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Report of the Third Meeting of the Global Collaboration for Development of Pesticides for Public Health (GCDPP)

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World Health Organization
Communicable Disease Control, Prevention and Eradication
WHO Pesticide Evaluation Scheme (WHOPES)

CONTENTS

1. Introduction

The third meeting of the Global Collaboration for Development of Pesticides for Public Health (GCDPP) was held at the World Health Organization Headquarters in Geneva, 30-31 May 2002. The reports of the first two meetings (documents CTD/WHOPES/GCDPP/98.1 and WHO/CTD/WHOPES/GCDPP/2000.4) held 14-15 October 1998 and 6-7 April 2000 at WHO/HQ, Geneva, are available from the WHO Pesticide Evaluation Scheme (WHOPES) and on the Internet at http://www.who.int/ctd/whopes.

The GCDPP represents a unique collaboration of the commercial and public sectors brought together under the auspices of WHOPES to address the increasing challenges of vector-borne disease control. This third meeting of the GCDPP included commercial sector representatives from the major manufacturers of pesticides and application equipment, as well as marketers of consumer household insect control products (14). From the public sector, the participants included representatives from academic research institutions (4), national and government supported agencies (9), and regional and international organizations (6) concerned with vector-borne disease control programmes and the rational use of pesticides. One WHO Regional Office was also represented at the meeting (see list of participants, Annex 2).

The meeting was opened by Dr M.P. Neira, Director, Communicable Disease Control, Prevention and Eradication (CPE), who highlighted the importance of a strong pesticide management infrastructure at the national level. Dr Neira stressed that this GCDPP meeting facilitates the vital process of bringing together the public and private sectors in order to develop and make more accessible the tools for vector control. In addition, she stressed the importance of the GCDPP being an appropriate mix of representatives from different sectors and addressed its very large responsibility in international vector control. The meeting has a crucial role, she added, to identify specific areas of public health pesticide management that need strengthening at the national level. She

thanked the participants for committing their own travel budgets to this cause and commented on the limited funds available for this important WHOPES function.

Dr L. Savioli, Coordinator, Strategy Development and Monitoring for Parasitic Diseases and Vector Control (PVC) welcomed and introduced the participants.

During the opening addresses the focus was directed to fulfilment of vector control responsibilities at the national level by Member States, which set the stage for in-depth discussions on the current status of these functions.

The meeting was convened in plenary sessions (see Annex 1, Agenda). Dr M. Mulla was appointed as Chairman, Dr David Dame as Rapporteur, and Drs D. Kanungo and D. Kelili as co-rapporteurs.

2. Activity reports

2.1 WHO Pesticide Evaluation Scheme (WHOPES)

Dr M. Zaim, Scientist in charge of the WHO Pesticide Evaluation Scheme (WHOPES), and the Secretary of GCDPP, presented an overview of WHOPES and its main objectives: to facilitate the search for alternative pesticides and application methodologies which are safe and cost-effective; and to develop and promote guidelines and strategies for the use of pesticides in public health and assist and monitor their implementation by the Member States.

He stated that WHOPES is a four-phase testing/evaluation programme, studying the safety, efficacy, acceptability and cost-effectiveness of pesticide products for public health use. The reports of WHOPES laboratory and field testing, as well as other existing published data on the use of a pesticide are reviewed by the WHOPES Working Group. The critical analysis of the reports and the justification for the WHOPES recommendations are published as a WHO document and distributed widely. He mentioned that

these documents have shown to be extremely valuable to country programmes as well as registration authorities.

He added that since 1997 seventeen pesticide products have been successfully tested by the Scheme, mostly for indoor residual spraying and treatment of mosquito nets for malaria vector control. He also mentioned that 4 pesticide application equipment units have been tested during the same period for compliance with WHO specifications. He requested industry to assist WHOPES in identification of independent research institutions which may collaborate with the Scheme on bench testing of pesticide application equipment since the current WHOPES collaborating centres can not respond to the increasing needs in this field.

Dr Zaim reviewed the current global strategies for the control of major vector-borne diseases and drew attention to the acute need for development of alternative insecticides for vector control, especially as it relates to malaria and dengue vector control. He noted the small market size of vector control insecticides and drew attention to the need for harmonization of registration of such products, as well as better use of WHO recommendations and resources, as an incentive for investment by industry in R&D of public health insecticides. He reviewed the recent WHOPES activities in promoting development of alternative insecticides, including the establishment of a joint programme with the London School of Hygiene and Tropical Medicine's Gates Malaria Programme.

Dr Zaim also emphasised the need to promote selective vector control and the judicious use of insecticides, to extend the useful life of the existing insecticides, and informed participants of the activities of WHOPES in this regard, notably publication of a document on "Malaria vector control - selection criteria and procedures for judicious use of insecticides" and development of a training course in collaboration with CPE/SMT (Social Mobilization and Training) and WHO Regional Office for South-East Asia (SEARO).

Dr Zaim also noted the limited capacity of Member States for quality control of pesticides and emphasised on the need to expand the network of WHO collaborating centres for such activities. He also informed participants of the establishment of the Joint FAO/WHO Meeting on Pesticide Specifications (JMPS) and the new procedure for development of WHO specifications, based on which the WHO specifications do not necessarily apply to nominally similar products of other manufacturers, nor to those where the active ingredient is produced by other methods of synthesis. The scope of these new WHO specifications may be extended, by WHO, to apply to similar products when JMPS has been satisfied that the additional products are "equivalent" to those which formed the basis of the reference specification.

Dr Zaim added that the main theme of the 3rd GCDPP meeting on "public health pesticide management" is to further promote the safe and judicious use of insecticides in public health.

He stated that by pesticide management he refers to the whole cycle of distribution and use of pesticides, and noted the existence of the International Code of Conduct on Distribution and Use of Pesticides in which the role of governments and international organizations, as well as industry has been well defined. He, however, invited the participants to consider the critical "grass roots" management issues of vector control insecticides, which constitute the daily concerns of the ministries of health and the municipalities in most developing countries, and requested GCDPP to:

- recognise and highlight importance of pesticide management in public health;

- identify critical issues and shortcomings related to pesticide management in public health; and

- propose actions to address the identified needs.

2.2 LSHTM's Gates Malaria Programme and WHO: Development of alternative insecticides

Dr M. Rowland, London School of Hygiene and Tropical Medicine (LSHTM), reviewed the objectives of the LSHTM's Gates Malaria Programme. He noted that the global malaria control initiative, Roll Back Malaria, advocates insecticide treated nets (ITN) as the most appropriate tool for preventing malaria in tropical Africa and many parts of Asia. Despite progress in the distribution and sale of nets, two problems are threatening to undermine present gains and reduce the potency of ITN: (1) the spread of pyrethroid resistance in *Anophelines* in Africa and Asia; (2) low re-treatment rates of nets.

Dr Rowland also noted that the malaria control market has become less attractive for industry, and insecticide registration for vector control has declined. The market supports only a modest product range and volume, all-or-nothing contracts give unpredictable returns. There is competition with generic insecticides and perceived checks on novel vector product development. He stated that to meet the challenges will require a new collaboration between the agrochemical industry, WHO and the Gates Malaria Partnership. WHO and Gates have joined forces to identify and evaluate alternative insecticide products, provide technical support, and share some of the development costs with industry. The products will include (a) new and current insecticides not yet used in malaria control that have the potential to overcome resistance, and (b) new impregnation processes - long-lasting nets (LLN) - that enable the insecticide treatments to withstand repeated washing over the lifetime of the net. While the emphasis is on ITN, insecticide products more suited for indoor residual spraying will also be evaluated.

Dr Rowland reviewed some of the potential compounds which may be suitable for further testing and evaluation for malaria vector control. These included neo-nicotinoids, fiproles, ecdysone agonists and inhibitors of mitochondrial electron transport. He added that the development process has several phases: initial testing in the

laboratory; field testing against natural vector populations; malaria disease control trials; development of specifications; and implementation research. The collaboration will arrange for (a) testing against susceptible and resistant strains in the laboratory, and (b) small-scale entomological studies in experimental huts and outdoor platforms and user acceptability studies in Africa and Asia. He informed participants of the establishment of field sites with partners in E. Africa (Tanzania), W. Africa (e.g. Côte d'Ivoire), and Asia (Pakistan) in order to demonstrate product potential under the broadest epidemiological conditions. Dr Rowland added that promising products will go forward for testing in disease control trials in Africa and Asia. He noted that there may be alternatives to pyrethroids for vector control, but we need to be pro-active in identifying and bringing them more efficiently to vector control.

