



**TOGETHER**  
*for a sustainable future*

## OCCASION

This publication has been made available to the public on the occasion of the 50<sup>th</sup> anniversary of the United Nations Industrial Development Organisation.



**TOGETHER**  
*for a sustainable future*

## DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as “developed”, “industrialized” and “developing” are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

## FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

## CONTACT

Please contact [publications@unido.org](mailto:publications@unido.org) for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at [www.unido.org](http://www.unido.org)

RESTRICTED

20698

DP/ID/SER.A/1708  
17 August 1994  
ORIGINAL : ENGLISH

## REGIONAL NETWORK ON PESTICIDES FOR ASIA AND THE PACIFIC

DP/RAS/93/061

Sub-Programme of  
Farmer-Centered Agricultural Resource Management (FARM)

Technical report: Report on the proceedings of the  
Workshop on *Ecotoxicology*, Islamabad, Pakistan,  
27-31 March, 1994\*

Prepared for the Government of the Member States of the Regional Network  
(Afghanistan, Bangladesh, People's Republic of China, India,  
Indonesia, Islamic Republic of Iran, Myanmar, Malaysia, Nepal, Pakistan,  
Philippines, Republic of Korea, Sri Lanka, Thailand and Viet Nam)  
by  
the United Nations Industrial Development Organization  
acting as Executing Agency for the United Nations Development Programme

Based on the work of the UNIDO Secretariat  
and Pakistan Agricultural Research Council (PARC)

Backstopping Officer: B.Sugavanam, Chemical Industries Branch

United Nations Industrial Development Organization  
Vienna

---

\* This document has not been edited

V.94-25565

## CONTENTS

	<u>Page</u>
1. Introduction	1
2. Inauguration of the Ecotoxicology Research Centre	2
3. Opening of the Workshop	2
4. Country Report (Abstracts)	3
5. Lectures (Abstracts)	12
6. Summary of Panel Discussions:	20
Panel 1. Ecotoxicology related to water (aquatic toxicology, ground water contamination)	20
Panel 2. Terrestrial ecology and soil contamination	20
Panel 3. Need for assistance to Asia and the Pacific countries in monitoring movement and fate of xenobiotics in the ecosystem.	20
7. Conclusions and Recommendations	21
8. Course Evaluation	25
9. Valedictory Session	26
10. Annex 1            Programme	27
Annex 2            List of Participants.	29
Annex 3            Speeches on Workshop & Ecotoxicology Research Centre opening	32
11. UNIDO comments	38

## 1. INTRODUCTION

1.1. Today thousands of chemicals are produced by chemical and allied industries for use in various outlets. It is well established that standard of living in any country or society depends on the amount of chemicals produced and consumed per capita. Even for basic necessities such as health, food security, shelter, hygiene, animal welfare, education etc. chemicals are vital for man's daily existence. At the same time chemical industries, rightly so, are widely blamed for various problems associated with the deterioration of the environment such as contamination of soil, air and water with toxic chemicals, acid rain, eutrophication, ozone depletion, global warming and damage to flora and fauna.

1.2. Among the various chemicals used, it is needless to say that pesticides and fertilizers have a special significance in that they are vital for crop protection/production and also in public health (pesticides) and have to be deliberately introduced into the environment. However, continuous and excessive use of these chemicals in agriculture has caused great concern regarding the ecological damages. These damages generally go unnoticed until a catastrophe results. In order to avoid and eliminate environmental risks associated with these chemicals, the developed countries have taken seriously to ecotoxicology and environmental monitoring of man-made chemicals especially toxic/hazardous ones. Among these chemicals pesticides have been exclusively monitored as to their effects on beneficial insects, soil micro-organisms, aquatic and avian species and wild life. While ecotoxicology/environmental monitoring of chemicals particularly pesticides is becoming a high technology oriented; only a few developing countries have the capability to understand let alone carry out studies on ecotoxicology.

