UNITED NATIONS ENVIRONMENT PROGRAMME

Chemicals

UNEP

PROCEEDINGS

of the Regional Workshop on the Management of Persistent Organic Pollutants (POPs)

Hanoi, Vietnam, 16-19 March 1999

IOMC

INTER-ORGANIZATION PROGRAMME FOR THE SOUND MANAGEMENT OF CHEMICALS

A cooperative agreement among UNEP, ILO, FAO, WHO, UNIDO, UNITAR and OECD

PROCEEDINGS
of the Regional Workshop on the Management of Persistent Organic Pollutants (POPs) Hanoi, Vietnam, 16-19 March 1999

CONTENTS

Introduction

UNEP Governing Council Decision 19/13C, adopted in February 1997, which promoted international action to protect human health and the environment through measures to reduce and/or eliminate releases of twelve specified persistent organic pollutants (POPs), called on UNEP to act as follows:

- to prepare for and convene an Intergovernmental Negotiating Committee (INC) to prepare a legally binding instrument on POPs
- to initiate a number of immediate actions including: intensify POPs information exchange, improve availability of information on alternatives to POPs, assist countries in identifying PCBs as well as dioxin and furan sources, and develop an inventory of PCBs destruction capacities.

To increase awareness of developing countries and countries with economies in transition of POPs-related problems, initiate immediate action at the national and regional/subregional levels and prepare the countries for international negotiations on a future global POPs convention, UNEP jointly with the Intergovernmental Forum on Chemical Safety (IFCS) organized eight regional/subregional POPs Awareness Raising Workshops across the globe in July 1997 – June 1998. The proceedings of the meetings were published in the UN languages specific to each region and distributed world-wide.

UNEP assisted the governments in convening INC and organizing its two meetings held in Montreal, Canada in mid-1998 and Nairobi, Kenya in January 1999. The third meeting of INC will be held in Geneva, Switzerland from 6-11 September 1999. In addition, two meetings of an expert group established by INC to develop science-based criteria and a process for identifying additional POPs as candidates for future action were organized by UNEP in Bangkok, Thailand, November 1998 and Vienna, Austria, June 1999.

As a follow-up to the POPs awareness raising campaign, a Regional Workshop on the Management of POPs was organized by UNEP jointly with the National Environment Agency (NEA), Ministry of Science, Technology and Environment of Vietnam in Hanoi, Vietnam from 16-19 March 1999. The purpose of the meeting was to encourage the countries of the Asia and the Pacific Region to initiate development of national strategies and action plans for reducing/eliminating releases of POPs, assist national officials, including POPs national focal points, implementing immediate national and/or regional actions determined to protect against the risks of POPs and prepare countries for technical implementation of a future global convention on POPs.

The workshop was attended by government experts and decision makers from twenty three countries of the region and from the South Pacific Regional Environment Programme (SPREP) which represented fourteen small island countries of the South Pacific. Representatives from UNEP Chemicals, SBS, UN ECE, WHO, AMAP, ASEAN, Greenpeace, IPEN and a number of observers also attended (list of participants is attached). The meeting was financed by the Government of Australia, Inuit Circumpolar Conference (ICC) and UNEP. Expert presentations were provided by a few leading experts invited from inside and outside the region as well as from intergovernmental and non-governmental organizations (programme of the meeting is attached).

The participants in the meeting were updated on recent POPs-related activities of international and regional IGOs and NGOs as well as on the progress made by INC in discussing a future global convention on POPs. Presentations were also made to upgrade knowledge of participants on modern trends, policies and practices in managing industrial chemical POPs, unintended by-products/contaminants and pesticides, and provide information on approaches for developing inventories of POPs in use, in stockpiles, and being released to the environment as well as information and data on reducing risks of POPs, including safe destruction/disposal and cleaner production, selection chemical and non-chemical alternative substances and technologies.

Various case studies of POPs-related health and environmental problems and the challenges posed by POPs experienced by countries in the region and beyond were discussed in the two workshop working groups (POPs pesticides; and industrial chemical POPs and unintended by-products/contaminants). Actions taken by countries to address both national and regional problems posed by POPs were also considered. Finally, the workshop discussed development of national strategies and action plans and immediate actions for reductions in the risks of POPs.

These proceeding contain reports from the workshop working groups and expert presentations. The proceedings will be made available at the third session of POPs INC and on the Internet: www.chem.unep.ch/pops.

Programme of the Meeting

Monday, 15 March

18:00-19:00 Meeting of Workshop Presenters (at the Mekong Room, Hanoi Horison Hotel)

Tuesday, 16 March

08:00-9:00 Registration

I. OPENING SESSION - Van Mieu 1 Meeting Hall

09:00-09:30 Official opening of the meeting

Opening remarks — **Pham Khoi Nguyen, Vice-Minister of Science, Technology and Environment**
J. Willis, Director, UNEP Chemicals

Presentation of participants

Overview of programme — **G. Shkolenok, UNEP Chemicals**

09:30-10:00 Keynote Presentation:

Global Action on POPs: Objectives and Strategy — **J. Willis, UNEP Chemicals**

10:00-10:30 **Break**

II. RECENT DEVELOPMENTS IN ADDRESSING THE POPs PROBLEM: THE WORK OF GLOBAL AND REGIONAL MULTILATERAL ORGANIZATIONS AND NON-GOVERNMENTAL ORGANIZATIONS

10:30-12:00 Panel discussion.

Moderator: **A. Munro, SPREP**

Progress in the Negotiations on the Global POPs Convention — **J. Willis, UNEP Chemicals**

UN ECE Protocol on POPs: Provisions and Management Options — **L. Nordberg, UN ECE, Geneva**

Main Results of the AMAP Assessment of POPs Pollution — **V. Kimstach, AMAP, Oslo**

ASEAN Working Group on Transboundary Pollution: Regional and Country Perspectives — **Somsak Pipoppinyo, ASEAN**
Nisakorn Kositratna, Thailand

Policies and Strategies of the International POPs Elimination Network — **J. Weinberg, Greenpeace, Chicago**
R. Quijano, IPEN, Manila

12:00-12:30 **Group discussion**

12:30-13:30 **Lunch**

III. WORKING GROUP SESSIONS

WORKING GROUP 1
Group Leader H. Fiedler, Germany
INDUSTRIAL CHEMICAL POPs AND
CONTAMINANTS/UNINTENDED BYPRODUCTS
Moderator: **Kyung-Hee Choi, Republic of Korea**

13:30-15:00
1. PCBs

Arctic Council/AMAP/Russia Action to Deal with PCBs
V. Kimstach, AMAP, Oslo

The Problem of PCBs in Electrical Equipment and Spillages - European-tested Decontamination and Remediation Technologies for Addressing Similar Problems in South-East Asia
J. Ehretsmann, A. Duhamel
APTECHNOLOGIES, Switzerland

15:15-17:00

PCBs Management in Canada
D. Stone, Canada

The Success of Nationally Co-ordinated Efforts to Manage PCBs in Australia
I. Rae, Australia

Group discussion

WORKING GROUP 2
Group Leader A. Sunden-Bylehn, UNEP Chemicals
POPs PESTICIDES

Moderator: **R.Ouijano, IPEN**

13:30-14:00
Introduction
1. Characterization of POPs Pesticide Use
A. Sunden-Bylehn, UNEP Chemicals
Group discussion

14:15-15:00
2. Available Alternatives and Strategies for Replacing POPs
a) vector control
Alternatives to POPs for Disease Vector Control: Methods and Strategies
R. Bos, WHO, Geneva

15:00-15:15 **Break**

15:15-16:15

New Perspectives on Alternatives to DDT for Malaria Mosquito Control
P.C. Matteson, FAO-Vietnam
Group discussion

16:15-17:15

b) agriculture and other sectors
Integrated Pest Management (IPM)
M. Whitten, FAO-Philippines,
Lim Guan Soon, CAB International, Malaysia
Group discussion

17:30-19:00 **Cocktail reception** (hosted by UNEP Chemicals)

Wednesday, 17 March

09:00-10:30

WORKING GROUP 1 (continued)

Moderator: **Kyung-Hee Choi, Republic of Korea**

2. Dioxins and Furans

National and Regional Dioxin Inventories
H. Fiedler, Germany

Dioxin Reduction in Japan
J. Abe (presented by Y. Maesawa), Japan

Dioxin Inventory Project in Thailand
Pornpimon Chareonsong, Thailand

WORKING GROUP 2 (continued)

Moderator: **V. P. Sharma, India**

3. Experiences Using Alternative Approaches

a) vector control:

Opportunities and Challenges in Sustainable Malaria Control in India
V.P. Sharma, India

Malaria Control Programme – Sri Lankan Experience
S. de Silva, Sri Lanka

Group discussion

10:30-11:00 **Break**

11:00-12:30

Dioxin Inventory New Zealand:
from Fact Finding to Regulation
H. Ellis, New Zealand
(presented by H. Fiedler)

Group discussion:
Data Generation, Analytical Requirements,
Data Quality and Data Control
Guidance on Establishing an Inventory

Integrated Pest Management (IPM)
M. Whitten, FAO-Philippines,
Lim Guan Soon, CAB International, Malaysia

Termiticides in Australia: Replacing OCPs
I. Rae, Australia

Group discussion

12:30-13:30 **Lunch**

13:30-14:15 **First reports from working groups: the Issues Identified**

14:15-15:15 Panel discussion. Moderator: **J. Willis, UNEP Chemicals**

UNEP Immediate Actions to Support Activities on POPs **A. Sunden-Bylehn, UNEP Chemicals**

Presentation of POPs Clearing House **A. Kool, UNEP Chemicals**

UNEP's Databank on Alternatives and Collection of Action Plans/Studies **A. Kool, UNEP Chemicals**

15:15-15:30 **Break**

IV. MANAGEMENT OF UNWANTED STOCKPILES OF POPs

15:30-17:00 Panel discussion. Moderator: **Nisakorn Kositratna, Thailand**

Collecting and Destroying OCPs and Other Pesticides in Australia **I. Rae, Australia**

Environmentally Sound Management of POPs Wastes **V. Jugault, SBC, Geneva**

Actions on Managing/Disposing of Unwanted Stocks of Pesticides **J. Willis, UNEP Chemicals**

General discussion

18:00-20:00 **Dinner** (hosted by the Government of Vietnam)

Thursday, 18 March

09:00-10:30

WORKING GROUP 1 (continued)

Moderator: **Kyung-Hee Choi, Republic of Korea**

Group discussion:
Needs for Immediate Action at the National Level

Recommendations to Players at National, Regional and International Levels

WORKING GROUP 2 (continued)

Moderator: **V.P. Sharma, India**

Selecting Alternatives and Alternative Strategies – Need for Co-ordination
A.Sunden-Bylehn, UNEP Chemicals

Group discussion:

Needs for Initiating Action at the National Level

Recommendations to Players at National, Regional and International Levels

10:30-11:00 **Break**

11:00-11:20 Working group session (continued)

V. NATIONAL AND REGIONAL POPs RELATED ACTIONS

11:20-12:30	Panel discussion	Moderator: **L. Nordberg, UN ECE**
	POPs: Current Situation in Nepal	**P. Manandhar, B. Palikhe, Nepal**
	The Situation of POPs in the Republic of Maldives	**A. Majeed, Maldives**
	Actions Taken to Reduce/Eliminate the Releases of POPs in the Republic of Korea	**Kyung-Hee Choi, Rep. of Korea**
	Current Status of Persistent Organic Pollutants in Mongolia	**D. Sodnom, Mongolia**
	POPs Management in Cambodia	**To Gary, Cambodia**
12:30-13:30	**Lunch**	
13:30-14:00	**Reports from working groups**	
14:00-15:00	Panel discussion (continued)	
	Management of Persistent Organic Pollutants in Indonesia	**K. Untung, Indonesia**
	National Experience to Enforce Ban on the Production and Use of POPs	**M. Hossain, Bangladesh**
	Country Report on POPs	**M. Tahir, Pakistan**
	Addressing POPs Related Problems in Small Island Countries	**A. Munro, SPREP**
	Studies of Persistent Organic Pollutants in Malaysia	**Cheah Uan Boh, Malaysia**
	National Action Plan for the Management of POPs in Malaysia	**V. Pachaimuthu, Malaysia**
	Group discussion	
15:00-15:30	**Break**	
15:30-17:00	Panel discussion (continued)	
	Moderator: **R. Bos, WHO**	
	Pesticides Industry in India: POPs; DDT and Malaria	**J. Singh, India**
	Preliminary Study of Pesticides Contamination in Inlay Lake Environment of Myanmar	**U Than Aye, Myanmar**
	Management of POPs in Myanmar	**Daw Kyi Kyi Myint, Myanmar**
	Current Philippine Initiatives on Chemical Management and Emission Control	**E. Navaluna, Philippines**
	Results of a POPs Case Study from Vietnam	**Le Thi Bich Thuy, Vietnam**

Friday, 19 March

09:00-09:30	Initiation of POPs related Case Studies	**J. Willis, UNEP Chemicals**
	POPs-related Activities under GEF	**H. Fiedler, Germany**
09:30-10:00	**General discussion:**	
	Development of National Strategies and Action Plans for Reducing/Eliminating POPs	Moderator: **Nguyen Khac Kinh, Vietnam**
10:00-10:30	**Break**	
10:30-11:15	**General discussion:**	
	Needs for Capacity Building and Possible Regional Co-operation to Address POPs Issues	
11:15-11:30	Procedure for completing the meeting report	**G. Shkolenok, UNEP Chemicals**
11:30	Closure of the meeting:	
	remarks by UNEP Chemicals and NEA	**J. Willis, Director, UNEP Chemicals, Nguyen Ngoc Signh, Director General, NEA**

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Working Group 1 Report

Working Group Industrial Chemical POPs and Contaminants/Unintended Byproducts

- Moderator: Kyunghee CHOI, Rep. of Korea
- Rapporteur: Vellayutham PACHAIMUTHU, Malaysia
- The WG comprised representatives from 16 countries, namely: Australia, Bangladesh, Cambodia, China, India, Indonesia, Japan, S. Korea, Malaysia, Myanmar, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, Vietnam. In addition
- Representatives from Greenpeace, AMAP Program, UN-ECE convention, Secretariat of the Basel Convention

1 Polychlorinated Biphenyls (PCB)

1.1 The WG Summarized the Present Status of PCB in the Region as Follows

- All countries in the Asia-Pacific region have banned the import of PCB. Care must be taken with second-hand equipment which may contain PCB.
- Presently, there is no PCB production in the region. However, practically, in most countries PCB is still in use in transformers and capacitors and other electrical equipment. These are the major sources of PCB.
- The issue of alternatives to PCB was raised.

1.2 The Management of PCB

- The wide use of PCB in transformers and capacitors has caused potential threat to the environment and human health.
- It is therefore imperative that a program of action is being developed and implemented to destroy PCB.

For the success of this program, the working group has identified the following issues that need to be resolved:

(i) Need for government involvement
(ii) Financial support
(iii) Need for comprehensive inventory of electric installations, storage and disposal facilities. Inventory of other sources of PCB.
(iv) Availability of technology to destroy PCB in the region
(v) Public perception of the technologies applied to decontaminate PCB and PCB-containing wastes
(vi) Alternatives for the replacement of PCB
(vii) Pro’s and con’s of PCB wastes export for final disposal/destruction. Mobile vs. stationary plants.
(viii) Presence of large stationary plants for destruction of waste materials such as PCB may be a disincentive for the industry to adopt cleaner technology
(ix) Lack of data on destruction vs. removal efficiency
(x) Non-incineration technolgies developed and proven in the region are an option for broader application
(xi) Application of e.g. cement kilns to destroy PCB is not a recommended option. If used, it is required that they are specially adapted for this purpose and that they comply with emission standards.
(xii) Need to raise monitoring capabilities by capacity building in countries
(xiii) Rehabilitation of contaminated sites

(xiv) Cost factor for all destruction/decontamination technologies

2 Dioxins and Furans (PCDD/PCDF)

- Have never been produced intentionally
- Are unwanted byproducts of chemical industrial and combustion processes
- From industrialized countries it is known that in the past, the chemical industry was the major source of environmental contamination. Today's major releases are from combustion processes
- There is hardly any quantitative information on sources of dioxins and furans in the Southeast Asia-Pacific Region nor on environmental or human levels

2.1 Issues Identified by the Working Group

(i) Lack of facilities / technology which operate "dioxin-free"
(ii) Lack of analytical capacity in the region (due to high costs). Lack of experienced and skilled personnel.
(iii) Need for baseline information of dioxin and furan contamination in environment/foodstuffs/humans (→ trend analysis)
(iv) Testing of e.g. pesticides, dyestuffs in use in this region for dioxin/furan contamination; search for alternatives or cleaner production processes
(v) The Thai-German project to establish a dioxin inventory for Thailand (including confirmatory measurements) can be a pilot project for other countries in the region.

Needs for Initiating Action at the National Level

- Awareness-raising in all sectors – government, industry, and community – is needed in all countries of the region
- Establish a communication network in the country
- Establish a national action plan (define goals, scales and time frame)
- Begin construction of a POPs inventory (to be updated progressively)
- Establish ongoing education and training programs involving all sectors

Recommendations to Players at National, Regional and International Levels

- Regional harmonization may be difficult as the region is extremely large. Ways to facilitate interaction are to be found (Note that UNEP has regional offices already in Hanoi, Delhi, Bangkok).
- Information exchange in the region should be facilitated.
- Fund-raising to finance activities for instance by finding regional partners and establishing joint-ventures.
- Pilot projects to evaluate management strategies, technological processes, software, *etc.* should be made available to all countries and sectors.
- Using existing laboratory capacity in the region and upgrading as required.
  * Capacity for PCB analysis exists in the region but should be more widespread
  * There is little capacity and capability for dioxin analysis in the region. Decision needs to be taken how to enlarge regional capacity
- Establishing a framework for monitoring, in certain representative areas, to follow concentrations of selected POPs and establish time trends (following a globally harmonized protocol).

Working Group 2 Report
Working Group POPs Pesticides

Presence:
Representatives from Nepal, Myanmar, Mongolia, DPR Korea, I.R of Iran, Malaysia, Lao P.D.R, Indonesia, China, Brunei Darussalam, Bangladesh, Thailand, Sri-Lanka, Pakistan, Philippines, India, Cambodia, FAO, WHO, South Pacific Regional Environmental Programme (SPREP) and ASEAN Secretariat.

Conclusions:

1. The Group concluded that present uses of POPs pesticides are mainly restricted to disease vector and termite control. However, there might still be some illicit use for agricultural purpose, mainly through existing stockpiles, sometimes illegally imported. Furthermore, most countries in the region have or are planning to phase out the use of DDT for vector control.

2. It was also concluded that when developing alternative strategies, pest susceptibility to pesticides should be considered a resource to be maintained, especially for effective response to emergencies in epidemics and pest outbreaks.

3. Furthermore it was concluded that there is a need for consistent strategies and approaches which are well co-ordinated and mutually supportive between different sectors.

Recommendations;
The group made the following recommendations:

To Governments:

1. Governments should implement international agreements regulating manufacture, trade and use of hazardous chemicals and upgrade facilities for chemical analysis.

2. Many Asian countries have successfully implemented innovative agricultural extension practices, such as farmer field schools and farmer clubs. These promote IPM and sustainable agriculture and reduce pesticide dependency. The working group recommended that the scope of these activities be extended by national IPM programmes beyond plant and animal production to include IVM of human diseases such as malaria.

3. Governments are encouraged to ensure consistency and coherence in addressing POPs problems and recommended to establish a multi-agency task force / working group with well-defined responsibilities.

4. Address the present obsolete pesticide situation, and ensure that new stocks do not accumulate.

5. National POPs focal points should actively pursue a dialogue with the managers of disease vector control programmes - and with responsible policy makers in the health sector - on alternatives for POP pesticides and on integrated vector control strategies that aim to reduce pesticide use while improving control of disease transmission.

6. The group recognized the key role of local biodiversity in controlling pest and diseases of crops, animals and humans. Farmer and local communities should be assisted in understanding and managing these natural biological resources for reducing dependency and use of pesticides in plant and animal health. Furthermore, the impact on biodiversity should be a key criterion in the selection of pest and vector control components in an integrated approach.

In connection with the replacement of POPs pesticides by alternative products, methods and strategies, the following areas of research were recommended.

7. Sound economic evaluations of alternative products, methods and strategies as applied under local conditions, employing cost-benefit analysis in agricultural pest management and termite control, and cost- effectiveness analysis in disease vector control.

8. The development and testing of new alternatives that combine aspects of sustainability with the capacity to reduce reliance on chemical control methods.

9. The development, testing and implementation of methods of strategic risk assessment of agricultural pests and human vector-borne diseases allowing for informed decision making on components of integrated control approaches.

10. Assessment of new generation insecticides (such as insect growth regulators) for the nature and magnitude of the risks they pose to humans and the environment.

To International Organizations:

11. UNEP should explore with Governments options to link focal point functions to an institution rather that to an individual, and to promote the establishment of intersectoral groups on POPs elimination and alternatives.

12. The establishment of a strategic alliance between the health and environment sectors should be actively promoted by WHO, UNEP and other stakeholders, to provide synergy in addressing the crosscutting aspects of development in terms of both health and environment. Organizations like FAO and UNDP could usefully also be drawn into this.

13. The IGO's should ensure aid policies are coherent and supportive of IPM and IVM through addressing environment desks of such donor agencies.

To Pesticide Companies:

14. The pesticide companies should, pledge "from cradle to grave product stewardship of all products and should ensure that pesticide users are made aware of risks and, precautions to be taken.

15. The pesticide companies should actively participate in destruction of stockpiles and other related activities with standard procedures.

Discussion:

Mr. James B. Willis, The Director of UNEP Chemicals, recognized that the developments and implementation of National Action Plans are essential for the success of reducing and or eliminating the releases of Persistent Organic Pollutants into the environment. Mr. James Willis opened the discussion by asking the participants what major problems countries are facing in the process of developing and implementing a national action plan.

Participants made following comments and recommendations:

(a) There should not be put one single timeframe upon the development of a National Action Plan on Persistent Organic Pollutants. Countries may have different priorities for which work needs to be undertaken.

(b) There is a need for assistance, both on the technical as well as on the financial level, in order to develop National Action Plans. Developing countries should learn on a bi- and/or multilateral basis.

(c) It was said that sharing of information and knowledge, through co-ordination and co-operation among and between countries within the same region, is an essential part of the successful development and implementation of a National Action Plan, e.g. the sharing of analytical laboratory facilities.

(d) There is a great lack of baseline information in this region. Therefore, first priority should be a thorough assessment of the situation, i.e. the obsolete stockpiles, in order to develop National Action Plans.

(e) It was also stressed that the National Action Plans should where possible also encompass management of other chemicals than the twelve POPs.

(f) Control of illegal trade of POPs pesticides, POPs industrial chemicals, and/or other POPs containing products should be covered/considered under National Action Plans.

(g) It was emphasized that there is a need for co-ordination and co-operation among and between countries within the same region. UNEP could play the role as a facilitator and or platform of such co-ordinate and co-operative tasks.

Opening Statement

by Dr. Pham Khoi Nguyen

Distinguished guests,
Ladies and Gentlemen,

On behalf of the Workshop Organizers, I have great pleasure to welcome distinguished guest, foreign and Vietnamese participants to this opening session of the Regional Workshop on management of persistent organic pollutants (POPs). We would especially like to thank UNEP, Australia and Canada, who have provided financial support, thus facilitating the organization of this workshop.

In the field of environmental protection, the risk of pollution caused by persistent organic pollutants is a critical problem in many countries. It is especially a major challenge to countries with economies in transition. POPs not only pollute the environment but affect directly the health of animals and humans, causing serious health problems such as cancers, endocrine disruption, reproductive and immune dysfunction, neurobehavioral and birth defects.

In order to increase awareness, UNEP Chemicals in cooperation with developing countries have organized several regional Workshops on the management of POPs. It worked with other countries to develop the Convention on Persistent Organic Pollutants through meetings of the Intergovernmental Negotiating Committee for an international legally binding instrument for implementing international action on certain persistent organic pollutants held in Montreal, Canada in 1998 and Nairobi, Kenya in 1999.

Like other countries in the Asian Region, Vietnam is an agriculture country so the quantity and types of pesticides are increasing without effective controls. Eight POPs in Vietnam have been banned since 1992: Aldrin, Chlordane; DDT; Dieldrin; Endrin; Hexachlorobenzene; Heptachlor; Toxaphene. However, these POPs are still stored and are a major cause of environmental pollution in Vietnam. In addition, Vietnam has its own special problem of pollution from the herbicides used during the Vietnam war. The most toxic among these herbicides was Agent Orange, which contains 2,3,7,8TCDD or dioxins, which are considered the most toxic and persistent of all POPs in environment and human health.

Realizing the importance of this problem, the Vietnamese Government has promulgated Directive No. 29/1998/CT-TTg on strengthening the management of pesticides and persistent organic pollutant used.

The Ministry of Science, Technology and Environment, in collaboration with UNEP Chemicals and other interested countries have organized this regional Workshop on Management of Persistent Organic Pollutants. The objective of this workshop are to:

- Enhance public awareness of the toxicity of POPs and to prevent their pollution on environment.

- Encourage countries to develop the national action plans for eliminating and preventing of POPs.

- Assist government organizations in implementing and developing national action plans to reduce and prevent the risks from POPs.

- Arm countries with the knowledge and measures related to POPs management and the Convention on POPs.

We hope that in the coming year, we can develop our cooperation in environmental protection in particular and socio-economic cooperation in General between Vietnam and other countries, international organizations, and b
especially UNEP Chemicals.

Finally, I wish all our distinguished guests good health and a very pleasant stay in our beautiful country and big success to this workshop.

Thank you very much for your kind attention.

Global Action on POPs Objectives and Strategy

What are POPs and why are they a concern?

- o Toxic
- o Persistent
- o Bioaccumulative
- o Mobile in the environment

Continued environmental release leads to <u>increasing</u> levels, usually elsewhere

Not the <u>only</u> chemical management problem

International initiatives to address POPs

UNEP POPs Negotiations

UNEP Global Programme of Action (Marine)

UNECE LRTAP POPs Protocol

Helsinki Convention (Baltic)

Conference to Protect the North Sea

UNEP

International initiatives to address POPs

Oslo-Paris Convention (North-East Atlantic)

Barcelona Resolution (Mediterranean)

Arctic Environmental Protection Strategy

NAFTA/NACEC Resolution (3 POPs)

Canada/USA Great Lakes Agreement

UNEP

UNEP's Role - History and Mandates

Governing Council Decision 18/32 (May 1995):

Invited IOMC, IPCS and IFCS to initiate an expeditious assessment process:

- o beginning with: PCBs, dioxins, furans, DDT, aldrin, dieldrin, endrin, chlordane, mirex, heptachlor, hexachlorobenzene, toxaphene;
- o taking into account circumstances of developing countries and countries with economies in transition;

UNEP

Based on results of assessment process and outcome of UNEP Conference on Protection of Marine Environment, IFCS to develop:

recommendations and information on international action

including any information needed for possible decision on appropriate international legal mechanism on POPs

to be considered at the 1997 sessions of the UNEP GC and the World Health Assembly.

UNEP

UNEP Global Programme ofAction

Washington, D.C. (November 1995)

Recommended a global legally binding instrument on POPs

Referenced elements of mandate in Decision 18/32

***IMPLEMENTATION OF DECISION 18/32*:**

Working Group set up under UNEP (October 1995), later adopted by IFCS

Included intergovernmental organisations, governments, industry, public interest groups and scientific organisations

Meetings in Washington (October 1995), Canberra (March 1996) and Manila (June 1996)

IFCS report submitted to UNEP and WHA in September 1996 and accepted in 1997

CONCLUSIONS & RECOMMENDATIONS

sufficient science to warrant immediate international action to protect health and environment

immediate international action to protect health and environment from 12 POPs

different treatment for pesticides, industrial chemicals, and by-products & contaminants

develop global legally binding instrument (start in 1998, conclude by 2000)

involve all participants in negotiations

scientific criteria to identify additional POPs

UNEP

UNEP Governing Council Decision 19/13C (May 1997)

Three Key Elements:

1. Begin negotiations of a legally binding instrument on POPs to be concluded by year 2000

2. Develop criteria and a process for including possible additional POPs in the convention

3. Undertake "Immediate Actions"

UNEPand IFCS jointly held 8 regional/subregional awareness raising workshops

UNEP

Negotiations of a Global POPs Treaty [Including Criteria/Process]

(covered in detail in later presentation)

UNEP

Immediate Actions

Information Access and Exchange

Alternatives to POPs

Identification and Management of PCBs

PCB Disposal Capacity

Identification of Sources of Dioxins and Furans

Cooperative Programmes on Dioxins and Furans

UNEP

Integrating other Activities

Assessment related work (e.g, GEF)

Helping to facilitate bilateral activities

Promoting National Case Studies

Encouraging GEF country-based projects

Integrating Partners

UNEP

Summary

Need for global action on 12 POPs agreed

Need for mechanism to add further POPs acknowledged

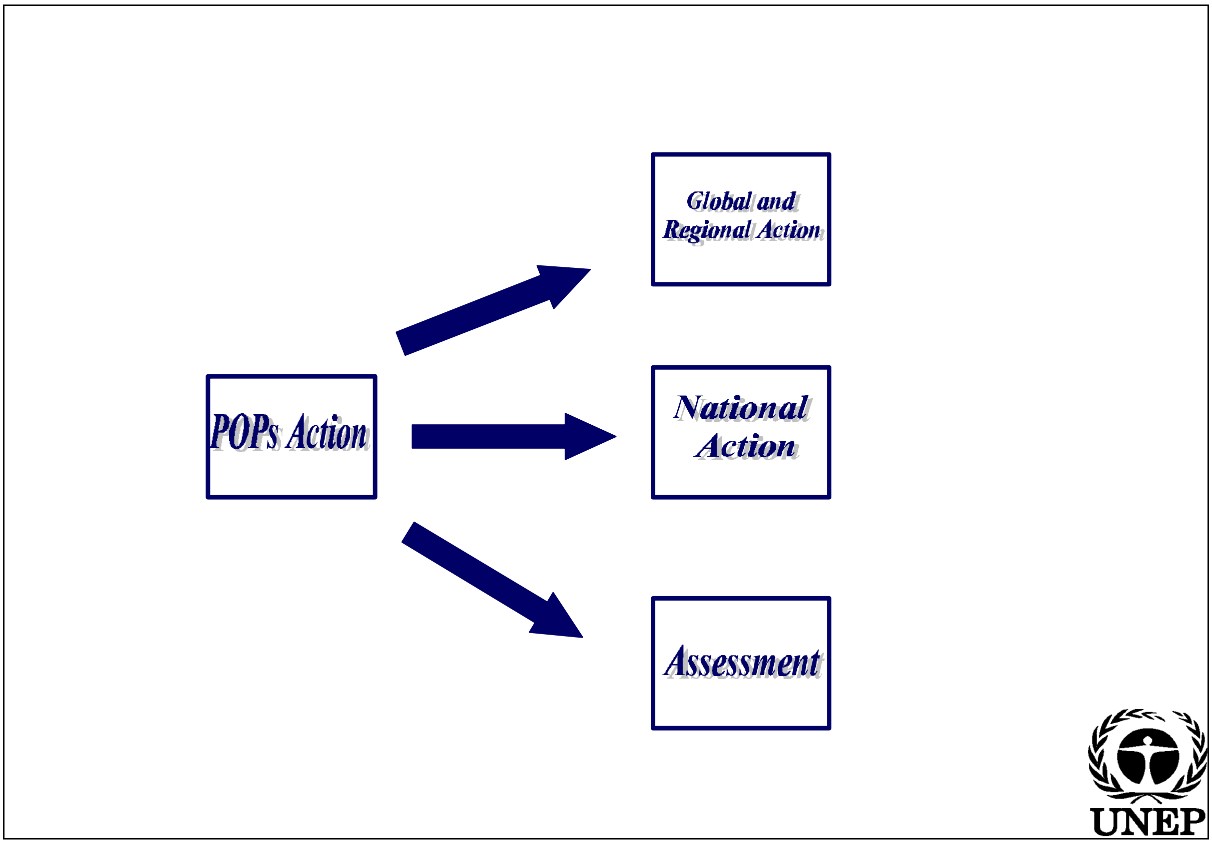
Negotiations “on track” for completion in year 2000

Some assessment completed, but more is needed - many data gaps for non-arctic regions

Acknowledged need for countries to identify and address national POPs releases

Immediate actions can enable countries to better understand possible obligations under the convention

UNEP


Global and
Regional Action
POPs Action
National
Action
Assessment
UNEP

Progress in the Negotiations of the Global POPs Convention

UNEP

Background

UNEP's Governing Council requested that negotiations begin in 1998

Allowed for negotiations of the Rotterdam Convention to conclude

Provided time to implement regional/sub-regional awareness raising workshops

Allowed for better understanding of the work of the UNECE on POPs

UNEP

First Negotiating Session (INC-1)

Montreal Canada, June/July 1998

Outcomes:

Bureau elected (J. Buccini, Chair)

Rules of Procedure agreed

Draft “Outline” of future convention agreed

Criteria Expert Group agreed (intersessional)

“Implementation Aspects” subsidiary body agreed

Secretariat given lots of work

UNEP

First Session of the Criteria Expert Group (CEG-1)

Bangkok Thailand, October 1998

Bureau agreed at INC-1 (F. Ndoye and R. Arndt co-Chairs)

Outcomes:

In depth discussions of criteria

Detailed discussions on socioeconomic factors

Criteria for adding POPs generally agreed by participants

Secretariat asked to draft a more fully elaborated proposal on procedures

UNEP

Second Session of the INC (INC-2)

Nairobi Kenya, January 1999

Substantial progress made

Outcomes:

- Draft text of possible articles agreed as starting point
- Considerable work on format and content of annexes
- Implementation aspects group discussed issues related to capacity building, assistance, technology transfer and financing

Secretariat given lots more work

UNEP

Next Steps……………………..

CEG-2 Scheduled for 14-18 June 1999 in Vienna

- Work anticipated to conclude

INC-3 Scheduled for 6-12 September 1999 in Geneva

- 6-Day session
- CEG may meet day before if necessary
- Integrate CEG work into convention
- Continued work of implementation aspects group
- Discussion of measures for 12 POPs

UNEP

3. The UN/ECE Protocol on Persistent Organic Pollutants: Provisions and Management Options

by Mr. L. Nordberg

Description

The 1998 UN/ECE Protocol on Persistent Organic Pollutants (POPs) under the 1979 Convention on Long-range Transboundary Air Pollution (ECE/EB.AIR/60) was adopted on 24 June 1998 and subsequently signed by thirty-five governments in Europe and North America and the European Community. It will enter into force after sixteen ratifications. The objective of the Protocol is to control, reduce or eliminate discharges, emissions and losses of POPs. The Protocol contains provisions for elimination, restrictions on use and reduction of total annual national emissions. It is structured with basic obligations and other obligations contained in the main text of the agreement and a number of annexes on the specific requirements. The structure allows for amendments to be made without a need to revise the text itself.

Salient points of the provisions and relevant management options are contained in the following charts and tables prepared on the basis of the Protocol:

SUBSTANCES SCHEDULED FOR ELIMINATION

Unless otherwise specified in the present Protocol, this annex shall not apply to the substances listed below when they occur: (i) as contaminants in products; or (ii) in articles manufactured or in use by the implementation date; or (iii) as site-limited chemical intermediates in the manufacture of one or more different substances and are thus chemically transformed. Unless otherwise specified, each obligation below is effective upon the date of entry into force of the Protocol.

Substance	Implementation requirements	
	Elimination of	**Conditions**
Aldrin CAS: 309-00-2	Production	None
	Use	None
Chlordane CAS: 57-74-9	Production	None
	Use	None
Chlordecone CAS: 143-50-0	Production	None
	Use	None
Dieldrin CAS: 60-57-1	Production	None
	Use	None
Endrin CAS: 72-20-8	Production	None
	Use	None
Hexabromobiphenyl CAS: 36355-01-8	Production	None
	Use	None
Mirex CAS: 2385-85-5	Production	None
	Use	None
Toxaphene CAS: 8001-35-2	Production	None
	Use	None

Substance	Implementation requirements	
	Elimination of	Conditions
DDT CAS: 50-29-3	Production	1. Eliminate production within one year of consensus by the Parties that suitable alternatives to DDT are available for public health protection from diseases such as malaria and encephalitis. 2. With a view to eliminating the production of DDT at the earliest opportunity, the Parties shall, no later than one year after the date of entry into force of the present Protocol and periodically thereafter as necessary, and in consultation with the World Health Organization, the Food and Agriculture Organization of the United Nations and the United Nations Environment Programme, review the availability and feasibility of alternatives and, as appropriate, promote the commercialization of safer and economically viable alternatives to DDT.
	Use	None, except as identified in Annex II
Heptachlor CAS: 76-44-8	Production	None
	Use	None, except for use by certified personnel for the control of fire ants in closed industrial electrical junction boxes. Such use shall be re-evaluated under this Protocol no later than two years after the date of entry into force.

Substance	Implementation requirements	
	Elimination of	**Conditions**
Hexachlorobenzene CAS: 118-74-1	Production	None, except for production for a limited purpose as specified in a statement deposited by a country with an economy in transition upon signature or accession.
	Use	None, except for a limited use as specified in a statement deposited by a country with an economy in transition upon signature or accession.
PCB The Parties agree to reassess under the Protocol by 31 December 2004 the production and use of polychlorinated terphenyls and "ugilec".	Production	None, except for countries with economies in transition which shall eliminate production as soon as possible and no later than 31 December 2005 and which state in a declaration to be deposited together with their instrument of ratification, acceptance, approval or accession, their intention to do so.
	Use	None, except as identified in annex II.

SUBSTANCES SCHEDULED FOR RESTRICTIONS ON USE

Unless otherwise specified in the present Protocol, this annex shall not apply to the substances listed below when they occur: (i) as contaminants in products; or (ii)in articles manufactured or in use by the implementation date; or (iii) as site-limited chemical intermediates in the manufacture of one or more different substances and are thus chemically transformed. Unless otherwise specified, each obligation belwo is effective upon the date of entry into force of the Protocol.

Substance	Implementation requirements	
	Restricted to uses	**Conditions**
DDT CAS:50-29-3	1. For public health protection from diseases such as malaria and encephalitis.	1. Use allowed only as a component of an integrated pest management strategy and only to the extent necessary and only until one year after the date of the elimination of production in accordance with annex I.
	2. As a chemical intermediate to produce Dicofol.	2. Such use shall be reassessed no later than two years after the date of entry into force of the present Protocol.

Substance	Implementation requirements	
	Restricted to uses	Conditions
HCH CAS: 608-73-1	Technical HCH (i.e. HCH mixed isomers) is restricted to use as an intermediate in chemical manufacturing.	
	Products in which at least 99% of the HCH isomer is in the gamma form (i.e. lindane, CAS: 58-89-9) are restricted to the following uses: 1. Seed treatment. 2. Soil applications directly followed by incorporation into the topsoil surface layer. 3. Professional remedial and industrial treatment of lumber, timber and logs. 4. Public health and veterinary topical insecticide. 5. Non-aerial application to tree seedlings, small-scale lawn use, and indoor and outdoor use for nursery stock and ornamentals. 6. Indoor industrial and residential applications.	All restricted uses of lindane shall be reassessed under the Protocol no later than two years after the date of entry into force.

Substance	Implementation requirements	
	Restricted to uses	**Conditions**
PCB The Parties agree to reassess under the Protocol by 31 December 2004 the production and use of polychlorinated terphenyls and "ugilec".	PCBs in use as of the date of entry into force or produced up to 31 December 2005 in accordance with the provisions of annex I.	Parties shall make determined efforts designed to lead to: (a) The elimination of the use of identifiable PCBs in equipment (i.e. transformers, capacitors or other receptacles containing residual liquid stocks) containing PCBs in volumes greater than 5 dm^3 and having a concentration of 0.05% PCBs or greater, as soon as possible, but no later than 31 December 2010, or 31 December 2015 for countries with economies in transition; (b) The destruction or decontamination in an environmentally sound manner of all liquid PCBs referred to in subparagraph (a) and other liquid PCBs containing more than 0.005% PCBs not in equipment, as soon as possible, but no later than 31 December 2015, or 31 December 2020 for countries with economies in transition; and (c) The decontamination or disposal of equipment referred to in subparagraph (a) in an environmentally sound manner.

Annex III

SUBSTANCES REFERRED TO IN ARTICLE 3, PARAGRAPH 5 (a), AND THE REFERENCE YEAR FOR THE OBLIGATION

Substance	Reference year
PAHs [a/] Dioxins/furans [b/] Hexachlorobenzene	1990; or an alternative year from 1985 to 1995 inclusive, specified by a Party upon ratification, acceptance, approval or accession.

a/ Polycyclic aromatic hydrocarbons (PAHs): For the purposes of emission inventories, the following four indicator compounds shall be used: benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene.

b/ Dioxins and furans (PCDD/F): Polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF) are tricyclic, aromatic compounds formed by two benzene rings which are connected by two oxygen atoms in PCDD and by one oxygen atom in PCDF and the hydrogen atoms of which may be replaced by up to eight chlorine atoms.

MAJOR STATIONARY SOURCES

MEASURES

(a) Replacement of feed materials which are POPs or where there is a direct link between the materials and POP emissions from the source;

(b) Best environmental practices such as good housekeeping, preventive maintenance programmes, or process changes such as closed systems (for instance in cokeries or use of inert electrodes for electrolysis);

(c) Modification of process design to ensure complete combustion, thus preventing the formation of persistent organic pollutants, through the control of parameters such as incineration temperature or residence time;

(d) Methods for flue-gas cleaning such as thermal or catalytic incineration or oxidation, dust precipitation, adsorption;

(e) Treatment of residuals, wastes and sewage sludge by, for example, thermal treatment or rendering them inert.

MOBILE SOURCES

TECHNICAL MEASURES

EMISSION LEVELS

FUEL PARAMETERS

1979 Convention on Long-range Transboundary Air Pollution, entry into force 1983; 43 Parties

(i) 1984 Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP), entry into force 1988; 37 Parties.

(ii) 1985 Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent, entry into force 1987; 21 Parties;

(iii) 1988 Protocol concerning the Control of Nitrogen Oxides or their Transboundary Fluxes, entry into force 1991; 26 Parties;

(iv) 1991 Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes, entry into force 1997; 17 Parties;

(v) 1994 Protocol on Further Reduction of Sulphur Emissions, signed by 28 Parties, entry into force 5 August 1998; 21 Parties;

(vi) 1998 Protocol on Persistent Organic Pollutants (POPs), signed by 36 Parties; ratified by one;

(vii) 1998 Protocol on Heavy Metals, signed by 36 Parties, ratified by one;

(viii) Protocol on photochemical pollution, eutrophication and acidification (in preparation).

1 March 1999

B A N

THE PROTOCOL BANS THE PRODUCTION AND USE OF SOME PRODUCTS:

ALDRIN, CHLORDANE, CHLORDECONE, DIELDRIN, ENDRIN, HEXABROMOBIPHENYL, MIREX AND TOXAPHENE

S U B S T A N C E S   C O V E R E D

The ECE protocol on persistent organic pollutants focuses on **16 substances**:

PESTICIDES: ALDRIN, CHLORDANE, CHLORDECONE, DDT, DIELDRIN, ENDRIN, HEPTACHLOR, HEXACHLOROBENZENE (HCB), MIREX, TOXAPHENE, HEXACHLOROCYCLOHEXANE (HCH) (INCL. LINDANE);

INDUSTRIAL CHEMICALS: HEXABROMOBIPHENYL, POLYCHLORINATED BIPHENYLS (PCBs);

BY-PRODUCTS OR CONTAMINANTS: DIOXINS, FURANS, POLYCYCLIC AROMATIC HYDROCARBONS (PAHs).

EMISSION REDUCTIONS

DIOXINS, FURANS, PAHs AND **HCBs** TO BELOW THEIR LEVELS IN 1990 (OR AN ALTERNATIVE YEAR BETWEEN 1985 AND 1995).

BEST AVAILABLE TECHNIQUES TO CUT EMISSIONS OF THESE POPs.

RESTRICTION ON USE

THE PROTOCOL SEVERELY RESTRICTS THE USE OF **DDT, HCH (INCLUDING LINDANE)** AND **PCBs.**

LIMITED USES FOR WHICH THERE ARE NO ADEQUATE SUBSTITUTES, CAN BE EXEMPTED.

DDT WILL BE ALLOWED FOR PUBLIC HEALTH EMERGENCIES.

L A T E R E L I M I N A T I O N

SUBSTANCES SCHEDULED FOR ELIMINATION AT A LATER STAGE:

DDT, HEPTACHLOR, HEXACHLOROBENZENE, PCBs

Commonalities

The negotiations of a global legally binding agreement on POPs take full advantage of the regional ECE Protocol which was preceded by several years of studies, assessments and negotiations. In particular, the following points have strong interlinkages between the two processes:

1. The scientific underpinning of risk and associated criteria for selection of POPs based on sound science.
2. Structure of agreement with main text and annexes.
3. Reporting and data collection.
4. Atmospheric transport modelling.
5. Implementation and compliance monitoring.
6. Initial list of substances (the ECE Protocol contains all twelve POPs identified for initial global action as well as chlordecone, hexabromobiphenyl, HCH (Lindane) and PAHs.
7. Application of the precautionary principle.
8. Flexible management options.
9. Cost-effective, practical and realistic measures.
10. Obligations based on existing information regarding e.g. inventories, techniques and expenditures.
11. The notion that the agreement should be designed to stand the test of time.
12. The full and mutual utilization of each other’s experience as well as the experience of other multi-lateral environmental agreements.

Conclusion

The ECE Protocol on POPs is an example of an intergovernmental agreement, which as appropriate, provides input for the envisaged global treaty. While the scope of the Protocol is regional and geared towards air pollution it has been prepared, taking into account the global nature of the problem, with the aim of protecting human health from deleterious effects of POPs in whatever medium they occur, following atmospheric transport. The Protocol is an important contribution to curbing the global fluxes of POPs, and the institutional arrangements set up under the Convention on Long-range Transboundary Air Pollution provide a machinery for refinement and long-term monitoring and follow-up of the agreement, including provisions for adding new substances to the Protocol.

4. Main Results of the AMAP Assessment of POPs Pollution

by Mr. V. Kimstach

Arctic Monitoring and Assessment Programme (AMAP) was established in 1991 as an intergovernmental program of the eight Arctic States (Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden, and USA) with the main objective to monitor, assess and report levels and trends of pollutants in the Arctic environment and their effects on ecosystems and humans. International organizations of the Indigenous peoples of the Arctic, a number of non-Arctic countries and international organisations, including the UN Specialized Agencies, have the status of the AMAP Observers and participate actively in its activities.

Following the request of the Ministers, from the very beginning of the Programme persistent organic pollutants (POPs) and their effects received the highest priority in the AMAP activities. To provide data for assessment, special circumpolar monitoring programme was designed and implemented. Main characteristics of this programme are presented in the Table 1.

This programme was built, as far as possible, on already existing monitoring and research activities of the participating countries, with their harmonization in the circumpolar context. However, a number of new national, bilateral and circumpolar programmes and activities have been initiated to meet the AMAP objectives. A new monitoring and research programme which has been developed and implemented developed in Greenland, is an example of new AMAP-oriented national activities. Establishment of a special station in the mouth of Lena River to monitor long-range atmospheric transport of POPs, as a part of circumpolar network, has been made within the framework of the Canadian-Russian bilateral cooperation. Circumpolar actions had a special focus on data comparability and quality assurance. For example, it was agreed to arrange collecting samples from humans in all Arctic countries and analysing them in one Canadian laboratory experienced in this type of work.

The 1st phase of AMAP has been finished in 1997 by presentation to the 4th Ministerial Meeting (Alta, Norway) of the report entitled ”Arctic Pollution Issues: A State of the Arctic Environment Report”. This report which is supported by more scientifically substantial ”AMAP Assessment Report: Arctic Pollution Issues” which was presented to the 1st Ministerial Meeting of the Arctic Council (Iqaluit, Canada, September 1999). The findings and recommendations of the AMAP assessment, as well as the other Arctic Council environmental programmes, are decided to be taken by the Arctic States into consideration in their policies and programmes for remedial actions to reduce pollution impacts on the Arctic environment and health of human population.

The following conclusions have been made in the Assessment Reports regarding POPs:

1. *Over much of the Arctic, the levels of POPs can only be explained by long-range transport from lower latitudes.*

Levels of lindane and chlordane are correlated with long-range transport episodes from use areas in the mid-latitudes of North America, Europe and Asia. Higher concentrations of PCBs are related to transport of air masses from industrialized areas of western Europe and eastern North America. Strong south to north air flows, particularly over Eurasia in winter, transport POPs from lower latitudes. Cold temperatures in the Arctic create favourable conditions for their condensation in this region.

However, there are some sources of POPs within the Arctic. PCBs from decommissioned Distant Early Warning radar line sites in Canada, and dioxins/furans from smelters in Northern Norway are examples of identified sources of POPs within the Arctic. Other such sources probably exist but are presently unknown.

2. Large Arctic rivers contribute to POPs contamination of the Arctic region.

Basins of some Arctic rivers, particularly in the Asian part of Russia, occupy vast, sometimes highly industrialized territories down to 45^{o}N. Three of the Arctic rivers (Yenisey, Ob and Lena) are among the world's 10 largest (from the point of catchment areas) rivers. Contaminants from polluted areas of these basins are transported by river flows and can reach the Arctic. Due to this pathway, suspended solids in the Ob and Yenisey River deltas carry high levels of PCB and DDT, as do sediments in Indigirka and Pechora rivers.

3. Ocean waters are a major reservoir and transport medium for water soluble POPs. Sea ice may be important in transporting POPs.

Relatively water solubility of some POPs, like HCH, favour their partitioning from air into water, especially at low temperatures. Due to this process, the world's oceans became to major reservoir of HCHs. Global models estimate that approximately 20% of the HCH present in the environment are held in the ocean surface layer. Even though the heaviest use of HCHs has been in remote regions, levels in surface seawater are an order magnitude higher in the Arctic. Thus, the transport and distribution of HCHs exemplifies the "cold condensation" effect.

The transport of POPs by sea ice either in ice and overlying snow could result in their release in the marginal ice areas. Focusing of POPs in some Arctic areas may be due to combined effects of long-range atmospheric transport plus the melting of ice transported from other areas, e.g. impacted by runoff of large rivers.

4. Freshwater and marine ecosystems contain higher levels of POPs than terrestrial ecosystems. Biomagnification of POPs is especially significant in wood webs dominated by organisms with high fat content. Many upper trophic level carnivores may transfer POPs to off-spring during extended gestation and lactation.

Due to hydrophobic properties, POPs are easily soluble in fats. It promotes their biomagnification in Arctic food webs, where species with high fat content dominate. The highest levels are usually recorded in top predators of long food chains, particularly in the marine environment, such as polar bear, the third-level carnivores (Table 2). This can be contrasted to the short terrestrial food chain.

The levels of POPs in marine mammals are higher in males than in females and also depend on the age of an animal. Studies show that whales get a large portion of their load of POPs very early in life, from their mother milk. The female, nursing the young, rids her body of some of its contaminant load. That is why reproducing females have much lower concentrations of organochlorines than males of the same age. As the result, young cubs of marine animals receive high dose of POPs at a period of growth and development when they are the most sensitive.

Table 2.
PCB biomagnification in the Arctic marine food web.

Compartment	Concentration (ng/g)
Air	.022 - .034 ng/m^3
Water	< .01
Sediments	1 – 32
Invertebrates (lipids)	20 – 360
Cod (liver)	60 – 400
Seabirds (eggs)	
Common eider	20 –30
Glaucous gull	Up to 2290
Seabirds (fat)	
Common eider	Up to 730
Glaucous gull	(1.2 – 1.5) x 10^4
Harp seal (blubber)	Up to 6000
Beluga (blubber)	Up to 5000
Harbor porpose (blubber)	2.4 x 10^4
Polar bear (fat)	Up to 7.8 x 10^5

5. *Some species and/or their prey contain large POPs burdens from overwintering at lower latitudes.*

Arctic has over 150 species of breeding land birds, most of which fly south to warmer climate areas to avoid harsh winter conditions. Some of waterfowl and terrestrial birds carry substantial POPs burdens from their overwintering areas farther south. Birds of prey are particularly susceptible to the effects of contaminants from overwintering areas. Migratory birds is a substantial biological pathway of POPs into the Arctic. Gyrfalcons, which are year-round residents of Iceland, have high concentrations of PCBs, because they feed on contaminated migratory birds.

6. *POPs levels in some birds, fishes and mammals exceed some thresholds associated with reproductive, immunosuppresive, and neurobehavioral effects.*

Due to biomagnification, many species, which occupy high trophic levels in food webs, particularly predator ones, have concentrations of POPs that are close to or above thresholds known to be associated with immunosuppresive and neurotoxic effects. Some predator birds, like peregrine falcon, suffer from eggshell thinning caused by increased concentrations of PCB and DDE.

The toxaphene levels in burbut liver from Canadian lakes reach up to 2300 ng/g. These levels are close to those known to affect bone development and reproduction in other fish.

Among marine mammals, polar bears are recognized as the most affected ones. Their contaminant levels are high compared to other Arctic animals. In six of the regions included into the circumpolar study, PCB concentrations in polar bears are in a range that is known to affect the reproduction of other mammals. One of the areas where levels in polar bears are highest is Svalbard. In 1996, two female cubs accompanying their mother on Svalbard were noted to have abnormal external genitalia, making them pseudo-hermaphrodites or hermaphrodites. In later years, such cased were noted more often. Polar bears from east Greenland, Svalbard, and Arctic Canada also have enough PCBs in their bodies to raise serious concerns about immune-system effects. They have increased liver enzyme activity, which can be correlated with the levels of coplanar PCBs. There are also some indications that PCBs have affected the thyroid hormone and vitamin A level, as well as other POPs effects.

7. *Exposure to POPs is the primary environmental health concern for the Arctic population. Some indigenous groups are exposed to levels that exceed established tolerable levels. Transfer to infants can result in levels in newborns which are 2-10 times higher than in regions further south.*

Persistent contaminants, derived to the environment from long-range transport or local sources, accumulate in animals that are used as traditional foods. Arctic residents, particularly in some indigenous communities, traditional diet is high in animal foods. These products are rich sources of protein as well as many vitamins and essential elements. However, there are strong evidences that groups of population, which consume high amount of such food, receive high doses of POPs, with the risk of the corresponding health effects.

Women from an area that includes western Greenland and the eastern Canadian Arctic have the highest levels of PCBs, which most likely reflects their diet of sea mammals, fatty fish, and perhaps seabird eggs. This indicated that there might be a concern for fetal and childhood development in these regions. POPs cross the placenta barrier, and preliminary results indicate that average umbilical cord blood levels of these contaminants are two- to ten-fold higher in newborns in the Arctic than in newborns from regions farther south.

Although there is both scientific and public concern that breast feeding will transfer contaminants from mother to her child, known benefits of breast feeding outweigh the currently-known risks from contaminants, To date, there have been no proposals to limit the duration of breast feeding.

This paper is based on the results of the AMAP Assessment, in which a large number of experts from all the Arctic countries participated, and the role of the author of this paper was limited by compilation of these results and their presentation at the Workshop on behalf of AMAP.

However,

Table 1.

Monitoring Persistent Organic Pollutants in the Arctic

Programme	Media	**Persistent Organic Pollutants**											
		PAH	Planar CB	PCB	DDT/ DDE/ DDD	HCH	HCB	Chlordane	Dieldrin	Toxaphene	Dioxins/ PCDD	Dibenzo-furans/ PCDF	Mirex
Atmospheric	Air	R		E	E	E	R	E	E	E	R	R	R
	Precipitation	R		R	R	R	R	R	R	R	R	R	R
	Snowpack	R		R	R	R	R	R	R	R	R	R	R
Terrestrial	Soil	ES	ES	ES	ES	ES	ES	ES	ES	ES	ES	ES	ES
	Humus	R	R	R	R	R	R	R	R	R	R	R	R
	Lichens	R	R	R	R	R	R	R	R	R	R	R	R
	Mosses	R	R	R	R	R	R	R	R	R	R	R	R
	Mammals/Birds	ES	ES	ES	ES	ES	ES	ES	ES	ES	ES	ES	ES
Freshwater	Sediments	E	R	E	E	E	E	E	E	R	R	R	R
	Water	R	R	ES	ES	ES	ES	ES	ES	ES			
	Susp. Solids			E	E	E	E	E	E	E			
	Biota	R	R	E	E	E	E	E	E	E	R	R	R
Marine	Sediments	E	R	E	E	E	E	R	R	R	R	R	R
	Water	R	R	R	R	R	R	R	R	R	R	R	
	Susp. Solids	R	R	R	R	R	R	R	R	R	R	R	
	Biota	E	R	E	E	E	E	R	R	R	R	R	R
Human Health	Blood	R	E	E	E		E	E			E	E	E
	Placenta	R											

E –ESSENTIAL, ES – ESSENTIAL SUB-REGIONAL, R - RECOMMENDED

5. ASEAN Cooperation on Persistent Organic Pollutants

by Mr. P. Somsak

I. ORGANIZATIONAL STRUCTURE FOR ASEAN COOPERATION ON THE ENVIRONMENT

1. The organizational structure for ASEAN cooperation in the field of the environment consists of the ASEAN Senior Officials on the Environment (ASOEN), and its subsidiary bodies, the Meeting of the ASEAN Environment Ministers and the ASEAN Secretariat.

1. ASEAN Senior Officials on the Environment (ASOEN)

2. ASEAN cooperation on the environment started in 1977 with the establishment of the ASEAN Experts Group on the Environment (AEGE) under the ASEAN Committee on Science and Technology (COST). AEGE was elevated in 1989 to become the ASOEN.

3. ASOEN meets once a year to consider the reports of its Working Groups, which also meet annually, and provide operational policy guidance on the various environmental programmes being pursued. To date, ASOEN has met 9 times with the latest meeting held in Singapore on 23-25 September 1998 and the next meeting scheduled for July 1999 in Thailand. As a matter of procedure, the reports of the ASOEN meetings are adopted by the ASEAN Standing Committee which in turn reports to the ASEAN Ministerial Meeting (AMM) comprising of the ASEAN Foreign Ministers.

4. The cooperative programs and projects of ASOEN were, until recently, carried out through the following Working Groups :

(a) ASEAN Seas and Marine Environment
(b) Environmental Economics
(c) Nature Conservation
(d) Environmental Management
(e) Transboudary Pollution
(f) Environmental Information, Public Awareness and Education

5. In addition to the above-mentioned Working Groups, a Haze Technical Task Force (HTTF) was also set up in 1995 to operationalize and implement the measures recommended in the ASEAN Cooperation Plan on Transboundary Pollution relating to atmospheric pollution. The HTTF is chaired by Indonesia and originally comprised of concerned senior officials from Brunei Darussalam, Indonesia, Malaysia, and Singapore. The Task Force has met eleven times and since the third meeting, all remaining ASEAN Member Countries and the ASEAN Secretariat were invited to attend. The most recent HTTF meeting was held on 19 November 1998 in Hanoi and the next one is scheduled for April 1999.

6. To further intensify regional efforts in addressing forest fires and haze problems, two Sub-Regional Fire-fighting Arrangements (SRFAs) -- one for Borneo involving Indonesia, Malaysia, Singapore and Brunei Darussalam, and the other for Sumatra involving Indonesia, Malaysia, and Singapore -- have been established. The SRFA for Borneo has met four times, while the SRFA for Sumatra has met seven times. In addition, Joint Meetings of the Working Groups on SRFAs for Borneo and Sumatra have been held twice since December 1998. The latest SRFAs meetings were held on 25-26 February 1999 in Singapore.

7. At the most recent ASOEN meeting, a decision was made to restructure and streamline the ASEAN working groups to be more responsive to emerging regional and international environmental issues. As a result, only three working groups were maintained and these are the working groups on Nature Conservation and Biodiversity chaired by the Philippines, Coastal and Marine Environment chaired by Thailand and Multilateral Environmental Agreements chaired by Malaysia. The meeting also agreed to the issues and programs/activities that are to be addressed by the new working groups and these are outlined in **Appendix 1**. The Haze Technical Task Force was retained in view of the need to continually address the critical environmental issue of haze arising from land and forest fires in the region.

2. ASEAN Ministerial Meeting on the Environment (AMME)

8. To promote ASEAN cooperation and ensure that the decisions of the Heads of Government relating to environment are carried out, the ASEAN Ministers for the Environment have met regularly at least once every 3 years since 1981. So far, the ASEAN Environment Ministers have met seven times. The most recent ASEAN Ministerial Meeting on the Environment (AMME) was held on 16-18 September 1997 in Jakarta while the next AMME is scheduled to be held in Malaysia in the year 2000.

9. In between the normal 3-year intervals for the formal AMME, informal meetings of the ASEAN Environment Ministers have been held almost every year since 1994. The latest informal AMME was held on 20 November 1998 in Hanoi. The next informal AMME is expected to be held at the end of 1999. In addition, the first ASEAN Ministerial Meeting on Haze (AMMH) was convened in Singapore on 22-23 December 1997 to address the problem of smoke haze in the region caused by land and forest fires. The AMMH has met five times with the most recent meeting held on 30 July 1998 in Kuala Lumpur while the next meeting is scheduled for mid-April 1999 in Bandar Seri Begawan.

3. The ASEAN Secretariat

10. Issues pertaining to environment cooperation in ASEAN fall under the purview of the Environment Unit of the Functional Cooperation Bureau. The ASEAN Secretariat normally services the afore-mentioned meetings as resource person and rapporteur as well as assists the above-stated bodies by providing substantive inputs in the planning, coordination, implementation and monitoring of the various cooperative projects on environment undertaken by them.

11. The current organizational structure for ASEAN cooperation in the field of the environment and tranboundary haze are shown in **Figures 1** and **2**, respectively.

II. RECENT ASEAN INITIATIVES ON POPS

12. Prior to the restructuring of ASOEN's Working Groups, in 1998, issues pertaining to POPs were under the purview of the Working Group on Transboudary Pollution (WGTP). At the 7th WGTP Meeting in Phuket, Thailand, in May 1997, the Meeting took note and expressed its appreciation to Ms.Agneta Sunden-Bylehn, Scientific Affairs Officer, UNEP Chemicals based in Geneva, Switzerland, for her presentation on matters relating to POPs. The Meeting agreed to recommend the following to the ASOEN:

(a) Monitor closely and communicate at national level the development of matters concerning POPs undertaken by international and regional organisations, particularly the Convention on Long-Range Transboundary Air Pollution and the development of criteria in identifying additional POPs;

(b) Establish and strengthen national coordinating body in each member country in dealing with POPs matters;

(c) Organise a regional workshop on POPs to promote awareness on POPs matters; and

(d) Request UNEP to carry out a pilot study in Vietnam on POPs residues resulting from the chemicals used in the past decades.

13. The ASOEN, at its 8th Meeting in September 1997 in the Philippines, agreed to the above-mentioned recommendation of WGTP.

14. A number of initiatives relating to POPs have since been undertaken in line with the recommendations of 7th WGTP and 8th ASOEN Meetings. For example, UNEP Chemicals has provided the ASEAN Secretariat a set of documents pertaining to POPs, in particular on the first session of the Intergovernmental Negotiating Committee to prepare an international legally binding instrument for implementing international action on certain persistent organic pollutants held in Montreal in mid-1998, for which the Secretariat has subsequently conveyed them to the WGTP Chairman. Thailand in collaboration with the International Register of Potentially Toxic Chemicals (IRPTC)/ UNEP, organized a Regional Awareness Raising Workshop on POPs in Bangkok in November 1997 with participants from 26 countries including all of ASEAN Member Countries.

15. ASEAN cooperation on POPs was followed up at the 8th WGTP Meeting held in June 1998 in Ayuutthaya, Thailand. Various activities and initiatives on POPs were presented and discussed, such as Status Report on Thailand's Activities on POPs, POPs Situation in Vietnam, Immediate International Action on POPs, and List of National Focal on POPs in ASEAN Countries. The Meeting also noted Vietnam's project proposal, Registration of POPs Used and Its Polluted on the Soil and Air in Vietnam, and to request UNEP to carry out a pilot study in Vietnam on POPs' residues resulting from the chemicals used in the past decades, as endorsed by the 8th ASOEN Meeting. In this connection, Vietnam has later informed the WGTP Chairman on the availability of funding from UNEP Chemicals to support initial work of the above-mentioned project proposal as a country pilot study.

III. ASEAN'S ROLE AND FUTURE COOPERTION AT THE INTERNATIONAL LEVEL

16. ASEAN countries share many of the environmental concerns of the global community. ASEAN' s commitment to international cooperation for the protection and enhancement of the environment was spelled out in the various ministerial statements and action plans that have been adopted, and through the ratification of and accession to various international environmental agreements. A list of status of the ratification of some significant multilateral environmental agreements by ASEAN countries as of mid-1998 appears as **Appendix 2**.

17. It is rather common for ASEAN countries to send insufficient number of delegates to international conferences and negotiation sessions which can be highly technical complex and multifaceted. This situation puts ASEAN countries at a disadvantage during the discussions and negotiations. ASEAN, from a regional standpoint, should strengthen its institutional capacities to implement regional and global environmental protocols and conventions and its legal capacities to present its concerns and interests in international legal discussions on the environment.

18. As the POPs issue is becoming a focal area for ASEAN cooperation and in view of the anticipated POPs convention to be implemented in the near future, there is a need to develop institutional and legal capabilities of ASEAN national and regional bodies in order to implement ASEAN cooperative programmes on POPs as well as effectively participate in the negotiation of this forthcoming international treaty. This also coincides with the recent establishment of the ASEAN Working Group on Multilateral Environmental Agreements (MEAs) as to enhance ASEAN cooperation with regards to multilateral agreements on the environment including the POPs Convention and to reach a common ASEAN stand in implementing them.

19. The ASEAN Secretariat is therefore of the view that close consultation, collaboration and coordination among relevant agencies, such as those in the preparation for discussion, negotiation, and implementation with regard to the forthcoming POPs convention, should be undertaken. UNEP could be well positioned to play an active, supportive and coordinative role in this connection. ASEAN also would like to call on UNEP to explore arrangements with relevant organizations to provide technical and/or financial assistance to the region to support the implementation of ASEAN activities, particularly on POPs matters.

Appendix 1

ISSUES TO BE ADDRESSED BY ASOEN WORKING GROUPS/TASK FORCE

Body	**Topics**	**Issues**	**Programmes/Activities**
Task Force	Transboundary Atmospheric Pollution	• Haze	• RHAP and RETA project • RFAs for Sumatra and Borneo
Working Group	Nature Conservation And Biodiversity	• ARCBC and regional R&D center • International and regional agreements • Biosafety protocol • Conservation of ASEAN heritage parks • Capacity building and public awareness	• Information exchange and technology transfer • Exchange understanding on biosafety issues • Institutional strengthening and networking • Management of transfrontier parks • Training and public education programmes
Working Group	Protection of Coastal and Marine Environment	• Control land and sea based pollution • Oil spill response	• Monitoring regime • Capacity building/R&D • Networking of agencies • Follow up on regional programmes, e.g. COBSEA, IMO projects • Directory of agencies and institutions in monitoring and managing marine pollution
Working Group	International Conventions	• Basel Convention • Climate Change • Montreal Protocol • PIC Convention • POP INCs • Trade and Environment	• Exchange views on negotiation positions • Networking among focal points/agencies • Regional project formulations • ASEAN co-operation on the management and control of movements of hazardous waste in ASEAN

Appendix 2

STATUS OF RATIFICATION BY ASEAN COUNTRIES OF SEVERAL MULTILATERAL ENVIRONMENTAL AGREEMENTS

A. The Agreements on the Protection of the Stratospheric Ozone Layer

1. The tables below list the status of ratification of the Montreal Protocol and related agreements by ASEAN member countries.

The Vienna Convention for the Protection of the Ozone Layer (1985)

COUNTRY	RATIFICATION
Brunei Darussalam	26 July 1990
Indonesia	26 June 1992
Laos	
Malaysia	29 August 1989
Myanmar	24 November 1993
Philippines	17 July 1991
Singapore	5 January 1989
Thailand	7 July 1989
Vietnam	26 January 1994

The Montreal Protocol on Substances that Deplete the Ozone Layer (1987)

COUNTRY	RATIFICATION
Brunei Darussalam	27 May 1993
Indonesia	26 June 1992
Laos	21 August 1998
Malaysia	29 August 1989
Myanmar	24 November 1993
Philippines	17 July 1991
Singapore	5 January 1989
Thailand	7 July 1989
Vietnam	26 January 1994

The London Amendment to the Montreal Protocol (1990)

COUNTRY	RATIFICATION
Brunei Darussalam	
Indonesia	26 June 1992
Laos	
Malaysia	16 June 1993
Myanmar	24 November 1993
Philippines	9 August 1993
Singapore	2 March 1993
Thailand	25 June 1992
Vietnam	26 January 1994

The Copenhagen Amendment to the Montreal Protocol (1992)

COUNTRY	RATIFICATION
Brunei Darussalam	
Indonesia	
Laos	
Malaysia	5 August 1993
Myanmar	
Philippines	
Singapore	
Thailand	1 December 1995
Vietnam	26 January 1994

B. Basel Convention on the Control of the Transboundary Movements of Hazardous Wastes and their Disposal

2. The table below lists the status of ratification of the Basel Convention by ASEAN member countries.

COUNTRY	RATIFICATION
Brunei Darussalam	
Indonesia	20 September 1993
Laos	
Malaysia	8 October 1993
Myanmar	
Philippines	21 October 1993
Singapore	2 January 1996
Thailand	24 November 1997
Vietnam	13 March 1995

C. Framework Convention on Climate Change

3. The table below lists the status of ratification of Framework Convention on Climate Change by ASEAN member countries.

COUNTRY	RATIFICATION
Brunei Darussalam	
Indonesia	23 August 1994
Laos	4 January 1995
Malaysia	13 July 1994
Myanmar	25 November 1994
Philippines	2 August 1994
Singapore	29 May 1997
Thailand	28 December 1994
Vietnam	16 November 1994

D. Convention on Biological Diversity

4. The table below lists the status of ratification of Convention on Biological Diversity by ASEAN member countries.

COUNTRY	RATIFICATION
Brunei Darussalam	
Indonesia	23 August 1994
Laos	20 September 1996
Malaysia	24 June 1994
Myanmar	25 November 1994
Philippines	8 October 1993
Singapore	21 December 1995
Thailand	
Vietnam	16 November 1994

E. Convention on Wetlands (Ramsar Convention)

5. The table below lists the status of ratification of Convention on Wetlands by ASEAN member countries.

COUNTRY	RATIFICATION
Brunei Darussalam	
Indonesia	8 August 1992
Laos	
Malaysia	10 March 1995
Myanmar	
Philippines	8 November 1994
Singapore	
Thailand	13 September 1998
Vietnam	20 January 1989

Figure 1 ***Organizational Structure of ASEAN Environmental Cooperation***

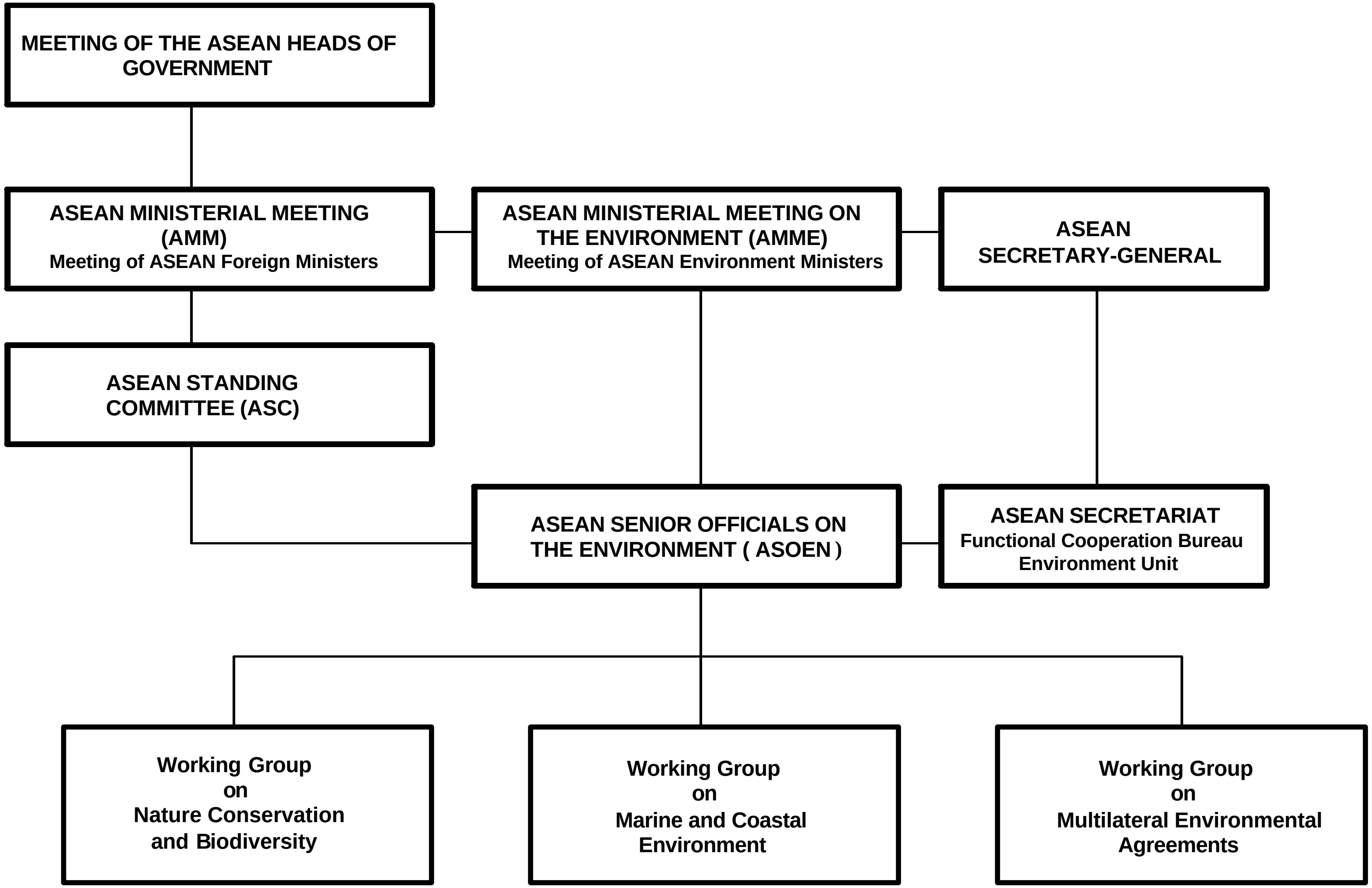
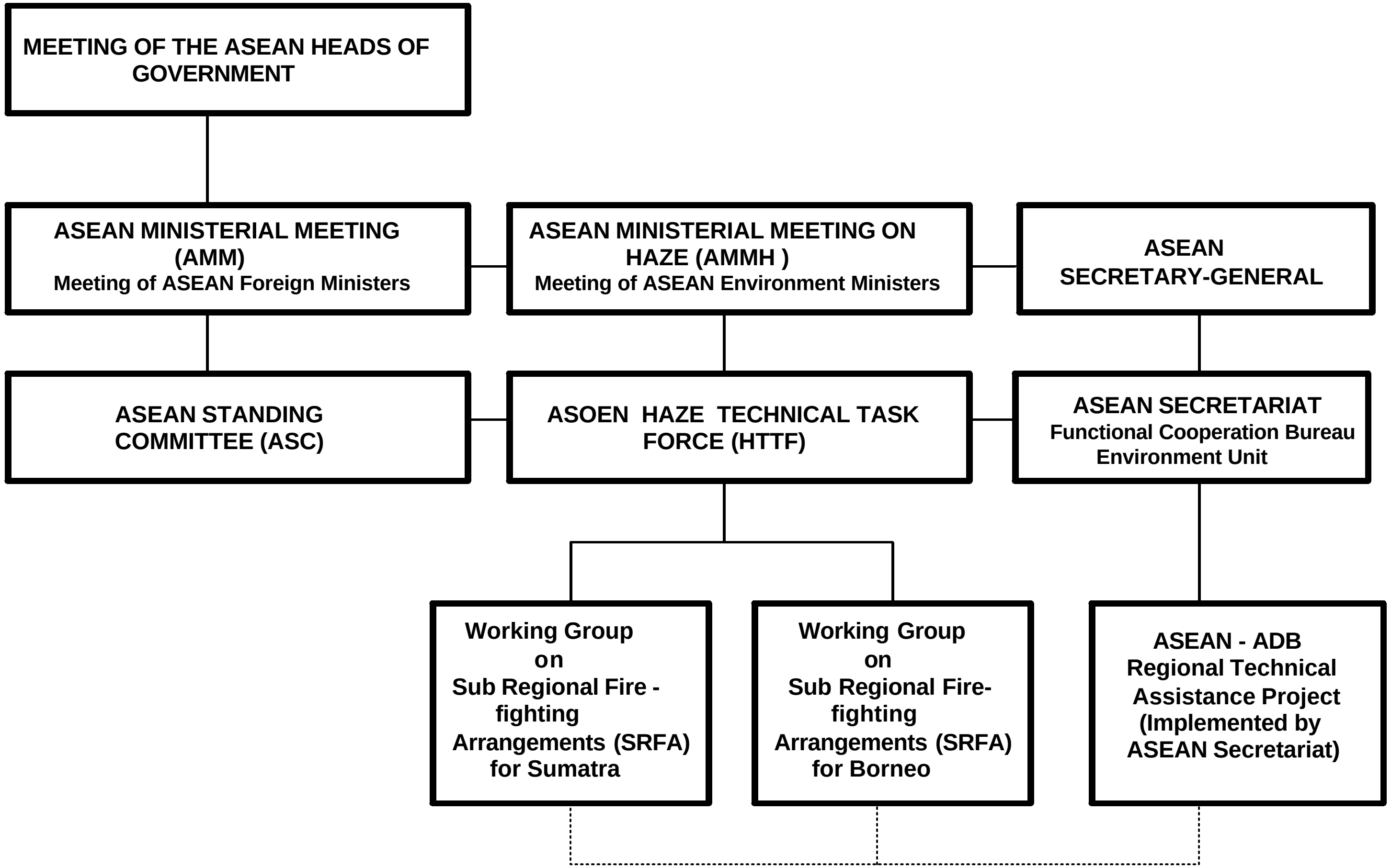


Figure 2 ***Organizational Structure of ASEAN Environmental Cooperation on Haze***



6. ASEAN Cooperation on Persistent Organic Pollutants : Regional and Country Perspectives

(Additional to ASEAN Secretariat Information Paper)

by Mrs. Nisakorn Kositratna

The organization structure for ASEAN cooperation in the field of the environment is ASEAN Senior Officials on the Environment or ASOEN. ASOEN has carried out the cooperative programs and projects through several Working Groups. The Working Group which supporting POPs activities are the Working Group on Transboundary Pollution (WGTP) chaired by Thailand in 1995 – 1998. During the Eighth Meeting of the WGTP in Thailand in June 1998, the meeting has noted on POPs by Thailand and Vietnam and also noted Vietnam's project proposal to request UNEP to carry out a pilot study in Vietnam on POPs residues resulting from the chemicals used in the past decades as endorsed by the Eighth ASOEN Meeting.

