	Ongoing				10.0	10.0	63.0	UNDP	510,660	0	108,945	24	32
	KEN/FUM/44/INV/38*	Ongoing				0.0	0.0		UNDP	306,396	0	0	24	24
Peru	Included in Horticulture	Completed	LAC	Potential users only	1.3				UNDP					
Turkey	Included in Horticulture		EUR	Substrates, Steam	479.7				UNIDO					
SUB-SECTOR TOBACCO														
Brazil	BRA/FUM/22/DEM/73	Completed	LAC	Floating Trays Systems (FTS)	711.6	0.0	0.0	N/A	UNIDO	393,800	-28,691	365,109	25	37
	BRA/FUM/28/INV/142	Completed				84.4	84.4	N/A	UNIDO	2,344,440	-23,656	2,320,784	38	29
Croatia	CRO/FUM/25/DEM/08	Completed	EUR	Floating Trays Systems (FTS)	15.7	0.0	0.0	N/A	UNIDO	288,200	-28,577	259,623	25	35
	CRO/FUM/35/INV/14	Ongoing				16.2	12.6	N/A	UNIDO	476,833	0	302,912	62	61
Macedonia	MDN/FUM/26/DEM/09	Completed	EUR	Floating Trays Systems (FTS)	12.2	0.0	0.0	N/A	UNIDO	259,600	-969	258,631	25	42
	MDN/FUM/32/INV/16	Completed				27.2	27.2	N/A	UNIDO	1,075,207	0	1,031,328	62	49
Malawi	MLW/FUM/32/DEM/15*	Completed	AFR	Floating Trays Systems (FTS), Metam Sodium, Basamid	112.7	19.3	19.0	129.0	UNDP	400,000	0	400,000	12	12
	MLW/FUM/34/INV/16*	Completed				20.9	21.0		UNDP	1,000,000	0	1,000,000	13	42
	MLW/FUM/40/INV/18*	Completed				41.1	41.0		UNDP	750,000	0	750,000	12	17
	MLW/FUM/43/INV/21*	Ongoing				29.7	0.0		UNDP	849,824	0	5,144	12	12
Peru	Included in Horticulture	Completed	LAC	Floating Trays Systems (FTS)	1.3				UNDP					
* Tranches of Multi-Year Projects														
** Project approved for Italy and implemented by UNIDO.														

ANNEX I: Countries Visited During the Field Study and Main Characteristics of the Projects Evaluated
Post-Harvest

As of May 23, 2005

Country	Project Number	Status	Region	MB Baseline	Commodities Included	Alternatives Chosen	Approved Phase-Out (ODP Tonnes)	Actual Phased Out (ODP Tonnes)	Total Phase-Out Approved For Multi- Year Agreements Projects (ODP Tonnes)	Implementing Agency	Funds Approved (US\$)	Funds Returned (US\$)	Funds Disbursed (US\$)	Approved Duration (Months)	Actual Duration (Months)	
Iran	IRA/FUM/29/INV/57	Ongoing	ASP	26.7	Dried dates and figs, nuts, pistachio, grain and seeds	Fumigation with solid phosphine formulations in bag stacks and chambers	12.4	10.0	N/A	UNIDO	260,698	0	170,454	25	68	
Kenya	KEN/FUM/21/DEM/12	Cancelled	AFR	217.5	Cereal grain	Demonstration on the use of CO ₂ in combination with Phosphine in silos and permanent sheeting of grain bag stacks	0.0	0.0	N/A	Australia	232,834	-91,869	140,965	N/A	N/A	
	KEN/FUM/26/DEM/20	Ongoing				Use of diatomaceous earth formulations in an IPM (integrated pest management) scheme	0.0	0.0	N/A	Canada	100,000	0	73,000	13	83	
Syria	SYR/FUM/24/DEM/30	Completed	ASP	188.6	Cereal grain	Fumigation with solid phosphine formulations, cylinderized phosphine, and phosphine CO ₂	0.0	0.0	N/A	UNIDO	509,850	-34,038	475,812	25	39	
	SYR/FUM/34/INV/80*	Ongoing				Cereal grain	Fumigation of bag stacks with solid phosphine formulations	5.0	5.0	105.0	UNIDO	300,000	0	77,704	17	54
	SYR/FUM/41/INV/89*	Ongoing						29.8	20.0		UNIDO	351,725	0	0	12	37
Turkey	TUR/FUM/31/INV/69	Ongoing	EUR	479.7	Dried Figs	Phosphine fumigation, CO ₂ treatment in pressure chambers, Volcani cubes	30.0	0.0	N/A	World Bank	479,040	0	418,175	27	60	
* Tranches of Multi-Year Projects																