2.3 Development of long-lasting insecticidal fabrics

Dr P. Guillet, scientist CPE/PVC, reviewed the current status of development of the long-lasting insecticidal nets and materials. He noted that after years of efforts and investment (behavioural change, social marketing, etc.), less than 5% of the mosquito nets currently used in Africa for malaria control have been properly treated or regularly re-treated with insecticides. The development of individual insecticide doses (e.g., sachets and tablets) bundled as a package with mosquito net has been the most significant step taken to improve the situation. Involvement of pesticide companies in local or international partnerships as well as agreements they passed with net producers have also positively contributed to global efforts to increase treatment coverage. However, the most significant step has been the development and promotion of a new concept, the long-lasting insecticidal nets (LLINs), which are treated at factory and do not need further re-treatment during its entire life span.

Dr Guillet added that today, only one LLIN (Olyset®) has been fully tested and recommended by WHO. One is still under evaluation (PermaNet®) but extensive information on this product has already been gathered through lab and field testing. Three other LLINs have

been developed by industry but have not yet been widely tested and submitted to WHOPES for evaluation. An Expression of Interest on LLINs has been published by UNICEF and its partners within Roll Back Malaria and more than 30 companies responded positively.

When testing LLINs, Dr Guillet added, standardization is essential and a standard protocol for testing efficacy and wash resistance is under development. In this protocol, the dynamic of insecticide release has been considered so that lab testing would not over or under estimate wash resistance.

Dr Guillet also added that a major issue under consideration is related to technology transfer and local production of LLINs in Africa. Innovative partnerships are under consideration involving pesticide manufacturers and net producers, as well as fibre or polymer companies and charity funds, donations or initiatives.

Dr Guillet stated that for the time being, LLINs only captured a small part of the current ITN market because of price, availability and the fact that only one product completed WHOPES testing and was recommended. Results achieved so far are very encouraging although it should be recognized that availability of additional truly long-lasting nets treated once forever, may require more time. Everybody is confident about the feasibility of having these nets and the time needed will likely depend on market opportunities and competition between companies.

Meanwhile, until LLINs are widely available and have replaced conventional nets, it is essential to further strengthen current efforts to improve re-treatment of conventional nets. This will be possible through, among others, availability of simplified treatment schemes and guidelines, multisectoral collaboration involving social scientists, marketers, NGOs, various partners and, of course, the insecticide manufacturers.

Dr Guillet noted that mosquito nets are only one example of long-lasting insecticidal materials. Other interesting products are already under development such as plastic tarpaulins and canvas for refugee settings (control of vector mosquitoes and synanthropic flies) and jar covers against dengue vectors. The slow release technology currently developed in long-lasting insecticidal fabrics might also be further used for long-acting larvicide formulations that could be used against dengue vectors with a residual efficacy of at least 6 months.

Dr Guillet emphasised that there is a wide range of potential applications for long-lasting insecticidal materials which better involves community in control efforts. There are also interesting opportunities for multi-disease prevention, the same material being active against several vectors in the same environment, e.g. malaria, lymphatic filariasis and leishmaniasis for LLINs. He added that effective development of long-lasting insecticidal materials relies on close and pro-active collaboration between pesticide industry, scientists, control programmes, NGOs and WHO. New initiatives such as the one involving the Bill and Melinda Gates Foundation, WHO, the London School of Hygiene and Tropical Medicine and industry should be further encouraged.

2.4 Dengue and lymphatic filariasis vector control: An update

In the context of dengue and lymphatic filariasis, Dr M. Nathan, scientist CPE/PVC, provided an update from the perspective of vector control, including disease status, chemical control measures and their challenges, and possible future directions. On dengue prevention and control he discussed the role of chemical control within a broader integrated vector management approach, noting a sharp increase in the amount of pyrethroids used in recent years and a concomitant decline in the use of organophosphates. Among the three WHO Regions most affected by dengue (Americas, South-East Asia and Western Pacific) the Americas accounted for over 90% of all organophosphates used and over 75% of all pyrethroids used during the period 1996-2000. Further analysis of available data showed that most of the insecticide was used for space spraying.

Programmes face major operational challenges with respect to insecticidal interventions, not least the scale and difficulties of applying them in large urban cities and in sustaining any gains that have been achieved. It was noted that concern remains about the efficacy of space spraying, particularly relating to transmission control. WHO Guidelines have recently been prepared to encourage and assist programme managers to assess the efficacy of these measures against *Aedes aegypti*.

On the matter of insecticide resistance in *Ae. aegypti*, Dr Nathan emphasised the need for more extensive and systematic monitoring. There is increasing resistance to organophosphates, particularly to temephos, a widely used larvicide. This is a matter of particular concern given the very limited number of alternatives for application to potable water. Pyrethroid resistance is under-reported but also appears to be widespread. He mentioned the uncertainties and challenges of designing and implementing effective insecticide resistance management strategies to address the problem.

New developments that appear to warrant further investigation include finding safe and cost-effective alternatives to temephos; the use of long-lasting insecticide-treated materials; the combined application of adulticides and larvicides (Bti) from space spray machines; indoor residual insecticide application, also using motorized equipment; and the use of lethal (insecticide-treated) ovitraps.

In summary, for dengue vector control, Dr Nathan reminded the group that insecticides remain as part of a broader integrated vector management strategy, and that when used, they should be applied judiciously. He also stressed the need for better formulations and new insecticides, and for an increased role of communities in their use and application, taking the necessary safety and environmental issues into full account.

On lymphatic filariasis vector control, where proven and cost-effective, its role is to augment the Global Programme to

Eliminate Lymphatic Filariasis (GPELF), which has a two-fold strategy, namely the interruption of transmission using mass drug administration, and the alleviation and prevention of disability through appropriate hygiene practices. At a WHO Informal Consultation to Define the Roles of Vector Control and Xenomonitoring in the GPELF, held in January 2002, it was estimated that 57% of transmission is attributable to *Culex quinquefasciatus*, mostly in SEARO, and a further 39% by anophelines, mostly in AFRO. While the limited resources available to the GPELF must remain focused on the two main strategies, in areas where *Cx. quinquefasciatus* is the major vector, improved sanitation and the appropriate use of expanded polystyrene beads were considered to be potentially the most important vector control interventions that may contribute to the public health goals of the programme. In areas of anopheline transmission, evidence has shown that the Roll Back Malaria interventions of indoor residual spraying and insecticide treated nets can have a major impact on filariasis. It was therefore recommended at that consultation that there should be optimal coverage with malaria vector control measures in areas which are co-endemic for the two diseases.

3. Pesticide management in countries and regions

3.1 Critical review of public health pesticide management practices in Member States (summaries)

3.1.1 India

The working paper **Critical Review of Public Health Pesticides, Management Practices in India and Recommendations for their Improvement** was presented by Dr D. Kanungo, Division of Medical Toxicology and Risk Assessment, Directorate of Plant Protection, Faridabad, India.

The National Anti Malaria Programme (NAMP) and the National Filariasis Control Programme (NFCP) are responsible for malaria and filariasis control, respectively, throughout India. Vector control

is conducted with annual indoor residual spraying (IRS) for malaria and larvicides for malaria coupled with larvivorous fish for filariasis. Regionally kala-azar transmission is interrupted with two IRS applications annually. Japanese encephalitis control involves fogging and space sprays. Dengue is also present. For these purposes the government purchases and manages large amounts of malathion, pyrethroids, DDT, and several larvicides, including fenthion and temephos.

Household use of pesticides for personal protection is prevalent, using coils, mats, aerosols, space sprays and ITNs. Information on the amount of these retail purchases is not available. Vector control is conducted with annual indoor residual spray for malaria and use of larvicides as well as larvivorous fish for both malaria and lymphatic filariasis control. These products undergo government oversight in the same manner as other pesticides.

Pesticides are formally registered under the Insecticides Act of 1968 following strictly defined process of deliberation by a Registration Committee, which includes review of a broad spectrum of scientific findings submitted by the registrant. This is followed by mandatory internal small and large scale testing (at the registrants expense, performed by internal scientists) under a provisional registration for public health pesticides - which is reviewed by a separate Technical Advisory Committee. Satisfactory efficacy and safety results lead to a permanent registration. The major public health users of pesticides are primary, secondary and tertiary health care units, municipal corporations and the army.