At the Ninth Meeting of the ASOEN in September 1998 in Singapore the meeting agreed to establish the Working Group on Multilateral Environmental Agreements chaired by Malaysia. The new Working Group will enhance ASEAN cooperation with regards to multilateral agreements on the environment including the POPs Convention.

Having recognized the impact of POPs chemicals to human health and the environment, Thailand by several government agencies has been carried out monitoring program on chemical residues in soil and water including the POPs pesticides and PCBs. Data and results have been compiled and evaluated in annual environmental situation. On the issue of Dioxins and Furans Thailand has initiated the inventory of the potential sources of dioxins and furans from industries. This program is supported by the German Technical Cooperation (GTZ), The first meeting workshop will be organised in May 1999 in Bangkok.

7. Policies and Strategies of the International POPs Elimination Network

by Mr. J. Weinberg

Hello.

My name is Jack Weinberg and I am Senior Toxics Campaigner for the international environmental organization, Greenpeace. For ten years, I have worked on Greenpeace campaigns to raise the public's awareness and understanding of the serious health and environmental injury caused by persistent organic pollutants and to secure policies and practices that will prevent and eliminate this serious form of toxic pollution at the source. My work began in the Great Lakes Region of North America and more recently it has moved to the global level.

I want to thank UNEP for inviting me to this important workshop. I also want to thank the Government of Vietnam and the Ministry of Science, Technology and Environment for the opportunity to visit your beautiful country.

I speak today as a representative of Greenpeace and also as a co-chair of the Dioxin and PCBs Working Group of the International POPs Elimination Network (IPEN). My IPEN colleague, Dr. Romeo Quijano, will also speak and will present the IPEN platform and perspectives with special emphasis on pesticide issues. In my remarks, I will address the perspective of Greenpeace and many other IPEN participating organizations on three topics: dioxins, PCBs, and shared responsibility.

DIOXIN. No country adequately monitors the levels of dioxin in its environment and its food supply and no country has yet come close to adequately characterizing its dioxin sources. As a special point of concern, however, many Asian countries have virtually no data on dioxin levels in their environment, in their food supply and in their human populations. Rapidly acquiring good data on dioxin levels in Asian countries should be a matter of some urgency.

Many Asian countries are now undergoing rapid changes in industrial development, in consumption patterns and in the materials that circulate in society through cycles of production, use and disposal. We in Greenpeace, and many others, suspect that these societal changes – unless they are accompanied by preventive action – will likely lead to a rapid increase in the amount of dioxin that is generated and released to the Asian environment.

Governments are now concluding the negotiation of a global convention on POPs and many countries in this region are now or soon will begin planning national dioxin abatement measures. It is important that this action go forward as rapidly as possible. Action to reduce and eliminate the generation and release of dioxin to the environment should not wait until a legally binding global convention on POPs is finalized and enters into force. Nor should it wait until a full complement of dioxin base-line data has been collected or until a complete dioxin source inventory has been taken.

Still, countries in this region must seek to secure good base-line data on dioxin levels in the environment and the food supply as rapidly as possible (with help, as needed, from the international community). In addition it is most important that countries rapidly secure base-line data on human dioxin body burdens from multiple regions in your countries and from multiple human populations with differing dietary patterns.

Without such data, it will be very difficult to maintain a good perspective on the urgent need to implement dioxin abatement and elimination measures in your countries and it will also be difficult to evaluate whether the measures you implement are having the desired result.

Many of us believe that dioxin levels in many Asian countries are, right now, rising at a very steep rate due to rapid changes in industrial practice and changes in consumption patterns now taking place. It is possible – even likely – that environmental dioxin levels could continue to rise sharply even as governments begin to implement dioxin action plans. A proper understanding of the root sources of rising dioxin levels (if such rises are, in fact, occurring) will suggest preventative measures that can be taken. But without base-line data, one will not know if dioxin levels are rising, one will not understand the situation a country is facing, and one will not know whether measures taken are having the desired effect.

A second issue of concern to Greenpeace and many other NGOs is the methodology that will be used in establishing dioxin inventories and in designing dioxin abatement programs. We suggest priority should not be given to attempts to quantify dioxin releases in your countries. Experience from other countries shows that efforts at quantitative dioxin inventories yield results that are highly imprecise; results that often obscure more than they reveal.

But while attempts at dioxin source quantification should have low priority, high priority should be given to identifying and characterizing your dioxin sources. By this we mean that it is important to identify in a comprehensive way both the kinds of facilities and the kinds of processes that generate and release dioxins to the environment without necessarily attempting quantification. We mean, in addition, that it is important to identify for each source category, the chain of dioxin synthesis and, in particular, identify the chlorine donor source in that chain of dioxin synthesis. Taken together, these make up the primary information that is needed to design effective dioxin abatement and elimination measures.

In our view, many countries that have put significant work into developing dioxin inventories have, nonetheless, failed to properly identify and characterize their dioxin source categories. This is because some industry groups have been able to use their influence and power to politicize and compromise the process in order to obscure the ways that their products and processes contribute to dioxin generation and its environmental release.

In addition, approaches to dioxin source identification and characterization developed for use in highly industrial countries will be of only very limited use in a newly industrializing country.

For example, in many countries, open burning of household waste is a common practice (and landfill fires are also common). One hundred years ago, open burning of waste was a common practice, but in those days open burning generated little if any dioxin. This has now changed. At present, open waste burning is often a highly significant dioxin source – and if current trends continue, this will become more so in the future. Why?

Most countries in this region have experienced recent growth in the use of chlorinated plastic (e.g. PVC or "vinyl") materials for packaging, toys, notebook covers, short-lived furniture and many other products that soon find their way into the ordinary waste stream. As the composition of the waste streams change in this way, open burning of waste, landfill fires, and also incineration of waste become increasingly significant dioxin sources.

Dioxin (in significant quantities) is not caused by combustion per se. Open fires and hearths have been part of human society since our earliest ancestors first walked this earth. Dioxin pollution (at levels of concern) on the other hand, is a fairly recent problem. It first became a significant problem in this century after large quantities of anthropogenic (man made) chlorinated organic materials began to be produced, began to circulate in the environment, and became a contaminant in combustion incidents.

Chlorinated plastic (PVC) is the largest and fastest growing chlorinated organic material currently in production and use, and it has become an increasingly large proportion of waste streams everywhere. Fortunately, satisfactory alternative materials exist for virtually all uses and new alternatives are rapidly entering the market.

These alternatives include not only traditional materials but also a generation of newer plastics (e.g. metallocene catalyzed polyolefins) that can be cost competitive with PVC, that can be made to posses virtually all the same desired properties as PVC, but that contain no chlorine and therefore will not contribute to dioxin formation upon combustion (and that can be more easily recycled). The best course of action is for countries to establish materials policies that discourage the expansion of PVC production and use; policies that instead, promote a shift toward alternative materials – in some cases, a shift toward production and use of more modern plastics.

Another example

Twenty years ago, many organochlorine pesticides manufactured in OECD countries contained high levels of dioxin. Some still contain dioxin such as, for example, pentachlorophenol and 2,4-D, but in general, dioxin levels in OECD-manufactured organochlorine pesticides have been greatly reduced. So, while these pesticides tend to have other serious problems, their contribution to total environmental dioxin levels has tended to decline.

Now, however, organochlorine pesticides are also manufactured in this region. In some cases, they may never have been tested and may contain substantial levels of dioxin as a contaminant. It is important to monitor and verify levels of dioxin in organochlorine pesticides and also in dyes and other chemical products that contain chlorine or that are made by a synthesis route that involves chlorinated intermediates and/or catalysts. One should also suspect that wastes associated with these processes are also highly dioxin contaminated. And finally, one should suspect that incineration of associated organochlorine wastes will represent still another significant dioxin source.

With more time, we could provide other examples that suggest important dioxin sources in this region that may have a different profile than dioxin sources in most OECD countries. Greenpeace will examine this topic in more detail in a report we plan to produce prior to the next POPs INC. This report will also detail practical proposals for the implementation of dioxin elimination measures.

PCBs. PCB elimination should be a high priority activity. We understand that many countries will need assistance in identifying which equipment contains PCBs and also in identifying PCB stocks and PCB contaminated soils and sediments. Assistance in achieving the capacity to identify PCBs and to develop a comprehensive PCB inventory should be a very high priority.

Once PCB stocks, stores and contaminated sites have been identified, they need to be collected and destroyed as rapidly as possible, and in an appropriate way. Remediation of PCB contaminated soils and sediments is often just as important as destruction of stocks and stores.

We consider combustion of PCBs in incinerators or cement kilns to be inappropriate because such devices are not nearly as efficient in destroying PCBs as are other available technologies. Also, dioxins and furans will always be created as unwanted byproducts of PCB combustion and incineration.

Serious problems with incineration exist even in highly industrial countries with strong regulatory infrastructure and strict regimes for monitoring and testing emissions and other releases. In many countries, community-based opposition to PCB incineration has stalled well-intended efforts to clean up PCB contaminated sites and to destroy PCB stocks. In developing countries with less well developed regulatory infrastructure and with little capacity to monitor and test emissions and releases, these problems can even be more serious.

Fortunately, newer destruction technologies have been recently commercialized that tend to be much more appropriate than incineration. (See Greenpeace Report: Technical Criteria for the Destruction of Stockpiled Persistent Organic Pollutants, 7-October, 1998)

In cases where the PCB stores and stocks are relatively small, and when there is little or no associated PCB contaminated soils and sediments, the best answer may be to ship the PCBs to a more industrialized country for appropriate destruction. In other cases, the best solution may be to bring a transportable, appropriate destruction device to the PCB contaminated location. But when this is done, special measures are required to assure proper operation and monitoring and provide opportunity for oversight to civil society organizations in nearby communities.

SHARED RESPONSIBILITY. Greenpeace and many other NGOs believe that the responsibility for implementing a country's commitments under a global POPs convention is a shared responsibility.

Everyone acknowledges that the POPs convention is likely to mandate commitments and actions that stretch or exceed the capacity and the resources available to many developing countries. When a country lacks the resources or capacity to implement such a commitment, then responsibility for finding the needed resources and help does not reside in the individual country alone. Rather, this becomes a responsibility that the individual country shares with the Conference of the Parties (COP) as a whole.

In our view, shared responsibility will be an essential ingredient of a successful global POPs convention. It may be a contentious point, but it is an approach certain to garner major support from the public interest NGO community.

Thank you again for the invitation to attend this important workshop.

8. Multilateral Cooperative Pilot project for phase-out of PCB use, and management of PCB-contaminated wastes in the Russian Federation.

by Mr. V. Kimstach

Background

Based on the information from the Russian officials, PCB production in Russia ceased in 1995. However, until recently, produced amounts of PCB were used in production of some types of electric equipment. Extensive use of PCB for several decades in energy production and a number of industries caused actual and potential threats to the environment and human health in the Russian Federation.

To solve the PCB problem in Russia, it is necessary to develop and implement a special Federal Programme, which would be funded by the Russian sources and financial support of participating countries and international financial institutions. This programme should be oriented on:

- prevention of resuming of PCB production and use;
- development and construction/retrofit of facilities for production of alternatives to PCB;
- environmentally sound decommissioning of PCB stocks and contaminated equipment and containers;
- rehabilitation of PCB-contaminated territories.

This Federal Programme should include the following actions:

(1) comprehensive inventory of electric installations and containers for storage of PCB-containing liquids;

(2) comprehensive inventory of PCB storage and disposal facilities, including technology used and past and current practices;

(3) assessment of international experience on utilization of PCB and PCB-contaminated equipment for conversion/retrofit to alternative fluids;

(4) selection of alternative dielectrics for replacement of PCB, with acceptable environmental and economic characteristics and feasible production;

(5) construction/retrofit of facilities for production of alternative dielectrics;

(6) construction/retrofit of major PCB use sector facilities for use of non-PCB alternative compounds;

(7) development and implementation of environmentally sound technology for destruction of PCB-containing liquids;

(8) development of technology and construction of facilities for destruction of PCB-contaminated containers, equipment and their elements;

(9) evaluation of Russian and Western PCB rehabilitation technologies and rehabilitation of PCB-contaminated territories.

The Multilateral Cooperative Pilot Project.

As a follow up of the conclusions and recommendations of the AMAP Assessment Report regarding PCB in Arctic and Northern environment, and the corresponding commitments of the Ministers of the Environment of the Arctic States ay their 4th Ministerial Meeting in Alta, Norway in 1997, an initiative has been introduced by all Arctic countries to assist the Russian Federation in handling their PCB problem. This initiative was welcomed and supported by the 1st Ministerial Conference of the Arctic Council (Iqaluit, Canada, September 1998).

The pilot project presented here isthe practical outcome of this initiative. It might be used as a model for the Federal Programme, mentioned above. The pilot project will be performed mainly by Russian experts and institutions, with assistance of western experts and funding support from the participating countries and international financial institutions. It consists of three phases covering all stages, from evaluation of the situation to implementation of demonstration projects.

Phase 1. Evaluation of the current status of the problem with respect to environmental impact, and development of proposals for priority remedial actions.

(1) *Production term characterization.*
To identify total production levels of PCB-containing liquids, numbers of production facilities and their location. To identify for each production and former PCB production facility the locality where its PCB were/are used to the extent such information can be provided.

(2) *PCB use term characterization.*
To identify types of PCB use in Russia, both former and current. To identify total production levels of PCB-containing equipment, numbers of such equipment production facilities and their location. To rank the uses in order of magnitude to the extent such information can be provided.

(3) *PCB-containing equipment use characterization*
To provide an inventory of PCB-containing equipment in operation and storage, including number, location and condition. To characterize maintainance of PCB-containing equipment.

(4) *Waste related characterization.*
To estimate state of storage and handling of PCB-containing wastes including facilities put out of operation or abandoned, amounts of wastes and locations of storage sites.

(5) *Release inventory*
To estimate annual environmental release of PCB from production facilities, usage, storage and disposal facilities or sites to the extent such information can be provided.

(6) *Production and use prioritization.*
Based on the results and analysis of Phase 1, tasks 1-5 and considering both production, use and storage quantities and estimated releases, to establish selection criteria and prioritize actions for their potential conversion or phase out, with special focus on those practices that potentially have the highest impacts to the Arctic environment.

Phase 2. Feasibility study.

After presentation of the report from Phase 1, a feasibility study should be initiated covering the following issues:

(1) *Implementation/cost benefit analysis.*
To evaluate problems and benefits associated with conversion to non-PCB based compounds with respect to technology needs (e.g., high voltage transformers used in power transmission grids) cost implications, and other factors.

(2) *Selection of alternatives for replacement of PCB, with acceptable environmental characteristics and feasible production.*
To provide comparable evaluation of the results of Russian research and pilot production of alternative fluids with the existing Western technologies, and to select feasible types for possible production in Russia.

(3) *Selection of the site for construction/retrofit of a prototype facility for production of alternative fluids.*
To select the site for implementation of a demonstration project for production of alternative fluids based on the assessment of environmental impact of the existing production facilities on the Arctic, and the engineering design and cost estimates for conversion/construction of a non-PCB production facility using Russian engineers, labour, and equipment to the extent possible.

(4) *Selection of the site for construction/retrofit of a prototype facility for use of non-PCB alternative compounds in a major PCB use sector.*
To select the site for implementation of a demonstration project for a major PCB use sector for construction/retrofit of a prototype facility for use of non-PCB alternative compounds, based on the assessment of environmental impact of such existing use facilities on the Arctic, and the engineering design and cost estimates for conversion/construction of a non-PCB use facility using Russian engineers, labour, and equipment to the extent possible.

(5) *Selection/development of environmentally sound technology for destruction of PCB-containing liquids.*
To develop feasible, economically and environmentally sound demonstration project proposals on facilities and technology for destruction of PCB-containing liquids in the area relevant to the Russian Arctic.

(6) *Selection/development of environmentally sound technology for destruction of PCB-contaminated containers, equipment and their elements.*
To develop feasible, economically and environmentally sound demonstration project proposal on facilities and technology for destruction of PCB-contaminated containers, equipment and their elements in the area relevant to the Russian Arctic.

(7) *Selection/development of standard/innovative technology for rehabilitation of PCB-contaminated areas.*
To develop feasible, economically and environmentally sound demonstration project and technology on rehabilitation of PCB-contaminated area in the Russian Arctic or adjacent regions that impact the Russian Arctic.

Phase 3. Implementation of demonstration projects.

Based on the results of the feasibility study, a selection of pilot projects for implementation will be performed. The pilot projects may cover the following:

(1) *Implementation of a demonstration project on production of alternative fluids.*
Concrete actions to be determined based on the results and analysis of Phase 2, tasks 2 and 3.

(2) *Implementation of a demonstration project in a major PCB use sector for construction/retrofit of a prototype facility for use of non-PCB alternative compounds.*
Concrete actions to be determined based on the results and analysis of Phase 2, task 4.

(3) *Implementation of a demonstration project on construction/retrofit of facilities for the destruction of PCB-containing liquids.*
Concrete actions to be determined based on the results and analysis of Phase 2, task 5.

(4) *Implementation of a demonstration project on construction/retrofit of facilities for the destruction of PCB-contaminated containers, equipment and their elements.*
Concrete actions to be determined based on the results and analysis of Phase 2, task 6.

(5) *Implementation of a demonstration project on rehabilitation of PCB-contaminated area in the Russian Arctic or in the adjacent regions that impact the Russian Arctic.*
Concrete actions to be determined based on the results and analysis of Phase 2, task 7.

Phase 1 of the project, which will be preformed under international coordination of the AMAP Secretariat, has total cost of 160,000 US dollars. The participating countries allocated additional fund for participation of their experts in the project implementation. This phase will be performed within one year, and should be started this spring.

9. POLYCHLORINATED BIPHENYLS
Decontamination and remediation technologies for electrical equipment and polluted soils

by Ms. A. Duhamel and Mr. J. Ehretsmann

1. Introduction

The increasing awareness of the negative effects of POP's, and in particular of polychlorinated biphenyls, has led to considerable information becoming available on the origins of these chemicals, on their occurrence, and on their effects on the environment.

However, this information is only the first step in the process of solving the POP problem, whose objective is the elimination of these chemicals, and the prevention of new sources being created.
This presentation seeks to formulate advice for making a selection of the most appropriate means to attain this objective. It is based essentially on the experience acquired in several European countries.

Furthermore, the presentation aims at selecting technologies which are appropriate for the Asia Pacific Region.

2. The background

The problem of eliminating PCB's is a complex one to the extent that the chemical occurs in many different contexts. Each one can call for a different elimination technology. It is thus indispensable to list the nature of the state in which the PCB's exist, to propose then the most appropriate treatment technology.

This list is arranged in such a way that the difficulties of elimination increase as one goes down the list.

- Clean electrical oils (therefore the easiest)
- Transformers and capacitors
- Waste oils
- Polluted soils.

These are the main sources of PCB's to be considered.

3. Decontamination technologies

Before attributing a decontamination technology to a particular PCB problem, one can consider the characteristics of these technologies.
Without a doubt, incineration is the most widely used technique for getting rid of a source of PCB. Incineration has the advantage, when carried out under the right conditions of allowing any of the above PCB sources to be completely destroyed. This big advantage is however offset by a certain number of shortcomings:

a) an incinerator designed for the destruction of chlorinated wastes such as PCB's operates at much higher temperatures than a domestic waste incinerator ;

b) the incinerator must be fitted with a completely effective gas-scrubbing system to prevent the emission of dioxins and furans ;

c) because of a) and b), there is a minimum size to such an incinerator to be economically viable, such a size may exceed that corresponding to the requirements of a small country ;

d) a high temperature incinerator is an enormous investment.

Point c) links up to the question of the trans-boundary movement of toxic waste; such legislation is now affecting the destruction of toxic wastes in some European countries.

Solvent washing can be applied to electrical equipment, but many technical problems arise, due to the actual physical structure of the transformers and capacitors, and thus to the non-accessibility of the solvent to the PCB's in the equipment. Furthermore, the PCB is only transferred to the solvent; it must then be disposed of by another technology, i.e. incineration, chemically, or by one or two very effective processes which will be presented. Note that solvent washing can be applied to soil decontamination.

Chemical methods are limited in their application to the decontamination of "pure" oils, i.e. those taken from transformers. So-called "waste oils" are those collected from various industrial sources which have somehow got contaminated with PCB's. Impurities such as water droplets, carbon particles, other foreign matter can interfere with the chemistry which is sometimes sophisticated.

4. Practical cases of decontamination

It is assumed, in presenting practical technologies applicable to the Asia Pacific Region, that incineration is not an available technology, and that the construction of a high temperature incinerator will not be a short-term solution to the PCB problem (see "Inventory of world-wide PCB destruction Capacity"; UNEP, December 1998).

a) Transformers and capacitors

These two similar categories of equipment can be considered together. It will be shown that the only viable technique in the present context is probably solvent washing, or improved techniques derived from it. The improved techniques aim at overcoming the problems of :

- relative inefficiency of a liquid solvent in attaining all the PCB (especially in wooden components of transformers for example) ;
- the treatment of the solvent to destroy the PCB (the large amounts used would necessitate an expensive chemical treatment).

One approach which is successful in Europe is that in which solvent vapour is used, this vapour being condensed and re-used in the pure form. Little solvent is required as it is recycled. One obtains a concentrate of the PCB's in the solvent. In France, where this technology is exploited, this product is burnt to generate hydrochloric acid. There is thus no need for a special incinerator.

b) "Pure" oils

These are transformer oils removed from the equipment prior to being replaced by a non-PCB dielectric oil. Several chemical methods can be used. These methods have the advantage of chemically decomposing the PCB's, the chlorine atoms being reacted with sodium or with a sodium-containing compound. No PCB remains.

c) Polluted soils

These present special problems because each case of pollution can be different depending on the nature of the soil; sand behaves very differently to clay with respect to water or solvent. Two general approaches can be adopted:

i) treatment of the soil by chemical or biological means to destroy the PCB's ;

ii) removal of the soil, then washing with a solvent or water; in this case, the PCB's must subsequently be destroyed by another method.

Practically speaking, case i) calls for the participation of a specialised engineering firm who can analyse the geo-pollution problem and propose appropriate solutions. For ii), mobile washing plants are now available and these may provide a good solution in the Asia Pacific Region.

5. CONCLUSIONS

- Incineration is an expensive, but effective technology; it does not appear to be a short-term solution in the Asia Pacific region ;
- Improved solvent washing techniques appear the most elegant solution to problems of PCB's in transformers and capacitors, allowing recycling of primary components, such as e.g. aluminium, copper, which have a good commercial value. The PCB oil coming from the solvent washing process is then treated at reduced cost ;
- Chemical treatment of liquids, applicable in certain cases, is a small scale technology which can be applied on a local scale and solve some PCB pollution problems ;
- Polluted soils can be effectively decontaminated by mobile plants, an attractive solution for disseminated polluted sites.

10. The Management and Disposal of PCBs in Canada

Mr. John C. Hilborn and Mr. John Buccini
(presented by Mr. D. Stone)

1. Introduction

In Canada, federal and provincial governments share responsibility for the management of PCBs. The federal government regulates PCBs in commerce (e.g. manufacture, use, sale, import, export), and the management and disposal of PCBs on federal land. The provinces regulate PCB management and disposal within their jurisdictions, and generally control these activities by issuing permits to manage or dispose of PCBs. Transportation of PCBs is regulated by federal and provincial Transportation of Dangerous Goods Regulations.

Canadian federal and provincial Ministers of the Environment establish policy, and provide scientific and technical guidance on PCB management, through an organization known as the Canadian Council of Ministers of the Environment (CCME). The CCME has produced a number of guideline documents on managing PCBs that set out criteria that both levels of government can adopt in their respective jurisdictions. More stringent requirements can be implemented, if necessary, through provincial regulatory and permitting processes.

The federal government became involved in the management of PCBs in the 1970's in response to scientific evidence that these substances were harmful to the environment. In 1973, the Organization for Economic Cooperation and Development (OECD) issued a Decision document titled "Protection of the Environment by Control of PCBs", which called for measures to keep these substances out of the environment. To implement the OECD Decision in Canada, regulations were made in 1977 to control the dispersive use of PCBs. PCB use was permitted in situations where the PCBs are well contained, such as in electrical transformers and capacitors.

A number of initiatives were undertaken to promote better management of PCB wastes. In 1977, an inventory and labelling program was initiated to identify and keep track of PCB-containing electrical equipment. To assist PCB owners, the federal government produced a number of reports, including "Guidelines for the Management of PCB Wastes" in 1978; "Guidelines on Central Collection and Storage Facilities for Waste Material Containing PCBs", also in 1978; the "Handbook on PCBs in Electrical Equipment", in 1981; and "Fires in Electrical Equipment Containing PCBs", in 1985. A number of these publications have been updated, and some were the basis for future Canadian PCB regulations.

The CCME also commissioned an Action Plan for PCB management in Canada. The 1979 Action Plan called for the establishment of PCB destruction facilities and the development of a long-term PCB phase out strategy. The objective of the phase-out strategy was to accelerate the removal of PCBs from service. The plan also called for the development of national codes and standards for storage, handling and destruction of PCBs.

By 1985, many Canadian provinces had enacted hazardous waste legislation that could be used to control the management and disposal of PCBs in their jurisdictions. The province of Ontario had gone a step further, and had developed regulations specifically for PCBs. Disposal of PCB wastes was still a problem since there were no provincially-permitted high level PCB destruction facilities in the country. There was little opportunity to export PCB wastes for disposal because the United States had closed its border to PCB waste imports and exports in 1980, and many European countries would not accept international PCB waste shipments. Although a small amount of

Canadian PCB waste was shipped to Europe for disposal, most of Canada's PCB wastes were simply stockpiled at more than 3,000 locations across the country. A number of provinces were considering siting hazardous waste facilities that would be capable of handling PCB wastes, but only one had advanced beyond the planning stages. The province of Alberta had made good progress, expecting to have a facility operational by 1987.

Beginning in 1985, a number of high-profile events involving PCBs occurred in Canada that raised public sensitivity to PCB issues to an unprecedented high level, and set the tone for future public debate on PCB issues in this country. As a direct result of these events, more regulations were enacted by the federal government to control how these substances were to be managed.

The first major incident occurred on April 13, 1985, when a PCB transformer that was being transported across Canada on a flat-bed truck leaked PCB fluid over 100 kilometres of the Trans-Canada Highway. The contaminated highway pavement was ultimately torn up and replaced. There was great concern expressed in the media about the potential health implications for people travelling the highway behind the truck.

The second major incident occurred in 1988, three years later, when a large stockpile of PCB wastes caught fire. Several thousand residents of the town of Saint-Basile, in the province of Québec, had to be evacuated because of that fire.

Immediately after the 1988 PCB fire, the federal government enacted strict PCB waste storage regulations and launched the $15 million Federal PCB Destruction Program. The objective of the federal program was to site mobile PCB destruction facilities in several regions of the country. The key features of the federal program were that it provided limited financial assistance to get projects underway; federal lands were considered as potential destruction sites; both federal and private-sector wastes were to be destroyed; temporary, mobile facilities were to be used; facilities were to be sited in several regions of the country; and facilities would not be imposed on communities. Financial support was potentially available for studies to characterize the PCB waste inventory, public education and consultation, the site selection process, environmental assessment, and environmental monitoring. In late 1989, a mobile PCB incinerator was commissioned to destroy PCB wastes at Goose Bay, Labrador. However, despite a concerted public consultation and education process over the next five years, public opposition to siting similar facilities in other regions of the country prevented the siting of more mobile facilities.

These were not the only events that Canada would experience where PCBs were implicated. An abandoned stockpile of PCB wastes in the town of Smithville, Ontario was discovered to have leaked PCBs and contaminated the community groundwater supply and a costly clean-up program was initiated. In 1989, a shipment of PCB waste originating from the 1988 PCB fire in Québec, which had been sent to the United Kingdom for destruction, had to be returned to Canada. British dock-workers had refused to unload the dangerous cargo. There was also strong public opposition when the preferred site for a hazardous waste management facility in southern Ontario was announced.

Concern about PCBs continued into the 1990's. PCBs were discovered on a sunken barge that was to be raised from the Gulf of St. Lawrence, and it was feared that the PCBs would leak when the barge was lifted. An industrial site in Atlantic Canada was also discovered to contain high levels of PCBs. Collectively the events described above led to the introduction of a series of regulations and guidelines in Canada for the management of PCBs, and an intensive effort to secure more PCB destruction capacity.

2. Federal PCB Regulations

The federal government has enacted four PCB regulations.

The Chlorobiphenyls Regulations

These regulations were introduced in 1977 to implement the OECD decision to control non-dispersive uses of PCBs, and have been amended several times since then. They prohibit all dispersive uses of PCBs from the time the regulations were made in 1977; set out allowable PCB concentrations in products; prohibit commercial activities involving PCBs, such as manufacture, processing, use, offer for sale and import (except import for destruction of PCB wastes); and prohibit PCB use in servicing and maintaining equipment, except for electromagnets and transformers, and as new filling or make-up fluid in this equipment. The only remaining uses of PCBs in Canada are in electrical transformers and capacitors existing in Canada before July 1, 1980, and in certain other "closed-use equipment" (specifically heat transfer equipment, hydraulic equipment and vapour diffusion pumps) that were in Canada before September 1, 1977. The regulations also limit environmental releases, as a result of a spill or leak, to 1 gram of PCB per day.

Storage of PCB Materials Regulations

Immediately after the PCB fire in 1988, regulations governing the storage of PCB wastes were made. The regulations require anyone who owns, controls or possess PCB material to maintain control over entry to the storage site, store PCB materials in specified containers and in a specified manner; make stored equipment and containers accessible for inspection; protect stored equipment; have fire protection and emergency plans and clean-up procedures; and provide the specified fire alarms, fire suppression systems, fire extinguishers, and clean-up materials.

Storage sites must be inspected monthly and maintained as prescribed in the regulations. Labels must be affixed to specified equipment and containers; records pertaining to the PCB equipment and containers of PCB material at the storage site must be maintained and available for review by inspectors. A copy of the records of wastes stored and material received at, or removed from, storage sites must be submitted to Environment Canada within specified periods. Changes in the name or address of the owner or manager, or the location of the site, must also be reported.

Federal Mobile PCB Treatment and Destruction Regulations

These regulations were made in 1989 in conjunction with the Federal PCB Destruction Program. They apply to mobile systems that destroy the PCB molecule by chemical or thermal means, and only apply on federal land, or to operations under federal contract. Under these regulations, there is a duty for federal departments to ensure that the person who operates a mobile PCB treatment system or a mobile PCB destruction system under contract with them complies with the requirements of the regulations. The regulations require persons operating these systems to operate them such that they do not release pollutants to the environment in concentrations in excess of the emission standards specified in the regulations. Before operating the system, an operator must provide the Minister of the Environment with information on the design and performance of the system to demonstrate that the emission standards can be met, and obtain written authorization from the Minister to operate the system. If performance information cannot be provided, the operator can obtain a federal authorization to test the system to determine if it is capable of meeting the emissions standards. During commercial operation of the system, the operator can be required to conduct compliance tests to determine if the system continues to meet emission standards. The sampling and analytical methods to be used to test emissions are also specified in the regulations.

PCB Waste Export Regulations

The export of PCB waste was banned in 1990 after the PCB waste shipment was sent back from the United Kingdom in 1989. An exception was made for the export of PCBs to the U.S. In November 1995, the federal government amended the regulations and closed the border to PCB waste exports to the United States (U.S.-owned PCBs in Canada could still be exported to the U.S.). The border was re-opened in February 1997 under new PCB Waste Export Regulations that allow export for treatment and destruction at U.S. Environmental Protection Agency-approved facilities, but do not allow export for landfilling of PCB wastes. However, in July 1997, a U.S. court decision overturned the U.S. rule that allowed import of PCB wastes into the U.S., and therefore at present no PCB wastes are crossing the Canada-U.S. border.

3. CCME Guidelines

The CCME has also developed guidelines for the management and disposal of PCB wastes.

The "Guidelines for Mobile PCB Treatment Systems (1990)" and the "Guidelines for Mobile PCB Destruction Systems" (1990) address the technical requirements for these systems, recommended permitting procedures, selection of sites for the operation of these systems, operating requirements and procedures, monitoring and inspection, occupational health, waste transport, process waste disposal, emergency response and contingency planning, and site clean-up and closure. Under the PCB treatment guidelines, PCB-contaminated mineral must be decontaminated to below 2 ppm PCB. Under the destruction guidelines, a PCB destruction and removal efficiency (DRE) of 99.9999 percent is required, which in practice means that no more than one molecule of PCB is released to the air in the stack gases for every million PCB molecules entering the system. Criteria for dioxin, furan, hydrogen chloride, particulate matter and other substances are also specified.

The 1989 "CCME Guidelines for the Management of PCB Wastes" define a PCB waste as any PCB liquid, PCB solid or PCB equipment containing more than 50 parts per million PCB that have been taken out of service for the purpose of disposal. The guideline addresses decommissioning and decontamination of PCB equipment, storage of PCB wastes, labelling and record-keeping, transportation, and gives an overview of PCB disposal capacity in Canada at that time.

The 1995 CCME "PCB Transformer Decontamination Standards and Protocols" were developed in response to demand for more detailed information on how to clean transformers than was given in the 1989 general PCB waste management guidelines. This document outlines the management options in Canada for the reuse of transformers and for the recycling of both PCB-contaminated and askarel transformer components. Transformer management practices in other countries are also reviewed.

Based on available data, the report concludes that if a transformer that contains PCB liquid at a PCB concentration below 200 ppm is carefully drained, the metal surfaces are considered to meet the criteria of 10 micrograms PCB per square metre or less, and can be landfilled, or preferably, recycled. In addition the porous components of such a transformer are considered to contain less than 50 ppm PCB and can be landfilled without further testing. In order to dispose of a transformer that contains PCB liquid with a PCB concentration above 200 ppm, however, the transformer must be cleaned, and all metal and porous components tested before disposal or recycling.

4. PCB Disposal in Canada

Mobile PCB Treatment Systems

Mobile PCB treatment systems have operated routinely since 1983 in Canada, under both federal and provincial permits, to service low level PCB contaminated mineral in electrical transformers. Operating permits limit the maximum PCB concentration in the untreated oil to up to 14,000 ppm PCB, depending on the process. An estimated 75% of the contaminated mineral oil in Canada contains less than 500 ppm PCB, and 95% contains less than 1,000 ppm. Most of the mobile treatment systems use technology based on the reaction of sodium with the chlorine on the PCB molecules to produce sodium chloride and non-chlorinated biphenyl. Four companies in Canada operate commercial mobile systems, and have been permitted under federal regulations to treat federal PCB contaminated mineral oil: PPM Canada Ltd., RONDAR (ENSR), Sanexen, and TASSCO.

Mobile PCB Destruction Systems

With the advent of the Federal PCB Destruction Program, mobile and transportable PCB incinerators were investigated to help solve Canada's PCB problems. Smaller systems, capable of processing about 2 tonnes of PCB waste per hour, and larger transportable incinerators, capable of processing 5-10 tonnes per hour were both considered. The smaller systems were attractive because Canada has over 3,000 PCB storage sites, some of which contain very small amounts of PCB wastes. The larger systems were generally considered, as a rule of thumb, to be applicable where about 3-5000 tonnes of PCB waste was available to process at one location. Consolidation of PCB wastes in Canada is not widely practised, a legacy of past experiences where waste stockpiles were mismanaged.

The mobile incinerators that have been used in Canada were developed in the United States for the clean-up of contaminated sites. Some of the incinerators were also approved for PCB destruction under the U.S. Toxic Substances Control Act, although more recently, dedicated stationary hazardous waste incinerators have been used for PCB waste destruction in the U.S. These mobile technologies were designed primarily to handle soil and sludge, but some rotary kiln incinerators were built that could also handle liquid PCBs. The use of mobile technologies became a logical option for Canada because stationary facilities were not available, except in the province of Alberta.

The federal government has been involved in both demonstration tests of PCB destruction technologies and in the use of this technology for commercial PCB destruction projects. Demonstration tests are designed to show if a PCB treatment or destruction system is capable of meeting regulatory requirements. In contrast, destruction projects are conducted with commercially available proven technology. Environment Canada defines the latter to mean technologies that have operated successfully under sustained, routine field conditions, and have received regulatory approval. In theory, a demonstration project can be carried out in tandem with a destruction project, however this is not encouraged. Experience has shown that the assessment of demonstration test results invariable is slow, may be controversial if not all tests are judged to be successful, and may therefore delay a planned PCB destruction project.

For both demonstration projects and regulatory compliance testing during PCB destruction projects, it is essential to have a quality assurance plan to document the proposed program, emissions and environmental sampling and analysis protocols, quality assurance and quality control procedures (external and internal), and to specify data quality objectives. It is also very important to define clearly the roles and responsibilities of all parties to a test program, and to develop a clear understanding of how test results will be interpreted and used.

Mobile PCB Destruction Technology Demonstration Tests

The Vesta 100 mobile PCB incinerator demonstration test program was conducted at the Alberta Special Waste Treatment Centre between November 1989 and May 1990. The Vesta 100 system is a small mobile, rotary kiln incinerator. The pilot-scale Eco Logic hazardous waste was tested at Bay City Michigan under a cooperative program with the U.S. EPA in 1992. This is a unique system, developed in Canada, which destroys PCBs by hydrogen reduction. The Vesta 200, a second generation system, was tested at Baie Comeau, Québec in 1992. The full-scale Eco Logic system is being tested in Ontario this year on PCB liquids, solids and electrical equipment. The Cintec Environnement Inc. fluidized bed incinerator is also being tested at full-scale at Baie Comeau, Québec. Final test results for the Cintec and EcoLogic full-scale systems are not yet available.

Demonstration test programs provide the operators with valuable experience working with regulatory authorities in designing and conducting tests that will satisfy regulatory requirements. These companies also acquire valuable operating experience which enables them to redesign and improve their systems, if necessary, before scale-up or commercial operation.

PCB Destruction in Canada

The only stationary PCB disposal facility operating in Canada is the Alberta Special Waste Treatment Centre, located near the town of Swan Hills, Alberta. That facility began operating in 1987, and expanded its rotary kiln incineration capacity in 1994 to 35,000 tonnes per year. A transformer furnace is used to decontaminate the casings and internal transformer components. Since February, 1995, the facility has been available to destroy PCB wastes from across Canada. The overall nominal hazardous waste treatment capacity of the facility is 55,000 tonnes per year.

The Goose Bay, Labrador PCB destruction project was conducted on Department of National Defence property in 1989-90. The majority of the PCB wastes destroyed were owned by the Canadian military and originated in Labrador. Over the next five months, about 3,500 tonnes of PCB waste belonging to the federal and Newfoundland governments were destroyed using a mobile infrared incinerator operated by O.H. Materials Ltd.

In 1985 the province of Ontario took over the management of the PCB waste that was contaminating the community water supply in the town of Smithville, Ontario. A contract was awarded to the U.S. company Ensco Inc. of Little Rock, Arkansas to perform the PCB destruction work using the ENSCO MPW-2000 transportable rotary kiln incinerator. The incinerator underwent compliance testing at Smithville beginning in February 1991, and operated until December 1992. During this period, the incinerator destroyed about 18,000 tonnes of liquid PCBs and shredded PCB-contaminated electrical equipment, concrete and soil.

5. Current Status of PCB Management in Canada

Significant quantities of PCBs are still in use in Canada, mainly in electrical equipment, and large quantities of PCB wastes are still in storage awaiting destruction. PCB destruction capacity in Canada is available, and new PCB destruction technologies are undergoing demonstration tests this year. Entrepreneurs continue to explore opportunities to introduce new, emerging technologies. Canadian PCB waste owners have indicated that they want more disposal options, including the option of shipping PCBs to the U.S. for disposal.

The Council of the Commission for Environmental Cooperation adopted resolution #95-5, "Sound management of Chemicals" in October 1995, creating a framework promoting regional (North American) cooperation on chemicals of mutual concern, one of which is PCBs. To implement the resolution, a PCB Task Force was struck, which developed a Regional Action Plan for the management of PCBs in North America. The draft plan embodies the principles of sound regional environmental management, life cycle management, pollution prevention, shared use of treatment-disposal capacity, treatment and disposal in reasonable proximity to the wastes, consistency with international and domestic obligations, transfer of technology, and periodic review and assessment of the plan. The draft Regional Action Plan call for developing a code of practice for managing PCB wastes; open controlled borders; phase out of PCBs in sensitive locations; elimination of dispersive uses of PCBs; elimination of non-dispersive uses of high concentration PCBs; harmonized sampling and analysis, waste classification, labelling; and PCB waste storage time limits.

13. Conclusion

Good progress has been made in Canada in putting in place the regulatory and administrative framework that is necessary to manage these substances. These efforts continue, and there is every reason to believe that there will be a successful resolution of the PCB problem in Canada in the foreseeable future.

11. Managing Chemical Wastes in Australia

by Prof. Ian D. Rae

Background

Several national management plans for waste chemicals have been adopted by Australian governments. They have been prepared since 1994 by two groups reporting to a ministerial council consisting of environment ministers of the states and territories and the Commonwealth (the Australian and New Zealand Environment and Conservation Council, ANZECC).

The ministerial council took up the matter of what were termed 'Scheduled Wastes', following earlier attempts by two states and the Commonwealth to find a suitable location for a high temperature incinerator, which could be used to destroy Australia's waste chemical substances. The establishment of an incinerator was strongly opposed by members of the environment movement - some readers will remember the agitation that followed a proposal to site such a facility near Corowa, in southern NSW.

In 1993 a decision was taken not to construct a high temperature incinerator, at least for the time being, but to encourage the development of facilities capable of destroying particular components of the waste stream. Although the wastes were variously known as hazardous, toxic, bioaccumulative, and/or persistent, the term 'Scheduled Wastes' was adopted and several categories of waste were 'scheduled'. The waste chemicals concerned were all chlorinated and exhibited various acute and chronic toxicities, exacerbated by their extreme chemical stability, fat solubility and consequent tendency to bio-accumulate in the environment.

The first of these was the class of polychlorobiphenyls (PCBs), which were widely distributed in the electricity generation and supply industry, and found minor use as plasticisers in sealants and other industrial products. Two further categories of Scheduled Waste were the large stockpile - approximately 8000 tonne - of waste from production of chlorinated solvents held by a Orica at its Botany site, in Sydney, and unused, unwanted quantities of organochlorine pesticides (OCPs) which existed mainly on rural properties throughout Australia. The Botany waste, contained in steel drums, consisted largely of HCB, although other chlorinated products were present, and there was also 45,000 cubic metres of contaminated soil stored in a large plastic envelope beneath a car park on the site.

The development of Scheduled Wastes management plans for ANZECC was entrusted to the Scheduled Wastes Management Group assisted by the National Advisory Body on Scheduled Wastes. The Management Group consisted of senior officers from the environment departments of the states, territories and the Commonwealth. The Advisory Body had representation from major industry and environment groups, together with local government and trade unions. These bodies had a common chair and frequently met together, although public consultation was handled almost exclusively by the Advisory Body. Their work was supported by a small secretariat located in the Commonwealth environment department (now Environment Australia).

In the absence of a high-temperature incinerator, and aided by a Commonwealth decision to adhere to the Basel protocol on trans-boundary shipment of wastes, Australia has experienced the development of several facilities for the destruction of its Scheduled Wastes, notably PCBs. None has been exported, and while no major importation is envisaged, consideration has been given to importing waste from nearby developing countries (for example, Pacific island states) for destruction in Australia.

The management plan for PCBs, adopted by the ANZECC ministers in late 1995, is being implemented by state and territory jurisdictions in accord with their particular laws and regulations. It should be noted that there is very little national ‘environment’ law in Australia, a consequence of the separate development of British colonies before and since they were federated in 1901.

PCB Management Plan

The main features of the PCB management plan are that it:

- defines Scheduled PCB as material containing 50 mg/kg or more of PCB, identifies the 2-50 mg/kg regime as constituting ‘unscheduled PCB’, while material with less than 2 mg/kg is termed ‘PCB free’.

- sets timescales for destruction of PCB, recognising that equipment containing low concentrations of PCB will come under the plan as it is taken out of service.

- does not specify destruction methods, but sets limits on emissions from destruction processes and specifies that PCB must be treated to below 2 mg/kg (that is, so as to become PCB free, not merely unscheduled PCB).

- provides for jurisdictions’ (states and territories, and the Commonwealth) setting up PCB registers, and for review of the operation of the management plan after five years.

- calls for monitoring of PCB levels in the Australian environment.

The first report compiled under this direction has been published (September 1998) and indicates that PCB levels in foodstuffs, sewage (and biosolids), and landfills are not causes for concern. Some human breastmilk samples are close to acceptable daily limits, and there are marine areas which warrant continued monitoring. Few data are available for Australian wildlife.

The technologies

Four quite different technologies are being employed to destroy PCBs in Australia. Conceptually the simplest is a plasma arc, struck in argon gas, and exemplified by the Plascon facility developed in partnership by CSIRO and a private company, and marketed by SRL Plasma. The organic molecules are broken down in the plasma arc to their constituent atoms (carbon, hydrogen and chlorine, in the case of PCBs) and the post-plasma gas stream is quenched to prevent recombination. The first Plascon units were installed at a chemical company to destroy a waste stream containing organochlorines, and a separate facility has been established for destruction of CFCs. In early 1998, a Plascon unit was installed at BCD Technologies, Brisbane, to destroy concentrated PCB liquids.

BCD Technologies has operated for some years the base catalysed decomposition (BCD) process invented by the US EPA. Hot paraffin (approximately 300oC) in the presence of caustic soda and a proprietary catalyst destroys PCBs under reductive conditions, where no dioxins and furans can form (and existing quantities are also destroyed). The process is particularly suitable for dilute solutions of PCB in paraffin, such as those deriving from the back-filling of large electrical equipment with paraffin which followed removal of PCB in the 1980s. An improved, faster version of the BCD process has been developed by another Australian company, ADI, in conjunction with a New Zealand Crown Research Institute. The process will be used, in conjunction with thermal desorption, to rehabilitate soil at the Sydney Olympics site.

A second type of reductive process, probably using metallic sodium (the details are proprietary) is used by another Queensland-based company to remove PCBs from paraffin oil in large electrical equipment, the process being operated 'in-line' so as to avoid interruption to operations.

Finally, in Kwinana (WA), ELI Ecologic operates a hydrogenation plant using technology invented in Canada. Hydrogen gas at approximately 800oC reduces PCB and other organochlorines, with production of hydrochloric acid and methane. The reductive conditions ensure that any dioxins and furans are destroyed.

Progress with PCBs

All likely holders of PCBs were contacted during the consultation phase of preparing the management plan. The electricity supply industry had already compiled an inventory and considerable work had been done in informing holders of safe practices. PCBs have been removed, in most jurisdictions, from sensitive areas such as schools and hospitals, as required by the management plan.

In the building and construction industry, large quantities of PCB are encountered in ballasts for older fluorescent light fittings, which are removed during building refurbishment. Past practice often involved landfilling such material, but it is now collected separately for treatment and destruction of PCBs. To assist with this, the Scheduled Waste secretariat prepared and distributed a handbook for electricians so that they could identify PCB-containing equipment. A similar compilation had been made in New Zealand, and initially it was felt that this might serve for Australia, too, but it became evident that there had been significant differences in the equipment imported into the two countries and a separate publication was thus warranted.

It was initially estimated that approximately 30,000 tonne of PCB had been imported into Australia up to 1975 when world-wide concern led to phase-out of the material. Only about one third of this quantity could be accounted for at the time the PCB management plan was developed, and it was assumed that as much as 20,000 might have found its way into landfills. There was no evidence, in those landfills which were examined, that any PCB was present in the leachate - that is, in liquids seeping through the landfill. Subsequent figures, largely obtained from treaters of PCB waste, suggest that there large quantities of PCB held in various industrial sectors were not taken into account in the initial reckoning.

In the five years 1993-1998, as treatment facilities were developing in Australia, approximately 5,700 tonne of PCB (expressed as concentrated PCB, although much of the material was in dilute solution in paraffin)was destroyed. The best available information now puts the amount lost to the environment as 3,500-7000 tonne, with 5000-9000 tonne still to be accounted for. More reliable information is expected to be available by late 1999, when state registers of PCB holdings are fully developed. Uncertainty surrounding the figures is partly caused by the commercial confidential nature of transactions involving PCB destruction, for which prices of $5000 - $10,000/tonne are quoted.

Australia seems to have management and destruction of its PCB holdings well in hand. Several factors have worked together to enable the country to arrive at this situation. These are:

- the cooperation of the electricity industry and recognition of the threats to human health and the environment posed by PCBs.

- the strength of the environment movement in Australia and its concern for development of appropriate management regimes.

- actions by governments in respect of high-temperature incineration, export of wastes, cooperation through the ANZECC ministerial council.

- involvement of governments, industry and the public (as represented by the environment movement) to prepare management plans which are acceptable to all three interest groups. The Scheduled Wastes process was recently complimented by an audit of Commonwealth spending as being ideal for resolution of problems which are as much social and political as technical in nature.

Hexachlorobenzene (HCB)

Although hexachlorobenzene was used as a fungicide in the past, which us use is probably responsible for residual quantities detected in the environment and in human tissue, the Scheduled Wastes process concerned itself with the stockpile of crude material held at Botany by Orica (formerly ICI Australia). A management plan, similar that devised for PCBs has been accepted by ANZECC and is being implemented by the company under the aegis of the NSW EPA. An interesting feature of the management plan is the setting up of a Community Participation and Review Committee, chaired by Dr Paul Brown (UNSW) and with representatives of the local community and the company.

The company has considered a number of technologies for the destruction of the HCB waste, which presents difficult problems because of the variation in content of the stored drums, including used saftey and redrumming equipment as well as a rnage of chemical substances and material consistencies. Trials are soon to begin of a vitrification process similar to that used to immobilise radioactive wastes at Maralinga, but also said to be capable of destroying organochlorines in a soil melt. Trials with the Ecologic hydrogenation process may also take place, and it is anticipated that a suitable technology will be selected on the basis of these trials.

Organochlorine pesticides (OCPs)

Organochlorine pesticides (OCPs) such as DDT and dieldrin and a number of others are no longer registered for use in Australia (exceptions are Mirex and Toxaphene). Unused, unwanted quantities of these materials are classified as ‘Scheduled Wastes’ and a plan for their management and destruction has been prepared for the Australian and New Zealand Environment and Conservation Council (ANZECC).

OCP Management Plan

The OCP management plan was accepted by the ministerial council (ANZECC) in late 1997, but has not yet been made public, for reasons which are discussed below. The key features of the management plan are that it:

- specifies threshold quantities and concentrations of substances covered by the plan.

- excludes contaminated sites.

- does not specify destruction technologies, but places limits on emissions from such facilities.

- contains provision for review of the plan after some years' of operation.

- calls for a monitoring study of OCP levels in the Australian environment. A contract has recently been let for the first such study.

National collection

The ministerial council (ANZECC), in late 1997, also received a proposal for a nationally coordinated scheme for storage, collection and destruction of rural chemicals, largely OCPs. Drawing on the experience of those states which had conducted collections in the past, and on survey data from the state of Queensland, it was estimated that approximately 1200 tonne of pesticides (half of which were OCPs) were held on rural properties around Australia. Most of this dispersed stockpile consists of unused, unwanted chemicals, many of them now out of registration and therefore no longer legally usable.proposal was accepted in principle, and at present, the various jurisdictions are seeking funding through their budget processes to support the nationally coordinated scheme in the financial years 1999-2000 and up to two succeeding years. The relevant industry body, Avcare, has agreed to make available specialist assistance during the collection period. Release of the OCP management has been held over until funding for the collection is in place.

ChemClear

When presented with the OCP management plan and the proposal for a nationally coordinated collection storage and destruction scheme, ANZECC asked that a complementary scheme be developed for on-going management of unwanted, unused chemicals in the years following the nationally coordinated collection. Negotiations with the suppliers and manufacturers - represented by Avcare and the Veterinary Manufacturers and Distributors of Australia - and with users - represented by the National Farmers Federation - explored options for funding of the scheme. There was emphasis on the threats to Australia's trade in primary produce which might result from contamination with improperly stored pesticides.was noted that changes already taking place in the supply and use of pesticides would result in lower volumes of unwanted, unused rural chemicals in the future. These changes included the use of returnable refillabl be crushed and re-melted, while plastic ones will be shredded and used for energy recovery, pending better recycling options. Funding for the scheme is provided by a levy of 4c/L (or kg) on the selling price of the product.

It was agreed, however, that the most effective way to avoid the build-up of unwanted, unused chemicals was for them to be returned by the holders for destruction, at no direct charge. Industry will commence the scheme - known as ChemClear - with the cooperation of the National Farmers Federation, in any region where the nationally-coordinated collection has taken place, thus setting a baseline for future chemicals management. It is not known at this stage whether suppliers will accept returned chemicals or whether separate depots will be established. The extra cost to purchasers, which will enable suppliers and manufacturers to operate the ChemClear scheme, is estimated to be 1c/L (or kg) on the selling price of products. Improved management by the industry, as described above, will help to minimise the volumes of returned chemicals.

The ChemClear scheme has its analogue in the suburbs of Melbourne, where household chemicals may be returned to municipal centres on selected Saturdays. The cost of professional staff and of destruction of the materials so collected is met by a levy on landfilling of certain classes of waste, while the major chemical industry body, the Plastics and Chemicals Industry Association, provides ancillary staff at collection points.

Internationally

The United Nations Environment Program (UNEP) has spnsored several meetings in recent years and hopes to achieve international agreement within the next 18 months to discontinue the use of Persistent Organic Pollutants (POPs). A similar agreement has been reached in Europe, under the Long Range Transport of Pollutants (LRTP) protocol, and the list of chemicals - what Greenpeace calls ‘the dirty dozen’ - includes a number of organochlorine pesticides (OCPs), industrial chemicals such as the PCBs, and substances such as dioxins and furans and polycyclic aromatic hydrocarbons (PAHs) which are undesirable by-products of many combustion processes.

Such a treaty will entail not onmly cessation of use, but also destruction of stockpiled chemicals. In the northern hemisphere this is most commonly achieved with high temperature incinerators, which burn a range of waste products under condisitons where dioxin/furan production is minimised. Flue gases are also extensively treated to keep emissions of these dangerous subsatnces to a minimum. Australian technology holders will be hoping that countries expanding their treatment facilities will turn to non-combustion methodologies, and especially those which have flourished in Australia under the political and economic conditions pertaining here.

Professor Ian Rae has chaired the Scheduled Waste Management Group and the National ASdvisory Body on Scheduled Wastes, on behalf of the Australian and New Zealand Environment and Conservation Council, since 1994. The above summary of the work in which he has been invovled was adapted from presentations he made to a UNEP regional workshop in March 1999.

13. Dioxin Reduction in Japan

Mr. J. Abe (presented by Mr. Y. Maesawa)

1. Introduction

Along with the development of modern legal systems after 1868's Meiji Restoration, "**Waste Cleansing Law**" was enacted as Japan's first law concerning waste management in 1900, with the purpose of preventing infectious diseases associated with waste. Under the law, following the standards established from public health view point, wastes were disposed at farmland, etceteras and decomposed naturally.

After World War II, waste increase and urbanization made waste management difficult to rely on land disposal and treatment. In 1954, "**Public Cleansing Law**" was enacted in order to secure public health associated with waste management, under which sanitary waste treatment was promoted through construction of solid waste incinerators and night soil treatment plants especially in urban areas.

However, living standards in Japan have been rapidly rising since 1960, as a result of economic development. Hand in hand with this rise, the volume and variety of waste material has also increased. In particular, industrial waste was no longer coped with by the traditional measures for domestic waste disposal. In those days, environmental pollution problems were highlighted as a crucial social problem all over the country, and finally in 1970, several laws for environmental pollution control such as the **Air Pollution Control Law** and the **Waster pollution Control Law** were established. In respect to waste, the **Waste Disposal and Public Cleansing Law** was enacted.

2. Other related domestic waste disposal regulations

These law provides the fundamental matters of municipal waste management, industrial waste management, and night soil treatment.

These law is enacted for the purpose of not only improving public health but also preserving a living environment through the restriction of waste discharge appropriate disposal of waste and conservation of clean environment.

3. Classification of wastes

"Wastes" refer to refuse bulky refuse, ashes, sludge, human excretion, waste oil, waste acid and alkali, carcasses and other filthy and unnecessary matters, which are in solid or liquid stage excluding radiation waste or the one which is polluted by radioactivity.

And the waste are classified into two kinds. One is the "Domestic Waste" and the other is the "Industrial Waste".

4. Waste Management administration in Japan

This is the administrative system of domestic waste management as contrasted with that of industrial waste management.

National Government promote development of waste management technologies, and give necessary technical and financial assistance to municipalities and prefectures.

Prefectures give necessary advice to the municipalities for carrying out adequate performance of duties of municipalities.

Municipalities propagate concepts of cleansing, and carry out domestic waste management efficiently by improving ability of the faculty, consolidating disposal facilities and developing operation techniques.

5. Structure related to the Waste Disposal in the Ministry Health and Welfare

The national government office principally responsible for waste disposal in the Environmental Health Bureau, Ministry Health and Welfare.

6. Estimated amount of dioxins in Japan

The Environmental Agency estimated annual release of dioxins in Japan being about 5,000g.

Japan became one of the most heavily polluted country by dioxins in the world.

Discharged dioxin from exhausted gas from domestic waste incineration is significantly higher than the other subjects.

7. The change of domestic solid waste discharge

The annual domestic solid waste discharge was 50.5 million tons, between Apr. 1994 and Mar. 1995, according to the annual survey on waste management by Ministry Health and Welfare. 43.8 million tons of them were collected by municipalities and the remains were brought into disposal facilities directly by dischargers themselves.

It mean that domestic solid waste discharged per person in fiscal year 1994 was 1,106 g/day.

The discharged quantity of waste is closely correlated with the Gross national product (GNP). In other words, from 1955 to 1970, in company with activation of economic activity, the discharged quantity of waste has just increased uphill, and with the oli crisis in 1973 as the borderline, its growth has became blunt.

8. Solid Waste Treatment Facilities

The basic principle of waste management is, at first to reduce the amount of waste through recycling, and then to treat it sanitary without giving bad effect to environment. Most of waste are incinerated in Japan. Because incineration is very effective to reduce the quantity of wastes and to stabilize them. At the same time, in order to prevent secondary pollution, exhaust gas treatment facilities, drainage treatment facilities, noise prevention equipment, etceteras are installed.

Besides, bulky waste treatment facilities for crushing and compaction are installed in many municipalities. There was bulky waste treatment plants in operation with capacity of 25,050 tonnage per day at the end of fiscal year 1994.

9. Emission Standards for Incineration Plant

This is our Emission standard for Incineration Plant in order to cut down dioxins. The exhausted gas from solid waste incineration plants is regulated by Emission Standards according to the Air pollution Control Law.

Disposal capacity of incinerator was classified ,Over 4 tonnage per 1 hour, Between 2 and 4 tonnage per 1 hour, and Under 2 tonnage per 1 hour.

Newly established incinerator are controlled 0.1, 1, 5 respectively,

After November 1998, existing incinerator were controlled by suspension of the application of standards.

Between December 1998 and November 2002, existing incinerator which between 2 and 4 tonnage per 1 hour of disposal capacity are controlled under 80 ngTEQ/m3N.

After December 2002, existing incinerator will be controlled under 1, 5, 10 ngTEQ/m3N respectively.

10. Estimate of annual release of dioxins

This is estimate of annual release of dioxins in Municipal of the exhausted gas from solid waste incineration according to Emission standard for Incineration Plants.

Before impose legal controls, annual release of dioxins was 4,300 g Toxic Equivalents per year

At the end of September 1999, annual release of dioxins will be controlled under 3,100 g Toxic Equivalents per year.

After Dismember 2002, annual release of dioxins will be controlled under 600 g Toxic Equivalents per year.

11. Change of dioxin levels of Mother's milk

Shows the transition data of 28 year period on the dioxin contents of the milk, mothers of which had been living in Osaka area, and which had been obtained, frozen and preserved for the period. The test materials are the mixtures of the foremilk obtained from 10 or 15 mothers since the year 1972 and frozen and preserved for the testing purpose now.

Apparently, the amount of both dioxins and Co-PCBs have decreased gradually every year. Probably by our guessing, the dioxins existing inside the pesticides had accumulated in high concentrations for the period of the year 1970s.

It is now said that the municipal waste incinerators emit more than 90% of dioxins now detectable here in Japan. In our conclusion, therefore, the success in decreasing the dioxin emission from the municipal incinerators will bring us a great breakthrough for less human exposure and less accumulation of dioxins.

12. Research programs in Japan

Lastly, We are pleased to advise you that we have the plan to invite 2 or 3 specialist staffs for the joint-research of dioxins or endocrine disrupters.

The specialists from either developed or developing countries will be accepted. They will engage themselves in the research together with Japanese staffs for the period of one to six months in the facilities of laboratories or institutes.

Also, we hope we can exchange the relative information with those specialists from abroad on the respective fields and countries of their own.

You can present your application to the chieves whom we already explained about or introduced with you. Your travelling and staying expenses in Japan will be paid by Japanese government.

Younger applicants will be more welcomed.

Really lastly, we are pleased to tell you that we have the firm plan, too, to work together with those specialists from abroad for all round data collections and research on dioxin contaminations in Asian countries ranging from relative industries and facilities to the food intake and human exposure.

If the person present here, wish to apply with us now, please contact us immediately after the meeting is over.

Thanks lots for your attendance today.

14. Dioxins and Furans Inventory in Thailand

by Ms. P. Chareonsong

The development of Science and Technology lead to more and more widespread use of chemicals in agriculture, industry, household and other sectors. As other United Nations member countries, Thailand has recognized the problem of chemical hazards as a high priority, particularly the importance of the chemical management under the Chapter 19, Agenda 21. Special attention has been taken on the decisions 18/12 and 19/13A of the UNEP Governing Council on the establishment of legally binding instrument for the Application of the Prior Informed Consent procedure for Certain Hazardous Chemicals and Pesticides in International Trade (or Rotterdam Convention) as well as the decisions 18/12 and 19/13c of the UNEP Governing Council on the establishment of legally binding instrument for implementing international action on POPs. Following the Second Session of the Intergovernmental Forum on Chemical Safety (IFCS), Ottawa in 1997 Thailand has actively taken actions to reduce or eliminate impacts on human health and the environment related to productions and uses of Persistent Organic Pollutants (POPs) chemicals. Especially those 12 specified as aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, toxaphene, PCBs, dioxins and furans.

Project initiation

Thailand has recognized the impact of POPs chemicals to the human health and the environment is not only the international problem but also a national one. It is well illustrated that, in the past few years, Thailand has taken all possibly actions as recommended by the UNEP Governing Council. At present, all organochlorine pesticides and PCBs are more or less managed in environmentally sound manner. All of a pesticides and PCB, in one hand, have been totally banned and routinely monitored by several agencies. On the other hand, dioxins and furans, is still far behind compared to the developed countries as far as the management is concerned. Thailand believes that the initiation of the dioxins and furans inventory would be the first priority approach for this issue.

It has been realized that industrialised countries like Germany have a longstanding experience in implementing chemicals management systems. Thailand has learned that Germany via the German Technical Cooperation (GTZ) has initiated the Pilot project for the improvement of chemicals management in developing countries. The project's task is to provide information on expertise and experience in specific instruments at the request of institutions in developing countries, and to assist in implementing under the specific conditions prevailing in the respective partner country.

It is well understood that, dioxins and furans problem is not at all a priority among all other environmental issues in Thailand which would reflect as a non priority for the national fiscal budget allocation. For this reason it brought up Thailand attention to the GTZ Pilot Project and requested funding even a small amount to GTZ through Dr. Matthias Kern, the Project co-ordinator.

Thailand has requested the following project activities from GTZ in December 1997.

1. Development of inventories for Dioxins and Furan emissions
2. Establishing a comprehensive system in place to monitor the release of Dioxins and Furans

3. Establishing the Pollutant Release and Transfer Registers (PRTRs)
4. Development of the national chemical inventories
5. Training on Risk assessment and management

Such activities have been identified for possible co-operation under the scope of the GTZ Pilot Project on chemical management. The activities on Dioxins and furans Inventory and monitoring has been approved in February 1998. Following approval, GTZ has arranged meeting and discussion among Thai administrator in this field with the German government and GTZ in Germany during 5 – 11 September 1998.

In November 1998, GTZ sent Dr. Heidelore Fiedler to visit the Pollution Control Department (PCD) and to help PCD staff drafting a project a little more in detail.

The main activities are to make a preliminary list of dioxins and furans sources, how to collect information and prepare the content for the awareness raising workshop for related stakeholders in Thailand.

Dioxins and Furans activity in progress

During the past two months, Thailand has performed the following;

- Set up a steering committee in order to facilitate this project. The committee includes

- Pollution Control Department	Chairman
- Department of Industrial Works	Member
- Department of Agriculture	Member
- Department of Health	Member
- Department of Science Service	Member
- Bangkok Metropolitan Administration	Member
- The Industrial Estate Authority of Thailand	Member
- The Federation of Thai Industries	Member
- PCD Staff	Secretariat

The functions of the steering committee are

1. consider guidelines and procedures for dioxins and Furans problems solution,
2. prepare dioxins and Furans sources inventory,
3. prepare the action plan for dioxins and furans monitoring system,
4. perform other duties as assigned.

- PCD staff with cooperation of Dr. Heidelore Fiedler has prepared a questionnaire related to the dioxins and furans inventory.
- PCD staff has visited staff assigned by each government agency related to the dioxins and furans generation and explained how to complete the proposed questionnaire.
- Up to now, some selected industries have been compiled such as cement plants, power plants, crematoria, non-ferrous metal production from lead plants.
- A week before the Workshop, GTZ has kindly asked Dr. Heidelore Fiedler and Dr. Hans Hartenstein to observe and to visit industry in order to evaluate which industries should be monitored and how to collect the emission samples for dioxins

and furans analysis. Those proposal industries are waste incinerator, copper plant, aluminum plant, crematorium, cement kiln and steel plant.

Future Activities

PCD has planned to make the dioxins and furans inventory as completed as possible in the near future. At present, the problem has arised since Thailand has no specified dioxins and furans laboratory. Laboratory for dioxins and furans is one of the most necessary facility to complete this project. Thailand with cooperation of Dr. Matthias Kern of GTZ and Dr. Reiner Arndt, of the Institute of Occupational Safety and Health in Germany, therefore has requested assistance from the European Industry through Dr. Arseen Seys, the Director of EURO CHLOR to absorb the expenses of the dioxins and furans sample analysis in Germany. It was unofficial accepted the request for approximately 200,000 USD for sampling analysis. The official agreement will be issued soon after the Workshop.

Thailand also has planned to establish the specified dioxins and furans laboratory in Thailand to perform the long term monitoring system. This laboratory could not only for dioxins and furans analysis in More detail on laboratory establishing will be discussed later since it will inveloe both financial problem and personal expertise.

15. Reporting on Persistent Organochlorines in New Zealand

H. Ellis, S. Buckland (presented by Ms. H. Fiedler)

1. Introduction

Schematic overview of the Organochlorines Programme, Based on robust science (data generation for organochlorines in environmental media, food and human tissue - serum) which is then used in to an environmental and human health risk characterisation. This will lead to development of Govt. policy, national environmental standards and guidelines along with development of a management plan. Besides the components of the work covered in this presentation, other work includes determining the concentrations of organochlorines in serum and an inventory of dioxin emissions to air, land and water.

The data that this study has generated likely to be of interest to the global community and not just New Zealand scientists. Primary goal has been to make this information accessible as possible to all interested people. Full reports for organochlorine levels in food (and estimation of dietary exposure for New Zealanders), in riverine and in estuarine environments are available on the Ministry for the Environments web page (http://www.mfe.govt.nz/issues/waste/organo.htm). The reports on concentrations in soil and air will be available shortly. These data will also be available on CD ROM, along with an Access database. The can be obtained from the Ministry for the Environment.

2. Overall Goal and Achievements of the Programme

The environmental survey was designed in a way that recognises the interactions between the different environmental compartments. The key intention was to obtain typical or average concentrations in these compartments, therefore most of the work was based on the analysis of composite samples.

2.1 Air

The air sampling programme involved the collection of 20 day samples using PS-1 high volume air samplers. Typical volumes were ca. 4,000 m^3 of air. Urban sites were Auckland City, Hamilton, Masterton, Greymouth and Christchurch. The Auckland City site was located at a major traffic intersection to assess vehicular emissions. Sites in the remaining four centres were in primarily residential areas.

Concentrations of dioxins in air. The data shows I-TEQ levels that include one half the limit of detection for non detected congeners. For the reference sites, very low levels (typically 1-2 fg I-TEQ m^{-3}) were found. At Baring Head, the samples were collected only when the wind was coming from the Southerly direction. In this direction, There is no landmass between this point and Antarctica. The data at this site therefore reflects Southern Ocean atmospheric concentrations. At the rural sites, the lowest levels were found at Culverden. The levels at Te Wera were slightly higher and higher than was expected for this site. Subsequent investigations identified the possibility of uncontrolled combustion from an industrial process that was the likely source of dioxins. Nonetheless, the low levels in New Zealand rural environment is in agreement with the low levels of dioxins present in New Zealand agricultural soils.

At a number of the urban sites, the dioxin levels in air varied with the season. At Culverden, Hamilton, Masterton, Christchurch and Greymouth, the highest levels were measured in the coldest winter months and the lowest levels in the warmer summer months. At these sites, the

lower the night-time temperature the higher the dioxin level in the air. At Christchurch and Masterton, the levels of dioxin were also strongly correlated to the aromatic hydrocarbon retene, which is a chemical indicator of wood burning. These findings indicate that home heating is an important source of dioxins for some parts of New Zealand. In contrast, the Auckland City site showed very similar dioxin levels throughout the year, which is consistent with a continuous background of emissions that might be expected with motor vehicles emissions.
These levels were below air quality standards that exist overseas (e.g. Canadian and the US [State of Connecticut] values).
Comparison with data from other countries shows that in New Zealand urban concentrations are generally lower than similar environments in the northern hemisphere.
Seasonal variation was found for dioxin concentrations in Christchurch air. Similar seasonal variations are observed for other urban centres as well. The mean night time temperatures are shown above each bar. At Christchurch and other urban centres, there was a statistically significant negative correlation between mean night time temperature and dioxin concentrations.
It was found that air dioxin concentrations in New Zealand rural and reference environments are generally lower than found overseas for comparable environments. The low rural air concentrations are consistent with the finding of low levels in New Zealand soils compared to overseas rural soils, and the low dietary exposure dioxins for the New Zealand population compared to overseas (see later).

2.2 Soil

For the assessment of dioxins in soil, comparable environments to those investigated in the ambient air phase of the study were chosen. Therefore the Forest and grassland soils were taken from National Parks and represent reference sites. Hill country and flat land pasture reflect he different agricultural uses in New Zealand. Urban soils were taken from established parks and reserves in provincial and metropolitan centres. Soils were collected to a depth of 10 cm, and were composites of multiple soil cores. For the reference and rural soils, sampling sites were randomly selected from eight regions of the country. For provincial and metropolitan centres, criteria were used to identify areas that were typical of each urban centre studied.
Dioxins in hill country and flat land pasture soils are illustrated for each of the 8 regions the country was divided into. TEQ data includes half limit of detection for non detected congeners. For all samples but one, I-TEQ were below 1 ng kg^{-1} dry weight. Only very few congeners were quantified, with the TEQ arising primarily from LOD values. One hill country pastoral sample (from Northland) had a comparatively higher dioxin concentration. The primary contributor to the TEQ level was 2,3,7,8-TCDD indicative of 2,4,5-T usage. This herbicide was historically used in New Zealand for the control of gorse and other brush weeds. The level found can not have arisen from routine application at typical application rates and dioxin microcontaminant concentrations in 2,4,5-T formulation, and it is believed that the levels found are a result of sampling in an area where spillage of concentrated 2,4,5-T formulation has occurred. This level was not observed anywhere else in the survey. These levels are below the current New Zealand guideline and overseas guidelines for dioxin residues in soil to be used for agricultural purposes.
The very low levels of dioxins in New Zealand's agricultural soils is consistent with low dietary exposure to dioxins from the consumption of meats and dairy products.
The New Zealand hill country soil is shown as two bars. The bar on the left hand side is for all sampling points excluding the elevated Northland sample. The northland sample is shown as the narrow bar on the right hand side of the plot. The data indicates that levels of dioxins in New Zealand's agricultural soils are generally lower than concentrations reported in Europe and North America.

