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Item 5 (a) (i) of the provisional agenda*

**Matters for consideration of action by the Conference
of the Parties: measures to reduce or eliminate releases
from intentional production and use: DDT**

Report of the expert group on assessment of the production and use of DDT and its alternatives for disease vector control **

Note by the Secretariat

1. As referred to in paragraph 9 of document UNEP/POPS/COP.4/4, the report of the expert group on the assessment of the production and use of DDT and its alternatives for disease vector control is set out in the annex to the present note. The report is presented without formal editing.

* UNEP/POPS/COP.4/1.

** Stockholm Convention, Article 3 and Annex B, Part II; reports of the Conference of the Parties on the work of its first meeting (UNEP/POPS/COP.1/31), annex I, decision SC-1/25, on the work of its second meeting (UNEP/POPS/COP.2/30), annex I, decision SC-2/2, and on the work of its third meeting (UNEP/POPS/COP.3/30), annex I, decision 3/2.

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Annex

Report of the expert group on the assessment of the production and use of DDT and its alternatives for disease vector control to the Conference of the Parties of the Stockholm Convention at its fourth meeting

I. Background

1. At its third meeting, the Conference of the Parties to the Stockholm Convention (COP), in its decision SC-3/2: DDT, paragraph 6, requested 'the Secretariat in collaboration with the World Health Organization (WHO) to carry out the activities of data collection, data analysis and assessment of the continued need for DDT for disease vector control established in the process for reporting on and evaluation of DDT and provide guidance for the Conference of the Parties to make an evaluation at its fourth meeting and encourages non-Party States to participate in the data-gathering activities.' The Conference of the Parties also requested the Secretariat in close collaboration with the WHO to report on the status of the implementation of integrated vector management, and to develop a business plan for promoting a global partnership on alternatives to DDT.
2. The DDT Expert Group met from 18-20 November 2008 in Geneva to report on the assessment of DDT. There was no reporting obligation on the production and use of DDT for Parties since the last meeting of the Expert Group in November 2006. In the absence of new data from the DDT questionnaire, the assessment relied on information available from other sources. One source was a comprehensive report on the global status of DDT and its alternatives, which had been developed by the Secretariat in collaboration with the WHO in advance of the Expert Group meeting. The development of a business plan has been addressed in a separate report presented to the Conference of the Parties resulting from a stakeholder meeting held 3-5 November 2008 in Geneva.
3. The following party-designated experts participated in the meeting: Mr Gao Qi (China); Mr. Andreas Stadler (Germany); Mr. Hossein Ladonni (Iran, Islamic Republic of); Mr. Nicolae Opopol (Republic of Moldova); Ms. Adriana Mariana Borş (Romania); and Mr. Baba Gadji (Senegal). The following experts selected by WHO participated in the meeting: Ms. Btissam Ameur (Ministry of Health, Morocco), Ms. Maureen Coetzee (National Institute of Communicable Diseases, South Africa); Mr. Pradeep K. Das (independent consultant, India); Ms. Brenda Eskenazi (University of California, USA); and Mr. Theo Vermeire (RIVM, Netherlands). The following experts selected by the Secretariat participated in the meeting: Mr. Henk Bouwman (North-West University, South Africa); Mr. Hans Rudolf Herren (Millennium Institute, USA), and Mr. Henk van den Berg (independent consultant, Netherlands),). Participating in the meeting as observers were Mr. Jan Betlem (United Nations Environment Programme) and Ms. Marie Alice Limage (Ministry of Environment, Haiti). Mr. Bouwman chaired the meeting.
4. Opening remarks were given by Mr. Donald Cooper, Executive Secretary of the Stockholm Convention and Mr. Tim Meredith, Senior Adviser, Department of Public Health and Environment of the World Health Organization. Mr. Cooper welcomed all the experts to Geneva and informed them of the task at hand during the meeting. He also reminded the experts of their obligations to gather and present scientific facts as accurately as possible so that the decisions of the policy makers at the Conference of the Parties could be based on sound evidence. He noted that another nine chemicals have been recommended for listing under the Convention at the next meeting of the Conference of the Parties. He further noted that the work of the Expert Group was unprecedented and provided a unique model with potential to be replicated by the Conference of the Parties given similar challenges. Mr. Meredith reiterated the commitment of WHO to the goals of the Stockholm Convention and, in particular, to the reduction of the use of DDT for malaria vector control. He said WHO faces a double challenge on DDT: the need for DDT in the arsenal against the mosquito vector that carries the malaria parasite and environmental protection concerns regarding DDT. He stated that WHO promotes the application of integrated vector management and is also working with other partners to find alternatives to DDT. Mr. Meredith informed the meeting that WHO is concerned with the impacts of DDT on human health. His, he said, is based on recent studies in some countries which have revealed human health concerns for the use of DDT in areas where IRS is being implemented. WHO has responded to these concerns by revising the terms of reference for the risk assessment of DDT and the results of this study will be peer reviewed. He said that WHO was completing the human health risk assessment on

DDT based on the decision to update the previous result and this revised assessment should be available by early 2010.