Annex II

Indicators for MB Projects which could be used in Future Reporting

- (a) Compliance with phase-out timeline and MP schedule;
- (b) Consumption and import data sources;
- (c) Technical feasibility and environmental sustainability of selected alternatives:
 - (i) Specific reason for using MB;
 - (ii) Alternatives selected and their performance/ suitability for the specific circumstances of the project, sector involved, climate, etc.;
 - (iii) Development and introduction of an Integrated Pest Management (IPM) Approach.
- (d) Economic feasibility:
 - (i) Yields and quality of alternatives in comparison with MB, if possible for more than one year or growing season;
 - (ii) Costs of alternatives relative to MB, if possible for more than one year or growing season;
 - (iii) Particular constraints (e.g. missed market windows, lack of registration).
- (e) Institutional support - Participation of production sector and other stakeholders
 - (i) Participation of the sector (direct users, e.g. growers) and other stakeholders (trade associations research, academic, extension, regulatory bodies);
 - (ii) Government involvement;
 - (iii) Activities carried out by the NOU and National Counterpart of the Project. Mechanisms to ensure participation.
- (f) Regulations and other government activities to support sustainability of phase-out
 - (i) Awareness raising and training activities and results, including government agencies;
 - (ii) Regulations and/ or controls to ensure compliance with the agreed phase-out schedule;
 - (iii) MB use in the country. Registered formulations, application method. Use of VIF;
 - (iv) Legal regulations and/or controls to restrict MB imports, sales, use;
 - (v) Regional legislation/ agreements to support MB phase-out and avoid re-use in the future.
- (g) Additional issues:
 - (i) Project delays and reasons
 - (ii) Lessons learned.

Annex III

General Interview Checklist for Field Evaluations of MB Projects

ISSUES EVALUATED	SPECIFIC QUESTIONS
Compliance with phase-out timeline and MP schedule, project results	<ul style="list-style-type: none"> - Is consumption below, above or within agreed levels? - How are the activities of the project progressing? - Are any delays to observe and what are the reasons?
Consumption and import data sources	<ul style="list-style-type: none"> - Customs - Importers - Others
Technical sustainability	<ul style="list-style-type: none"> - Is the reason for needing MB clearly identified? - Alternatives selected and their performance/ suitability. If there was a previous demo project there a logical succession? - Are alternatives implemented within an IPM framework? - Are environmental issues considered?
Economic feasibility	<ul style="list-style-type: none"> - Are supplies or equipment for implementing alternatives locally sourced? If not, is their use still within economical feasibility? - Have yields and quality been compared to those obtained with MB? - Have costs of the alternatives been compared? Over several seasons? - Have economical constraints to adoption been identified?
Institutional aspects	<ul style="list-style-type: none"> - Have interested stakeholders been consulted in the project preparation? If yes, how? If not, or only partially, why? - How was the main counterpart organization been selected and why? - How were participants for training and awareness programmes as well as equipment allocations selected? What are their commitments with the project? (e.g. allowing open field days to take place in their premises, sharing or publishing trial results) - Describe activities carried out to this respect by the NOU and National Counterpart of the Project. What mechanisms have been used/are in place to ensure participation? (e.g. field days, meetings with growers, training sessions, printed materials) - If a trade association exists for the sector, is it aware of the project and/ or actively participating? If yes, how? If not, why not? - What lessons have been learned with respect to technology transfer? Positive results, constraints?
Regulations and other government activities to support sustainability of phase-out	<ul style="list-style-type: none"> - Regulations and/ or controls to ensure compliance with the agreed phase-out schedule or the MP schedule? - Are relevant government agencies sufficiently aware of the need to legally regulate MB phase-out? If not, how can this be improved? - How is MB used in the country? Registered formulations, application method (e.g. canisters or injection)? Is VIF or similar used and/ or required? - Legal regulations and/or controls to restrict MB imports, sales, use? - Regional legislation/ agreements to support MB phase-out and avoid re-use in the future?
Additional issues	<ul style="list-style-type: none"> - Are regular progress reports be prepared and send to the IA? - Are growers/ users members of eco-labels or environmental programs that prohibit MB use? What certification/ control scheme is used? Have these programs or labels encouraged users to adopt alternatives?