1.3. Pakistan in 1983 offered to host a regional sub-network on ecotoxicology. In order to expose the subject to the developing countries UNIDO with the financial assistance of UNDP has included ecotoxicology coordination unit in Pakistan in the project Regional Network on Pesticides for Asia and the Pacific (RENAP). Based on this Regional decision, Pakistan requested UNIDO to provide the capability in ecotoxicology to the country so that it could make an important contribution to the Asian Region. In order to assist Pakistan in establishing an Ecotoxicology Centre, UNIDO through a Danish contribution to its Industrial Development Fund (IDF) is assisting Pakistan in the establishment of an Eco-toxicology centre.

1.4. RENAP as a network funded by UNDP and executed by UNIDO, covers topics to promote safety in production and use of pesticides with emphasis on user and environment friendly pesticides in support of integrated pest management (IPM). The programme includes various core topics in pesticides through following technical co.ordination units:

Pesticide data collection	India/Thailand
Pesticide formulation technology	India
Bio-Botanical Pesticides	Thailand
Industrial Safety and waste management-	Indonesia
Industrial hygiene and occupational safety	Philippines
<b>Ecotoxicology</b>	<b>Pakistan</b>
Raw material prospecting and analysis	Iran
Impurities in technical materials	South Korea
Application technology	Malaysia

1.5. In order to provide a platform and promote North-South interaction to discuss various aspects related to environmental monitoring and studying fate of xenobiotics with emphasis on pesticides, a workshop was organized in Pakistan at Islamabad from March 27-31, 1994. The agenda and the list of participants for the workshop are attached as annex 1 and 2.

## 2. INAUGURATION OF THE ECOTOXICOLOGY CENTRE

2.1. **Sardar Farooq Ahmad Khan Leghari**, President of Pakistan warned against indiscriminate use of agro-chemicals (pesticides, fertilizers etc.). Unless backed by scientific research the indiscriminate use of agro-chemicals is damaging to crops and simultaneously degrades soils and pollutes the environment. He made this statement while inaugurating the "Eco-toxicology Research Centre" at campus of the National Agricultural Research Centre (NARC) of Pakistan Agricultural Research Council on 27 March 1994.

2.2. The President underscored the need for strong scientific system to back-up the modern agro-chemical technology that could help in curbing the indiscriminate use of agro-chemicals. Sardar Leghari pointed out that this Government is strongly in favour of strengthening the agricultural research system because agriculture is back-bone of Pakistan's economy. He emphatically stated that user awareness concerning safe use of agro-chemicals particularly pesticides was amongst his top priority issues because it concerns human being, environment and the wild-life. This is also important to wage a war against insects, diseases and weeds.

## 3. OPENING OF THE WORKSHOP

3.1. **Sardar Farooq Ahmad Khan Leghari**, President of Pakistan inaugurating the "workshop on Eco-toxicology": attended by member countries of the Regional Network on Pesticides for Asia and the Pacific including Bangladesh, India, Indonesia, Iran, Republic of Korea, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Thailand and Vietnam, declared his full support for the establishment of "Eco-toxicology Research Centre" in Pakistan to be shared by the Regional Countries. He emphasized upon the workshop participants to thoroughly deliberate the agenda; formulate feasible recommendations and chalk-out practical strategy. The inaugural address of the President is at Annex-3A.

3.2. **Navab Muhammad Yousaf Talpur**, Federal Minister for Food, Agriculture and Livestock in his welcome address, stated that the Government would give high priority to a scientific pest management system and safe use of pesticides in particular. He said that the establishment of "Eco-toxicology Research Centre" was a first step towards promotion of our plans for safe use of Pesticides. The address of the Federal Minister for Food, Agriculture & Livestock is at Annex-3B.

3.3. **Dr. Zafar Altaf**, Chairman, PARC and Secretary, Ministry of Food, Agriculture & Livestock, Government of Pakistan welcomed the delegates and workshop participants while **Dr. Umar Khan Baloch**, Dy. Director General & National Project Director, Eco-toxicology Research Centre introduced the workshop objectives and the programme. UNIDO representative from Vienna presented UNIDO/UNDP remarks. **Dr. Muhammad Hanif Qazi**, Member (Crop Sciences) PARC present vote of thanks. Their presentations, respectively are at Annex. 3C-3F.

### 3.4. Adoption of the agenda

The agenda was adopted is placed at Annex-1.