5. The Expert Group discussed the following issues that were included in the process for assessment of the production and use of DDT that was adopted at the third meeting of the Conference of the Parties in its decision SC-3/2:

- (a) Situation analysis of the production and use of DDT;
- (b) Availability, suitability and implementation of alternative products, methods and strategies to DDT;
- (c) Analysis of progress to strengthen capacity of countries to transfer safely to reliance on suitable alternatives products, methods and strategies to DDT;
- (d) Assessment of actions by Parties to control and reduce release of DDT;
- (e) Current Policies and Guidelines and activities regarding DDT and disease vector control;
- (f) Conclusions and recommendations of the Expert Group.

II. Situation analysis of the production and use of DDT

2.1 Production trends and new developments

6. During the 2005 global DDT assessment, its production was estimated at 6,269 tonnes (active ingredient). Currently, DDT is being produced in three countries, India, China and DPR Korea. The latest data on production in India is 4,495 and 3,441 tonnes (active ingredient) in 2007 and 2008, respectively; an estimated 150 tonnes (active ingredient) per year are produced for use as an intermediate in the production of Dicofol.

7. Currently there are two countries with exemptions for DDT production. India and China have specific exemptions to produce DDT as an intermediate only in the production of Dicofol. China also produces DDT as an additive for the production of anti-fouling paint. China has also notified the Secretariat of its intentions to cease the production and use of DDT in 2009. However, China will retain the right to re-introduce the use of DDT for malaria vector control until 2010 if an outbreak of the disease warrants the use of this insecticide.

8. In Democratic Peoples Republic of Korea about 160 tonnes of DDT (active ingredient) is produced per year for use locally in agriculture and for vector control purposes. However, Democratic Peoples Republic of Korea has not yet notified the Secretariat of any production or use of DDT. The reported use of DDT in agriculture in DPR Korea needs urgent attention.

9. India and China both export DDT, either as a technical product or formulated for the purpose of vector control to countries in Africa. Recent export of the product produced in India to Mozambique and Eritrea has not been in accordance with the guidelines and requirements of the WHO. DDT continues to be formulated in Ethiopia and South Africa with ingredients imported from China. South Africa exports part of the formulated material to other African countries and has notified accordingly.

2.2 Conditions of use

10. The Expert Group estimates that there are currently 15 countries in Asia and Pacific and Africa that use DDT for vector control (see table 1). From country reports and other sources, it is estimated that in 2007 a total of at least 3,950 tonnes of DDT (active ingredient) was used for the purpose of disease vector control, but recent information is missing from some countries that use DDT. Eighty to 90% of global use for vector control is in India alone. Use in India has declined by around 20% over the last six years. There is no information available on the use of DDT from the Americas.

11. Nine Parties have notified the Secretariat of the use of DDT with another six reserving the right to use DDT in the future. Five Parties do use DDT but have not notified the Secretariat. It is confirmed that one non-party is using DDT for disease vector control. The main use of DDT is for malaria control, but it is estimated from the latest information that on average, 1000 tonnes (active ingredient) of DDT per annum is used for the control of leishmaniasis in India.

Table 1. Information on the notification of the use of DDT by Parties

Categories on notification	Countries
Parties that have notified on DDT use	Ethiopia, India, Mauritius, Mozambique, Myanmar, South Africa, Swaziland, Uganda, Yemen
Parties that use DDT but have not yet notified on the use	DPR Korea, Eritrea, Gambia, Namibia, Zambia
Parties that have notified to reserve the right to use DDT	Botswana, China, Madagascar, Marshall Islands, Morocco, Senegal
Non-Parties that are known to use DDT	Zimbabwe

12. For Myanmar and Yemen, their notifications to the Secretariat indicate that they are still using DDT for vector control. However, recent informal reports from various sources indicate that decisions have been made in the two countries to no longer use DDT for vector control except for periods of malaria outbreaks. These decisions have not been formally communicated to the Secretariat.