ANNEX IV.1

Summary of Sub-Sector Report on Tobacco

1. Tobacco accounted for about 11% of total MB consumption in A5 countries in 2001. MB users in this sector are very diverse ranging from small farmers to very large companies. The Executive Committee has approved 28 projects in this sector in different countries: 13 demonstration, 12 investment, 2 training and one technical assistance. Almost 1,700 ODP tonnes of MB will be eliminated by 2007 through investment projects. The majority of the approved projects is in Latin America and the Caribbean (9), followed by Africa (5), Eastern Europe (5), and Asia (4).
2. There are no projects in some important tobacco producers (e.g. India, Indonesia, and Turkey). Further, world tobacco production is undergoing many changes since 2000. Vietnam, Thailand, Zambia, Tanzania, South Africa, Uganda and Mozambique are now growing tobacco while traditional producers like Zimbabwe, EU member states, Canada and USA show declining market shares. It is evident that a global approach for phasing-out MB in this sector is needed as efforts made in some countries could easily be compensated by increased consumption in new production areas.
3. Countries selected for the Field Study include large and medium tobacco sectors, in different regions, with completed demonstration projects and on-going investment projects; with diverse baselines and focusing only in tobacco or encompassing a larger sector (mostly horticulture). Countries visited were Brazil, Croatia, Macedonia, Malawi and Peru.
4. All countries visited have made significant progress in phasing-out methyl bromide and appear to be in compliance with and ahead of the 2005 20% reduction. Four countries (Croatia, Macedonia, Malawi and Peru) reported zero MB imports during 2004. Concerns over potential illegal imports from neighbouring countries were frequent and should be addressed in order to sustain current achievements.
5. The tobacco sector is unique in that a specific alternative to MB has been found, the Floating Tray System or FTS. This alternative is more sustainable in the mid-term than the chemical alternatives, as it involves investment and infrastructure changes that make it very unlikely for growers to go back to conventional growing techniques involving MB use. Although some technical problems can arise growers have adopted necessary measures to control them. IPM practices on the other hand could be improved. Stakeholders in some large sectors such as Brazil are also aware of the potential pollution of water bodies arising from water disposal and are taking pertinent measures, but this was less developed in other countries. The same was true for the disposal of old and broken polystyrene trays. Although having a suitable alternative in FTS the challenge remains in transferring this complex technology – many times to thousands of growers – within the timeframe of the MLF projects.
6. The FTS system may encounter economic constraints if the necessary supplies need to be imported. Only in Brazil, due to its developed industrial sector, all inputs can be locally sourced at reasonable costs to growers. In Croatia and Macedonia there is local production of trays and substrates respectively, with the rest of the inputs being imported, while Malawi depends wholly on imported supplies.

Annex IV.1 (Cont'd)

7. Stakeholder involvement was generally adequate. Diverse institutional arrangements were found across projects. The type of arrangement depends on the organization of the tobacco sector as a whole, the relative influence of private and governmental institutions on the tobacco market and the design of the sector's policies. In Croatia, the demo project influenced the tobacco companies to promote FTS; in Brazil, the companies decided to switch to FTS even before the demo project; in Macedonia, the Faculty of Agronomy and the Institute of Agriculture, with the active participation of the implementation agency, decided what alternatives to test during the demo and to find out what was the better one for transferring to the growers. Malawi, on the other hand, had a Steering Committee composed by the main stakeholders who decided on the main technologies to test and transfer.

8. Brazil, Croatia, Malawi and Peru already have regulations to ensure the committed phase-out. Some of these regulations are specific for MB while others relate to ODS in general. In some cases insufficient knowledge about their existence was observed particularly among growers. Macedonia has not issued regulations banning MB import and use but some stakeholders consider them unnecessary as demand has disappeared.

9. No attempts envisaging implementation of labeling and/or certification systems were detected in the countries visited. However, the biggest international tobacco buying companies are imposing "Good Agriculture Practices Guidelines" (GAP) on their suppliers which exclude the use of MB.

ANNEX IV.2

Summary of Sub-Sector Report on Horticulture

10. The horticulture sub-sector, comprising vegetables, melons, strawberry and other fruit crops, is the largest consumer of methyl bromide among all sub-sectors such as flower crops, tobacco and post-harvest treated commodities.

11. 18 investment projects (17 on-going and one completed) and 21 demonstration and technical assistance/training projects (15 completed and 6 on-going) in the horticulture sub-sector (vegetables and fruit crops) have been approved by the Executive Committee. Field evaluations were conducted in projects covering a small number of large growers (Romania, Guatemala and Costa Rica); projects covering a large number of medium-size growers and smallholders (Turkey, Kenya) and small, diverse growers (Peru).