Procurement by the Central Government accounts for ca. 75% of the total quantity (and all of the DDT), which is then distributed to states as per need. Much of this is delivered directly to district levels for subsequent further distribution. Strict regulations govern the packaging of pesticides, labelling and verification of activity by the supplier. The Government also conducts its own pre-dispatch and post-distribution sample analyses and provides enforcement over the management of pesticides.

Storage and handling methodology is prescribed by the Government. Insecticide containers are destroyed and buried. Insecticide disposal is not a problem as procurement are need-based.

Safety and operational training for dilution, application, equipment calibration is provided at each supervisory level and printed guidelines are distributed to workers at the grass roots level and above. Protective clothing is provided. Monitoring is primarily for safety and health aspects, such as poisonings.

Identified vector control pesticide programme needs include a speedier registration system, simplified procurement, early on-site delivery, more judicious pesticide use to offset the probability of resistance, better acceptance of ITNs, quality control and increased availability of household pesticides by direct delivery to homes, an in-country WHO pesticide analysis centre, and more cadre for pesticide safety training. Increased attention is being given to IPM approaches utilizing fish and source reduction techniques to reduce the potential for environmental pollution.

3.1.2 Sri Lanka

The working paper **Critical Review of Public Health Pesticide Management Practices in Sri Lanka and the Recommendations for their Improvement** was presented by Dr P.W. Fernando, National Malaria Control Program, Colombo.

Chemical control of malaria vectors in Sri Lanka was initiated in 1946 with DDT. Vector control activities are currently conducted throughout by the State Sri Lanka for the control of malaria, filariasis, dengue, Japanese encephalitis and plague vectors. Pest control operators treat some residential premises, but residents use coils and personal protection measures for protection from vectors. In 1980 the parliament enacted a formal regulatory mechanism (amended in 1994), which designated the Department of Agriculture as the responsible authority. This includes licensing, advertising,

import packing, labelling, storage, formulation, transport, sale and use of the pesticides both in agriculture and public health.

A Registrar of Pesticides conducts the registration process. There is also a pesticide technical and advisory committee consisting of members representing pesticide-related disciplines (but excluding persons with commercial interests in pesticides). This committee advises the Registrar. No pesticides are manufactured in Sri Lanka. Applicants for registration must provide specific information on: manufacturer; formulator; product trade name; label; container; methods and results of prior of analyses and residue determinations; and statements of potency, stability in storage, period of usage, efficacy, environmental safety, composition (chemical identity and properties), impurities and toxicology. With no evidence of adverse effects on human health and the environment a 3-year licence or a provisional 12-month registration may be issued.

Procurement of public health pesticides is based on an international tender procedure. Payment for accepted tenders is completed only after confirmation by an accredited independent laboratory (with both pre-shipment and post-shipment chemical and formulation analyses) of the provider's quality certificate. Products must meet WHO specifications. The post-shipment analyses are conducted on samples each 25 metric ton consignment/lot. The State Environment Authority sets guidelines for storage, transport and handling.

Most of the public health pesticides are housed at the Malaria Control Programme in a central stores complex ca. 160 km from the capital city. District malaria officers maintain district level stores and distribute pesticides to sub-district units.

Identified vector control needs include the establishment of a WHO regional reference laboratory at the Industrial Technology Institute of Sri Lanka, which is being upgraded to international standards. Sri Lanka sees the need to regularly test for residual pesticide levels in potential contamination sites located in areas where residual insecticides are widely used. There is a need for

greater interaction and dialogue between private pest control and state vector control agencies in order to develop pesticide management practices that minimise selection for resistance in vectors.

3.1.3 South Africa

The working paper **Critical Review of Public Health Pesticide Management Practices in South Africa and Recommendations for their Improvement** was presented by Dr R. Maharaj, Malaria Research Programs, Medical Research Council.

In South Africa, the registration and use of pesticides is regulated by means of an Act of Parliament (Act 36 of 1947). No trade in pesticides is permitted unless the provisions of this Act are adhered to. Authority for pesticide regulation lies with the Registrar of Insecticides. Registration involves a number of actions and the review of an application can take up to one year. The registration procedure takes cognisance of the "International code of Conduct on the Distribution and use of Pesticides" and "Guidelines for the Registration and Control of Pesticides" issued by the Food and Agriculture Organization of the United Nations.

The South African Bureau of Standards has set criteria for testing and evaluating pesticides, and for packaging and determining the quality of pesticides. Labelling practices are regulated by the Guidelines for the RSA Classification Code of Agricultural and Stock Remedies and Associated Labelling Practices. Guidelines are also in place for the transport and storage of pesticides.

Registrants must provide credible information, data and/or samples of the label, pharmacology, toxicology, environmental impact, toxic metabolites, formulation toxicity data, biological efficacy, methods of analysis for the product and for residues and toxic metabolites. The application is evaluated by a panel of experts from the departments of agriculture, environmental affairs and tourism, health, and water affairs and forestry. The South African Bureau of

Standards (SABS) conducts tests on safety to humans and the environment, and on efficacy and fate with regards to the local climatic conditions. Renewal of pesticide registrations occurs on an annual basis and reviews occur on a two-year basis.

Enforcement issues are dealt with as complaints are registered, which may lead to analysis of active ingredient content. End users of pesticides are encouraged to monitor the quality of pesticides purchased. Specific regulations apply to packaging, labelling, formulation, transport, storage, storage facilities, handling and container disposal. Disposal of quantities of pesticide in excess of 5 kg is by high temperature incineration or by authorised waste disposal companies. Quantities of less than 5 kg can be buried.

Monitoring of the use of pesticides is the responsibility of the Department of Agriculture in collaboration with the Environmental Health section of the Department of Health, but is not pursued actively due to a lack of human and financial resources. However, use of specific pesticides such as DDT is monitored strictly since use of this pesticide is restricted to malaria control activities. Pesticides that are freely available are not monitored unless a problem is brought to the attention of the Registrar.

The development of resistance of public health pests to pesticides is a growing problem. Governmental and non-governmental organizations as well as the WHO and industry are working together in developing strategies to prolong the effective life of pesticides and in reducing the development of resistance through resistance management mechanisms such as mosaic spraying and rotational spraying methods.

Although the public health pesticide management practices are sufficient to regulate the distribution and use of pesticides, there are areas for concern. Procedures need to be developed to ensure that these pesticides are used properly to prevent environmental contamination and the development of insecticide resistance. At present these are limited to restricted insecticides but should be

expanded to include the more toxic compounds and pesticides for which there is no suitable alternative should resistance develop.

Also, the necessary infrastructure needs to be developed to better enforce compliance. At present claims are investigated on an *ad hoc* basis due to a lack of financial and human resources. And, although there are general guidelines with regards to the disposal of unwanted insecticides and their packaging material, there is no system in place to ensure that obsolete insecticides are disposed of in an appropriate manner. Facilities for the collection and destruction of pesticides and containers need to be created to assist in reducing environmental contamination and ensuring that old, ineffective insecticides are used. This would have an impact in reducing the development of insecticide resistance.

3.1.4 Brazil

The working paper **A Critical Analysis of the Use of Pesticides in Public Health in Brazil and Recommendations for their Improvement** was presented by Dr L.C. Meirelles, ANVISA, Ministry of Health.

Public health vector control campaigns in Brazil address diseases such as Chagas, dengue, schistosomiasis, yellow fever, malaria, leishmaniasis, schistosomiasis and bubonic plague. Although the total amount of pesticides used in these campaigns is much less than that used in agriculture, the exposure of the general public to these products is greater.

The National Health Foundation (FUNASA) is responsible for policies and strategies concerning health. Evaluation and registration of pesticides is the joint responsibility of the Ministries of Agriculture, Health and Environment within the scope of their areas of competence. The Ministry of Health establishes guidelines and requirements for data and information for registration and minimization of risks posed by pesticides, components and related products destined for use in public health campaigns and other

venues. It provides preliminary toxicological evaluation of pesticides, technical products, pre-mixtures and related products destined for research and experimentation, and grants the register for these uses. It is responsible for public health pesticide registration, monitoring residues, establishing analytical methods and tolerances, labels, formulations, repackaging, import and export, product examination, quality control, training manuals, and providing support for Federation vector control units.