13. In recent years, indoor residual spraying (IRS) programmes have greatly expanded in Africa, with major support from the US President's Malaria Initiative. The use of IRS has expanded in Angola, Benin, Ethiopia, Ghana, Kenya, Liberia, Madagascar, Mali, Malawi, Mozambique, Rwanda, Senegal, Tanzania (including Zanzibar), Uganda, and Zambia. A number of these countries have re-introduced DDT or may do so in the near future.

14. There are indications that the quality of IRS is a critical issue. For example, in India, it was reported that the average coverage of targeted houses with IRS was 53%, but only 16% of treated houses had uniform and complete spraying while spray equipment was found to be of poor quality. This might also be true for other countries using IRS but data are lacking. Care must be taken to ensure that IRS is not used where exophagic and exophilic vectors are prevalent.

15. The Roll-Back Malaria Partnership is an important player in setting the agenda for the scaling up of insecticide-treated nets (ITN) and IRS. The Global Malaria Action Plan of the Roll-Back Malaria Partnership involves, amongst other malaria control activities, the scaling up of ITN and IRS to achieve rapid impact on malaria. Hence, the use of IRS, and possibly the accompanying use of DDT, could increase in the years ahead, particularly in Sub-Saharan Africa.

2.3 Vector resistance to DDT

16. Since its last report in 2005, the African Network on Vector Resistance to insecticides (ANVR) has not updated its results from resistance sentinel sites across the African continent. Nevertheless, a number of new publications have reported DDT resistance in malaria vectors (*Anopheles arabiensis*) from Sudan, Zimbabwe, Morocco and South Africa. Hence, resistance to DDT appears to be spreading. The use of DDT in South Africa is, however, still effective. The *kdr*-mutation gene, which confers cross-resistance to pyrethroids is reported in vector populations in several parts of the African continent and beyond. The role of this mutation in *An. arabiensis* is currently unknown, and in *An. gambiae* is worrisome.

17. International vector resistance networks have not yet been established in other regions but some individual countries in those regions have established systems for monitoring resistance. In India, resistance to DDT and multiple resistance to alternative insecticides remains a key problem in many districts. A recent report on vector control in India indicates that the insecticide choice for IRS is rarely based on contemporary insecticide susceptibility testing and there are strong indications that this is also the case in most other countries.

18. DDT also has repellent and irritant properties. The relative importance of these properties in relation to malaria control is variable and not fully understood. Standard testing of DDT resistance focuses on the toxic action, but repellent and irritant actions may also need monitoring.

III. Availability, suitability and implementation of alternative products, methods and strategies to DDT

3.1 Availability, suitability and cost effectiveness

19. Integrated vector management (IVM), which has been defined as “a rational decision-making process for the optimal use of resources for vector control”, aims to provide a long-term strategy for vector control, transmission reduction and resistance management that is integrated with other arms of public health and other sectors. Introduction and promotion of IVM needs to be strengthened. The criteria for the implementation of the IVM spectrum need to be further clarified and consolidated to allow its introduction across varying local conditions. The utility of tools for vector control need to be assessed within the IVM framework.

20. Two of these, ITN and IRS using alternative insecticides, are being implemented on a large scale because of their impact on malaria transmission. Several other alternatives, particularly non-chemical methods, have not received sufficient attention in contemporary malaria control efforts, but have an essential role to play.

21. IRS with DDT remains affordable and effective in many situations but, with regard to the direct costs, the relative cost advantage of DDT vis-à-vis alternative insecticides seems to be diminishing. Purchase cost of pyrethroids is approaching that of DDT. It has been noted that incorporation of the cost of ensuring safe use of DDT will significantly change its comparative cost advantage in relation to alternative insecticides not considering the cost of externalities such as cost to human health and the environment.

22. Another major method is the use of ITN, and in particular long-lasting insecticidal nets (LLIN) which retains the efficacy for at least three years. Pyrethroids are the only chemical group recommended for use in ITNs. There are indications from several African countries of increased frequency of resistance genes attributable to expanding ITN programmes, and in an area in Benin insecticide resistance has already undermined the efficacy of ITN locally. In many malaria-affected countries, ITN is rapidly being scaled up, resulting in a reduction in malaria incidence. However, to be prepared for disease emergencies in the future, it is critical that effective insecticides are available and can be quickly mobilised.