12. Except for Guatemala, all countries visited (Costa Rica, Kenya, Peru, Romania and Turkey) are in compliance with the MB freeze in 2002; the same situation is expected with respect to the 2005 20% reduction.

13. With the exception of Romania and Peru, all investment projects were preceded by demonstration projects, which screened MB alternatives and adapted them to one representative production area. In Turkey, the demonstrated alternatives, soil solarization in particular, were well received by the clientele and adopted in considerable proportion at the commercial level. In Guatemala and Costa Rica, there was a considerable time gap between the end of the demonstration project and the beginning of the investment project and this made some demonstrated alternatives irrelevant. Further, the demonstrations were not always laid out in full collaboration with the growers associations, which led to poor cooperation and even resistance. In Kenya, transfer of know-how from demonstration to phase-out was affected by lack of staff continuity.

14. Even if the demonstration stage is successful, investment projects may need to address new research findings and development problems as they arise and find better suited technologies such as grafting for melons in Guatemala, which was introduced after heavy losses caused by wilt of melons.

15. The choice of the technologies was generally adequate. Although new for certain countries, chemical alternatives are more conventional as there are few new compounds or technological breakthroughs in this area. More controversial are the non-chemical alternatives, especially those involving high costs such as grafted seedlings of vegetable crops and melons, biofumigation where manure is rare, and soil steaming. Soil solarization is less expensive but its application engages the soil for relatively long periods of time, however it is well suited for Costa Rica where the soil remains fallow between crops. Low-cost local practices such as sanitation, removal of crop residues after harvesting, crop rotation, kill-off of harvested plants, removal of wild hosts and volunteer plants, etc. should be strongly promoted. Grafted seedlings provide a non-chemical alternative of high and sustainable potential; however, it should be selected and implemented with caution as it can be technically challenging and costs can be a constraint. Despite initial resistance, this technology is now field-tested in Guatemala by most large growers.

Annex IV.2 (Cont'd)

16. Awareness raising and training activities were systematically carried out as a first step in the promotion of all projects. They were continued throughout the projects' lifetime and play a major role in the commercial adoption of the alternatives. By definition, the involvement of stakeholders, particularly growers, was easier to organize when the number of growers was smaller (Romania, Guatemala, Costa Rica). Public and private extension support is essential in projects with large farming clienteles such as Turkey and Kenya. Whatever the case, it is essential that the project management and the leading Ministries are sufficiently involved in the project and help approach the growers. This is illustrated by Guatemala where growers embarked first on a political blockade rather than on technical cooperation to resolve the difficulties of methyl bromide substitution. Most projects have not created a formal framework to enable stakeholders full-fledged participation in decision making. To this end, it is strongly recommended that Steering Committees be established in all projects.

17. The import and supply of methyl bromide is limited through import controls in all countries visited. The import controls are apparently efficient in Romania, Turkey and Costa Rica while Guatemala and Peru report illegal trade from neighbouring countries. Kenya has no appropriate regulations. The soaring methyl bromide prices in Turkey reflect low availability and deter potential consumers from its use. With the exception of Peru and Kenya, commercially or officially recognized ODS-free status of agricultural produce or eco-labels are known in theory in the countries surveyed but are not enacted.

Annex IV.3

Summary of Sub-Sector Report on Floriculture

18. In 2001, flowers accounted for approximately 9% of MB consumption in A5 countries for soil uses. According to Ozone Secretariat data, this amounted to approximately 1,470 ODP tonnes of MB in 2001. Twenty-eight projects fully or partially relating to floriculture have been approved and undertaken. Of these, 9 were demonstration projects and have been completed and 19 are ongoing: 17 are investment projects and 2 are for information dissemination. A new investment project is being presented this year for Brazil. Projects cover a wide variety of flower species in all regions where floriculture is important and MB is consumed. Propagation materials, not only cut flowers, are also considered within some projects. Investment projects will account for early phase-out of over 900 ODP tonnes of MB by 2008.

19. The floriculture sub-sector was addressed covering countries from different regions of the world, where floriculture is a large economic activity (Ecuador, Costa Rica, Kenya, Turkey) as well as countries where flowers are produced for the local market (Turkey, Peru; Peru is at this stage a potential user). Of the 28 projects fully or partially involving flowers, 13 were in Latin America, 7 in Africa, 5 in Asia and the Middle East and one in Eastern Europe. This appropriately covers the regions where commercial floriculture is important at present.