Vector control operations are developed and conducted by the states and municipal districts, which are responsible for organizing activities, hiring and training the labour force, and acquisition and management of pesticides and related products. This has come under criticisms due to the lack of uniformity in the actions implemented in different areas of the country and the exacerbation of dengue in the country that could be related to this organizational problem. Prior to decentralization the organization of public health campaigns was established at the division level by federal authorities and regional, sector and special district co-ordinations by regional authorities.

Due to the large area and climatic variation found in Brazil vector-borne disease control requires extensive application of insecticides. The adverse impact of these insecticides on the spray applicators has resulted in a public health controversy. There is an urgent need for a well-defined epidemiological map that will help define the dynamic process of occupational health exposure and intoxication related to the exposure to pesticides. The lack of occupational health and safety services, individual protection equipment and measures for collective protection constitutes a health problem for these workers.

The Ministry of Health has been following WHO recommendations concerning the selection and purchase of pesticides and the methods of application used in control programs. There is, however, a need for the establishment of an interdepartmental coordination committee for the selection and use of insecticides. The greatest problems are related to the registration of products used in the

control programs which are purchased directly through the Pan American Health Organization.

In Brazil all technical and formulated pesticides destined for agricultural use, wood preservation, use in urban and industrial areas, right of ways (highways, transmission lines) and aquatic environments are subject to toxicological and eco-toxicological evaluation by the National Agency of Sanitary Surveillance (ANVISA) and IBAMA. In some municipalities products formulated and used in the control programs are not evaluated and consequently they lack appropriate registration. This hinders the ability of ANVISA and IBAMA to respond to the requests by the public concerning the legalisation of these products and their effects on the health and environment, particularly during periods of intense vector control activities.

Another area of concern is the method of commercialisation of these products. The Ministry of Health publishes a monograph of the authorized active ingredients indicating how these products are to be used. Larvicides used in control programs can only be used by government agencies and specialized entities. With the increase of dengue transmission, companies are pressuring the government to allow sales to the public of larvicides that are presently used in the control programs. Because the repercussion of this form of distribution has not been evaluated from the point of view of the development of insecticide resistance or from the perspective of public health safety and environmental contamination, ANVISA has not authorized the sale of these larvicides to the public.

Possible restrictions and recommendations to improving public health actions:

Concerning the system:

- Evaluate the strategy of decentralizing the actions in vector control, recommended by the present health system in Brazil,

due to the exacerbation of transmitted diseases in the last years.

- Improve the aspects related to the historic and organizational mechanisms of FUNASA.

- Provide the competent sectors of FUNASA with the necessary conditions to make decisions together with other governmental and non-governmental organizations in order to find solutions for occupational health problems.

- Evaluate the impacts of the different mechanisms of participation of the population and distribution of the products for campaigns of public health, in the face of the restricted availability of products that could quickly lose their effectiveness and the risks of contamination to human and environmental.

Concerning workers' health:

- Examine problems related to applicator use and exposure to pesticides in vector control campaigns in order to orient the organization of health program surveillance.

- Analyse the working processes related to pesticide use in order to contribute to the establishment of measures to control pesticide preparation, transport, application and storage.

- Support the worker health services plan by identifying needs to facilitate epidemiological and laboratory investigations.

Concerning pesticides used in vector control programs:

- Amplify the possible use of products of low toxicity for employment in control programs starting with actions taken together with productive sector.

- Conduct research on formulations and appropriate handling and application for the efficient and effective use of *Bti*.

- Evaluate systematically the mechanisms of authorization of products, such as the free sale of products used in vector control, seeking to reduce the risks of intoxication and the development of resistance to them.

3.1.5 Madagascar

The working paper **A Critical Analysis of the Use of Pesticides in Public Health in Madagascar and Recommendations for their Improvement** was presented by Dr C. Ravaonjanahary, Antananarivo (Abstract not available).

3.2 Public health pesticide management - Regional perspective (summaries)

3.2.1 SEARO

The working paper **Public Health Pesticide Management - Regional Perspective** was presented by the Chairman, Dr M. Mulla for Dr C. Prasittisuk, Regional Advisor, WHO Regional Office for South-East Asia**.**

Vector-borne diseases are a major health issue in the South-East Asia Region - malaria, dengue and dengue haemorrhagic fever, Japanese encephalitis and filariasis. In the absence of vaccines and specific drugs, vector control is important. Ineffectiveness of many pesticides due to resistance and environmental and toxicity concerns has caused social resistance to indoor residual spraying. To overcome these problems each country should adopt the following approaches.

1. Formulate a national insecticide policy with the following objectives: ensure effective and safe insecticide use for human and environmental health; provide technical guidelines to

decision-makers for appropriate selection and judicious use of insecticides; prolong usefulness of current insecticides by minimising selection pressure for insecticide resistance. The following should be considered essential components of the insecticide policy.

- Lists of approved pesticides with WHO specifications and hazard classification.

- National regulatory authorities with enforcement authority on registration, sales and distribution.

- Pricing regulations for public health pesticides.

- A decision management system for pesticide selection, based on local conditions with a strong surveillance component, logical rationale for restricted pesticide use (e.g., DDT), and pesticide use linked to objective and mode of exposure (IRS, larvicide, ITN).

- General guidelines for safe use of insecticides adopted from WHO recommendations and including insecticides, equipment, application procedures, safe handling and storage, and worker protection.

2. Promote judicious, selective and sustainable use of insecticides for vector control governed by local conditions. Determine most effective methods to use, and where, when, and how to use them to maximise cost effectiveness. Use the following factors: magnitude of the problem in quantitative terms; level of transmission and risk; priority groups or areas requiring protection; information on bio-ecology of vector species; and, infrastructure and resource requirements. Continuous political and financial commitment, continuous training of workers and continuous dialogue with communities is required.

3. Adopt integrated vector management approaches (IVM) by generating alliances between programme managers and community-based partners. "Partners" become local implementing agencies for vector control, and vector control specialists provide technical and official endorsement. For success, the following steps are essential:

   - Create an awareness of the problem.
   - Analyse the technical aspects of the problem(s).
   - Discuss situation and control strategy with PIA for cost effective approach.
   - Prepare integrated plan of action regarding delegation of responsibilities (not the strategy) endorsed by the Ministry of Health.
   - Implement IVM programme with the following inputs: management, monitoring and training; financing equipment and supplies; educational activities for promotion of community action; specialized activities; and then, programme adjustment following monitoring and evaluation.
   - Create social mobilization and behavioural change in communities to attain sustainability.

   For development projects, such as water development, which are associated with foci of disease outbreaks, pre-screen plans for adverse effects. Develop eco-friendly, cost-effective and sustainable mitigation measures.

4. Institute quality control of public health pesticides and related products by formulating a pesticide registration requirement complete with all of the routine pesticide management features

and enforcement authority. Adopt WHO standards and seek commitments from national laboratories.

5. Adopt guidelines and standards for application equipment and specifications for critical parts, required calibration, and droplet spectra. Recommend personal protection measures and household insecticide dispensers, keeping within the national standards for specifications.

6. Monitor vector resistance annually in order to detect changes in susceptibility to pesticides. Take into consideration target species, seasonal aspects, geographical areas. test frequency, and required equipment. Analyse and interpret data appropriately.

7. Establish data management systems to preserve information on insecticide consumption and availability, vector resistance and locations; test kit locations and results. Establish networking capability for information exchange, using SEARO and WHO as a coordinating body.

8. Promote capacity building and updated infrastructure for vector control. Planning and implementation of IVM requires managerial experience, financial resources, access to specialised information (epidemiological, entomological, socio-cultural, environmental), and information and data management specialists. Seek human resources in the following areas: entomology, epidemiology, health impact of development programs, comprehensive vector control, pesticide decision making integrated vector management, research, training in specialised techniques.

   Use national centres of excellence for WHO training purposes and national experts as WHO specialty educators.

3.2.2 AFRO

The working paper **Pesticide Management: A Regional Perspective** was presented by Dr L. Manga, Regional Advisor for Vector Control, WHO Regional Office for Africa**.**

Public health pesticide management is part of a broader action to control disease vectors through public health programs and vector control projects, including operational research, household and other uses. Pesticide management is a process that encompasses many activities of which the most important are: production, registration, distribution, quality control, storage and handling, application, monitoring and evaluation.