23. IRS and ITN are the key intervention strategies recommended by WHO for malaria vector control. However, their effectiveness varies from country to country. The cost-effectiveness of these interventions is dependent, among others, on the cost of the product used, the quality of the intervention, the negative social impact from the intervention and by the insecticide used.

24. Non-chemical methods such as environmental management, structural adaptations, biological control, hygiene and house improvement have clearly contributed to successful malaria control in some countries. More work is needed to study their effectiveness as main or supplementary interventions at programme level in all malaria affected countries.

3.2 Alternative chemicals in use

25. WHO has recommended insecticides for use in IRS operations for malaria vector control. Twelve insecticides (including DDT) belonging to four chemical classes are recommended for IRS. These recommended insecticides together have only limited scope because of overlapping modes of toxic action on the vectors. Selection of individual insecticides from these groups will depend on resistance, vector behaviour and other local parameters within the IVM spectrum.

26. Effective monitoring programmes and decision support systems are lacking in most malaria-affected countries but are needed to detect insecticide resistance, the susceptibility of vectors and the epidemiological conditions in different operational settings and on a timely basis. Moreover, locally conducted situation analysis would allow for evidence-based decision-making on vector control interventions tailored to local conditions.

3.3 Alternative non-chemical strategies employed

27. Contemporary cases on the implementation of IVM are few. Besides the reported cases of Mexico, Central America, India and Sri Lanka, new data on the implementation of IVM from Zambia show promising results that could be of value to other countries.

28. Intensive control efforts are needed to reduce the prevalence of malaria. Levels of transmission and prevalence of malaria are clearly declining in a number of countries following intensive control

efforts. Therefore, there is now greater opportunity for sustaining and improving the achievements made in reducing malaria transmission by incorporating IVM strategies which will further reduce the reliance on DDT and other chemical interventions.

3.4 Research on alternatives

29. A number of efforts are being undertaken to develop new products or methods of malaria vector control. Most of these efforts are in the context of international public-private partnerships, notably the Innovative Vector Control Consortium (IVCC), or as bilateral or regional research projects. In general, increased emphasis on research and development on alternative products, methods and strategies is needed.

30. There are two new developments with regard to IRS. First, some existing insecticides not currently available for public health purposes show potential. Second, new formulations of existing pyrethroid and non-pyrethroid insecticides with prolonged residual activity are being developed. Two of these, slow-release formulations of pyrethroids are already available on the market. In the selection of alternatives to DDT, a comparative assessment of health and environmental risks is required.

31. Research has been initiated on the use of non-pyrethroid insecticides for treatment of bed nets to cope with the problem of resistance, but safety issues are a major concern. At least one new insecticide with novel chemistry is being developed for LLIN by the IVCC, but this product will only come to the market in a few years depending on the success of the development and deployment process.

32. The effectiveness of available non-chemical methods for malaria control as main or supplementary interventions at programme level urgently requires further study. A number of potential technologies (e.g. fungi; repellents; attractants; genetic methods) are under development but need increased investment.

33. The evidence base on cost-effectiveness in accordance with local conditions needs strengthening. The cost assessment of DDT versus its alternatives needs to be made more comprehensive. Issues relating to the external costs of negative effects to human health, the effects on the environment by long range transport, and hindrance to international trade for agricultural products have to be considered.

34. The procedures for the accessibility of financial resources need to be simplified. Financial support is urgently needed to establish and implement long-term, integrated and multi-partner strategies for disease vector control.

IV. Analysis of progress to strengthen capacity of countries to transfer safely to reliance on suitable alternatives products, methods and strategies to DDT

4.1 Status of capacities of countries to implement alternatives

35. The capacity to enforce regulations, risk reduction and good management practices for DDT, and the capacity to monitor use of DDT and the conditions of such use, remains inadequate in most DDT-using countries. Agencies funding the purchase of DDT should be obligated to provide adequate financial assistance to ensure that proper regulations are in place.

36. National inter-ministerial coordination is generally weak. There is a need for the Ministry of Health to consult with the Ministry of Agriculture and Environment and with other relevant stakeholders in the country when considering the safe use of DDT and its disposal in an environmentally sound manner.

37. To shift to reliance on alternatives, in-country capacity is inadequate for the required management skills, scientific and technical knowledge and for the implementation or delivery of interventions. One example is the capacity building that has been ongoing in many countries to enable the delivery of ITNs through mass campaigns, and by distribution through existing public- and private-sector outlets.