20. The choice of alternatives for this sector is generally adequate. Substrates, steam and alternative chemicals have been technically validated in many regions, climates and cropping systems around the world. Alternative chemicals include metham sodium, dazomet and 1,3 – dichloropropene + chloropicrin. Although successful results have been obtained, efficiency and consistency of performance in these fumigants can be influenced by the application method and soil conditions. Technically, steam is equally effective to MB. However, many variables influence its success and cost-effectiveness and appropriate IPM programmes and maintenance of the boilers are essential. General acceptance on the part of stakeholders concerning this alternative was found to be high, particularly in larger companies. Production in substrates is a definite trend in the international floriculture sector. Although initial investment can be high, it can be compensated through increased yields and better quality, which was confirmed in Ecuador. Substrate production is technically challenging, which may make this a good option for more competitive or progressive growers only.

21. Cost is the main constraint for the adoption of steam. In some countries (Turkey, Ecuador) availability of less expensive fuel sources and locally manufactured boilers help make this alternative feasible. Locally sourced substrates are usually less expensive than imported ones. However, substrates like coconut coir or coconut peat are presently imported to many countries including Ecuador and are still economically feasible.

22. In the case of chemical alternatives, one clear constraint is lack of registration. This is particularly true for 1,3-dichloropropene and its different formulations with chloropicrin. This fumigant is not registered in Ecuador, Kenya or Peru (in Peru additionally, metham sodium and dazomet are not registered at present). Although initializing registration lies outside the scope of action of Governments and is a commercial matter, mostly in the hands of private companies, they could facilitate and speed the legal registration procedure once such companies make an application. In some cases, stakeholders mentioned that MB prices have gone up (Turkey) but generally its cost remains competitive or is lower than that of alternatives (Ecuador.)

Annex IV.3 (Cont'd)

23. In spite of the above, commercial adoption of alternatives has occurred. In Costa Rica, larger flower growers already use steam. In Turkey, adoption of substrates was reported for carnation growers, the main users of MB. In Kenya and Ecuador use of substrates is also reported.

24. All projects include efforts to raise awareness and diffuse alternatives, although with variable results. Stakeholder involvement is variable between the projects. In some cases, priority given to MB phase-out by the Government and the trade association is low (Ecuador), in others (Costa Rica), key stakeholder participation is increasing and the Government is highly involved. It seems particularly important to involve stakeholders from different fronts in order to generate sufficient response. Local universities and research centers, larger or more frequent MB users and government institutions should be included. Multidisciplinary teams – regional if needed – bring positive results.

25. Specific regulations concerning MB import, distribution and use are presently in place in some countries where projects were evaluated, and in others they are projected. There are no specific regulations concerning MB formulations, dosages, or application methods. Pre-occupation with the possibility of diverting use of MB imported for QPS uses to soil uses was expressed by two of the countries visited, Ecuador and Peru.

26. A smooth and fruitful transition between demonstration and investment projects was not always apparent. In Kenya, for example, results of the demonstration project have not been incorporated into the investment project. In Costa Rica, transition between the two projects is somewhat fragmented, reportedly due to key stakeholders not being involved. In Ecuador, the demonstration project never properly started due to different reasons and was finally converted into a technical assistance project.

27. Several environmental programmes and eco-labels exist in this sector, such as the Dutch MPS with members in many countries including Kenya, Costa Rica and Ecuador, the German Flower Label program with members mostly in Ecuador and EUREPGAP, which now contains a specific chapter on flowers and is active in Africa and Latin America. UNDP might study the possibility of granting official recognition of ODS-free status to those countries that successfully eliminate MB in different sectors, as this could give growers a “commercial edge” when advertising their products.

ANNEX IV.4

Summary of Sub-Sector Report on Post-Harvest

28. The importance of MB use in the post-harvest sub-sector varies from country to country. In Iran, it declined from 33 % of the total national MB consumption in 1998 to 6 % in 2003. In Syria, the post-harvest sub-sector grain fumigation consumed 56 % out of the total consumption in 1998. In 2004, MB consumption in the sub-sector had declined to 53 % of the baseline value. Turkey reported post-harvest use of MB only for dried figs, which amounted to 5% of total MB imports in 1996. This number was reported to remain stable during recent years. For Kenya, reliable figures could not be obtained. Estimations vary between less than 10 % and more than 25 % of the baseline consumption.