Dioxin concentrations found in provincial centres and the metropolitan centres of Auckland and Christchurch. TEQ data includes half limit of detection for non detected congeners. Again, levels are very low, even for samples taken from industrial areas of Auckland and Christchurch. For most samples, non detected congeners are the primary contributor to the TEQ level determined. Again the data are below current New Zealand guideline and overseas guidelines for dioxins in urban soils. Comparison of the New Zealand data and overseas data for urban soils illustrates the low levels of dioxins in urban soils in New Zealand compared to Europe and North America.

2.3 Rivers

Thirteen New Zealand rivers were studied. This involved the analysis of river water and freshwater finfish (eel and trout). Two species of finfish were studied because they cover different life cycles and histories. Eel are commonly found throughput the country, are bottom feeders, have a higher lipid content and live to a longer age than trout. Eel are also an important food for the indigenous Maori population. Trout will represent more recent exposure to organochlorines. Trout were not as easy to capture as eel, and from sites no analytical sample was obtained.

Strict protocols were developed for the collection of riverine samples. Biota samples analysed were composites of typically six individual fish. Sites studied covered a range of environments from baseline (reference) through to impacted. Reference sites were located in remote areas, usually in the upper reaches of the rivers. Impacted sites were downstream of diffuse sources from agricultural runoff, and point source discharges from industrial and domestic activity.

Data for dioxins in eel and trout at the 16 sampling sites. TEQ data includes half limit of detection for non detected congeners. Dioxins were not detected in either eel or trout at most sites, with the TEQ level shown on this graph coming solely from LOD values. At the sites where dioxins were found, levels measured were between 0.16 - 0.39 ng I-TEQ kg^{-1} for eel and 0.016 - 0.20 ng I-TEQ kg^{-1} for trout.

Two major New Zealand rivers (Waikato and Tarawera) were not studied in this current survey. Both these rivers are recipients for bleached kraft pulp mill effluent, and dioxin concentrations in finfish from these rivers have previously been measured as part of other environmental impact studies.

2.4 Estuaries

Sediment and shellfish (cockles and oysters) were collected from 12 estuaries. Knowing the contaminant concentrations in shellfish is especially important, because shellfish are often a step in the food chain for people and wildlife. Estuaries were selected from remote areas, agricultural areas and urbanised catchments. From each estuary, 2 or 3 sediment and shellfish samples were analysed. All samples analysed were composite samples. Sediment samples were collected as 10 cm cores.

The average dioxin concentration found in shellfish is where data includes half LOD values for non detected congeners. For most samples, LOD values were the major contributor to the TEQ level determined. These concentrations reported are generally lower than levels reported in other countries, and are below overseas guideline limits for human consumption.

The levels of dioxins found in sediment in the current New Zealand study were between 0.081 - 2.71 ng I-TEQ kg^{-1} dry weight basis (including half LOD values for non detected congeners). This concentration range is compared with data reported overseas, and shows that levels in New Zealand estuarine environments appear to be lower than data in the northern hemisphere.

2.5 Food

The foods studied were those that are commonly eaten in New Zealand, are available nationally and have been shown to be a source of exposure to dioxins and PCBs in other countries. They included meats, poultry, fish and dairy products. Staple foods such as cereals and potatoes were also analysed. However, because organochlorines are usually found in foods that do not contain fat, less emphasis was placed on analysing a wide range of fruit and vegetables.

All foods were bought at supermarkets and other retail outlets in four main centres, and one provincial centre. The samples of each food were prepared and cooked, as most New Zealanders would do in making any meal.

Two model diets were prepared - for an 80 kg adult male on a typical diet and a 70 kg adolescent male on a high energy diet, and an estimate of their dietary intakes of dioxins and PCBs made. Males were chosen because they generally eat more food than females, and are therefore likely to represent a 'worst case' exposure through the diet.

For both the adult male and adolescent male diets, the levels of exposure to dioxins and PCBs were below the WHO tolerable daily intake range for dioxins and PCBs of 1-4 pg TEQ/kg bw/day. This is shown in the following slide.

This slide compares the dietary exposure for the New Zealand adult male (first bar from the left) and the adolescent male (second bar from the left) with dietary exposures estimated in the Netherlands for a typical male (third bar) and high energy adult (fourth bar), the United Kingdom average adult (fifth bar) and high energy adult (sixth bar) and the United States average adult (seventh bar). The WHO TDI range is also shown.

The New Zealand data includes half LOD values for non detected congeners. Much lower intake estimates are obtained in LOD values are excluded. Nonetheless, intake are still below the WHO target of 1 pg/kg bw/day. Even though the adolescent male is approaching this target TDI, the TDI are for a lifetimes exposure, and the adolescent male is only exposed to these levels of intake for a short period of their life.

Levels of exposure to dioxins and PCBs are also below those estimated overseas, although it is noted that exposures are falling in these countries.

The low level of dioxins and PCBs found in New Zealand meats and dairy products, and the low level of dietary exposure for New Zealanders is consistent with the very low levels of these contaminants measured in rural soils across New Zealand.

16 Characterization of POPs Pesticide Use

by Ms. A. Sunden-Bylehn

Current production and use of POPs Pesticides

- ALDRIN
- DIELDRIN
- ENDRIN
- CHLORDANE
- HEPTACHLOR
- DDT
- MIREX
- HEXACHLOROBENZENE
- TOXAPHENE

ALDRIN

- Probably not produced anymore
- Possible "residual" uses through stockpiles

Reported uses include:

- termite control in tree nurseries and buildings
- insect control in grain storage
- soil pests in maize
- possibly control of tsetse flies and
- ectoparasites on cattle

DIELDRIN

- Probably not produced anymore
- Possible "residual" uses through stockpiles

Reported uses include:

- locust control
- termites control in buildings, crops, nurseries and forest plantations
- insect control in grain storage
- possibly control of tsetse flies and
- ectoparasites on cattle

ENDRIN

- Probably not produced anymore
- Possible "residual" uses through stockpiles (although it seems not to be used anymore)

Reported uses include:

- Control of lepidopteran pests in crops (maize, rice, cotton, and sugarcane)
- control of mice and water voles

CHLORDANE

- US manufacturer stopped production in 1997

Reported uses include:

- termite and ant control in buildings, crops, nurseries and forest plantations
- control of Rhinoceros beetles

HEPTACHLOR

- US manufacturer stopped production in 1997

Reported uses include:

- termite and ant control in buildings, crops, nurseries and forest plantations
- control of cut worms

DDT

- Still in production -(up to 50 000 tons per year according to certain estimates, probably including production as an intermediate for dicofol manufature)

Reported uses include:

- vector control: malaria mosquitos; sand and tsetse flies (leishmaniasis and trapanosomiasis); fleas (plague)
- illicit control of crop pests, eg lepidopteran

HEXACHLOROBENZENE (HCB)

- Produced as an intermediate in dye production and as a by-product in manufacture of other chemicals
- Probably not produced as a fungicide anymore

Reported uses include:

- fungicide, particularly effective against bunt and dwarf bunt on wheat

MIREX

- Some production of smaller quantities may still take place

Reported uses include:

- termite and ant control in crops, grassland, forests and buildings
- (fire retardant)

TOXAPHENE (Camphechlor)

- Believed to be out of production
- Possible "residual" uses through stockpiles

Reported uses include:

- insect control mainly in cotton, but also in soybeans, vegetables and on livestock pests
- possibly control of tsetse flies and
- ectoparasites on cattle

Monitoring Data on POPs

Information from developing countries are rather scarce.
Data from Africa indicate that recent concentrations in animal tissues are considerably higher than they were in Europe when exposures were considered a concern

17. Alternatives to POPs for Disease Vector Control Methods and Strategies

by Mr. R. Bos

1. The history of malaria vector control.

This section draws on the publication The tomorrow of malaria *by Socrates Litsios.*

The history of malaria vector control started a century ago with the discovery by Sir Ronald Ross, in 1898, of the role of mosquitoes in the transmission of the disease. Not long before, the parasite causing the disease, a protozoan living in the blood had been discovered. The early years of the 20th century provided fertile conditions for basic research and, therefore, witnessed rapid progress in the understanding of the epidemiology of the disease.

It was soon determined that only mosquitoes of the genus *Anopheles* transmit malaria and, to be more precise, exclusively female mosquitoes belonging to this genus since they require a bloodmeal for the maturation of their eggs.

The discovery of the exclusive role of insect vectors in the transmission of malaria and a number of other diseases (including trypanosomiasis -sleeping sickness-, filariasis and leishmaniasis) opened new perspectives of interrupting transmission by controlling mosquitoes and research soon developed into this direction.

It became rapidly clear that the genus *Anopheles* contained a large number of species with only a limited number actually serving as vectors of malaria. Within this group of vector species great differences in ecological requirements were observed, in terms of characteristics of larval habitats and blood feeding and resting behaviour. Species also differed in their effectiveness to transmit malaria.

In those early days, celebrated scientists like Sir Malcolm Watson, who worked in Malaysia (then the British colony Malaya), and Professor Nicolaas Swellengrebel (in the then Dutch East Indies, now Indonesia) successfully exploited opportunities to modify the environment and reduce mosquito population densities to a level that transmission was interrupted. Swellengrebel even coined a new expression for this: *species sanitation* and he forcefully promoted this approach as being the most cost-effective and what we would now call sustainable. There were, however, also many failures of attempts to apply "naturalistic" methods (nowadays they would be referred to as environmental management) and this period should certainly not be romanticized as the glorytime for an ecologically balanced approach to mosquito vector control. In fact, many of the environmental management measures relied on drainage, an activity which from the present day perspective of nature conservancy would no doubt meet with strong resistance ! In retrospect failures can be attributed to limitations in the "species" concept at the time (mainly determined on the basis of morphological characteristics; only later it was found that within many of these "species" genetically different sibling species exist with differences in vectorial capacity and ecological requirements) and by the fact that in areas of high endemicity it is not possible to reduce mosquito populations by larval control alone sufficiently to have an impact on the transmission.

The early days of malaria vector control were also days of controversy. Malariologists were divided into camps over a number of issues. One of these was the link between socioeconomic development and malaria. There were those who argued that control of the disease was a prerequisite for socioeconomic development in rural areas, while others claimed that socioeconomic development should be the primary goal with improvements in the malaria situation automatically following in its wake.

Similarly, there was a debate over medical (in those days reliant on quinine treatment) versus vector control interventions, nurtured by observed paradoxical phenomena concerning vector populations and malaria endemicity (in later days, so-called anophelism without malaria, one of these paradoxes, could often be traced back to the earlier mentioned genetic differences between sibling species).

Finally, consensus on a strategy was reached at the Intergovernmental Conference of Far Eastern Countries on Rural Hygiene held in Bandoeng (now: Bandung) in 1937 under the auspices of the League of Nations.

The Bandoeng Conference came up with the following declarations:

- *malaria is a health and social problem; it must be attached simultaneously from both these angles.*

- *malaria in badly affected areas forms a considerable barrier to the development of other welfare activities and oftentimes must be checked before other types of work become possible.*

- *the opening of public health work in rural areas can often be used as the entering wedge for the development of a broader programme embracing education, sociology, engineering and agriculture.*

- *Since malaria is a focal disease in any country –absent in some rural areas, lightly prevalent in others and moderately or heavily endemic elsewhere- the structure of and programme for rural health organization, including health units and health centre, should not be stereotyped but flexible. In those areas where malaria is the outstanding social and health problem, the resources of the health administration, specially augmented where necessary, should be directed chiefly to malaria control, even if this should entail the restriction of other public health activities, until malaria is no longer of major importance.*

There were also observations made concerning the need to expand the knowledge base on the effectiveness of naturalistic measures which may be interwoven.*with agriculture, pisciculture and animal husbandry, and in line with the economic realities of the rural areas of the world…*

Implementation of the recommendations of the Bandoeng Conference was not to see the light of day, as the onset of World War II was imminent.

Enter DDT ! In the euphoria over this new miracle insecticide, with its extended residual activity, its relatively low cost and its low acute toxicity for human, the intentions expressed in Bandoeng were soon forgotten. DDT served a public health purpose and it also served a strategic political purpose in the new cold war era. It became the cornerstone for WHO's global malaria eradication programme which was formally launched in 1955.

What is the balance of DDT's impact in retrospect? On the positive side, DDT's contribution to humanity includes, *inter alia*:

- millions of human lives were saved by the residual house spraying campaigns with DDT and, subsequently, with second generation residual insecticides when DDT resistance occurred.
- malaria, usually of the unstable type, was eradicated from substantial areas in the temperate and sub-tropical zones and from some small island states in the tropics.
- the malaria eradication campaign brought health services to the community level in many countries (and into remote rural areas often for the first time !) and provided a form of employment and livelihood for tens of thousands of people.
- reliance on DDT and other residual pesticides triggered new research into behavioural aspects and genetics of vectors, particularly in relation to insecticide resistance.

On the negative side of the balance, the following aspects feature:

- the concept emanating from the Bandoeng Conference, of a flexible malaria control programme geared to generating local solutions to local problems, underwent a paradigm shift to a monolithic, vertical programme relying on blanket application of a single intervention in a virtually military operation.
- traditional multidisciplinary and intersectoral support for malaria vector control operations was replaced by strictly health sector confined operations; malaria disappeared from the rural development agenda.
- research on the ecology and biology of vectors came to a virtual standstill.
- commercial vested interests started to dominate decision making on malaria control strategies.
- and, unbeknownst to those promoting DDT at the time, the build up of an environmental load of this persistent organic pollutant started, although it should be stressed that the proportion of DDT used for public health purposes has been minor compared to the amounts applied in the agriculture sector, even taking into consideration its banning for agricultural use in the 1970s.

Table 1. A century of malaria control.

1898	Ross discovers the role of mosquitoes in malaria transmission
	Early discoveries in vector biology and malaria epidemiology "Naturalistic" interventions Controversy over development vs malaria control; and,

Over medical interventions vs vector control

1937 Bandoeng Conference

World War II

DDT

WHO's Global Malaria Eradication Programme 1955-1969

1978 Primary Health Care (Alma Ata Declaration)

1992 Amsterdam Ministerial Conference: WHO Global Malaria Strategy

1999 WHO's Roll Back Malaria Initiative

2. The current state of malaria and DDT use.

The resurgence of malaria at the end of the eradication era was mainly due to the induction of insecticide resistance in vector populations (implying the need to shift to other, more expensive pesticides), the managerial breakdown of eradication programmes as political priorities shifted and growing refusal rates in house spraying campaigns. The argument that there were links between the withdrawal of DDT and the resurgence (often using Sri Lanka as a case in point) can be easily refuted. In most cases the resurgence started in the second half of the 1960s, and in countries where DDT was withdrawn (usually because of vector resistance) this did not happen until the early 1970s and it was then generally replaced by another residual insecticide such as malathion.

In the 1970s the malaria situation was exacerbated by the development of drug resistance in *Plasmodium falciparum*, first against chloroquine alone, later multiple drug resistance occurred. In the Asian countries a shift also occurred from the predominance of the more benign *Plasmodium vivax* infections to the more lethal *Plasmodium falciparum*.

Currently, the global population estimated at risk of malaria infection is estimated at 2 billion, with an estimated 100 million episodes of malaria each year and an estimated 860,000 deaths each year. The distribution of the burden of disease and mortality shows that 90% occurs in sub-Saharan Africa, 9% in Asia and 1 % in Central and South America. War zones and areas undergoing major ecological/demographic change because of land and water resources development have become hotspots for malaria. As unplanned urbanization continues to create large peri-urban areas lacking the necessary basic services, malaria is also on the rise in the urban setting.

WHO is in the process of preparing an inventory of the current use of DDT for malaria vector control. First indications are that this use is limited to a small number of countries on each of the three continents where malaria is a public health problem, with a trend towards phasing out its production and use. Reasons for the phasing out of its use include the falling differences in price between DDT and substitutes of choice, the pyrethroids, difficulties in obtaining good quality DDT on the world market, trade regulations concerning DDT residues in agricultural produce and the shift from reliance on residual spraying to the use of insecticide impregnated mosquito nets.

3. WHO's inputs into the INC process

The WHO has assumed an active role in the currently on-going intergovernmental negotiating committee meetings to develop a POPs Convention before the end of 2000.

As a first step, the World Assembly adopted, in 1997, Resolution 50.13, which endorsed the recommendations made by the International Forum on Chemical Safety (IFCS). In this Resolution, the WHA called upon Member States to, *inter alia*:

- take steps to reduce reliance on insecticides for the control of vector-borne diseases through promotion of integrated pest management approaches in accordance with WHO guidelines …

- ensure that the use of DDT is … for public health purposes only, limited to government-authorized programmes that take an integrated approach and … [prevent] diversion of DDT.

The Assembly also requested the Director-General

- To participate actively in the INC on the currently identified POPs, in the drafting of a legally binding instrument for the "PIC" procedures and in other intergovernmental meetings … in particular those relating to the use of pesticides for vector control …

  The most recent WHO Technical Report (no. 857, 1995) addressing the DDT issue states:

  DDT may … be used for vector control, provided all of the following conditions are met:

  - *use for indoor house spraying only*
  - *it is effective (i.e. the vector is susceptible, and bites/rests indoors)*
  - *material is manufactured according to WHO specifications*
  - *safety precautions are applied in use and disposal*

An internal working group was established at WHO headquarters in Geneva, consisting of professionals of the relevant programmes responsible for malaria control, disease vector management, chemical safety, food safety and environmental management for vector control, to provide a concerted effort in response to WHA Resolution 50.13.

A first analysis of the participation in a series of preparatory awareness raising workshops prior to the start of the POPs negotiations indicated that the ministries of health had been under-represented and that representatives from ministries of health were mainly chemical safety professionals and not managers of malaria vector control programmes. As its input to the INC-1 in Montreal WHO therefore raised the various relevant issues that need to be addressed (alternatives to POPs pesticides for vector control, destruction of obsolete stockpiles of DDT, DDT stockpiles kept by countries for emergency outbreaks and inadvertent imports of DDT through unsuspected sources such as certain brands of mosquito repellent coils). WHO announced the preparation of an action plan that will aim to assess the needs of Member States in terms of technology transfer, research and development and capacity building, in order to make the transition to alternative vector control methods and strategies, while maintaining or improving current levels of effectiveness of vector control programmes. The complete draft of this report is expected by the end of March and will be subject of a meeting of independent experts in Milan (3-5 May 1999).

4. Alternative methods and strategies for vector control

Three caveats should be made before classifying malaria scenarios and possible alternatives to DDT.

the epidemiological significance of chemical adulticiding

Longevity of vectors is a crucial determinant of their vectorial capacity. The longer an individual vector mosquito lives, the greater the probability that it will transmit the disease. At a minimum, the female *Anopheles* will have to take one blood meal from an infected host, and sufficient time should elapse between this and the next blood meal to allow for the parasite life cycle to take place inside the mosquito and render it infectious. The great strength of residual spraying is that it interrupts transmission by reducing longevity in areas where reduction of mosquito population densities would not have this effect. This fact has to be considered when dealing with alternative methods and strategies to POPs pesticides for vector control.

exceptional position of DDT

In many countries DDT's strong position as the pesticide of choice for vector control was due to the early banning of its use for agricultural purposes. This meant that the induction of vector resistance could be delayed significantly, even though limited quantities found their way illegally for use in crop protection. Alternative pesticides do not offer this advantage. Synthetic pyrethroids are widely used in agriculture and development of resistance to one of the pyrethroids invariably gives rise to cross-resistance to all. Pesticide susceptibility is a key resource that should be protected to the extent possible in order for chemical control to be reserved for occasions when it is really essential.

alternative methods or alternative strategies?

Selection of alternatives to POPs pesticides in the area of disease vector control is no simply a matter of replacing one pesticide by another, or even of substituting one method of control by another. This is underscored by points 1 and 2 above. This transition will require an in-depth analysis of the managerial functions of vector control organizations and their programmes, an assessment of the knowledge base on locally important vectors and the development of decision making criteria for the composition and regular updating of an integrated vector management programme. Such a programme should build on community involvement and intersectoral action. Part of the operational functions of ministries of health should be taken over by other ministries and authorities, with the health authorities assuming a regulatory role based on an effective legislative framework. Integrated vector management does **not** mean abandoning chemical control of vectors altogether; it means a clear definition of the concept of judicious use of pesticides in terms of decision making criteria for the composition of the most cost-effective and synergistic intervention package drawing on all vector control methods available, minimizing the chemical component.

The expanding evidence base on issues of biodiversity in integrated pest management in agriculture are of particular interest to integrated vector management. There are also research outputs in the area of vector biology and ecology with a direct bearing on the issue of biodiversty. The work of P.F. Amerasinghe in Sri Lanka during the 1980s showed, for example, how habitat simplification (i.e. reduced biodiversity) in areas of the Accelerated Mahaweli Development Project favoured *Anopheles* species that transmit malaria. This phenomenon, combined with the hydrological changes in the Mahaweli River Basin caused serious malaria outbreaks in the newly irrigated areas as well as at altitudes where the disease had never occurred before.

For the Asia / Pacific region a first, rough characterization of ecotypes for malaria, based on ecological criteria, provides the following scenarios:

- Vector species linked with agro-ecosystems such as irrigated rice: e.g. *Anopheles culicifacies*, *A. aconitus*

- Vector species associated with tropical forests: e.g. *A.. dirus*, *A. minimus*

- Vector species associated with relatively pristine ecosystems, including plains and foothills with slow running streams: e.g. *A. fluviatilis, A. maculatus, A. annularis*

- Urban vector species: *A. stephensi*

- Brackish water breeding vector species: e.g. *A. sundaicus*

Vector control interventions that can be incorporated in an integrated approach include:

Environmental management:

- environmental modification (usually capital intensive, infrastructural works, but may also be design modifications to infrastructural works of other sectors such as irrigation schemes, road construction of housing development)

- environmental manipulation (recurrent activities to reduce environmental receptivity, often linked to operation and maintenance work, conducive to community participation, especially when linked to income generation)

- zooprophylaxis (the use of cattle to divert zoophilic vector species away from biting humans; the use of attractants distilled from animal odours to attract vectors to baited traps)

- personal protection (mosquito nets, screening of houses)

Biological control

- use of predators / parasites (the use of larvivorous fish is the most common approach and can be linked to fish culture for income generation; introduction of specific predator insect species in an ecosystem)

- use of bacterial toxins (e.g. Bacillus thuringiensis)

- use of biologicals (neem is a traditional biological Under scrutiny for its pest control value, others are insect growth regulators)

Chemical control

- alternative pesticides for adulticiding through house spraying or impregnating mosquito nets (frequent arguments on these alternatives include their costs, the risk of insecticide resistance, and for some their higher acute toxicity)

- larvicides are of limited application, mainly in urban settings.

5. Final recommendations

For the desired transition from reliance on POPs pesticides (i.e. DDT) to an alternative, integrated vector management approach with an overall reduced dependency on pesticides, it will first of all be necessary to initiate a dialogue between the environmental policy makers and the managers of malaria vector control projects and the responsible policy makers in the health sector. This is an important task for national POPs focal points to undertake.

For continued collaboration in this area the establishment of a strategic alliance between health and environment ministries is recommended as a mechanism to jointly address cross cutting environment and health issues in development.

In the discussion over alternatives to POPs pesticides and the reduction of reliance on pesticides in both crop protection and vector control, biodiversity is a crucial issue. In fact, many of the problems caused by crop pests and vector-borne diseases result from habitat simplification caused by development projects. Pesticide based control further reduces biodiversity, usually favouring noxious insect species. In this connection, options may be explored for support for case studies from the biodiversity window of the Global Environment Facility.

At the country level, strategic risk assessments for malaria and other vector-borne diseases should be carried out, and an inventory should be prepared of all available data on vector biology and ecology. This first step should provide the basis for the development and testing of locally suitable alternatives for vector control together with the development of sound decision making criteria for an integrated vector management approach.

18. New Perspectives on Alternatives to DDT for Malaria Mosquito Control

by Ms. P. Matteson

The call for a global ban on the production and use of DDT is controversial only in the health sector. Most countries outlawed DDT in agriculture decades ago, because of widely-recognized risks to consumers and wildlife. Many countries have already dropped DDT for public health use, as well. However, DDT is still used in some countries for house spraying against insect vectors of diseases, in spite of longstanding problems with vector resistance, citizen refusal of house spraying, and environmental pollution.

There are several main reasons why some public health people oppose a global ban on DDT. They are familiar with it, and depended on it for decades after DDT came into wide use after World War II. They rightly appreciate that DDT has saved many millions of lives from malaria and other vector-borne diseases. In the past, no other insecticide equalled DDT's combination of effectiveness, low cost, and low danger of acute applicator poisoning. Insecticide resistance is a threat to vector control, and many consider it unwise to discard DDT when vectors in some regions are still susceptible to it. Therefore, some people fear that without DDT, effective control of insect-borne diseases, particularly malaria, might be impossible.

Today, the situation has changed. Effective, affordable, and safer alternative insecticides, new ways to cut costs, and insecticide resistance management techniques are now available. They mean that DDT is no longer necessary, and that DDT can be eliminated without endangering public health. Many decision makers in the health sector are still not aware of these new developments.

Cost

- The price of effective substitute chemicals for house spraying has dropped. Recent international cost information compiled by a researcher for the U.S. Environmental Protection Agency shows that the per-house insecticide cost of some of the newer substitutes for DDT--the synthetic pyrethroids and malathion--is now comparable to, or only slightly higher than, the cost of DDT.

- It is not necessary to apply the newer synthetic pyrethroids to houses more frequently than DDT. Both those pyrethroids and DDT are customarily applied to house interiors every six months.

- The lower dosages and more convenient formulations of synthetic pyrethroid insecticides reduce spraying time and transport and storage charges. Therefore, the operational costs of house spraying with them are lower than for spraying with DDT.

- Better targeting and insecticide formulation and application technology can reduce the amounts of insecticide required for vector control. Researchers are evaluating promising approaches such as low-volume insecticide application, the selective treatment of indoor surfaces of houses, and "focal control," which targets only homes of people who have contracted malaria within the recent past.

- WHO's Global Strategy for Malaria Control recommends the elimination of house spraying in most epidemiological situations. Newer chemical control approaches, such as insecticide-treated bed nets, require far less insecticide. Bed net treatment is inexpensive because nets are treated at a low dose, and operations are simple and quick.

- Integrated vector management strategies that use no insecticide at all can be cheaper than spraying houses with DDT.

- Many alternative vector control measures, notably environmental management, biological control, and treated bed nets, lend themselves to community participation and cost sharing.

- Private sector interests that benefit from effective, less-toxic disease control (for instance, the tourism industry) may be willing to collaborate and share costs.

Applicator safety

Synthetic pyrethroid insecticides are generally less acutely toxic to people than other alternatives to DDT. Unlike organophosphate and carbamate insecticides, their use does not entail frequent monitoring of applicators for signs of poisoning. Safety clothing and safety equipment for applying DDT and pyrethroids are comparable.

Insecticide resistance management

The development of insecticide resistance can be avoided or slowed down by eliminating or minimizing routine insecticide use for vector control. Good practice of integrated vector management calls for maximum reliance on nonchemical vector control measures such as environmental management, biological controls, traps, and physical barriers between people and disease-bearing insects. When insecticide use is necessary, products with low persistence should be applied only to a well-targeted, minimum area.

Recent research on insecticide resistance management in agriculture and public health has generated effective management strategies. Alternating the application of two or more insecticides with dissimilar detoxification vulnerabilities can prevent or slow the development of resistance. It is important to monitor vector populations for signs of resistance. If resistance occurs, the resistance mechanism that is responsible should be determined in order to plan the most effective management measures.

These recent developments are part of the reason that most countries in the Asia/Pacific region have already been able to drop DDT from public health programs without causing an upsurge of disease. For example, for environmental reasons The Philippines banned all uses of DDT as of September, 1992, after 35 years of depending chiefly on house spraying with DDT for malaria vector control. The new strategy of the Malaria Control Service was to switch to alternative insecticides for house spraying, while gradually phasing in synthetic pyrethroid-treated bed nets as its main vector control measure. Between 1993 and 1996, expenditures for malaria control insecticides dropped more than 40%, while the number of malaria cases per 100,000 population sank from 97 to 55.

It is important to remember that it may be possible to replace DDT application with nonchemical integrated vector management without increasing operational costs. For instance, from 1983-1989, the Malaria Research Centre in India implemented an alternative Integrated Disease Vector Control pilot project that covered over 350,000 people in Kheda District, Gujurat. This project replaced the standard malaria control package with an integrated strategy centering on intensified case detection and treatment and an array of bioenvironmental vector control activities, including the elimination of mosquito breeding sites and biological control using fish. A vigorous health education campaign enlisted broad intersectoral participation from government agencies, nongovernmental organizations, and communities. A WHO cost-effectiveness evaluation found that this alternative strategy controlled malaria as well as conventional practices including DDT, but at a lower cost per person protected. The analysis did not include the added value of nonchemical vector control's environmental health benefits, such as eliminating insecticide toxicity to people and pollution of the environment.

Bioenvironmental vector control also proved successful at several other sites in India, under an array of environmental and epidemiological conditions. Similar nonchemical disease management programs are controlling malaria successfully in other parts of the world. In the Amazon region of Brazil and the Choco coastal area of Colombia, two zones long afflicted with high rates of malaria-related illness and deaths, new programs combining health education, aggressive case detection and treatment, and environmental management to eliminate *Anopheles* breeding sites have reduced malaria incidence significantly.

19. A Role for Small-scale Farmers and Rural Communities in Reducing the Entry of Persistent Organic Pollutants (POPs) into the environment

by Mr. M. Whitten

BACKGROUND

UNEP has been active in recent years in drawing attention to the environmental and health problems caused by the production and use of a suite of particularly toxic and persistent organic pollutants called POPs. Nine of the twelve currently listed POPs (aldrin, endrin, dieldrin, chlordane, heptachlor, DDT, hexachlorobenzene, mirex and toxaphene) have been widely used for pest management in agriculture and in the urban or 'built' environment. DDT has also found a continuing use in public health for controlling diseases, such as malaria, where the vector is an insect or other arthropod.

Across the globe, production of these nine chemicals has either ceased or is likely to do so in the near future. Most countries in Asia and the Pacific have banned all nine POPs from agricultural use. China claims to have banned the use of DDT within China but continues to manufacture it for sale to other countries. Mirex manufacture has not ceased, but is likely to soon. Details about production and continued availability of the pesticidal POPs are provided by other speakers at this workshop, or are contained in various document produced by the UNEP Chemicals group.

Substantial stocks of most POP pesticides are still held by most countries in the region, waiting for disposal or destruction. These stockpiles continue to pose a serious threat, either through unintended leakage as a result of poor storage and/or plain neglect (see presentation by Andrew Munro at this Workshop), or because of illicit access to these stockpiles by farmers or others in the community. For example, in his introductory speech to the Workshop, Vice-Minister Pham Khoi Nguhen, said that 8 insecticidal POPs had been banned in Vietnam, but surplus stocks remain a major source of environmental pollution in his country.

Farmers and community groups in Asia use POPs and other highly toxic pesticides, partly because these are still available, and partly because of a perceived need to deploy these chemicals as practical interventions for pest or disease vector management. The problem is graphically illustrated by the situation in Cambodia.

In October 1998, the Cambodian Government adopted a Sub-Decree on Standards and Management of Agricultural Materials. No prior legislation or regulations existed in Cambodia which dealt with the production, importation, sale, use or disposal of any agricultural materials, including chemical pesticides. Article 1 of the 1998 Sub-Decree states:

"This sub-decree is aimed to guarantee a consistent high quality agricultural material inputs to enhance agricultural production and to promote a highly efficient and sustainable agriculture in the country by providing appropriate quality standards and regulatory mechanisms to protect both the end-users, the manufacturers, distributors, and dealers of these inputs as well as the environment."

However, the Government has neither the human or financial resources to formulate or police any consequential regulations to achieve the objectives articulated in the Sub-Decree. As a consequence, no chemical pesticide in use in Cambodia today is labelled in the national language. Indeed, many pesticides, including methyl parathion, chlordane and DDT, reach Cambodian farmers unlabelled, diluted and contaminated. In some cases, these chemical pesticides start their journey to Cambodia as Aid packages from Europe or Japan.

Let us focus on one specific example of pesticide pollution of great environmental significance for Cambodia and, ultimately, for the Mekong delta in Vietnam as well. It concerns the production of mung beans on the shores of Lake Tonle Sap. This large freshwater system is part of the Mekong riverine system in Cambodia; it represents the most important fresh water ecosystem in Southeast Asia. On the shores of Tonle Sap during the dry season each year, some 2000 families grow around 2000 hectares of mung beans. This is a traditional crop, grown by these farmers for several generations. During each wet season, the mung bean field is under some seven metres of water. Annually, the area becomes part of an important fish-breeding habitat. In recent years, these farmers have applied around 10 tonnes (active ingredient) of three or more pesticides (prepared as a cocktail) to control several lepidopteran pests attacking the mung bean crop. The three main chemicals are: Folidol (methyl parathion – manufactured in Germany, formulated in Thailand, labelled in Thai, and freely available to the mung bean farmers); Thiodan (endosulfan, labelled in Vietnamese); and DDT (labelled in Thai or unlabelled).

During the wet season, unspecified amounts of these pesticides, especially the more stable DDT, enter and contaminate the overlying water. These toxins presumably finds their way each year into the Mekong River during the ensuing dry season, eventually reaching the Mekong Delta downstream in Cambodia and Vietnam. The Provincial Government of Siem Reap plans to deny the traditional mung bean farmers access to Lake Tonle Sap from the year 2000. However, it is expected that the National Government will over-ride this decision and allow the farmers to maintain tenure of these traditional lands for mung bean production. A possible solution to this serious environmental and health problem is suggested in this paper.

In some other countries, probably a majority in the region, resources are not available to effectively police existing pesticide regulations. In a number of these countries, the pesticide lobby influences Government policy and practice, often with financial incentives, to promote and increase usage of pesticides. A policy of direct and indirect subsidies for pesticides is one obvious method of favouring continued overuse of pesticides. Methyl parathion is banned in some countries (eg Vietnam and Malaysia) but it is imported from Germany and formulated in Thailand (where it is registered under more than 250 names!) and finds its way into Laos, Cambodia and Malaysia invariably labelled in the Thai language and carrying the Folidol trade name. Around 50% of insecticide used on vegetable production in Cambodia is methyl parathion (under the trade name Folidol). This permissive climate allows the continued sale of DDT and chlordane in Thailand and neighbouring countries. It also encourages the use of POPs-related pesticides such as endosulfan throughout much of Southeast Asia.

Objective of this Paper

What are some practical measures that can be suggested that will reduce the use of POPs and other highly toxic pesticides in agriculture and for disease vector control? This paper will argue that farmer and community knowledge can be a powerful weapon in the POPs war. The ability to make an informed decision is an essential first step, so that all the consequences of an action are realised at the time the action is taken. But an equally important element is the availability of alternative options that are practical and cost effective.

If alternative options to chemical pesticides, and the know-how to use these, are available to farmers, the principal two conditions are met for reducing farmer dependency and use of chemical pesticides. Firstly this will reduce the need or temptation to resort to POPs for crop protection against arthropod pests. And, secondly, it will reduce use of non-POP chemicals, delay the onset of resistance and so broaden the scope of non-POP pesticides available to farmers for crop protection.

In this paper I will give four examples of options for pest management in the tropics which aim to reduce the dependency and use of chemical pesticides including POPs.

These are:

- Rice IPM in Southeast Asia
- Cotton IPM in Vietnam
- Vegetable Production in Southeast Asia, and
- Mung bean production on the shores of Tonle Sap in Cambodia.

A unifying theme of these examples is farmer empowerment – farmers becoming experts in growing healthy crops. Empowerment, coupled with access to non-chemical options is a key to removing POPs and their negative influences. This knowledge-based and environmentally-friendly approach could be extended to disease management, especially malaria, where DDT is still seen as an essential tool. A possible partnership between UNEP, WHO, FAO and governments in the region in removing the use of POPs in malaria control is explored.

Four examples for pest management approaches in agriculture in the Asia-Pacific region that reduce the dependency and use of toxic pesticides

1. <u>IPM and farmer empowerment as a means of reducing pesticide dependency in the tropical rice paddy.</u>

In a healthy rice paddy in the tropics, we find a high abundance of insects and other biota (see figure 1). Convincing evidence is emerging to demonstrate that sustainable agriculture depends on this diverse array of plants, micro-organisms and animals (especially invertebrates). Community ecologists argue that this biota, especially the large number of predators, parasites and pathogens, plays a buffering role in regulating numbers of plant herbivores (Settle et al 1996; Schoenly et al, in press; Matteson, in press). We also know that soil fertility and the availability of nutrients to crop plants is dependent on a network of many organisms, fungi, nematodes, annelids, insects, mites, bacteria, viruses and protozoans. In the tropical rice paddy, this complex system is largely driven by the available organic matter (see figure 2). Energy from the breakdown of organic matter sustains the food web, and ultimately provides the fertility and resilience of the rice paddy (Settle et al 1996; Whitten and Settle 1998).

The rich diversity of organisms in a healthy tropical rice ecosystem

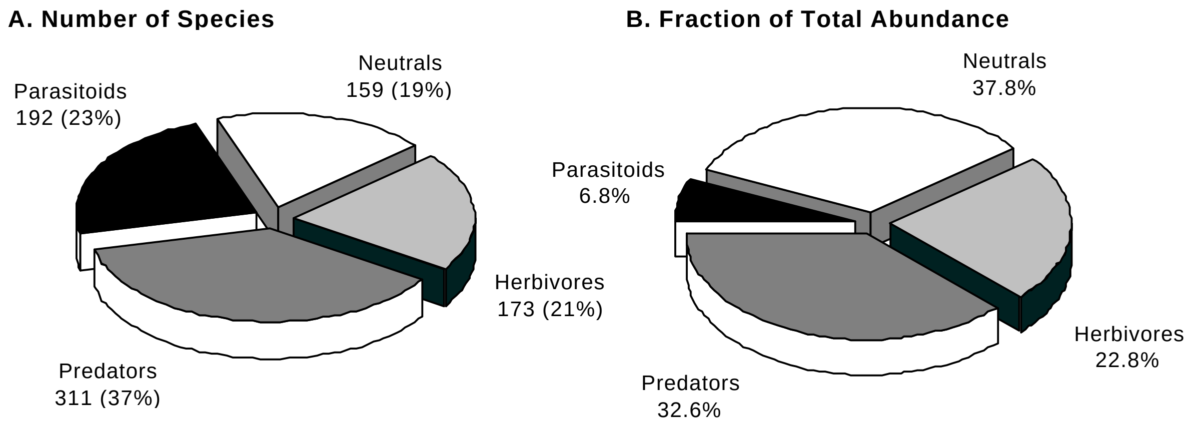


Figure 1. Trophic-level distributions from vacuum samples over six sites in West and Central Java: A. Number of species (fraction of total in parenthesis), and B. Fraction of total abundance (after Settle 1997)

How do rice farmers come to terms with the fact that they are so resource-rich? And how can they protect and take advantage of their diverse biota? These are big questions. After all, one third of the world's population consists of Asian farming households. The region's food security relies on their economic viability. And small-scale farmers continue to be the bedrock of Asian economic development, especially in the midst of the region's economic uncertainty. It follows that all our wellbeing and security is dependent on small-scale farmers now and for the foreseeable future. They are the custodians of much of the earth's biodiversity. Small-scale farmers, therefore, are the ones who need to be literate in conserving, managing and exploiting the local biodiversity of their agro-ecosystems. In one sense, the Green Revolution has been a grand diversion from the main game plan of human survival. Its dependency on external inputs has disempowered many small-scale farmers. They have lost much of their traditional knowledge and have become the unwitting tools in the destruction of their biodiversity resource base.

A community ecologist's perception of the tropical rice ecosystem

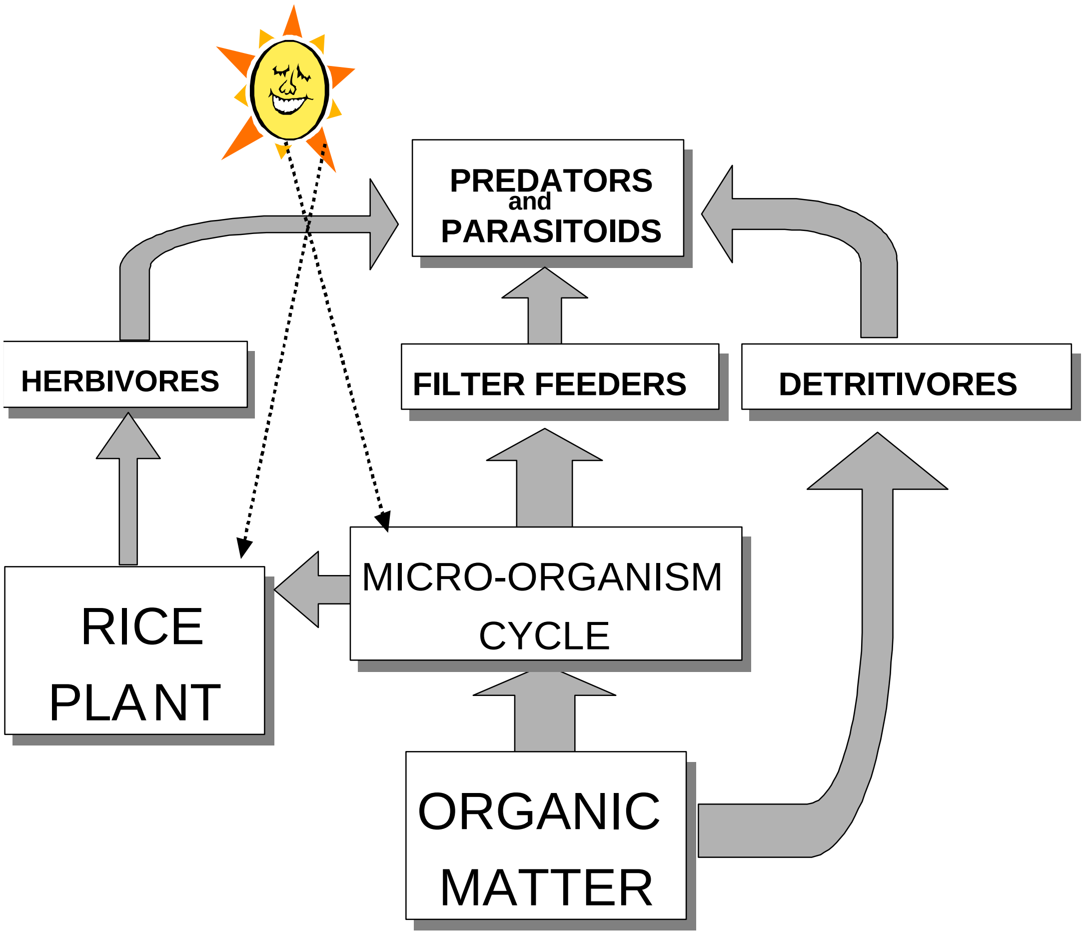


Figure 2. Hypothesized flow of energy in tropical rice ecosystems. Organic matter drives the development of high early-season populations of predators and parasitoids (principally predators) through pathways that include microorganisms (zooplankton and phytoplankton) being fed upon by filter-feeders (mosquitoes and midges), or alternatively, organic matter directly feeding detritous-feeding insects (Diptera larvae, Collembola, and some Coleoptera larvae) (after Settle 1997).

A novel approach to meet this challenge, the Farmer Field School (FFS), has emerged in Southeast Asia. The FFS offers the prospect that farmers can enjoy the gains from higher yielding varieties but, at the same time, keep a responsible eye on broader and longer term issues - amongst them conserving the biodiversity of their local paddies and gardens. A typical FFS comprises season-long training activities where a group of around 25 farmers meet regularly in the field to learn about the rice ecosystem by self-discovery and experimentation. A conspicuous feature of all FFSs is the ecosystem analysis where farmers are encouraged to make an inventory of the organisms in their field and discover the function of these diverse organisms. The farmer's field becomes the classroom. A sense of surprise and delight follows a farmer's realization that spiders, dragonflies and lady beetles consume other insects that, unfettered, eat their crop. When a farmer discovers that a spider is a 'friend' and that he/she has been paying scarce money to destroy a biological asset, this is a piece of knowledge a farmer will not forget; nor will a feeling of deception depart easily. Farmers also discover the rice plant's considerable capacity to compensate for foliar damage. The critical questions become ones of determining whether there are sufficient natural enemies to keep the herbivores in check; and what level of damage can a rice plant tolerate without yield loss. IPM farmers can test for themselves if the claims of pesticide salesmen on effectiveness and specificity are plausible.

IPM farmers invariably discover that increasing the level of inputs like seed density or amounts of fertilizer does not necessarily lead to higher yields; but sometimes creates more favourable conditions for disease outbreaks like rice blast. In subsequent seasons, surveys show that farmers have changed their practices, reduced inputs while maintaining or increasing yields. During the first two seasons of FFSs in rice in Lao PDR in 1997, IPM farmers have discovered that they could increase yields over 20% by the more effective use of existing levels of fertilizer - three applications at critical crop development stages rather than applied only during transplanting. Yield variation is frequently lower with IPM farming, meaning a more stable food supply. It also indicates that IPM farmers are better crop managers (see figure 3).

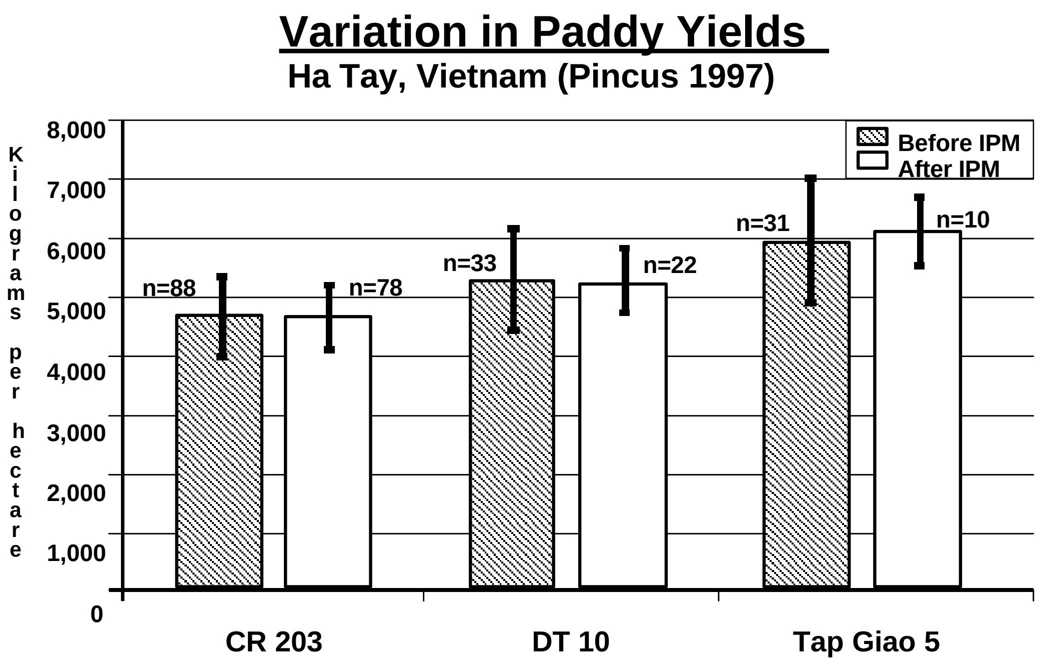


Figure 3. Reduction in yield variation for 290 IPM rice farmers in Ha Tay province in the winter/spring season of 1994/5 following attendance at season-long Farmer Field Schools. This reduction indicates that these IPM farmers have become more effective managers of their crops (Jonathan Pincus, FAO, Hanoi, unpublished data).

To date, over one million Indonesian farmers have graduated from FFSs, over 400,000 in Vietnam and over 170,000 in the Philippines since the commencement of the FFS movement by their Governments. The non-formal educational approach used in FFSs fosters farmer participation in identifying key crop management problems, and encourages farmer leadership in discovering solutions. The curricula reflect farmer interest and concern, and so the FFS tends to cover all aspect of growing a crop from land preparation, choice of variety, and management of all inputs (water, fertilizer and pesticides). IPM farmers in Indonesia are increasingly marketing value-added rice-based products. In Indonesia there are around 20,000 farmer-trainers; in Vietnam, some 2000. IPM farmers have established numerous farmer clubs and associations (over 1000 in Vietnam) which provide a climate for discussion, experimentation and further development.

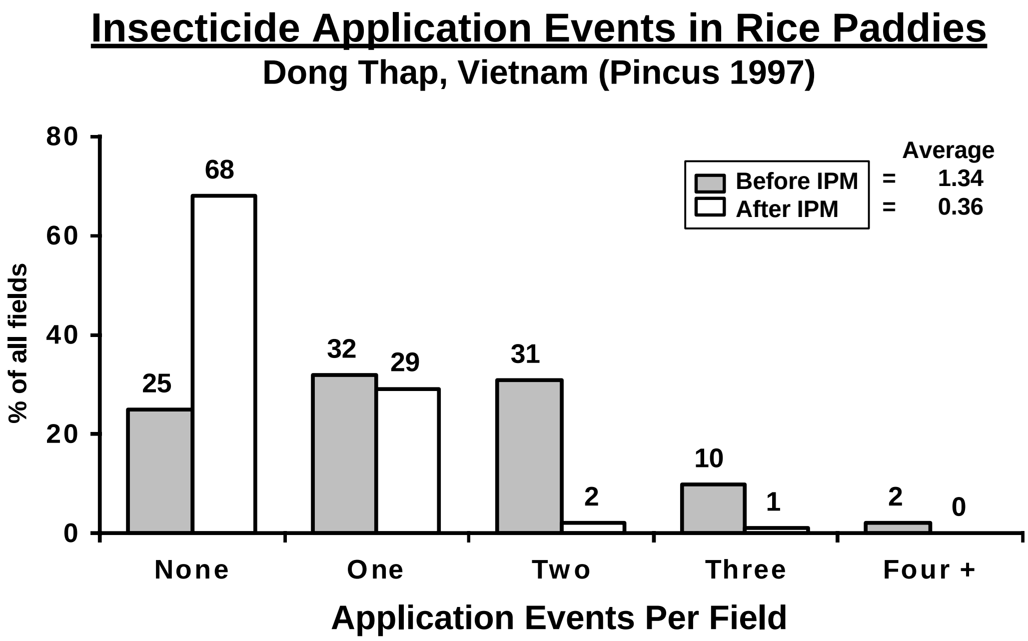


Figure 4. Change in pesticide practice by IPM rice farmers in Dong Thap province following attendance at season-long Farmers Field Schools. The survey covered 287 IPM farmers and showed a reduction in insecticide applications from 1.34 to 0.36 application events over the full winter/spring season of 1994/5 (Jonathan Pincus, FAO, Hanoi, unpublished data).

While the aggregate amount of pesticide used in rice is much higher than in vegetables throughout tropical Asia, the intensity of pesticide usage is much higher in vegetables. It should be noted that POPs were never used to any significant degree in the tropical rice ecosystem, compared to cotton and vegetables. Some vegetable crops are exposed to cocktails of 4-10 pesticides every second day during much of the growing season. This can amount to more than 40 applications during the life of a cabbage crop in Thailand, or in excess of 80 over the season for brinjal (eggplant) in Bangladesh. However, in rice while the average might only be 1-2 applications per season, there is a significant tail of growers that will apply 2-4 applications over the season. And it is in this group where the health and environmental problems are concentrated. In a 1996-1998 study of the impact of IPM on farmer practice in two provinces in Vietnam, Jonathan Pincus showed that the proportion of IPM farmers using no insecticide over the season can increase from 40 to 68%, while the proportion of farmers that use 2 or more applications can fall from 43% to less that 4% (see figure 4). Thus averages don't tell the whole story. IPM farmers greatly reduce their dependency and use of chemical pesticides. Their production costs are reduced, their yields are not reduced and their net profit is higher.

2. ***Cotton IPM in Vietnam***

Cotton is produced by some 14,000 farmers with an average holding of less than one hectare. Each year some 12,000ha are planted and the average yield is about 1,000 kg/ha. The crop provides about 10% of Vietnam's cotton requirements. The single major constraint to economic cotton production in Vietnam has been the cotton bollworm, *Helicoverpa armigera.* Resistance to the major chemicals and worker health problems made it uneconomical and unattractive for farmers to enter into contracts with the Vietnam Cotton Company to grow cotton under contract; and farmers elected to grow other crops.

In 1996, the Vietnam Cotton Company, organised a Training of Trainers (TOT) in cotton IPM with support from the FAO Intercountry Program for IPM in South and Southeast Asia, and with funds from the Australian Government. Some 23 extension workers studied all aspects of growing a healthy crop but with special emphasis on reducing pesticide usage and relying on the native natural enemies to keep H armigera in check. The curricula of the TOT included: ecosystem analysis, cotton plant physiology, insect and disease management, insect zoos and plant compensation experiments. A novel component of the curriculum was the use of biological pesticides, especially a nucleopolyhedrosis virus (NPV) and *Bacillus thuringiensis* (Bt) to augment the native fauna of predators and parasitoids. Associated with the TOT were four Farmer Field Schools (FFSs) with a total of 120 farmers. The cotton farmers in the FFS grew cotton under two sets of conditions; one called Farmer Practice (following local farmer practice) and a second set in which farmers and trainers studied the ecology and agronomy of the crop in a participatory personal-discovery manner. They made decisions following field observation and discussion of the crop's state of development. IPM farming practice greatly reduced the use of chemical pesticides (down 96%), yield increased significantly (up 22%) and net profit was higher (up 85%).

In 1997, the Vietnam Cotton Company ran 24 FFSs with 674 farmers participating. The results were similar: with farmers making informed crop management decisions - cost of pesticides (62% lower), yield (15%higher) and net profit (32%higher). The VCC is currently conducting another 24 FFSs during the 1999 season with modest financial assistance from the Government of the Netherlands. The average cost of a FFS is around USD1000. This investment is recouped within the first season of a farmer adopting IPM and making better decisions about all aspects of crop management.

These outcomes were essentially achieved by the Vietnam Cotton Company, together with their own extension staff and farmers contracted to the VCC. The partnership between the company, trainers and farmers developed a knowledge base that, as far as pest management was concerned, exploited the native natural enemies. To a large extent the pest problem was a pesticide-induced, or at least a pesticide-aggravated problem because pesticides were suppressing native natural enemies. The native biota was augmented by the production and release of an NPV which itself had been originally collected from *H. armigera* in Vietnam.

Thus, the solution to pesticide abuse in cotton in Vietnam has two key components. The first, the option bit, is already partly available within the farmer's field – the biodiversity of natural enemies. This option can be strengthened by farmers learning how to grow their own biopesticides (as happens in parts of Indonesia like West Sumatra) or by accessing these agents from local manufacturers. In Brazil, one million hectares of soybean is protected against the soybean caterpillar with an NPV grown by five national companies. (for details, see Whitten 1999). The second component, the knowledge to make an informed decision, can be obtained readily enough by farmers. But farmers need to be given the opportunity to obtain, or even create, this knowledge.

3. IPM in vegetables and reduced pesticide dependency

The problem for most farmers in Asia today is that they have been exposed to Green Revolution thinking which relies on external technical inputs as universal solutions. The Green Revolution has contributed to food and fibre security in many cases (rice production has increased over 4-fold in the past 20 years) but certainly not in all cases (cotton production has decreased due to over-reliance on chemical pesticides). In many senses, the Green Revolution has been a technical success. However, this positive contribution has been blunted by its obvious unsustainability. Undoubtedly, its other Achilles' Heel has been in the social arena - its disempowerment of small-scale farmers. As one Indonesian farmer recently said of the Green Revolution as practised in his country "it reduced us to being inputs". The same farmer said that the IPM movement "made farmers into people again".

If we could extrapolate from the cotton IPM story, still in its infancy in Vietnam, to other crops, especially vegetables, and other countries, we can contemplate its generality. There is little doubt about the universality of the notion that farmers can become experts at growing a healthy crop if they are provided with a fair chance to develop these abilities – and have access to alternative options. But what about the universality of the alternative options being readily available in a farmer's plot. Experience in other crops such as vegetables, and especially rice, in tropical Asia, also demonstrates that some key pests are pesticide-induced, others pesticide-aggravated. The difference between rice and vegetable IPM is one of degree. The simplest dictum for rice IPM is 'informed non-intervention'; while the rule of thumb for vegetables is 'informed intervention'.

Let us now compare the situation on bio-pesticides for vegetable pests and diseases in Brazil and Indonesia in the hands of IPM farmers as two approaches to solving this problem.

The Brazilian example concerns control of *Anticarsia gemmatalis*, a key caterpillar pest of soybean. This story entails a collaborative partnership stretching back to the 1970's (Moscardi 1997). It features four players: farmers, trainers, researchers and industry working together to exploit an element of the local biodiversity and reduce pesticide dependency in soybean production. It began with some strategic research that recognised the potential of using a strain of an insect-specific baculovirus, AgNPV as an alternative to chemical pesticides (Step I in Figure 3). The first substantive field trials to show 'proof of concept' were conducted on 2000ha of farmer-grown soybean in the 1982/3 season (Step II in Figure 3)). In successive seasons, the treated area expanded to 20,000ha, then 200,000ha, 500,000h, 700,000ha; and since 1988/9 the average area under treatment with AgNPV has been one million of the 11 million ha national soybean crop. During the scaling up phase, official farmer cooperatives assisted in viral production; but since 1991 five private Brazilian companies have a contractual agreement with EMBRAPA (Brazil's CSIRO) to supply the virus to farmers each season (Step III in Figure 3).

An ideal partnership between farmers, trainers, researchers and industry in vegetable production

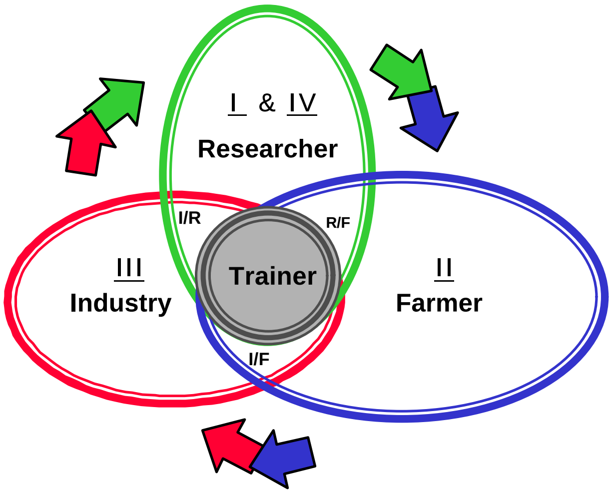


Figure 5. A formalised presentation of the partnership between researchers, farmers, and industry, facilitated by extension workers and trainers, leading to farmer empowerment and informed decision making. A specific example of the value of the four way partnership is the production and use of AgNPV for *Anticarsia gemmatalis*, a soybean herbivore in Brazil. The idea of using NPV stemmed from strategic research in EMBRAPA, Brazil (Step I); proof of concept was demonstrated in the field by farmers and researchers with the assistance of trainers (Step II); transforming AgNPV into a practical bio-pesticide required expansion of the partnership to include five national companies (Step III). Quality control and strain purity etc is maintained by the researchers (Step IV). See text for more detailed explanation.

In 1997 some 35 metric tons of AgNPV-dead larvae were collected from farmers fields. Virus isolated from infected larvae is sufficient to treat 1.75 million ha of soybean. Thus the field-reared caterpillar represents a valuable resource as it comprises the rearing medium for the NPV. The companies purify the virus, store and make it available in effective form during the following season. Farmers have found that one application of AgNPN early in the season is sufficient to control *A. gemmatalis*. This compares with an average of 2 applications of chemical pesticide per season in conventional practice. To facilitate the process, the 'quiet achiever' in the programme has been the extension worker/trainer (Figure 3). Completing the cycle, the researchers now ensure quality control and strain purity (Step IV in Figure 3). This example outlines a partnership where each player has been critical to the ultimate success; and it is a clear win for each partner, economically and socially. The approach is now in use in Argentina, Bolivia and Paraguay and is being tested in Colombia, Uruguay, Mexico and the USA (Moscardi 1997).

Now to the Indonesian story. It also began with some strategic research, this time by two American scientists and their colleagues in Indonesia. They conducted a national survey of the potential of locally-occurring natural enemies, both arthropod and microbial which might be relevant to developing non-chemical alternatives for controlling pests and diseases of vegetables (Shepard and Shepard 1997). One important conclusion of the survey was that pesticide usage could be reduced by at least 75%

without a reduction in yield if farmers effectively exploited the native biota, especially the insect pathogens.

What was rather unique about the Indonesian research was that it involved a partnership between farmers and trainers right from the outset. The trainers and farmers were graduates from the FFSs described earlier. This participatory approach ensured the research was highly relevant at the outset, and generated useful bio-pesticide options for IPM farmers. It also produced a bank of potentially useful pathogen species that are being maintained in cold storage in Bogor, Indonesia. Enterprising trainers from Indonesia, especially West Sumatra, have since worked closely with IPM farmers to isolate, rear and use new species of microbial pesticides from local farmers' fields. Here, there is an emphasis on local isolation and farmer or co-operative production of bio-pesticides. Funds from AusAID support over 50 'bio-agent posts. In essence, these comprise an IPM farmer with a refrigerator stocked with locally-isolated and manufactured bio-pesticides. Farmer-trainers use their home as a learning center where each leads groups of around 20 interested farmers who discover the art of isolating, rearing and deploying the bio-pesticides. After three hand-outs, the farmers are on their own -- local solutions to local problems devised by local heroes with local biodiversity!

4. An IPM and farmer empowerment approach to mung bean production on the shores of Lake Tonle Sap in Cambodia.

During the 1998/1999 dry season, the National IPM Program in Cambodia conducted a pilot FFS for 30 mung bean farmers on the shores of Tonle Sap. The IPM farmers demonstrated that they could successfully grow a crop without the use of any hard pesticides. Only two applications of Bt were used by the IPM farmers during the season, compared to five applications of a cocktail of methyl parathion, endosulfan and DDT in normal farmer practice. Yields were similar (950kg per ha for IPM farmers, 930kg per ha with normal farmer practice). The return on investment for IPM farmers was 252% compared with 191% with normal farmer practice.

At a field day during the last week of the FFS, neighbouring farmers expressed strong interest in acquiring the knowledge, which had been gained by the FFS participants. Both Ministries of Agriculture and the Environment and FAO were represented by senior officers at the field day. It was agreed to extend the FFS to all 2000 mung bean farmers over the coming two or three years with the objective of removing all hard pesticides, especially DDT from this sensitive environment, as quickly as possible. A local bio-pesticide industry would be established, using native pathogens (viruses, fungi and nematodes) to give farmers practical alternatives to chemical pesticides. Tonle Sap could become a showcase of how farmers could minimise damage to the environment while continuing to farm in an economically sustainable manner. Indeed, the environment would not simply be viewed passively as a resource worth protecting; rather it is more positively viewed as a key resource for sustainable agriculture. [The field day at Tonle Sap occurred two weeks after the POPs Workshop in Hanoi; and the plan to empower all farmers growing mung beans on the shores of the Lake, could be viewed as a specific outcome of the Workshop. Cambodian Secretary of State for the Environment, To Gary, and Max Whitten, FAO, agreed during the Hanoi Workshop to attend the Field Day which has resulted in the planned removal of all hard pesticides, including DDT, from the Tonle Sap ecosystem.]

The IPM movement and disease vector control – a possible linkage between WHO, UNEP, FAO, National Governments and communities in Asia.

So far, I have argued the case that it is possible to reduce the demand for chemical pesticides in small-scale agriculture. It is true that the IPM movement has only reached less than 2 million of over 200 million farming households in Asia. But the criticism cannot be about the direction but rather the distance traversed so far. The IPM movement has only been in harness since the early 1990's and the gains so far argue for increased commitment both by donors and national governments. Let us assume that the trend will continue. What is its relevance to disease vector control and a reduction in POPs entering the environment as a result of disease vector control programs. First, there is the indirect relevance. A farming community that has reduced its dependency on chemical pesticides is likely to reduce pressure on selection for pesticide resistance. Thus, there will likely be a wider variety of non-POPs available for disease vector control. Second there is a direct relevance of the existence of an informed farming community that is more literate about pesticides and alternatives.

An 'IPM' farmer learns to make informed decisions about all aspects of growing a healthy crop, from soil preparation to harvesting and post-harvest issues. The basic principles are developed within the FFS. Plant protection and reduced pesticide dependency remains a conspicuous feature of most FFSs but it is more an entry point to a process of learning with builds confidence in a farmer and shows the benefit of knowledge and the high cost of ignorance and prejudice. In many farming communities, the FFS is just the first step in a continuing process of non-formal adult education. For example, in Vietnam, it is estimated that there are over 1000 farmer clubs, which meet on a regular basis and discuss a wide range of topics. One club near Hanoi has met weekly and their activities include: development of farmer trainers, funding FFSs, vegetable IPM studies. Other clubs study rice/fish farming or rice/fish/vegetable mixed farming. The number of farmer associations and their diversity is even more impressive in the Indonesian IPM movement.

It would seem a simple step to broaden the interest of these Farmer Clubs to encompass malaria vector ecology and management. This could either be pursued in those situations where malarial mosquitoes breed in the rice paddy. However, it could also embrace the more important case of mosquitoes whose breeding sites are in neighbouring forest or in man-made structures. Professor Sharma, in his presentation, gave good evidence that community-based methods of control of malarial mosquitoes were cheaper and as effective as chemical control methods, including DDT. The challenge is how can the farming and rural community gain ownership of that knowledge. In other words, Professor Sharma demonstrated that the options are available. The community lacked the ownership of the knowledge to be able to exercise the option. I would suggest that an informed 'IPM' community would go much further. They would refine the option and likely identify new and improved options.

It seems reasonable to suggest that FAO work with WHO and UNEP to identify some communities where malaria, or some other arthropod-vectored disease, is a problem and where the IPM movement is well developed to explore ways and means of developing a follow-up activity in which the curriculum covers vector control (bio-environmental options) or disease management (host protection from vectors such as bed nets). This possibility could be explored either with the FAO Global IPM Facility or with the Regional IPM Programs in Asia.

Acknowledgments

Much of the text for the section dealing with Rice IPM was drawn from a paper by Whitten and Settle (1998) and it describes the research and interpretations by Dr Bill Settle. The proposal for extending IPM concepts to all the mung bean farmers on the shores of Lake Tonle Sap emerged from discussions with Rob Nugent, FAO Country IPM Officer for Cambodia, Dr Mok Mareth, Minister of Environment and Mr To Gary, Secretary of State for the Environment, Cambodia. A group of Indonesian trainers, including Ir Zamzami, Widyastama Cahyana and Ir Djoni, have led the initiatives they call the 'socialisation' of bio-pesticides for vegetable farmers in Indonesia. Comments on the manuscript by Dr Pat Matteson have been very helpful.

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20. Mitigating the Undesirable Effects of POPs Pesticides: the IPM Option

by Mr. LIM Guan Soon

ABSTRACT

There are many issues associated with the use of pesticides, including those categorised as persistent organic pollutants (POPs). The role of integrated pest management (IPM) in eliminating or reducing their use or dependence is discussed. Case studies are presented to illustrate how successful IPM programs are developed, including what the requirements are and what are the benefits. These studies encompass plantation crops, rice, vegetables, and several others. Follow up activities and policy issues for promoting IPM to reduce pesticide use and dependence are also suggested.

INTRODUCTION

In pre-World War II days, the methods used in controlling agricultural pests have mostly been traditional cultural means and other simple techniques. However, these methods rapidly phased out with the Chemical Revolution, which moved into high gear at the end of the war, largely because synthetic pesticides provided spectacular results. As more chemicals became easily available, pesticide dependence by farmers rapidly set in.

Ironically, pesticides that were developed to control pests, to increase food production, and to improve the standard of living, are also posing a threat to biodivesity and human health. It soon became clear that the risk from these originally well-intentioned chemicals outweighs their benefits, and for many, their continued use is no longer warranted. Among many other pesticides, are also those categorised as persistent organic pollutants (POPs), which have continued to attract world-wide attention. There are many issues associated with their use. Collectively with the non-POPs pesticides, many of which also share similar problems, these various issues are examined in this paper. The implications of their use are discussed and possible options on alternatives to eliminate or reduce their use or dependence are suggested, including the needed follow-up actions.

THE ISSUES OF PESTICIDES (INCLUDING POPs)

The POPs pesticides are similar to most other pesticides in that they are generally very toxic chemicals. However, in addition, they are also characterised by being very persistent and resisting the normal processes of degradation, a special affinity for fat, and a propensity to evaporate and travel long distances. They have become a pervasive global problem today. Examples of POPs pesticides include aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, mirex, and toxaphene, while non-pesticide POPs are the industrial chemicals (polychlorinated biphenyls or PCB and hexachlorobenzene), and the unintended by-products of the manufacture, use, and/or combustion of chlorine and chlorine-containing materials (dioxins and furans).

Both the POPs pesticides and non-POPs pesticides, like the non-pesticide POPs, pose a host of hazards. In particular, acute exposure to pesticides in tropical agriculture has caused large numbers of human deaths and injuries, including severe nervous system and liver damage. For example, 17 rice farmers in Tanjung Karang (Malaysia) were hospitalised in 1979 after inhaling carbofuran dust while broadcasting the granules. In a separate mistblowing incidence involving other insecticide 30 rice farmers in Kedah (Malaysia) were hospitalised and one died a week later. In the Philippines, the health impairment of rice farmers with prolonged exposure to pesticides included eye, skin, lung, cardiovascular, and neurological diseases. The health costs increased by 0.74% for every 1% increase in insecticide dose (Rola and Pingali, 1993). To date, numerous studies have also linked pesticides to cancer and other significant health problems in people and wildlife.

Indiscriminate use of pesticides can have drastic effects on pest ecology, particularly that of insecticides on arthropod species. For example, insecticide-induced outbreaks of the rice brown planthopper have occurred in many parts of Asia. A primary reason for resurgence is because insecticides frequently destroy its natural enemies, which normally keep the planthopper at low level. Another effect on pest ecology is when pests develop resistance to the pesticides used against them. A classic example is that of diamondback moth on crucifer vegetables in Southeast Asia where the moth has become resistant to almost all kinds of insecticides introduced into the market (Lm 1990).

Pesticides also have major impact in decreasing the biodiversity of agricultural ecosystems. For example, many non-target organisms in rice fields, such as fish, snails, crustaceans, and others, easily succumb to applications of endrin or endosulfan. So also are the natural enemy species of pests, which can often replace the need for pesticide inputs. Natural enemies regulate the populations of their preys and ensure co-existence of species by allowing none to become too abundant or become pest. Despite this, these biological control agents run high risks of being destroyed by heavy use of harmful chemical pesticides in present-day agriculture.

More recently, emerging science has also heightened concern about a new kind of hazard known as “endocrine disruption”, including compromising the health and intelligence of the next generation. Repetto and Baliga (1996) reported about public health risks from pesticide-induced suppression of immune system. Other studies have revealed the link to hormone abnormalities. Examples include stunted penises, reproductive failure, and skewed hormone levels in the alligators in Florida’s Lake Apopka. Alligator eggs collected there had relatively high levels of a variety of contaminants, including toxaphene, dieldrin, and the DDT breakdown products DDE and DDD.

Clearly, today’s pest control practice of relying mostly on chemical pesticides is fraught with many serious problems, thus warranting an alternative approach. Ironically, for some major crops (e.g., rice, cabbage), the dramatic increase in usage have not even significantly increase crop yield or farmers’ income.

THE IPM OPTION

Because of the serious adverse effects of pesticides, various efforts have been made to develop alternative approaches aiming at eliminating or reducing their use or dependence. Although they do not specifically target at POPs pesticides, these approaches neither exclude them. In practice, several models exist and have been advocated; the main ones being (i) integrated pest management (IPM) and integrated crop management (ICM) which emphasise “judicious” as opposed to “indiscriminate” use of pesticide, (ii) low external input sustainable agriculture (LEISA), and (iii) organic agriculture (OA). Presently, IPM provides the best option for many crops and is more widely adopted. IPM has, and continues to play, a major role in reducing and eliminating the use of many agricultural pesticides, including the POPs pesticides.

Over the years, various definitions of IPM have been put forth in evolving IPM activities and processes. In essence, the IPM principles entail:

- keeping pests below economically damaging levels rather than seeking to eradicate them.
- relying, to the extent possible, on non-chemical measures (cultural practices and/or tolerant/resistant varieties, biological control methods, mechanical/physical means) to keep pest populations low and within acceptable levels
- selecting and applying pesticides, when they have to be used, in a way that minimises adverse effects on beneficial organisms, humans and the environment
- recognising that IPM is a *process* by which farmers are closely involved with extension specialists and researchers in *experiential learning* and *self-discovery* towards finding solutions to their pest problems, and that this process is *dynamic* with solutions continuously reshaped as the problems change.

In practice, the development and implementation of IPM usually involve diverse activities. These range from: (i) highly technical research undertaking to more general and holistic management strategies, (ii) strategic extension to human resource development, and (iii) from biological aspects of crop-pest-natural enemies to communication science and social dimension involving a wide range of people (farmers, extension specialists, researchers, policy makers, other community members).

IPM CASE STUDIES AND THEIR BENEFITS

Besides some early failures, there are now many notable IPM successes reported for different crops. To illustrate how the IPM programs have developed and what were involved, selected cases are briefly described here.

1. **Plantation Crops:** In the early sixties in Sabah (East Malaysia), large areas of natural vegetation were cleared for commercial planting of cocoa. In particular, vast tracts of the under-storey in primary forests were cleared. Prior to clearing, most insect pests were suppressed by their natural enemies and there were generally no serious or major pest problems.

Following the clearing and subsequent intensive cocoa cultivation only the ring bark borer posed a problem initially. However, dieldrin, a wide-spectrum insecticide, was applied extensively in an attempt to control it. Soon leaf-feeding caterpillars built up and caused serious injuries. More sprays with other chemicals were applied, leading to more pests of other groups. Ultimately, there were many instances of total defoliation by psyched bagworms.

Realising that chemical insecticides were disrupting natural control, many plantations stopped spraying. Rapidly, many pests diminished, except f or the bagworms, which were then controlled with the selective insecticide, trichlorphon. This eventually restored the natural balance of pests and their natural enemies. Eventually, only the ring bark borer remained a problem of moderate scale. It was however easily controlled by restricted use of dieldrin and proper management of the alternate host shade trees.

Somewhat similar events also occurred with oilpalm cultivation. Initial minor problems led to gradual increase in indiscriminate and extensive use of broad-spectrum insecticides. Through “chain effects” many new problems arose, leading to more extensive applications, and bigger pest problems.

However, with cessation or restricted spraying, this eventually restored the balance of natural control, resulting in occasional pest problems only.

2. **Rice:** There are many success cases reported in many parts of Asia. An outstanding one is that of the rice brown planthopper (BPH). The indiscriminate and repeated use of pesticides caused massive BPH outbreaks, resulting mostly from destroying its beneficial parasitic and predatory species. However, cessation or reduced spraying against this pest conserved the beneficial species leading to drastic decline of the BPH problem. Consequently, in many countries particularly India, Indonesia, and the Philippines, there were significant increase in rice output and profits. For example, the Indonesian government saved foreign currency amounting to US$100-150 million/year. National savings in the Philippines amounted to US$5-10 million/year.

3. **Crucifers:** Likewise, success in IPM has been achieved in crucifer vegetables. Here, the typical insecticide *treadmill* was overcome by introducing a highly effective parasitoid, *Diadegma semiclausum*, to control the diamondback moth (DBM). When most of the conventional broad-spectrum insecticides were replaced by *Bacillus thuringiensis*, a selective biopesticide, the parasitoids flourished and multiplied rapidly to provide effective suppression of the DBM.