38. Programmes on capacity building for malaria control need to incorporate specific activities to support countries to make informed decisions when switching to DDT alternatives. A number of African countries have in recent years established or strengthened their capacity for implementing IRS programs, which may include the use of DDT, with substantial support from the US President's Malaria Initiative. This increased capacity, which contributes to malaria control, should also address the need for capacity on alternatives to DDT wherever it is used.

39. Parties and countries using DDT generally lack research capacity and implementation on innovative technologies and integrated approaches.

40. The clearinghouse mechanism of the Convention should be used to collect and make available all relevant information regarding the production and use of DDT and its alternatives for vector control. Consideration should be given for the creation of an independent network of the Parties that use or intend to use DDT for disease vector control to share information on lessons learnt in the development and deployment of alternatives to DDT.

4.2 Opportunities for sustainable transition

41. Scaling up of malaria control interventions leads to reduction in the number of cases. Levels of transmission and prevalence of malaria are decreasing in a number of African countries as a consequence of recent scaling up of malaria control interventions. This changing epidemiological situation creates the opportunity for incorporating non-chemical methods into IVM strategies to achieve further reductions in malaria transmission. This should result in a reduced reliance on chemical insecticides; DDT in particular.

42. Currently, the WHO in collaboration with UNEP is implementing regional projects to demonstrate alternative methods and strategies to DDT for disease vector control. The successful completion of the project in Central America and the ongoing work in Africa and the Mediterranean should have far reaching implications regarding the reduction in DDT use for countries participating in these projects.

43. The establishment of a global partnership of all stakeholders will enhance the opportunities for developing and deploying alternatives to DDT. The interim report on the preparation of a business plan for such a partnership was reviewed by representatives of stakeholders at a meeting, held 3-5 November, 2008, in Geneva. The proposed business plan provides a major opportunity for working towards the development and deployment of alternatives to DDT in the future and will be presented to the COP in a separate report.

44. There are other opportunities for reducing the reliance on DDT and establishing IVM programmes. These include: (i) The recently marketed pyrethroids with enhanced residual action, which could potentially replace DDT in certain settings, but require further field study and studies on exposure and the potential health consequences; (ii) Establishing collaboration between IGOs (WHO, FAO, UNEP, UNDP) on integrated strategies of vector control offers an opportunity, for example, in terms of initiating joint training and capacity-building programs; (iii) There is opportunity to facilitate collaboration between relevant ministries in selected countries where the health sector could benefit from achievements made in community mobilization; (iv) There are increased calls for chemical safety in disease vector control (e.g. by the IFCS, Forum VI) Creating a demand for non-chemical alternatives to DDT and other chemical insecticides; and (v) innovative technologies on repellents, fungi, botanicals and genetic methods are under development, but need increased investment.

45. The Global Malaria Action Plan advocates an increased emphasis on IVM to improve malaria vector control. Additionally, the application of an IVM strategy is important in achieving success for eventual elimination of DDT.

4.3 Case studies on successful elimination of DDT use

46. The effectiveness of alternative strategies as main interventions should be urgently studied and demonstrated in the local contexts. The case of Mexico and other countries in Central America has been used as an example of a successful shift from the reliance on DDT to the use of an integrated strategy and non-chemical methods for vector control, while still reducing malaria prevalence. This approach should be investigated in other regions. Conditions in the African region are different insofar as the breeding and transmission characteristics of local vectors and the diversity of environmental conditions are concerned. Nonetheless, modelling studies and limited field data suggest that the effect of IRS and ITN will be amplified by environmental management even in areas of intense transmission.

4.4 Limitations for reducing reliance on DDT

47. Reform in the health sector has, in many malaria-affected countries, resulted in decentralization of planning and budgeting. Decentralization can be expected to favour integrated vector management by facilitating situational analysis and tailored action at the local level. However, decentralisation in some situations has led to inadequate technical and programmatic capacity at lower administrative levels and insufficient priority given to malaria control in local allocation of resources by the health sector. More guidance is needed to assist Parties to take advantage of the opportunities for vector control offered through a decentralized system.

48. The collaboration between key sectors at national level is limited. Interventions involving larval control methods, house improvements and other environmental management strategies along with hygiene are dependent on the participation of other sectors (i.e. agriculture, industry, education) and communities. Also, inter-sector collaboration will be a major challenge for the health sector, especially in the absence of a framework for policy development. Further attention should be given to the linking of vector control with agricultural projects or income-generating initiatives to increase community participation and create win-win situations following the examples in India and Sri Lanka.