### 3.5. Election of the chair-person

Dr. Umar Khan Baloch, Dy. Director General, National Project Director, Ecotoxicology Research Centre, PARC was unanimously elected as chair person and Dr. Yang-won Kim as Co-chair person. The participants Mr. E.F. Rimando from the Philippines and Mrs. Nursiah Tajol Aros from Malaysia were proposed as Rapporteurs. The proposed officers were agreed by the participants of the workshop unanimously.

## 4. COUNTRY REPORTS

All the delegates of the member countries presented their country papers. The discussions on the country paper generated lively issues which resulted in the form of recommendations. Abstracts of the papers are as follows.

### 4.1. Bangladesh

Bangladesh is a low lying country having a total area of 143,949 sq.km. and with a population of about 120 millions. It has a tropical monsoon season and a network of rivers and canals. Bangladesh has an agrarian economy. Rice, jute, sugarcane, tea, tobacco, pulses and vegetables are the main crops. Among the industries, jute, chemical fertilizers, sugar, newsprint, textiles are important.

Use of pesticides in Bangladesh, started in fifties. Their use is relatively low compared to developed countries, but it is increasing with the passage of time to meet up the increased demand of agricultural production. About 20-30% of the crops are now damaged by insect pests. Presently, a quantity of about 7,750 M.T. of different pesticides are used. Most of the farmers have little knowledge about the hazards in pesticide use and handling. As a result, pesticides are being used indiscriminately causing toxic effects on non-target i.e. wild-life, fish, livestock and humans. Water, air and soils. The Government, however, have formed rules and regulations on environmental protection aspects, registration of the products, manufacture, sale and distribution of pesticides to minimize environmental risks. Plant protection wing of the Directorate of Agriculture (Extension) regulates the pesticides Acts/Rules presently. Use of DDT and BHC are banned in agriculture sector, due to residual effects. Heptachlor is, however, being used as soil insecticide. The use of DDT in public health sector and its productions in the local DDT factory are suspended since 1991, till now, by a Government decision. But many casualties out of Malaria, have been reported during this period. WHO advised the Government to use DDT, for public health sector. It was also told that DDT is bio-degradable and does not cause high environmental hazard or toxicity, if used at recommended doses.

Research works on Eco-toxicology in Bangladesh is inadequate. Some facilities are available with Bangladesh Agricultural Research Institute (BARI), Bangladesh Agricultural University (BAU), Government Pesticides Analytical Laboratory under Agriculture Deptt., Laboratory under the Ministry of Forest and Environment, Bangladesh Institute of Nuclear Agriculture (BINA), Institute of Nuclear Biology, Dhaka University and several other institutions/

organization. Such research facilities are to be further strengthened and coordinated.

#### 4.2. India

India has attained self-sufficiency in pesticide production and supply and presently only around 2% of the technical grade materials were imported. Consumption of pesticides has gone up from about 2000 MT in 1955 to over 76,000 MT in 1992-93. Finished formulated pesticides are locally produced from technical grade materials and the domestic market is one of the fastest growing one in the Asia Pacific region.

Out of the 147 pesticide products registered with the Central Insecticides Board of the Govt. of India, about 60 technical grade pesticides are manufactured by different industrial units. Supply of technical grade materials registered an overall increase of 37% over 1985 with herbicides showing the highest rate of growth of 219% followed by insecticides 29.5% and fungicides 15.6%. India is also exporting pesticides to USA, UK, USSR, Japan, Belgium, Italy, Germany, Africa, Middle East and many countries of the Asia Pacific region and the value of annual pesticide export has touched US\$ 100 million.

With a view to prevent risk to human beings, animals and the eco-system at production, import and use of pesticides stage, the Govt. of India enacted the following legal provisions:

1. The Insecticides Act, 1968 and Insecticides Rules 1971.
2. The Air (Prevention and Control of Pollution) Act, 1981.3) The Water (Prevention and Control of Pollution) Act, 1974.4) The Environment (Protection) Act, 1986.
3. The Forest (Conservation) Act 1980.
4. The Wild Life (Protection) Act, 1972
5. Prevention of Food Adulteration Act, 1954
6. Factories Act, 1940.