Most successful IPM programs have demonstrated how crucially important the natural enemies are, particularly in insect management. However, empowering farmers through participatory and self-discovery methods to make farmers aware, understand, and conserve the biological agents, is also an important social element necessary for implementing IPM successfully (Kenmore *et. al.*, 1994). This is well illustrated by the case of DBM in the Cordillera Highlands (Philippines) and the Cameron Highlands (Malaysia). In the former, although *D. semiclausem* had become established in 1989, it could not increase/spread out beyond the released areas because farmers were unaware and continued to spray heavily. DBM remained a serious problem and farmers eventually resorted to using cyanide, resulting in consumers avoiding the vegetables and threatening a collapse of the vegetable industry. A pilot TOT (training of trainers) which incorporated FFS (farmer field school) was mounted to teach the farmers IPM and the role of the parasitoids, including how to conserve them. With awareness and understanding, farmers reduced substantially the use of toxic insecticides and the parasitoids rapidly increased to exert effective control of the DBM. The IPM program expanded, with numerous FFS conducted over a wide area along with additional parasitoid releases, resulting in bringing the DBM under natural control in most of the Cordillera Highlands.

In the case in Malaysia, the situation is different. Even after *D. semiclausem* and *Diadromus collaris* are established for several years in the Cameron Highlands, impact on DBM is limited, primarily because farmers do not understand the role/importance of the parasitoids and continue to apply insecticides regularly, thereby preventing the parasitoids from exerting their full potentials. However, in small pockets of organic farms where no insecticides are used, the parasitoids are abundant and DBM does not pose a problem.

4. **Others:** IPM has been tested and applied on several other crops as well, including cotton (e.g., India), sugarcane (e.g., Pakistan), soybean (e.g., Indonesia and Brazil), brinjal (Bangladesh), and fruit trees (e.g., Pakistan and Costa Rica). Many of these are now well documented (Hansen, 1987; Ooi *et. al.*, 1992).

5. The benefits of IPM

The successful IPM programs have produced many benefits. Broadly, these are as follows:

- lower production costs (at farm level) compared with the conventional pest control method with its high inputs of pesticides.
- enormous savings for governments from pesticide imports and reduced subsidies for pesticide use.
- reduced environmental pollution, particularly improvement of soil and water quality.
- reduced farmer and consumer risks from pesticide poisoning and related hazards.
- ecological sustainability by conserving natural enemy species, biodiversity, and genetic diversity.

In general, the stability that IPM provides to agricultural production enhances political stability in a country where agriculture is a dominant sector of the economy. In rural areas, it is important in developing local self-reliance through farmer empowerment. Thus, IPM can achieve broad and long-lasting socio-economic benefits far beyond plant protection activities, in addition to reducing or eliminating the use of some pesticides.

DISCUSSION

That IPM is a sound option for managing pests and also for reducing dependence on pesticides by farmers is now well established and widely accepted. Since the IPM approach addresses pesticides in general, all the POPs pesticides are also included.
In IPM, the efforts put in toward eliminating or reducing pesticides have been a key objective. Since IPM can play crucial role in achieving this, it is important that the related activities and policy issues be identified for follow up actions.

One key policy is creating a policy environment that is conducive to IPM and discouraging pesticide use. This may be achieved through banning the use of POPs pesticides, and where they are still in use, to remove pesticide subsidies (if any), avoid technology "packages" which include substantial use of pesticides, provide economic incentives to develop/use alternative pest control methods, and to adopt, promote and support IPM programs and IPM-related activities.

Since natural enemies are crucial elements in IPM, activities that will promote these biological agents should be given support and carried out. Some major activities would include (i) introducing and establishing key natural enemies where they are absent, (ii) where the key natural enemies are present, to develop conservation practices to protect them, (iii) undertaking research on pesticide effects on natural enemies, (iv) conducting training on pesticide effects on natural enemies, and (v) building a database on pesticide effects on natural enemies and developing an information sharing system for it.

In the case of promoting increased participation and IPM adoption by farmers, the activities should include conducting IPM participatory programs for relevant scientists, extension specialists, technicians and farmers. In doing so, the lessons gained from the successful participatory TOT and FFS activities for crops like rice and vegetables in various parts of Southeast Asia should be taken into consideration. Strong support should also be given to develop and undertake participatory action research activities, particularly in any training programs for farmers

With banningof more POPs pesticides (and also other toxic chemicals), it is crucial that there be parallel development for other suitable alternative products and technologies which can be incorporation into IPM programs. Some of these would include biopesticides and other biological control agents, appropriate cultural techniques, practical trapping devices, and other suitable or novel alternatives.

It is also necessary to strengthen and promote regional cooperation in all the above activities, in particular in information sharing and capacity building.

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21. Challenges and Opportunities in Malaria Control in India

by Prof. V.P. Sharma

Abstract

DDT spraying under the National Malaria Eradication Programme (NMEP) to control malaria produced spectacular results, and malaria was nearly eradicated from India in the early 1960s. Malaria resurgence started from. the foci left in persistent malaria transmission areas, towns and the migration of population. Malaria cases multiplied in the late 1960s and 1970s reaching the peak incidence of 6.45 million parasite positive cases in 1976. In 1977 implementation of the Modified Plan of Operation (MPO) resulted in the declining trend of malaria but MPO was successful in the control of P. vivax and not P. falciparum. Over 3 decades malaria has occupied man made environment, vectors have become resistant to the insecticides and parasites to the anti-malarial drugs. Spraying the main weapon of control is done in about 50% population living in high risk areas. Malaria control therefore has become a formidable task. The strategy of indoor residual spraying (IRS) has become unproductive and unaffordable. Insecticide are found every where and their residues are harmful to the environment and human health. Although insecticides (IRS) are still used in malaria control but malaria situation is far from satisfactory, and malaria epidemics occupying the entire eco-epidemiological zones have started visiting the country. New strategies based on IRS and based on IRS have not improved malaria situation in the country. The challenge lies in the control of resurgent malaria with simple, low cost and en vironmental friendly technologies that work in harmony with nature and Indian ethos. As an alternative, bioenvironmental malaria control strategy was demonstrated in the control of endemic malaria in various epidemiological settings, and the strategy is being applied in the control of malaria in Karnataka and Maharashtra. Impact of interventions have produced spectacular results in malaria control. Bioenvironmental methods control malaria on long term basis and once implemented small expenditure on maintenance is enough to sustain the impact of interventions. The strategy is cost effective, easy to apply, utilise local talents and resources, generates employment, inculcates scientific temper in the communities, sustainable, can be linked with income generating schemes; and the strategy brings about holistic development of rural areas.

1. Introduction

Malaria is endemic in India and the entire population is at risk except areas 1800 m above sea level. Before the spraying of DDT in malaria control, malaria was a major scourge of humankind. There used to be an estimated 75 million malaria cases and 0.8 million deaths due to malaria annually. The incidence of malaria was much high during the epidemic years. This situation was dramatically changed with the spraying of DDT in malaria control. Wherever DDT was sprayed malaria was wiped out. This led to the launching of the National Malaria Control Programme (NMCP) in 1953. The results under the NMCP were so spectacular that in 1958 Government of India converted the control programme to the National Malaria Eradication Programme (NMEP). Spraying under NMEP was highly productive and by 1967 malaria was eradicated from 3/4th of the country, and NMEP was heading towards malaria eradication. These were the days of highest achievements under the NMEP. From the lowest number of about 100,000 cases in 1967 malaria cases started to rise and gradually peaked in 1976 to 6.45 million parasite positive cases. Malaria in India was a rural disease but return of malaria was seen entering the towns. Cases started to multiply rapidly in the urban areas. To contain the growing problem of urban malaria, Government of India launched Urban Malaria Scheme (UMS) in 1971-72. Towns with >40,000 population and malaria APT > 2 at 10% ABER were included in the UMS, and the scheme was implemented in phases in 131 towns over a period of 2 decades (Pattanayak et al. 1981; Sharma 1987a) To control the rising trend rural malaria, in 1977 Government of India re-organized malaria control under the Modified Plan of Operation (MPO) emphasizing focused spraying in areas with 2 or more API (Pattanayak and Roy, 1980). During the same period epidemiological investigations revealed that P. falciparum was localized in the northeastern states. Further drug resistance in P. falciparum detected for the first time in Assam was spreading. Therefore in 1977 a Swedish International Development Authority (SIDA) supported P. falciparum Containment Programme (PfCP) was launched in the northeastern states to prevent the spread of P. falciparum to the plains of India, particularly drug resistant strains. PfCP was extended to the plains of India along with the rise in P. falciparum, and at one time covered 98 million population. PfCP was a time bound programme and had to be terminated after 11 years of field operations without achieving its targets. P. falciparum and its resistant mutant strains were found rising all over the country (Ray, 1979; NMEP, l986). After the implementation of MPO malaria cases started to decline in the country and reached about 2 million in the 1980s, but there was no further improvement. During the 1980s period malaria outbreaks and deaths due to malaria were reported each year. In the 1990s malaria further deteriorated and cases increased to about 3 million (Sharma and Mehrotra, 1986). The impact of MPO was pronounced on reduction of P. vivax and not on P. falciparum. Fig. 1 gives the epidemiological profile of malaria in India (Sharma, 1996; 1998). In 1992 NMEP implemented the Global Malaria Control Strategy with the aim to reduce malaria mortality by half in 5 year period. There was no improvement in malaria situation. In 1990s malaria epidemics were witnessed occupying the entire eco-epidemiological zone. At the initiative of the Prime Minister of India a Revised Malaria Control Strategy was launched in the country in 1995. Malaria control in high risk areas received priority but there was no perceptible improvement in the malaria situation. Malaria control was reviewed for the World Bank assistance and in 1997 Enhanced Malaria Control Project was launched in high transmission areas, particularly in high P. Falciparum areas (NMEP, 1997). In 1999 WHO has launched Roll Back Malaria initiative in Africa but discussions have been initiated in SEA region to introduce new concerpts in malaria control (Sharma, 1998a). At present malaria cases fluctuate between 2.5 to 3 million malaria cases annually. WHO (SEARO) estimates 15 million malaria cases and 19,500 deaths in the country annually. A study by the Malaria Research Centre on the true incidence of malaria in the country based on chloroquine consumption revealed 38 million cases in 1993 (Pattanayak et al. 1994). World Bank (1993) estimated 0.95 million DALY due to malaria in India. Malaria cases in India are under-reported due to inadequate surveillance and therefore malaria incidence reported by the NMEP provides the trend of the disease.

2. Challenges in Malaria Control

Malaria situation in the country has not improved in the country despite of: re-organization of malaria control; enhanced funding by the government of India and external support; spraying of DDT, HCH, malathion, and synthetic pyrethroids in areas with 2 or more API supported by the distribution of adequate quantities of anti-malarial drugs; urban malaria is rising although UMS covers 131 towns; and malaria in the tribal population remained refractory as before (Sharma, 1987). Table 1. Gives the high risk population to malaria in India requiring immediate interventions. In addition to this 29 towns with >50,000 population also belong to this category where slide positivity rate is >10. In rural areas 25% population belongs to high risk group (Shiv Lal et al. 1998).

2.1 Vector Control: Fig. 2 gives malaria vectors in India. There are mainly two problems in vector control i.e. insecticide resistance and exophilic and or exophagic vector behaviour. In the west vector resistance is more pronounced particularly in An. Culicifacies. As the vector populations move towards east there is an increasing tendency towards exophilic vector behaviour and vectors in the eastern states are predominantly exophilic and avoid contact with the sprayed surfaces. Table 2 gives the role of vectors in the transmission of malaria, including the drug resistant malaria. There are 6 major vectors of malaria in India. Anopheles culicifacies is the vector of almost all rural and peri-urban malaria in the peninsular India. This vector transmits 65% of malaria in the country. An. stephensi is the vector of urban malaria, and it transmits about 12% malaria in the country. An. fluviatilis is the vector of malaria in the foot hills and plains and transmits about 15% malaria. An. minimus is found in the northeastern states and inhabits the degraded forests and breeds in the streams. An. Dirus is the vector of malaria in the jungles of north-eastern states. These two vectors transmit about 10% malaria cases. An. Sundaicus is the vector of malaria in the Andman and Nicabor islands and transmits < 0.1 cases of malaria. Therefore malaria control in India is largely the control of An. Culicifacies and NMEP spends its 80% budget and time in the control of An. Culicifacies transmitted malaria. All vectors transmit P. Vivax and P. Falciparum malaria and the drug resistant P. Falciparum malaria (Sharma, 1996).

In malaria control DDT was the first insecticide used to interrupt transmission. Resistance to DDT in An. Culicifacies was first reported in the 1960s, and this resistance spread rapidly demanding the use of replacement insecticides. Dieldrin was initially introduced in some areas. High level of resistance to Dieldrin developed in about one year and therefore instead of Dieldrin, HCH was introduced in malaria control. In about 5-7 years there were reports of resistance to HCH particularly from Gujarat and Maharashtra (Sharma and Mehrotra, 1986). To combat malaria in these regions malathion spraying was introduced. In about 3-5 years resistance in An culicifacies developed to malathion as well (Rajagopal, 1977). In areas with multiple resistance synthetic pyrethroids are being sprayed. The problem of resistance is mainly confined to An culicifacies and not to other vectors, but this vector accounts for the bulk of malaria transmission in the country. Almost all rural and peri-urban malaria is transmitted by An. culicifacies. It may be noted that pronounced resistance leading to control failures has been reported in Anopheles culicifacies only and in other vectors the problem is exophilic and or exophagic vector behaviour leading to avoidance of resting on the sprayed walls. However in case of An. stephensi, resistance to these insecticides has been reported but An. stephensi control is based on larviciding the breeding grouds.

The technique of indoor residual spraying had failed in 9% of the country's population (Sharma and Mehrotra, 1986). These were the hard core areas and mostly tribal population. A study in 1990s revealed that malaria transmission in the tribal population is very high as shown in Table 3. Insecticides are considered essential for the control of malaria, but they also cause widespread environmental contamination resulting in harmful effects on human health, destruction of beneficial fauna, loss of biodiversity, poisoning of workers in the production units, excessive exposure of spraymen and a source of intentional poisoning. Demand on natural resources to sustain the increasing population and re-emergence of vector borne diseases is likely to substantially increase the use of redial insecticides, continued dependence on insecticides may result in high levels of pollution of the environment with adverse impact on health of the people. The challenge lies in initiating timely preventive action, and in the introduction of alternative methods of disease vector control and selective and absolutely essential use insecticides.

2.2 Drug Resistance: The problem of malaria control is further complicated by the emergence of chloroquine resistance in P. falciparum. Resistance was first detected in 1973 in Assam and it continued to spread first in the northeastern states and entered Orissa and finally to the entire country. At present chloroquine resistance is widespread in the country. RI level of resistance has spread to cover the entire country but RII and RIII level of resistance is limited to high transmission regions of the country e.g. in the north-eastern states, Orissa, Madhya Pradesh and in the projects. Fig. 3 gives the situation of chloroquine resistance in the country. The percentage of P. falciparum has increased to about 40%. Along with P. falciparum the percentage of resistant mutants is also increasing and in the 1990s about 35-40% cases are resistant to chloroquine (Mishra, 1996).

To interrupt malaria transmission residual insecticides are sprayed. The cost of spraying per million population is increasing every year. From 1985-86 to 1995-96 cost of DDT (50% WP) has increased from Rs. 33 to 99 lakhs; HCH (50% WP) from Rs 36 to 90 lakhs and malathion (25% WP) from 192 to 364 lakhs and the cost of synthetic pyrethroids is Rs. 445 lakhs to cover one million population. Figure 3 also shows the rising trend in the cost of DDT along with the rise in falciparum malaria. If the cost of insecticides increases, there is compromise on the spray targets and this leads to further deterioration in malaria situation. This is what is happening in the control of malaria in the country. In areas with RII and RIII resistance bases on 25% resistant cases in a sample of 30 in a PHC drug policy is changed to sulphalene/sulphadoxine pyrimethamine combination drugs and in the hospitals quinine is used to save lives. Serious cases of malaria are treated with quinine. Mefloquine, halofantrine and artemisinin based drugs have been introduced in the country to treat serious and drug resistant malaria cases. Resistance has appeared to these drugs as well but in limited areas. Recently chloroquine resistance in P. vivax has been detected in Mumbai, Mathura and Chennai (Carg et al. 1995; Dua et al. Dua et al. 1996d; Sharma, 1999). This problem is rising with the increasing tendency of the use of drugs instead of transmission control. However true picture of the resistance in P. vivax is hidden and may emerge as a big challenge in the control and treatment of malaria.

2.3 Insecticide Residues: DDT was the principal insecticide used in malaria control. Over 3-4 decades of spraying DDT lost collateral benefits of killing other harmful domestic insect pests. Gradually refusals increased and spraying coverage of households was reduced to 25-30% or so. In sprayed areas transmission was maintained, although at low level which is not perceived by the communities. There was evidence of DDT and HCH residues in the environment, bioamplification, food chain contamination and other adverse health effects. Studies at the Malaria Research Centre have shown widespread contamination of the environment with insecticides used in public health (Dua et al. 1996a; 1997a). HCH residues have been found in rain water (Dua et al. 1994). DDT and HCH residues have been found in village ponds in areas where malaria is not endemic (Dua et al. 1998). Residues of these insecticides have been found in all the breeding grounds of mosquitoes leading to the rapid build up insecticide resistance. Table 4 gives residue levels of DDT and HCH used in the control of malaria.

Use organochlorine compounds in malaria control has become controversial. This led to ban of HCH in malaria control beginning from April 1st, 1997 and DDT phase out by 2005. Malathion spraying has also become problematical because of high refusals due to pungent odor, high cost and vector resistance. Chemicals in general are being criticised because of their sub-acute toxicity. Chemicals used in malaria control damage immune system, and enhance susceptibility to various infections, damage the reproductive system by causing deleterious effect on sexual maturity, induce abortions, low birth and premature delivery and chromosomal abnormalities etc. Synthetic pyrethroids used in malaria control cause permanent changes in the brain anatomy and hyperactivity of nerves. Beta BHC has carcinogenic properties, and there are several studies linking the use of insecticides to a variety of cancers. Aplastic anemia and related blood dyscrasiasis have been reported since 1948. Soft tissue cancer associated with pesticides have been reported since 1968. Leukemia associated with the use of pesticides has been recorded amongst farmers. Indirect relationship of brain tumors with pesticide use have been recorded. Limited studies have also shown association of pesticides with tumors of gastro-intestinal and respiratory tract.

2.4 Malaria Ecotypes: In India malaria was a rural disease. NMCP/NMEP were rural malaria control programmes. Developments under the five year plans have transformed the country, and major ecological changes have taken place resulting in new malaria ecotypes. For the first time in 1971-72 urban malaria emerged as a major ecotype and 131 towns were identified. In 1998 NMEP identified 29 towns with > 10% slide positivity rate for the Enhanced Malaria Control under the World Bank assistance. An estimated 75 million population lives in the towns with risk of malaria and another 75 million population in peri-urban and other urbanized townships. In the later group An. stephensi and An. culicifacies both participate in the transmission of malaria. Malaria situation in urban areas is deteriorating because of the water shortages practices, leakages in water supply and rain water collections. All these sites are preferred habitats of An. stephensi. India is emerging as a major industrial force in the world. Industrial areas provide enormous opportunities for the An. stephensi to breed uninterruptedly and therefore industrial malaria has emerged as a new malaria ecotype. An estimated 10 million population is involved in industrial malaria. India's irrigation has increased from 22.6 million hectare in 1950 to 95 million hectare in 1997. An. culicifacies breeds in irrigated areas and irrigation malaria has emerged as a new ecotype involving 200 million population. Another 100 million population is at risk in areas with rainfed malaria. Tribal malaria involves 50 million population in the deep forests and forest fringe and another 20 million in areas with degraded forests with disturbed ecology. Almost all vectors are involved in malaria transmission in the forests except. An. stephensi. Migration of population for agriculture, industry and other purposes involves 1 million population and cuts across all ecotypes. Migrants transport parasites and new strains and seed these parasites in far-off places establishing new malaria foci often resulting in malaria outbreaks (Adak et al. 1994). Border malaria is a serious problem all along the international borders. There is no malaria control in 16 km area on either side of the highly porous borders. There are no facilities of proper diagnosis and treatment. Back and forth population movement leads to dissemination of parasites across the borders. An estimated 5 million population lives in these high risk aread (Pattanayak et al. 1994). Each of these ecotypes have their own characteristics of transmission based on malariogenic conditions peculiar to that region and calls for specific ecological approaches for control.

3. Opportunities in Malaria Control

Emergence and re-emergence of malaria has provided tremendous opportunities of developing new tools and concepts in malaria control. In the background of problems faced in malaria control, I quote "No responsible person contends that insect-borne disease should be ignored. The question that has now urgently presented itself is whether it is either wise or responsible to attack the problem by methods that are rapidly making it worse". Rachel Carson *Silent Spring,* 1962. We provide a brief account of the bio-environmental malaria control strategy as a solution to the many problems faced in the chemical control of malaria.

3.1 Bioenvironmental malaria control strategy comprises of the following components.

(i) Vector control: Application of biological and environment management methods to eliminate mosquito breeding. Larvivorous fishes, *Bacillus thuringiensis, Bacillus sphaericus,* fungi, bugs etc. Are all used wherever found suitable. Stagnant water is drained or filled and levelled, improvement of drainage, installation of soakaway pits, minor engineering interventions, changes in agricultural practices, improved housing, hermetically sealing of water storage tanks, mosquito proofing and other non-chemical methods of mosquito control are applied depending on the suitability of each method. Personal protection methods are encouraged in the community e.g. use of repellents etc. In areas where environmental interventions may not be feasible, use of insecticide treated mosquito nets/curtains is recommended. In urban and industrial areas municipal and building bye laws are applied rigidly, and vector control work is done on deposit basis.

(ii) Parasite control: Surveillance is re-organized at weekly intervals. Prompt examination of slides results in early treatment of cases. All cases are given full radical treatment. Serious cases of malaria are referred to the hospitals. New techniques in the diagnosis and new drugs in the treatment of malaria are used wherever indicated.

(iii) Control Strategy: Health impact assessment of all projects for preventive vector control; constitution of intersectoral committees are established at the Central, state, district, town and project levels. These committees would be responsible for administrative and financial sanctions, identify and involve collaborating agencies with specific assignment and responsibilities, review the progress of interventions and provide direction to the interventions. Geographical reconnaissance of the target population to identify site specific interventions. Preparation of action plan and budget. Strategy requires participation from all sections of society e.g. action groups, non-government organizations, schools and communities. Income generating schemes and other development programmes of the government are encouraged e.g. edible fish culture in village ponds, farm forestry alternate sources of energy etc. Community participation is elicited through information, education, and communication. In this strategy indoor residual spraying is discouraged but some reserves of insecticides may be required to fight emergencies or special situations.

3.2 Feasibility Trials: In 1983 an epidemic of malaria in Bamrauli village in Nadiad Taluka, Kheda district killed 36 people, and surveys revealed high parasite rate in the community. Epidemiological investigations revealed that Kheda district had highest incidence of malaria in the state. P. falciparum was the main cause of deaths. The vector was Anopheles culicifacies. Spraying of DDT and malathion was ineffective and vector populations were high enough leading to an epidemic of malaria. At the request of the state health department a field station of Malaria Research Centre was opened in Nadiad to systematically study the epidemiology of malaria and apply non-insecticidal methods of malaria control. Geographical reconnaissance (GR) was carried out in 7 most affected villages of Nadiad Taluka and based on the results of GR an action plan was prepared to control mosquito breeding. Sites were drained or filled. This required major earth work and therefore tractors were pressed into service. In ponds which were the source of mosquito breeding larvivorous fishes (Guppy and Gambusia) were introduced. Surveillance was intensified and all cases of fever were given radical treatment to eliminate parasite reservoir from the community. There was dramatic reduction in malaria. In the first year itself malaria cases were reduced by 90% and again in the second year by 95% and finally malaria transmission was interrupted. The areas were expanded to 25 villages, than to 100 villages and finally covered 2 talukas with 350,000 population. The bioenvironmental malaria control strategy was highly successful in areas where spraying had failed. The success and many benefits of the new strategy were hailed all over in the country and more funds were made available to demonstrate malaria control in different ecological settings. This was the beginning of a major change in malaria control strategy in the country. In subsequent years malaria control was demonstrated in more rural areas, urban areas, industrial townships and the coastal areas by establishing field stations at 12 locations in the country (Sharma, 1987; Sharma and Sharma, 1989; Sharma, 1991; Kumar et al. 1995; 1997b). Field work has been evaluated by an international team of experts and also by several groups of national experts. Table 5 gives a comparative study of the two methods of control i.e. Bioenvironmental vs. Chemical control. Bioenvironmental methods were found superior to chemical methods. The strategy was cost effective, environmental friendly, sustainable and can be developed into a holistic approach for the development of rural areas.

In the development of this technology many new techniques were developed such as the: mass production, distribution and release of larvivorous fishes; composite fish culture comprising of larvivorous and edible fish production to generate income and increase edible fish production in village ponds producing otherwise enormous mosquito populations (Gupta et al. 1986). Two new larvivorous fishes were discovered. Expanded polystyrene beads were tested extensively and found suitable for the long term control of mosquito breeding in wells and tanks. *Bacillus thuringiensis* and *Bacillus sphaericus* were evaluated in the control of vectors and its impact on malaria transmission. While both insecticides were useful in the control of mosquito breeding and clearly impacted the transmission of malaria and filariasis, B. Sphaericus induced resistance and thus was not found suitable as larvicides. B. Thuringiensis has been introduced in the control of urban malaria. Drainage and minor engineering interventions to control mosquito breeding; community participation in vector control to enhance sustainability; intersectoral partnership to ensure health impact assessment, reduce cost and share interventions in disease vector control are being incorporated in the national disease vector control programmes. Two new fungi have been discovered with high mosquitocidal action. These are currently undergoing laboratory and field experimentation. A herbal repellent is in the advance stage of development. Need based repellents have been developed which are safe, low cost, and indigenous (Sharma et al. 1993). Insecticide treated mosquito nets (ITMN) and curtains in the control of malaria have emerged as a major advance in the control of malaria. In India demonstration of malaria control in Assam and Orissa using the ITMN technology resulted in the transfer of this technology to the NMEP, and currently the ITMN programme is under expansion to cover high transmission areas under the enhanced malaria control project of the NMEP (Dev et al. 1993; Yadav et al. 1993; Sampath et al. 1998a; 1998b; Eadav et al. 1998).

3.3 Transfer of Technology: A major problem of the demonstration of malaria control by bioenvironmental methods through the primary health care system still remained. Therefore training workshops were organized in Karnataka to transfer the technology of malaria control without the use of insecticides. Field work started by involving the health staff in the control of malaria. In the first instance Kamasundaran PHC was taken for demonstration work. In this PHC malaria cases were rising and there were deaths due to malaria. Villagers refused to accept residual spraying due to fear of adverse effect on the silk worms. This area is famous for silk production in the country. Bioenvironmental interventions produced dramatic effect on the reduction of malaria transmission. In these villages fishes were introduced only once and monitoring was done to study the impact of fish introduction. Subsequently in another areas with high transmission were taken up for bioenvironmental malaria control. Fig. 4 gives the impact of bioenvironmental interventions on the malaria API in Karnataka. Environmental interventions and fish introduction and re-introduction resulted in sharp decline in malaria transmission. Such an impact is possible with a very potent insecticides and not with DDT or HCH or in many areas with malathion. Bioenvironmental malaria control is now spreading to other districts of Karnataka. In these areas there is no need of spraying. In comparison villages where DDT was sprayed there was no effect on the transmission and in villages with synthetic pyrethroid spraying, malaria returned after the termination of spraying with equal vigour and these areas required preventive spraying with the synthetic pyrethroids. Study on the cost of bioenvironmental methods showed that this is the cheapest method of malaria control i.e. Rs. 4.36 against Rs. 9 for DDT and Rs. 30-40 for IRS and ITMN. In areas where bioenvironmental methods are used in malaria residues of insecticides gradually decline to low levels (Dua et al. 1996a). The technology has been transferred to the state of Maharashtra and fish hatcheries have been established all over the state at the sub-centre level. Fishes are now being introduced in the villages to control mosquito breeding. The impact of interventions is so pronounced that the state government is now planning to stop preventive spraying as the routine method of malaria control, instead spraying would be done only to abort the epidemic build up. Currently the method is also being used in the control of malaria in Ahmedabad city and it has already reclaimed large pieces of land and improved the environment with clear indications on the reduction in mosquito populations and in the decline of malaria and dengue fever.

Based on field experience, the salient features of the biology of major malaria vectors and appropriate bioenvironmental interventions are briefly described below.

1. Anopheles culicifacies: The strategy of indoor residual spraying (IRG) was highly successful in control of An. culicifacies transmitted malaria. The vector has developed multiple resistance and currently during epidemics synthetic pyrethroids are used. However IRS is not productive and produces diminishing returns in malaria control. An. culicifacies is entering new areas coming under agriculture. This vector is basically zoophilic and maintains unstable malaria. Population build up due to rain brings malaria. Irrigation also provides opportunities for high population build up and thus in areas with irrigation malaria endemicity increases manifold. Vector control should rely on drainage, filling and levelling; widespread application of larvivorous fishes; health impact assessment to prevent the creation of mosquitogenic conditions; insecticide treated mosquito nets; and species sanitation to reduce operational cost of the interventions. Effective malaria control and its maintenance would require vigilance; early case detection and treatment, screening of migrant population and radical treatment of positive cases...
2. Anopheles stephensi: An. stephensi type form is an important vector of urban malaria. Type form prefers to breed in stored water in a variety of containers, wells, rainwater collections etc. And maintains endemic malaria. Spraying of insecticides in urban areas is nearly impossible and therefore vector control relies on source reduction and other anti-larval interventions. An. stephensi control should rely on preventive methods; source reduction; application of larvivorous fishes, biolarvicides; rigid implementation of legislative measures and building bye laws; and insecticide treated mosquito nets and curtains.
3. Anopheles fluviatilis: The vector comprises of three sibling species viz., species S, T and U. An. fluviatilis species S is the vector where as T and U are non-vectors. In areas with malaria endemicity maintained by species S, this species has disappeared due to ecological changes and the vacated niches have been occupied by the non-vector species T and U. Developments in agriculture are injurious to the survival of S sibling species. Vector control in areas with species S should rely on species sanitation, agricultural developments, use of siphons for flushing; spraying of biolarvicides and the use of insecticide treated mosquito nets/curtains.
4. Anopheles minimus: This vector maintains stable malaria in the northeastern states. An minimus breeds on the margins of slow running streams. Vector populations are exphilic and endophagic in behaviour. Vector control should rely on jungle clearance, drainage, use of siphons, repellents and insecticide treated mosquito nets/curtains.
5. Anopheles dirus: This vector is distributed in the northeastern states in the deep jungles in East Asia. It breeds in puddles with shade. Clearance of jungle eliminates breeding but gives way for the invasion of An. minimus. The vector is exophilic and exophagic and maintains stable malaria. Vector control should rely on the insecticide treated mosquito nets, personal protection methods, and ecological barrier or > 500 m jungle clearance.
6. Anopheles sundaicus: The vector is distributed the Andman and Nicobar Islands. It breeds in brackish water and maintains endemic malaria. Vector control should rely on the installation of one way sluice gates across the creek; application of larvivorous fishes; insecticide treated mosquito nets and encouragement of mangrove forests.

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22. Chemical Control of Termites in Australia

By Prof. I. Rae

Background

Nearly 200 species of termite are found in Australia, and all areas of the continent are colonised by termites of one species or another. Termites damage trees in forests and plantations, as well as ornamental trees and shrubs and those involved in horticulture, but the most prominent economic damage occurs to timber in buildings and structures.

Mastotermes darwiniensis, the largest termite found in Australia, inhabits northern sections of the continent. It is extremely destructive, attacking houses and other buildings, bridges, posts and poles, and many plant species and animal products. *M. darwiniensis* can ringbark and kill living trees, and also attacks sugarcane. It has been recorded as feeding on substrates as diverse as paper, leather, hides, wool, horn, vegetable fibre, hay, sugar, flour, bagged salt, bitumen, rubber, ebonite and human excrement. It can damage glass and some metals.

The smaller *Coptotermes* species are found in all areas of Australia and are responsible for the majority of economic damage to structures, and a number of other species may be extremely active in localised areas.

Termite management

Control techniques for termites may be <u>curative</u> or <u>preventative</u>. To begin with the second category, we may further subdivide it into physical and chemical barriers.

Many local building authorities require that preventative measures against termites be incorporated during the construction of new buildings. Such measures may take the form of simply impregnating the soil, and perhaps some parts of the building foundations, with suitable termiticides and organochlorine pesticides (OCPs) were widely used for this purpose. The use of OCPs against termites was one of the last uses of this group of substances to be phased out - a process that began in the late 1970s. The one remaining OCP used against termites is mirex, following the deregistration of chlordane and heptachlor in late 1997, and the use of mirex is expected to end soon.

The OCPs possessed the great virtue of persistence, being very long-lived in the environment, but of course that was also the underlying reason for their phaseout, since longevity gave scope for relocation and concentration in the environment, thus enabling their toxic effects to be realised in a range of animal species.

A physical barrier, in the form of crushed, sized granite (Granite Guard) can be effective if the particle size is correctly matched to the size of the termites likely to attack the structure. Another barrier is stainless steel mesh of particular dimension (Termimesh) have been used in Australia but again size is important - a mesh size of 0.6 mm x 0.45 mm was effective against larger species but smaller species were able to slip through. Because of uncertainty surrounding the performance of these physical barriers in given situations, many traditional builders and building-owners still prefer chemical treatment, even if the chemical substances now employed are not the ones formerly used. This preference is reinforced by the need for concrete slabs in tropical Australia to be anchored to deeply-buried tie rods, which help prevent cyclone damage. These rods provide potential entry points at which Termimesh is difficult to install.

A combined chemical and physical and physical barrier, the Kordon Blanket, consists of a layer of insecticide (deltamethrin) -soaked fabric sandwiched between two sheets of impermeable (but hardly to termites!) plastic.

Some success has been obtained through the use of aluminium flashing around the base of houses erected on concrete slabs, especially where construction adhesives are compounded with insecticides to prevent their being consumed by termites which might thereby gain access to the building. Holes in the concrete slab, for instance around drainage or supply pipes, require stopping with physical barriers such as Termimesh.

Curative treatment of buildings and structures is much more difficult, as is treatment of infested plants. The use of termiticides with shorter effective lives than the OCPs has made such curative treatment (or at least, repeated application) essential, however. One recent approach to this matter has been the installation of reticulation pipes in the concrete foundation slabs of new buildings, with the intention that termiticides could thus be pumped in at intervals of several years to control termite infestations.

Termiticides

Both organophosphate and synthetic pyrethroid termiticides have been employed in Australia. Chlorpyrifos has been registered for a number of years for prevention of termite attack under suspended floors, where retreatment is also possible, and also for use as a perimeter spray. In 1994, it use in the reticulation systems built into concrete slab foundations (described above) was approved, and more recently it has been hand-sprayed into soil beneath existing slabs. Other OPs to find application have included isofenphos and prothiophos.

Synthetic pyrethroids can be effective, but their well-known toxicity to fish somewhat limits their application. Alpha cypermethrin is the most used but esfenvalerate and bifenthrin (Biflex) are also marketed and used in Australia. Imidacloprid (Premise), which belongs to the newer class of nicotinyl imidazolidines, is also used as a termiticide, and the insect growth retardent hexaflumuaron is used in the form of baits.

Arsenic is toxic to termites, as it is to most animal species, but dispersing arsenicals in the form of dust is unacceptable as a means of control these days. If termite nests can be identified, and the potential for subsequent migration of arsenic can be assessed as negligible, then arsenical assault on the massed termites can be effective. However, termites tend to abandon nests that are disturbed, so the destruction of the termite colony must be effected completely at the first attempt.

Mastotermes darwiniensis is a serious pest in tropical Australia, especially where tropical fruits are grown, and mirex baits have been used to control attacks, especially in mango plantations. Total usage, because of the baiting system used, is quite small but extreme care has to be taken to avoid the presence of termiticide residues in produce. As mentioned above, this use of mirex is likely to cease in the foreseeable future. Some work has been done with organophosphorus and synthetic pyrethroid substances as termiticides for orchard application, but it is frequently the case that application rates and soil levels required to control infestation are such that unacceptable resides may be detected in the produce. More success has been obtained with the insect growth retardent, hexaflumuaron.

Biological control

The Entomology Division of Australia's government research organisation, CSIRO, has conducted trials with two types of biological control agents for termites. Since termites seem to be resistant to available viruses and bacteria, more complex agents such as fungi and nematodes have been employed.

A number of fungi have been shown to be effective against termites in the laboratory but field conditions are very different. However, a strain of *Metarhizium anisopliae* has shown promise in control of termites. Certain nematodes are also known to attack termites, and CSIRO scientists have grown substantial colonies of these predators, and applied them with some success to control of termite infestations in coconut plantations in Fiji.

Summary

Control of termites is extremely difficult in Australia, as it is in many other countries. Even the best mechanical barriers suffer from high cost and technical complexity, and exhibit certain technical deficiencies, which may yield slowly to further study and trials. OCPs, which are the most effective chemical agents, have almost all been phased out as termiticides, although more slowly than they were removed from other operational spheres. New chemical termiticides have been introduced and we can expect more developments in this area when OCPs have finally gone. Biological agents who show great promise have been developed in Australia and there is interest in further developing this type of control agent.

In the longer term, it is likely that biological agents and physical and chemical barriers will find a place in integrated pest management (IPM) strategies now being evolved by CSIRO.

Contacts

In the first instance, inquiries concerning termiticides in Australia should be directed to the Commonwealth government department, Environment Australia. Details are given in the 'Solutions' newsletter, distributed as part of the Scheduled Wastes (of which OCPs form a part) process which is described in accompanying presentations at the Hanoi workshop. The department's website URL is www.environment.gov.au.

UNEP

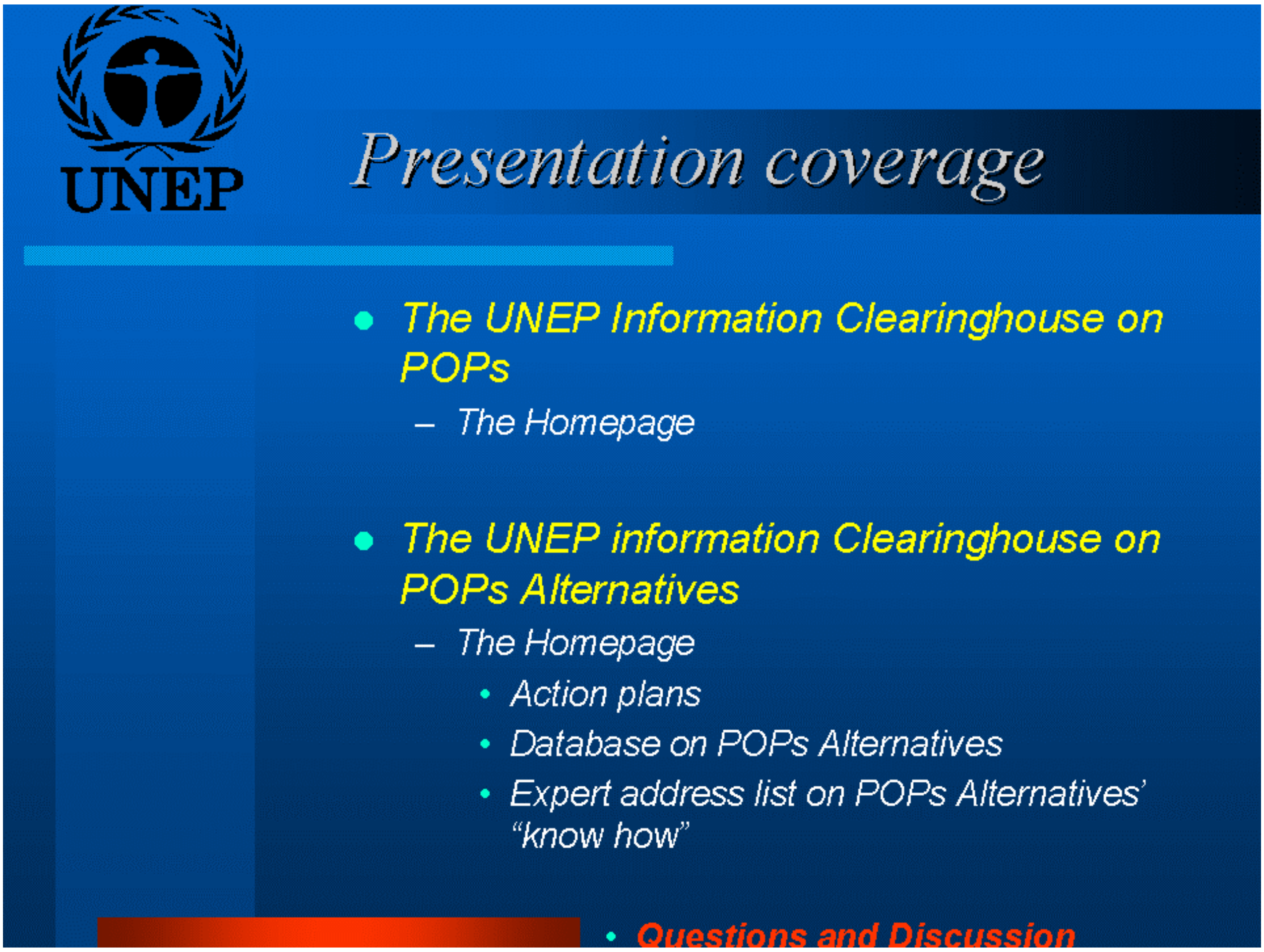
Information Clearinghouse on POPS and their Alternatives

Alwin Kool
Associate Expert
UNEP Chemicals

UNEP

Objective

- Showing the information we have, we offer and will offer in the future through UNEP POPs Homepage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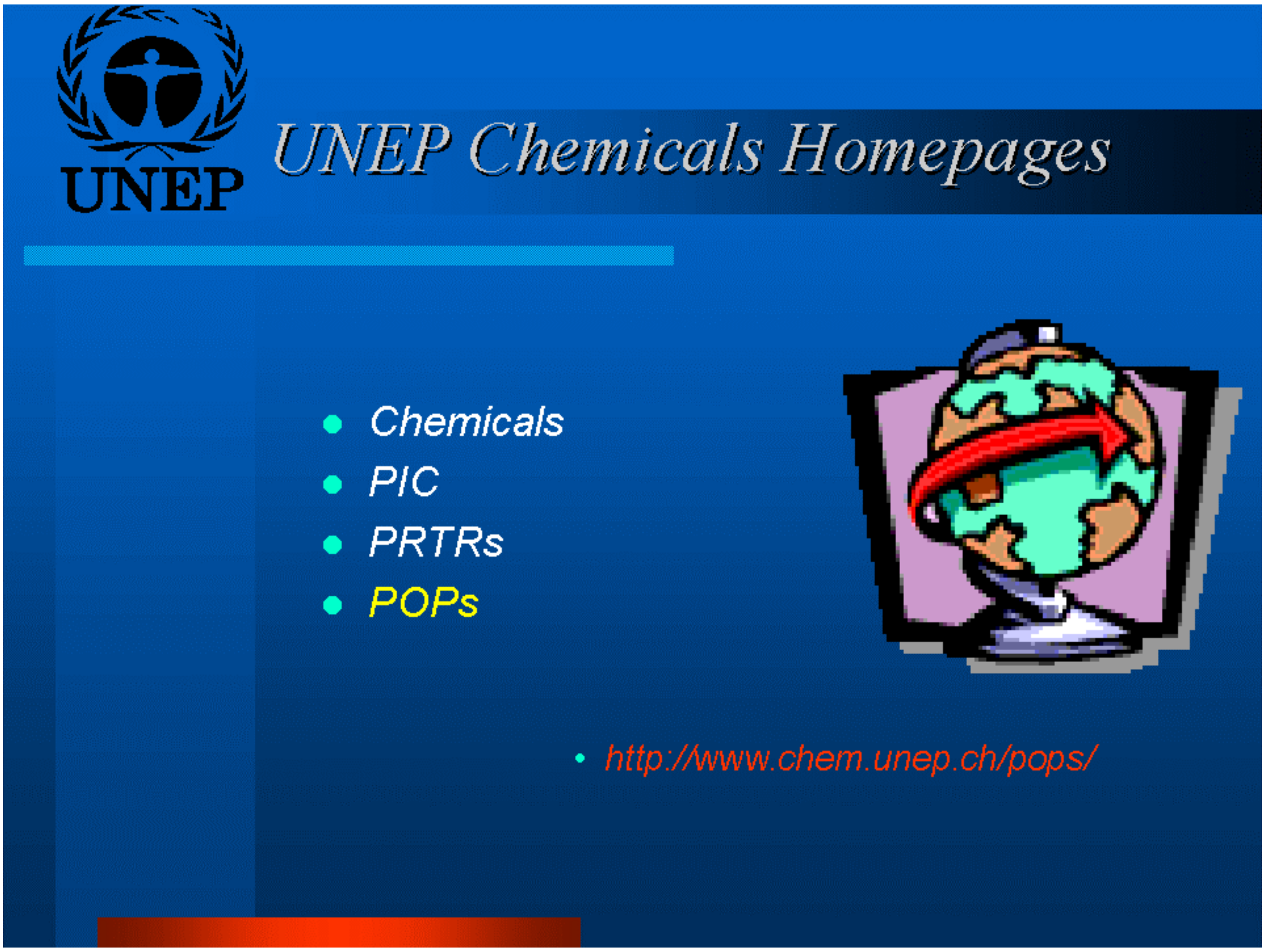
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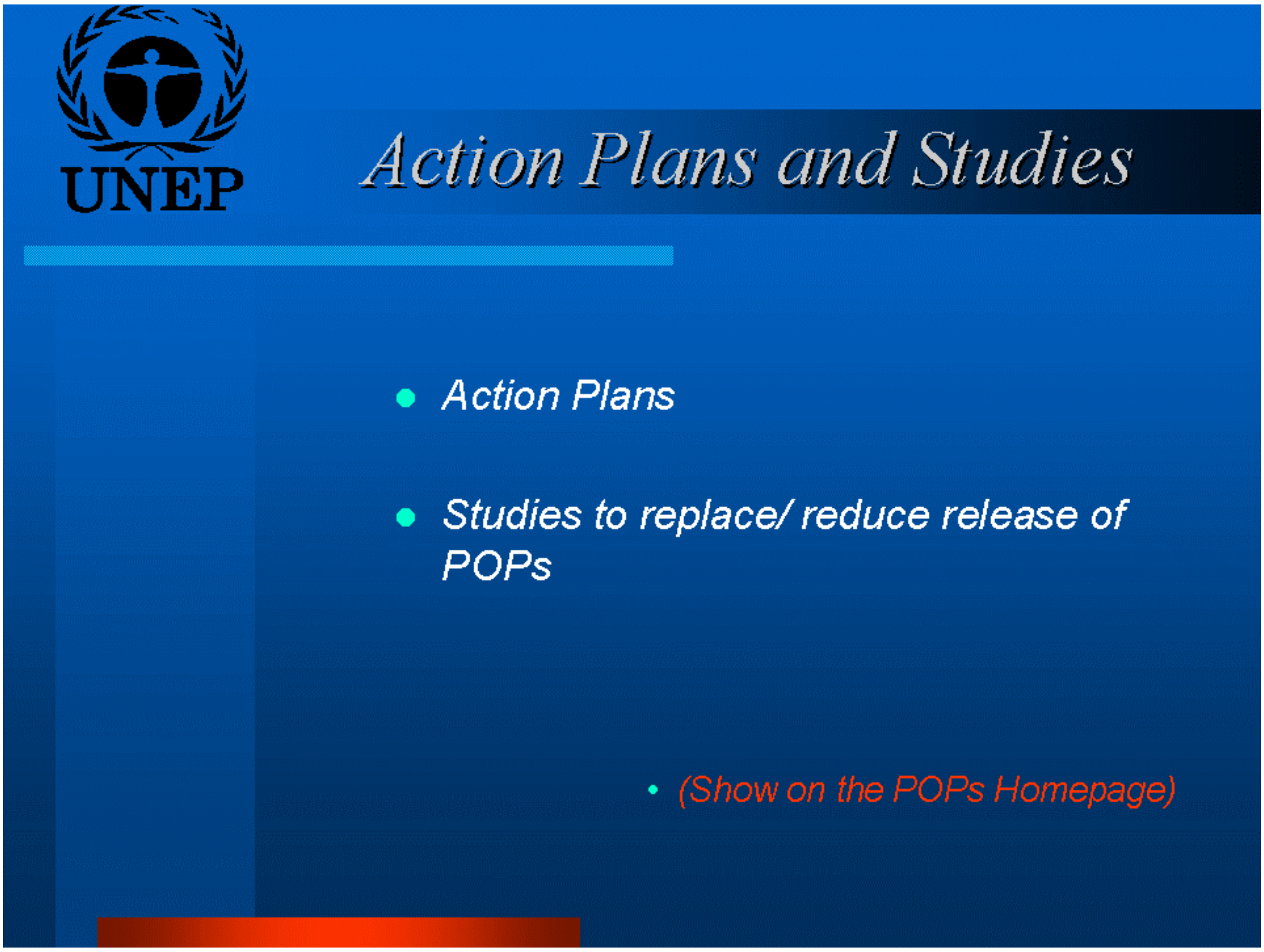
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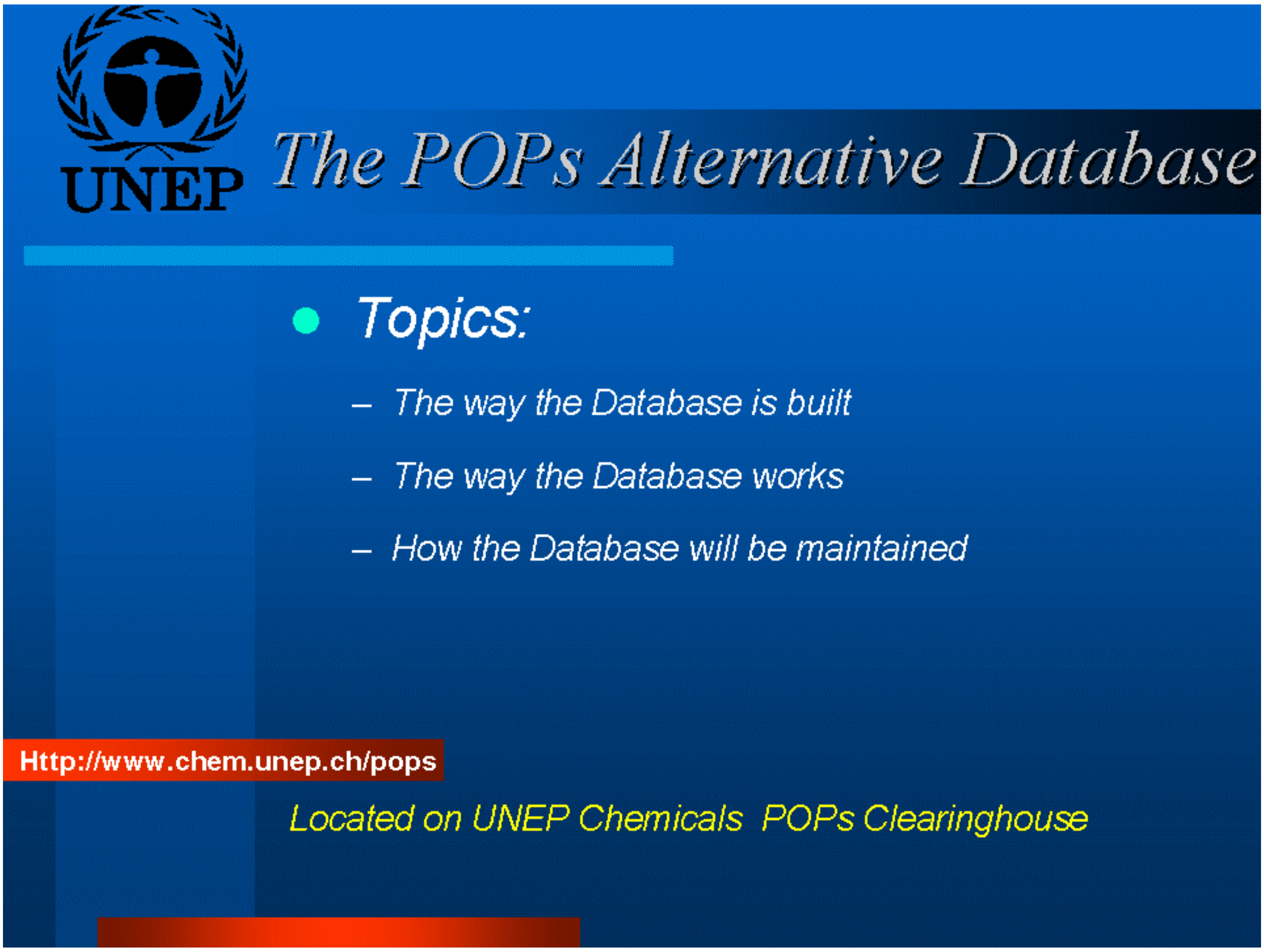
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– The Potential Implications
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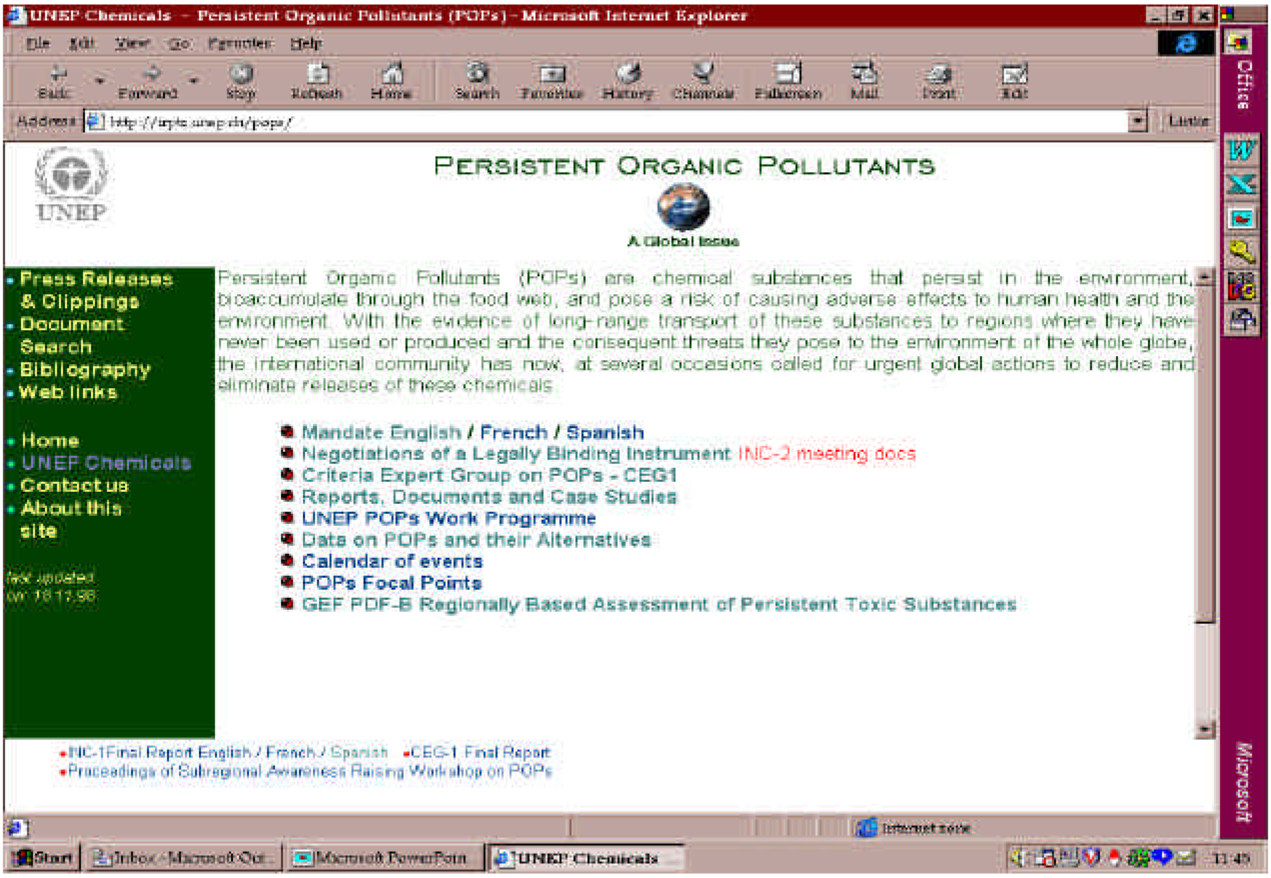
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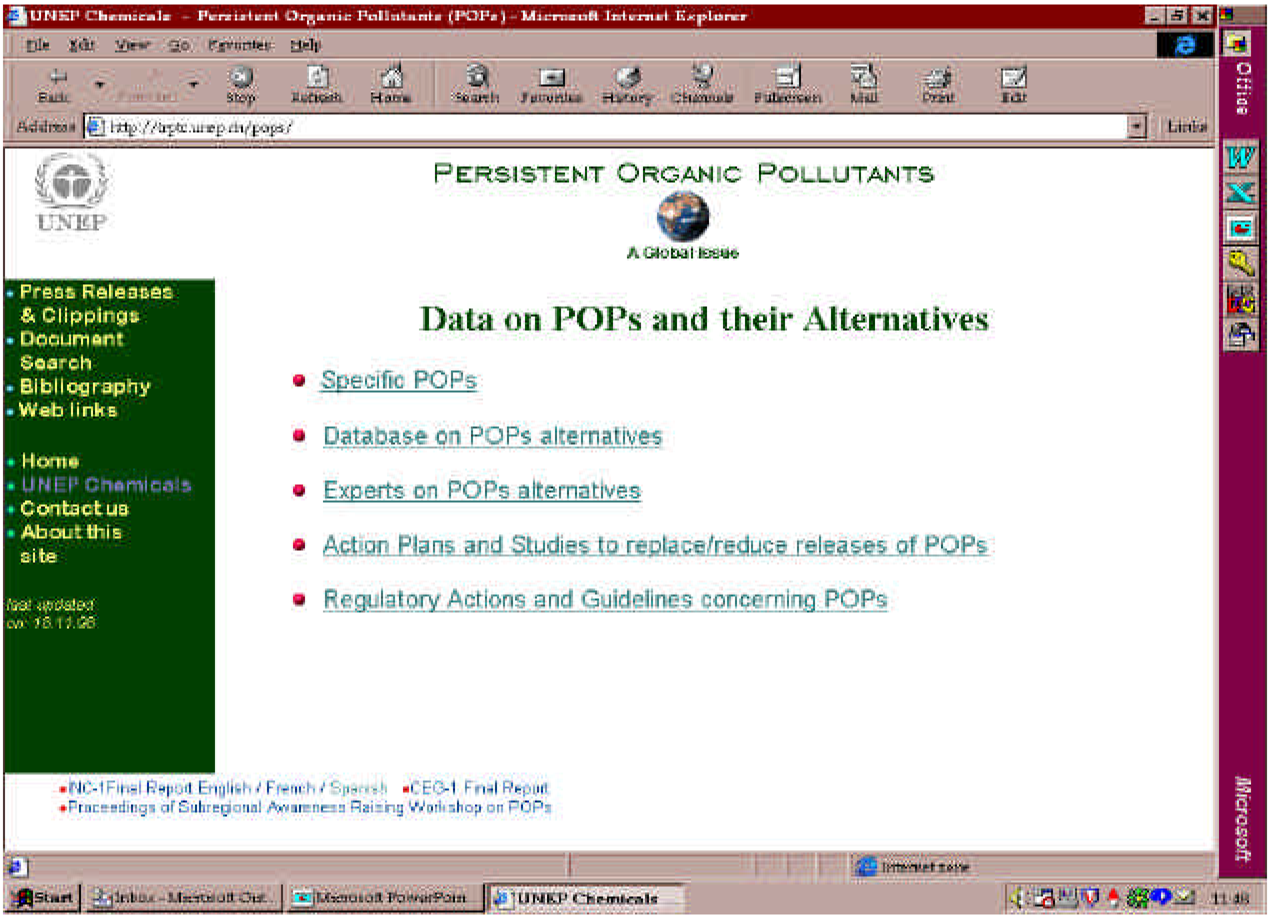
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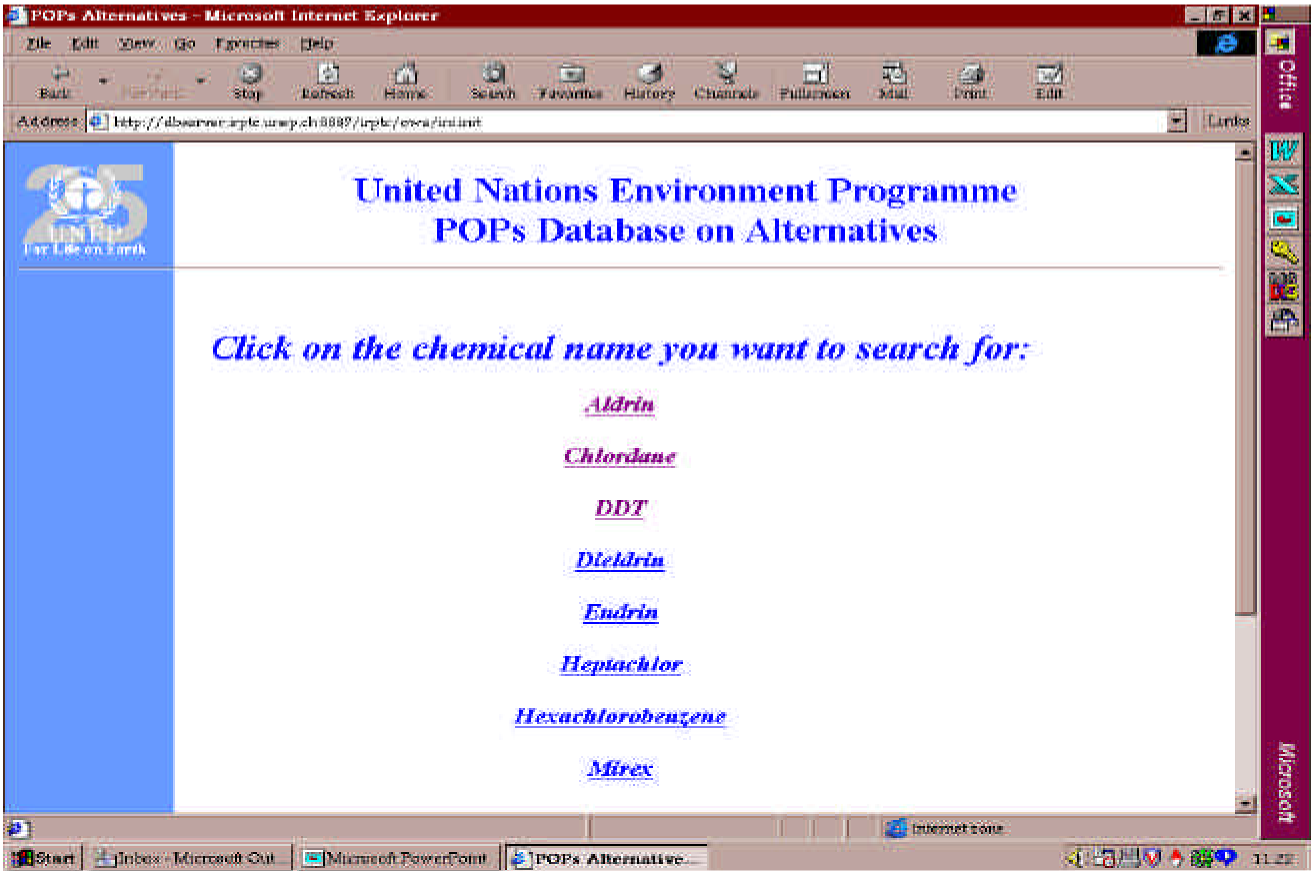
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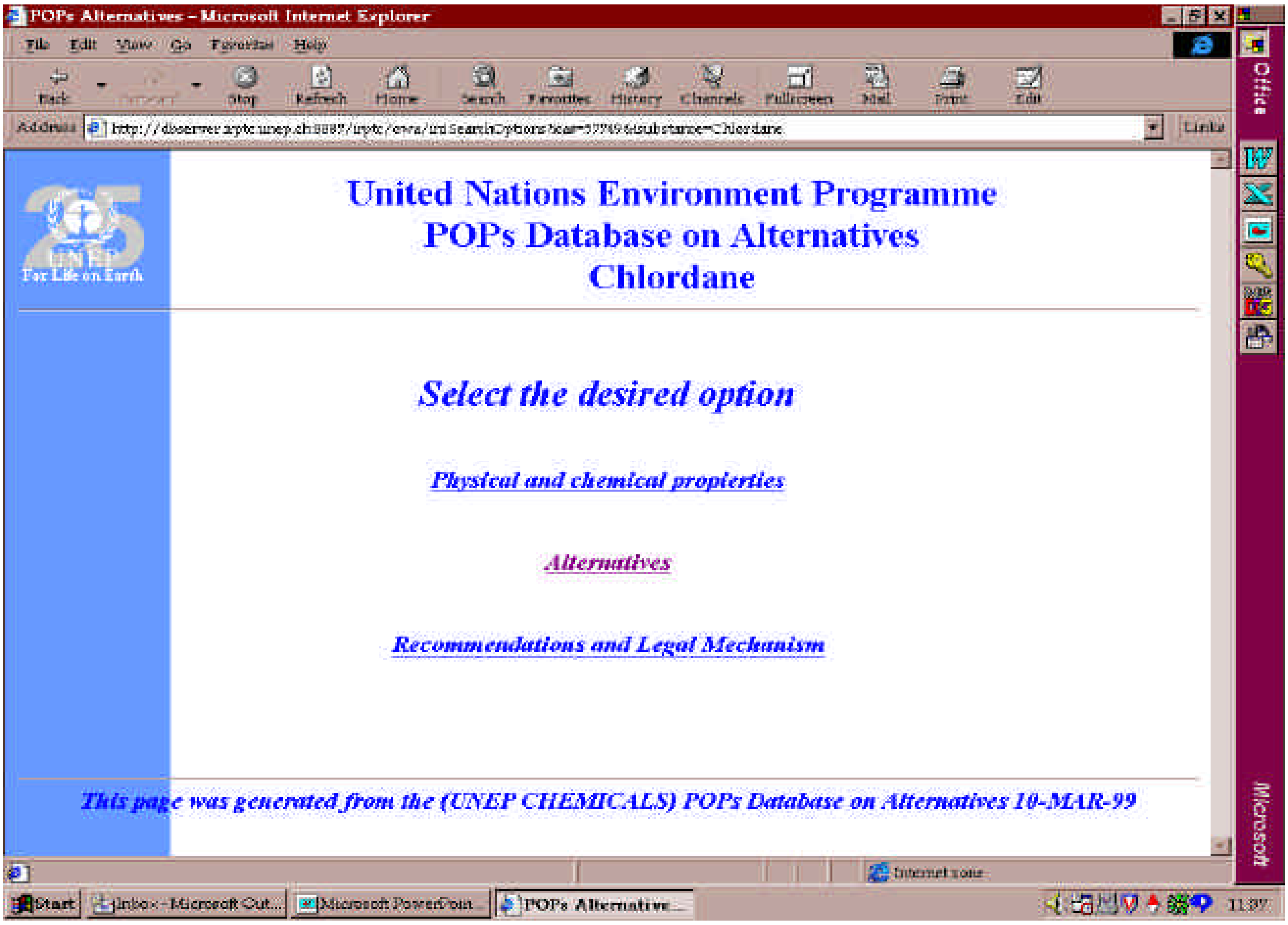
Endrin
Heptachlor
Hexachlorobenzene
Mirex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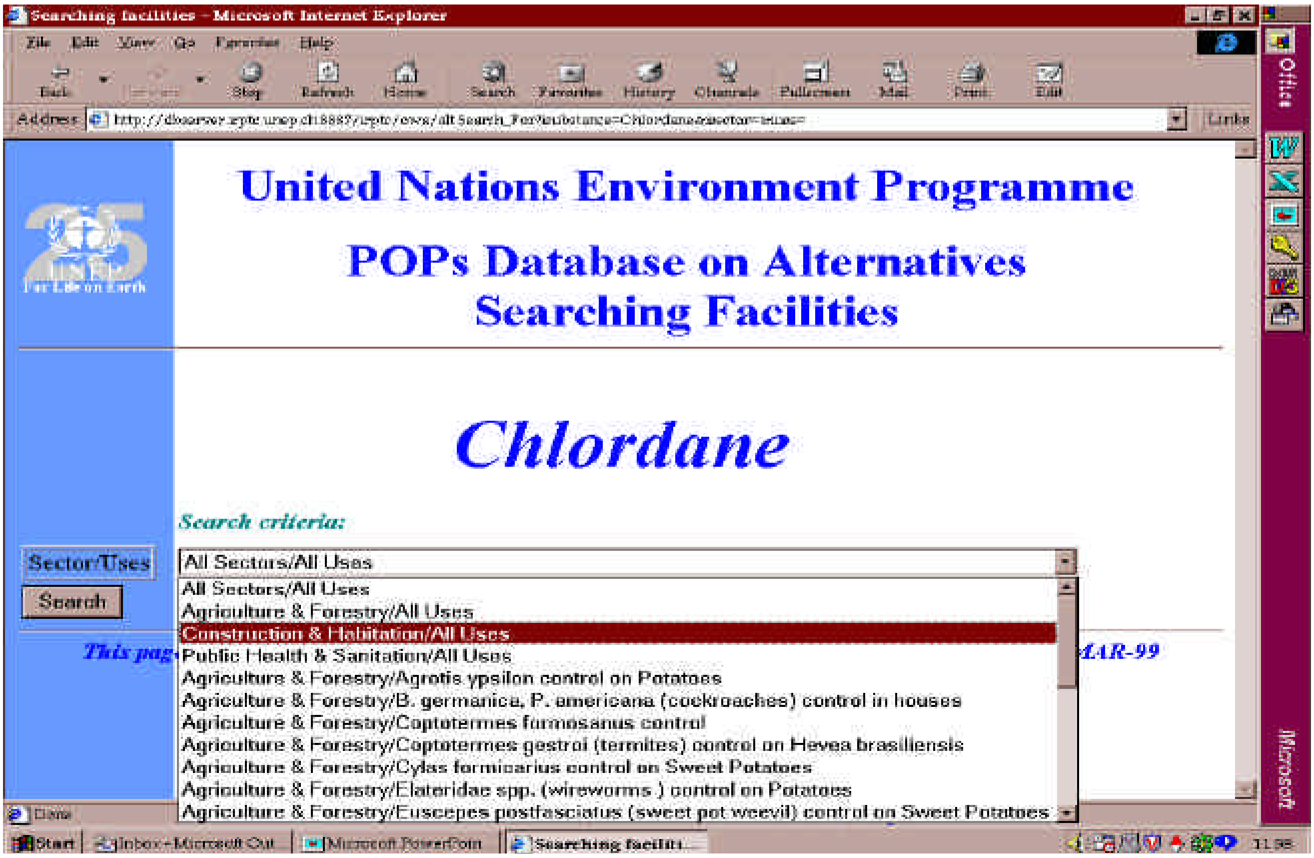
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Agriculture & Forestry/B. germanica, P. americana (cockroaches) control in houses
Agriculture & Forestry/Coptotermes formosanus control
Agriculture & Forestry/Coptotermes gestroi (termites) control on Hevea brasiliensis
Agriculture & Forestry/Cylas formicarius control on Sweet Potatoes
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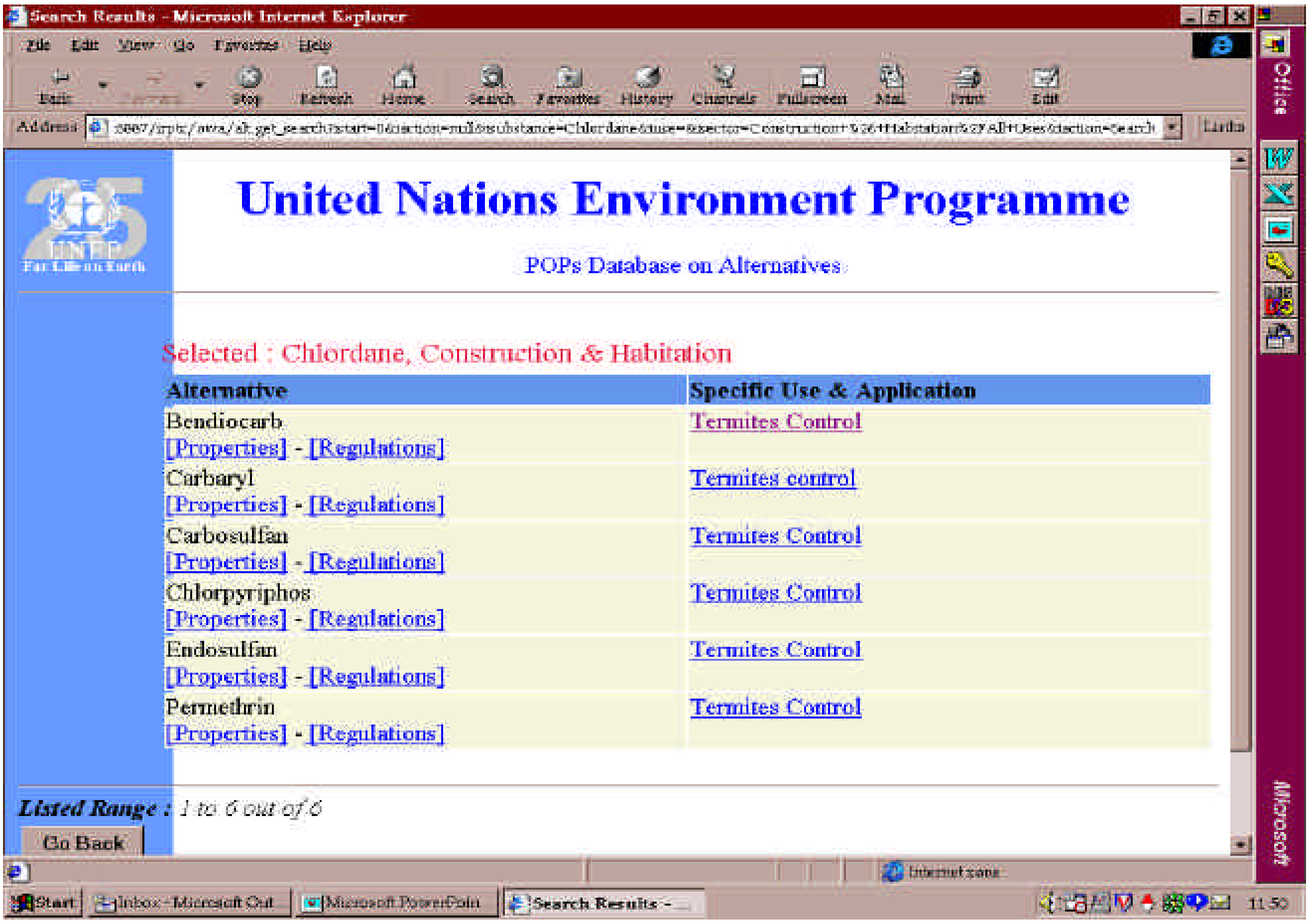
Agriculture & Forestry/Euscepes postfasciatus (sweet pot weevil) control on Sweet Potatoes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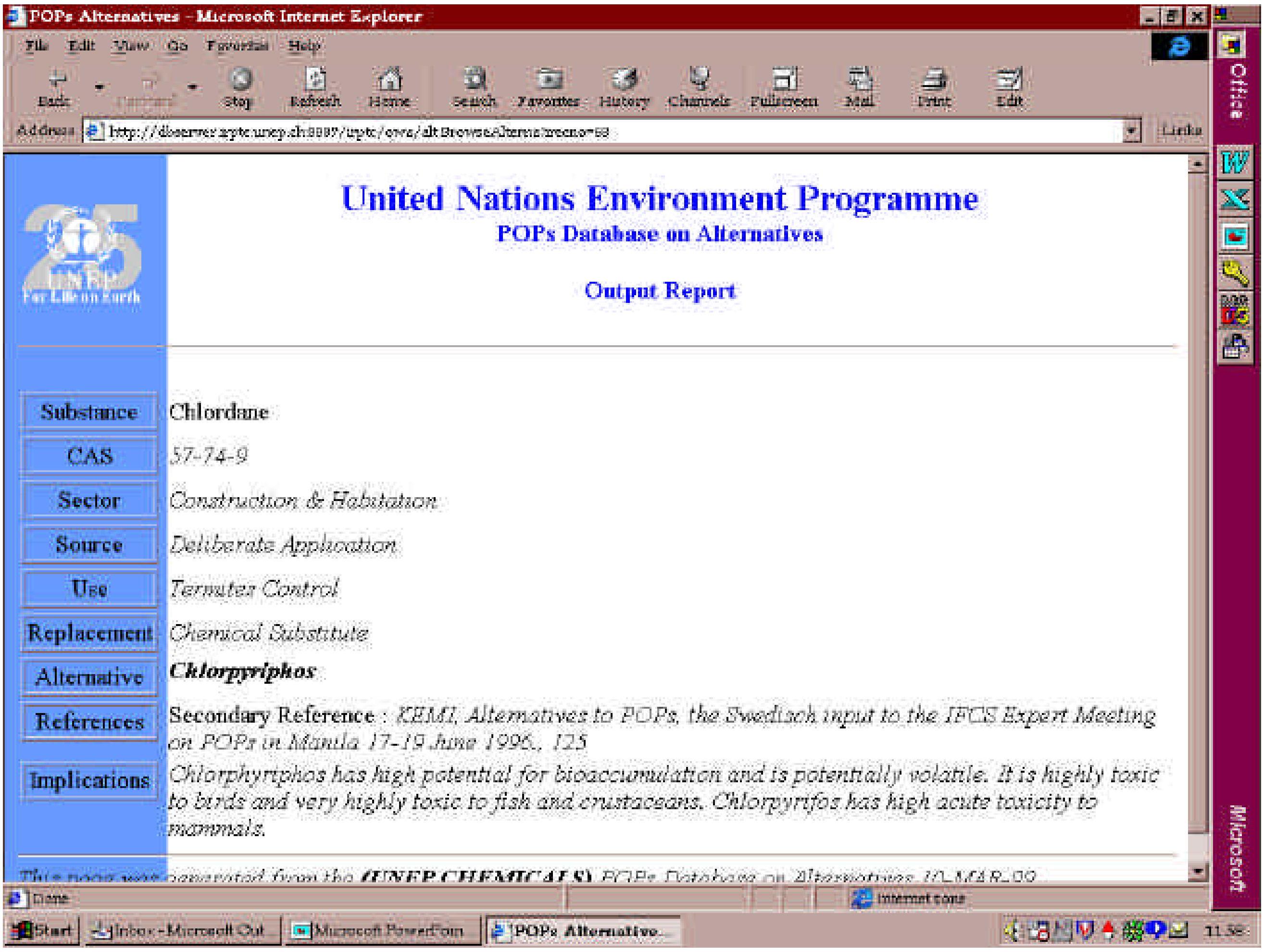