49. Malaria control should be seen in the context of economic development. Economic development leading to urban growth without sufficient sanitation infrastructure can result in increased vector breeding and transmission. Similarly, rural agricultural development requiring irrigation may provide additional breeding habitats. However, economic development increases the ability of the community to afford self-protection measures such as coils, aerosols and home improvement, which leads to reduction in infected bites.

50. IVM requires well trained personnel with a potential for career advancement. The capacity for vector monitoring and control is urgently needed at the appropriate administrative levels.

V. Assessment of actions by Parties to control and reduce release of DDT

5.1 Development of regulatory and enforcement mechanisms to restrict DDT use

51. Many countries need to strengthen legislation and enforcement of DDT use. Countries that use DDT invariably have inadequate legislation or lack capacity to implement or enforce regulations on pesticide management. Some countries lack any legislation in relation to DDT. Others have banned the importation and use of DDT in sectors other than public health, but lack legislation on the management of public health pesticides including DDT.

52. The enforcement of pesticide regulations and its enforcement are often insufficient to avoid misuse or trafficking of DDT outside of the health sector. Some countries are planning to introduce or amend laws in the context of their National Implementation Plans on Persistent Organic Pollutants. The new laws could address illegal trafficking and use of DDT in sectors other than health. The transfer of DDT stocks between countries is not always documented nor reported and this poses a problem in tracking quantities of the chemical and to establish the quality of DDT transferred.

53. The submission of the required data by Parties and countries producing and using DDT is necessary for evaluation of regulations and their enforcement of issues related to DDT production and use.

5.2 Implementation of suitable alternative products, methods and strategies

54. There are several potentially effective alternative methods for malaria vector control that have shown potential. The past years have seen an increase in financial and human resources available for implementation of vector control interventions, which include the use of alternatives products and methods. However, in countries where DDT is used, alternative methods have not generally replaced it, but rather have complemented it. ITN is reaching above 50% coverage of households in at least 11 African countries.

55. Contemporary cases of sustained implementation of non-chemical methods as part of IVM are not common. Examples of effective non-chemical methods include: the use of intermittent irrigation in rice in China; the training of volunteers and mobilization of community members to clean streambeds and eliminate green algae in Mexico and Central America; a strategy using engineering, elimination of vector breeding sites, use of larvivorous fish, chemotherapy, community participation, health education and income generation in Gujarat, India; the application of larvivorous fish in parts of India; water management regimes in a natural stream to reduce malaria vectors in Sri Lanka; and an inter-sector approach to educating rice farmers about environmental management in Sri Lanka. Most of these are carried out in research settings for demonstration projects and sustainable activities at the national level are lacking.

56. The evidence base on non-chemical tools and IVM strategies according to local conditions needs urgent strengthening. Several ongoing or planned projects aim to demonstrate the effectiveness of alternatives to DDT in several regions.

57. In DDT-using countries, mechanisms need to be further strengthened to reduce reliance on DDT and to implement IVM alternatives. These mechanisms, which include decision-support systems, good

management practice, monitoring and evaluation, inter-sector collaboration, risk assessment, as well as regional networks on insecticide resistance, require enhanced and expedited technical support and facilitation by the WHO.

5.3 Implementation of vector resistance management strategies

58. There is need to build national capacities for testing, monitoring and management of insecticide resistance to malaria vectors. Some countries, such as Mozambique, have made recent progress in this respect, but much work remains to be conducted there and elsewhere.

59. There are indications from the limited available data, that insecticide resistance management strategies may not always be able to prevent insecticide resistance, e.g. through the use of rotations, mosaics or mixtures of the chemicals available. The arsenal of unrelated insecticides available for vector control remains limited, which restrict the prospect for sustaining chemical control.

60. Therefore, the potential value of non-chemical methods in reducing the risk of insecticide resistance (e.g. through suppression of vector breeding; reduction of human-vector contact), needs emphasis in future IVM strategies.

5.4 Measures to strengthen health care

61. Increased resource deployment is essential for the reduction of transmission of malaria. Increased resources have been mobilized in recent years for malaria control efforts in endemic and epidemic countries, which include resources for surveillance, prevention and treatment and the strengthening of health systems to provide these services. For example in those countries that have *falciparum* malaria, artemisinin-based combination therapies (ACTs) seem to be effective. Consequently, ACT, in combination with vector control and active case detection, has reduced transmission of malaria.

62. Availability of basic health care to all populations at risk is a crucial element of IVM. In this respect, the Roll-Back Malaria Partnership advocates community health worker networks and the scaling-up of home-based management of fevers with ACTs in order to decrease severity and mortality of malaria cases.