The various Acts and rules are in operation under the overall supervision of the Ministry of Agriculture, Ministry of Environment & Forests, Ministry of Food & Supply and the Ministry of Labour. In India, word "insecticide" according to Insecticides Act covers all the pesticides. The pesticide industry is gearing to meet the various provisions under the Acts and rules mentioned above.

Out of the 133 pesticides with full registration, 18 are not approved for use, 12 are banned, 12 are under restricted use and 17 are currently under the active review of the Govt. of India for evaluation and placement in banned/restricted list. Presently the organo-chlorine compounds occupy the major share of pesticide usage. During the 80's major capacities for the production of safer and less persistent varieties of insecticides including Synthetic Pyrethroids were extended with the objective of replacing the persistent organo-chlorine and toxic organo-phosphorous compounds progressively. In the area of fungicides, sulphur and copper based compounds occupy the major share. During the 80's Butachlor as rice herbicide and Isoproturon as wheat herbicide have been introduced and significant production capacities for production has been built up. Bacillus-thuringiensis and Bacillus-sphericus have been provisionally registered as biocides and experimentally introduced in the IPM programme. Nem as a botanical pesticide

has also been provisionally registered and efforts are on for its commercial production and application.

After the Bhopal disaster, there has been significant strengthening in the enforcement of various legal provisions for protecting the environment and the eco-system. While some of the legal provisions have been further refined and strengthened, enforcement has been taken up on a comprehensive manner through strengthening of the Pollution Control Boards at the Centre as well as in the States. The Ministry of Environment & Forests has set limits of toxic chemicals permissible in the effluent discharged from the pesticide producing units and the industry by an large conforming to the requirements of the law.

The National Environmental Engineering Research Institute (NEERI) of India has been doing pioneering work in the field of effluent treatment and pollution control and providing the industry with industrial designs and assisting in the setting up of effluent treatment plants specific to the requirements of the individual industries. There are three Toxicological Research Laboratories in the private sector, which generate acute, sub-acute and environmental data required by the Central Insecticides Board for granting registration to the candidate pesticides. While the Ministry of Agriculture has taken up a large programme for introducing Integrated Pest Management with the aim of rationalization and scientific use of pesticides, the Institute of Pesticide Formulation Technology, a country project of UNIDO is actively engaged in the development and production of safe, effective, economical and environmentally friendly pesticide formulations meeting the exacting needs of Indian agriculture.

In order to provide a comprehensive protection to the eco-system, a three-pronged programme is indispensable. While the Governments should strictly select safer and eco-friendly products, the industries must be made to adopt clean process routes, the Pollution Control administration would need to assist the industry to upgrade and adopt appropriate pollution control measures within the battery limits of the factories so that the effluent meet the specifications in respect of the candidate pesticides indicated under the Environment Protection Act. It would also be necessary to train all those engaged in the production, handling, storage and usage of pesticides for ensuring that pesticides handle and use is in conformity with the relevant regulations which would eliminate pollution thereby help in the preservation of the eco-system.

#### 4.3. Indonesia

In order to provide the effective protection to the population on effect of environmental contaminants, the risks associated with toxic substance in environment, the government of Indonesia promotes a number of preventive measures.

1973, Government Decree No.7 was enacted to regulate the distribution, Storage, import and use of all pesticides. The Decree is implemented jointly by the Minister of Agriculture and Ministries related e.g. Ministry of Health, Ministry of Industry and Ministry of Trade.

1983, Regulation of Ministry of Health No.453/ MenKes/Per/XI/1983 on Hazardous Substances to regulates classification of Hazardous Substances, producing, importing and distributing, managerial responsibility, compulsory registration, packaging and labelling and management of waste.



There have been 273 registered pesticides in Indonesian market with different formulations and brand name(s). There is growing disquiet among the general public that toxic chemicals found in food and in the environment, ecotoxicology (air, water and soil), may have deleterious effects on human health. The public is uncertain whether pollution is giving rise to chronic poisoning in exposed populations, whether effects are accumulative and whether there are long-term sequelae. Furthermore, deleterious effects of toxic chemicals on non-human species within the environment, whether they may be acute or chronic, are of growing concern both to the scientific community and to the public. Particularly where there is no other ready access to information on toxic chemicals.