In the WHO African region, the production of public health pesticides is very limited and focused on household products. This production, however, depends on external supply of active ingredients, synergists and other inputs. The most important of the products used at large scale for public health programs and projects are imported. It is unclear if, with the limited production capacity and business interests, production of public health pesticides in countries of the African region is feasible.

The standard registration procedure requires appropriate policies, a registration authority, national procedures and, technical and logistical capacity. These entities are lacking in most countries. As a consequence, many products in use in the region are not registered. There is an important role for the WHOPES to make the necessary recommendations to Member States regarding the use of non-registered products in the region and how the situation could be improved.

The distribution of appropriate pesticides is ensured through either the public sector channels (ministries of health), identified private systems or through unidentified and informal systems. The role of the informal sector in channelling pesticide products in Africa may be important. There is a need to assess the quantity of pesticide

products being channelled through these systems, which products are being distributed, and the origin of such products.

Quality control of pesticides is not routinely conducted in Africa, because only a very limited number of countries have the necessary capacity. WHO is currently identifying a collaborating centre to perform this function for the 46 countries of the region.

In countries with routine insecticide application programmes there are adequate storage facilities. However, many of them need to be upgraded. In other countries, insecticides are stored anywhere. There is a need for awareness and proper training on safe and judicious use of pesticides including within communities, where non-professional handling of pesticides is increasing, including at household level.

Even countries with established vector control programs have insufficient skills on insecticide application methods and procedures. WHO/AFRO is currently conducting a training program on insecticide application and maintenance of equipment in many countries.

Monitoring of production, distribution and usage and effectiveness of products is an important component of pesticide management activities. There is great need to develop monitoring systems which are articulated with chemical/pesticide management coordination boards.

In general, the current situation of pesticide management in the WHO African region requires a situation analysis that should lead to the establishment of inter-sectorial programs for appropriate pesticide management.

3.3 Discussion summary

The presentations on national programmes and regional perspectives generated much in-depth discussion. The more significant topics are reported below.

Quality of insecticide application

There is wide variation in the quality of application of public health insecticides. Training inconsistencies and inadequacies are common. In many situations government training programs for spraymen are inadequate or non-existent. Some applications are conducted by private entrepreneurs with little or no suitable training. Major wastage of pesticide is likely due to inaccuracy of dilutions and inconsistencies of application. Resulting worker and public insecticide exposure and environmental impact are probable. Vector under-exposure resulting from these deficiencies would increase the likelihood of selection for resistance.

While there is no easy solution to this problem, because it requires capacity building and upgrading of the training standards, the need for improvement is critical. National emphasis on training is required at all levels, utilizing WHO support and documentation. In those instances where inadequacy prevails, national level leadership is required to raise the priority on proper execution of vector control. This can be accomplished by standardizing treatment programs, certifying supervisors, and providing adequate training.

Substandard pesticides and equipment

Industry states that it cannot control its products after sale and that product stewardship does not guarantee user compliance with label directions or proper use of application equipment. National acceptance of WHO recommendations of approved suppliers and products and methods of application could reverse this trend. Preferential support from WHO for approved products from suppliers that follow appropriate production standards would enhance the impact of product stewardship and reduce procurement of substandard products.

Insecticide resistance

This complex issue is exacerbated by ubiquitous pesticide use. Vector resistance often results from exposure to agricultural pesticide products in vector breeding habitats. Selection for resistance is enhanced when both the immature and adult stages of vectors are exposed to pesticides with the same mode of action, e.g. agricultural exposure of larvae followed by ITN exposure of adults. Sublethal exposures, due to inappropriate application, failure to re-apply at appropriate intervals, or incidental exposure also lead to selection of resistant genotypes.

The primary approach to resolving this problem is through adequate monitoring for signs of resistance among vector populations. Regular routine susceptibility testing should be conducted regardless of whether resistance development is suspected. Often the perception of resistance is in reality a failure to expose the target insect, either by inappropriate or poorly timed application or by factors that exclude the target insect from exposure to the insecticide. In either case, susceptibility testing usually resolves the matter.

Prevention of resistance cannot be guaranteed if there is exposure to the pesticide. However, with competent pesticide management practices the probability of resistance may be reduced. This includes, but is not limited to, proper application, appropriate re-application interval, restricting a mode of action to a single development stage (either larvae or adults, but not both), and rotation of insecticides with different modes of action at appropriate intervals.

Tariff exemption for WHO-approved products

Import taxes in the form of duties, tariffs, special fees, etc., not only increase the expense of public health pesticides, application equipment, replacement parts and other products, but they also impede the delivery process. These add-on expenses are actually borne by those who implement them - the governments that conduct the vector control operations. There are many excellent reasons for

provision of national exemptions from such fees for WHO-approved products. It was noted that agricultural equipment enjoys tariff protection in some countries. Such exemptions would reduce costs, allow for expedited delivery to end users, and encourage users to purchase WHO-approved products. This would help to reduce misapplications of pesticides by using appropriate products and ensuring adequate product stewardship by the WHO-approved supplier. Also, there might be merit in WHO cooperative purchase arrangements for countries that would like to group together to benefit from discounts available for larger consignments.

Related to this issue is the question of patent duration. Industry is hampered by the fact that patents are about to expire shortly after new products are marketed even though it may take 30 - 40 years to realize return on investment. Industry would benefit from relaxation of patent rules in a manner that would extend the patent life for public health pesticides.

Product registration

Proper registration and regulation of public health pesticides protects the public and the environment because proper pesticide use is enforced by government. It also provides incentive for industry to develop quality products because of the awareness that procurement of quality products is a governmental objective. National registration includes the promulgation and enforcement of all aspects of pesticide usage - registration, labelling, formulation, packaging, transport, storage, distribution, application, safety, etc.

WHO involvement in the establishment of national pesticide management would provide greater uniformity and better understanding of the guiding principles of pesticide usage. Improved health and environmental safety would be likely and public health pesticides could enjoy enhanced management as a result. WHO and FAO documentation for the registration process and guidelines for pesticide management could be presented through regional and national conferences. It was recognized that regional differences

exist in pesticide management capability. Assistance to needy nations might be expedited through the auspices of the Roll Back Malaria Programme.

Insecticide treated materials

Long-lasting insecticidal mosquito nets will soon be available in world-wide markets. Discussions on commercial vs. community net treatment included the issues of human exposure to pesticides, environment impact, rotation of mode of action, expanded use and proper disposal when such items are discarded. Other treated or impregnated products include tarpaulins and tents that are factory treated. These issues deserve further attention.

Worker and public exposure

Human and environmental safety is an increasingly important facet of public health pesticide usage. Transport, distribution, handling and application create potential for both public and worker exposure. Some suggestions (in addition to those mentioned above) were put forward to reduce exposure to public health pesticides:

- use of packaged materials that do not require reformulation;
- availability of proper storage facilities;
- delivery of ready-to-mix / use product to the end user; and
- extensive public education on low risk from properly conducted applications.

Availability of WHO information

Participants reported that access to WHO publications and information has become more difficult because notification of new releases is no longer distributed directly to users. Online release of publications is an essential part of the process, but this does not help those who do not have Internet access. Furthermore, users may not know what has become available if not directly notified. One agreed-upon solution would be to provide email notice to those

interested enough to submit their mail addresses to WHO for this purpose.

Monitoring and surveillance

Monitoring environmental exposure and the effectiveness of public health pesticide applications are important facets of pesticide management. But these activities are not routinely conducted by most vector control agencies. This programme activity should be incorporated into national pesticide management plans. WHO involvement in preparation and maintenance of national pesticide management programmes would help to correct these shortfalls.

4. The working paper **Pesticide management issues in relation to the Stockholm Convention on Persistent Organic Pollutants and related UNEP activities** was presented by Dr A. Sunden-Bylehn, UNEP Chemicals, United Nations Environment Programme.

Persistent organic pollutants (POPs) are chemicals that bioaccumulate in fatty tissues, biomagnify through the food chain and cause adverse effects to health and the environment. Individual counties are unable to control the environmental pollution from POPs because they are transported through the environment across borders. Therefore, a global treaty was adopted in 2001 (but not yet completely ratified) for trade restrictions and disposal requirements for the 12 POPs on the initial list, which includes DDT. A temporary exemption from the ban has been granted for DDT for public health use.