5.5 Promotion of research and development of alternatives

63. The Bill & Melinda Gates Foundation is providing financial support for the development of alternative chemical products to DDT through the research being undertaken by the Innovative Vector Control Consortium. Research and development on IVM strategies and deployment, in particular non-chemical methods for vector control, need to be further promoted.

64. A global partnership is critical for the timely and effective development and deployment of alternatives to DDT. Such a partnership would encourage the consolidation of research efforts and the efficient development of alternative chemical and non-chemical products, methods and strategies.

5.6 Environmentally sound storage of stockpiles and destruction of DDT wastes

65. There are insufficient data on the quantity, quality and location of DDT stockpiles and wastes. The limited available information indicates that large amounts of DDT are remaining in a number of countries. Most of the stock is obsolete and of unknown quality. Some countries have reported keeping stocks in the event of malaria outbreaks, but such stocks could become obsolete or of poor quality if not used within the normal shelf-life of the chemical.

66. Proper management of stocks and quality control is an issue requiring attention. Following the example of the Africa Stockpiles Programme, additional effort is required for the disposal of DDT wastes in all countries with stockpiles of DDT. Product stewardship (cradle to grave) for the management of stocks should be incorporated in any donor-funded IRS programme which uses DDT.

5.7 Assessment of health and environmental effects

67. DDT available for vector control purposes has not been recently subjected to the WHOPES assessment scheme. Whereas the new insecticides have to comply with the WHOPES requirements, the specifications for DDT have not been evaluated and updated for many years.

68. There are inadequate data on exposure to communities and pesticide applicators resulting from the use of DDT in IRS programmes. Recent studies in South Africa have reported very high levels of body burden of DDT among those living in sprayed houses. There is particular concern for the exposure of fetuses and children to DDT. Breastfeeding is advisable and a vital contribution to the development of children. However, breastfed children are likely the most exposed subpopulation to DDT as this

chemical is readily stored in the fatty tissue of the breasts. A specific monitoring system is needed to assess exposure through indoor spraying, including the specific routes and pathways of exposure. There is a need to develop interventions to reduce both residential and occupational exposure from DDT applications.

69. There are limited data on the health consequences from DDT in IRS programmes. Previous health research has focused on populations with lower body burdens. These studies suggest associations with developmental, reproductive and chronic disease. The WHO is conducting a re-evaluation of health risks of DDT but the results are not expected before March 2010. In view of the urgency from currently expanding IRS programmes, this evaluation process needs to be expedited. There is no thorough research on the health consequences to human populations under IRS programmes. Additional research is needed on the health consequences to human populations living in communities where DDT is used in IRS programmes.

70. There are limited data on the environmental transport of DDT from its use in IRS programmes. The environmental transport of DDT applied in IRS remains to be studied. DDT used for indoor spraying is likely to end up in the environment as suggested by recent studies in several countries. This potential contamination requires close monitoring and investigation. Parties generally lack the capacity and resources to conduct such studies.

71. There are limited data on the ecological impact from DDT in communities with IRS programmes. The ecosystems and environmental conditions are different in the current malaria-control areas from those previously studied. There is a concern about food safety in communities where DDT is used, but there is little information about contamination.

72. Chemical alternatives should also undergo the same exposure related examination for ecological and health impacts as proposed for DDT. For example, although animal data have suggested that pyrethroids have neurotoxic and reproductive effects, there have been virtually no studies of human populations, particularly in IRS conditions. Many communities using IRS are exposed concurrently to both DDT and pyrethroids; animal studies suggest a synergistic effect between these chemicals.

VI. Current policies and guidelines and activities regarding DDT and disease vector control

73. WHO recommends ITNs and IRS as the two main approaches for the control of mosquito vectors. These core interventions may be complemented, usually in specific locations, by other methods such as larval control or environmental management. WHO recommends DDT for indoor residual spraying. "Countries may use DDT for as long as necessary, in the quantity needed, provided that the guidelines and recommendations of WHO and the Stockholm Convention are all met."

74. The Global Malaria Action Plan of the Roll-Back Malaria Partnership aims to achieve universal coverage with locally appropriate interventions for all populations at risk. The Plan also targets the elimination of malaria from certain countries by 2015, and the global eradication of malaria in the long term.