Mechanisms for systematic collection, validation and follow-up of data need to be established, as well as the comparability of such data nationally and internationally, if full advantage is to be taken of the potential for improving the scientific basis in the field of human toxicology for the benefit of all countries.

The need for data bank providing threshold levels of toxic chemicals commonly used as pesticides both in the eco-system as well as in the food crops and establishment of a suitable information exchange system amongst the developing countries is crucial.

Harmonization and improving the international flow of communication, information and experience in the field of eco-toxicology is needed.

#### 4.4. Myanmar

The pesticide usage Myanmar is about 1000 tons per year. Some are still being imported as formulated products. Insecticides are the main pesticides used.

The National Commissioner for Environmental Affairs has formed four special committees (Conservation of Natural Resources; control of pollution; research, information and education and international cooperation) for coordinating environmental issues.

Pesticide Law was enforced in 1990. The Ministry of Agriculture is held responsible for registration of pesticides. The Pesticide Registration Board was formed with Myanmar Agricultural Service taking the official functions.

A number of Laws and Acts have been enforced to ensure safety at manufacturing level. For example, Factories Act from Ministry of Labour, dealing with working conditions and working environment of work places, Public Health Act from the Ministry of Health, setting norms for health care, Electricity and Factory Inspection Law from the Ministry of Industry for inspection of factories according to the law, health of the workers at manufacturing level is carried out regularly.

For safety at pesticide application level, extension workers are assigned at village level to assist farmers in safe and effective use of pesticides. Cooperation with international organizations such as FAO, ESCAP/ARSAP, etc. is being done on these aspect. But proper monitoring is not be done at present.

There is no separate ecotoxicological laboratory in the country. But some laboratories are conducting analysis. For analysis of pesticide residues

in crops. plant protection lab. and post-harvest crops lab. are engaged in the job. For health of workers, and if necessary, that of neighbouring population by occupational health lab. and for omission of dust and toxic gas is done by factory(s) in spectorate lab. under Ministry of Labour.

#### 4.5. Malaysia

Pesticides in Malaysia are used for a variety of purposes, not only in agriculture but also in the forestry, public health, veterinary and other sectors. This practice is expected to continue since research in crop protection, although progressing, has not yet reached a point where effective control measures are available without the use of these chemicals. Control and use of pesticides in the country are regulated by the Pesticides Board (serviced by the Department of Agriculture), Department of Environment and Ministry of Health, covering aspects such as approval for manufacture and use, pollution, residues, poisoning and others. Information on the contamination profile of pesticides in the Malaysian environment are limited although some studies have been done on water and soil in some areas. Public interest in pesticide poisoning has increased as a result of awareness by a better educated and increasingly well-informed public. Through legislation, encouragement of appropriate farming practices, training, education and also research, efforts are being made to ensure that pesticides used in Malaysia do not cause adverse effects to the environment.

#### 4.6. Nepal

Ecologically, Nepal is divided into mountain, hill and terai (plan) regions. Each region differs with other with respect to weather condition, livestock production and type of crop cultivation. Terai is the most important region for area (1943 th.ha) and production (4455 th.metric ton) of the food, cash and pulse crops. A significant portion of crop production is lost due to pests and plant diseases at field and storage levels. Farmers and public health workers are using number of pesticides ranging from organo chlorine to synthetic pyrethrides. There are 60 common pesticides with 150 trade names in the market. Annually about 1000 metric tonnes of pesticides is being used in agriculture and public health work for suppressing the crop pests and vectors of human diseases.

In order to protect the environment and for the judicious use of pesticides, the pesticide Act 1991 and regulation 1994 have been passed and are ready for enforcement in the country (16 July, 1994). The Pesticide Board & Registration office are responsible authorities for national policy, registration activities and ensuring the legal requirement on pesticides, respectively. Environment protection council is formed under the chairmanship of Honourable Prime Minister which is an apex body for environment protection.