29. Four post-harvest sub-sector projects were chosen for the Field Study: Iran, Kenya, Syria and Turkey. The selection of projects did not attempt to provide a representative coverage of regions and commodities or structures but rather to obtain reliable answers to questions originating from the desk study, on the planning and implementation of some of the 34 projects with post-harvest activities approved so far. Nevertheless, the projects selected include several alternatives and implementing agencies.

30. Technical feasibility of MB alternatives for post-harvest uses does not really require further validation since their range is comparatively small and extensive experience already exists. Experiences from other countries and regions are more easily transferable than in the other sub-sectors, as treatments relate to a limited number of commodities and structures with similar features. Thus, there is no need for further demonstration projects but rather for more intensive and thorough adjustment to local needs and constraints during the preparation of investment projects.

31. Technology choice was driven by different considerations and the extent to which such choice matched the needs was variable. The Iranian project benefited from an easy to use, comparatively safe, inexpensive and effective technology (fumigation with solid phosphine), but technical sustainability is endangered by using only tablets which are not the ideal formulation for treating dried fruits because they are less easy to handle than plates, for example, and have the gross disadvantage of a 60-day waiting period which is definitely too long for the requirements of the users. Expensive electronic gas detectors have been purchased that need yearly calibration which cannot be done in the country. Simple and inexpensive gas measuring pumps with tubes would have been a better option. Important framework conditions such as occupational safety have been neglected by the project.

32. Technology choice for grain storage fumigation in Kenya was not based on real and expressed needs. A demonstration project focusing on CO₂ was cancelled in March 2000 after some years of efforts, and now diatomaceous earth formulations plus Integrated Pest Management (IPM) does not seem to be in line with possibilities and preferences in the country. Reliable alternatives like phosphine were not considered and technical sustainability is presently not evident. Syria adopted well known and trialled technologies (bag stack fumigation with solid phosphine formulations), which are appropriate for low priced commodities such as cereals. However, valuable time was spent on testing other alternatives in a demonstration project, which in hindsight was not needed. The technology choice of the project in Turkey was both pragmatic (phosphine fumigation, Volcani cubes) and sophisticated (high pressure chambers for CO₂

ANNEX IV.4 (Cont'd)

treatment). Such pressure chambers require a high initial investment and can only be considered as an alternative for a few companies big enough to afford them as part of a longer-term market strategy, for example, to treat organic products and to enter new markets. The commitment of the Turkish Government, at the time of project approval, to take care of all the remaining MB phase-out in the post-harvest sector, has now to be transformed into an action plan, which might include support for some smaller companies.

33. Institutional sustainability was also found to be variable, mainly because of weak institutional infrastructure (Iran) and partial lack of local expertise (Iran, Kenya, Syria). Turkey represents a remarkable exception with a fruitful collaboration between institutions, universities and ministries, which are involved in MB phase-out. A major consequence of delays and deficits in training in all countries is the fact that MB users are insufficiently prepared to apply alternatives. There is also a marked reluctance to adapt to new requirements, especially when these imply changes in management practices to use effectively alternatives such as phosphine that take longer exposure times than treatment with MB.

34. Import and utilization control of MB (Iran, Syria, Turkey) and price increases (Iran, Turkey) contribute to project related MB phase-out. No major problems with illegal MB imports were detected. They could become an issue, however, as full control of borders is difficult in all countries visited. Governments should pay attention to this risk in order to ensure sustainability of national phase-out policies.

35. Generally, high priority was given during project implementation to technical issues such as purchasing and installing equipment, comparing the effects of different treatments on target pests, checking possible side effects on commodities and fine tuning of application techniques. However, no detailed economic assessments were prepared which should not only compare costs of different alternatives but also study the impact of new technologies on the relevant business.

36. Preparatory project missions should be undertaken by multi-disciplinary teams composed of experts from different technical, economic, social and/or other relevant disciplines coming from outside and the project country. Flexibility that allows reaction towards new experiences and developments is a valuable asset. Continuous monitoring and step wise planning of activities is a good way to correct problems arising in the course of the project and/or incorporate new and appropriate technologies.

37. Throughout the field evaluation it was obvious that needs and wishes of beneficiaries had not been sufficiently considered. Local expertise was often not consulted to maximum extent. This neglect certainly contributed to a number of problems such as choice of alternatives that were not well adapted to the needs (Kenya, and to some extent Iran); implementation of technologies without the necessary supporting framework (Iran, Syria); lack of motivation of some specialists to further contribute to training (Iran); insufficient acceptance of MB alternatives by users (Iran, Syria, Turkey).