75. The Secretariat has proposed a provisional timeline for a three-phase plan for DDT elimination. The first phase is the preparation of a global business plan and partnership on developing alternatives to DDT and establishing the national capacities to deploy these alternatives (2007-2010). The second phase is the deployment of selected alternatives to DDT, resulting in a termination of DDT production (2009-2017). The third and final phase is the cessation of all uses of DDT and the destruction of all remaining stocks and stockpiles of DDT by the year 2020.

VII. Conclusions

76. There is an urgent need for monitoring and research on environmental and human exposures and health consequences of DDT and chemical alternatives in malaria-control programmes. Particular consideration should be given to vulnerable populations such as pregnant women and children and for food safety pertaining to both export and local consumption. There is need to develop interventions to reduce both residential and occupational exposure from DDT and other chemical applications.

77. In view of the scaling up of vector control interventions, which include the use of DDT, and amidst accumulating reports on the emergence of insecticide resistance, it is increasingly important that effective monitoring and decision support systems are in place in malaria-affected countries so that

insecticide resistance can be detected at an early stage. Any implementation or consideration of IRS should take into account the local diversity of vector species and their characteristics.

78. Between 80-90% of global use of DDT is in India alone. A recent report on an evaluation of vector control in India indicated shortcomings with regard to the monitoring and decision-support system and with regard to quality control of the intervention. These are causes of concern, and could provide lessons for other DDT-using countries.

79. Besides the current efforts of scaling up IRS and ITN interventions in line with malaria control objectives, there is need for long-term, innovative, integrated and multi-partner strategies of malaria vector control to achieve further reductions in malaria transmission, to reduce reliance of chemical insecticides, and to increase sustainability of control efforts.

80. In the development of alternatives the emphasis has been on malaria control. However, considering the reported amounts of DDT used for leishmaniasis control in India, and given that other Parties have reserved the right to use DDT for this and other vector borne diseases, more attention is needed to address DDT use for controlling other vector borne diseases.

81. The Expert Group regrets that the WHO was not able to participate in the deliberations on the substantive issues during the meeting. Given the required close collaboration of the Stockholm Convention with the WHO, the expertise within the WHO in malaria vector control would have provided meaningful input during the discussions on the use of DDT and its alternatives in malaria vector control.

VIII. Key Recommendations

82. DDT should continue to be used only in malaria affected areas where locally appropriate, effective alternatives are not yet available. If needed, DDT should be used strictly within WHO recommendations and guidelines for disease vector control only.

83. Effective monitoring and decision support systems are essential and must be introduced in malaria-affected countries so that insecticide resistance can be detected at an early stage.

84. As IRS programmes using DDT are expanding in Sub-Saharan Africa, the re-evaluation of health risks of DDT in relation to IRS and accompanying research on health outcomes needs to be expedited,

85. Projects should be developed to establish revised strategies that will reduce both occupational and residential exposure to DDT and other chemicals during IRS applications.

86. The development and initiation of projects on demonstrating the effectiveness of alternatives to DDT, with support from the Global Environment Facility and international donors and sources, need to be expedited and expanded to include more countries and other new relevant initiatives.

87. Financial support for the establishment of IVM approaches for malaria vector control needs to be provided including capacity-building at the local and operational levels.

88. New methods and products for malaria vector control have recently come to market. The donor community and the financial mechanism of the Convention should, as a priority, undertake rapid assessment of these products and, where appropriate, support the introduction of these alternatives to DDT.

IX. Other Recommendations

89. DDT available for vector control purposes has not been subjected to the latest WHO specifications. Funds need to be made available to allow the updated assessment of DDT under the WHOPES scheme.

90. The ongoing initiative to establish a global partnership should be fully supported and funds earmarked to allow its implementation.

91. DDT use in agriculture should be abandoned. Therefore, immediate provision should be made to support Parties that currently face the ongoing use of DDT for agricultural purposes to introduce alternatives.

92. The clearinghouse mechanism of the Convention should continue to be used to collect and make available all relevant information regarding the production and use of DDT and its alternatives for vector control.

93. An assessment of the other vector borne diseases should be undertaken to determine which alternatives to DDT are available to control vectors of leishmaniasis and can be used to promote integrated vector management to control this disease.
 94. The completion and timely submission of the “DDT questionnaire” by Parties and non-Party countries (that use or produce DDT) is essential for the evaluation and decision for the continued need of DDT by the Conference of the Parties.
 95. An assessment should be made to ascertain the effectiveness of regulations and their enforcement by countries currently using and producing DDT.
 96. Ongoing WHO demonstration projects to DDT alternatives currently being implemented in selected countries in Africa and the Mediterranean should be expanded to include all malaria endemic countries.
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