Parties can produce and / or use DDT for disease vector control in accordance with WHO recommendations and guidelines when no locally safe, effective and affordable alternatives are available. Production and use must be notified in a public DDT register and each user must every 3 years provide information on the amounts and conditions of use and the relevance of its use in their disease

management strategy. Public health users must strictly control DDT so that it is not used for other purposes and to ensure that it is afforded proper disposal as directed by the Convention. By May 2001, 32 countries had indicated the need to use DDT for disease vector control. Under the Convention the continued use of DDT will be evaluated every 3 years.

The Global Environment Facility (GEF) has been identified as the principle entity of the interim financial mechanism to handle funding of capacity building and other related activities. Regarding the use of POPs pesticides, UNEP's activities focus on raising awareness of sustainability aspects of alternative approaches in both pest and vector control and on promoting the principle of integrated pest and vector management.

5. The working paper **The Role of Industry in Public Health Pesticide Management: Technical and Regulatory Challenges from Design to Deployment** was presented by Dr D. Kelili, CropLife International Public Health Project Team.

Pesticide manufacturers commitment to public health pesticide management may not be universally understood. Currently, industry devotes 12 to 16 years and expends $US 70 - 100 million on each new molecule that reaches the market. To realize a positive return on investment, that product may have to remain a marketable item for up to 40 years. Whereas it used to be possible to discover a marketable product with less effort, it is now quite difficult to do so because the easier discoveries have been accomplished.

A significant feature of industry's risk in product development is that the patent, which must be executed as soon as possible in the discovery process, is likely to expire before the cost of development has been recouped. The process of discovery and development to market can be viewed as series of separate phases. The initial phases of discovery average 3 - 4 years during which an estimate of minimal potential use for a new molecule is likely to be determined. The manufacturer must decide on the potential retail merits of the

discovery and whether to commit the necessary resources to its development. Products that merit further development take an average of 8 - 12 more years before reaching the market. Many products are withdrawn along the way before they complete their "life cycle" for a variety of technical and practical reasons.

Public health insecticides are considered only later in the development process because of this market's low return on investment. Furthermore, this use is less attractive because it calls for extra risk assessment for indoor exposure in addition to its duplicated regulatory aspect of international programs and national agencies constituting an extra hurdle not favoring investment. The high incidence of product abortion and the low discovery interest for public health pesticides constitute a serious security issue for global health. This issue needs to be addressed by the concerned parties: WHO, National Registration Authorities and Industry.

Products that are marketed for public health require the manufacturer's stewardship over the life of the product in terms of providing acceptable product guides for users and regulatory agencies, developing community awareness of product usefulness and limitations, training end users in the appropriate application methodologies, emergency response issues, etc. However, efforts by national agencies are needed to enforce the practices and label directions in order to ensure safety. Industry cannot control actual adherence to the label content that took many years to be completed. All parties involved must reflect on how to make recommendations understood and adhered to as well as how to reduce unnecessary hurdles that antagonize investment in public health and how to devote more time and resources to effective and safe use.

6. Summary of findings and proposed actions

Some Member States have established sound public health pesticide management practices, but this is neither standardized among Member States nor uniformly practised by vector control operations. Although most countries have legislative statutes that deal with

pesticide registration and usage, there is often no designated lead agency that sets policy and regulations. Many do not have specific performance standards for either pesticides or application equipment. Frequently there is little communication between agencies mandated for significant pesticide usage. This situation leads to inconsistency and can cause major deficiencies in pesticide management.

Thus, there is a need for national policies or improvement of existing national policies for the regulation of pesticides and enforcement of proper pesticide management. National policy should address registration and worker safety, procurement, formulation, repackaging, storage, transport, distribution, application, disposal, monitoring, resistance management and quality control. The existence of recognised policies help to maximise the efficiency of public health pesticide programmes and minimise adverse effects on human health and the environment.

Proper legislation is a key component to establishing appropriate national pesticide management plans. Statutes should authorize a lead government agency to promulgate and enforce proper rules and regulations for pesticide management. Under such leadership uniformity in pesticide containment, safe human and environmental exposure levels, worker training and other basic factors can be realized. Pesticides and equipment can be procured with the expectation of satisfactory performance. The public can be informed about vector control and other pesticide use activities and be able to compare the risks of pest control versus the risks of not controlling them.

WHO conducts in-depth professional level investigations on public health pesticides and application equipment. It evaluates these products in order to be able to make recommendations to Member States about selection criteria and procurement of pesticides. Because pesticides can be hazardous when misused, WHO provides guidelines for acceptable management and judicial operational practices for vector control. Details can be found in WHO documents and on the Internet at

http://www.who.int/ctd/whopes and in FAO documents on pesticide management at http://www.fao.org/waicent/faoinfo/agricult/agp/agpp/pesticid/. Country agencies can keep abreast of new developments by submitting their e-mail addresses to WHOPES in order to receive automatic notice of new and modified advisories.

It is important that Member States adopt national policies related to pesticide management, including vector control activities. Improved pesticide management practises can lead to reductions in pesticide usage, extended usefulness of specific pesticides and application equipment, and safer conditions for pesticide workers and the public. The following discussion depicts pest management functions that can be implemented and/or improved in Member States to enhance vector control, reduce potential risk to human and environmental health and achieve greater benefits in relation to expenditures.

6.1 Product registration

Each Member State should include in its pesticide legislation statutes that enable the delegation of authority for pesticide oversight, promulgation of regulations, and compliance enforcement to reside within a single agency. This designated agency would be responsible for ensuring that governmental, commercial and private pesticide usage conforms to written national standards. Within this delegated authority would be the understanding that there are some basic differences in pesticide application methods and risks between user groups, such as agriculture, vector prevention and control, structural pest control, etc. Special legislative consideration should be afforded to public health pesticide management because of the relatively low public and environmental risk attached to the proper conduct of vector control and the need for rapid response in emergency situations involving arthropod-borne diseases. Effective national registration policies will speed up the introduction of safer, more effective public health pesticides.

Vector control products and equipment should be exempted from customs duties, entry taxes and special tariffs in order to reduce the

cost of protecting the public from arthropod-borne disease and annoyance and to expedite essential pesticide product delivery to national, regional and local public health and vector control agencies. These agencies should be fully responsible for compliance with national pesticide management regulations and practices in the use of these tariff-exempted items.

WHO act as official international clearing house for determination of acceptability of public health pesticides and application equipment and practices. Therefore, national legislative statutes should recognise published WHO guidelines for the purpose of registration and procurement of vector control products and for operator safety. Such recognition would expedite the availability of appropriate pesticides and equipment and minimise the probability of acquiring substandard products. It would also reduce or eliminate the need for local product testing and assessment prior to registration or re-registration.

In this regard and in addition to the above discussion, national pesticide management authorities should adopt the following policies:

- Harmonize, through legislative action, the national pesticide registration system for public health pesticides and products with the WHOPES Evaluation System, which assesses chemical and environmental data, safety information and procedures, and cost analysis for vector control pesticides, equipment and products, including insecticide-treated materials.

- Designate a lead agency for pesticide regulation and enforcement.

- Seek WHO technical support in the development of national pesticide legislation.

- Avoid unnecessary national duplication of WHO data collection and assessment by adopting WHO specifications and not routinely requiring additional in-country testing of vector control related products. When such tests are deemed necessary because of lack of adequate data for special ecological situations, expedite them and limit them to the minimum levels required to confirm acceptability.

- Require collection and publication of data on pesticide imports, and maintenance of records on local use of formulations and misuse of pesticides.

6.2 Procurement

Major costs and administrative problems can be avoided by advance planning and the adoption of proper purchasing routines related to vector control. In addition to the need for tariff exemption and the regulatory aspects discussed above, it should be understood that pesticide procurement is highly specialised and complex. Because of the quantities involved and the necessary lead time to ensure timely inventory replacement, experienced and knowledgeable staff should be dedicated to procurement for vector control. In most cases the actual purchases are more effectively conducted at the central national administrative level, rather than at regional or local levels. It may be appropriate to refer to the International Code of Conduct for Distribution and Use of Pesticides and WHO guidelines/recommendations when planning vector control procurement.

Because of the professional effort expended by WHO in assessing vector control products, selection of products approved by these international agencies will best assure their acceptance and durability. International and local markets offer a great variety of substandard pesticide and equipment products which, if purchased, may fail in operational conditions and could cause unnecessary health and environmental risks. This risk can be minimised by procuring WHO approved products. Any potential for extra initial

cost is retrieved by added product durability, quality, dealer and manufacturer support and reduced replacement needs.