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POPs Database on Alternatives

Output Report

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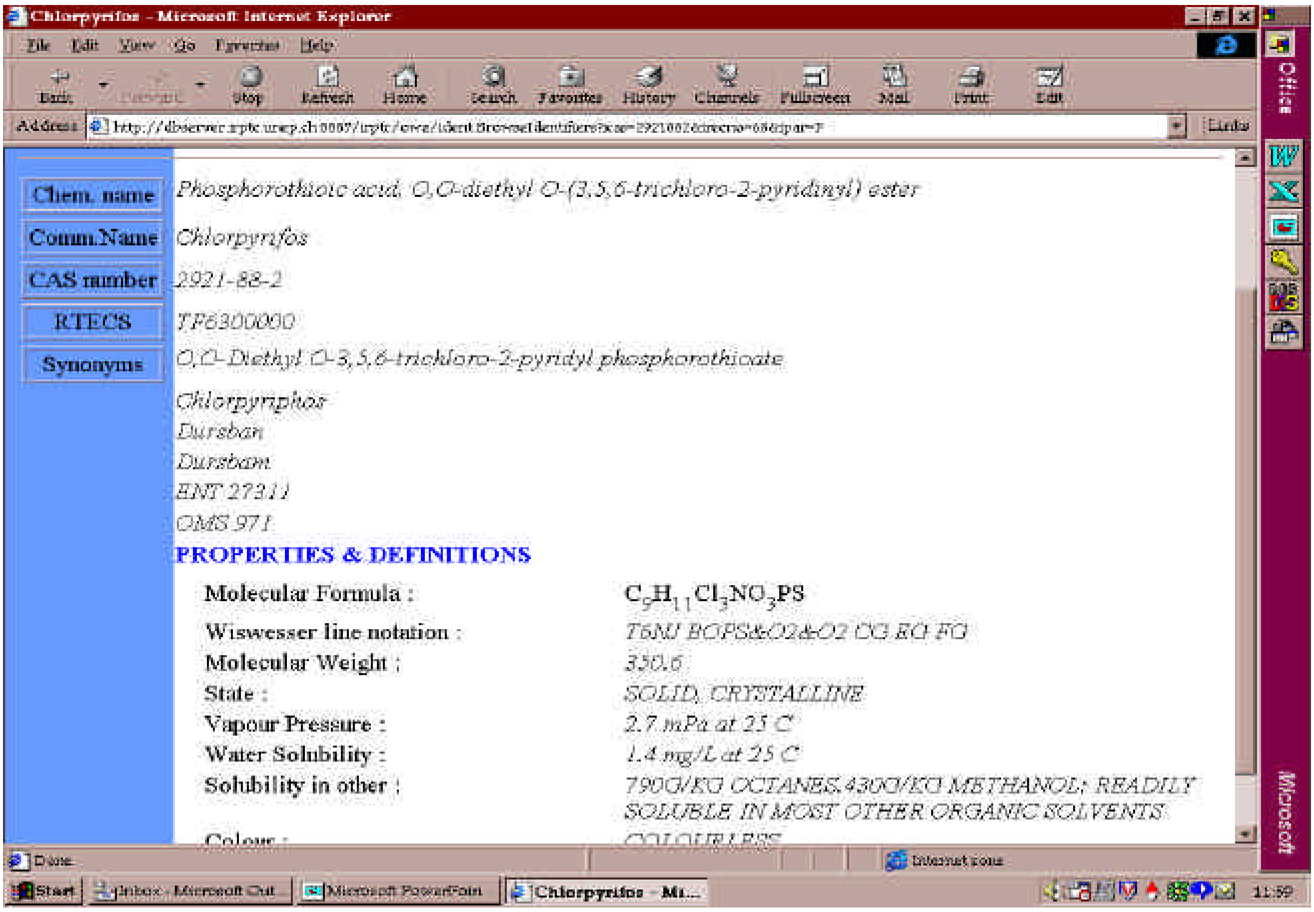
Replacement	*Chemical Substitute*
Alternative	***Chlorpyriphos***
References	Secondary Reference : *KEMI, Alternatives to POPs, the Swedisch input to the IFCS Expert Meeting on POPs in Manila 17-19 June 1996., 125*
Implications	*Chlorphyriphos has high potential for bioaccumulation and is potentially volatile. It is highly toxic to birds and very highly toxic to fish and crustaceans. Chlorpyrifos has high acute toxicity to mammals.*



Chlorpyrifos - Microsoft Internet Explorer

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CAS number	*2921-88-2*
RTECS	*TF6300000*
Synonyms	*O,O-Diethyl O-3,5,6-trichloro-2-pyridyl phosphorothioate* *Chlorpyriphos* *Dursban* *Dursbam* *ENT 27311* *OMS 971*

PROPERTIES & DEFINITIONS

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Vapour Pressure :	*2.7 mPa at 25 C*
Water Solubility :	*1.4 mg/L at 25 C*
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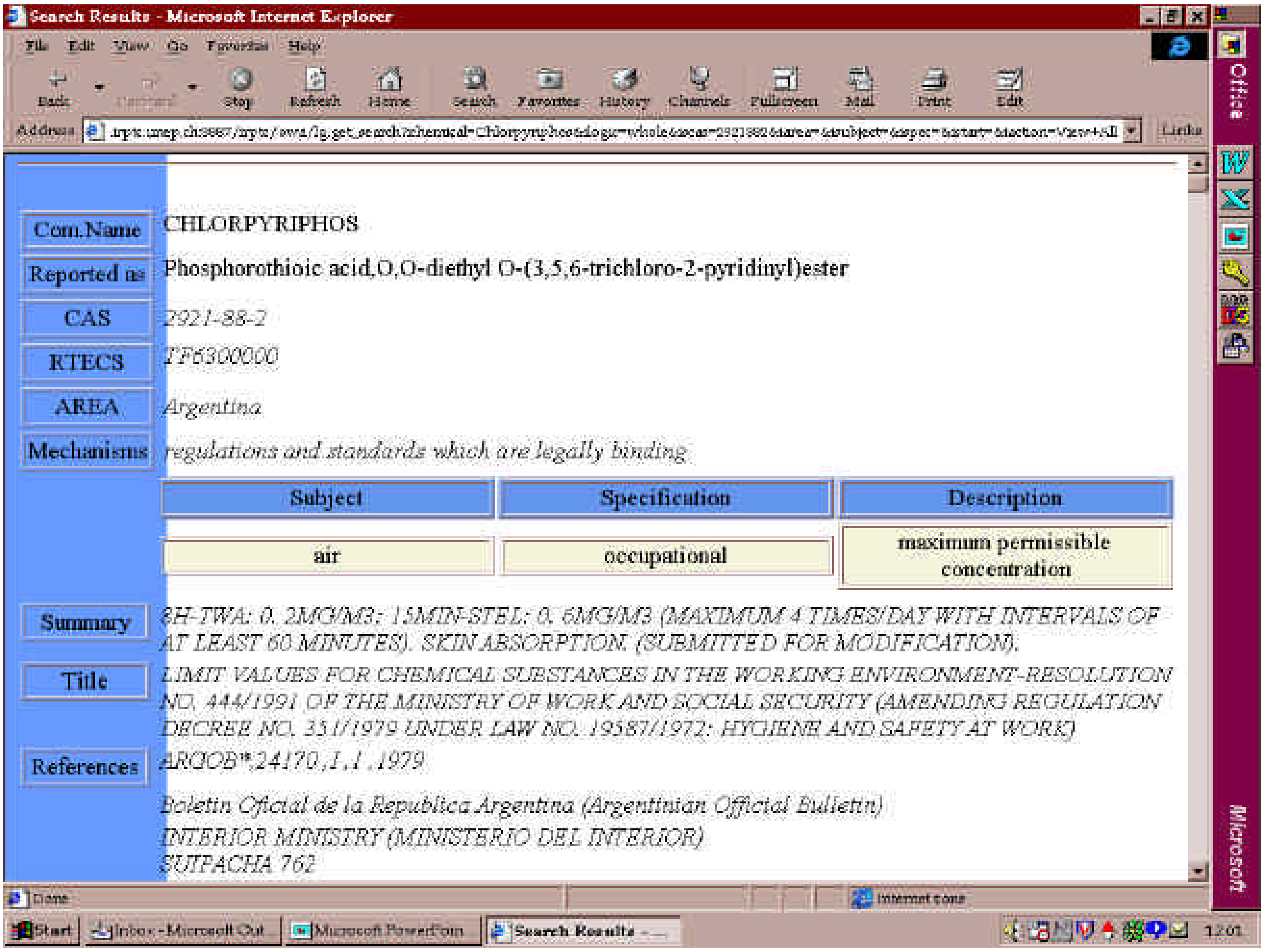
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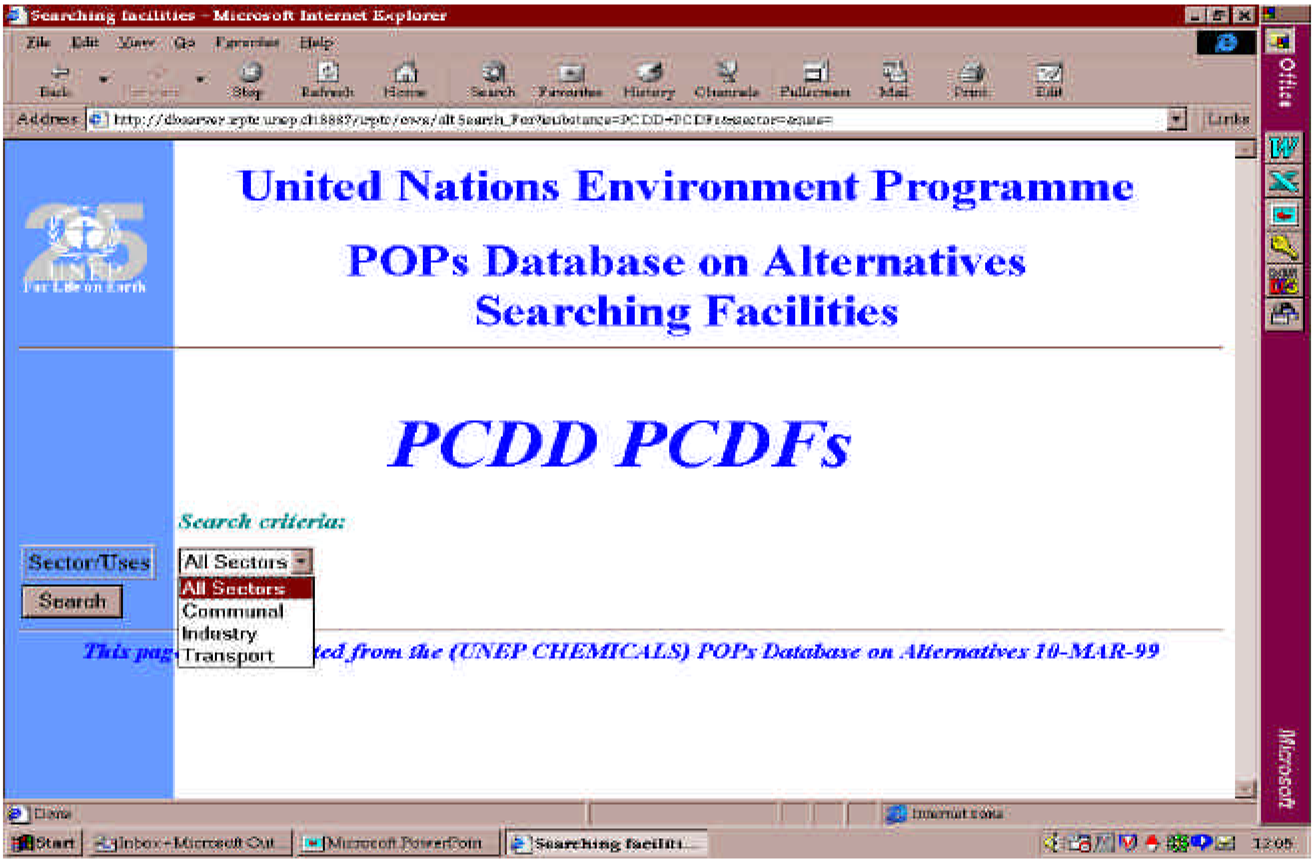
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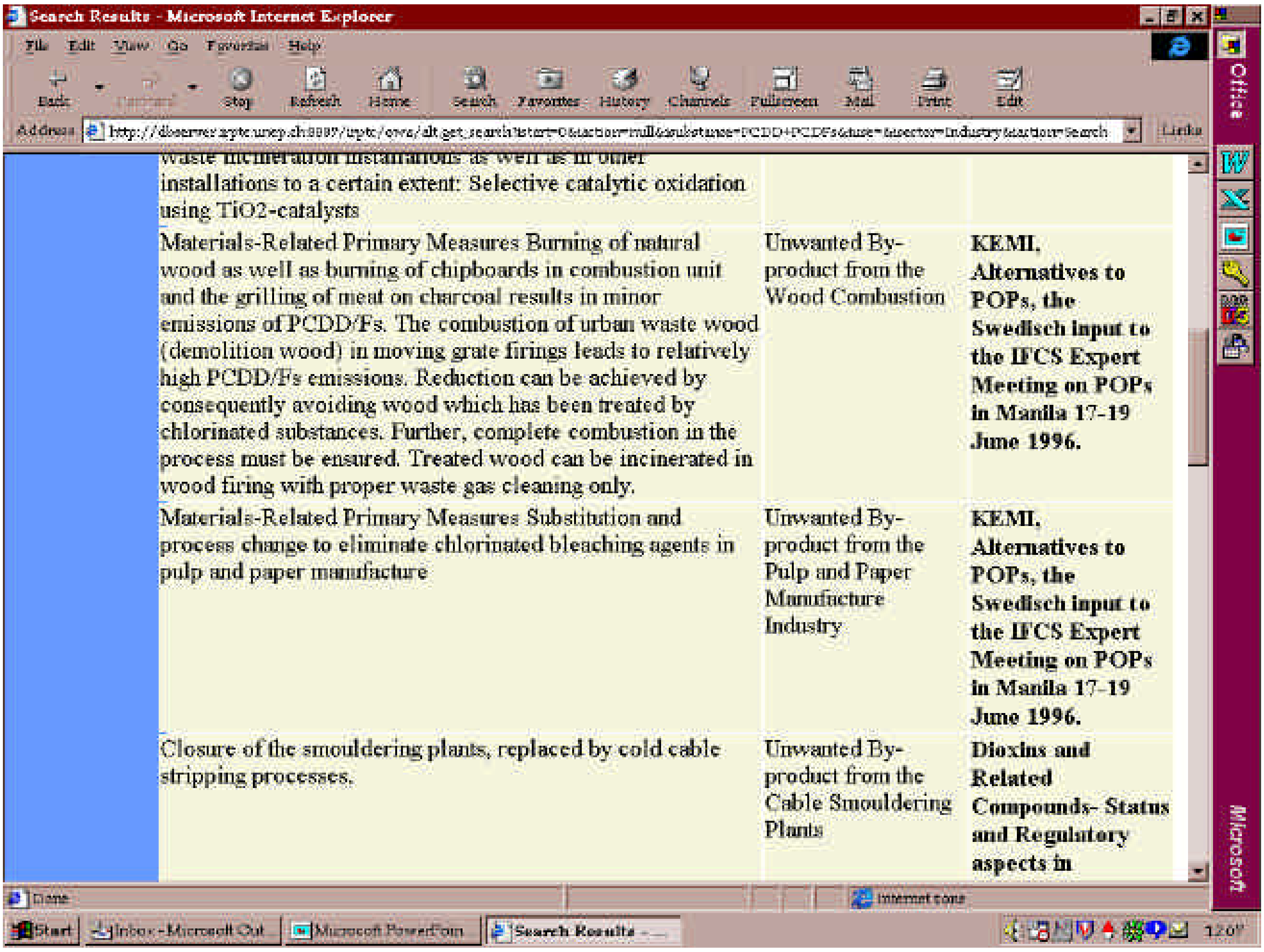
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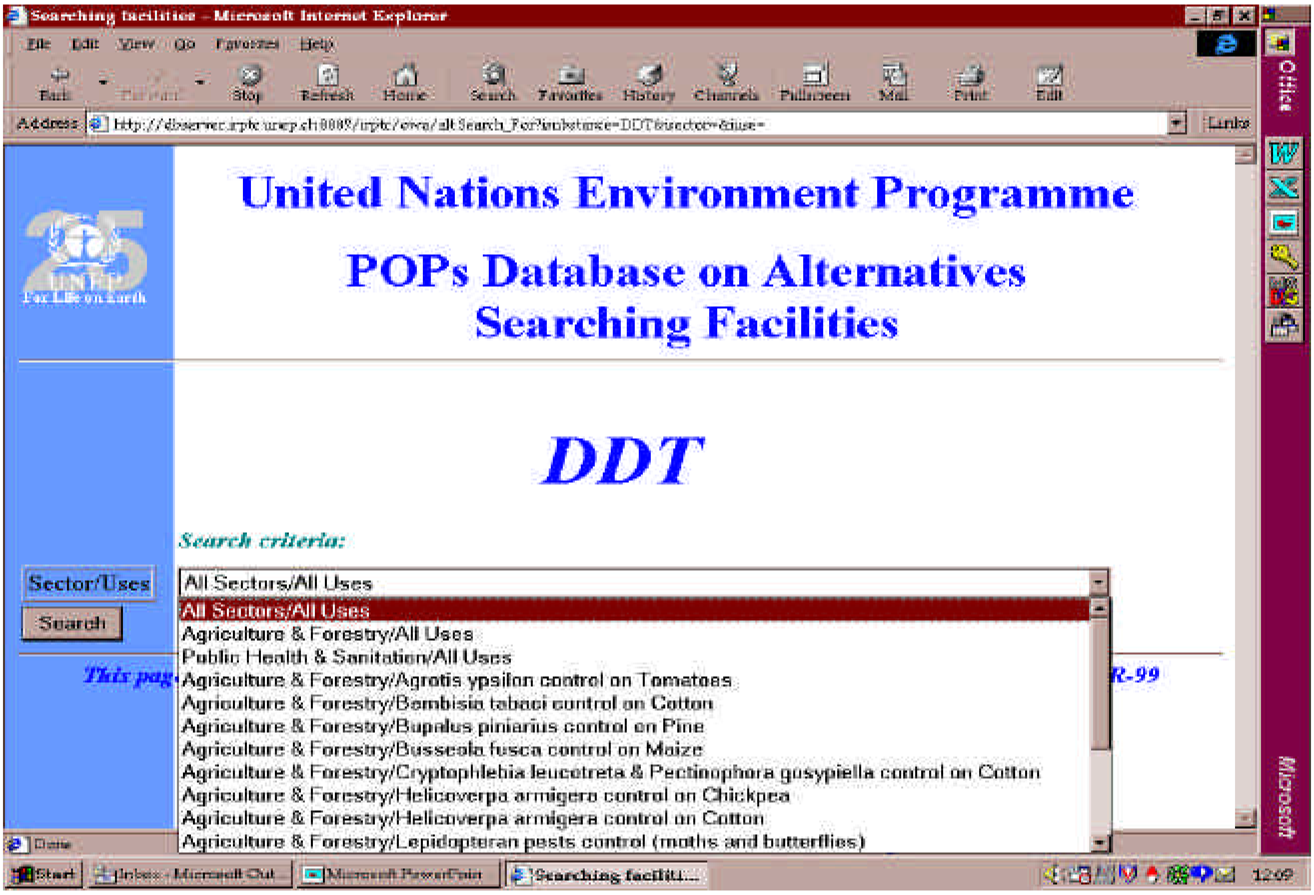
waste incineration installations as well as in other installations to a certain extent: Selective catalytic oxidation using TiO2-catalysts		
Materials-Related Primary Measures Burning of natural wood as well as burning of chipboards in combustion unit and the grilling of meat on charcoal results in minor emissions of PCDD/Fs. The combustion of urban waste wood (demolition wood) in moving grate firings leads to relatively high PCDD/Fs emissions. Reduction can be achieved by consequently avoiding wood which has been treated by chlorinated substances. Further, complete combustion in the process must be ensured. Treated wood can be incinerated in wood firing with proper waste gas cleaning only.	Unwanted By-product from the Wood Combustion	**KEMI, Alternatives to POPs, the Swedisch input to the IFCS Expert Meeting on POPs in Manila 17-19 June 1996.**
Materials-Related Primary Measures Substitution and process change to eliminate chlorinated bleaching agents in pulp and paper manufacture	Unwanted By-product from the Pulp and Paper Manufacture Industry	**KEMI, Alternatives to POPs, the Swedisch input to the IFCS Expert Meeting on POPs in Manila 17-19 June 1996.**
Closure of the smouldering plants, replaced by cold cable stripping processes.	Unwanted By-product from the Cable Smouldering Plants	**Dioxins and Related Compounds- Status and Regulatory aspects in**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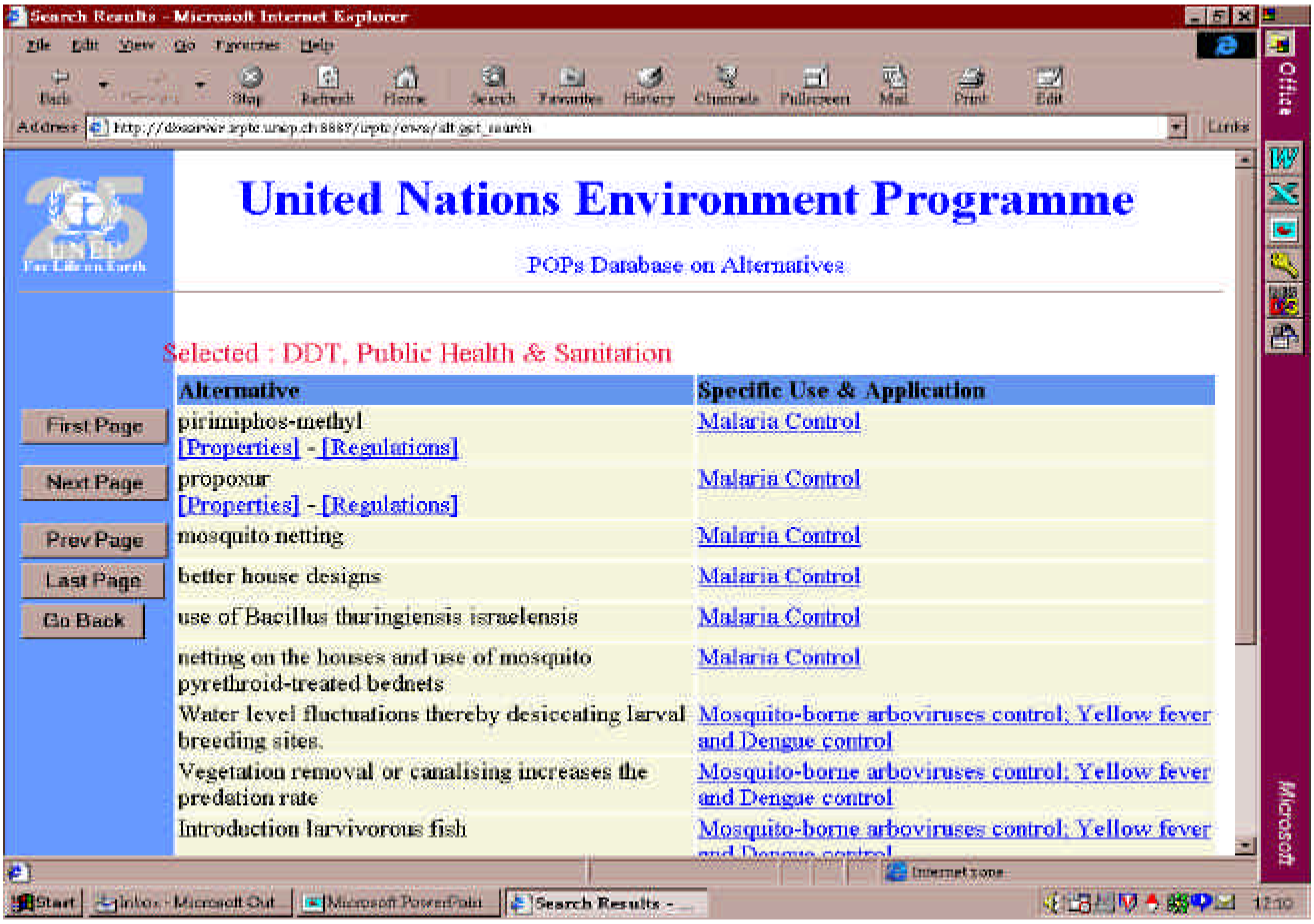
Public Health & Sanitation/All Uses
Agriculture & Forestry/Agrotis ypsilon control on Tomatoes
Agriculture & Forestry/Bembisia tabaci control on Cotton
Agriculture & Forestry/Bupalus piniarius control on Pine
Agriculture & Forestry/Busseola fusca control on Maize
Agriculture & Forestry/Cryptophlebia leucotreta & Pectinophora gosypiella control on Cotton
Agriculture & Forestry/Helicoverpa armigera control on Chickpea
Agriculture & Forestry/Helicoverpa armigera control on Cotton
Agriculture & Forestry/Lepidopteran pests control (moths and butterflies)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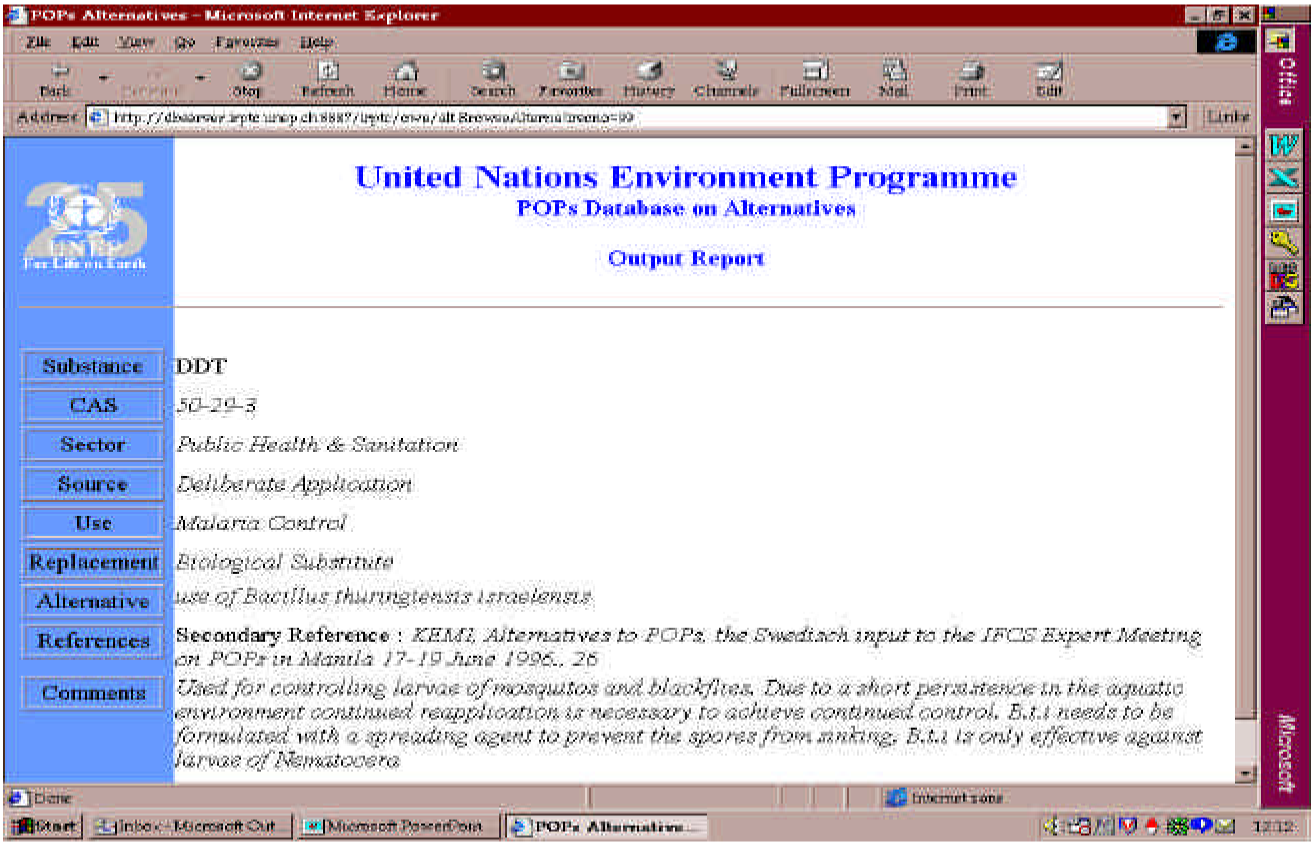
propoxur [Properties] - [Regulations]
Malaria Control
mosquito netting
Malaria Control
better house designs
Malaria Control
use of Bacillus thuringiensis israelensis
Malaria Control
netting on the houses and use of mosquito pyrethroid-treated bednets
Malaria Control
Water level fluctuations thereby desiccating larval breeding sites.
Mosquito-borne arboviruses control; Yellow fever and Dengue control
Vegetation removal or canalising increases the predation rate
Mosquito-borne arboviruses control; Yellow fever and Dengue control
Introduction larvivorous fish
Mosquito-borne arboviruses control; Yellow fever


POPs Alternatives - Microsoft Internet Explorer
United Nations Environment Programme
POPs Database on Alternatives
Output Report
Substance
DDT
CAS
50-29-3
Sector
Public Health & Sanitation
Source
Deliberate Application
Use
Malaria Control
Replacement
Biological Substitute
Alternative
use of Bacillus thuringiensis israelensis
References
Secondary Reference : KEMI, Alternatives to POPs, the Swedisch input to the IFCS Expert Meeting on POPs in Manila 17-19 June 1996., 26
Comments
Used for controlling larvae of mosquitos and blackflies. Due to a short persistence in the aquatic environment continued reapplication is necessary to achieve continued control. B.t.i needs to be formulated with a spreading agent to prevent the spores from sinking. B.t.i is only effective against larvae of Nematocera

UNEP

The Database in the future

- OUTPUT NOW
  - Alternative
  - The Reference
  - Properties
  - Regulatory Information
  - Potential Implications
- *OUTPUT in the Future*
  - Interactivity
  - Links to action plans
  - Links to Case studies
  - Links to Experts
  - Links to Legal File

UNEP

Database Maintenance

- *UNEP Chemicals Staff (Secretariat)*
- *Experts (Interactive homepage)*
- *Users (Interactive homepage)*

UNEP

Experts on POPs Alternatives

- *Name/ Institute/ Organization*
- *Field of Expertise (Alternative)*
- *Region/Country*
- *Interactive*
- *Comments section*
- *Availability of the Expert*

UNEP

Questions and Discussion

- **Hmmm....**

23. Managing OCPs and Other Unwanted Pesticides in Australia

by Prof. I. Rae

BACKGROUND

Most organochlorine pesticides (OCPs) are no longer registered for use in Australia (exceptions are Mirex and Toxaphene). Unused, unwanted quantities of these materials are classified as 'Scheduled Wastes' and a plan for their management and destruction has been prepared for the Australian and New Zealand Environment and Conservation Council (ANZECC). An outline of the Scheduled Wastes process is given in an accompanying document, also prepared for the Hanoi meeting, in which Australia's management of PCBs is described. The Scheduled Wastes process ensures that management plans for selected wastes are prepared with full public consultation and meet with the approval and support of industry, government and environment groups. They are implemented by the Australian states, territories and the Commonwealth.

Management plan

The OCP management plan was accepted by the ministerial council (ANZECC) in late 1997, but has not yet been made public, for reasons, which are discussed below. The key features of the management plan are that it:

- specifies threshold quantities and concentrations of substances covered by the plan.
- excludes contaminated sites.
- does not specify destruction technologies, but places limits on emissions from such facilities.
- contains provision for review of the plan after some years' of operation.
- calls for a monitoring study of OCP levels in the Australian environment. A contract has recently been let for the first such study.

National collection

The ministerial council, in late 1997, also received a proposal for a nationally coordinated scheme for storage, collection and destruction of rural chemicals, largely OCPs. Drawing on the experience of those states which had conducted collections in the past, and on survey data from the state of Queensland, it was estimated that approximately 1200 tonne of pesticides (half of which were OCPs) were held on rural properties around Australia. Most of this dispersed stockpile consists of unused, unwanted chemicals, many of them now out of registration and therefore no longer legally usable.

The proposal was accepted in principle, and at present, the various jurisdictions are seeking funding through their budget processes to support the nationally coordinated scheme in the financial years 1999-2000 and up to two succeeding years. The relevant industry body, Avcare, has agreed to make available specialist assistance during the collection period. Release of the OCP management has been held over until funding for the collection is in place.

Chemclear

When presented with the OCP management plan and the proposal for a nationally coordinated collection storage and destruction scheme, the ministerial council asked that a complementary scheme be developed for on-going management of unwanted, unused chemicals in the years following the nationally coordinated collection. Negotiations with the suppliers and manufacturers - represented by Avcare and the Veterinary Manufacturers and Distributors of Australia - and with users - represented by the National Farmers Federation - explored options for funding of the scheme. There was emphasis on the threats to Australia’s trade in primary produce, which might result from contamination with improperly stored pesticides.

It was noted that changes already taking place in the supply and use of pesticides would result in lower volumes of unwanted, unused rural chemicals in the future. These changes included the use of returnable refillable containers (such as Envirodrums) on the one hand, and soluble packaging on the other, as well as better advice to users and availability of a better range of package sizes. These initiatives were to be seen as part of a waste reduction strategy being pursued under the aegis of an Industry Waste reduction Agreement entered into with the Commonwealth government. An important component of this, a recycling program for rinsed containers - called DrumMuster - was coming into operation. Steel containers will be crushed and re-melted, while plastic ones will be shredded and used for energy recovery, pending better recycling options. Funding for the scheme is provided by a levy of 4c/L (or kg) on the selling price of the product.

It was agreed, however, that the most effective way to avoid the build-up of unwanted, unused chemicals was for them to be returned by the holders for destruction, at no direct charge. Industry will commence the scheme - known as ChemClear - with the cooperation of the National Farmers Federation, in any region where the nationally coordinated collection has taken place, thus setting a baseline for future chemicals management. It is not known at this stage whether suppliers will accept returned chemicals or whether separate depots will be established. The extra cost to purchasers, which will enable suppliers and manufacturers to operate the ChemClear scheme, is estimated to be 1c/L (or kg) on the selling price of products. Improved management by the industry, as described above, will help to minimise the volumes of returned chemicals.

The ChemClear scheme has its analogue in the suburbs of Melbourne (population approximately 3 million), where household chemicals may be returned to municipal centres on selected Saturdays. The cost of professional staff and of destruction of the materials so collected is met by a levy on landfilling of certain classes of waste, while the major chemical industry body, the Plastics and Chemicals Industry Association, provides ancillary staff at collection points.

Technologies

As explained in the accompanying account of Australia’s management of its PCBs, the political and industrial environment has been such that several technologies are operating and are capable of destroying OCPs, although most work to date has been done with PCBs and CFCs.

Plasma arc technology (Plascon) developed in Australia is used to destroy PCBs, CFCs and also other organochlorines, at three separate locations in the states of Victoria and Queensland. The BCD (base catalysed dechlorination) process is applied in Queensland and will soon be employed for treatment of desorbed material from soil at the Sydney Olympics site. A smaller operation, also based in Queensland, employs alkali-metal reduction to remove PCBs from contaminated paraffin in electrical equipment. Finally, in Western Australia, the ELI-Ecologic plant utilises gaseous hydrogen to destroy organochlorines and a considerable quantity of DDT has been destroyed in this way. The plasma arc technology does not permit recombination of atoms to molecules larger than carbon monoxide, water, and hydrogen chloride, and thus dioxins and furans are not formed. The chemical processes are reductive in nature, and possess similar virtues where dioxins and furans are concerned.

Contacts

Inquiries concerning Australia's management of OCPs should be directed to the Commonwealth government department, Environment Australia. Details are given in the 'Solutions' newsletter, a copy of which is provided, which is prepared for distribution to approximately 3000 Australians who have expressed interest in the Scheduled Wastes process. The newsletter also contains a list of available documents deriving from Australia's Scheduled Wastes process, which are available from the website at www.environment.gov.au/epg/swm.html

24. Preparation of National and Regional Action Plans for the environmentally sound management of PCBs and PCB containing equipment

by Mr. V. Jugault

Goal

To create the legal, institutional and technical conditions for the development and implementation of plans for the ESM of PCBs and PCB containing equipments

Aims

CTo train Governmental officials and owners of PCB containing transformers/capacitors on the e.s.m techniques for PCBs;

CTo collect/develop the elements necessary for the implementation of national action plans on the e.s.m of PCBs and PCB containing transformers/capacitors;

CTo coordinate/integrate national policies on the e.s.m of PCBs and PCB containing transformers/capacitors at the (sub) regional level.

Environmental and technical guiding principles

C progressive phase out of PCBs;

C improve operating conditions of equipment until end of life;

C prevent further release of PCBs into the environment;

C prevent further imports of PCBs in Contracting Parties in developing areas.

Expected outputs

- C Inventories of PCBs (stocks, equipments);
- C Registered stocks of PCB and discarded PCB containing transformers&capacitors stored under sound conditions;
- C Draft regulations (or other legal texts) and harmonization at (sub)regional level;
- C Up-graded storage infrastructure and set up of national control systems;
- C Improved operating conditions of electrical equipment;
- C Trained governmental officers, inspectors and owners on the various aspects of the e.s.m of PCB and the maintenance of equipments;
- C Decision-supportive tools developed with duplicating effects in other countries;
- C National Plans;
- C Sub-regional plan;

National Programme

A. National Workshop for the preparation of the national plan for the environmentally sound management of PCB and PCB containing equipments:

- **National Committee (administrations, professional associations, NGOs,)**
- **Review of the regulatory, organizational and technical aspects of the project**

B. National inventory;

- **Training programme aimed at governmental (and other) inspectors in view of field and desk activities;**
- **Sensibilization programme (owners, industry & associations);**
- **Use of existing decision-supportive and management tools (database, manuals, etc);**
- **Field activities;**
- **Compilation and analysis of results (technical information on equipments, stockpiles, contaminated sites, etc.)**

C. National Strategy;

- **Policy Paper;**
- **Reasonable objectives and targets (maintenance, storage, decommissioning, decontamination of equipments; destruction of stocks of PCBS;**
- **Agenda; Technical Plan, National Control System, draft Regulation;**

D. Technical Plan

D.1 Maintenance & Training Programme;

- **On site training;**
- **Maintenance / Code of Practice;**

D.2 Sound storage of PCB and PCB containing wastes;

- **Front line action/short term;**
- **on-site and/or collective storage facilities;**
- **Legal convention;**

D.3 Phase out of PCBs;

- **Technical and financial plans**
- **Integration at (sub)regional level**

E. National Control System / Legal Framework

- **National/regional network of accredited laboratory facilities;**
- **Monitoring and control systems for stocks of PCB containing equipment and PCB wastes;**
- **Set-up of a national/regional codification/labelling system;**
- **Enforcement of the PIC Convention and Basel Convention regulatory regimes;**
- **Awareness raising activities (owners from the private & public sectors);**

C Draft regulations.

Issues of interest

- **Implementation of Regional Plans in OECD countries;**
  - **European Commission;**
  - **Commission for Environmental Cooperation (CAN/MEX/USA)**
  - **others**

- **Review of (new) technologies for the destruction of PCBs and the decontamination of equipments;**
  - **Environmental standards;**
  - **Economic and technical assessments;**
  - **On site/mobile/off shore;**

- **Unsound practices related to PCBs;**
  - **uncontrolled release;**
  - **'illegal' imports;**
  - etc.

Some results from the Pilot Activity in Côte d'Ivoire

Testing over 30 transformers in an urban agglomeration:

- **Transformers: 1/3 mineral oil/dry # 2/3 PCB containing;**
- **Imports of PCB containing transformers stopped after 1984;**
- **Majority of PCB transformers prior to 1984;**
- **Majority of private-owned versus state-own;**
- **Rate of use of electric power < nominal power;**
- **All non-protected sites are contaminated;**
- **Lack of security measures:**
  - **Labelling, ventilation, retention tanks, etc**
  - **Mix- mineral/PCB transformers;**
- **Lab tests show concentration levels:**
  - **50-200 ppm (50%)**
  - **2000-2500 (25%)**
  - **> (25%)**
- **Need and interest for centralized storage platforms;**
- **Interest for training/maintenance programmes;**

Tools available for the environmentally sound management of PCBs

- **Technical Guidelines for the E.S.M of PCBs, PCTs and PBBs (SBC)**

- **PCB Hand Book (SBC/private company)**

- **Database for the Inventory of Transformers (SBC-Côte d'lvoire) (http://nt1.kister.ch/transfo/)**

- **Regulations (Compendium, draft EC59/96 # Côte d'lvoire)**

- **Identification methods for PCBs (UNEP-Chemicals)**

- **Inventory of PCB Destruction Facilities (UNEP-Chemicals)**

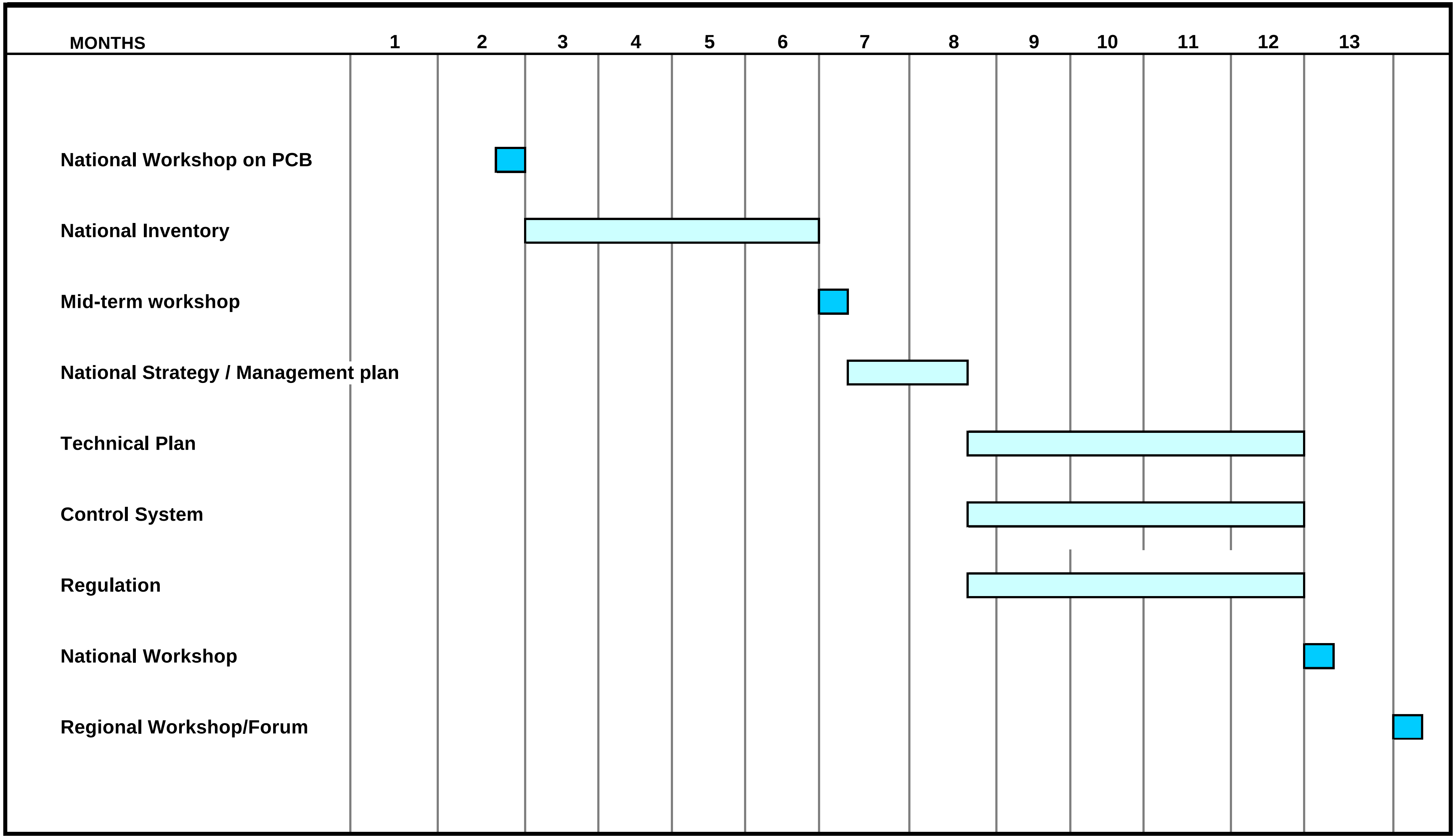
- **[Decision supportive tool for the environmentally sound management of PCB containing equipments at the local/national level] [SBC-]**

- **[Estimation models] [SBC-]**

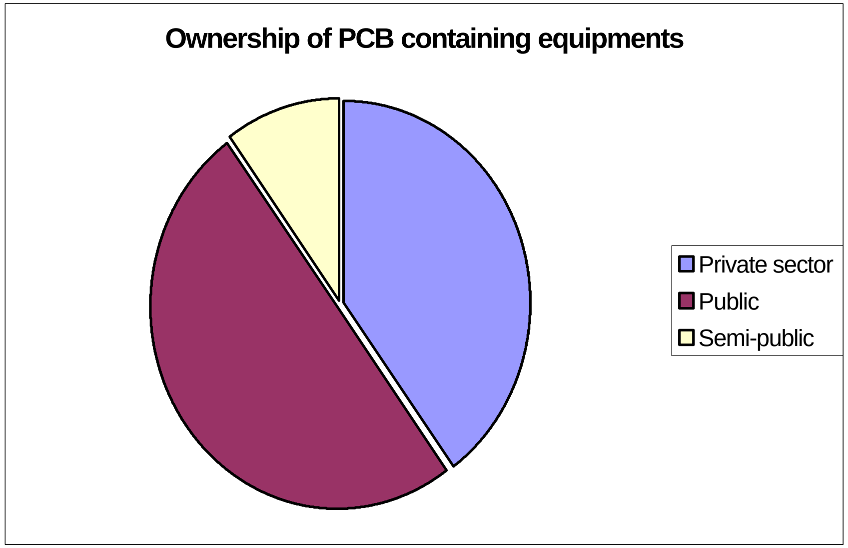
- **[Guidance Manual on the preparation and implementation of national PCB management plans in the context of the implementation of the Basel Convention] [SBC-]**

TIMETABLE FOR THE IMPLEMENTATION OF PROJECT ACTIVITIES

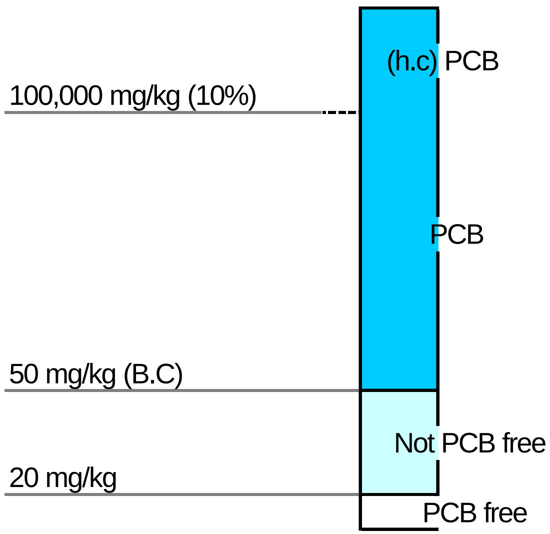
Small size country / 1000 equipments



RESULTS OF INVENTORY



Total Quantity



Technical Options

	<8y	800	100	2500
-	<10 y	1000	160	2300
-	<12y	1300	200	250
	<14y	1500	250	400
	<16y	2200	315	1200
-	<18y	2320	400	1800
-	<20y	**1800**	500	2000
-	<22y	2400	630	1900
	<24y	**2000**	800	2300
	<26y	1800	1000	2100
	>26y	1000	1250	2200
			1600	500
-			2000	300
-				
-				
-				

29. POPs: Current Situation in Nepal

by Mr. P.P. Manandhar and Mr. B.R. Palikhe

ABSTRACT

Agriculture occupies a dominant role in Nepal, 90 percent of population and 42 percent of GDP are tied up with agriculture. In Nepal Pesticides are commonly used to control various economic pests and diseases. Overuse, misuse and abuse of pesticides were often seen and heard of. Hazardous chemicals have the potential to seriously endanger life and pollute the environment. Such chemicals specially Persistent Organic Pollutants (POPs) and Prior Informed Consent (PIC) listed pesticides have to be banned from the country or carefully managed at all times to prevent any accidental release. Integrated Pest Management (IPM) has been declared as national pest control strategy in the country's Agriculture Perspective Plan (APP). There has been wide acceptance of bio-pesticides globally. It is the only eco-safe alternative. Regulatory and legislative provisions have been made through the implementation of Pesticide Act & the Regulation in the year 1991 & 1993 respectively.

Getting into the topics :

Nepal's Agriculture sector is the largest contributor engaging 90 percent of its total population. The share of agriculture in the national GDP is 42%. Agricultural production in the country has not been rising as expected in spite of increased pesticide use. Almost all crops grown on earth are being cultivated in the country. Introduction of high yielding exotic crop plants during the last three decades have threatened the farmers in the country for pest colonization. The crop losses due to pest is approximately 55% out of which 35% loss is caused by insects alone (Cramer 1967). One of the reason of pest out break in the country has been misuse and overuse of insecticides. Indiscriminate use of chemical pesticides has resulted in development of alarming resistance in pests to pesticides. It must not be forgotten that the pest problem is an outcome of nature's reaction against disturbances to natural ecosystem by the human beings, otherwise in nature nothing is pest.

More persistent pesticides are insecticides. The twelve substances & groups of substances listed in the UNEP decision are; aldrin, dieldrin, endrin, chlordane, heptachlor, DDT, mirex, toxaphene, hexachlorbenzene (HCB), which are all pesticides, Polychlorinated biphenyls (PCB), which is industrial chemical & polychlorinated dioxins & furans (PCDD/F) which are by products of various industrial & other processes. These 12 POPs are internationally recognized as needing immediate global action. Besides chemicals covered under PIC list are 27 (Pesticides : 22 & Industrial: 5) which have been banned or severally restricted. Many of these chemicals are persistent organic pollutants (POPs), highly toxic chemicals that persist in the environment for long periods of time, accumulate in wild life and people & are mobile in the environment, possibly travelling thousands of kilometres from where they were released. As we know Asia is the greatest consumer of pesticides in the world and over 90 countries in the world have banned DIRTY DOZEN pesticides. Dirty Dozen includes;

Aldicarb	Comphechlor	Chlordane
Heptachlor	Chloridimeform	DBCP
DDT	The Drins (Aldrin, dieldrin, endrin)	EDB
HCH/BHC	Lindane	Paraquat
Parathion	Methyl parathion	Pentachlorophenol (PPC)

2, 4, 5-T

The Regional Workshop on Management of Persistent Organic Pollution (POPs) will help to solve these pressing human health and environmental problems by reducing the use of these chemicals to where they are absolutely increasing & can be used safely.

IPM could be a novel approach for empowering farmers with knowledge. Commodity exporting countries that are / would be WTO member have to adhere to WTO/codes rule. This needs effective quality control. Crops untreated will pesticides have very high market demand in Japan.

Utilization of pesticides in Nepal:

Chemical pesticides were introduced in Nepal in 1950s for malaria irradication and agricultural purpose. At that time, the general awareness on environmental issues was so minimal and people were not told adequately about the hazardous aspect of the pesticides. People just saw their miraculous effect on malaria and the pests. However, the long term effect on human health and the environment was invisible. People started to call the pesticides as medicine. The government also encouraged the use of pesticides, especially for agricultural purpose. Different types of pesticides were imported through the government owned Agricultural Input Corporation (AIC). Among that, a significant amount of obsolete pesticides is stored in several warehouses in different parts of the country.

The pesticides issue was highlighted during early 1990s and the government initiated some steps to assure controlled and rational use of the pesticides. AIC has stopped importation and distribution of pesticides. Despite of all the legal and administrative provisions the trade and use of pesticides have not been regulated. It is realized that the mass awareness can be an effective tool to combat the problem of uncontrolled availability and haphazard use of the pesticides.

In Nepal pesticides are commonly used to control various economic pests and diseases. The agro-pesticides uses are ograno-chlorines, organsphosphates, carbamates, synthetic parathroids, fungicides and herbicides. Pesticides are also used for ectoparasites control on animals. As our country is not industrialized yet and modern agricultural practices are limited, quantity & type of toxic chemicals used and hazardous wastes generated are limited too. Organochlorine pesticides are not widely used in the country. However, locally banned ones are being smuggled into the country. The consumption of pesticides (commercial formulations) per unit area is estimated to be 142 gm/ha (IUCN 1995). This is supposed to be very low quantity of pesticides compared to many of its neighbours (750 mg/ha). 40 to 50% of the total pesticide use is in rice, 14 to 20% in pulses 13 to 15% in fibre crops & 10 to 20% in vegetables & fruits. (Table 1) The consumption of leading pesticides is in the order of Insecticides > Fungicides > Herbicides > Rodenticides > others.

In commercial production areas plant protection services are provided by the pesticide distributors as well. In the process of increasing production and productivity, cropping intensity & external inputs use have been increased. In such cases overuse, misuse & abuse of pesticides were often seen and heard of. It has resulted into environmental pollution and hazards to human health, although many people are not aware of it. A large problem regarding pesticides in Nepal is adulteration. This leads to inadequate pest control. Farmers prefer to purchase highly toxic & cheap pesticides.

Most pesticides used in Nepal are imported from India, some from China on the basis of a registration certificate. Nepal Pesticide and Chemical Pvt. running since 1977 with the capacity of formulating 700 MT of dust preparations (primarily malathion) and about 500 litres of emulsifiable concentrates (methyl parathion). It imports raw material from India. Two parties have applied to establish formulation. Plants for agro-chemicals under the Nepal Krishi Rasayan Product with a capacity of 162 MT & Pashupati Agrochem Nepal Pvt. Ltd. with a capacity of 197

MT. According to the latest estimate of Pesticide Registration Office (PRO), Plant Protection Division (PPD), Dept. of Agriculture, pesticides in quantity equivalent of 55 MT of a.i. formulations are consumed annually (PRO, PPD, 1998). (Table 2)

It has been found that 59% of farmers used pesticides after the outbreak of insect pests, 21% of farmers just after the crop harvest and 39% of farmers practiced preventive & safety measures (IUCN 1995). (Table 3) The source of diffusion and dissemination of technical know how in regard to use of pesticides through retailers, neighbours, technicians and others is estimated to be 34%, 19%, 13% & 34% respectively. (Table 4) About 52% of farmers does not have the knowledge / information against potentially harmful impacts from pesticides. 38% of farmers disposed the surplus and unused pesticides by burying and burning, 25% of farmers disposed in open place, 18% farmers handed and distributed to neighbours / friends and 19% by other disposal methods. (Table 5)

The status of POPs in Nepal :

Significant proportions of the population are illiterate. Chemicals are often misholded and poorly labelled. There is generally a poor awareness of toxic risks of chemicals among the public.

In order to collect information on POPs pesticides from the resellers, importers and users, we have developed questionnaires about POPs. The questionnaires have been distributed door to door to concerned personnel. Going through their feedback and response it shows & reveals the total lack of public awareness on POPs. It indicates and proves that this is high time to call public awareness into being.

The government of Nepal in the last 40 years has periodically received sizeable donations of pesticides from international sources as a measure to increase food production and combat insect vectored human diseases. For various reasons, large tonnage of these pesticide acquisitions were not used in a timely manner and have since accumulated in government warehouse scattered throughout the country.

In 1990, the ADB provided a Technical Assistance (TA) to the Department of Agriculture, Ministry of Agriculture to improve regulation, management & disposal of pesticides in Nepal. Under the TA by Feb. 1993, 114 MT of surplus pesticides material had been disposed by burying, spreading over land, or reformulation. The balance of about 51 MT of obsolete pesticides are stored at Agriculture Inputs Corporation (AIC), which in words of Dahal (1995) sits like a **chemical time bombs**.

The amount of obsolete organochlorine pesticide now stored is about 35 m.tons. Most of which are no longer in the market & are banned in the country. But the amount of POPs listed pesticides is about 8 MT (Table 6). However, the safe disposal of stockpiles is a significant problem, but it can be said that the amount of stocks are not too much. Organochlorine insecticides can be disposed by incineration and microbial degradation. But there does not exist any facility & technology in this regard. So if seems that keeping them in storage is the best solution at present.

There is one thing to be kept in mind that there is danger of toxic by products such as dioxins and furans forming if temperature drop below 1100^0 C in the burning zone. Dioxins & furans are highly toxic to human & are persistent in the environment (FAO 1996). Pesticide Management Specialists of TA 3008 Nepal, IRAS reported about 7.4 MT organomercury fungicides. They were used as seed treatments. Organomercury fungicides cannot, for environmental reasons, be disposed of in Nepal and either should be placed in secured storage or exported to a country that can recycle or be otherwise disposed. Under TA 3008-NEP, IRAS, it is anticipated that 8 MT of non persistent pesticides of AIC will be repacked for safe/convenient transport to disposal site.

TA 3008 is funded by the Asian Development Bank (ADB) & has specific linkages to the Second Agriculture Program Loan. Under the TA, there is a plan for repackaging operations of POPs pesticides in sound management manner. The experts of TA would provide practical training to Department of Agriculture & AIC staffs to try & empower to manage this local issues with local resources for repackaging operations.

The use of banned or restricted chemicals would not be prevented effectively because of illegal trans boundary movement of pesticides. Smuggling is one of the source of PIC & POPs chemicals in Nepal.

Survey at retail level, revealed that some of the retailers don't fulfil some of the criteria. The academic qualification of the retailers is so meager that they can not advocate & educate the farmers.

Management and control of POPs chemicals :

To promote environmentally sound management of chemicals, Nepal has got a pesticide registration scheme. Th Pesticide Act 1991 & the Pesticide Rule 1993 cover measures to regulate import, manufacture, sale, storage, transport, distribution and use of pesticides. It is mandatory that any pesticide before distribution and importation should be first registered through the registration procedure adopted by the Pesticide Board. The registration at present restricts the trade of highly hazardous pesticides (WHO classes IA & IB). Pesticides belonging to WHO class IA and organochlorine pesticides (Endrin, DDT Dust, Chlordane Dust, Lindane, Aldrin, Heptachlor, dieldrin, toxaphene) are banned due to acute toxicity environmental persistence & bio-accumulation in Nepal. All pesticides on the Prior Informed Consent (PIC) list except methyl-parathion, monocrotophos & phosphamidon have been banned or not registered.

There are 125 licensed resellers and 123 pesticides products registered already but none of them are being manufactured in the country. They are mostly organo phosphates, carbamates, synthetic pyrethroids, fungicides, herbicides, rodenticides and bio-agents.

United Nations Convention on Environment (UNCED) Agenda 21 emphasis IPM as the best tool for 21st century plant protection services. Realizing its potentiality, HMG/Nepal is trying to create public mass awareness and implementing effective IPM program through IPM Farmer Field School (FFS) for proper, sound & judicious management of pesticides & control of hazardous chemicals. Most of end users are often poor or ignorant about the ill effects of pesticides, they do expose themselves and the environment. If misused, pesticides can pose grave hazardous problems. So they must be managed in a sound manner, so as to protect human health & the integrity of the environment. This cause upon to develop policies for sound management of chemicals and to establish & implement chemical safety programmes at national, regional and local levels. This calls for policy direction at the highest level in government.

IPM enables farmers understand local agro-ecosystem & devise IPM techniques accordingly. They are the one to be made IPM expert. The concept that IPM is by farmers & not of the farmers be made clear to all concerned people. IPM is considered as national strategy in Nepal. It is concern of every country policies to select safer pesticides and start elimination of highly toxic chemical insecticides from the country, without which national thrust on IPM concept will be difficult to materialize.

His Majesty's Government has appointed the Pesticide Inspector, being appointed pursuant to Section 13 of the Pesticide Act, with the identity cards for their identification. Pesticide Inspectors are responsible for training, educating resellers & users in pesticide safety. An Inspector shall also have the power to seize any pesticide imported or being sold contrary to the Act & Rules.

Pesticide Association of Nepal (PAON) was established in 1997 as an association of Pesticide traders in Nepal. It integrates firms, companies & individuals involved in importation, distribution and marketing of pesticides. One person of this association is represented in the Pesticide Board. The PAON look after the safe and effective use of pesticides and other potentially toxic chemicals.

Nepal Forum of Environmental Journalists & Pesticide Watch Group is also creating public awareness on POPs chemicals through electronic media, publication, workshop, seminars & public gatherings.

Being 1500 Km long porous & open border with India, there are varieties of problems. Illegal entry of pesticides & banned pesticides over Nepal's border are smuggled into local markets. It is difficult for the proper implementation of pesticide regulation in the country. POPs pesticides specially DDT dust and other organochlorine compounds are being openly sold. Pesticide exporting countries are obligated under the provision of the Basel convention to notify recipient countries of shipments of banned chemicals.

PIC & POPs listed chemicals are extremely supposed to be a threat to the public health and environment of all countries & the globe as a whole. Our general mass people are poor and illiterate. They are not aware of harmful effect of POPs chemicals upon health and environment. The strict implementation of the legally Binding Instrument for PIC (Rotterdam Convention) will eliminate such illegal use. Effective measures should be found to prevent. Smuggling of chemicals & toxic chemicals should be banned. This would support the free trade concept promoted by WTO.

Measures to Minimise POPs pesticides:

1. Strict regulation to control POPs through monitoring and enforcement of Pesticide Act & the Pesticide Regulation,
2. Education and Training (the farmers, dealers & users have to be trained about toxic chemical)
3. Licensing control
4. Following PIC voluntary procedure
5. Finding of alternatives to PIC & POPs chemicals.
6. Public awareness campaigns & programmes on POPs
7. Technology transfer (Clean technology)
8. Developing effective technical guidelines
9. Information dissemination through seminars, workshops & talk progarmmes
10. Making import decisions and response
11. Providing export notifications
12. IPM declared as a 'National Pest Control Strategy'.
13. IPM activity initiated in 3 districts during FY 1994/95, expanded now to 25 districts
14. Pest surveillance programme more scientific / organized
15. "IPM in Rice" with technical assistance of FAO.
16. DOA promoting IPM tools like Pheromone traps, Light traps, Biological agents, Herbal plants etc.
17. Peoples reaction / response toward IPM - very positive

Nepal's Participation in Workshop on POPs:

Nepal has been participating in various United Nations Environment Programme (UNEP) & Inter governmental Forum on Chemical Safety (IFCS) activities. Nepal attended Sub-Regional Awareness Raising workshop on Persistent Organic Pollutants (POPs) in Bangkok, Thailand, 25-28 November 1997.

Nepal Bureau of Standards and Meteorology (NBSM) is acting as National Focal Point for IFCS as appointed by HMG/Nepal. NBSM already received support & fund from UNEP. This support & fund (US$ 3000) is being utilized for POPs Profile Information Reporting Package. This Reporting Package is in its final stage & will be submitted to UNEP in the near future.

Constraints to promotion of safe use of pesticides:

Pesticide promotion is a very sensitive issue in the present context, especially in view of health hazard and environment pollution. It needs to be examined from different angles like quality, target group and regulation. To handle these issues, Nepal is facing lots of constraints as given below:

- open boarder with neighbouring countries invites chances of entry of unregistered products into the country.
- no well equipped laboratory facilities for quality and residue analysis
- illiterate and ignorant target groups (farmer / user)
- lack of skilled manpower for effective implementation of the Act and Regulations
- unawareness among farmers regarding safe use of pesticides (farmers have no idea of pesticide poisoning, first aid, waiting period and protective measure etc.)
- monitoring and follow ups of pesticides resellers and dealers, particularly post-registration is not very effective due to priorities of Pesticide Inspectors in other programmes.

Nepal's proposal for future action:

As mentioned earlier, Nepal imports about 98% of the pesticides from foreign countries. It has only few formulated products (methyl parathion & malathion). In this situation, the country needs to have good information about list of registered pesticides from the member countries of RENPAP & UNEP, PIC Secretariat. Moreover, Nepal seeks assistance in the following aspects:

- Information exchange on safe and eco-friendly pesticides.
- Access to pesticide, residual analysis facilities. Information on the safety measures for production / formulation plants need to be exchanged.
- Information exchange on disposal of unused pesticides
- Nepal could offer to member countries study sites for collaborative research in areas related to safe chemicals as well as bio-pesticides
- Manpower development in the field of pesticide quality and residue analysis.

In addition to this, Nepal proposes to coordinate in the area related to raising awareness on safe use of pesticides at farm level. We propose this as a new technical programme component. It also seeks actions in near future to establish a Pesticide Laboratory.

Another technical programme, we propose to take up utilizing the available trained manpower, is the exploration of indigenous strains of bio-agents, specially, *Bacillus thruniugieusis* for pest management.

Issues and Suggestions :

1. Risk Reduction of Pesticides

i) Farmer's education in proper use of pesticides

- On-site training and education for farmers and inspection for pesticides residues.
- Mass media (T. V. Radio) effective to educate farmers on pesticide risks.
- Label in local (national) language.
- Pressures to be exerted on private companies to provide training in the proper use of pesticides.

ii) Reduced use of highly toxic pesticides

- Government should start to phase out the production import and use of highly toxic pesticides.
- Banning highly toxic pesticides help find overseas markets for agricultural exports.

iii) Development and use of Bio-Pesticide

- To reduce environmental damage and risks to consumers/users.
- To reduce the cost of application and pesticides.

iv) Development of new safer formulation

- Chemical companies be encouraged to develop new, safer formulations
- Replace WP (dangerous to farmers) and EC (dangerous to environment) with EW (emulsion oil in water), Capsules, WDG (water dispersible granules), SC (suspension concentrates) etc.

v) Implementation of IPM systems

- IPM for the crop which consume heavy pesticides
- Awareness to be improved on IPM tools and methods
- National extension systems to be reviewed in terms of capacity to support IPM. Extension strategies for IPM are farmer centred environment friendly.

1. Harmonization of technical standards

i) Pesticides analytical methods

- Countries need to share their procedures
- FFTC need to hold a training course on:
  - Pesticides analytical methods
  - Pesticide residues analysis methods

ii) Pesticides specifications for quality control

- Countries manufacturing pesticides follow FAO/CIPAC specifications and guidelines for quality control, transport, trade, storage

Database Development and Sharing

1. Regional database on
   - Registration data
   - pest resistance data

- Country-wise list of banned pesticides
- Improved data on production potentials, actual crop losses from pest

Regional Cooperation

- Improvement of laboratory procedure
- Local and regional analysis of samples
- Sharing information
- Development of skills through regional training programmes

Production and use of bio-pesticides

- Focus on indigenous resources
- Care needed with introduced bio-agents
- Share information on bio-pesticides by organizing workshops, seminars

Conclusion:

Like many developing countries, pesticides hazards on human health, persistence of toxic residues of pesticides in living organisms, impact of pesticides in living organisms, impact of pesticides on non target organisms, pest resistance due to pesticide use and other ill effects of pesticides have not been studied and monitored in Nepal. The government realizes that pesticide use creates problems to health and environment. Misuse or negligence on the direction for use, especially the pre-harvest interval can create residue problems. Modern farming system is also characterized by high agricultural inputs, which are detrimental to human health and natural resources. Concerted efforts must be made to find viable alternative pest control methods, & if pesticides are used, thy are judiciously applied to minimize its unwanted effect in the long run. IPM concept is finding and increasing eco-friendly means of dealing with pests. Pesticide Act & the Pesticide Rule enforced by the HMG/Nepal, was enacted to minimize the risk posed by pesticides.