Industry's role does not end when the product has been shipped. Technical support, training and product stewardship are essential post-sales activities of pesticide producers. These activities are essential to ensure proper use of the pesticide and application equipment products.

In this regard and in addition to the above discussion, procurement of public health pesticide management products should also be guided by the following policies:

- Include the specifics of after-sale support, maintenance, training and stewardship commitments in initial tenders.

- Follow published WHO guidelines for tenders and for approved products.

- Routinely publish, post and otherwise distribute details of procurement contracts.

- Require that donated public health pesticides and products are pre-certified to meet established WHO specifications and conditions for approval and are available for use within the product use dates.

- Specify appropriate packaging and require clear labelling so that end-users will receive pesticide products in a ready-to-use-form whenever possible and thereby avoid unnecessary pesticide exposure from reformulation and/or ensure compliance to appropriate labels.

- Specify packaging that will ensure efficacy, shelf-life, human and environmental safety in handling of the packaged product.

- Procure recommended protective clothing and devices to minimise worker exposure to pesticides.

- Instruct suppliers to provide shipping documents that clearly identify "tax-exempt" contents in order to optimize the likelihood of timely delivery to end-users.

- Require manufacturer's certificate of analysis and product acceptability.

- At the national level conduct pre-distribution and after-sale chemical and physical analysis of product.

6.3 Formulation and repackaging

The sale and distribution of public health pesticides may require the assistance of formulators to dilute the product or alter it to forms suitable for a variety of uses and then repackage and re-label the resulting products. For a variety of reasons the original product may be subject to repackaging without reformulation. These processes need to be closely controlled by the government to ensure that proper safeguards exist for prevention of illegal product diversion and that reformulated products meet accepted quality and labelling standards. Equally important is the consideration of human and environmental exposure that might result if accidental spills or improper handling occurs during reformulation.

In this regard and in addition to the above discussion, production and distribution of reformulated public health pesticide products should also be guided by the following policies:

- Require that formulators are registered, certified and regulated.

- Aggressively enforce national pesticide regulations.

- Prevent unauthorized sale or distribution of vector control pesticides.

6.4 Storage and transport

Handling of public health pesticides and equipment for storage and transport may affect product efficacy or cause contamination of the surroundings. To protect from adverse events and accidental poisonings, there are specific rules and conditions for safe storage and transport. The governmental agency designated the responsibility for managing pesticides is obliged to promulgate and enforce rules and regulations for safe, responsible storage and transport. These include maintenance of the original product labels, spill prevention, container adequacy, proper signage in storage, facility specifications, product separation, protection from moisture and contamination by other products, restriction of access, and other restrictions to ensure product integrity and safety.

In this regard and in addition to the above discussion, storage and transport of public health pesticide management products should be also be guided by the following policies:

- Follow WHO / FAO guidelines for handling pesticide-related products during storage, transport, fires and spills.

- Require official reports to the national level and follow-up enquiries on fires, spills, poisonings and other hazardous events.

6.5 Distribution

Strict regulations should apply to the distribution of public health pesticides. When undiluted, these products may be highly toxic even though they are safe to use as indicated on the label after dilution. Misdirection or mishandling can cause the product to get into the hands of uninformed recipients or cause human or environmental risk. Thus, proper packaging is important (see the International Code of Conduct for Distribution and Use of Pesticides at http://www.fao.org/waicent/faoinfo/agricult/agp/ agpp/pesticid/).

In this regard and in addition to the above discussion, distribution of public health pesticide management products should be also be guided by the following policies:

- Select original packaging suitable for avoiding repackaging for distribution.

- Ensure that distributor is aware that the shipment is a public health product.

- Suppliers are not usually responsible for actions of independent distributors.

- Distributors must provide timely service to ensure that products are available on an agreed date that takes into consideration the time of the original order and other related shipment matters.

- Procurement process should anticipate shipment and distribution schedules.

6.6 Application

Application of public health pesticide products is a complex function. Application complexity exists because of the multiplicity of target insects and habitats, seasonal variability, and the many different control strategies.

Professional expertise is required at each organizational level. Trained and knowledgeable leadership is essential to ensure that the correct application technology is safely utilized. To attain the necessary expertise at all levels of public health pesticide management, formal and repeated training is required. Documentation for such training can be acquired from WHO and FAO. Subject matter manuals and documents should be made available at all levels, and knowledge of their contents should be demonstrated through a certification process for all supervisory and

managerial personnel, the only exceptions being seasonal worker-applicators. These usually temporary employees should be trained at the beginning of each season.

A basic premise of application technology is to be selective in the use of specific pesticides so that the appropriate material is applied at the proper place and time, and in the prescribed manner under the guidance of a certified supervisor. Public health pesticides are used judiciously within the context of an integrated vector management (IVM) program in which several other measures may be used concurrently or in a sequential fashion - against the same or another stage of the vector's life cycle. Further discussion on this topic is beyond the scope of this document, but it is important that the management skills required be present among the on-site workforce.

In this regard and in addition to the above discussion, application of public health pesticides and use of approved application equipment and other products should also be guided by the following policies:

- Provide training and resource manuals for staff, based on WHOPES documents or equivalent sources.

- Require certification and annual refresher/update training at all management and supervisory levels.

- Provide and enforce the use of protective clothing / devices to minimise worker exposure to pesticides.

- Apply pesticides safely according to best management practices as outlined by WHOPES.

- Utilise integrated vector management approaches whenever feasible.

- Institute procedures to prevent and monitor incidents of misuse.

- Maintain accurate records of application sites, rates, worker exposures, etc.

6.7 Maintenance and disposal

Public health pesticides, application equipment and other products require routine attention and maintenance. Dedicated funds and manpower should be available for this purpose. In order to remain fully operational it is necessary to maintain adequate inventories of pesticides, equipment and replacement parts. Lacking these, it may become impossible to correctly apply the necessary materials at times suitable for disease intervention.

When pesticides and pesticidal products are outdated or otherwise compromised, there are specific methods of disposal that must be followed. This activity should comply with international standards for disposal of hazardous materials. Likewise, when equipment is no longer serviceable it should be removed from inventory, decontaminated and dis-assembled to ensure that it will not be subsequently diverted to other uses because of its unreliability.

International treaties dictate disposal options on some insecticides. Technical guidelines are to be developed under the framework of the Basel Convention on Transboundary Movement of Hazardous Waste and the Stockholm Convention on Persistent Organic Pollutants (POPs). These guidelines when available will apply to DDT, the single POP currently in use in vector control.

In this regard and in addition to the above discussion, maintenance and disposal of public health pesticides and products should be also be guided by the following policies:

- Follow WHO / FAO Guidelines for handling pesticide-related products during storage, transport, fires, spills and disposal.

- Where available, utilise GTZ international disposal resources.

- Prevent emptied packaging and containers, rinsates and outdated products from endangering human and environmental health.

- Utilize industry / pesticide provider information on the label or supporting packet regarding pesticide-specific disposal protocols, and follow provider's stewardship advice.

6.8 Monitoring and surveillance

Public health pesticide usage may on occasion cause environmental contamination or adverse human effects. Organized vector control units are responsible for monitoring and reporting such events and for confirming application efficacy. Often it is possible to take corrective action regarding adverse impact or reduced efficacy if the event is recognized and reported in a timely manner.

Worker exposure to public health pesticides may be more intense than that of the general public because the worker may handle pesticide concentrates on a regular basis. In addition to providing protective clothing and equipment and requiring that it be used properly and in appropriate circumstances, the organization may be responsible for serological monitoring of worker exposure.

In this regard and in addition to the above discussion, surveillance and monitoring of human and environmental exposure to public health pesticides and application efficacy should be also be guided by the following policies:

- Promote monitoring of personnel for pesticide exposure at frequencies and with methods recommended by WHOPES.

- Maintain records on poisoning events and report each to the national level.

- Conduct routine monitoring of application efficacy at the frequency and with the methodology recommended by WHOPES.

- Maintain records of public health pesticide usage by product, quantity and location.

6.9 Management of insecticide resistance

Loss of susceptibility to a pesticide or class of pesticides is termed resistance. Vectors may become resistant through repeated exposure to a specific pesticide or a class of pesticides with a similar mode of action. Often the phenomenon is related to exposure to pesticides that were used for control of other insect pests co-existing in similar habitats. When resistance occurs in a vector it may no longer be feasible to use that pesticide. Until it is replaced by an effective pesticide, interruption of disease transmission may be very difficult.

Thus, it is important to monitor target mosquito populations for signs of the development of resistance. There are effective methods for doing this, and each program should incorporate a system of surveillance to detect the onset of resistance at the earliest stage possible. In addition, agencies should use appropriate integrated pest/vector management practices to delay or prevent the phenomenon.

In this regard and in addition to the above discussion, resistance management and surveillance should be also be guided by the following policies:

- Follow WHO recommendations for systematic monitoring of susceptibility.

- Utilise WHO guidelines for resistance prevention and management.

- Use appropriate application equipment calibrated for proper droplet size range and only the application rates designated on the label.

- Re-apply residual and long term products at designated intervals.

- Maintain cross-communication with other agencies conducting similar monitoring.

6.10 Quality control

Several processes in public health pesticide management can be monitored by systematic quality control tests or observations. Perhaps the most important of these is the insecticidal activity of the pesticide. If the concentration of active ingredient or the physical characteristics of the formulation fall below acceptable levels, the application may not provide adequate control. And at the same time it may initiate the onset of resistance by selection of the tolerant individuals that survive exposure to the pesticide.

In this regard and in addition to the above discussion, monitoring public health pesticides for the level of active ingredient should be also be guided by the following policies:

- Require manufacturer's certificate of analysis of product activity and formulation acceptability for every batch (production lot) purchased and accept only those that meet specifications and have acceptable expiration dates.

- Follow WHO specifications for chemical analysis and formulation and perform all relevant quality control tests.

- At the national level, conduct pre-dispatch and after-receipt analysis of pesticides as is warranted, utilizing WHO Collaborating Centres when available.

6.11 Capacity building

Many countries do not have an agency dedicated specifically to pesticide management. As a result the infrastructure for training and execution of pesticide management in vector control programs may be inadequate. This imbalance can lead to inconsistencies in public health pesticide usage and effectiveness. It may cause increased human and environmental risk from improperly managed pesticides. To correct this imbalance it is necessary to designate a lead agency that will provide the expertise to manage and regulate pesticides. Vector control activities then have access to proper guidance and training tools that lead to proper public health pesticide management.

In this regard and in addition to the above discussion, capacity building should be also be guided by the following policies:

- Designate a lead agency to regulate and enforce compliance for all pesticide use, including public health.

- Provide informed leadership in pesticide matters.

- Provide training, education and certification for employees engaged in pesticide-related activities dealing with what, how, when and where pesticides will be used.

- Recognise the different needs of upper, middle and lower management and arrange training and support for pesticide management accordingly.

6.12 Public education

Public support for the use of public health pesticides is an increasingly important factor in effective management of the vector control process. Long term strategies are required to educate the public sufficiently for it to draw informed conclusions about the pesticide management practices in question. Therefore, all levels of public health pesticide management should maintain active programs

for informing the public and providing accurate information about vector control programs.

In this regard and in addition to the above discussion, public education efforts should also be guided by the following policies:

- Use multiple-media approaches to inform the public repeatedly of reasons for pesticide use, any risks involved, and the possible consequences of not using pesticides.

- Provide these informational releases throughout the year, not only at the onset of control activity.

- Advise the public on reasons for selecting specific pesticides and targeting specific diseases.

- Educate high level government and community decision-makers on options available for vector control, the risk of pesticide use versus the risk related to failure to use pesticides when required in integrated management programs.

- Train management and field personnel how to interact with the public and serve as public education messengers.

- Inform legislators about public health pesticide management and vector control so that they will be better informed about these issues.

7. General recommendations

Public health pesticide management is operating at differing levels of acceptance within vector control units among Member States. The findings of this committee suggest several areas of concern as indicated in sections 3.3 and 6 of this report. Section 6 specifically addresses approaches that national authorities should implement to improve public health pesticide management practices.

There is an urgent need to nationalize pesticide management procedures in the public health arena. Too many Member States lack the very basic infrastructure and skills necessary to safeguard the products required to protect the public from arthropod-borne disease. Many that have the infrastructure lack the appropriate regulations or authority to ensure appropriate usage. Adverse human and environmental consequences are a direct result of these shortcomings at the national level.

These shortcomings can be overcome by adherence to the dictates of WHO pesticide recommendations and registration policies. National bodies should accept WHO pesticide guidelines and harmonize internal registration and management procedures to match the objectives espoused by WHO. They should take advantage of WHO assessments of new products and formulations. By providing favored status and waiving duties and import fees, nations can expedite the distribution of essential public health products. And by allocation of adequate personnel and facilities, it will be possible to meet international standards for the use of public health pesticides and application equipment.

In order to implement these approaches in support of the factors discussed in this report and particularly those outlined in section 6, the following recommendations are presented.

- Strengthen national capacities to implement pesticide management practices.

- Promote efficient and harmonized registration of public health pesticides, taking into account WHOPES recommendations for use and specifications.

- Provide consideration and planning for pesticide resistance monitoring and its management.

- Promote the close collaboration between WHO, Industry (pesticides, application equipment and other relevant

products), research organizations, and national authorities in order to promote sound pesticide management.

- Take steps to improve dissemination of information concerning WHOPES recommendations and specifications and other relevant documents, using email, the Web-site and other methods. Recipients should include WHO country offices, other UN agencies and relevant NGOs, national regulatory authorities, and national vector control organisations.

ANNEXES

Annex 1. Agenda

Thursday, 30 May 2002

09:00 – 09:10	**Opening of the meeting and appointment of officers** Dr María Neira, Director, Communicable Disease Control, Prevention and Eradication (CPE)
09:10 – 09:25	**Welcome addresses and presentation of the participants:** Dr Lorenzo Savioli, Coordinator, Strategy Development and Monitoring for Parasitic Diseases and Vector Control (PVC)
09:25 – 09:45	**The WHO Pesticide Evaluation Scheme (WHOPES) – progress report and objectives of the meeting** Dr M. Zaim, CPE/PVC/WHOPES
09:45 – 10:00	**LSHTM Gates Malaria Programme and WHOPES: Development of alternative insecticides** Dr M. Rowland, London School of Hygiene and Tropical Medicine (LSHTM)
10:00 – 10:15	**Development of long-lasting insecticidal fabrics: An update** Dr P. Guillet, CPE/PVC
10:15 – 10:30	**Dengue and lymphatic filariasis vector control: An update** Dr M. Nathan
10:30 – 11:00	**Coffee break**

	Critical review of public health pesticide management practices in Member States
11:00 – 11:20	- India Dr D. Kanungo, Directorate of Plant Protection, Faridabad, India
11:20 – 11:40	- Sri Lanka Dr P.W. Fernando, Anti Malaria Campaign, Colombo, Sri Lanka
11:40 – 12:00	- South Africa Dr R. Maharaj, Medical Research Council, South Africa
12:00 – 12:30	**Discussion**
12:30 – 14:00	**Lunch break**
	Country reports continued
14:00 – 14:20	- Brazil Dr L.C. Meirelles, ANVISA, Brasilia, Brazil
14:20 – 14:40	- Madagascar Dr C. Ravaonjanahary, Antananarivo, Madagascar
	Public health pesticide management – Regional perspective
14:40 – 15:05	- SEARO Dr C. Prasittisuk, Regional Adviser, WHO Regional Office for South-East Asia

15:05 – 15:30	- AFRO Dr L. Manga, Regional Adviser, WHO Regional Office for Africa
15:30 – 16:00	**Coffee break**
16:00 – 17:00	**Discussion**
18:00	**Reception – WHO Cafeteria, Main Building**

Friday, 31 May 2002

09:00 – 09:30	**Pesticide management issues in relation to the Stockholm Convention on Persistent Organic Pollutants and related UNEP activities** Dr A. Sunden-Bylehn
09:30 – 10:00	**The role of industry in public health pesticide management: Technical and regulatory challenges from design to deployment** Dr D. Kelili
10:00 – 10:30	**Coffee break**
10:30 –12:00	**Discussion**
12:00 –14:00	**Lunch break**
14:00 – 17:00	**Conclusions and recommendations**
17:00 – 17:10	**Closure of the meeting**

Annex 2. List of participants

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