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DISTRIBUTION AND MARKETING OF PESTICIDES

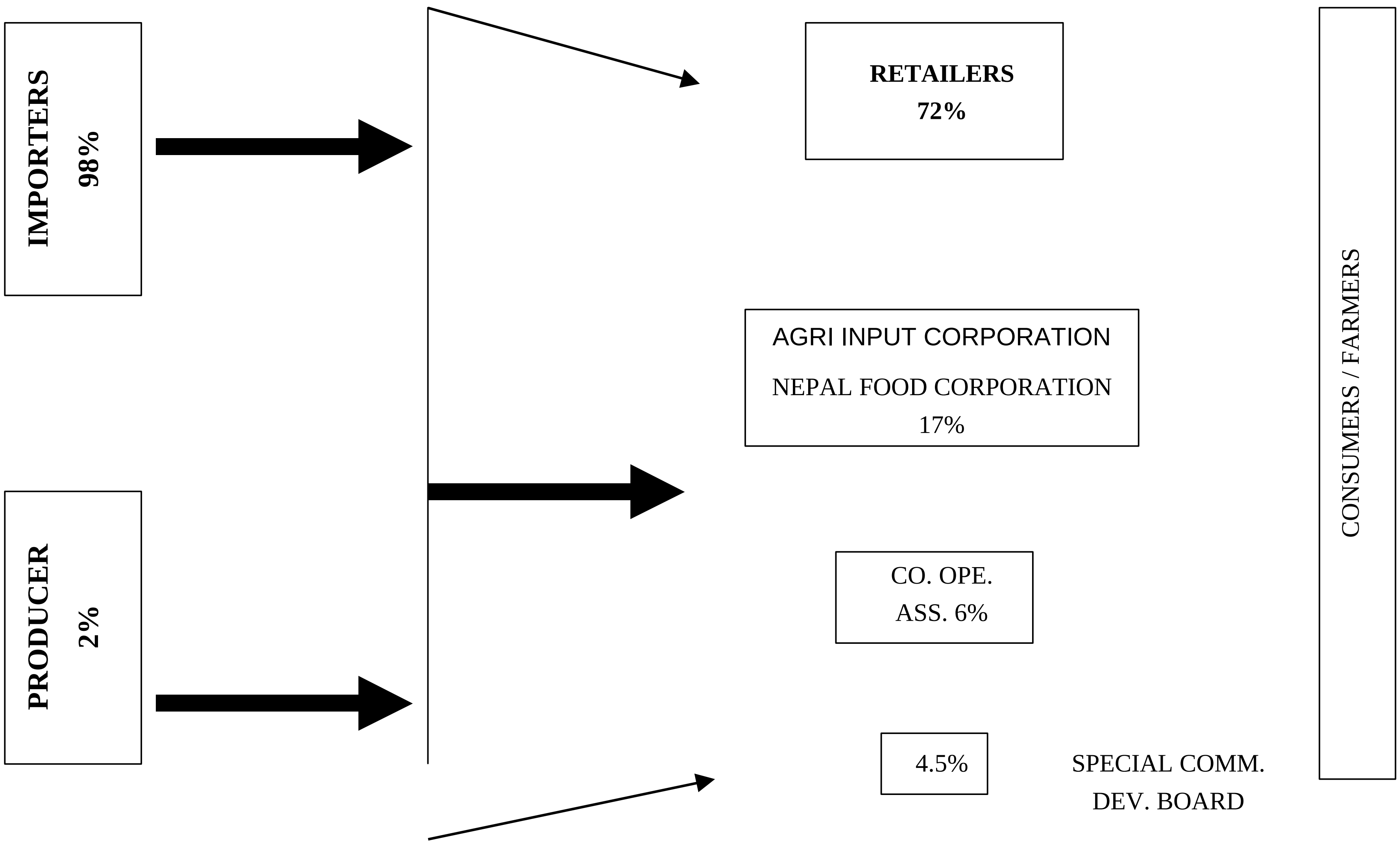


Table 2

Pesticides Consumption

Item	Quantity of Active Ingredient (Kg./Lt.) 1997
1. INSECTICIDES	
1.1 Chlorinated hydrocardons	3992.5
1.2 Organo-phospates	16247.78
1.3 Carbamates-insecticides	237.0
1.4 Others : Aluminium phosphide Dicofol Cartap	 377.44 3.7 4.5
TOTAL INSECTICIDES	33355.82
2. HERBICIDES	
2.1 Phenoxy hormone products	16.0
2.1 Amides	6575.0
3.0 Others : Glyphosate C. Oxyfluorfen	 155.8 1.15
TOTAL HERBICIDES	6747.95
3. FUNGICIDES, BACTERICIDES and SEED TREATMENTS	
3.1 Inorganics	869.00
3.2 Dithiocarbamates	14058.00
3.3 Benzimidazoles	512.00
3.4 Others : Ediphenphos Captan Dinocap	 62.50 50.00 2.40
TOTAL FUNGICIDES, BACTERICIDES and SEED TREATMENTS	15576.65
4. PLANT GROWTH REGULATORS	
Phenoxy Harmones products NAA	- 1.00
5. RODENTICIDES	
Zinc phosphide	184.00
TOTAL RODENTICIDES	184.00

Note: Chlorinated Hydrocarbons: ENDOSULFAN

Table 6

Amount of POPs stored in the AIC's warehouse

as reported by TA 1073 & 3008-NEP, Institutional Reforms in the Agriculture Sector

S.No.	Kind of Pesticides	Unit	Amount	Remarks
1.	ENDRIN DUST	Litre	1200	
2.	ALDRIN DUST	MT	2	
3.	CHLORDANE DUST	MT	1.3	
4.	DDT DUST	MT	3.3	
Total			7.8	

Table 1

Pesticides Market : Usage by Crop

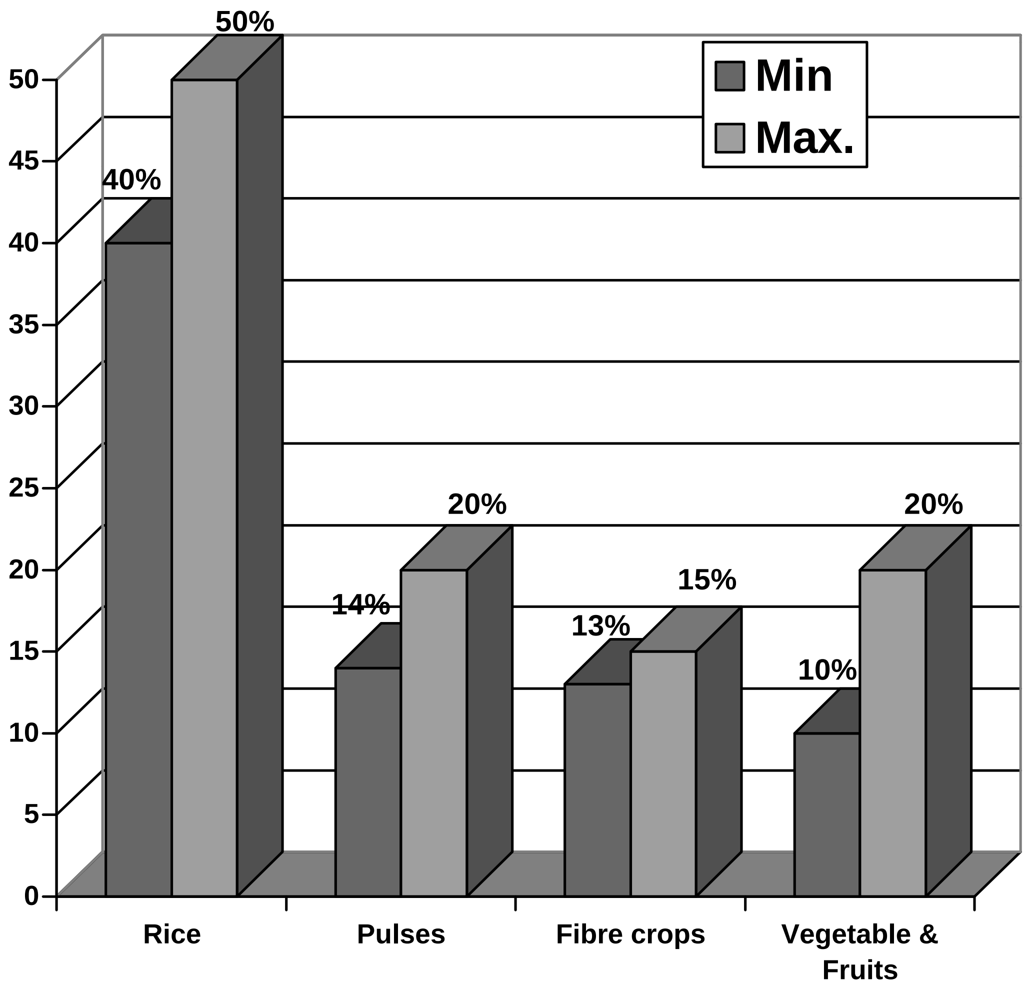


Table 3

Pesticide Use Pattern on Crop by farmers

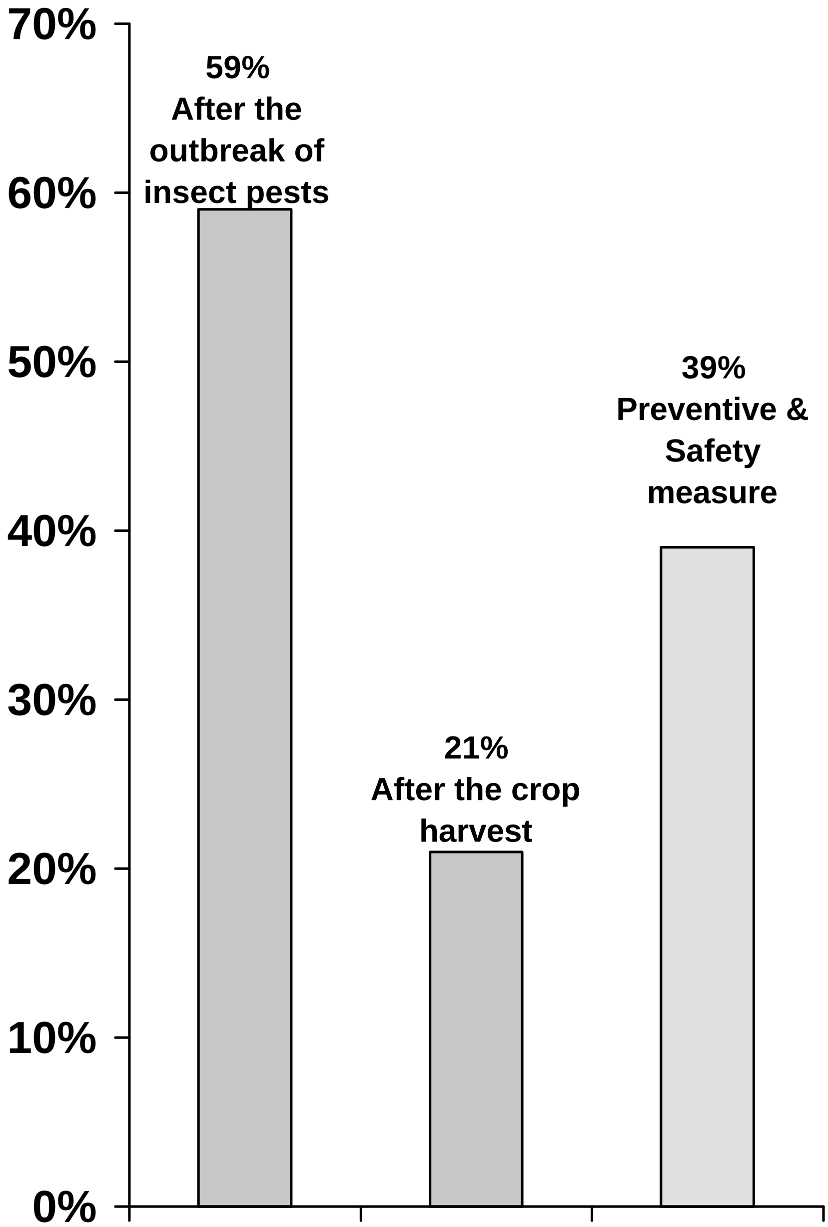


Table 4

<u>Sources of TOT</u>

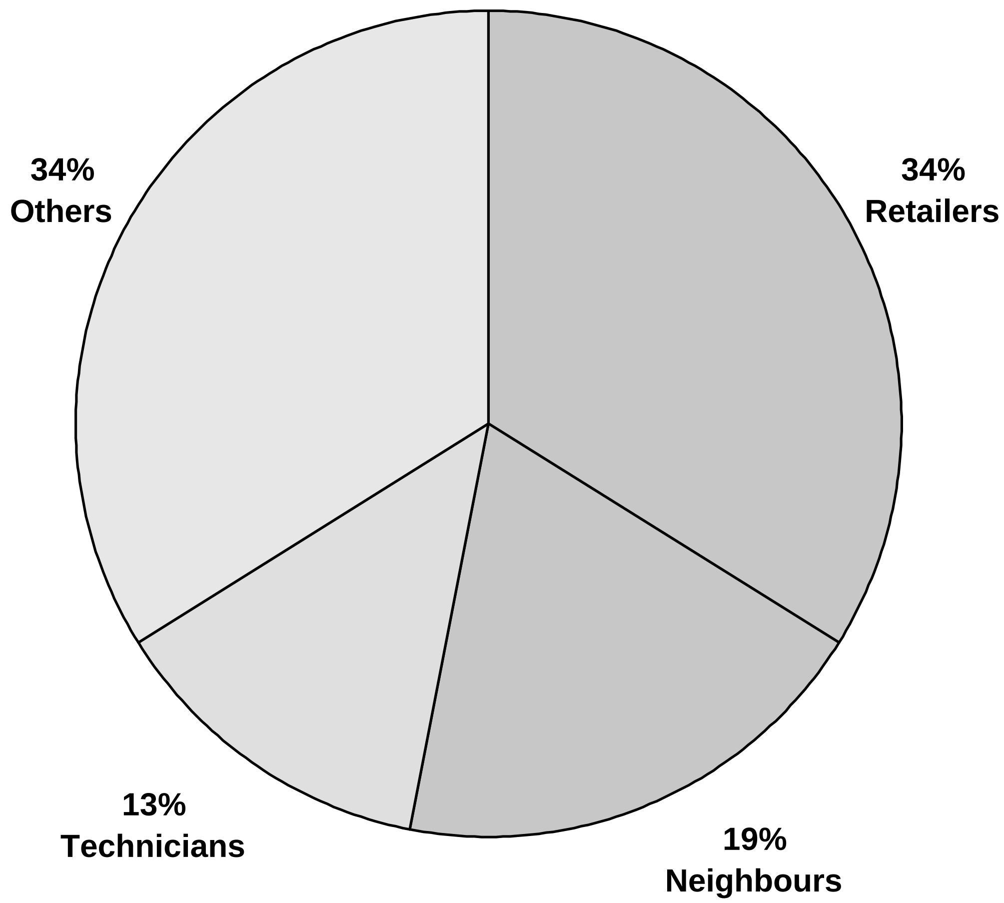
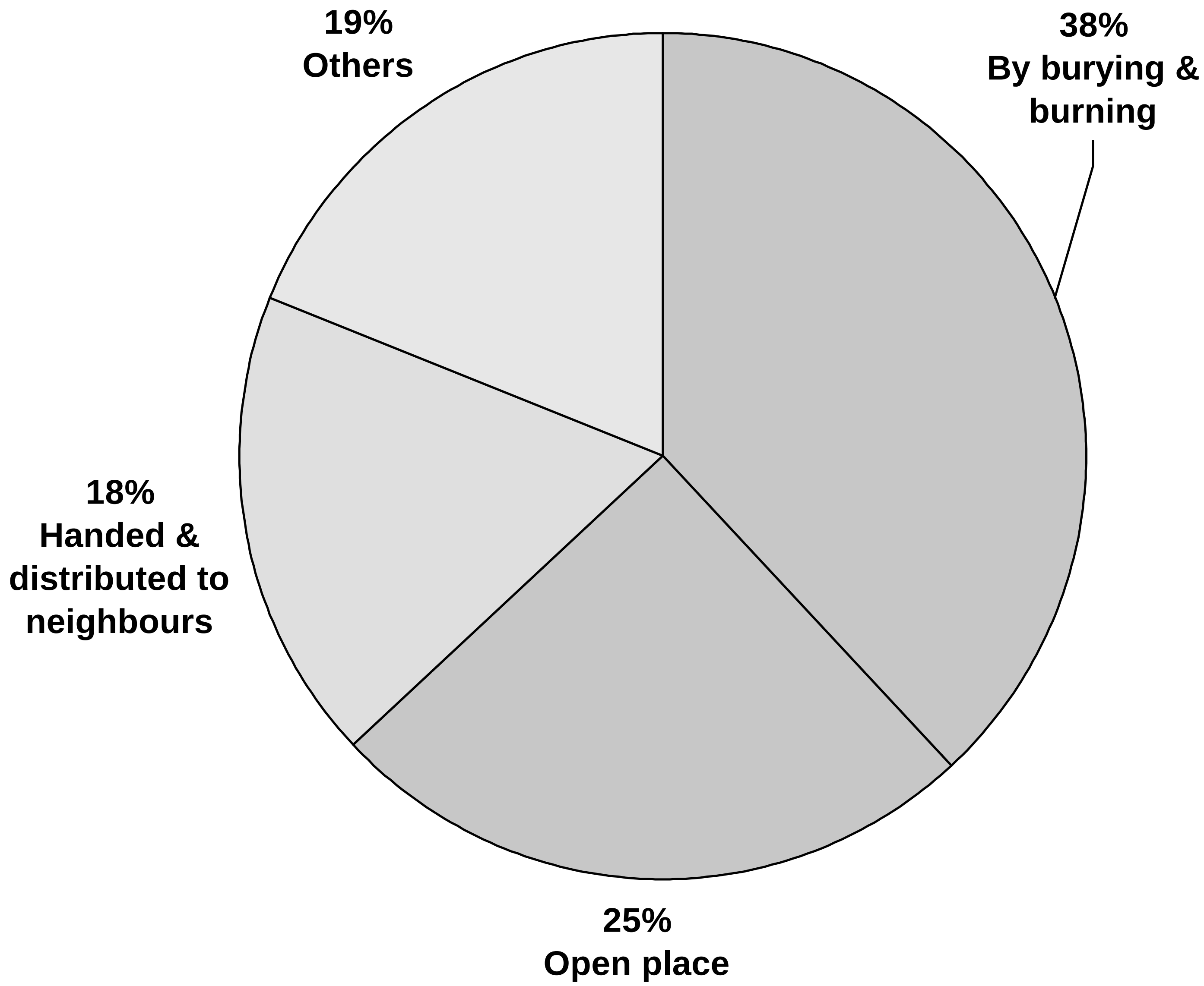


Table 5

Disposal of Surplus & Unused Pesticides



30. The Situation of Persistent Organic Pollutants (POPS) in the Republic of Maldives

by Mr. A. Majeed

GEOGRAPHY AND ISLAND ECOSYSTEM

The Republic of Maldives is a low-lying double chain of coral islands in the central Indian Ocean. These islands numbering 1190 stretch 80 to 120 kilometres wide in a length of approximately 860 kilometres, The fragile archipelago protected by coral reefs traverse the Equator from 7°6'N to 0°41S between 72° 32' and 73° 45'E longitude. The islands vary from 0.5 to 3 square kilometres totalling 298 square kilometres of land, while the exclusive economic zone is about 90,000 square kilometres.

The average elevation of the Republic is 1.25 metres above the mean high tide. There are 26 natural atolls grouped into 20 administrative atolls, with the capital island of Male' forming a separate administrative unit.

CLIMATE

The Maldives experiences a monsoonal climate. The dry, north-east, monsoon is from December to March. Hot days, cooler nights with slight seas are the common features of this monsoon. The wet, south-west, monsoon prevails from May to November. Gales and heavy rainfall occur during this monsoon. The seas become moderate to rough.

The mean daily maximum temperature reaches 30oC while the minimum is 26oC. The annual average rainfall for Male' is 1944 mm and the corresponding figure for Gan is 2454 mm.

POPULATION

The estimated population of Maldives is 263,189 and a little over a quarter of the population resides in the capital island Male'. Among the 1,190 islands of Maldives only 200 are inhabited. The overall population growth rate during the intercensual period 1990 -1995 was 2.8 percent.

Maldives has achieved an extremely high literacy rate of 98% for both sexes, through provision of primary and secondary education through the country. Significant strides have also been made in the social infrastructure, especially with respect to heath. Both infant and maternal mortality rates have decreased and life expectancy has increased.

ECONOMIC DEVELOPMENT

The Maldivian economy has grown at an average annual rate of nearly 10% since 1980. The per capita reached about US$ 770 in 1995. The Maldives has a typical small island economy limited by natural and human resources, an acute shortage of raw materials, heavy imports of most requirements and an ever increasing demand on government revenue to cater for the basic needs of an expanding population. The mainstay of the Maldives economy is presently derived from tourism and fisheries and their associated industries.

With this increased economic growth it is obvious that there will be increases in the possibility that persistent organic pollutants (POPs) will be of growing concern to the Maldives. This is why we place importance on meetings such as this one where information can be disseminated on the identification, monitoring and control of POPs.

POPs and Maldives

At present there is no industry manufacturing POPs in the Maldives. Thus their presence in the country would only be by direct importation of these chemicals, incidental imports if they are contained within other import products or by transboundary transfer through the atmosphere, marine waters or accidental introduction by, for example, accidental or deliberate dumping by ships. Another possible source of some POPs in the Maldives could be their production as by-products from combustion of solid and chemical waste materials.

Direct Importation of POPs

Certain POPs have been imported for various purposes. DDT, for example, was used in malaria control programmes. Some pesticides have been used in agriculture, limited to very basic tropical fruits. A programme is underway to license the import of all chemicals and identify them not only generically but also specifically. So far 52 chemicals have been approved for import. None of these is one of the presently designated 12 POPs of international concern, but some, for example carbofuran, might lead to breakdown products such as furans, which are of concern.

Indirect Importation of POPs

The industrial chemical POPs of concern (hexachlorobenzene and polychlorinated biphenyls) are not manufactured in the Maldives. Their presence would only arise from their being contained in other products. For polychlorinated biphenyls the main source would be in electrical transformers or other heat exchange systems. For hexachlorobenzene the main sources would be in imported products of the chemical and allied industries such as for fertilisers, chemicals used in the paint, dye and textile industry, and chemicals used in plastics products.

POPs as By-Products

Solid and chemical wastes that could contain precursors of the POPs dioxin and furans could be produced through combustion of wastes, mainly plastics, chemical resins and paper products. The main points of production in the country would be at designated waste disposal sites, the main ones being at Male and Thilafushi islands and may be in resort islands where high temperature incinerators are used.

With respect to this considerable effort is needed in the Maldives to create a greater awareness of the problems of producing POPs as by-products through waste disposal practices.

SUMMARY AND CONCLUSIONS

The Republic of the Maldives is pleased to have been invited to be represented here. While all of the goals of the meeting are relevant to us we are particularly interested in learning about "approaches for developing inventories of POPs", "information on the approaches used in selecting chemical and non-chemical alternative substances" as well as "studies on the health and environmental problems related to POPs."

Given the expansion of the Maldives economy, heavily based on tourism and fisheries, there will be increases in many other sectors. This will enhance the amount of industrial chemicals used in the country and increase in the production of wastes. With the present limitation of technical expertise related to POPs it is imperative that the Maldives has to enhance its capacity to control the introduction of the chemicals to the environment. In this regard, I call upon UNEP and other competent agencies as well as the international community to come to its rescue.

31. Actions taken to reduce/eliminate the releases of POPs in the Republic of Korea

by Ms. Kyung-Hee Choi

1. Overview of Current Regulatory Actions on POPs

- Among the twelve persistent organic pollutants, five chemicals - Aldrin, Chlordane, Dieldrin, Endrin and Heptachlor – are allowed to use with severe restrictions, as an industrial chemical, i.e., as an additive for the production of industrial goods.
- Import, manufacture and use of DDT, PCBs and Toxaphene are banned.
- In addition, the restrictions are applied to the release of Dioxins and Furans.
- Other two chemicals - Hexachlorobenzene and Mirex - are new chemicals that have never been manufactured in or imported into Korea.

2. Restriction on the Release of Dioxins and Furans

- According to the Ministerial Ordinance of Waste Management Act, revised on the July 17 1997, newly installed municipal incinerators with their incinerating capacities equal or greater than 50 tons per day are required to keep the emission levels of dioxins and furans at or below 0.1ng-TEQ/N .
- On the other hand, existing municipal incinerators in operation before the revision date of the ministerial ordinance are recommended to keep the level at or below 0.5ng-TEQ/N until the 30th of June 1999, followed by the mandatory level of 0.5ng-TEQ/N until the 30th of June 2003 and that of 0.1ng-TEQ/N afterward.
- Municipal incinerators are required to conduct the regular monitoring for Dioxins and Furans twice a year.
- As of the end of 1996, 11 waste incinerators were operated for the urban waste treatment. Each has a daily capacity of approximately 3,000 tons. Among them, ten of the incinerators are stocker-type; the other one is a fluidized bed-type. Some of the incinerators are managed by local governments, while the others are commissioned to specialized agencies.
- Since the emission concentration of dioxine from the stack of one incineration plant in 1995 was 10 times of the designed, there has been growing awareness among the public on the toxicity of the dioxins.
- After rigorous research on the risk assessment of dioxins in depth, emission standard for dioxins was set to be 0.1ng-TEQ/Nm for both newly-built and existing incineration plants. All incinerators should meet the standard level from July 2003. Concentrations of dioxin emission are mandated to be measured 3 times a year for an incineration plant.
- The National Institute of Environment Research (NIER) authorizes official institutions for the dioxin measurement that should satisfy the dioxin analysis requirement including QA/QC.

3. Establishment of National Action Plan

- By the Waste Control Act of 1992, the government established the Comprehensive Waste Treatment Plan on December 1993. This is a long-term national blueprint, and long-term waste management plans of municipal governments were incorporated for greater coordination of local and regional plans.
- In Toxic Chemicals Control Act, article 4 (Responsibility of the Government), the government should establish and enforce plans and measures necessary to thoroughly ascertain hazardous chemicals impact on human health and the environment and to prevent any harm to human health or the environment.
- The government should develop plans and measures for monitoring pollution, examination and research, technological development, training of experts, and education and public relations for the sound management of hazardous chemicals, and should give any administrative or financial assistance for the proper control of hazardous chemicals.

4. Monitoring

- According to Water Quality Preservation Act, PCBs are classified as specific water pollutants**, which** are subject to release charge and regular monitoring; 4 times a year for drinking water systems for residential areas and once a year for other water systems. Restriction is applied even if trace amount of PCBs is detected.
- According to Soil Environmental Conservation Act, PCBs are also classified as soil pollutants subject to the regular monitoring once a year. In 1997 monitoring was conducted at 3000 different sites nationwide. 10,000 monitoring sites will be examined by the year of 2005. Restrictions are applied for the use of contaminated sites if the concentration of PCBs exceeds 30mg/Kg. Waste Management Act prescribes how the wastes containing 50ppm PCBs or more should be stored, handled, transported and destroyed. For example, to dispose of such wastes high temperature incineration method should be used by the licensed business entities. In addition, the level of PCBs in filtrate from waste landfill should be equal or below the designated levels that the Minister for Environment determines and publishes, e.g., maximum 0.005ppm for the filtrate of landfill in the area considered to affect nearby industrial water supply systems.
- In addition to the regular monitoring conducted by the Ministry of Environment in the environmental media described above, the residual levels of POPs are monitored in other environmental media by the Ministry of Health and Welfare, Ministry of Agriculture and Forestry, and other relevant ministries, such as agricultural products and marine products regularly,

5. Environmental Information Exchange System

- For the systematic collection of the information on toxic chemical substances and to support research, the Ministry of Environment has been computerizing the necessary information on chemicals, such as toxicity data, volume in circulation and response measures, since 1995. All information become available to the public, firms concerned, and other countries.

- NIER serves as the National Focal Point (NFP) of INFOTERRA, which is a vast international information exchange system established in 1975. 26 organizations in Korea are currently registered with INFOTERRA.

- A member country of NFP registers domestic organizations that possess chemical information on the country, and provides UNEP with a list of the registered organizations. On receiving a request for information, the NFP retrieves the International Directory of Sources and provides a list of appropriate information sources. Those who requested information select an information source on the list provided by the NFP and contact the selected source directly for information. The NFP can also directly ask NFP of relevant country for information and data, and is provided information to the end-users.

- When necessary, the INFOTERRA Program Activity Center (PAC) of the NFP or UNEP headquarters can provide information to the end-users. INFOTERRA can provide information and data in 21 environment-related fields, including data about the chemical management.

- NIER operate a Chemical Information Center in order to systemically collect and manage data regarding chemicals and to expand and promote the open exchange of relevant information. Chemical Information Center performs the duties of collecting, evaluating, managing, providing, conducting public relations, and expanding the exchange of domestic and overseas data or materials, which fall under any of the following items.

    - Data or materials regarding the toxicity and the risk assessment of chemicals, a measurement of the degree of pollution due to the chemicals, or a survey of the amount in circulation and release of chemicals

    - Data or materials regarding the regulation of hazardous chemicals, substitutes for hazardous chemicals and measures to reduce the risks of hazardous chemicals

    - Information regarding prevention, preparation and emergency measures for accidents involving the chemicals

    - Other information necessary for the sound management of hazardous chemicals

- KRPTC in NIER has been operating to facilitate the information flow from international organization to various administrates and research institute.

- NIER is also operating the 'ESCAP Clearing House' since 1998. working on establishing the computer network for fast information exchange related on sound chemical management. Korea will reinforce the cooperation and coordination among ministries in the process of establishing and performing policies. It will furthermore establish an information system for toxic chemicals and open it to the public, thereby enabling it to expand people's participation in policy-making decisions.

6. Future Plans

  - Monitoring of POPs in various environmental media will be continued and in particular, it is expected that more extensive work on POPs will be conducted as a part of the projects on endocrine disrupters from 1999.

  - The purpose of this project is to establish the state-of-the-art analytical methodology of endocrine disrupters including POPs, and to train personnel who are analyzing those compounds routinely. The scope of this study is as follows ;Establishment of analytical methodologies

    - Quality assurance and quality control of data

    - Training and technology transfer to related organizations

    - Environmental monitoring in various media such as air, water, soil, sediment and biota

- The data will be used to establish the national policy to protect environment from endocrine disrupters including persistent organic pollutants.
- Five chemicals - Aldrin, Chlordane, Dieldrin, Endrin and Heptachlor - that are classified as severely restricted according to Toxic Chemicals Control Act are expected to be banned completely in the near future.
- Regional networks such as ESCAP will be employed efficiently and effectively to exchange information and expertise about POPs to number of countries to the region.
- Furthermore, the government makes every effort to promote recycling by regulating product compositions with a design for environmental concept.
- The government also manages and operates many of sanitized landfills and incinerators with low-dioxin emission to destroy the wastes in an environmental safe way.

32. Current Status of Persistant Organic Pollutants in Mongolia

by Mrs.D.Sodnom

Before making my presentation I would like to extend my deepest gratitude to UNEP and the Government of Vietnam who organized this workshop on Persistent Organic Pollutants and invited representatives from Mongolia.

In early 1990 Mongolia started a fundamental shift from a socialist and centrally political system towards a democratic free market economy. During this period many industries and organizations have been divided into small operating unites, have undergone privatization and are experiencing economic difficulties.

Unified control of toxic substances and coordination of the utilization of those substances have been difficult during the transition phase towards the new system. Because many organizations, factories, enterprises and citizens are importing different kinds of chemical substances and there has not been any legislative basis for their control. Therefore, we developed the law for Mongolia on Protection from Toxic Chemicals. The purpose of this Law is to regulate the production, export, import, storage, trade, transportation, use and disposal of toxic chemicals.

We updated a list of restricted or banned chemicals, including POPs in 1997.

Mongolia is an importer of chemicals. It is estimated that several thousand tons of more than 7200 kinds of chemicals are imported from 10 countries each year for industrial use.

In Mongolia, there have not been any reliable statistics on chemicals, chemical management so far. We are still lacking of the statistics of persistent organic pollutants. So we need assistance from regional level for establishment of a database for POPs, their control and regulation in Mongolia.

Until 1980 organchlorine pesticides like DDT had been used in Mongolia.

They were some of the primary insecticides used. The effect of the pesticides extends also to the agricultural sector as a whole. After the application of the pesticides, they may be transported by wind or water into neighboring areas, resulting in a hazardous concentration in surface water and soil.

Unfortunately, DDT has not been monitored last few years. DDT became banned in 1995.

But in Mongolia a number of chemicals have appeared at the open-air markets without proper labels as they are packed in small packages from the bulky consignments. This has resulted in misuse or inappropriate application of pesticides and other chemical formulations.

Therefore, there is a need to monitor import of these substances especially, persistent organic pollutants and their use. In order to effectively control and manage them need to strengthen training personnels and analytical laboratories.

The Ministry of Nature and Environment is designated as a National Authority, which is responsible for issues concerning the POPs.

The Ministry of Nature and Environment should implement the following activities concerning Persistent Organic Chemicals:

7 The country should have a comprehensive information system on imports of pesticides products. Presently the Ministry of Agriculture and Industry is responsible for management of pesticides products.

7 It is necessary to establish a registry of other persistent organic products, which should include PCBs products.

7 A comprehensive information system should be established and coordinated by a single agency at the inter-institutional level, covering national, regional, and sectoral areas. Data entry, management, and control should be uniform, and data on imports, use, and disposal of pesticide compounds should be updated periodically.

7 public and private sectors need to be aware of the need for them to contribute information on persistent organic compounds

7 Laboratories should have the necessary analytical techniques and trained personnel for identification of organochlorine compounds.

List of Toxic Chemicals Banned or Severely Restricted in Mongolia

	Name of Chemicals	CAS-No	Degree of Restriction
1.	Aldrin	309-00-2	Banned
2.	Dieldrin	60-57-1	Banned
3.	DDT	50-29-3	Banned
4.	Dinoseb	88-85-7	Banned
5.	Fluoroacetamide	640-19-7	Banned
6.	HCH (mixed isomers)	608-73-1	Banned
7.	Chlordane	57-74-9	Banned
8.	Chlordimeform	6164-98-3	Banned
9.	Cyhexatin	13121-70-5	Banned
10.	Ethylenedibromide	106-93-4	Banned
11.	Heptachlor	76-44-8	Banned
12.	Oxirane	75-21-8	Banned
13.	Phenol, pentachloro-	87-86-5	Banned
14.	Zinc phosphide	1314-84-7	Severely Restricted
15.	Lindane	58-89-9	Severely Restricted
16.	Nitrofen	1836-75-5	Banned
17.	Captafol	2425-06-1	Banned
18.	Toxapene	8001-35-2	Banned
19.	Ugilec 121	81161-70-8	Severely Restricted
20.	Cyanide	57-12-5	Severely Restricted
21.	Endrin	72-20-8	Banned
22.	Benzidine	92-87-5	Severely Restricted
23.	Ethane,1,2-dichloro-	107-06-2	Severely Restricted
24.	Aminobiphenyl	92-67-1	Severely Restricted
25.	Propanoic acid, 2,2-dichloro-	75-99-0	Severely Restricted
26.	Maleic hydrazide 3,6-Pyridazinedione, 1,2-dihydro-	123-33-1	Severely Restricted
27.	Mercury (Hg)	7439-97-6	Severely Restricted
28.	Mercury oxide (HgO)	21908-53-2	Severely Restricted
29.	Mercury chloride (Hg2CL2)	10112-91-1	Severely Restricted
30.	Mercury dichloride(HgCl2)	7487-94-7	Severely Restricted

33. POPs Management in Cambodia

by H.E. Mr. To Gary

Excellency! Distinguished Delegates! Ladies and Gentlemen!

It is a great pleasure for me to be invited to participate in the Workshop Management of Persistent Organic Pollutants (POPs) Hanoi, Vietnam, 16-19 March 1999. On behalf of the Minister of Environment and myself, I would like to take this opportunity to welcome warmly to the program supporter, all participants and others who attend in this important workshop for sharing experiences and fostering cooperation in the region.

I. Introduction

The Kingdom of Cambodia covers an area 181,035 km2. It is located between latitudes 10° and 15° North and longitudes 102° and 108° East in the Tropical North. The Cambodian people are working hard in the effort to develop their country and improve their living standard.

Cambodia is an agricultural economy. Between 85-90% of the population engaged in farming. In this case, the main agricultural crop is rice, it account for around 75% of the calories consumed by Cambodians and is grown on over 90% of the current crop area. Given the priority of the government to increase food production to achieve food security, the increased use of pesticides, herbicides and fertilizers is inevitable.

Besides the agricultural field, industry also a part of National economic development. As yet Cambodia has very few industries, consequently the impact from industry on the environment is, to date, minimal. It is possible, however, that the manufacturing, textile, and light industry sectors will be concerned in the near future due to the chemical and hazardous wastes disposal with poor management.

II. Pesticide consumption

1. Pesticides problem in Cambodia

At lease ten different substances, classified by the World Health Organization as class Ia (extremely hazardous) and Ib (highly hazardous) are widely available in Cambodia. The active chemical ingredient, and common brand name, of a number of these pesticides is shown below.

Class Ia	Class Ib
Methyl Parathion (Folidol)	Carbofuran (Furadan)
Mevinphos (Phosdrin)	Dichlorophos (DDVP)
	Methamidophos (Monitor)
	Methomyl (Methomyl)
	Monocrotophos (Azodrin)

Remarkably, up to now farmer is using pesticides imported from neighbouring countries such as Vietnam and Thailand. These pesticide importation occurred without permission form line institutions.

The 1996 Lutheran World Service (LWS) report "Pesticides in Cambodia" described the pesticide situation in Cambodia as alarming. The most urgent issues are:

- a complete lack of regulations;
- people are unaware of the dangers of pesticides;
- pesticides on sale are labelled in Thai and Vietnam so it is difficult for farmers to follow instructions;
- The sale and use of many of the pesticides is completely banned, or severely restricted in other countries or only specially trained people are allowed to use them, and the users have to be protected by special equipment.

A 1994 study of pesticides used in Cambodia showed that extremely poisonous pesticides were most commonly used. Class Ia pesticides accounted for 70% of all pesticides old and class Ib accounted for 16% of all pesticides sold. Therefore, only 14% of all pesticides sold in Cambodia were not from Class I.

2. Guidelines for the safe use of pesticides

The choice and the use of pesticides must be given great care to insure that pesticides are not hazardous to man or crops, or ineffective and uneconomic. Correct pesticide use practice start with the observation of the problem in the field. The better the farmer knows which problem is affecting the crop, the better the treatment choice should be.

Some solutions to the pesticide problem in Cambodia were put forward in the Lutheran World Service (LWS) report. In the short term, it is very important that farmers are provided with more information about the impact of pesticide use on health and the environment and the ways to use pesticides correctly. Ideas for medium term solution put forward in the LWS report include:

- a ban of (at least) extremely hazardous pesticides, WHO class l;
- regulation of trade with pesticides;
- possibility to survey the pesticide market;
- education of extension workers and health workers on pesticide hazards.

III. Other hazardous chemical

During industrialization of the country, many factories and handicrafts have developed rapidly. Due to the development of paper and textile mills, chemical factories and food processing industries has probably caused additional problems of industrial solid waste and liquid waste disposal.

Obviously, most of factories in Cambodia have not had a particular wastewater treatment basin for treating their liquid waste. It is being discharged directly and indirectly into water sources. And some have their own treatment basin, but it seems to be improper depending on the technological sound. For instance, some amount of heavy metals in sludge from the treatment basin of the Galvanizing Factory are higher such as Zn = 338 g/kg, and Pb = 1 144g/kg. In the case of industrial and hazardous waste disposal so far are being caused a major concerning problems threatening to the human health and environment . In a short, industrial and hazardous waste management in Cambodia is limited.

Presently, the Cambodian Government is solving the problem of an illegal hazardous waste disposal in the Sihanouk Vill approximately 3000 tonnes committing by Taiwanese company and the Cambodian private company, namely, Muth Vuthy. Due to the analysis by Natimal Institute for Minamata Disease, Japan, on the waste sample brought from Sihanouk, we saw that the mercury concentration in those waste is higher (675 ~g/g). Replying to this concerned situation, the Government of the Kingdom of Cambodia set up an urgent strategy for proper wrapping those hazardous wastes for removing its back to Taiwan. But up to now, the 3000 tonnes hazardous waste have not transported out of the Sihanouk Vill yet.

IV. POPs management

1. Integrated pest management

The Ministry of Agriculture, Forestry and Fishery is developing several programs to strengthen national IPM capacities in research, extension, training and education, in cooperation with several NGOs and International Organizations. These are being conducted in the Department of Agronomy and the Extension office.

Integrated Pest Management Program is disseminated through education to some provinces tend to:

- undertake intensive practical and theoretical training on the growth cycle of crops;
- receive practical experience in the relationship between pests and their natural enemies;
- grow an actual crop to investigate the impact of their pest management, nutrient management, plant variety selection, land preparation, and weed management decisions on crop yield;
- receive training on special topics related to the key pests and other production issues, e.g. health issues related to pesticide use;
- gain experience in the use of non-formal education and discovery based learning;

Parallel with the IPM program, the dissemination and education program on pesticide use were set up also by the Ministry of Environment, supported by CEMP (I997) through some provinces, specially, the public education due to posters. The highlight points were focused:

- to reduce the pesticide use that suitable to the obvious situation, based on environmentally sound;
- to use this kind of toxic matter, farmer should be wearing a protected clothes during the implementing time;
- to determine the time for consumption its;
- to manage and separate clearly from pesticides and other domestic items.

2. Toxic and hazardous waste management

Toxic and hazardous waste management in Cambodia is poor. So far, we have no law, rules or criteria for governing these wastes. Waste load sources and amounts have not been inventoried quantitatively, but source can be expected to include acid and heavy metals from vehicle batteries, vehicle crankcase oil, diesel fuel and gasoline, pesticides and pesticide containers, solvents and other metal cleaners.

Hence, water sources and some dumping sites become the receiving source of these wastes. These types of wastes are perhaps being released to an extent that undocumented environmental damage is occurring to air, water and soil resources.

Uncertainty of present production and disposal of toxic and hazardous waste in Cambodia argue for timely inventory and monitoring activities to provide a base of knowledge for designing management controls. Until this done, temporary measures of control such as storage of the waste at their source of origin may be the only practical approach.

Currently, the Ministry of Environment prepared some draft Sub-Decrees relevant to the interception and halt various activities destroying the environmental quality include:

- Sub-Decree on Water Quality Management;
- Sub-Decree on Solid Waste Management;
- Sub-Decree on Protected Areas Management; and
- Sub-Decree on EIA.

Noticeably, the four Sub-Decrees above are being passed to the Council of Ministers for' adapting.

Mr. Chairman,
Ladies and Gentlemen!

The Regional Workshop Management of POPs here today is devoted to promote dialogues, understanding, experience sharing as well as cooperation fostering mutually between countries in the region, based on the technological sound. Before ending my presentation, I certainty keep a cooperation on with countries in the region for upgrading the local and regional environmental field. Taking opportunity, I reiteration of my heartfelt thanks to the workshop supporters and others that set up this crucial workshop for finding out the best solution relevant to the POPs management.

Thank you very much for your kind attention!

34. Management of Persistent Organic Pollutants in Indonesia

by Dr. Kasumbogo Untung

Introduction

Persistent organic pollutants (POPs) are hazardous chemicals that resist degradation by physical, chemical or biological pathways. Their persistence enables them to be transported by air, water or other means to remote regions where they have never been used. Since they are liable to bioaccumulate, they may concentrate in living tissues of species located higher in the food chain and present a risk to the well-being of human populations and wildlife. There has been growing international concern that the releases and emissions of POPs may endanger significant parts of the biosphere as well as human populations. POPs. synthetic chemicals with unique and dangerous characters pose a serious threat to wildlife and humans and merit global actions. POPs have four common properties i.e. persistence, bioaccumulation. global transport. and toxicity. Scientific research has revealed the alarming effects of these chemicals. which are still being used in several parts of the world.

The twelve persistent chemicals identified by UNEP and other international institutions have been used intensively and distributed in the environment widely for a long time, and its impact on the conservation and sustainable use of biological diversity and human health has been observed. both incidentally and on purpose up to these days. Indonesia as a developing country has a lot of experiences in managing these persistent organic pollutants ever since they were introduced to the global and national market forty years ago. They were used by several developmental sectors mainly agriculture, health, industry; mining and energy, and some others. They contributed significantly to part of the successes achieved by those sectors in attaining the targeted annual production and consumption of Indonesia development programs.

As the most concern of the central and local decision makers were on the implementation of their respective sectional programs, these officers paid limited attention to the safe use and impact assessment of POPs toward the environment and human health. Most of POPs insecticides have been banned and prohibited for pest control uses since 1970's, and in 1993 DDT as the last surviving POPs chemicals was abandoned in the national malaria control program. However, owing to the lack of appropriate knowledge. Technological skills; and institutional capacities, improper and irresponsible use of chemicals might be found: while systematic control mechanisms for their import, production, transport, sale, use, storage and waste disposal are not available.

The following report will describe the steps and policies which have been enforced, and the problems faced by the government in dealing with the management of POPs especially in three different sectors; namely agriculture. health and industries. Several alternative actions in reducing and replacing POPs will be reported accordingly.

POPs in Agriculture Sector

DDT and other chlorinated insecticides have been used and applied by farmers for plant pest control since 1950's in food crops, horticulture. and estate crops. Insecticides use increased significantly after the government introduced high yielding rice varieties and national rice intensification programme since 1960's. The total use of chlorinated insecticides for agriculture had gradually increased. The first group of insecticides that were introduced by the government for agriculture was DDT and others organochlorines. followed by organophosphates and carbonates in the late of 1960's.

In 1973 the Government Decree No. 7 of 1973 on the Control of Distribution. Storage and Use of Pesticides was issued and subsequently used as the basic instrument for pesticide management and legislation. Under this decree every pesticide for commercial distribution, sale and use in Indonesia has to be registered and approved by the Minister of Agriculture.

To implement stipulations in this decree, several decrees of the Minister of Agriculture were instituted, including the decree on the procedures of registration application and pesticide licensing, decree on the packaging and labelling requirements of pesticides, and decree on limitation of pesticide registration. These decrees were issued in 1973 also.

Government Decree No. 7 of 1973 mentioned that any pesticide has to be registered with the Minister of Agriculture and has to have permission from the Minister prior to its distribution, storage, and sale. The permission shall only be awarded to an applicant whose pesticide does meet registration requirements after technical and administrative data are completed and considered acceptable. The technical data consist of safety to human and the environment, and the effectiveness of pesticide to target pests.

In implementing the registration processes and procedure; the Minister of Agriculture is assisted by the Pesticide Committee, a non-structural government institution, which consists of officials and scientists from different related institutions such as the Minister of Agriculture, the Ministry of Health, the State Ministry of the Environment, the Ministry of Industry and Trade. and the Ministry of Labour. The first Pesticide Committee was appointed in 1974. and since then all pesticides which are used in agriculture are subject to the governmental regulation and must be reregistered and received formal permit from the Minister.

Under the new law and regulation of pesticide registration, since 1974 some of organochlorines insecticides were considered unacceptable for registering and prohibited. These including aldrin, DDT, endrin. and heptachlor. Owing to the unavailability of alternative insecticides, dieldrin and chlordane remained registered and allowed to be used restrictedly for termites control. Toxaphene 70 EC was specially registered and permitted to be used on cotton, but finally was also banned in 1980. In 1992 dieldrin 20 EC and chlordane 960 EC were the last group of organochlorines that were prohibited by the government for agricultural uses. Hexachlorobenzene and mirex are never registered and used in Indonesia for agricultural purposes.

The data on the total of imports. productions and uses of Organochlorines insecticides before 1974 was not available. and difficult to be tracked, including its stockpiles. In 1974 total imports and production of aldrin was 30,000 kg (a.i), chlordane was 20,902 kg (a.i), and toxaphene was 144 kg. (a.i.) In 1979 3,000 kg.(a.i) of dieldrin, 3,720 kg.(a.i.) of chlordane were imported and used. The latest recorded data on the use of dieldrin was in 1 990 when total of 3,492 kg (a.i.) was imported. Total of import and consumption of chlordane in 1990. 1991, and 1992, were 21,072, 25,984 and 37,871 kg (a.i) respectively.

Alternatives to POPs in Agriculture

As a result of continuing scientific analysis and recommendation by Pesticide Committee utilizing the latest available data and information the government always encourage the industry to register the newer, safer to human health and the environment, and more effective pesticide for controlling the target pests. If from the scientific and field evidences it proved that certain pesticide show hazardous impacts to human health and environment. the government will immediately terminate the registration permission. That was also the case for all POPs insecticides, which were prohibited since 1992.

The alternatives of POPs insecticides chosen by the government were other safer pesticides from different groups such as organophospahates, carbamates, synthetic pyrethroids, insect growth regulator, and biological pesticides. Since 1986 the Government has adopted the Integrated Pest Management (IPM) approach for the. basis of pesticides use to limit and terminate the use of hazardous and persistent pesticides such as POPs insecticides. By implementing IPM Indonesia was able to reduce the national consumption of pesticides.

POPs in Health Sector

In Indonesia DDT have been imported, formulated, distributed. stored. and used in health sector for a long time especially for mass control or eradication of Culex sp. and Anopheles sp., the main vector of malaria. The government through the Department of Health started introducing DDT and dieldrin for malarial control in 1952, although limited only in Java Island. Due to the success of the control, by the assistance of USAID and WHO. the government in 1959 start launching the national campaign; which was called Operation Command of Malaria Eradication (Komando Operasi Pemberantasan Malaria / KOPEM) covering the whole nation which was divided into 66 zones. Every area zone had a population of approximately 1 .5 million.

DDT was applied for indoor spraying in achieving long residual effect for controlling the resting mosquitos' adults. The most formulation of DDT used was 75% WDP (Water Dispersable Powder) and it was applied two times a year with a dose of 2 gram/m2. Million of houses throughout the country were sprayed with DDT annually during period of 1959-1968, and from the incidence of malaria reduction, the result of mass spraying was considered satisfactory. In 1968 the national malaria campaign was formally stopped, and DDT spraying activities became a routine program of the Directorate General of the Prevention, Control, and Eradication of infectious Diseases. Department of Health.

From 1969 to 1974 the number of houses sprayed by DDT was 8,900,000 and consumed 5,250,000 kg. of DDT 75% WDP. In 1975-1979 the number of house sprayed in Java and Bali were increased significantly up to 18,600,000 houses and consumed 13,300,000 kg. DDT. In outer islands of Java and Bali the number of house sprayed was 3,400,000 and 1,600,000 of DDT was consumed. During the period of 1984-1989 the number of house sprayed in Java and Bali was reduced drastically, down to 1.900,000 houses and consumed DDT of 1,200,000 kg, but in outer Java and Bali the number of house sprayed was increased up to 6,200,000 and 2,600,000 kg. DDT was applied.

After the Department of Agriculture established Pesticide Committee in 1974 and DDT was no longer registered and prohibited for agricultural purposes, the Minister of Agriculture issued special decision on the restricted use of DDT to the Minister of Health in managing DDT for malaria control program.

The yearly average total of DDT which was applied in malaria control programme was reduced significantly from 1969 (1,145 ton/yr.). 1974 (2,628 ton/yr.), 1979 (1,662 ton/yr.), 1988 (880 ton/yr.), 1990 (563 ton/yr.), and 1992/1993 (67 ton/yr.). In 1992/1993 by the decree of the Minister of Health on the use of DDT for malaria control was terminated in Java and Bali, and in 1993/1994 for the whole country.

Alternatives to POPs in Health Sector

As mentioned previously DDT has not been used for malaria control program in Indonesia since 1994. Some alternative insecticides have been used to replace DDT including, bendiocarb 80 WP,

fenitothion 40 WP, and several synthetic perithroid such as cyhalothrin 10 WP. bioalethrin 0.1 MC, deltamethrin 25 EC, etc.
The governmental decision on terminating the use of DDT for malaria control program is based on several reasons.

- Long term effect of DDT to human health and the environment
- Technology and insecticides alternatives with the similar efficacy and economic efficiency are available in the market
- Community, socio-politic and scientific pressure for banning DDT For the sake of the environment and sustainable development
- The growing refusal from the house owner for indoor spraying. due to the smell and dirty appearance of DDT residues on the wall.

Production Plant of DDT and stockpiles policy

In 1984 the formulation plant of DDT was built under a special permission from the Department of Health and the Department of Industry in Cibinong Bogor (30 km south of Jakarta). The main task of the DDT formulation plan was to supply all the DDT need of the Department of Health for malaria control program. The rest of the production only permitted for export purposes. According to informal report, the DDT export from Indonesia was sent to Latin America and other Asian countries, which are still using DDT for health purposes. Most of the production of this industry actually for exports. Due to rather "undisclosed" nature of the management of this company. relevant data dealing with the total annual production and export of this company are difficult to be accessed.

After the Department of Health in 1994 decided that DDT was no longer used for health purposes, the government soon decided to gather all the DDTs stockpiles remained in storages of the Department of Health and sent it together to the DDT plant in Cibinong Bogor to be reexported. It is reported that those DDT were exported to Nepal and Myanmar. Under this policies formally the Department of Health has solved a national problem of DDTs stockpiles.

According to the report of Department of Health officials. after the termination of DDT use in the health sector, the production activities of the DDT formulation plant should be stopped also, including export activities.

POPs in Industrial Sector

Comparing to the agricultural and health sectors, POPs policies and problems in industrial sector including Mining and Energy Sectors have not established clearly. No information is available about the existence and incidence of POPs industrial chemicals namely PCBs, dioxins and furans. The policies, which have established by respective departments dealing with PCBs. dioxins and furans are not clear or may be not yet exist.

According to an informal report of the Department of Industry and Trade. PCBs chemicals have not been imported to Indonesia for the last 5 years, and they have been prohibited to be used in industrial activities.

The Department of Mining and Energy which manage the supply of electrical power for the whole country, and also PLN (National Electrical Company) never put a concern and special instruction on the use of PCBs in the electrical system including the use of PCBs in or as the insulators.

capacitors and generators. We suspect strongly that PCBs is still contained in some electrical appliances, which have been used and distributed widely in the country

Due to the lack of information, the user did not realise how dangerous they are to the environment and human health. In this respect. education on the effect and hazard to public health and environment is required to promote public awareness in controlling PCBs emission.

No information is available on the emission of Dioxins and Furans in the environment as the by-products of industrial activities such as incinerators. plastic production, pulp and paper plant, etc. The common practice to burn down household garbage including plastic bags, jars, etc. was not realised by public as a source of Dioxines and Furans which are very toxic. Therefore public awareness and education should be promoted.

Dioxin was observed as contaminant in 2,4 D and 2.4.5 T herbicide, for that reason the existence of this contaminant could be expected in the area treated by these herbicides. 2,4 D herbicide has been used in Indonesian plantation.
Unfortunately no research institution in Indonesia are able and capable to detect and analysis the residue level of dioxins and furans in different environment compartments.

Data of POPs in the environment

Since 1980's residues of certain POPs chemicals in various components of the environment have been identified, detected and reported by the Department of Agriculture and some scientists. Residues of p,p'-DDT and p,p'-DDE were detected in almost any samples taken including in fruits (apple, orange and grapes), vegetables (tomato, potato, cabbage; carrot, cauliflower, shallot, long beans, etc.), rice, soybean. DDT was also detected in river water, seawater. paddy soil, soybean field, upland soil, forest soil, and sediment. stream, chicken meat, fish meat, and mother milk. Other POPs insecticides, which were detected with less, frequent compared to DDT. namely, aldrin, dieldrin, chlordane.hexachlorobenzene, and endrin. Residue of PCB was detected by Japanese scientist from Java Sea water.

Those data shows that nowadays POPs residues have been found and distributed in most components of the ecosystem in Indonesia. and became a long-term threat and hazard for human health and the environment.

Information Required

Information on POPs existence, behaviour, fate and degradation in Indonesian environment are scarce. Due to similar nature, climate and social condition , a regional monitoring network, research and development of alternative chemicals or practice can be initiated in an effective and efficient way. Whenever information exchange are possible; a comparable data are expected.

Information for public awareness and education on the effect and hazard caused bay the use and emission of POPs to the environment are still lacking; and information on the use of local alternative insecticides or techniques should be promoted to be the regional alternatives.

Monitoring Programme

Regional long-term monitoring network should be conducted to know the present state of POPs pollution and its effect on the various ecocompartment in South East Asia Region. These informations are used for evaluation of the ecological and human health effects.

Due their persistency, the long-term ecotoxicity data and regional environmental fate and behaviour of POPs obtained in these mutual monitoring programme, can be used to recognise the trend of POPs pollution. These trends are important for the decision maker to manage POPs pollution and to recognise pollution of the long range environmental transportation of POPs.

Evaluation of information based on monitoring result can answer the question of factors determining the effects, the obstacles adequate for the monitoring, and how far the future monitoring agree with the international actions.

In order to be able to communicate and exchange the obtained monitoring data, the data should be of the same quality. For that reason, standard guidance in POPs monitoring should be established. Data handling and reporting procedures should met the objectives of the monitoring program. Therefore there is a need for standardization data analysis and processing protocols, data reporting, data management and archiving.

To have a comparable data within the regional network, interlaboratory quality control procedures should be performed by means of collaborative studies and proficiency testing.

Standardized Risk Assessment Method

Fate and behaviour assessment could be done by modelling. Physical, chemical and biological characteristics for certain POPs can be used to estimate the compounds movement, partition, and degradation in a specific environment. In this model several regional, national and local factors should be considered. Several multimedia and single media modes are available. therefore an agreement of the chosen model which will be used in this regional network should be met.

Based on the obtained data, evaluation and thorough review of the risk assessment. a scientifically based POPs management can be carried out on the regional and national levels. Since risk assessment is the scientific foundation for national, regional and international regulatory decisions and actions. international harmonization of risk assessment methodologies is essential.

35. National Experience to Enforce Ban on the Production and Use of POPs in Bangladesh

by Mr. M. Hassain

INTRODUCTION

Bangladesh is geographically located between 23°34’ and 26°38’ north latitude and between 88°01’ and 92°41’ east longitude. India bounds Bangladesh on the west, the north and the north–east. Mayanmar is on the south-east and the Bay of Bengal is on the south. Bangladesh is predominately an agricultural country and has 111.4 million people in a land area of 1,47,500 sq. km. About 20% of the total cultivated area of 9.1 million hectare has been brought under intensive agriculture. The agricultural crops are paddy, wheat, pulses, sugar-cane, spices, oilseeds, fruits, vegetable, tea and jute fibers. The contribution of the agriculture sector to the GDP is 31%.

The country is being industrialized and industrial activities have increased in recent years. The major industrial group are a) Food, Beverage and Tobacco, b) Jute, Cotton Textile and Leather industry, c) Paper and Paper Products, d) Chemicals, Fertilizer, Pharmaceutical, Petroleum and Rubber, d) Cement and ceramics. The contribution of the industrial sector to the GDP is 10%. At present Bangladesh uses 7 million tons of industrial chemicals and 0.011 million tons of pesticides annually.

EXISTING GOVERNMENT POLICIES REGARDING POPs

The Environment policy 1992 has identified environment action plan for 15 different sectors of our economy. For the agriculture sector the environmental action plan has defined the following regulations.

a) Control use of insecticides and pesticides with due consideration of the prevailing socio-economic condition of the country,
b) Phase out production, import, and use of persistent organic pesticides,
c) Use easily biodegradable pesticides and
d) Encourage integrated pest management (IPM)

The environment policy has the backing of the following legislation to regulate production, import, export, transportation, storage, handling, and use of toxic chemicals and generation and disposal of hazardous waste in Bangladesh.

1. The Environment Protection Act 1995,
2. The Environment Protection Rules 1997,
3. The Pesticide Ordinance 1971 and Pesticide Rules 1985,
4. The Customs Act 1969
5. The Poison Act 1919.

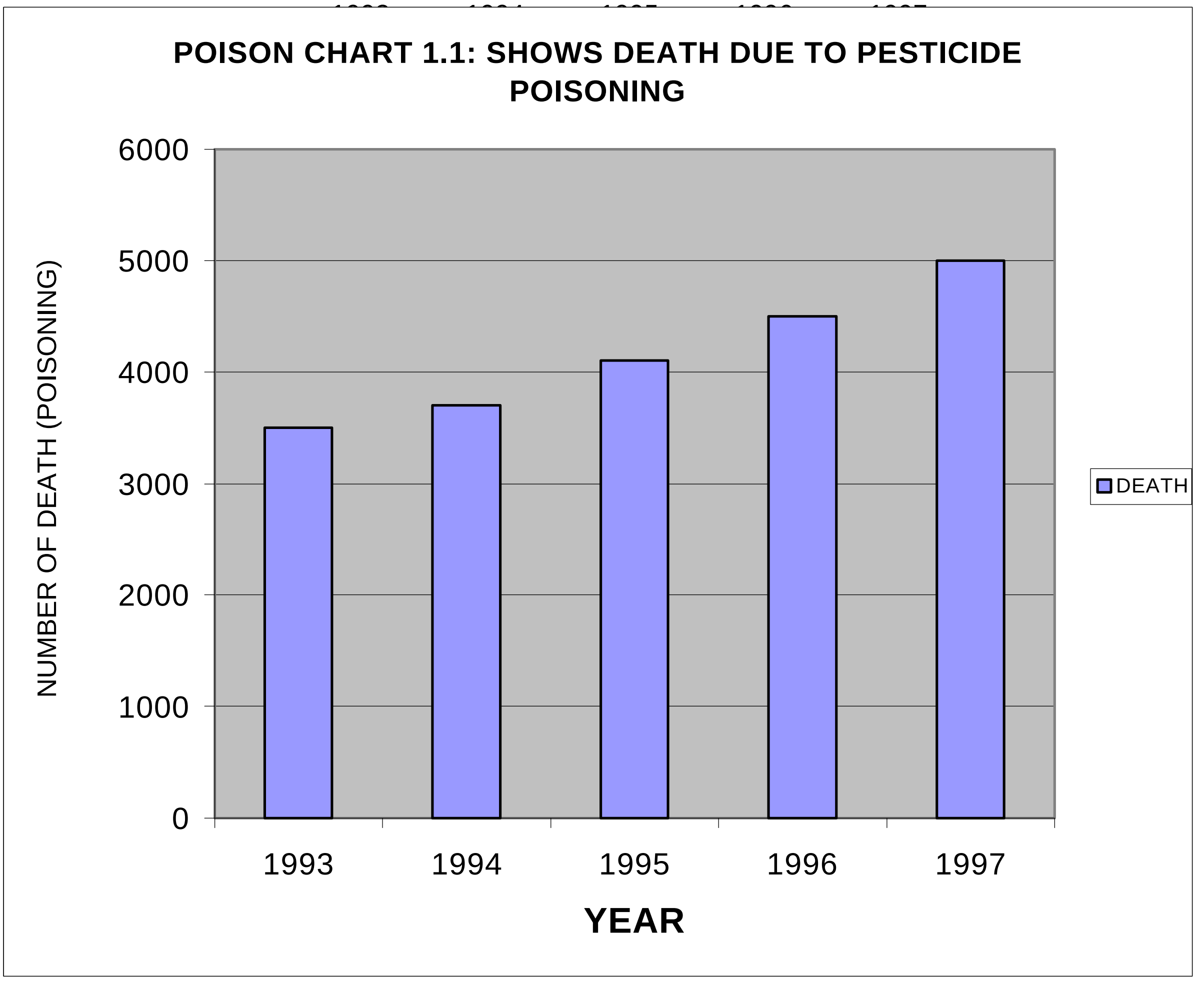
The Pesticide Ordinance has the provision to constitute a Pesticide Technical Advisory Committee (PTAC) to advice the government on technical matters. The Department of Environment is an active member of PTAC. There is a pesticide registration scheme in Bangladesh. No pesticides and insecticides are registered without reviewing the available Toxicological and Eco-toxicological information of the candidate pesticide. However, there is no specific legislation for controlling the production and use of hazardous industrial chemical.

IMPACTS OF HAZARDOUS CHEMICAL USE

There is no systematic and organized study undertaken in the country to identify the environmental impacts of POPs. However, the increase rate of cancer, leukemia, liver and kidney diseases among the rural people, decreasing rate of open water fish production, extinction of wild life is suspected to be the cause of highly persistent and hazardous pesticides and industrial chemical use. The incidence of death due to suicidal, homicidal and accidental poisoning by pesticides and chemicals are alarmingly high in Bangladesh. During the decade of sixty and seventy the acute poisoning cases would occur with Endrin, Aldrin and Dieldrin. Now most of the poisoning cases are reported to be with organo-phospherous pesticides.

The physicians in the General Hospitals, who are not expert in toxicology, usually treat the poisoned victims. As a result percentage of death of poisoned victims is very high. Comprehensive statistics of death due to pesticide poisoning is not available, because there is a trend to keep the poisoning cases secret to avoid legal proceedings.

However, statistics available from the institute of Public Health under the Directorate of health service shows that in 1997 alone, 5000 death cases have been reported from all over the country. The poison chart shows the reported death cases of poisoned victims for the period 1993-97.



POISON CHART 1.1: SHOWS DEATH DUE TO PESTICIDE POISONING

The forest, estuaries, inland and marine water of Bangladesh is rich in bio-diversity. But in recent years open water fish production has decreased by 40%. Increased chemical input for agriculture, untreated sewage and industrial waste is assumed to be responsible for extinction of wildlife and declining fish production. The table No.1 shows the extinct and endangered species of wildlife in Bangladesh.

Table 1: Number of extinct and threatened fauna of Bangladesh

Class	Total Number	Number Extinct	Number Threatened
Mammals	125	12	40
Birds	579	4	70
Reptiles	124	1	24
Amphibians	19	0	2
Total	847	17	136

MEASURES TAKEN TO REDUCE/ELIMINATE Pops EMISSION

Bangladesh has cancelled the registration of all Pops pesticides and in order to protect the public health and environment government has placed fifteen pesticides in the banned list. The table-2 shows the banned list of pesticides.

Table-2: LIST OF PESTICIDES BANNED IN BANGLADESH

Sl. No.	Common Name	Trade Name	Remarks
1	BHC	Sevidol 10 G	POP
		Padigard 10 G	
2	Chlordane	Chlordane 40WP	POP
3	DDT	DDT	POP
4	Dieldrin	Afodril 20 EC	POP
		Dieldrin 20 EC	
		Dieldrin 40 WP	
		Dieldrin 50 WP	
5	Dicrotophos	Bidrin 24 WSC	
		Bidrin 85 WSC	
		Carbicron 100	
6	Disulfoton	Solvigam 10 G	
		Disyston 10 G	
7	Endrin	Endrin	POP
8	Ethyl Parathion	Ethyl Parathion	
9	Isobenzen	Telodrin	
10	Methyl Parathion	Methyl Par rathion	
11	Methyl Bromide	Methyl Bromide 98	
		Methibron	
		Melbromide-98	
		Mebron-98	
12	Mercury Compound	Aritan-6	
13	Methoxychlor	Methoxychlor	
14	Phosmet	Imidan 50 WP	
15	Heptachlor	Heptachlor 40 WP	POP

Bangladesh has a DDT manufacturing plant. The plant has a production capacity of 300 MT DDT per annum. Just after declaration of the National Environmental Policy in 1992, the DDT plant has been shut down. As a result of the shut down 300 staff and workers of the plant have been lay-off. Local **Chlorine** and **Rectified Spirit** manufacturer lost a potential customer. The left over stock of about 500 tons of DDT is now being used only for vector borne diseases control program.

Chemical imported as electric transformer oil, hydraulic fluid, and gear oil may contain **PCB,** but it could not be ascertained. The exporters of this chemical do not use proper label on the container. For the same reason we do not have any inventory of PCB equipment.

There is no large-scale waste incinerators in the country which releases **dioxins and furans**. Leaded petrol is one of the sources of dioxins emission. Bangladesh banned import of leaded petrol. But our only Petroleum refinery in the country is still producing leaded petrol, which contain about 0.01gram lead per liter. An investment of about 30-40 million US dollar is required for process modification of the refinery to produce lead free gasoline.

OBSTACLE TO REDUCE/ELIMINATE EMISSION OF POPs

The very persistent characteristic of POPs is an obstacle to eliminate its use. Dry fish is a popular and delicious food in Bangladesh. It needs to be preserved for about six months to one year. Though it is forbidden to use pesticides as food preservative, it is reported that the unscrupulous traders apply pesticides to preserve dry fish and obviously they prefer DDT. Since DDT is highly persistent, its single application can protect the dry fish for a long time against pest attack, which other pesticides can not do.

Since Bangladesh stopped production and banned import DDT, it should not be available in the market. But some regional countries still produce DDT, and it may be available in the black market. Same is the case with Heptachlor. People prefer to apply it for termite control so as to protect their building and may be available in the black market.

Malaria and Kala-azar has reported to be broken out in some parts of Bangladesh. Health department using the left over stock of DDT in those Malaria prone areas for mosquito control. Experts of the World Health Organization (WHO) also prescribe DDT to use in the Kala-azar prone district of Bangladesh.

Bangladesh does not have the technology and expertise to identify and monitor the sources of PCB, dioxins and furans. A chemical safety programme was initiated in the country. But due to lack of resources the program could not make expected progress. Donor agencies and financial institutions did not show interest in such a program.

Bangladeshi farmers are conscious of the harmful impact of the hazardous pesticides and chemical. They use pesticide as well as practice non-chemical method of pest control. Biological pest control and the Integrated Pest Management (IPM) is practiced in the country. Crop rotation, burning the agricultural residue in the field, use of light trap and catching pest by net are some of the techniques used to control pest in the country.

CONCLUSION

Health and environmental threat of POPs is a global concern. Release of POPs does not remain limited within the territorial boundary of any country. Therefore, in order to reduce and eliminate emission of POPs step should be taken for

a) Early ratification and effective implementation of Rotterdam convention by all countries,
b) Formulation of uniform national and regional action plan to reduce and eliminate emission of POPs,
c) Making available the effective, cheaper and safer alternatives to POPs for the developing importing countries,

e) Provision of technical and financial assistance for the developing countries should be made available to identify the POPs related problems and its cost-effective solution.
f) Banning production of all POPs with immediate effect and the time frame for prohibiting the use should not exceed more than three years after the ban on production has come into effect,
g) Making available the technical and financial assistance for identification and monitoring of the sources of unintended by-products dioxins and furans,
h) Transfer of technology to reduce and eliminate releases of dioxins and furans from all sources including the transformer oil (PCB) related source.

ENVIRONMENT POLICY 1992

a) Control pesticides use considering the prevailing socio-economic condition,
b) Phase out production, import, and use of persistent organic pesticides,
c) Use easily biodegradable pesticides and
d) Encourage integrated pest management (IPM)

Legislation to regulate production, import, export, transportation, storage, handling, use and disposal of toxic chemicals

- **The Environment Protection Act 1995,**
- **The Environment Protection Rules 1997,**
- **The Pesticide Ordinance 1971 and Pesticide Rules 1985,**
- **The Customs Act 1969**
- **The Poison Act 1919.**

Number of extinct and threatened fauna of Bangladesh

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2	Chlordane	Chlordane 40WP	POP
3	DDT	DDT	POP
4	Dieldrin	Afodril 20 EC Dieldrin 20 EC Dieldrin 40 WP Dieldrin 50 WP	POP
5	Dicrotophos	Bidrin 24 WSC Bidrin 85 WSC Carbicron 100	
6	Disulfoton	Solvigam 10 G Disyston 10 G	
7	Endrin	Endrin	POP
8	Ethyl Parathion	Ethyl Parathion	
9	Isobenzen	Telodrin	
10	Methyl Parathion	Methyl Parathipon	
11	Methyl Bromide	Methyl Bromide 98 Methibron Melbromide-98 Mebron-98	
12	Mercury Compound	Aritan-6	
13	Methoxychlor	Methoxychlor	
14	Phosmet	Imidan 50 WP	
15	Heptachlor	Heptachlor 40 WP	POP

MEASURES TAKEN TO REDUCE /ELIMINATE POPs EMISSION

- **Cancelled Registration of POPs pesticides**
- **Shut down a DDT manufacturing plant**
- **IPM Programme implemented**
- **Imposed ban on all sorts of waste import**
- **Import only unleaded petrol**
- **Conversion of petrol driven automobile into CNG fuel**
- **Phase out two-stroke engine auto-rickshaw**

33. Pakistan Report on POPs

by Dr. S. S. Tahir

Identification and evaluation of POPs Pesticides and their impacts:

Pakistan is an agricultural country with 130 million population. It has 88.2 million hectares of land within its border. Approximately 20 million hectares are used for agriculture. Pakistan holds one of the world's largest stocks of pesticides including POPs. The stocks are lying in 2000 provincial stores in four provinces. The stocks are predominantly in the cotton growing areas of the Provinces of Sind and Punjab, but there are also stocks in North West Frontier Province and Baluchistan. According to a report submitted by the Plant Protection Department of M/o Agriculture to the Federal Government in 1996, a huge quantity of POPs was lying at different places in the country. A brief summary for some of them is follows,

Name of POPs	Quantity	Location
Endrin	173 Ltrs	NWFP
Dieldrin	363 Ltrs	NWFP
Heptachlor	307 Ltrs	NWFP
Endrin	137 Kg	Punjab
HCB	203070 Kg	Punjab
DDT	178976 Kg	Punjab
Dieldrin	27038 Kg	Punjab
Heptachlor	296111 Kg	Punjab
Endrin	4283 Kg	Punjab

Most of the POPs (pesticides) were originated (imported/donated) from Europe, and in particular Germany, Switzerland and Netherlands'. Many futile attempts were made in the past to manufacture pesticides in Pakistan. The Government regulatory policies favored the import of the active ingredients of pesticide along with emulsifier, carrier and stabilizer for local formulation rather than manufacture. DDT, BHC, Dieldrin were among the locally manufactured POPs in 1991. In 1985 46 m ton active ingredient of DDT and 65 m ton active ingredient of BHC was produced whereas the manufacturing capacity was 1920 and 1320 m ton active ingredients respectively. In Pakistan DDT was registered for the control of cotton pest complex and for the treatment of paddy nursery, while BHC was registered for use against rice stem borer, locust and black-headed cricket. BHC was used to treat rice nurseries.
Their manufacture has been stopped and factory closed.

The following three national surveys have been completed so far.

1. Storage stability of pesticides and their residues in crop:

These studies were carried out during 1978-1985 at the Federal Pesticide Research Laboratories, Karachi (Baig, 1985). Under these studies the following aspects were covered:

- Translocation of residues of DDT into seed oil
- DDT residue in agricultural soil environment of the Punjab and NWFP
- Residue of DDT in tobacco in NWFP
- Contamination of paddy ecosystem with DDT spraying in Baluchistan

In all these findings DDT was the only pesticide monitored. In the first instance, the ppDDT under semi-field conditions of 5 -7 sprays was found to be 0.8 - 1.3 ppm in cotton seed oil. Moreover, the cotton seed oil from aerial sprayed cotton contained 0.18 - 0.92 ppm of DDE. In second study random sampling of soil from agricultural areas of Punjab and NWFP where DDT was in use for decades was undertaken. Upto 5.77 ppm of DDT were present in the cotton growing areas of Multan, upto 0.6 ppm in the rice fields around Kala Shah Kaku and 0.2-0.59 ppm in sugarcane and tobacco fields of NWFP and in the orchards of Bhalwal.

At Agricultural Research Institute, Tarnab Peshawar, the tobacco nurseries were treated with DDT and analysis of crop leaves at 39 days after treatment revealed DDT at 2.5 ppm level. Similarly, it was found that after 10 days of aerial spray of paddy crop in Baluchistan DDT residues diminished by 85 and 39% in straw and pinnacles, respectively, while 18% increase occurred in soil. There was decline in DDT in edible portion to much lower than tolerance limits for paddy posing. ,

2. Food contamination and control studies in Asia and Far East

Under the auspices of FAO a comprehensive study on food contamination and control was carried out during 1981-84 at the National Institute of Health, Islamabad. Salient features were that organochlorine insecticides were found in all 48 composites (100%). Among the organochlorine residues, heptachlor epoxide found in 3 composites or 6.25%. Endrin a banned product was still detected in vegetables

3. Residual levels of insecticides in food and feed stuff:

These studies conducted at the University of Agriculture, Faisalabad during 1981-84 were of more academic nature. In these studies 1.5% BHC, was sprayed on spinach (Spinacea Oleraceae). After four days, the maximum accumulation was156 pg/100 g, which declined to 2.2 in 16 days. Similarly 1 % DDT was sprayed on Methi (Mefliaviradis). The accumulation of DDT was maximum 1 day after spray (48 pg/100 g). Dieldrin (0.05%) sprayed on turnip (Brassica rapa) resulted in decline from 140 pg1100 g on one day after treatment to 54 pg on 8 days after treatment and below detectable limits subsequently. Likewise Endrin was sprayed on cabbage, radish, cucumber and okra. A spray of 0.05 % Endrin resulted in accumulation of 200-389 pg/100 g in cabbage and 380 pg/100 g in radish. However, Endrin persisted in edible portion of radish up to 10 days after treatment, and it declined thereafter. About 35 % market samples of cucumber showed Endrin ranging from 304-669 pgI100 g. In self sprayed experiment the Endrin progressively increased to 568 pglt00 g at 6th day and then diminished in 14 days. Similarly 42% okra samples collected from local market and Endrin residues ranging from 243-629 pg/100 g. Endrin accumulated in okra to 527 pg/100 on 6th day and declined to 200 pg/100 g in 14 days. The presence of Endrin in samples from market indicated that even after the ban on the use of Endrin, it somehow was reaching to the farmers, may be from the old stocks held by the supplies.

Side-effects of pesticides on human health

The survey for side-effects of pesticides experienced by the farming community was conducted in the districts of Bahawalpur, Rahim Yar Khan and Sahiwal (Jabbar and Nlohsin, 1992). In all 43 individuals (22 males and 21 female workers) were interviewed. Males were associated with the application of pesticides whereas the females were the ladies who pick the cotton. Age range of males was from 24-65 years whereas the age range of females was between 18-55 years. 81 % were married and 19% were unmarried. According to village life standards 95% said that they enjoyed good health. 77% responded affirmative to the question of experiencing any health risk or side-effects. 16% had blisters on the skin, 42% experienced vomiting, 49% had headache, 26%

complained of itching or allergic reactions, while 10% experienced other side-effects like depression, diarrhea, etc. In all this was for the last 10 years, occasionally reoccurring. The children ranged upto 1 per family, however, no visible effect on children was reported.

Lady cotton pickers get no medical treatment for any ill effects. 45% pesticide applicators did receive medical treatment or advice. In villages where doctor includes experienced paramedic staff, about 27% applicators sought advice from them. 86% males claimed to be aware of the side-effects of pesticides. On the contrary 86% female cotton pickers had no information on the side-effects. 82% male applicators were taking precautionary measures whereas 95% ladies interviewed said that they were not taking any precautionary measure. This fits well with their level of awareness and extent of consulting and medical advice. Lack of education in the female population and unavailability of trained female practitioners in the rural areas is the main cause. This reflects the plight of our female workers.

The studies by Masud and Baig (1991) at Multan have shown that out of a total of 88 lady cotton pickers only 1 % could be termed as out of danger, 74% had blood acetylcholinc esterase (AChE) inhibition between 12.5 - 50%. 25% were in dangerous conditions where blood AChE inhibition was between 50-87.5%. Out of 33 male cotton workers studied it was revealed that 12% could be ranked out of danger. 51% had blood AChE inhibited between 12.550% and 36% were dangerously exposed i.e. AChE inhibited to the extent of 50-87.5%. Although the situation of the cotton workers at Central Cotton Research Institute, Niultan was slightly better with about 28% male and female workers out of danger, but this is far from being satisfactory. There were again 57% of the female workers had their AChE inhibited to the extent of between 50-87.5%.

Pesticides Residues in Human

In a study conducted in Karachi area by Mughal and Rehman (1973) more than sixty samples of human adipose tissue from the general population were analyzed for chlorinated compounds by colorimetric and chromatographic procedures. The average level of total DDTequivalent was 25 ppm, total benzene hexachloride (BHC) was 0.48 ppm, and dieldrin was 0.047 ppm. Values varied widely and the frequency distribution was positively skewed. The tendency towards lower concentrations in females was due, perhaps, to their greater fatty pool distribution of residues. The concentration of p,p'-DDD, an intermediary of DDT metabolism, was definitely higher in autopsy as compared to biopsy material due, probably, to post-mort~m anaerobic microbial metabolism.

Occupational Exposure to Pesticides:

In the absence of any monitoring program it is very difficult to comment on the adverse effects of pesticides on the health of the workers associated with the industry. Some cases of occupational exposure reaching accidental level have been cited by Baloch (1985).

Major poisoning accident occurred in Multan in 1972 when workers with ii~proper clothing were unloading a consignment of phorate under extreme summer conditions became ill and seven of them died. Survey of 200 employees of the Department of Plant Protection, associated with the flying and engineering unit of their aerial section, for cholinesterase activity in their blood showed that nearly 50% of them possessed low enzyme activity (Rahman, 1982).

In 1976 an epidemic of poisoning due to water-wettable powder of malathion occurred among 5,350 spraymen, 1,070 mixers and 1,070 supervisors in malaria control program in Pakistan. During the entire epidemic there were five deaths, but these occurred before special study began arid details were not available.

Accidental Poisoning Incidence

The examples of accidental pesticide poisoning around the world are innumerable but in Pakistan there is lack of scientific information on the subject. Except the following reported case most cases appear as reports in the press, which need verification before acceptance and quotation. In summer of 1984 an epidemic of endrin poisoning occurred in Talagang, District Attock. Acute convulsions were recorded in 194 affected persons in 18 villages: 70% cases were in the children of 1-9 years of age. Nearly 10% (19 out of 194) patients died. The epidemiology of the Talagang outbreak suggested that a shipment of food (possibly sugar) was contaminated en route to the city (Schauerte et al 1982.).

Contamination of groundwater

The agricultural activity based heavily on the usage of pesticides to increase crop yields has proved to be a potential source of groundwater contamination. The study by Ali and Jabbar (1991) revealed that the shallow groundwater in Samundri area drawn from a depth of 30-40 feet is contaminated with pesticide residues. Endrin was present in the range of 0.1 to 0.2 ppb. The report on drinking water contamination in Pakistan focuses on cattle drinking water in Karachi (Parveen and Masud, 1987) revealed contamination of ten samples with chlorinated pesticides or their metabolites. Six samples were found to contain r-BHC in the range of 1.0 to 16.4 ppb, one contained p, p'-DDT in traces. In two samples p, p'-DDE was found to be present in traces. Aldrin and dieldrin were present in one sample in quantities from 2.0 to 31.5 ppb, respectively.

Contamination of Soil

The soil of Samundri in cotton growing area is contaminated with pesticide residues. The organo-chlorine insecticide residues of aldrin, dieldrin, endrin, p,p'-DDT and its metabolites p, p'-DDD and p, p'-DDE are detected in the lower 2 to 3 feet layers of the soil. Their concentration varies from traces to 9.6 ppb. In an other study by Hussain and his group (1988) at Nuclear Institute for Agriculture and Biology, Faisalabad using sandy loam soils have indicated that most of the applied DDT is retained by the top 5 cm layer. Movement down to 10 cm and 15 cm is very slow. This may be due to the fact that DDT is water insoluble.

Industrial Chemicals (PCBs & HCB)

The PCBs and HCB may be present in different equipment products but these POPs have not been investigated so far due to lack of awareness, limited monitoring capabilities and adequate resources. The following would be the major sources were PCB could be present in considerable concentration in Pakistan.

- Transformer oils
- Capacitors
- Paints
- Sealents
- Flooring
- Coal mining/asphalt plant
- Automobile service station
- Heat exchange fluids
- Incinerators
- Humic acids (being suggested as fertilizer)
- Open burning sites/places

Government of Pakistan is very much interested to involve in the monitoring and destruction of PCBs programmes if adequate international technical support and funding are available.

Dioxins/Furies:

The monitoring Information is not available in Pakistan. The major sources could be the incinerators, asphalt plants, open fires, burning of solid waste, traffic, metal industries, plastic molding factories etc.

GOVERNMENT RESPONSE:

The Government of Pakistan is well aware of the issues associated with POPs and had taken the following major actions:

1. Promulgation of pesticides ordinance 1971
2. Ban on import & manufacturing of 21 pesticides including POPs
3. Created awareness among masses on harmful effects of pesticides
4. NGOs & other community-based organizations are being associated to support the government in dealing with the issues of POPs 5. Preparation of a roster of experts on POPs
6. Formation of POPs Committee in the M/o Environment
7. Identification of problems associated with POPs with the help of UNEP financial support

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Annex-I

LIST OF PESTICIDES BANNED IN PAKISTAN

(As of May 1993)

S.No.	Name of Pesticide	S.No.	Name of Pesticide
1.	Binapacryl	12.	Dieldrin
2.	Bromophos Ethyl	13.	Disulfoton
3.	Captafol	14.	Endrin
4.	Chlordine Form	15.	Ethylene Dichloride + Carbon Tetrachloride
5.	Chlorobenzilate	16.	Leptophos
6.	Chlorthiophos	17.	Mercury compounds
7.	Cyhexatin	18.	Mevinphos
8.	Dalaphon	19.	Propergite
9.	DDT	20.	Toxaphene
10.	Dibromochloropropane + Dibromochloropropene	21.	Zineb
11.	Dicrotophos		

Source: MINFA 1993b

Annex-II

PESTICIDES IMPORT IN PAKISTAN

Year	Quantity	% Growth since 1973-74	Value
1973-74	6473.6	-	171360
1974-75	6927.6	7.01	257682
1975-76	13258.3	104.81	310415
1976-77	16225.7	150.64	460639
1977-78	12754.4	97.02	254464
1978-79	7727.3	19.37	188810
1979-80	4419.1	-31.74	167655
1980-81	1705.0	9.75	224717
1981-82	5481.0	-15.33	230626
1982-83	8860.3	36.87	396712
1983-84	10662.5	67.71	685840
1984-85	15889.9	145.45	1196624
1985-86	17498.9	170.31	1416809
1986-87	20647.8	218.95	1878039
1987-88	15765.4	143.53	1769267
1988-89	11326.5	74.96	1382904
1989-90	10543.5	62.87	1249274
1990-91	13030.1	101.28	1489428
1991-92	15258.3	135.70	1945981

PESTICIDES (POPs) RESIDUES IN DIFFERENT MATRIX IN PAKISTAN

S.No.	Matrix	POPs name	Concentration (ppm/ppb)	Reference	Remarks
1.	Cotton Seed	pp-DDT	0.8-1.3 ppm	Baig, 1985	5-7 Sprays
2.	-----do-----	DDE	0.18-0.92	-----do-----	Aeriaaly sprayed
3.	Soil	DDT	Up to 5.77 ppm Up to 0.6 ppm 0.2-0.59 ppm		Multan, cotton field. Kala Shah Kaku, rice fields NWFP, sugarcane, tobacco fields
4.	Milk	Organochlorines	+ve	Parveen et al, 1973	163 samples analysed
5.	Human adipose tissue from Karachi	DDT BHC Dieldrin	25 ppm 0.48 ppm 0.047 ppm	Mugal et al 1973	
6.	Blood	pp-DDT	4.83 ppb	Krawinkel et al, 1989	
7.	Ground Water	Endrin	0.1-0.2 ppb	Ali et al, 1991	
8.	Cattle drinking water	r-BHC pp-DDT Aldrin + dieldrin	1.0-4.0 ppb traces 2.0-31.5 ppb	Parveen et al, 1987	79 samples from Karachi
9.	Soil	Aldrin, Dieldrin, pp-DDT, pp-DDE	Traces to 9.6 ppb	Ali & Jabbar, 1991	Samundri cotton growing area

34. POPs in the Pacific - The Legacy

by Mr. A. Munro

The South Pacific Region

The region is large geographically stretching from Palau in the north west to the Cook Islands in the south east, and covers an area of about 29 million sq. km. Despite this vast expanse of water land areas and populations are small. Populations in the fourteen countries of the region range from Niue with about 2,000 people to Papua New Guinea with almost 4 million and a total population of about 7 million.

POPs in the Pacific?

So can a region with such a small population in comparison to its Asian neighbours possibly have a problem with POPs? After all this is the idyllic Pacific Ocean with its Island lifestyle - this is paradise! Unfortunately this is a popular myth and the warning signs of potential problem are clearly apparent:

- The region has embraced Westernization with accompanying improved living standards bringing electricity, and forcing countries in the region to strive for economic growth through such industries as fishing and intensive agriculture;
- Standards of public education are low in comparison with more developed countries; and
- Malaria and dengue fever are common in some areas with few countries in the world being burdened with malaria infection rates as high as those in the Solomon Islands where only a few years ago they exceeded 100%.

AusAID Chemicals Management Project

SPREP and AusAID have recognised that the capacity of many countries in the region to manage chemicals is low with issues identified including:

- Lack of access to information regarding chemicals;
- Poor community education levels;
- Limited knowledge of health and environmental implications of chemicals;
- The absence of disposal options for unwanted chemicals; and
- Government priorities concentrating on economics rather than environmental issues.

Persistent Organic Pollutants in Pacific island Countries (POPs in PICs)

In response to these problems AusAID has funded Phase I of the SPREP implemented POPs in PICs project. Phase I is essentially an assessment of the ‘State of Play’ of chemicals management in the region. Inventories of waste and obsolete chemicals have been compiled and preliminary assessments made of chemicals contaminated sites. Recommendations regarding disposal options for chemicals identified in the inspections have also been formulated, and formal and informal training programmes to provide education regarding responsible chemicals management are to be developed. There has been no attempt however to assess environmental contamination from long-term agricultural and industrial uses of chemicals, with the project concentrating instead on one-off ‘hot spots’.

The POPs in PICs inspections have covered more than simply POPs and have included:

- Pesticides;
- Electricity transformer oil;
- Medical wastes and unwanted drugs;
- School and other laboratory wastes;
- Waste oil;
- Bitumen in 200 litre drums remaining from past construction projects;
- Timber treatment chemicals; and
- Chemicals contaminated sites.

The inspections have been undertaken in all Pacific Island Countries with the exception of Papua New Guinea and have identified several of the twelve POPs included in the convention currently under negotiation. In addition to the examples shown below it is understood that up to 120 tonnes of waste and obsolete chemicals have also been identified in Papua New Guinea:

- A total of 200,000 to 300,000 litres of PCB contaminated electricity transformer oil in 80 to 100 transformers are currently estimated. Quantities in individual countries range from over 100,000 litres in the Federated States of Micronesia (FSM) to none in Fiji and very minor quantities in the Marshall Islands and Palau where the USEPA has already undertaken a clean-up campaign. The clean-up in the Marshall Islands alone cost almost US$ one million;
- DDT is still used for mosquito control in the Solomon Islands but has been banned in all other Pacific Island Countries. Including current stockpiles in the Solomon Islands a total of about twelve tonnes has been identified with a further three tonnes buried in Palau and FSM. Attitudes to the management of DDT could be described as indifferent with for example the manager of the malaria control programme in Vanuatu informing me that all DDT had been removed from the country five years previously when a decision was made to ban it in Vanuatu. The next day I inspected about 900 kg of DDT in poor condition at the hospital of one of the outlying islands. Storage conditions for DDT in the Solomon Islands have also been somewhat substandard;
- Small quantities (less than one tonne) of other POPs including Aldrin, Chlordane, and Dieldrin have also been identified. Other waste pesticides of concern include Propanil (an anilide), Trichlorfon (Dicidex), various Carbamates and Fenamiphos (an organophosphate). Quantities of copper, chromium, arsenic and arsenic pentoxide were also found.

A preliminary assessment of contaminated sites has also been undertaken principally for the purposes of identifying sites, which require further investigation. Notable findings include:

- A pesticides shed associated with a rice growing industry in the Solomon Islands. The industry collapsed financially and the shed was abandoned and essentially ignored for almost twelve years. Local villagers broke in and stole pesticides, which they used to kill fish for the dinner table. The shed deteriorated with the inevitable result that it must now be classified as a contaminated site. Among pesticides stored in the shed were Propanil and Mocap. The sludge now spread on the floor includes Mocap which contains ethoprophos with an LD50 of 15 mg/kg;

- Government agriculture departments have buried unwanted pesticides in four locations. At one of these the site was later sold and a house built on it. DDT has also been buried at one site in FSM and one site in Palau;
- Timber treatment facilities. There are about four abandoned timber treatment facilities in the region and the simple conclusion which can be reached is that this is a very easy way to contaminate a very large area of land very quickly; and
- Sites contaminated with oil and bitumen are common with in some cases the contamination extending into underground drinking water lenses.

Phases II & III of POPs in PICs will include the provision of safe storage facilities, the disposal of hazardous wastes identified, and the remediation of contaminated sites. Funding for this work has not yet identified although discussions with donors including AusAID have been most encouraging, and it is intended to seek funding from the Global Environment Facility (GEF) under the International Waters portfolio and the chemicals industry will also be approached to assist.

UNEP Chemicals and the World Health Organization will also be approached for technical assistance if necessary and it is hoped that it will become a joint effort involving AusAID and perhaps other donors, the GEF, the chemicals industry, UNEP Chemicals and WHO.

A Chemicals Friendly Future

It appears that significant progress has been made in achieving the long-term goals of Chapter 19 of Agenda 21. Thanks to the work of UNEP Chemicals, the Inter-Governmental Forum on Chemical Safety (IFCS), WHO, FAO and others we have confidence in the future. The Rotterdam Convention, the POPs Convention and other programmes reinforce this confidence.

In addition to becoming involved in these programmes and the POPs in PICs project, SPREP is commencing a project with assistance from the Government of New Zealand to increase long-term capacity to manage chemicals and hazardous wastes in the South Pacific region. ‘HazWaste’ will both develop and implement programmes to ensure that potentially hazardous chemicals are treated with the respect they deserve.

The Pacific Does Not Need POPs

The problems associated with the ‘Dirty Dozen’ POPs in the South Pacific region are solvable. It is also considered that ultimately the only way to ensure that DDT or any of the other twelve POPs can never again be imported into the region is to ensure that their manufacture is banned throughout the world. SPREP therefore suggests that the POPs Convention currently under negotiation should recognise the following principles:

- The ultimate aim must be for total elimination of the twelve POPs;
- All countries in the world must be encouraged to strive for this goal;
- There must be significant emphasis on the need for technical and financial assistance to assist; and
- The Convention must recognise the concept of shared responsibility on the part of both developed and developing countries to attain this goal.

STUDIES ON POPs IN MALAYSIA

Conducted mainly in agroecosystems

Emphasis on pesticides

AGROECOSYSTEMS INVESTIGATED

1. Vegetables-growing areas of the Cameron Highlands and Johore
2. Muda rice agroenvironment
3. Tobacco and rice agrosystems of the Kelantan Agricultural Plains

STATUS OF POPs IN MALAYSIA

Pesticide	Aldrin	Withdrawn
	Dieldrin	Withdrawn
	DDT	Being withdrawn
	Endrin	Not registred
	Chlordane	Withdrawn
	Hexachlorobenzene	Not registerd
	Mirex	Not registed
	Toxaphene	Not registred
	Heptachlor	Withdrawn
Industrial chemical	PCBS	
By-products	Furans	
	Dioxins	

VAPOUR PRESSURE OF POPs

POPs	V.P. (mm Hg)
Aldrin	2.31×10^{-5} (20^{o} C)
Chlordane	10^{-6} (20^{o} C)
DDT	-
Dieldrin	1.78×10^{-7} (20^{o} C)
Endrin	7×10^{-7}
HCB	1.089×10^{-5} (20^{o} C)
Heptachlor	3×10^{-4}
Mirex	3×10^{-7} (20^{o} C)
Toxaphene	0.2 – 0.4

VAPOUR PRESSURE OF POPs

Dioxin	(Pa x 10^{-3})
M_1CDD	73 - 75
D_2CDD	2.47 – 9.24
T_3CDD	1.07
T_4CDD	0.00284 – 0.275
P_5CDD	0.00423
H_6CDD	0.00145
H_7CDD	0.000177
O_8CDD	0.000953

Half life of POPs

POP	Half-life
Aldrin	Mostly converted to dieldrin
Chlordane	1 year
DDT	10 – 15 years
Dieldrin	5 years
Endrin	12 years
HCB	2.7 – 22.9 years
Heptachlor	> 2 years
Mirex	> 10 years
Toxaphene	100 days – 12 years
Dioxin (TCDD)	10 – 12 years
Furans	10 – 12 years
PCBs – monochlorobiphenyl	10 days
Heptachlorobiphenyl	1.5 years

Organochlorine insecticide residues in water - Johore agroecosystems

	Residue levels (ng/ml)							
Sampling date	Apr. 91*		Aug. 91**		Nov. 91**		Feb. 92 ***	
Compound	DS	CR	DS	CR	DS	CR	DS	CR
Lindane	1	ND-0.027	5	ND-0.961	5	ND-0.961	4	ND-0.091
Aldrin	0	ND	0	ND	0	ND	1	ND-0.099
Dieldrin	0	D	0	ND	6	ND-0.111	5	ND-0.202
Endosulphan I	3	ND-0.059	4	ND-0.110	3	ND-0.423	0	ND
Endosulphan II	2	ND-0.063	5	ND-0.018	5	ND-1.013	2	ND-0.025
Endosulphan sulphate	6	ND-0.275	6	ND-0.280	7	0.0094-4.410	5	ND-0.073
Total endosulphan	6	ND-0.397	6	ND-0.405	7	0.019-5.848	5	ND-0.073
Total DDT	1	ND-0.017	1	ND-0.0020	8	ND	1	D-0.038

Organochlorine insecticide residues in soils - Johore agroecosystems

	Residue levels (mg/kg)							
Sampling date	Apr. 91*		Aug. 91**		Nov. 91**		Feb. 92 **	
Compound	DS	CR	DS	CR	DS	CR	DS	CR
Lindane	6	0.0016-0.0375	3	ND-0.0058	4	ND-0.0014	1	ND-0.0095
Aldrin	0	ND	1	ND-0.0023	1	ND-0.0037	0	ND
Dieldrin	2	ND-0.314	2	ND-0.201	0	D	0	ND
Endosulphan I	4	ND-0.061	7	ND-0.023	3	ND-0.0023	0	ND
Endosulphan II	0	ND-0.061	7	ND-0.023	5	ND-0.023	0	ND
Endosulphan sulphate	0	ND	7	ND-0.389	5	ND-0.461	2	ND-0.116
Total endosulphan	4	ND-0.061	8	0.0037-0.578	6	0.011-0.465	2	ND-0.133
Total DDT	3	ND-0.0029	7	ND-0.571	5	ND-0.039	2	ND-0.032

Organochlorine insecticide residues in water - Cameron Highlands agroecosystems

Sampling date	Apr. 91*		Aug. 91**		Nov. 91**		Feb. 92 **	
	Residue levels (ng/ml)							
Compound	DS	CR	DS	CR	DS	CR	DS	CR
Lindane	5	ND-0.0085	10	ND-0.030	10	ND-0.069	7	ND-0.087
Aldrin	6	ND-0.0053	11	ND-0.026	2	ND-0.054	1	0.043
Dieldrin	3	ND-0.033	5	ND-0.050	2	ND-0.041	7	ND-0.053
Endosulphan I	0	ND	10	ND-0.100	12	ND-0.039	5	ND-0.062
Endosulphan II	3	ND-0.072	16	ND-0.070	13	ND-0.144	4	ND-0.028
Endosulphan sulphate	14	ND-0.757	18	ND-0.655	18	ND-0.884	10	ND-2.512
Total endosulphan	14	ND-0.829	18	ND-0.737	18	ND-0.884	10	ND-2.574
Total DDT	5	ND-0.11	4	ND-0.052	4	ND-0.10	2	ND-0.017

Organochlorine insecticide residues in soils - Cameron Highlands agroecosystems

Sampling date	Apr. 91*		Aug. 91**		Nov. 91**		Feb. 92 **	
	Residue levels (mg/kg)							
Compound	DS	CR	DS	CR	DS	CR	DS	CR
Lindane	5	ND-0.034	2	ND-0.058	5	ND-0.039	7	ND-0.068
Aldrin	1	ND-0.003	1	ND-0.017	1	ND-0.021	0	ND
Dieldrin	6	ND-0.189	4	ND-0.100	6	ND-0.128	0	ND
Endosulphan I	1	ND-0.0084	1	ND-0.200	2	ND-1.093	1	ND-0.014
Endosulphan II	2	ND-0.012	4	ND-0.463	6	ND-0.039	4	ND-0.230
Endosulphan sulphate	4	ND-0.038	7	ND-0.434	5	ND-0.236	4	ND-0.23
Total endosulphan	5	ND-0.038	7	ND-0.921	7	ND-1.085	5	ND-0.342
Total DDT	4	ND-0.300	3	ND-0.220	7	ND-1.392	2	ND-0.145

Organochlorine residues in water resources of Muda rice agroecosystems

Time of sampling	No. analysed	Pesticides detected	No. detected	Concentration ng/ml
Nov. 92	26	Lindane	11	< 0.002 - 0.15
	26	Aldrin	1	< 0.002 - 0.01
	26	Dieldrin	16	< 0.002 - 0.12
	26	Endosulphan	25	< 0.002 - 0.37
	26	DDT	14	< 0.004 - 0.08
Dec 92	42	Lindane	7	< 0.002 - 0.15
	42	Aldrin	6	< 0.002 - 0.06
	42	Dieldrin	13	< 0.002 - 0.10
	42	Endosulphan	33	< 0.002 – 25.5
	42	DDT	13	< 0.004 - 0.30

Organochlorine residues in water resources of Muda rice agroecosystems

Time of sampling	No. analysed	Pesticides detected	No. detected	Concentration ng/ml
Jan 93	51	Lindane	22	< 0.002 - 0.09
	51	Aldrin	26	< 0.002 - 0.16
	51	Dieldrin	7	< 0.002 - 0.04
	51	Endosulphan	49	< 0.002 - 0.32
	51	DDT	4	< 0.004 - 0.09
April 93	20	Lindane	5	< 0.002 - 0.23
	20	Aldrin	3	< 0.002 - 0.15
	20	Dieldrin	3	< 0.002 - 0.04
	20	Endosulphan	13	< 0.002 - 0.04
	20	DDT	2	< 0.004 - 0.05
May 93	6	Lindane	2	< 0.002 - 0.04
	6	Aldrin	3	< 0.002 - 0.06
	6	Dieldrin	3	< 0.002 - 0.06
	6	Endosulphan	5	< 0.002 - 0.54
	6	DDT	2	< 0.004 - 0.05

Organochlorine residues in water resources of Muda rice agroecosystems

Time of sampling	No. analysed	Pesticides detected	No. detected	Concentration ng/ml
Jun 93	27	Lindane	17	< 0.002 - 0.14
	27	Aldrin	11	< 0.002 - 0.04
	27	Dieldrin	11	< 0.002 - 0.09
	27	Endosulphan	23	< 0.002 - 2.3
	27	DDT	15	< 0.004 - 0.03
Ju1 93	7	Lindane	7	< 0.002 - 0.05
	7	Aldrin	6	< 0.002 - 0.01
	7	Dieldrin	0	< 0.002
	7	Endosulphan	7	< 0.002 - 0.04
	7	DDT	7	< 0.004 - 0.02

Organochlorine residues in water resources of tobacco agrosystems in the Kelantan Plain

Time of sampling	Pesticides detected	No of detected samples				% of detected samples exeeding EU standards	
		P	W	D	R	P	W
Mar 92	Endosulphan	29	26	-	-	20.7	19.2
	Lindane	9	7	-	-	33.3	42.9
	Aldrin	29	19	-	-	6.9	8.7
	Dieldrin	NA	NA	NA	NA	-	-
	DDT	NA	NA	NA	NA	-	-
May 92	Endosulphan	3	1	-	-	0	100
	Lindane	20	16	-	-	80.0	87.5
	Aldrin	29	23	-	-	6.9	8.7
	Dieldrin	10	5	-	-	0	20.0
	DDT	12	6	-	-	16.7	33.3
Dec 93	Endosulphan	0	1	2	0	0	0
	Lindane	1	1	1	1	0	0
	Aldrin	15	23	5	3	0	0
	Dieldrin	4	4	3	0	0	0
	DDT	8	7	3	0	36.9	40.4

Organochlorine residues in water resources of rice agrosystems in the Kelantan Plain

Time of sampling	Pesticides detected	No of detected samples					% of detected samples exeeding EU standards	
		P	W	D	IC	R	P	W
Jul 92	Endosulphan	37	28	32	4	3	8.1	7.1
	Lindane	21	16	16	1	2	38.1	56.3
	Aldrin	19	18	18	2	1	26.3	33.3
	Dieldrin	18	17	13	1	2	0	0
	DDT	6	9	4	0	0	0	0
Sept 92	Endosulphan	21	21	17	2	2	9.5	4.8
	Lindane	25	18	14	2	0	24.0	0
	Aldrin	15	7	6	0	0	28.6	14.3
	Dieldrin	26	21	22	2	0	3.8	0
	DDT	5	3	2	3	0	80.0	33.3
Feb 93	Endosulphan	47	28	34	6	5	8.5	14.3
	Lindane	3	3	3	1	1	0	0
	Aldrin	15	10	4	1	1	0	10.0
	Dieldrin	26	8	14	0	2	11.5	0
	DDT	9	3	8	3	3	11.1	33.0

INTERVENTION MEASURES

1. Disposal of existing stock
2. Alternative chemicals/technologies
3. Environmental monitoring for assessing effectiveness of remedial measures

36. National Action Plan for Management of Persistent Organic Pollutants (POPs) in Malaysia

by Mr. V. Pachaimuthu

1. Introduction

Persistent Organic Pollutants (POPs) are chemicals that resist degradation by physical, chemical or biological pathways, have the potential to travel for long distances, accumulate in tissues and pose a risk of causing adverse effects to human health and the environment. It was in response to the Rio Summit, which adopted Agenda 21 that action was initiated at international level to reduce or eliminate POPs. Recognising this as a serious problem that needed attention, Malaysia embarked on a national program to control POPs. As it was a relatively grey area, a study was carried out to find out its status in selected areas and identify potential sources and activities that release POPs into the environment.

2. Control of Industrial Chemicals and Pesticides

In Malaysia, the Department of Environment (DOE) is responsible for industrial chemicals while the Pesticides Board controls the pesticides. Under the Pesticides Act, 1974 there are provisions for rules and regulations that control the usage and handling of pesticides. These pertain to registration, labeling and advertisements of pesticides, licensing of premises selling and/ or storing pesticides for sale and import of unregistered pesticides for research or educational purposes. At present, the legislation for industrial chemicals is lacking but a comprehensive Act has been drafted. It is expected that with this Act, areas such as notification and assessment, inventory of chemicals, classification, packaging and labeling, import and export including the Prior Informed Consent (PIC) procedure, manufacture and storage as well as transportation would be clearly covered.

3. Focal Points

The Designated National Authority for pesticides is the Pesticides Board. Legislation for control of all pesticides, including those listed under the PIC, is provided for under the Pesticides Act 1974 where there is a Pesticides Board comprising members from many relevant agencies. DOE is the National Focal Point for UNEP, which implements the operation of the PIC procedure for industrial and consumer chemicals. In order to develop control actions and facilitate activities related to the implementation of the PIC procedure, it has established an inter-agency committee and consensus of the members is obtained before a decision to ban or severely restrict a hazardous industrial chemical is taken. DOE is also UNEP’s National Focal Point for Persistent Organic Pollutants in Malaysia.

4. Development of a National Programme to Control POPs

There have been scanty research conducted on POPs in Malaysia. Most reported studies were confined to agriculture areas or river systems related to such areas. Therefore, as Malaysia was a key player in environmental activities organised under the UNEP, the DOE initiated the project “Development of a National Programme to Control Persistent Organic Pollutants (POPs)” in response to UNEP’s call for global action to deal with this issue. The studies were on the present status of POPSs in Malaysia, to identify potential sources and activities that release POPs to the environment and to identify safe substitutes for POPs. The team is also required to assess contamination of POPs in the environment and to develop a National Plan of Action.

5. Selection of Study Sites

Six study sites were selected to represent diverse land use or main activities, which may contribute to the POPs problems in Malaysia. The sites include intensive agriculture areas (Muda Scheme in

Kedah, Cameron Highlands, Pahang and Kundasang, Sabah), industrial area (Juru, Seberang Prai), shipping and fishing area (Tanjung Piai, Johor) and timber processing area (Tanjung Manis, Sarawak).

(a) Muda Scheme, Kedah

Muda irrigation scheme is the largest paddy cultivation area in Malaysia. It is a very successful scheme and this area is known as the 'rice bowl' of Malaysia. Of course pesticides have played a role in that achievement while creating an adverse impact on the paddy ecosystem. However, the introduction of Integrated Pest Management (IPM) concept has shifted the emphasis on biological control rather than chemical-based pest control.

(b) Juru, Seberang Perai

The Juru river basin has a high percentage of urban area and the Prai Industrial Estate. It is a mixed industrial development area with heavy, medium and light industries clustered together.

(c) Tanjung Piai, Johor

This is a shipping area where illegal dumping of sludge from ships and oil tankers have occurred before. DOE has taken to court a number of ships for desludging activities in this area. Such activities have also affected the livelihood of fishermen in the area as it is also a fishing area.

(d) Cameron Highlands

It has been a tea growing area for more than 60 years. Later, vegetable farming was introduced and is now a major producer of vegetables. Apart from that, flower growing has been another major activity too.

(e) Kundasang, Ranau, Sabah

It is a highland area similar to Cameron Highlands in that the land has similarly been utilized for vegetable and flower growing.

(f) Tanjung Manis, Sarawak

It is a major industrial town with one of the largest timber and other wood products exporting facility in Sarawak. Chemicals are used for the treatment of timber particularly anti-borers, anti-stain and anti-termites.

6. **Results of Analysis**

From the six study areas, analysis of water, sediment and fish samples were carried out. The study indicates the presence of residual organochlorine pesticides. As expected, the levels of the organochlorine components present were in the order:

fish > sediment > water, consistent with the accumulation capacity of the media.

Since most of the organochlorine components, except DDT, which is used only under strict conditions for vector control, are no longer used or have been banned, the presence of these compounds in the samples analysed indicates:

- the persistent and accumulative nature of organochlorine components;
- the possibility of illegal usage of the organochlorine components by farmers;
- the possibility of transport of organochlorine components from other areas;
- a wider scope of monitoring all over the country is required as this study was very limited due to constraints.

Sediments analysed from all the six areas indicate that the sites were not contaminated with Polychlorinated biphenyls or if present, the levels are extremely low.

As the main source of dioxin and furans are incinerators the problem may not be that significant as most of the wastes in Malaysia are sent to landfills.

7. **National Action Plan**

A comprehensive system on the control of Pesticides by the Pesticides Board exists in the country. The only chemical of concern is DDT, which is imported and used under very strict conditions. To control industrial chemicals in the country, a comprehensive legislation is already in the pipeline. Meanwhile, the Prohibition of Import Order under the Customs Act 1967 has been effectively used to control imports. Hence, PCBs are already banned from being imported into the country. There is also a tight control over the setting-up of incinerators and all incinerators have to be licensed by the Department of Environment. But the monitoring of dioxins and furans is still an area of interest for the future.

8. **Conclusion**

Malaysia's commitment with regards to the issue of Persistent Organic Pollutants (POPs) is evident from the initiative it has taken. Though it was not an extensive and detailed study covering every aspect and area of concern of POPs due to limited resources, it was however, a major step towards the reduction and elimination of POPs in the country. This limited study can be regarded as a mini profile of the status of POPs in the country. However, it also exposes the limitations of a developing country like Malaysia and clearly emphasizes the fact that there is a need for financial and technical assistance to developing countries in their efforts to reduce or eliminate this problem of POPs, which affect both health and the environment.

37. Pesticides Industry in India: POPs, DDT and Malaria

by Mr. J. Singh

India occupies a prominent position among the Asian countries in the field of pesticides after Japan. The total installed capacity of Technical Pesticides in the country is around 1,42,000 MT and production achieved is around 90,000 MT.

Generally the use of pesticides can cause adverse effects on human health and the natural environment. Every pesticide manufacturing unit need to register with Central Insecticide Board. The objective of the registration is to ensure that the pesticides are effective and efficient and will not harm the consumers and the natural environment. Thus the goal of registration is to provide adequate protection to the society from adverse effect of the use of pesticides. The decision to restrict or ban a particular product is made after toxicity is assessed and the availability of less toxic and economically comparable substitutes is evaluated.

In 1968, Govt. Enacted Insecticides Act, 1968. The main objective of the Act is to regulate import, manufacture, sale, transport, distribution and use of insecticides with a view to prevent risk to human beings and animals etc. The act along with the rules framed under this Act in 1971 were implemented from August 1971. Various regulatory provisions made in the act include compulsory registration of pesticide at the Central level, issue of licence for manufacture/formulation.

Apart from safety standards in pesticide manufacture, the quality and safety assurance is also sought to be provided by the Prevention of Food Adulteration Act, 1956 and the Insecticide Act, 1968. The total quality parameters of pesticides of their formulations are prescribed under the Insecticides Act, 1968.

As regards enforcement of quality of pesticides produced in the country, both in-house quality assurance programme, in the industry and govt. Testing under the Insecticide Act. 1968 are being undertaken. There are 40 Pesticides Testing labs in the states, having a total capacity of analysing about 50,000 sample annually. Testing for quality is also being carried out by private testing houses. Bureau of Indian Standards has not only formulated nearly 250 analytical standards for pesticides so far, but also operates and comprehensive voluntary “BIS Mark Certificate Scheme” for quality assurance. Pesticides formulators also utilize BIS mark certificate system to ensure quality products for the users.

<u>Production of Pesticides</u>:

The production of pesticides in India for the last for years is an under:

Year	Quantity (in MT)
1994-95	88,890
1995-96	92,750
1996-97	92,000
1997-98	80,500

Export and Import of Pesticides:

The FOB value of Export and the CIF value of import of various Pesticides from India for the period 1994-95 to 1997-98 are as follows:

Year	FOB Value of Export (In Million Rs)	C.I.F. value of Import (In Million Rs)
1994-95	2665	56.9
1995-96	5160	62.5
1996-97	7104	96.9
1997-98	6788	98.3

Major Pesticides of export include quinalphos, endosulfan, cypermethrin, malathion, aluminium phosphide, isoproturon etc. The Pesticides are exported mainly to France, UAE, UK, Australia, Japan, Korea, Malaysia, Russia, Netherland, USA, Germany, Nepal, Bangladesh, Indonesia, Iraq, Poland, Belgium, China, Mexico, Philippines, Argentina etc.

Major pesticides of import include Parathion, Methyl, Thriam (Tetramethyl disulphide), methyl bromide, cypermethrin etc.

The pesticides permitted by different countries is often at variance because of different agro-climatic conditions and pest problems. 40 pesticides which have been banned/severely restricted in some countries are registered for use in India (Annexure I). The Govt. of India has banned 20 pesticides and placed restriction for use on 10 pesticides (Annexure II and Annexure III). 18 pesticides have been refused for registration by the Registration Committee. 29 pesticides are under review by the expert committee constituted by the Govt. of India. The production of 18 major pesticides which have been banned/severely restricted in some of the countries, but being used in India (Annexure IV). The list of Insecticides for use in India under section 9(3) of the Insecticides Act, 1968 as per Annexure V.

Persistent Organic Pollutants:

With a view to protect human health and the environment, arising out of 12 Persistent Organic Pollutants, the UNEP proposal on international action including a Globally Legally Binding Instrument so that risks to human health and environment is mitigated. These 12 chemicals are as under:

1. Aldrin
2. Chlordane
3. Dieldrin
4. Dioxins (PCDDs)
5. DDT
6. Endrin
7. Furans (PCDFs)
8. Heptachlor
9. Hexachlorobenzene
10. Mirex
11. Plychlorinated biphenyls (PCBs)
12. Toxaphene

Out of these 12 declared POPs, 6 POPs viz. Aldrin, Chlordane, Endrin, Heptachlor, HCB and Toxaphene are banned for use in India and are not produced. The use of Dieldrin and DDT is restricted. Use of DDT has been banned for agriculture purpose, but is used for only health programmes. Mirex is used as fire retardant in fire-proof garments and is not being produced. Dioxins and furans are emissions of chemical industry causing pollution problems in industrial pockets across the country. Manufacture of PCBs has been banned in country and are included PIC procedures.

A scientific criteria need to be laid down for inclusion of future candidates in the POP list.

Polychlorinated Biphenyls

Polychlorinated Biphenyls (PCBs) are recognised as a Health and environmental toxin. These are mixtures of chlorine substitute biphenyl compounds, with the formula $C_{12}H_{10-n}Cl_n$(n=1 to 10).

PCBs found immense applications due to some of the important characteristics such as thermal stability, resistance to oxidation, resistance to degradation by acid, bases or biological species, solubility in oil/fat, insolubility in water, low flammability, excellent dielectric properties. The above properties improve with the increase in chlorine content of PCBs are used as heat transfer fluid, plasticizer in paints, flame retardants, adhesive, lubricating oils, carbonless copy paper. The main uses of PCBs are in Transformers and capacitors, which consume approximately half of the production due to excellent stability and dielectric properties.

PCBs have been used commercially since 1930 and the consumption increased upto 1970. Approximately 1 million tons of PCBs were manufactured all over the world. The production deceased after 1970 due to govt. restrictions.

Transformers used more heavily chlorinated PCBs in combination with trichloro and tetrachloro benzenes.

The long term stability of PCBs had lead to their wide spread distribution in almost all types of environmental samples. In the environment, degradation of PCBs is very slow. PCBs with less than four chlorine atoms are slowly biodegraded, however, higher substituted PCBs are little degraded. PCBs have very high tendency to bioaccumulate with slow rate of degradation and low rates of elimination from organisms. PCBs contain impurities such as polychlorinated dibenzofuams (PCDFs) and chlorinated naphthalenes, known to have toxic effects. PCBs have been reported to cause mutation in plants, decline in some bird population and reduced the reproduction in sea mammals. Health effects in human include skin and eye irritation, chloracne, liver damage, reduced immune response, reduced fertility and cancer. This necessitates for the national and international efforts for better management of PCBs.

PCBs are now not being produced in India and import is also restricted through compulsory import licence.

DDT & Malaria Eradication Programme

DDT was first synthesized in 1874 but its insecticidal properties were discovered in 1939. Its uses were popular because of low cost, broad spectrum activity, lengthy persistence and safety to human and domestic animals. Other organo chlorine insecticides like Lindane, Toxaphene, Chlordam, Heptachlor, Aldrin, Diealdrin and Endrin were developed during the decade after world war II and dominated the market during 1945-1965.

DDT and Analogues:

DDT or Dichlorodiphenyl-trichloro-ethane is 1,1,1,-trichloro-2,2 bis (4-chlorophenyl) ethane having MP 109^{o}C. It is insoluble in water and soluble in kerosene and fuel oil and xylene. The rat LD_{50} Values for DDT are 113, 118 oral and 2510 (dermal) mg/kgm.

Mode of Action:

DDT and its analogues specifically affect the peripheral sense organ of insects resulting in hyperactivity, convulsion and paralysis. Death of insects results from metabolic exhaustion and the products of an endogenous neurotoxin. DDT also gets absorbed through the insect cuticle and penetrates to the nerve tissue.

Environmental:

Residues of DDT applied to indoor locations remain effective for a long period upto one year. Its insolubility in water, low vapour pressure and high stability has resulted in many environmental problems e.g. persistence in soil for a number of years, a half life of 2.5 to 10 years, bioaccumulation from water to fish and transport through food chains. However, in tropical conditions like India, half life may be much less.

Status of DDT in India

DDT is being produced in India by only one unit M/s Hindustan Insecticides Limited having installed capacity of 6900 MT. Their past production of DDT (Technical) is as under:

Year	Production
1993-94	5961 MT
1994-95	4251 MT
1995-96	6016 MT
1996-97	4147 MT
1997-98	4214 MT
1998-99 (upto Jan.)	2890 MT

In India, its use is banned for agricultural purposes since 1989. However it is allowed for public health programmes for eradication of Malaria. A ceiling of 10,000 MT of DDT consumption has been fixed for use in public health, however the actual consumption is much less than this limit. It is a fact that spraying of DDT has prevented malaria epidemics in India. DDT is observed to be the cheapest insecticide. The other substitute namely Malathion is four times more expensive and certain mosquitoes (Anopheles culcifacies) have developed resistance against malathion. Latest development is use of bed nets treated with synthetic Pyrethriod, which is non-toxic and biodegeradable and do not accumulate in nature as DDT. This strategy is now being introduced in phases in malaria control by the NMEP. Thus there is already an effort to replace DDT by other methods. Trials are also on to control mosquito breeding with biolarvicides. Research is continuing for developing integrated methods of malaria control to reduce insecticides application.

Annexure I

LIST OF PESTICIDES BANNED

S.No.	Name of the Pesticide
1.	Aldrin
2.	BHC
3.	Calcium Cyanide
4.	Chlordane
5.	Copper Acetoarsenite
6.	Dibromochloropropane (DBCP)
7.	Endrin
8.	Ethyl Mercury Chloride
9.	Ethyl Parathion
10.	Heptachlor
11.	Menazon
*12.	Nicotine Sulphate
12.	Nitrofen
13.	Paraquate dimethyl sulphate
14.	Pentachloro nitrobenzene (PCNB)
15.	Pentachlorophenol (PCP)
*17	Phenyl Mercury Acetate (PMA)
18.	Sodium Methane Arsonate (MSMA)
19.	Tetradifon
20.	Toxaphene

* These pesticides are manufactured in India for export purposes only.

Annexure II

LIST OF RESTRICTED PESTICIDES

S.No.	Name of the Pesticide
1.	Aluminium phosphide
2.	Chlorobenzilate
3.	Captafol
4.	DDT
5.	Dieldrin
6.	Ethylene dibromide (EDB)
7.	Methyl bromide
8.	Sodium cyanide
9.	Lindane
10.	Methyl Parathion

Annexure III

PESTICIDES REFUSED REGISTRATION

S.No.	Name of the Pesticide
1.	Ammonium Sulphonate
2.	Azinophos Ethyl
3.	Azinophos Methyl
4.	Binapacryl
5.	Calcium Arsenate
6.	Carbophenthion
7.	Chinomethionate (Morestan)
8.	Dicrotophos
9.	EPN
10.	Fentin Acetate
11.	Fentin Hydroxide
12.	Lead Arsenate
13.	Leptophos (Phosvel)
14.	Mephosfolan
15.	Mevinphos (Phosdrin)
16.	2,4,5-T
17.	Thiodemeton/Disulfoton
18.	Vamidothion

Annexure IV

LIST OF PESTICIDES UNDER REVIEW BY THE EXPERT GROUP

A. Pesticides not Yet reviewed

1. Carbofuran
2. Malathion
3. Maleic Hydrazide
4. Methoxy Ethyl Mercury Chloride (MEMC)
5. Pretilachlor
6. Thiram
7. Trichloro Acetic Acid
8. Tridemorph

B. Pesticides under restricted use

1. Aluminium Phosphide
2. Captafol
3. Arbaryl
4. Chlorobenzilate
5. DDT
6. Dieldrin
7. Ethylene Dibramide (EDB)
8. Lindane
9. Methyl bromide
10. Methyl Parathion
11. Sodium cyanide

C. Fresh review:

1. Aldicarb
2. Captan
3. Dicofol
4. Dimethoate
5. Endosulfan
6. Paraquat Dichloride
7. Phorate
8. Zinc Phosphide
9. 2,4-D

Annexure V

LIST OF INSECTICIDES FOR USE IN INDIA UNDER STCTION 9(3) OF THE INSECTICIDES ACT, 1968

S.No.	Name of the Insecticides
1.	Acephate
2.	Alachlor
3.	Aldicarb
4.	Allethrin
5.	Alphanaphthyl Acetic Acid
6.	Aluminium Phosphide
7.	Anilofos
8.	Atrazine
9.	Alphacypermethrin
10.	Aureofungin
11.	Bacilus thuringiensis (B.t)
12.	Barium Carbonate
13.	Benthiocarb (Thiobencarb)
14.	Benomyl
15.	Bitertanol
16.	Bromadiolone
17.	Butachor
18.	Captafol
19.	Captan
20.	Cartap Hydrochloride
21.	Carbaryl
22.	Carbendazim
23.	Carbofuran
24.	Carboxin
25.	Chlorbenzilate
26.	Chlorfenvinphos
27.	Chlormequat chloride (CCC)
28.	Chlorothalonil
29.	Chlorpyriphos
30.	Copper Oxychloride
31.	Copper Sulphate
32.	Coumachlor
33.	Coumatetralyl
34.	Cuprous Oxide
35.	Cyfluthrin
36.	Cypermethrin
37.	Dalapon
38.	Decamethrin (Deltamethrin)
39.	Dichloro Diphenyl Trichloroethane (DDT)
40.	Dichloropropene and Dichloropropanes mixture (DD Mixture)
41.	Dichlorvos (DDVP)
42.	Dicofol
43.	Diflubenzuron
44.	Dimethoate
45.	Dinocap
46.	Dithianon
47.	Diuron
48.	Dodine
49.	Diazinon
50.	Dieldrin
51.	d-trans allethrin
52.	2,4 Dichlorophenoxy Acetic Acid (2,4-D Sodium amine and Ester Salts)
53.	Ethylene Dibromide and Carbon Tetrachloride mixture (EDCT mixture 3:1)
54.	Edifenphos
55.	Endosulfan
56.	Ethofenprox (Etofenprox)
57.	Ethephon
58.	Ethylene Dibromide (EDB)
59.	Ethion
60.	Fenitrothion
61.	Fenarimol
62.	Fenobucarb (BPMC)
63.	Fenthion
64.	Fenvalerate
65.	Ferbam

S.No.	Name of the Insecticides
66.	Fluchloralin
67.	Fluvalinate
68.	Formothion
69.	Fosetyl-Al
70.	Gibberellic Acid
71.	Glyphosate
72.	Hexaconazole
73.	Iprodione
74.	Isoproturon
75.	Kitazin (Indole-3-butyric Acid)
76.	Lamdacyahalothrin
77.	Lime Sulphur
78.	Lindane (Gamma BHC)
79.	Malathion
80.	Maleic Hydrazide (MH)
81.	Mancozeb
82.	Metaldehyde
83.	Methabenzthiazuron
84.	Methoxy Ethyl Mercury Chloride (MCPA)
85.	Methyl Bromide
86.	Methyl Chlorophenoxy Acetic Acid (MCPA)
87.	Metalaxyl
88.	Metoxuron
89.	Methomyl
90.	Metolachlor
91.	Metribuzin
92.	Monocrotophos
93.	Myclobutanil
94.	Methyl Parathion
95.	Neem Products
96.	Nickle Chloride
97.	Oxidazon
98.	Oxycarboxin
99.	Oxyfluorfen
100.	Oxyfluorfen
101.	Paradichlorobenzene
102.	Paraquat dichloride
103.	Penconazole
104.	Pendimethalin
105.	Permethrin

S.No.	Name of the Insecticides
106.	Phenthoate
107.	Phorate
108.	Phosalone
109.	Phosphamidon
110.	Prallethrin
111.	Pretilachlor
112.	Pirimiphos-Methyl
113.	Profenofos
114.	Propanil
115.	Propetamphos
116.	Propiconazole
117.	Propoxur
118.	Pyrethrins (Pyrethrum)
119.	Quinalphos
120.	Simazine
121.	Sirmate
122.	Sodium Cyanide
123.	Streptocycline (Streptomycin)
124.	Sulphur
125.	Temephos
126.	Triadimefon
127.	Triallate
128.	Triazophos
129.	Trichlorfon
130.	Tricyclazole
131.	Tridemorph
132.	Trifluralin
133.	Thimeton
134.	Thiram
135.	Thiophanate Methyl
136.	Trichloro Acetic Acid (TCA)
137.	Validamycin
138.	Warfarin
139.	Zinc Posphide
140.	Zineb
141.	Ziram

38. A Preliminary Study on Pesticide Contamination in Inlay Lake Environment of Myanmar

by Mr. U Than Aye

Abstract

In Inlay lake, agriculture is one of the major source of in- come for the residents. The traditional practice, growing crops on man- made floating island in the water, makes inevitable for direct contamination of pesticides to the water its environment. In this study the samples of water, water weed and under- water soil were taken from villages of agriculture and non- agriculture profession, streams flowing into the lake and main body water to survey the residu levels being contaminated. Some samples of agricultural crops grown on the floating islands and on the land were also taken to analyze the residues. The environmental samples were found to be contaminated with organo-chlorine pesticides. The levels of contamination in samples from agricultural sites are found to be higher than those of non-agricultural areas. Also in groundnut samples grown on the land in the lake, Organo- chlorine residues are detected. It is assumed that the possibility of the food contamination could be derived from the environmental source.

A Preliminary Study on Pesticide Contamination in Inlay Lake Environment of Myanmar

by Than Aye [1] , Mu Mu Aye [2]

Background

Looking at the average consumption of pesticide products for the past ten years until 1996, the annual consumption is about 1000 MT of formulated products in the country. The agricultural use contributes over 90% of those and the other for vector control purpose. However, a sharply increasing trend of pesticide use can be seen or the last two-three years together with the change of economic policy towards the market-oriented system. Many private organizations are looking for opportunities of importing, marketing, distribution, and formulating of agro-chemicals in Myanmar. By now, the number of formulated products approved to be used legally in the country by the Pesticide Registration Board (government authorities) of Myanmar has reached 341.

Inspite of the low pesticide use in the past, the country encountered some environmental problems, which could not be less emphasized. The one which has extended to practical study is the determination of residue levels in Inlay Lake environment, a beautiful natural resource endowed with opportunities for residents to grow vegetables, high income cash crops, on man-made beds floating in the water so called floating-islands locally. The misfortune taken place from this unique agricultural practice is the direct contamination of the water and the related environmental compartment with the pesticides. The Pesticides can move from one environmental compartment to another. Soil adsorption, plant up-take of the residues from the soil, partition of adsorbed pesticides from the sediment to the water system, underground water contamination by leaching, have been evident from various studies using simulated eco-systems. (REF 1, 2, 3)

Pesticides used for many years in the area include organo-chlorines, which are notorious for their persistency for many years and their lipophilic property, which in combination, lead to well-known 'food-chain effect of the residues and to major role of contaminant (among pesticides) to the environment. Some farmers frankly admitted that they are still using, for instance, Aldrin, without having proper knowledge of the hazard.

In this study the authors tried to provide the scientific evidence of pesticide contamination in the Inlay environment by studying residues levels in the water, water weed and sediment/under-water soil samples taken from the area. An attempt is also made to compare residue levels in agricultural and non-agricultural zones of the region.

MATERIAL AND METHOD

Sampling sites

The sampling sites were chosen among the villages where the agriculture is major earning, villages with little or no agricultural practice, streams flowing into the lake from the surrounding mountains and from the main water-body of the lake of Inlay region as follows.

[1] Deputy General Manager, Plant Protection Division, Myanma Agriculture Service, Yangon.
[2] Assistant Supervisor, Pesticide Analytical Laboratory, Plant Protection Division, Myanma Agriculture Service, Yangon.

(1)	Agricultural villages	3 sites
(2)	Non-agricultural villages	4 sites
(3)	Water samples from streams flowing into the Lake	5 sites
(4)	Water samples from main water body	3 sites
(5)	Agricultural crops	9 samples

Sampling sites were selected with an attention to have a good coverage of the region and the sites are illustrated on the Inlay map in annex I.

Sample of water weeds, sediment/under- water soil, water and agricultural crops were taken according to the following methods.

SAMPLING METHODS

1. Water weed
   - Water weeds samples were taken from several places by using poles and locally devised scuppers to obtain weeds under-water.
   - Sub-samples from several places were taken to make about 1 kg wet weight composite sample.
   - Samples were placed in polyethylene bags and kept in cold storage (about 10°C) before shipment.

2. Sediment /Under-water soil
   - Soil samples were taken from the under-water part of the floating islands or from the bottom of the lake by locally made scuppers.
   - sub-samples were taken from several places to make about 2 kg wet weight composite sample.
   - Samples were placed in polyethylene bags, stored at about 10°C before shipment.

3. Water
   - To obtain integrated depth samples, sampling bottle was tied on a pole and dip to a depth and steadily taken up to surface to fill just about 2/3 or 3/4 of the bottle.
   - Sub-samples were taken from several places to make about 2 lit.
   - Samples were filled in glass bottles with polyethylene caps.
   - samples were stored at about 10°C before transfer.

4. Vegetables
   - Vegetables were collected from farming sites or from the market.
   - Composite sample about 1 kg was made from several sub- samples.
   - The samples were placed into polyethylene bags and stored at about 10°C before shipment.

All the samples were transferred to the Pesticide Analytical Laboratory in 2 days and stored at -20°C before analysis.

Analysis

Analytical methods used for different sample matrix are presented briefly below.

1. Water weeds

The samples were thawed and chopped. Residues were extracted by using ethylacetate and Ultra Turrex homogenizer. Activated charcoal and neutral alumina mini column clean- up was carried out after changing the solvent to cyclo-hexane.

2. Sediment /Under-water soil

Residues were extracted using n- Hexane : Acetone (9:1) in Soxhlet Extractor for three hours then the clean-up was carried out on a activated charcoal + neutral alumina chromatographic column using n-hexane as an eluting solvent.

3. Water

Residue was partitioned to chloroform and neutral alumina clean-up was carried out.

4. Non-fatty Vegetables

Ultraturrax extraction was carried out using ethylacetate and co-extracts were removed by neutral alumina clean- up.

4(a). Groundnut

Samples were mixed with florisil to make free flowing powder then on column extraction was carried out using n-Hexane: Dichloromethane (4:1) as extracting solvent. Neutral alumina chromatographic column clean- up was carried out using n-hexane equilibrated with neutral alumina as eluting solvent.

<u>Gas Chromatography Parameters</u>

All concentrated extracts of cleaned up samples were injected into the GC (Perkin Elmer Sigma 300) with Ni^{63} Electron Capture Detector using the following parameters.

Injector temperature: 220°C	
Column temperature: 215°C	
Detector temperature: 300°C	
Carrier and detector purge Gas:	N_2 (20 ml/min. for column and 50 ml/min. for the purge gas)
Column :	2mm ID glass column packed with mixed phase (1.5% OV17 + 1.95% OV202)

Confirmation

The residues were confirmed on columns of two different polarity (OV 1 and OV 225) and the chromatograms are illustrated in figure 1 and 2.

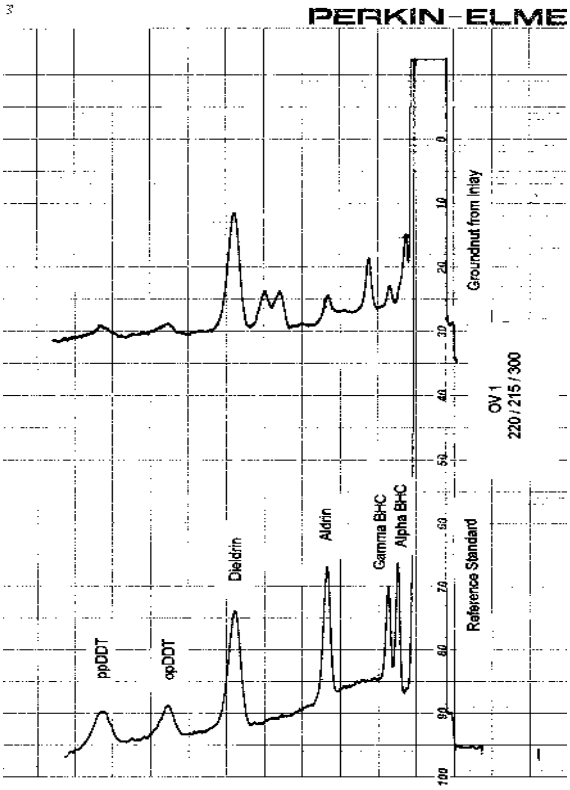

Figure 1. Chromatograms of residues detected in the groundnut sample from Inlay Lake compared with the Standard reference on a non-polar column, OV1 .

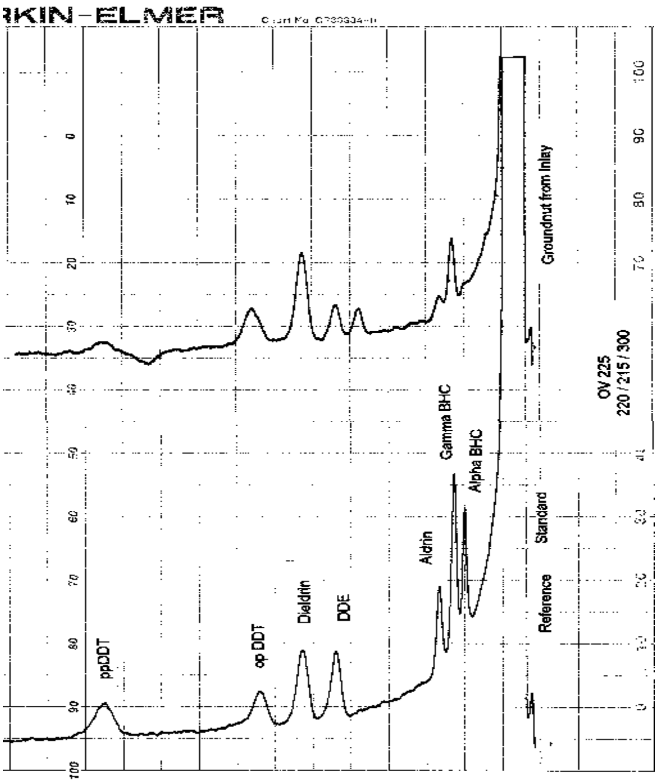

Figure 2. Chromatograms of residues detected in the groundnut sample from Inlay Lake compared with the Standard reference on a polar column, OV 225.

The relative retention times of the pesticides on the two different columns are listed in table 1 below.

Table 1. The Relative Retention Time of the Pesticides on columns of different polarity.

Pesticide	Mixed Phase	OV 1	OV 225
Alpha BHC	0.5	0.37	0.73
Gamma BHC	0.64	0.46	0.86
Aldrin	1.00	1.00	1.00
DDE	2.03	1.75	2.23
Dieldrin	2.22	1.75	2.64
op'DDT	2.83	2.29	3.14
pp'DDT	3.66	2.8	4.96

Recovery Studies

Recovery studies of residues were carried out with fortified pesticides for the three types of sample, the recovery percentage of residues at the relevant fortified levels are given below.

Sample	Pesticide	Fortified level (mg/ kg)	Recovery %	Limit of Determination (mg/ kg)
Water weed	Aldrin	0.02	112%	0.003
	DDE	0.05	101%	0.003
Sediment and under water soil	Aldrin	0.02	72%	0.002
	DDE	0.05	97%	0.002
Water	Aldrin	104.3 μg/L	86%	0.0002
	DDE	209.2 μg/L	109%	0.0002

Result and Discussion

Number of samples taken from agricultural area, non- agricultural area, streams and main water body and agricultural crops are listed in table 2 together with the major residue levels detected.

Table 2. Number of Environmental samples analyzed and the levels of pesticide residues detected.

	No: of samples analyzed	No: of samples contaminated	Residue levels detected
Agriculture area			
Water weed	3	1	Aldrin 0.05 mg/kg
Bottom sediment/ under water soil	3	3	Aldrin 0.02-0.04 mg/kg Dieldrin 0.01- 0.02 mg/kg
Water (from between cropping beds)	3	2	Aldrin 0.0002 mg/l
Water (used for drinking)	4	0	
Non-Agriculture area			
Water weed	4	1	Aldrin 0.008 mg/kg
Bottom sediment/ under water soil	4	3	Dieldrin 0.004-0.01 mg/kg DDE 0.004-0.01 mg/kg TDE 0.01 mg/kg
Water (used for drinking)	4	0	

From streams & main water body			
from 5 streams	10	0	
main water body	3	1	Aldrin 0.0005 mg/l
Agricultural crops			
Vegetables	6	0	
Ground nut	3	2	Aldrin + Dieldrin 0.04 - 0.39 mg/kg
Potato	1	0	
	48		

Chromatograms of detected residues in one of under-water soil samples and one of water weed samples are presented in figure 3 and 4.

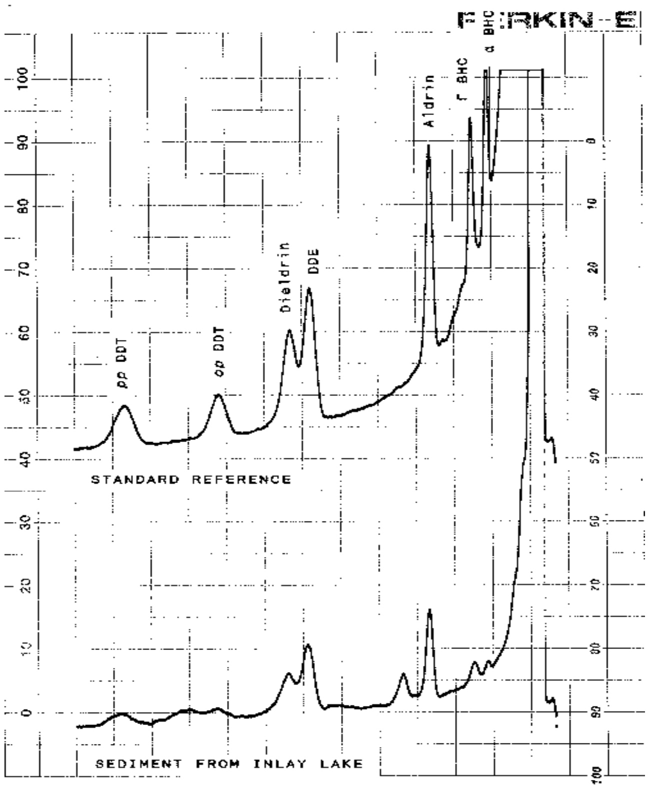

Figure 3. Chromatograms of residues in under-water soil sample compared with analytical standard reference.

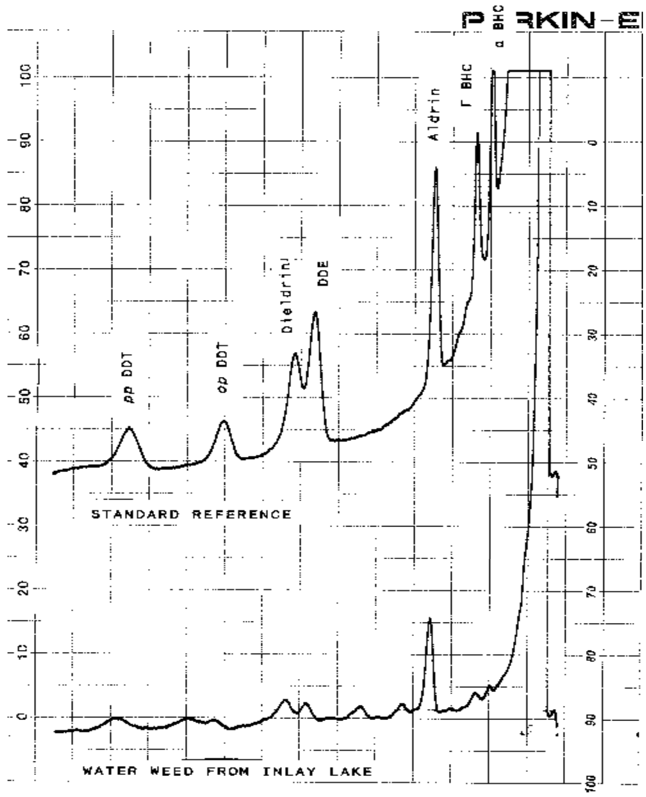

Figure 4. Chromatograms of residues in water weed sample compared with analytical standard reference.

In summary, organo-chlorine residues were detected in many samples both in agriculture and non- agriculture areas. Sediment/ under- water soil in agriculture areas seems to have higher level of contamination of Aldrin. Drinking water is taken traditionally from specified areas in the lake, far from residential & agricultural areas. Fortunately, the area seems not to be contaminated.

Aldrin was used to control soil-inhibiting insects on the floating agricultural beds for many years. DDT was also used but less in amount than that of Aldrin. Some illegal pesticides formulated with DDT related compounds are still available in the market. The cool ambient temperature, minimum 7.5°C to maximum 35°C on average year, with the pH of the water around 6.5 to 7.0, favours the stability of the compounds.

No organo-chlorine residues were detected in vegetable samples (Tomato, Cauliflower, Bitter gourd, Bean), nevertheless the number of samples studied was very small. It was very interesting to see that Aldrin and its derivative dieldrin is detected in an oil crop, groundnut. The acceptable level of Aldrin and Dieldrin in groundnut is not listed in Codex Alimentarius Extraneous Maximum Residue Limits (EMRLs). (REF 4). (This means that the sum of the two residue levels in groundnut should be less than 0.01 mg/kg.)

Out of the three groundnut samples analyzed, the two in which Aldrin and Dieldrin residues were detected, were taken from the same planting site for two different crop growing years. It was informed that the farmer did not use the pesticides. The possibility of this food contamination is deemed to arise from environmental contamination source, i.e. the plant may have taken up the residues from the soil, eventually the lipophilic chemical accumulated and become concentrated in oily portion of the plant.

Recommendation

The use of aldrin, dieldrin and endrins should be totally eliminated in the country by legal means as well as through extensive educational programs to the public.

Alternative chemicals or other measures should be looked for pest control programme to be used in areas of closed ecosystem such as Inlay.

The pesticide law enforcement, such as prohibiting the use of Persistent Organic Pollutant pesticides, should be strengthened with an interest not only to protect the environment from being contaminated with such hazardous chemicals but also to ensure food safety.

Acknowledgment

The authors have greatly indebted to the technical staff of Pesticide Analytical Laboratory (PAL) especially to Daw Mu Mu Aye and Daw Thida Than those who have carried out the analysis with long patience and interest, and to U Khin Maung Latt who has undertaken the painstaking task of sampling and transportation of them. The outcome of this report could not be completed without the keen interest and kind co-operation of personnels from Ministry of Health at various levels, participated in the project.

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39. Management of POPs in Myanmar

by Ms. Daw Kyi Kyi Myint

Introduction

Myanmar is situated on the mainland of Southeast Asia and has a total land area of 676,577 sq.km. Thailand and Laos lie to the east of Myanmar, Bangladesh and India to the west and north-west and China to the north-east. It is bounded in the south-west and south by the Bay of Bengal and the Andaman Sea. It has a total coastline of 2276 km.

Myanmar is basically an agricultural country with about 76 per cent of the population residing in rural areas. The agriculture sector provides about 65 per cent of the total labour force and contributes 40 per cent of GDP and 47 per cent of total foreign export earnings. The total population in 1997-98 is estimated at 46.40 millions with an average growth rate of 1.88 per cent. At this rate the population if unchecked, is expected to reach 50 million by the year 2000.

The use of pesticides has increased in recent years because of the growth in population, the expansion of cultivated areas and the introduction of double and multi cropping system. In 1992-93, the pesticide consumption in Myanmar was about 350 MT and it gradually increased year by year till the current use amounts to approximately 1000 MT as shown in Table 1.

The information regarding the use of PCBs, Dioxins and furans in the industries is not available.

Managing POPs Pesticides

The Government has set up the Pesticides Registration Board (PRB) which is the highest authority for banning and limiting registration of pesticides to be used in the country. The PRB has been constituted with representatives from the Ministry of Agriculture and Irrigation, Ministry of Health, Ministry of Commerce, Ministry of Forestry and Ministry of Livestock and Fisheries as attached in Table 2. Pesticide technical sub-committee and bio efficacy sub-committee have been formed under the PRB to recommend registration requirements. Pesticide Analytical laboratory has also been established under Myanmar Agriculture Service, Ministry of Agriculture and Irrigation to monitor pesticide residues in food mainly and also for survey of some residue in the environment. So far 341 pesticides have already been approved for registrations in Myanmar. The list of restricted pesticides are shown in Table 3 and banned pesticides are presented in Table 4.

Pesticide Production

There are two pesticide formulation plants in Myanmar. They are Neem Pesticide Plant and Pesticide Formulation Plant. The neem pesticide is a natural plant protection product with great potential in bringing about cheap pest control without harmful effects on environment. The pesticide production is intended for domestic use and not for export.

Issues of POPs Pesticides

In Myanmar, there are two significant issues regarding environmentally sound management of POPs pesticides.

1. Natural resources contaminated by persistent pesticides and their effects on the food chain.

2. There is an illegal trade in pesticides especially in the border areas. These pesticides are used without proper knowledge and information on their impacts and effects. There is also a lack of control on the trade in pesticides.

Existing laws relating to control of toxic chemicals

The Government of Myanmar has enacted the Pesticide law in 1990. The Law monitors and controls the selection, storage, transportation and use of pesticides to protect people, crops, other biological entities and the environment.

The Factories Act 1951 controls factories involved with chemical, particularly hazardous or toxic chemicals.

The Union of Myanmar Public Health Law, 1972 also controls the toxic substances used as consumer products and some purposes for human health.

Future Programme

Myanmar has formulated the Myanmar Agenda 21 in 1997, which includes activities for toxic chemicals as follows:-

(a) To establish a modern computer-based National Register of potentially toxic chemicals containing data on toxic chemicals. It will be upgraded periodically assisting government agencies to make decision on toxic chemicals.

(b) To cooperate and coordinate with international bodies to obtain sufficient information and knowledge about environmental toxicity of chemicals, their assessment and risk reduction programmes.

(c) To strengthen the national capacity for identification of problems, assessment of hazards and risk, and improved management of toxic chemicals through effective and closer coordination with various departments.

(d) To enhance information exchange between countries producing toxic chemicals and those vulnerable to such imports.

(e) To eliminate illegal trafficking in toxic chemicals.

(f) To enhance public awareness of toxic chemicals through mass media.

(g) To promote safety training and education for the management of toxic chemicals.

(h) To enhance control of international and national traffic of chemicals and toxic substances, information exchange procedures on banned and regulated chemicals with other countries.

(i) To enhance laboratory facilities, technical support and monitoring programmes for toxic chemicals to address future environmental pollution problems.

Conclusion

Myanmar is in need of sound environmental management regarding POPs chemicals. At present people are unaware of negative impacts of pesticides. The Pesticide Law aims to protect the environment and human health. In order to effectively implement the Pesticide Law, there is a need for training, extension services to the local communities, and to strengthen the institutional capacity of the responsible department. The adoption of POPs Convention would enhance the national level and contribute to international cooperation in this important area.

Table 1. Pesticides Consumption in Myanmar

Year	Pesticides					Total (M-Tons)
	Insecticide	**Fungicide**	**Herbicide**	**Fumigants**	**Others**	

1992-93	327	7	10	-	3	347.0
1993-94	413	21	14	-	3	451.0
1994-95	593	29	11	3	85	721.0
1995-96	806	35	15	10	26	893.0
1996-97	928	21	57	4	86	1096.0
1997-98	822	87	48	5	23	985.0

Table 2. Members of the Pesticide Registration Board

1. Managing Director
   Myanma Agriculture Service — Chairman

2. Director General
   Department of Health — Member

3. Director General
   Liverstock Breeding and Veterinary
   Department — Member

4. Director General
   Fisheries Department — Member

5. Managing Director
   Myanmar Agricultural Produce
   Trading — Member

6. Director General
   Department of Forest — Member

7. Director General
   Directorate of Trade — Member

8. Director — Member
National Health Laboratory
Department of Health

9. General Manager — Member
Extension Division
Myanmar Agriculture Service

10. Deputy General Manager — Secretary
Plant Protection Division
Myanmar Agriculture Service

Table 3. Restricted Pesticides List in Myanmar

No.	Active Ingredient	Group
1.	Methyl Bromide	Fumigant
2.	Phosphine	Fumigant
3.	Bromadiolone	Coumarin
4.	Zinc Phosphide	Inorganic
5.	Brodifacoum	Coumarin
6.	Fenthion	Organo Phosphorus
7.	D. D. T	Organo Chlorine

Table 4. Banned Pesticides List in Myanmar

No.	Pesticides	Status	Remarks
1.	Aldrin	PIC Initial List	Carcinogenecity Bioaccumulation Hazard to Wild life Other Chronic effect
2.	BHC (=HCH isomer)	PIC Initial List	Oncogenecity
3.	Captafol	PIC Candidate	Oncogenicity Acute and Chronic Wild life effect
4.	Chlordane	PIC Initial List	Oncogenicity
5.	Chlordimeform	PIC Initial List	Oncogenicity
6.	Cyhexatin	PIC Initial List	Tetratogenicity
7.	Dieldrin	PIC Initial List	Carcinogenicity Bioaccumulation Hazard to wild life Other Chronic effect
8.	Dinoseb	PIC Initial List	Tetratogenicity Reproductive effect
9.	EDB	PIC Initial List	Oncogenicity Mutagenicity Reproductive effect
10.	Endrin	No longer produced	Oncogenicity Tetratogenicity Reduction and endangerde and Non-target species
11.	EPN		Neurotoxicity
12.	Inorganic Mercury Compounds	PIC Initial List	Hazard to aquatic organism Accute Toxicity
13.	Organic Mercury Compounds	PIC Initial List	Hazard to aquatic organism Accute Toxicity
14.	Parathion Ethyl	PIC Initail List	Accute Toxicity Toxic to aquatic organism
15.	Strobane	No longer produced	Oncogenicity
16.	2,4,5 - T	PIC Initial List	Oncogenicity Fetotoxicity
17.	Toxaphene	No longer produced	Oncogenicity Population reduction in non-target species. Acute toxicity to aquatic organism Chronic effects to wild life

40. Current Philippine Initiatives on Chemical Management and Emission Control

by E. Navaluna

I. Country Profile

The Philippines is composed of 7,100 islands with a total land area of 300,000 sq. km. The islands are further grouped into three geographic areas namely Luzon, Visayas and Mindanao. The population as of 1995 is 68 million with Metro Manila posting as the most populous area in the country.

The Philippine economy is still predominantly agricultural but the country is slowly moving towards industrialization. The Philippine industrial sector ranges from the basic food and beverage industry to the large-scale petroleum and coal industry. The Philippine chemical industry includes basic chemicals and intermediates; agricultural chemicals; oleochemicals; detergent and surfactant chemicals; surface coating chemicals; industrial and specially gases; plastics and polymers; specially and miscellaneous chemicals; and fabricated chemical products. The Philippines is basically a chemical-importing country.

With the current industrialization the country has been experiencing for the past twenty years, highly urbanized cities including the premiere metropolis, Metro Manila have been saddled with air quality problems. Just like any highly urbanized city in the world, air pollution has become a major concern in the Philippines. Based on the latest emission inventory conducted for Metro Manila, mobile sources (motor vehicle) emit the largest amount of carbon monoxide (CO), total organic gases (TOG) and nitrogen oxides (NOx), stationary sources (industry) contribute the most sulfur oxides and area sources (e.g. construction sites) generates most particulate matters.

II. Regulatory Control

A. Chemicals Management

The control and management of chemicals in the Philippines is covered by a number of laws and handled by different government agencies. There are basically three categories of chemicals presently controlled.

The *Bureau of Food and Drugs created under Republic Act No. 3720* is in charge with the enforcement of programs designed to ensure the safety and purity of foods, drugs, cosmetics and to regulate the labelling, manufacture, sale and distribution of household hazardous substances. The *Fertilizer and Pesticides Authority under Presidential Decree No. 1144* is mandated to regulate the importation, manufacture, formulation, repacking, distribution, delivery, sale, storage and use of pesticides, fertilizers and other agricultural chemicals. The *Department of Environment and Natural Resources (DENR) through Republic Act No. 6969 (Toxic Substances and Hazardous and Nuclear Wastes Control Act)* is directed to regulate industrial chemicals and other unregulated chemical substances.

The *Environmental Management Bureau (EMB)* is the lead agency of the DENR in the implementation of R.A. 6969. Through the EMB, the Implementing Rules and Regulations of the said

Act was formulated and issued and is known as the *DENR Administrative Order No. 29 (DAO 29)*. Title II of DAO 29 provides the implementing rules and regulations for the management of chemical substances. Main provisions of Title II provides for the creation of an inventory of existing chemicals, the establishment of the Priority Chemicals List, the screening of new chemical substances imported or manufactured in the country and the issuance of Chemical Control Orders which will regulate priority chemicals.

R.A. 6969 also creates an Inter-Agency Technical Advisory Council which is chaired by the DENR and composed of the Departments of Health, Science and Technology, Agriculture, National Defense, Finance, Trade and Industry, Foreign Affairs, Labour and Employment, the Philippine Nuclear Research Institute and one non-government organization as members.

Pursuant to Section 19 of DAO 29, the DENR is mandated to develop a list of priority chemicals called the *Priority Chemicals List (PCL*). The Philippine PCL is a list of chemicals that the DENR has determined to potentially pose unreasonable risk to public health and/or the environment. Special reporting requirements are imposed by the DENR to firms, which import, use or handle chemicals under the PCL. These reports will enable DENR to obtain the necessary information concerning priority chemicals and their uses.

Moreover, under Section 20 of DAO 29, the DENR may further screen the chemicals in the priority list and establish controls in the form of *Chemical Control Orders (CCOs).* CCOs are issued to prohibit, limit, or regulate the use, manufacture, import, export, transport, processing, storage and distribution of selected priority chemicals. The DENR may call for the strict regulation, phase-out or ban of these chemicals because of the serious risks they pose to public health and the environment. General framework for the issuance of CCOs may include a graduate phase-out plan that may apply to importation, exportation, manufacturing, distribution or industrial use; limitation of use which may be apply to product or materials, premise or industrial use; substitution to chemicals posing lesser risks; handling and management requirements and reporting and record-keeping requirements.

B. AIR EMISSION CONTROL

Air emission is basically regulated by two (2) laws, the *Presidential Decree No.1181 (Motor Vehicle Emission Control Law)* which regulates air pollution from mobile sources and the *Presidential Decree No. 984 (Pollution Control Law)* which regulates emission (both air and water) from industrial sources.

PD 1181 provides standards for carbon monoxide, hydrocarbon and particulate matters from motor vehicles while PD 984 provides emission standards for air pollutants such as oxides of sulfur (SOx), oxides of nitrogen (NOx), Total Suspended Particulate (TSP), Carbon Monoxide (CO) etc. from industrial sources as well as ambient air standards within the vicinity of industrial sources.

The DENR basically conducts air quality monitoring on air pollutants such carbon monoxide, particulate matters, sulfur oxides and nitrogen oxides where monitoring equipment and laboratory facilities already exists. At present, the DENR has still no capability for monitoring pollutants such as dioxin and furan.

III. CURRENT EFFORTS AND LIMITATIONS ON THE MANAGEMENT OF CHEMICALS AND EMISSION CONTROL

A. Regulatory Control Mechanism for Polychlorinated Biphenyl (PCB)

In September 1998, the DENR has issued DENR Administrative Order No.98-58, which places 28 chemicals in the PCL. The chemical compound Polychlorinated Biphenyls (PCB) is one of the 28 chemicals included in the said list. Further, PCB has been considered to be among other chemicals to be issued a CCO. A draft CCO has been developed which includes gradual phase-out plan, limitation of use, substitution handling and management requirements, report and record keeping requirements.

Current limitation and problems on the management of PCB include the following:

1. No established, reliable information on the inventory of PCB and PCB contaminated wastes;
2. Lack of local laboratory facilities to analyze potential PCB contaminated wastes;
3. Limited technical capability on the management of PCB and PCB contaminated wastes;
4. No local Treatment, Storage and Disposal (TSD) facilities that handles PCB wastes;

With the above problems and limitations, some PCB wastes generators have to contract the services of high temperature incinerator facilities abroad while others with limited financial resources are constrained to store their PCB wastes on-site until a more suitable treatment/disposal facility is available the country.

B. Control Initiatives for Dioxin and Furan Emission

With the increasing concerns on the emission of dioxins and furans, the EMB, in 1998, initiated the creation a Inter-agency Technical Committee to draft emission standards for dioxin and furan for new and existing Municipal Solid Wastes and Hospital/Medical/Infectious wastes incinerators. The Technical Committee evaluated standards from other countries but decided to recommend the adoption of US EPA standard as well as Method 23 (sampling and analysis of dioxin method) for the sampling procedures as similarly done in some ASEAN countries. As part of the procedure for issuing environmental standards, the draft dioxin and furan emission standards was presented in a public hearing where the following problems and concerns were raised:

1. The immediate implementation of Dioxin and Furan emission standards would mean that samples may have to be sent abroad where facilities and expertise exists which would entail huge cost;
2. The establishment of design criteria such as high temperature combustion, electrostatic operation, etc. may be more feasible;
4. Conduct of a combustion efficiency test was suggested specifically for the control of dioxins and furans.

The final formulation of emission standards for dioxin and furan will have to address the above issues. However with the anticipated enactment of a Clean Air Act this year (1999), emission standards for dioxin and furans may finally be set-up with the needed technical and financial support for its implementation.

41. Persistent Organic Pollutants (POPs) Management in the Philippines

by Ms. A. Pablo

INTRODUCTION

Persistent organic pollutants (POPs) is a complicated problem that requires an integrated and comprehensive management approach. In the Philippines, a large number of government agencies are involved both at the national and local levels. Major players are those that are responsible for labour and health; environment; agriculture and research institute of science and technology. Cooperative efforts among these agencies to address the issues on POPs partly offset the scarce human resources and facilities. This paper discusses management strategies currently being implemented. It will also give information on current issues of concern related to POPs, immediate management needs and available options initiated by Department of Science and Technology (DOST) that partly address POPs management.

TODAY'S SITUATION

❖ POLICIES ENFORCED

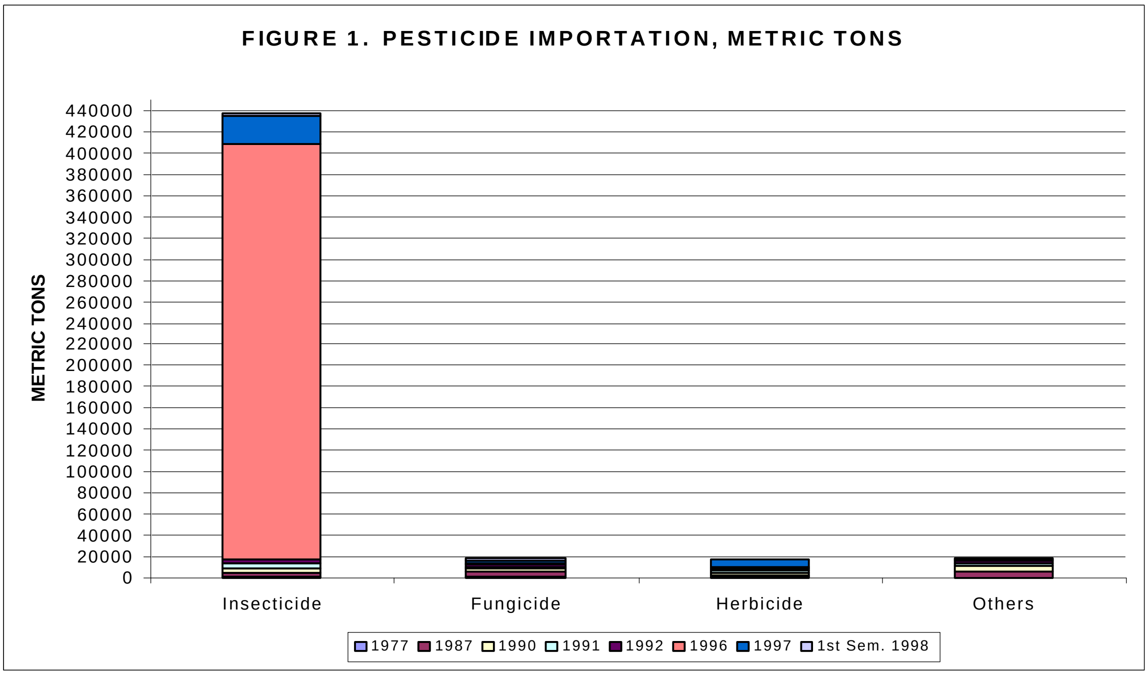
Both agricultural and industrial / commercial chemicals includes POPs. Department Agriculture regulates the former and the Department of Environment and Natural Resources the latter. Their functions are as follows:

- usual pre-importation notification, product registration, licensing of trade activities, prescribe standards to control and regulate use of POPs
- provide framework / guidelines for risk assessment new POPs

The Department of Environment and Natural Resources is presently intensifying registration of industrial facilities that are potential generators of hazardous waste including POPs. Table 1 shows major wastes generated as of 1st semester of 1998. For pesticide, Figure 1 shows the importation from 1977, 1987, 1990-1992 and 1996-1st semester of 1998. This is reported by the Fertilizer and Pesticide Authority (FPA) of the Department of Agriculture that control importation of pesticide in the country. Notice that insecticide dominates pesticide importation.

Table 1 Major Hazardous Waste Generated as of 1st Semester of 1998

Major Wastes	Quantity, MT	Source
Waste oil (some PCB contaminated)	1,329.385	Power generating plants and its substations
Solder dross	818.145	Semiconductor and electronics industry
Spent inorganic chemicals and solvent	187.685	Mixed sources



❖ TECHNICAL SUPPORT

National agencies such as research institutions and academe are partners of policy makers in the implementation of management guidelines. They are the following:

- provide research based information that aids in good policy decision making
- use of facilities, equipment and the conduct of laboratory analysis for monitoring and assessment of compliance to standards enforced

The Industrial Technology Development Institute (ITDI) of the DOST particularly conducts toxicity and assay test on new pesticides and other industrial chemicals being introduced in the market. The institute is also responsible for development, assess and / or appropriate treatment and disposal technologies. Table 2 shows research on pesticides and pest management in the Philippines while Table 3 show pesticide policies. Observe that research information on effect of insecticide use on rice economy is not significant had been available since 1979. But policy regulatory changes regarding such only took effect 1992. This only shows that research influence or impact on political decision making in the country is not as strong.

TABLE 2 RESEARCH ON PESTICIDES AND PEST MANAGEMENT IN THE PHILIPPINES

Health	Time	Economics / Environment
	1977	Organophosphates (OP) in harvestable cabbage
	1979	Insecticide use not economical on rice
Poisoning cases reported across country; prevalence estimates from hospital records.	1980	Brown Plant Hopper (BHP) resurgence from common insecticides; Organochlorine (OC) residues in plants, fish and vegetables
Misdiagnosis of pesticide poisoning frequent.	1985	Natural control is most profitable strategy in rice
Mortality impact due to occupational exposure to insecticides revealed; vegetable farmers more prone to poisoning than rice farmers	1987	Resistance, resurgence and toxicity to beneficial organisms, including fisheries
	1989	Insecticide residues in market-basket and farm samples
Evidence of chronic effects of pesticide use	1992	Insecticide residues in well-waters
	1993	Net benefits of pesticide use in rice are negative if externalities are taken into account; Potable water and groundwater suspected of residues.
	1994	Herbicides and molluscicides have no effect on yield

TABLE 3 POLICY ON PESTICIDES AND PEST MANAGEMENT IN THE PHILIPPINES

Pesticide Management	Time	Pesticides
Prophylactic use of chemicals recommended for rice	1972	Rice production programs linked government credit with agrochemicals
	1978	PD 1144 establishes Fertilizer and Pesticide Authority
	1980	Early bans on endrin and other compounds
IPM pronounced national crop protection policy	1986	Moratorium in registration of Category 1 pesticides
	1989	Ban on the Dirty Dozon/Restriction of endosulfan, organotin compounds
	1992	Ban on Category 1 insecticide; methyl parathion and azinphos ethyl; restriction on monocrotophos and endosulfan
IPM National Program implementation	1993	

❖ CURRENT PRACTICES

Industries generating POPs have limited options in management of their waste and are constrained to either store waste indefinitely or export to countries with available treatment and disposal facilities.

Consumers / Users of POPs chemicals especially farmers are unaware of its harmful health effects. Application of pesticide without protective clothing, improper storage and disposal resulted in poisoning and widespread contamination in the environment. Suppliers demonstrate indifference and are not responsible enough to dispose and retrieve pesticide containers.

CURRENT ISSUES OF CONCERN

❖ PESTICIDE POISONING

More than 8.5 million Filipinos are employed in agriculture in rural areas and pesticide use is widespread. Risk of pesticide poisoning episodes per year in the Philippines is large. Table 4 shows increase in health problems of farmers from exposure to pesticide.

Table 4 Increase in Health Problems of Farmers from Exposure to Pesticides

Health Problem	Increase in Rate of Illness / Symptoms from Pesticide Poisoning Range %
Eyes	22 - 36
Skin	12 – 50
Respiratory	15 – 45
Polyneuropathy	2 – 70
Gastrointestinal	18 – 87

Source: Rola and Pingali 1993

❖ UNDETERMINED EXTENT OF POPs ENVIRONMENTAL CONTAMINATION

This is due to lack of technical capability in assessing POPs such as technical expertise and appropriate laboratory facilities. Threat to biodiversity and marine resources destruction are attributed to POPs contamination but to what magnitude is uncertain. Massive conversion of farmlands to residential subdivisions with lack of information of the pesticide residues of the area as well as groundwater also is another problem that needs to be addressed. There are five (5) principal environmental exposure pathways identified by Environmental Health Services of the Department of Health that affects the national health status. Pesticide pathway is included and shown in Figure 2 below. Note that the pathway considers runoff waterways leading to fish sleds or habitat and should be address as it contaminates ecosystem that is vital for human sustenance and survival.

❖ **LACK OF UNDERSTANDING ON LONG-TERM HAZARDOUS EFFECTS**

This downgrade the management requirement as it only considers acute or immediate health effects and not the chronic and sub-chronic effects that are carcinogenic in nature.

❖ **LACK OF TREATMENT AND DISPOSAL OPTIONS**

This is demonstrated in the current practices adopted by industries and commercial establishment as discussed above. There are no disposal or treatment facility to readily accommodate large quantities and various types of industrial haz-waste. At present, continuous consolidation of data and information on type and quantity of haz-waste for preparation of Terms of Reference (TOR) for the conduct of feasibility study on the design, construction and operation of integrated Treatment, Storage and disposal (TSD) facility. A TSD infrastructure investment plan for consideration on Build-Operate-Transfer (BOT) scheme will be prepared to encourage private sector or investor's participation on hazardous waste management. As an option, DOST pilot study a small scale TSD facility that is currently handling and treatment hazardous laboratory waste. This will be discussed in detail on a later part of this report.

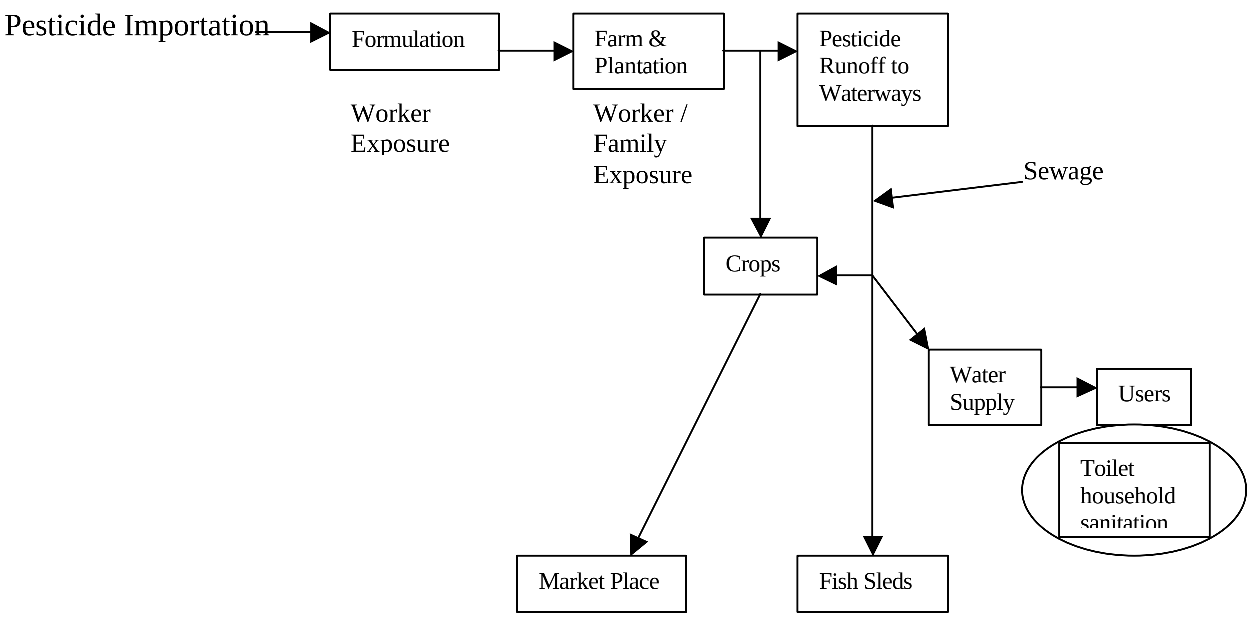


Figure 2 Pesticide Environmental Exposure Pathway

❖ **ILLEGAL CIRCULATION OF BANNED POPs PRODUCTS**

This maybe experienced by other developing countries. Assistance in international community on this issue is sought. Manufacturers of such products must be responsible and actively involved in retrieving and recalling of their products including countries where it is banned. Areas that prove to be contaminated by their products must also be responsible for remediation and clean-up.

IMMEDIATE MANAGEMENT NEEDS

- **STRONG EDUCATIONAL CAMPAIGNS ON POPS HAZARDS**

  To be included in curricula of educational system as well as development of training programs for different sectors.

- **TREATMENT AND DISPOSAL OPTIONS**

  Role of international community on this aspect is important. Particularly information of appropriate and cost-effective treatment and disposal technologies is needed.

- **INSTITUTIONAL & CAPACITY BUILD-UP ON POPs**

  The following are the specific needs for capacity building on POPs:

  - assess types and significance
  - conduct of site assessment and emergency clean-up of contaminated sites
  - conduct of rapid assessment of appropriate treatment methods and technologies applicable to local conditions
  - implement emergency response procedures

- **IDENTIFICATION OF POPs ALTERNATIVES**

  Information exchange among international communities will facilitate this activity and arrest the harmful global effect of POPs as each country eliminate its use in agriculture, public health and industry/commercial and shift to alternatives tha tare safe and effective.

- **DEVELOPMENT OF REGULATORY FRAMWORK AND PHASE-OUT IMPLEMENTATION ASSISTANCE**

  Developing countries relies upon international assistance on this aspect. Such should be initiated by developing countries since most of the manufacturer of POPs is from these countries.

DOST INITIATIVES

DOST recognizes the need to provide technical assistance in the implementation of management regulations of POPs. To address such, three related research project were undertaken by ITDI.

- **DEVELOPMENT OF DOST CENTRALIZED HAZARDOUS WASTE FACILITY**

  The primary purpose of the facility was for the proper management, treatment and disposal of hazardous waste (including POPs such as chlorinated organic compounds) generated by R&D and technical services laboratories of ITDI and other agencies of DOST. This was also intended to be a demonstration facility for encouraging other research institutions, academe, organization as well as industries having similar problems to replicate such action. The proper management of haz-waste by DOST can serve as a role model for technical link between industry and government regulatory agencies making it the focal point of comprehensive, multimedia haz-waste management strategy.

- ❖ **DEVELOPMENT OF LOCAL EXPERTISE ON RISK ASSESSMENT**

This project is intended to train researchers, government managers, academe, NGOs and industries on risk assessment. This deals with ecological risk assessment since it was identified as the only aspect of risk assessment not handled by concerned government agencies and in which ITDI can concentrate on in terms of investigative and research studies.

- ❖ **ESTABLISHMENT OF ENVIRONMENTAL TECHNOLOGY ASSISTANCE CENTER**

This will facilitate information exchange as database of treatment and disposal options are established.

Table 5 shows DOST initiatives that address the deficiency in technical implementation of POPs legal requirements.

Table 5 DOST Initiatives Addressing POPs Issues and Concern

Projects	Output	POPs Issues & Concern
Development of DOST Centralized Hazardous Waste Facility	❖ Demonstration TSD facility ❖ Training Program on Hazardous Waste Mgt	Technical aspects of implementing management regulations of POPs
Development of Local Expertise on Risk Assessment	❖ Conduct of regional training of Ecological Risk Assessment ❖ Ecological Risk Assessment R&D program	Lack of Technical Expertise to address POPs problems; Provide research based information to assists policy makers in developing guidelines for ecological risk assessment as part of management of POPs
Establishment of Environmental Technology Assistance Center	❖ Database of relevant and validated/verified treatment and disposal technologies	Provide treatment and disposal options for industries generating POPs

45. Persistent Organic Pollutants Situation in Vietnam

by Mrs. Le Thi Bich Thuy

I. Persistent organic Pollutants (POPs) used in the Vietnam Agriculture

1. Agricultural characters of Vietnam

Vietnam is an agricultural country, so the agriculture counts around 75% of its whole workforce and contributes almost 40% of GDP. The key agricultural products include rice (with 80% of total agricultural production), maize, sweet potatoes, cassavas... and some industrial crops such as rubber, coffee, and tea...

In order to boost productivity the agriculture have already used a large number of chemical fertilises that increased from 172,000 tonne/year in 1980 - 1981 to 428,000 tonne/year within 1984 - 1986, and about 500,000 tonne/year in 1989 - 1990. These figures, however, are not too high in comparison to other East Asian countries.

Although the amount of used fertilizes in Vietnam is not so large as in other East Asian countries, it contains mainly organic nitrogen due to the high concentration of nitrogen remaining in soil in some provinces of Mekong Delta. Using a large amount of chemical fertilizes with high concentration of organic nitrogen will lead to the intrusion of nitrogen from soil into underground water, polluting fresh water in Vietnam.

2. Use of pesticides

Pesticides are widely used in Vietnam since 1970s. Most pesticides used in
The country are imported in form of raw material and then processed and packed domestically. Within three years (1990 - 1992) Vietnam spent about 21.1 million USD per year to import pesticides, with 80 - 85% are insecticides (according to documents of Ministry of Agriculture and Rural Development). In 1991 only, around 20,000 tonne pesticides, with 80% insecticides, were used in Vietnam.

Pesticides are also harmful to human and environment. They will be
Decomposed due to effects of light, temperature, humidity and bacteria. The half-life of pesticides in soil often takes a long time, with two to several months for the organic phosphorus group, and several years or even dozens of years for organic chloride. While pesticides used in previous harvests have been not yet decomposed completely, the new one are already added for the next season, so that a big amount of pesticides remains in soil and air, causing the ecological unbalance, pollution of soil and water and reducing the biodiversity.

In recent pilot study on the breast cancer in Hanoi, we just found high DDT and DDE level in human body of the cancer patient than the control group. In other epidemiological study on the liver cancer was found a relative risk in the cancer group, who exposured to organophosphorous is five time higher than control group, who never exposured to these pesticides.

Under-law legislative documents of Vietnamese Government regarding the management of pesticide are following:

- State Law on Protection and Quarantine of vegetation dated on February15, 1993 proclaimed by President of the Socialist Republic of Vietnam

- State Decree number 92/CP issued on November 27, 1993 by Vietnamese Government on directions for implementing the State Law on Protection and Quarantine of vegetation, including:

. Regulations on Protection of vegetation

. Regulations on Quarantine of vegetation

. Regulations on Management of pesticide

- Decision of Minister of Agriculture and Rural Development to announce Lists of pesticides that are allowed, restricted or banned to be used in the agriculture of Vietnam, which dated back to February, 1994; May, 1994; and May, 1996.

To April 1995, the Ministry of Agriculture and Food Industry has already announced about 159 sorts of pesticide which are registered to be used in Vietnam with 404 trade names, including 19 sorts restricted and 22 sorts banned to be used in Vietnam. A decision by Minister of Agriculture and Rural Development, Number 1082 NN-BVTV-QD dated on July 8, 1996 bans using in agriculture all those pesticides that contain methyl parathion.

II. Other Hazardous Chemicals

1. Remains of PCB and organic chloride in Environment of Vietnam

During industrialization of the country, many industrial branches have Developed rapidly, particularly the power industry and other energy industries. While utilising electric generators and transistors... in industrial activities, a noticeable amount of oil has been discharged and is not yet managed. Moreover, there are no measures taken to treat and destroy it to avoid polluting the environment.

Recent analyses warned that the concentration of PCB is on the increase in Soil and the air of Vietnam. In 1992, a team of Japanese experts had analyzed soil samples of Vietnam and found that the PCB remaining in soil here is extremely high (320 µg/g) in comparison with Thailand and India. Another analyze also showed a high concentration of PCB in samples of dust in Hanoi.

At first, it is necessary to find out where PCB may come from, at the same time to implement active measures and tough rules in managing chemicals in order to prevent the release of PCB into the environment, undermining public health with skin diseases and cancer etc., and to avoid being poisoned by PCB as it was in Japan in 1968 (called Yusho Disease), killing 149 people until 1990.

2. Herbicide used during Vietnam War

During the Indochina War II United States had used a large amount of herbicides that made leaves fall in the South of Vietnam so-called "Operation Ranch Hand" between 1960 and 1971: about 15 sorts of herbicides were used in this Operation, with 72 million tonne chemicals, included 42 million tonne of Agent Orange, a special chemical contains an extreme toxic and most sustainable substance, 2,3,7,8 - TCDD or dioxin. According to the estimates of Westing, about 170-kg dioxin were sprayed in the South of Vietnam during 10 years of the War, and about 10% of total area of the Southern Vietnam were sprayed (Westing A.H, 1984).

More than twenty years passed after the war ended, but the effects of herbicides have still damaged the environment and the human health of Vietnam's people. A high level of dioxin still remains in their bodies and in soil. Recent analyses of fat samples of some Vietnamese shows that the level of dioxin is higher than people in the industrialized countries.

The long-term effects of herbicide on our natural forests are still severe. Twenty years after the war ended, 22% of natural forests and 31% of cropland in areas having sprayed remain not yet recovered. It is difficult to reforest in these areas because the soil is already eroded and turns into literate, so no other plants would grow than casuarina-trees and some grasses. Deforestation will lead to the disappearance of some rare creatures as well as of many bird’s sanctuaries in Vietnam.

Long term effects of dioxin still hit our country. Our people are suffering of cancer such as liver cancer, Hodgkin disease, non-Hodgkin diseases, soft tissue sarcoma, lung cancer and chloracne disease and other type of illness. We have high rate of birth defect children and malformations in our country such as Siamese twins, physical deformities, mentally retarded...etc.

III. Proposal and suggestion

In Vietnam, there have not any reliable statistic on chemicals, chemical management until now. We are lacking of the statistic of persistent organic pollutants (POPs), although the POPs were used largely in agriculture in Vietnam. So we need an assistant from regional level for establishment of the database of POPs, used in Vietnam, their control and regulation for these POPs. So we have submitted our project proposal with the title is: ***Registration of POPs used and its polluted on the soil and air in Vietnam*** to UNEP for consideration.

The project objectives are:

1- POPs statistics and their concentration in the soil and human bodies
2- POPs risk assessment on environment and human health
3- POPs management : Guideline, regulations and decisions.

We hope that the UNEP (IRPTC) will responds in financial support for above-mentioned project in Vietnam from relevant aid agencies.

As National correspondent in IRPTC activities, Vietnam National Environment Agency will do its best for the IRPTC success.

POPs Related Case Studies

UNEP Sponsored Case Studies

$50,000 US total

Cameroon - Health/environmetal problems caused by POPs in agriculture and industry

Colombia - Characterization of PCBs in use outside the power sector/PCB stockpiles and wastes

The Gambia - Inventory of PCB usage

Lebanon - Identification of dioxin/furan emissions

Madagascar - Characterization of PCBs in commerce, use and wastes

Nepal - POPs in agriculture and industry

Pakistan - Health/environmental problems caused by POPs in agriculture and industry

Senegal - POPs in agriculture and industry

Vietnam - Health/environmental problems from POPs in agriculture and industry

US is funding additional cases in South America

GEF-Funded Pilot Projects (proposed)

"PDF-B" to be submitted March 1999

Up to 8 pilot countries

Country-based/identification and action-based

Selected from 5 "regions" - Africa, Central and Eastern Europe, Latin America, Asia, Small Island Developing States

Estimated GEF budget - $3 million US

Matching funds ~ $3 million US

GEF Country Based Projects (possible)

Project concepts submitted February 1999

Country/Subregionally Based Project to Reduce or Eliminate the Use of DDT for Vector Control

Funding estimate - $1.5M GEF/$1M other

Country Based Project to Identify Major Sources of Dioxin/Furan Environmental Releases and to Implement Action to Reduce Those Releases

Funding estimate - $2M GEF/$2M other

Country Based Project to Inventory PCBs in Use, and Design and Implement a Strategy for Environmentally Sound Management and Disposal

Funding estimate - $2M GEF/$1.5M other

Country Based Project to Develop and Implement Alternative and Non-Pesticidal Approaches to Termite Control

Funding estimate - $2M GEF/$1M other

Sub-Regional Project to Inventory, Manage, and Dispose of Unwanted Stockpiles of Pesticides and Other Chemicals

Funding estimate - $2.5M GEF/$1.5M other

Summary

"Assistance" programme is just starting

Very limited funds from UNEP

Good opportunities for bilateral collaboration

GEF Pilot Projects will begin in 2000 with approximately $6 million for 8 countries

5 Additional GEF Country-Based projects are at the concept stage; total approximately $17 million

Donor pledge of $2 million for capacity building

47. The Persistent Organic Pollutants and Their Management in Vietnam

by Dr. Nguyen Ngoc Sinh, Mrs. Le Thi Bich Thuy,
Mr. Nguyen Khac Kinh, Dr. Le Bich Thang

Vietnam is situated in the South-Est Asian with a surface of 330.369 km2 and its population of 76 millions. 80% of populations are the farmers. In a period of economic development in Vietnam, the GDP is increased quickly from 3-9% (in period 1986-1990) to 7.6% (in period 1991-1993) and up to 8% GDP in 1996-1997. With the industrial development, the agriculture in Vietnam is growing up so we can supply 76 millions people the food and export more than 3 millions of rice per year. Vietnam becomes a rice exporting country in the third range in the world.

In Vietnam, the pesticides had been used since the years 40 of this century for preventive of plants diseases. In 1957, the pesticides had been used with the quantity of 100 ton/year. In recent years, the using of pesticides is increasing in quantity and sorts. If in the end of years 80, the quantity of pesticides used environs 10,000 ton/year so in the years 90, this quantity is growing up to double (21,600 ton/year in 1990) and triple (33,000 ton/year in 1995). The cultivate area is increased with the time from 0.48% in 1960 to 80-90% in 1997.

The use of pesticides with high quantity and different sorts is increasing year by year to cause the environmental pollution become more and more seriously.

There are persistent organic pollutants among the pesticides used in Vietnam. Knowing the effects and impacts of POPs on human health and environment, the UNEP Chemicals assist Vietnam a pilot case study on POPs and its long-term effects on ecology and human health. The objects of this study are follows:

- To investigate and to assess the level of POPs such as DDT, Aldrin, Dieldrin, HCB, PCB... contaminating in environment and human body.

- To study the effects of these POPs such as DDT, Dioxin on environment and human health (reproductive abnormalities, cancers...)

- To propose some POPs management in Vietnam for pollution prevention.

All results from this study are taken from the scientific studies in collaboration between Vietnamese and foreigner scientists in the world. However, till to now, Vietnam have not any study complete and systematic on this issue. The analytical results in this report are small and have low accurate. The samples were taken only in the some point so its have not representative characteristic for each region or each province in Vietnam. We do hope after this report and with a support from UNEP Chemicals, we can conduct a complete study on POPs in Vietnam.

I. The Persistent Organic Pollutants Used in Vietnam

The persistent organic pollutants are divides in two kinds: ones are from to pesticides used in agriculture and disease vector control, other ones are from industrial chemicals products or by-products such as PCB, Dioxins and Furans

A. The Persistent Organic Pollutants Used in Agriculture and Public Health Vector Control in Vietnam

Before 1985, Vietnam used pesticides importing from former Union Soviet and socialistic countries with a small quantity of 6,500 - 9,000 tons/year. These pesticides have high toxic, resist in environment such as DDT, HCB, Parathion Ethyl, Methyl Parathion, Polychlorocamphene... and several mercury fungicides as Falizan, Sinment.... In average, the quantity of pesticides used per cultivating unit less than 0.3 kg ai/ha. This quantity is lower than pesticides quantity used in the Asian countries and in the world. Unfortunately, we have not any statistic of total quantity of DDT, Aldrin and other POPs have been used in Vietnam before 1992. These pesticides have been banned in Vietnam since 1992 in the list of 22 banned pesticides and this list is increased into 26 in 1998 (see annex 1).

The statistic of total POPs in agriculture in Vietnam up to 1/11/1997 is 3,640Kg, among its the DDT and HCB are major. Other pesticides out of the permitting list are 5,000Kg. These POPs are stored in different pesticides storage in provinces and we have to dispose its but we lack the finance and technology for the disposal of POPs.

Vietnam was one of the countries in world which have a high rate of malaria, especially this rate is very high in the highland and forest areas in Vietnam. As other countries, from 1949 Vietnam decided to use DDT in the malarial combat. The quantity of DDT used was 315 ton in 1961 and it’s decreased to 22 ton in 1974.

In early 1980s, the use of DDT in combating malaria started deduct because of the parasite's resist to DDT and the Russian assistance started cut of. Table 2 shows the quantity of importing DDT from Russia, Netherlands in the period of 1957 - 1990:

Table 1

Quantity of importing DDT used in the combating malaria in Vietnam from 1957 to 1990

Years	Quantity (ton)	Type of DDT	Sources
1957-1979	14,847	DDT 30%	Russia
1976-1980	1,800	DDT 75%	WHO
1977-1983	4,000	DDT 75%	Netherlands
1981-1985	600	DDT 75%	Russia
1984-1985	1,733	DDT 75%	Netherlands
1986	262	DDT 75%	WHO
1986-1990	800	DDT 75%	Russia
Total	24,042		

Source: Medicine Preventive Department, Ministry of Health - 1998

The highest quantity of DDT used in 1962, 1963 and 1981 (environs 1,000 ton/year). In 1993, the quantity of DDT in the Parasite and Malaria Institute was finished, In 1994, this Institute stopped to supply the DDT into provinces, however several southern provinces reported that they were still using DDT with other chemicals.

Since 1995 today, Vietnam stopped to use DDT in the control mosquito vector of malaria and we use alternative chemicals of Pyrethroid group such as Lambdacyhalothrin, Permethrin. The DDT had been banned from 1992, however DDT was still used to 1995 in the health care (Table 3).

Table 2

Quantity of DDT, Deltamethrin, Lamdacyhalothrin, Ethofenprox used in Viet Nam from 1992-1997

Year	Quantity (ton)	The chemicals used
1992	237.748	DDT
1993	33.935	DDT
1994	151.675	DDT
1995	23.697	Lambdacyhalothrin, Deltamethrin, Ethofenprox
1996	17.836	Lambdacyhalothrin
1997	1.261	Lambdacyhalothrin

Source:Medecine Preventive Department, Ministry of Health - 1998

The problem of POPs contaminated in the old stockpiles (it calls obsolete organochlorine pesticides) and its polluted in the soil, water and food is one of the difficulty problem in Vietnam. We need the assistance of clean up and containment of PCB and dioxin contaminated areas, for the POPs treatment and disposal technology from countries and organisations in the world.

B. The Persistent Organic Pollutants in Vietnamese Industry

Polychlorua Biphenyls (PCBs) are mixtures of chlorinated hydrocarbons with general formulate $C_{12}H_{10-n}Cl_n$ (n is the Chlorine atom changing from 1 to 10). There are 209 possible PCBs, from three monochlorinated isomers to fully chlorinated decachlorobiphenyl isomer. The toxicology of PCBs is affected by the number and position of the chlorine atoms. PCBs have been used extensively since 1930 in a variety of industrial uses as dielectrics in transformer and heat exchange fluids and other useful characteristists. PCBs are widely used in the world. PCBs are used in the industry as follows:

- Dielectric in transformer and large capacitors
- Hydraulic and heat transfer fluids
- Paint additives, in carbonless copy paper and in plastic
- Lubricate oils...

Following the statistical in some country, the quantity of PCBs has been manufactured in 1970 of 33,000 ton. At the end of 1980, environs 1,050,800 ton of PCB have been manufactured and used in the world, in these amount the USA contributed 647,700 ton, Germany: 130,800 ton, France: 101,600 ton, England 66,800 ton and Japan: 59,300 ton.

In the years 70-80s, the resist and toxicology of PCB in environment and human body have been discovered so several developed countries started reducing and banning the PCBs used in industries.

In Vietnam, environs 27,000-30,000 ton of oil contaminated PCBs have been imported from former Soviet Union, China, Rumania. A part of these oils discharged directly in the environment and its caused environmental pollution and effected to human health. Some analytical results show very high level of PCB in soil that these areas became hot spots of PCBs in Vietnam and it is demanded urgent to clean - up these regions.

C. The Persistent Organic Pollutants Contaminated After the Indochina war II in Vietnam

In 1961, the Vietnamese southern struggle was developed, the US government with agreement of Vietnamese southern authority of Go Din Diem started prepare for the campaign of herbicides and pesticides use in the Vietnam war.

After the meeting in Kontum province in August 3 1961, MAAG decided to chose District Dacto of Kontum province to be a pilot place of dinoxol spraying to destroy trees, manioc and potato.

In parallel with the herbicides spraying pilot in Vietnam, the US Army reinforced herbicide spraying and transporting facilities in the Vietnamese southern battlefield.

The US President Kennedy has ratified the herbicide used program in Vietnam war in November 30, 1961 with the name of Ranch Hand Operation.

At 10:30 p.m. in January 7, 1962, three aircrafts C-123 cut off from Clark-Firld (Philippine) with aircrew and herbicide spraying equipment and landed in the Tan Son Nhat airport - Saigon. In January 11, 1962, more than 110,000 gallons of herbicides have been importing in South Vietnam by shipping route. It's were the first US Army's equipment and means serving the Ranch Hand Operation.

The Chemicals Companies such as Dowchemicals, Diamond, Alkali, Thompson chemical, Hercule, Monsanto, Ahsul... received the contract supplying chemicals for Vietnamese southern battlefield. The demand of Agent Orange was increasing so several chemical companies produced it that the substances in this Agent, especial dioxin, was different.

Following the US Army, the frequency of herbicides spraying was increased with raising the number of air sorties of aircraft C-123. In 1961 had only 60 air sorties, in 1962 had 107 air sorties up to 1967 had 4,682 air sorties, in 1968 had 5,238 time air sorties and during the first 6 months of 1969 the number of air sorties was 2,388. The number of air sorties of herbicide spraying by aircraft C-123 decreased in April 1970 and stopped in May 1971.

The herbicide spraying surface in 1963 was 5 fold higher than 1962, in 1964 it was 8 fold higher than 1964, in 1966 was 5 fold higher than 1965, and in 1967 it was 2 time higher than 1966. In 5 years, the herbicide spraying surface was increased in 300 times: from 2,000 ha in 1962 to 602,010ha in 1967 (New York Times, September 10, 1966).

In the chemical war in Vietnam, the three majors sorts of herbicides were used such as Agent Orange, Agent Blue and Agent White. The name of herbicides (Orange, Blue, White) was only the symbol indicated by Orange, Blue and White ribbons painted in the chemicals barrel (each barrel contained 55 gallons = 200 litres) for recognition during transportation and storage.

Following the US Army statistic, the total quantity of herbicides used during the Vietnam war was 17,585,778 gallons. This data may be not corrected because of militarily reasons.

Following the US National Academy of Science (NAS) and several US scientists such as Craig, Westing, Young... the total quantity of herbicides spraying in Vietnam was different and it differed from the US Army data in millions gallons.

In 1997, the US National Academy of Science based on MRI documents - 1967, NAS in 1974 and Young in 1988 published the data of herbicides used during the Vietnam war (table 4)

Table 4

The major herbicides and pesticides used in Operation Ranch Hand 1962-1971

Herbicides and Pesticides	Formula	Spraying Quantity (Gallon)	Year
Agent Purple	2,4-D and 2,4,5-T	145,000	1962-1964
Agent Blue (Phytar 560-G)	Cacodylic axit	1,124,307	1962-1971
Agent Pink	2,4,5-T	122,792	1962-1964
Agent Green	2,4,5-T	8,208	1962-1964
Agent Orange Agent Orange II	2,4-D and 2,4,5-T	11,261,429	1965-1970
Agent White (Tordon-101)	2,4-D; Pichoram	5,246,502	1965-1971

Source: US. NAS - 1997

Table 5

Quantity of herbicides and pesticides spraying in South Vietnam following different sources

(Unit: Gallons)

Chemicals	CRAIG (1975)	NAS (1974)	WESTING (1976)	YOUNG US Army
Agent Orange	10,645,904	11,266,929	11,712,860	10,630,428
Agent White	5,632,904	5,274,129	5,234,083	5,764,215
Agent Blue	1,149,740	1,137,470	2,161,456	1,190,585
Agent Purple	-	-	-	145,000
Agent Pink	-	-	-	122,792
Agent Green	-	-	-	8,206
CéNG	**14,423,554**	**18,936,068**	**19,114,169**	**17,801,223**

Source: US NAS - 1997

Following the US Army in 1969, the pesticide and herbicide dose in the US agriculture lower than its spraying in Vietnam war (table 6)

Table 6

Dose used (Kg/ha)

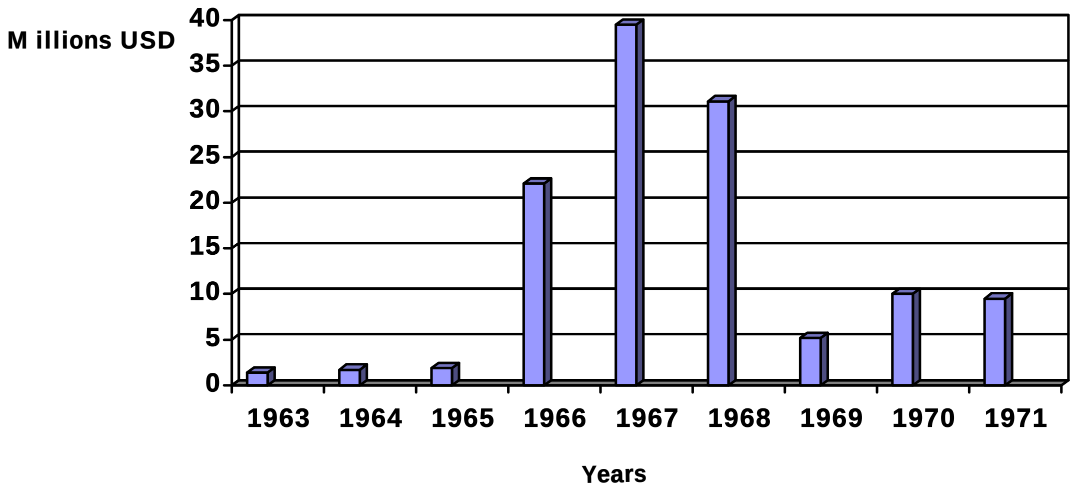
	US Agriculture	In Vietnam War	Note
Agent Orange	2.2	15 – 30	15 time higher
Agent White	0.6	16 – 18	30 time higher
Agent Blue	5.6	3 – 8	1.5 time higher
Bromacil	-	15 – 30	
Monuron	-	20 – 30	

Source: J.B. Neilands, 1972

The diagram 1 shows the US Army budget have been spent for herbicides and pesticides from 1963 to 1971

Diagram 1

The spending budget for chemicals of US Army
(Source: US Army, 1980)



The US government have to spend 124,4 millions US Dollars for herbicides and pesticides used in the Vietnam war from 1963 to 1971.

The Agent Orange and other herbicides have 2,4,5-T chemical contained one very toxic and resist substance with name 2,3,7,8-TCDD (common name is dioxin). Dioxin is toxic chemical, its toxicity is thousands time higher than environmental toxic chemical. The haft-life of dioxin in the soil is very long and it depends on the composition of the soil. Following the foreign scientists the haft-life of dioxin in soil varies from 12 to 17 years and longer.

The dioxin have been detected in the herbicides and pesticides used in Vietnam war, especial in Agent Orange, Agent Pink, Agent Purple and Agent Blue. Westing estimated environs 170 kg of dioxin spraying in the South of Vietnam.

The analytical results of US and foreign scientists show high level of dioxin in the soil, water and human body and it is higher than in the developed countries. This is difficulty and complicated problem in Vietnam and we should to solve it, to overcome the consequences of the chemicals war in our country.

Chapter II

Effects of POPs on Vietnam Environment

II.1 The Contaminate of POPs in Soil and Water in Vietnam

Recent studies of Vietnamese scientists to analyse the level of POPs in water in Hanoi areas show in table 7. Despite of banning these pesistent pesticides such as DDT, HCB, Lindane since 1992, the finding level of these POPs is still high :

Table 7

The level of organochlorine pesticides in water samples (mg/ml)

STT	Sample sites	HCB	Lin dan	Aldrin	DDE	DDT
1	Site No. 1	0.0011	-	-	-	0.007
2	Site No. 2	0.0065	0.01	-	0.009	0.004
3	Site No.3	-	-	-	0.005	-
4	Site No.4	-	0.008	-	-	0.005
5	Site No.5	0.0021	-	-		0.006

Source: Prof. Pham Binh Quyen, Hanoi National University, 1993

The analytical results of soil, water and air samples taking in the areas arounding the 36 old pesticides stockpiles show in following table:

Table 8

HCH and DDT leval in soil, water, air in areas arounding the old pesticides stockpiles in Vietnam

Sample type	Quantity of sample	HCH	DDT
Soil	423	0.3-7.1 mg/kg	0.02-22 mg/kg
Water	120	0.15-8.1 mg/l	0.01-6.5 mg/l
Ambien air	144	0.07-0.20 mg/m^3	0.06-0.40 mg/m^3

Source: Medecine Preventive Department , Ministry of Health, 1996

Other study to analyse the PCB level in the waste dumping sites in hanoi urban areas in 1996-1997 shown in table 10:

Table 9

PCB level in soil in Hanoi urban areas

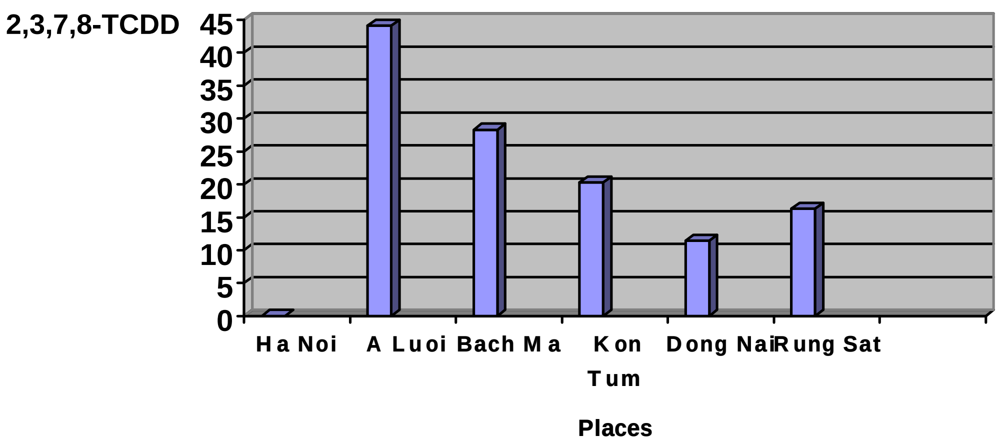
Sample site	PCB level
Around a transformer station	392 ppb
Around a transformed station	330 ppb
Municipal waste dumping site	1,426 ppb
A electrical factory	18,810 ppb
A waste dumping site	73,285 ppb

Source: §o Thanh Bai, Industrial chemical Institute, 1998

After the Vietnam war, we could not analyse the dioxin level in environment due to lack of equipment, facility and knowledge. Since 1980, based on international co-operation with foreign scientists and laboratories such as Netherlands, Germany and American Laboratories, Vietnam started to analyse the dioxin level in soil and mud. The dioxin contaminated in the soil in mud in Vietnam was presented in diagram 2:

Diagram 2

Dioxin contamination in soil in Vietnam *(1980-1997)*



Base on this diagram, we can observe the following remarks:

- In Vietnamese North, non-spraying areas, all samples have been non-detectable of dioxin (Red river mud and soil in Hanoi).
- In Vietnamese South, the herbicides spraying areas in the war, means of 2,3,7,8-TCDD level per positive samples are very high in comparison with northern part.

II.2 The POP Levels in Food and Wild Life in Vietnam

In Vietnam, the persistent organic pollutants used in agriculture have been banned from 1992, however the contaminate of these POPs in the old pesticide stockpiles is heavy polluted in environment so we have to sold this problem as soon as possible. The analytical results show elevated levels of DDT and HCH in vegetable, fruits and meets and it is polluted sources and effected on human health.

Table 10 shows high level of DDT in some vegetable in provinces of middle of Vietnam:

Table 10

DDT level in vegetable from some provinces in Vietnam
(mg/kg - 1993)

No.	Sample type	Quantity of Sample	p.p'- DDT
1	Place N.1		
	Onion root	20	0.505 ± 0.178
	Onion leave	20	0.335 ± 0.134
	Vietnamese onion root	20	0.429 ± 0.089
	Vietnamese onion leave	20	0.229 ± 0.071
2	Place N.2		
	Mustard green	20	0.489 ± 0.148
	Chinese lettuce	20	0.461 ± 0.160
	Celery cabbage	20	0.458 ± 0.154
	Amaranth	20	0.439 ± 0.138
	Spinach	20	0.229 ± 0.064

Source: Pham Binh Quyen, Hanoi National University, 1993

In comparison with, The DDT levels in table 10 are higher than permissible DDT level used in Vietnamese standard (0.02 mg/kg) from 10 to 25 folds in vegetable.

We have not data on PCB analyse in the food in Vietnam. We should to study more details of PCB level in environment and its effects on human health as well as on environment.

The American Association for the Advance of Sciences (AAAS) was protested the chemical war used in Vietnam and this association required to study the effects of herbicides used during the Vietnam war. In 1973, the American delegation of scientists from Harvard University (Boston- Massachusetts) came to Vietnam to study the effects of herbicides and pesticides used in Vietnam war. Dr. M. Messelson was head of this delegation and they took fish and shrimp sample from Saigon, Dong nai rivers and Can gio coastal line for dioxin analyse. The result has been shown in the table 11:

Table 11

2,3,7,8-TCDD level in food in Vietnam in 1973

Sample type	Level of 2,3,7,8-TCDD (ppt-wet samples)
Fresh waterfish Catfish Catfish	540 814 522
Catfish Shrimp	70 42
Frog Sea shrimp	79 18

Source: Baughmann-Messelson, 1973

This table shows the dioxin level in food in Vietnam was very high in 1973, after the end of chemical war: the mean of 2,3,7,8-TCDD level from 7 analysing samples is 297ppt with a range from 18ppt to 814ppt.

After this dioxin analyse of Masselson 12 years, Vietnam can come back to this issue.

Since 1986 to 1990, we co-operated with foreign scientists to analyse dioxin level in food in Vietnam from northern, southern (Hue City, Ho Chi Minh City, Binh Duong province) and analyse the dioxin level in the wild life animals (turtle and snake) in Tan Uyen, Tan Thanh, a heavy spray areas. Table 12 shows results of this analyses:

Table 12

Overview of Dioxin Level in Foods in Several Regions in Vietnam (1986-1990)

Sample sites	Quantity of sample	Means of 2,3,7,8-TCDD
Hanoi	8	0.38
Hue	1	0
Ho chi Minh City	13	0.61
Binh Duong (Thu Dau Mot)	2	1.8
Tan Uyen	2	0.065

Source: A. Schecter, 1986-1990

Following this table, we have some remarks:

- The means of 2,3,7,8-TCDD in 18 samples taken 4 different provinces in South of Vietnam were 0.64ppt (rang from non-detectable to 3.13ppt).
- In comparison of dioxin level in food in 1973 with it in this period (1986-1990) we can see: the dioxin levels in food were decreased from 297ppt (in 1973) up to 0.64 ppt (in 1990).

Table 13 shows the comparison the dioxin levels in food in Vietnam, Russian and Germany *(A. Schecter Chemospherre Vol.20- Nos.7-9 , pp. 789-806, 1990*):

Table 13

The PCDD/F TEQ levels in foods from Vietnam, Russian and Germany (ppt)

Vietnam			Russia			Germany		
Food	**Wet**	**Lipid**	**Food**	**Wet**	**Lipid**	**Food**	**Wet**	**Lipid**
Pork meet Pork fat Chicken liver Chicken fat	0.4 1.3 0.7 1.7	1.3 1.3 9.2 1.8	Skin milk Beef Chese Pork meet Butter Sausage	0.7 0.1 0.1 0.4 1.0 0.1	4.9 3.8 0.4 0.6 1.9 0.3	Milk Chese Butter Beef Pork meet		3.8 2.17 0.8 3.18 0.02

Source: A. Schecter, 1990

Base on this data, the author of this study could conclude that the dioxin levels in Vietnamese food were very high in 1973 and it was decreased in 1980 and these levels became in the same range in comparison with dioxin levels in food from developed countries.

The author was analysed the dioxin level in two wild life animals (turtle and snack) in Tan Thanh village, Tan Uyen District, Binh Duong province. Tan Thanh village was one of the villages belongs to military zone D and it was heavy spraying village during the wartime.

The analytical results show high dioxin levels in these wild life animals (see table 14). It is higher than dioxin levels in food taking from the markets.

Table 14

2,3,7,8-TCDD levels in wild life animals in South of Vietnam
(Wet Samples - ppt -1989)

		: Turtle			
	Snack	**Ovary**	**Liver**	**Muscle**	**Gall bladder**
2,3,7,8-TCDD	11.58	60.2	19.0	1.3	2.2
PCDD/F TEQ	13.71	68.7	20.2	2.1	4.8

Source: A.Schecter, 1989

We can see the rate of 2,3,7,8-TCDD per total of PCDD/F TEQ is very high so we can suggest that the founding dioxin levels in these animals comes from Agent Orange used during the war time, it does not come from other industrial activities.

Because of lacking of knowledge, equipment and facilities, we have not yet studied the effects of POPs on wild life animals as well as analyse the dioxin level in some long-life animals such as wildcat. We hope in the future, we can cooperate with the organisations in the world to conduct this study for assessment of POPs effects and its damage on environment and wild life animals.

Chapter III

The Effects of Persistent Organic Pollutants
on Human Health

III.1 The POPs Levels in Human Body

DDT is one of the chemicals belong to toxic class II with LD_{50} of 113 mf/kg (skin way). DDT resists in environment, accumulates in human body and acute and chronic poisons human. This toxic chemicals effect on several body parts and system such as nervous system, lever, endocrine system and cardiac system...

The analyse of DDT level in Vietnamese residents shows this level is still high though this pesticide had been banned since 1992 (Table 15):

Table 15

DDT level in blood samples of women in Hanoi (in 1995)

Substance	***Rural (n=30)***	***Urban (n=8)***
DDE (ng/ml)	9.24	24.84
DDT (ng/ml)	1.38	4.61
Total DDT+DDE (ng/ml)	11.68	32.3

Source: A. Schecter, 1996

The DDT level, especial DDE level is still high in human body and may be it is a cause of the breast cancer in Vietnam. The number of sample is small and we do not yet study completely the relationship between DDT and breast cancer.

There are not any analyse of other POPs level in Vietnamese residents such as PCB, HCB. This issue should to study more for understanding the etiology of diseases causing by POPs effects.

In the years of 1970-1973, the US group of scientists of AAAS arrived in Vietnam to study the effects of chemicals used during the Vietnam war on human health. Prof. J. Constable and Prof. Meselsson were the leaders of this group and they came to heavy spraying areas such as Tan Uyen Village (Binh Duong province), Can Gio, Ho Chi Minh City and other provinces to take breast milk from mothers feeding baby to dioxin analyse.

The breast milk samples were taken and analysed by R. Baughmann in the analytical laboratory of M. Messelsson of Harvard University, Massachussetts-USA. The analytical method is Gas Chromatography and Mass-spectroscopy - GC/MS). The results are shown in table 16

Table 16

The Dioxin level in breast milk of Vietnamese women
(ppt-lipÝt)

	1970		1973	
	Mean	Range	Mean	Range
2,3,7,8-TCDD	484,9 ppt	ND-1570	131 ppt	ND-232
PCDD/F TEQ			161,8	ND-270.6

Source: Baughmann vµ Meselsson, 1970 - 1973

This table shows that dioxin level in breast milk of Vietnamese women is very high. This is highest level in the world. High level of dioxin in women body may be cause a lot of problem of women and babies health.

After 3 years, in 1973, the dioxin level in breast milk was still high (mean of 2,3,7,8-TCDD is 131ppt) and it was decreased in comparison with this level in 1970 (mean level of 2,3,7,8-TCDD is 484.9ppt).

A. Schecter analysed the dioxin level in Vietnamese residents (Table 19). The dioxin level in Vietnamese southern residents is higher than those in Northern and in developed countries. May be the major contaminated sources of dioxin in human body of Southern residents of Vietnam are the consequences of Chemicals war, which had been used during the Indochina War II.

Table 17

PCDD/F TEQ level in Vietnamese residents
in comparison with developed countries
(ppt, lipid)

Samples	**USA**	**Germany**	**Northern Vietnam**	**Southern Vietnam**	**Russia**
Mean level in blood sample *(1980-1991)*	41 *(n=100)*	42 *(n=85)*	10 *(n=32)*	**49** *(n=33)*	17 *(n=50)*
Mean level in Fat tissue samples *(1980)*	24 *(n=15)*	69 *(n=4)*	4 *(n=26)*	**30** *(n=41)*	
Mean level in breast milk *(1980)*	20 *(n=43)*	27 *(n=185)*	9 *(n=30)*	**34** *(n=11)*	12 *(n=23)*

Source: A. Schecter, 1990

These results are setting up a co-operative study on the effects of POPs, especially the dioxin on Vietnamese human health.

III.2 The Effects of Dioxin on Human Health

In medicine, the way to find out the cause - effect relation between the diseases and its etiology is very difficult. This way requires a lot of time, of fund and scientists studies.

Vietnam is an agriculture country and has not scientifically modern equipment for certain study to assess the effects of POPs on human health. Dioxin is a specific problem in Vietnam and it was the consequence of chemicals used in Vietnam war. The long-term effects of dioxin on human health are the first priority of studies in Vietnam in recent period.

Dioxin is new toxic chemicals had been found out in the years of 1950 of this century so it is not easy to estimate the its effects on human. Till to day, the scientists could not find out the specific disease caused by dioxin. The diseases suspected to relate to dioxin may be cause by other interacting factors, so the diagnostic is not easy. Furthermore, the dioxin analyse costs very expensive and it is not confidence because of self-eliminate of dioxin from body by the time. Dioxin effects have very long latency period in body so when we find out this disease may be caused by dioxin, so the dioxin level was decreased very low with the time passing.

Several studies in the world were recognised that dioxin may be a risk factors of cancer, reproductive dysfunction and birth defects, immune system disorder and endocrine dysfunction.

Some studies show the results as follows:

Fingerhut et al. of CDC and Zobe Mans and Saracel of NIEHS shown the mortality rate of cancer was high. These studies conform the role of dioxin causes the cancer, which had been found in the Hardell works. Environs 19 studies recognised that dioxin caused cancer on experimental animals

The Birnbaum Laboratory of EPA - HERL studies shown that the immune system and reproductive organs are more sensitive with dioxin effects than cancer.

Other study of Ranch Hand Operation and NIOHS on the US Vietnamese veterans and workers exposured by dioxin show that dioxin may be cause of diabetes, lipid abnormalities to show the high lipid level in blood. This causes to circulatory and cerebral disorder.

Oliver and Schecter studied on the workers exposured to dioxin after the burning of electrical trasformater shown the relationship between dioxin and disorder of central and peripheral nervous system.

Dr. Walter Rogan of NIH observed the personality change of mothers exposured to PCB and dibenzofurans in his study of the PCB level in the residents from North Carolina. The study of Bowman on monkey exposured to 2,3,7,8-TCDD and study of Segal and Schantz on PCB effects showed the change of central neurosystem. These studies supported the suggestion that dioxin effects on central neurosystem as well as the effects of lead to decrease the EQ of children.

In Vietnam, there were some epidemiological studies in co-operation with INSERM (France), USA, IARC (WHO) on the cancer related to dioxin and DDT:

A. Breast cancer: During the period of 1994-1995, Vietnam co-operated with the US Scientists (Dr. A. Schecter) to conduct a study the relationship between DDT and breast cancer. This was a pilot study in the cancer hospital in Hanoi. The results shown that the group with DDE level more than 15.99 ng/ml in blood have a high risk of breast cancer. Table 20 shows the results of this study. However for having a full picture of the relationship between DDT and breast cancer, we should to conduct more epidemiological studies on population with a big sample size.

Table 18

Relationship between DDT level in blood samples and breast cancer

	Case	Control	OR (95%CI)
DDE(ng/ml)			
<4.35	8	6	1.00
4.35-15.99	5	9	0.45 (0.1-2.0)
>15.99	8	6	***1.14 (0.23-5.88)***
DDT (ng/ml)			
<0.8	8	8	1.00
0.8-2.19	9	5	***2.23 (0.4-12.6)***
>2.19	6	8	***1.21 (0.16-9.8)***

Source: A. Schecter, 1996

B. Liver cancer: Other epidemiological study in co-operation with INSERM Institute (France) to find out the relationship between Hepatocellular carcinoma and herbicides/dioxin exposured during the wartime was conducted in Northern Vietnamese veterans in the period of 1989-1991. In the results, a good relationship between the liver cancer with the duration of serving period in South of Vietnam (more than 10 year) with a OR_{adj}=9.6 (95%IC: 1.4-92.5) adjusted with other confounding factors such as HBC, HCV and pesticides exposure. In this study we found out the tendency of the risk of liver cancer increased with the serving time in the Southern military zone (p=0.001).

These results of the studies make some suggestion of the effects of dioxin and other POPs on human health in Vietnam. However for having an exact conclusion of this issue, we need to study more complete and deeply to assess the effects of POPs and etiology of certain diseases causing by POPs on human health in Vietnam.

III.3 Effects of Dioxin on Reproductive Abnormalities in Some Province in the South of Vietnam

Following the statistic of Tu Du Obstetrical Hospital in Ho Chi Minh City in period from 1952 to 1985, the rate of birth defect, choriomole and fetal asphyxia was very high and this rate was highest in the years of 1967-1968 correspond to the intensive herbicide including Agent Orange contaminated dioxin spraying period in south of Vietnam during the wartime.

The reproductive dysfunction such as spontaneous abortion, premature birth, choriomole and choriocarcinome have high frequency in South Vietnam and this frequency was higher than Northern. The recent study shows that the comparison of rate of choriomole and choriocarcinome in the two mother group coming the same province is different: The group of mother born during herbicides spraying period (1964-1970) have this rate (1.02%) higher than those in the group of mother born before the herbicides spraying period (1933-1963) (0.04%) (p<0.05) *(Nguyen Thi Ngoc Phuong et al. 1993)*

Birth defects is one of the problem arrested the attention of scientists. Before the foreign scientists did not accepted the suggestion of the birth defect from male, who exposure to dioxin. However, the studies in Vietnam based on the clinical diagnostic affirmed this suggestion. Results from an investigation of the northern veterans in Viet Yen Distric (Ha Bac province) shown high rate of birth defects among the families, which have a father served in the South during the wartime in comparison with the families, which have a person served in other place but not in the South during the wartime. This investigation found a direct proportion of the serving time in South of father and birth defect rate.

This founding of Vietnamese scientists have been confirmed by US studies in recently: the US study found out the dioxin level in the sperm of US Vietnamese veterans. The NIEHS recognised one type of birth defects is spinabiphyda related to Agent Orange's exposure.

However the birth defects are not only focus on spina bifida as the recognize of USA, they are variety in reality. The birth defects in the Agent Orange exposure group in Vietnam was found such as:

- Abnormally of nervous system such as anencephalie, microcephalie, hydrocephalie, spina bifida, brainy retarded, stupid, blind and dumb.
- Cleft palate, cleft lip and palate, club hand and food, polydactyly...
- One kind of birth defects not common but it is very specific - there are Siamese twins. In the world, the Siamese twins have very low rate. This rate is 1/20.000.000 giving births. If we follow this rate and birth rate in Vietnam so we could meet one Siamese twins in 10 years. In fact. during 5 years from 1980 to 1985, in the four hospitals in South of Vietnam: Tay ninh, Dong nai, Binh Duong provinces and Ho Chi Minh City (these were heavy herbicide spraying areas), we have 30 Siamese twins with different types: a baby have two heads and one body, one head with two faces, twin with stacking abdomen....

- The characteristic of birth defects in Vietnam under the effect of dioxin have been observed: there are several birth defect babies in one families and they have multi-abnormalites in their body. There is a family having 5 children, 4 children among them were abnormalities.

III.4 The Long-term Effects of POPs on Human Health

The results of primary studies were proved the scientific objective and the need to conduct more study on the effects of POPs such as dioxin, DDT, PCB on human health.

The first analytical result shows that Vietnam has dioxin level in environment and human body higher than this level in developed countries.

However the studies on the specific diseases caused by POPs are still small and shallow, especially the study on cancers. The cancers were recognised in the world associated with exposure to dioxin we have not study, event following the statistic, these cancers have very high rate and frequency in spraying areas in Vietnam. The reproductive dysfunction has been study more complete and we have some conclusion. The new finding in Vietnam was recognised by scientists in the world such as having birth defects from fathers, who exposured to herbicide spraying during war time. However, we want to clarify the relationship between choriomole, low birthweight and stillbirths with dioxin exposure.

There is a lot of problem we need to study the effects of dioxin as well as POPs on human health as follows:

- The other cancers, which have not study;
- The effects of Dioxin and POPs on genetic system;

- Immune system disorders (immune suppression and autoimmunity) associate with exposure to dioxin and POPs;
- Effects of dioxin on the metabolic and digestive disorders: diabetes, changes in liver enzymes, lipid abnormalities, ulcers...
- The most important in our study is preventive and treatment, clean up the dioxin and POPs contaminated in environment and human body. We face very difficulty to treat the patients having diseases associated with exposure to dioxin.

Chapter IV

Persistent Organic Pollutants
Management in Vietnam

A. Pesticides and Persistent Organic Pollutant management in Vietnam

The use of pesticides and persistent organic pollutants is increased the day by day without chemical management so that has resulted serious consequences of the environmental pollution such as water, air and soil pollution and causing dangerous diseases.

The major factors of violating the chemical safety in using the pesticides and persistent organic pollutants are the shortage of information, of the knowledge and of the consciousness, of the controlling the pesticide spraying process, lacking of regulation and guideline, failure in putting into practice of the regulations relating to the use and the uncontrolled sale of high toxic chemicals...

Vietnamese government took care of the pesticide management and safety, decentralised administration, each ministry having its proper responsibility such as: The Ministry of Labour, Invalids and Social Affair manages the safety and labour protection, The Ministry of Agriculture and Rural Development manages fertilisers, pesticides used in agriculture and the Ministry of Health manages the pesticides used in the medicine preventive vector diseases....

To strengthen capacity building of chemical management, a number of regulatory documents have been issued such as Decree on Vegetables Protection and Quarantine, Environmental Protection Law and some other regulatory documents concerned, among which the Ministry's Decide of the pesticides banned in Vietnam (26 pesticides including insecticides, herbicides and fungicides...in annex 1).

However in the pesticides and persistent organic pollutant management field in Vietnam there are still some remaining problems as follows:

- The integration of the legislative documents is in shortage. The cumbersome and overlapping of the responsibilities and functions of ministries and offices, appears in the above-said documents (comparison has been made to the Law on Labour, the Environmental Protection Law, the Decree on Vegetable Protection and Quarantine....).

- The overlapping situation of the inspecting and supervising the implementing of the governmental legislative documents from the top to the bottom and it is not effective.

- Regulatory documents already issued for the purpose of managing the pesticides and POPs are not sufficient.

- The media to provide people the information of pesticides and POPs safety and using is insufficient.

Therefore, the functional officers of the Vietnamese government must review the system of the legislative documents relating to the pesticide and POPs management and use from so far. Especially to build the legislative system of regulation and guideline of POPs controlling and management from the storage, transportation to the utilisation and its disposals.

B. The Urgent Problems Have to Solve in Vietnam

1. To Assess the POPs Risk and Residues in Environment

The first problem poses to conduct an inventory and assessment of total quantity of POPs such as DDT, HCH, PCB... remaining in pesticide stockpiles as well as transformater and capacitor storages in Vietnam. In present time, we have only elementary results of POPs surveys in several regions but we have not a general inventory to assess the quantity of POPs for treatment and disposal in Vietnam.

We should to survey and identify the hot spots, which were polluted by PCB, DDT and dioxin for building the plan of remediation and clean up these places, preventive the pervasive pollution and its effects on environment, biodiversity and human health.

2. To Study the POPs Treatment and Disposal Technology

As mentioned above, in Vietnam there were some heavy contaminated areas by PCBs and dioxin, but we have not the knowledge and technology for its remediation. In further step of this study, we would like to study and apply the effective technology to remedia these contaminated areas as well as other new finding out hot spots in Vietnam.

This work requires the modern scientific and technical knowledge and high costs, so Vietnam expects to have a fruitful cooperation and help from developed countries in the next step of these projects of UNEP.

c. Study and assess the long-term effects of POPs on environment and human health

a. To study and assess the effects of POPs on environment such as:
. The impact of POPs on ecological balance, floristic covers and biodiversity in each region of Vietnam;
. The POPs distribution in soil and water in Vietnam
. Base on GIS to build the POPs polluted areas
. To establish the registrative system of POPs as well as toxic chemicals used and caused pollution in Vietnam
. To remedy the POPs contaminated areas, rehabilitate the environment of these areas, especially to build an environmental rehabilitation programme, which had been destroyed by dioxin and Agent Orange during the chemical wartime in Vietnam.

b. To study and assess the long-term effects of POPs on human health and its solve:
. Study the specific cancer caused by POPs such as soft tissues sarcome, liver cancer, breast cancer and choriocarcinome...
. Study the reproductive abnormalities, birth defects causing by POPs and dioxin for Vietnamese residents.
. Study the specific diseases associated with POPs
. Study the way of POPs clean- up of human body, preventive the diseases cause by POPs for human

D. Strengthen the POPs Management in Vietnam

The persistent organic pollutants management in Vietnam is new. For integrating it with the POPs management system in other countries in the world and contributing our knowledge in the setting up the POPs Convention organized by UNEP, Vietnam has to push the following activities:

1. Establish the synchronised legislative documents, unified management of POPs in the ministries and in the central and local authorities. In particular, to strengthen the management, control, supervisor and preventive the polluted sources at the local levels.

2. Strengthen the inspection, control, supervisor of the prohibited discharge of transformater oils, waste oils and other industrial products containing Polychlorinated Biphenyls (PCBs) into environment of the manufactured and business facilities. To strictly control the import of transformaters containing PCBs into Vietnam.

3. Survey and assess the heavy contaminated areas by dioxin, PCB, DDT and other absoletes chemicals in Cupertino with international organisation and countries in the world to treat and dispose these chemicals.

4. Co-ordinate with media and public information organisations to propagate and disseminate local residents of the effects of POPs on environment and human health.

Conclusions

The assessing study of the POPs residues and its effects on environment and human health is complicated, required high technology and scientific knowledge.

Vietnam is a member of Asian Community (ASEAN) and as well as other countries in this region, so the environmental pollution caused by POPs in Vietnam is one of the imperious problems have to solve. Especially, Vietnam is differed from other countries in the world that Vietnam was withstand the large quantity of herbicides and pesticides, which contaminated one very toxic and resist substance is dioxin. This dioxin was spraying in south of Vietnam during ten years with a quantity of 170kg. This was saying that Vietnam is singleness country in the world to suffer the harmful effects of dioxin and there is only ideal place in the world for study the consequences and long-term effects of PCDD/F on environment and human.

The showing analytical results in this report have low exact and power, the analytical samples were sample-point have not representative. However, these results show us the picture of the effects of POPs on environment and human health in general in Vietnam.

Following these results, Vietnam is polluting by POPs such as DDT, PCB and dioxin. Because of allowable condition we have not the general study of the POPs effects on environment and human health. However, at the first need, Vietnam requires the modern and effective technology and fund for remediation of heavy contaminated areas by PCB and dioxin.

We do hope that our report will give UNEP Chemicals the review of the environmental pollution caused by POPs in Vietnam and we expect to have the assistance from UNEP as well as other international organisations in the further step of the project to study and assess the effects of POPs on environment and human health in general and more completely and its dispose technologies.

appendix 1

List of Pesticides Banned Vietnam

(Decision No. 39/1998/Q§-BNN-BVTV February 26, 1998 and Decision No. 86/1998/Q§-BNN-BVTV June 24, 1998 signed by Minister of Ministry of Agriculture and Rural Development)

No.	Common name - Trade name
	Insecticides
1	Aldrin (aldrex, Aldrite....)
2	BHC, Lindane (Gamma-BHC, Gamma-CHC, Gamatox 15EC, 20 EC, Lindafor, Carbadan 4/4G, Sevidor 4/4G...)
3	Cadmium compound (Cd)
4	Chlordane (Chlorotox, Octachlor, Pentichlor...)
5	DDT (Neocid, Pentachlorin, Chlorophenothane...)
6	Dieldrin (Dieldrex, Dieldrite, Octalox...)
7	Eldrin (Hexadrin...)
8	Heptachlor (Drimex, Heptamul, Heptox...)
9	Isobenzen
10	Isodrin
11	Lead compound (Pb)
12	Methamidophos, Isometha 50 DD, 60 DD, Isosuper 70 DD, Filitox 70 SC, Monitor 50EC, 60 SC, Master 50 EC, 70 SC, Tamaron 50 EC
13	Methyl Parathion (Danacap M25, M40, Folidol-M50 EC, Isomethyl 50 ND, Metaphos 40 EC, 50 EC, Methyl Parathion 20 EC, 40 EC, 50 EC, Milion 50 EC, Proteon 50 EC, Romethyl 50 ND, Wofatox 50 EC
14	Monocrotophos, Apadrin 50 SL, Magic 50 SL, Nuvacron 40 SCW/DD, 50 SCW/DD, Thunder 515 DD
15	Parathion Ethyl (Alkexon, Orthophos, Thiopphos...)
16	Phosphamidon, Dimecron 50 SCW/DD
17	Polychlorocamphene (Toxaphene, Camphechlor...)
18	Strobane (Polychlorinate of camphene)
	Fungicides
1	Arsenic compound (As) except Neo-Asozin, Dinasin
2	Captan (Captan 75 WP, Merpan 75 WP...)
3	Captafol (Difolatal 80 WP, Folcid 80 WP...)
4	Hexachlorobenzene (Anticaric, HCB...)
5	Mercury compound (Hg)
6	Selenium compound (Se)
	Rodenticide
1	Talium compound (Tl)
	Herbicide
1	2,4,5-T (Brochtox, Decamine, Veon...)

Closing Remarks

By Dr. Nguyen Ngoc Sinh, Director General, National Environment Agency of Vietnam

Distinguished guests,
Ladies and Gentlemen,

On behalf of the organising agency of the host country, I would like to congratulate all of you for the success of the Workshop.

The Regional Workshop on Management of POPs was being held in Vietnam from 16 to 19 March 1999. There are nearly 70 participants, scientists and lectures from 28 countries in the region and international organisations.

During four working days of the Workshop, we have been concentrating on discussion of matters relating to POPs. Special attention has been paid on the difficulties that many countries in the region are facing at the moment such as POPs inventories, POPs identification and the development of National and Regional Programmes to deal with POPs. We hope that after the Workshop, the developed countries and international organisations are able to understand the situation of management of POPs in the region as well as in Vietnam. It is quite sure that we will develop together an appropriate programme in the region in order to prevent pollution caused by POPs and to protect the environment for the sustainable development.

I would like to apologise all participants due to shortcomings in the organisation of the Workshop and unpleasantness that you have during your stay here.

I wish all the participants will keep good impression and feeling on the success of the Workshop.

I wish you good health, success and hope to see you again in other meetings in Vietnam.

Thank you.