In Nepal procurement of pesticides is done by Agri. Input Corporation, private dealers (6 dealers & 220 retailers) and local traders; while formulation is done by Nepal Pesticide and Chemical Company formulating 700 metric tonnes of dust (OC Group) and 5000 lit. of emulsifiable concentrates (OP Group).

Government has policy of using minimum quantity of safer pesticide in the crop protection needed for implementing IPM programme in the country: Import permit is given for limited quantity or just sufficient for season's demand. Good manufacturing practices are to be observed in the formulation plant so as to increase the safety measure to the workers. Right types of precautionary methods (choosing safer pesticide, wearing protective clothes,

disposing empty container safety) are to be followed while applying the pesticides in the field. Poisoning of human beings, fish, birds, snakes, honey bees, wild life etc. are reported here and there. Manuals and guidelines related to the safe use of pesticides are prepared and distributed by the national and international ecological research institute located at Kathmandu, Nepal.

#### 4.7. Pakistan

Agriculture contributes one third of the national income and employs 57% labour force which means the over-all progress and prosperity of this country is depending on increased food production. The annual average growth rate in the crop sector is 3.7%. The major crops grown includes cotton, wheat, rice, maize, pulses, sorghum, millet, sugarcane, fruits and vegetables. Our crops are highly vulnerable. A wide range of pests, which are major constraint to achieving higher crop yields in Pakistan, are estimated to inflict 30 to 40% crop yield loss.

The use of pesticides starting 1954 was controlled by Government by providing subsidy. In 1980 the marketing of pesticides was transferred to private sector. The growth of pesticide use over the 1981 has been tremendous which is now five fold in terms of tonnage and 37 fold in financial terms.

Pakistan promulgated Pesticide Ordinance in 1971 and Pesticide Act in 1973 which control the pesticide import, manufacture, marketing, storage and use. Pakistan so far had only one functional lab. for testing of pesticide for registration and quality testing purposes. The Government of Punjab has established three pesticide quality testing labs, one each at Multan, Lahore and Faisalabad but these labs, lack trained manpower and continuity of job for the people working therein.

The Pakistan Agricultural Research Council with the support of UNIDO and financial assistance from Government of Denmark is in the process of establishing facilities for Eco-toxicology at Islamabad and intends to extend these facilities in the various ecologies of Pakistan. The labs. for Terrestrial Eco-toxicology; Agro-chemical Micro-biology Lab. and Chemical Analysis constitute the Eco-toxicology Research Centre which was inaugurated by the President, Islamic Republic of Pakistan during the workshop.

#### 4.8. Philippines

The Fertilizer and Pesticide Authority (FPA) an attached agency to the Department of Agriculture (DA) is primarily tasked to assure the agricultural sector of adequate supplies of fertilizers and pesticides at reasonable prices, rationalizing the manufacture and marketing of these inputs, and protecting the public from the risks inherent in their manufacture, handling and application, particularly those of pesticide.

Pesticide safety is a multi-disciplinary, multi-dimensional, multi-phasic and multi-situational tasks and should therefore be addressed in a holistic manner by a multi-sectoral program calling for the active involvement of various individuals and agencies among which are: the Pesticide Technical Advisory Committee, the Department of Agriculture, the Department of Health, the Department of Environment and Natural Resources (DENR) particularly the Environmental Management Bureau (EMB) and the Ecosystems Research and Development Bureau (ERDB), the pesticide industry (CPAP) and universities and other research institutions.

It is a fact that the use of pesticides inevitably could cause toxicological problems in the entire ecosystem i.e. soil, water, air, farm, flora and fauna etc. Timely as it is, national, regional, and international development institutions should consider ways of providing support in the following areas:

1. Technical assistance in term of:
  - a. Strengthening of existing environmental legislation:
  - b. Training of personnel especially on environmental impact assessment:
  - c. Providing laboratory equipments and expertise for monitoring:
  - d. Developing and improving of risk assessment methodologies:
  - e. Developing and operationalization of national and regional data bank on eco-toxicology
2. Funding assistance for researches/studies with impact on enhancing and maintaining ecological balance and environmental quality
3. Promotion of regional/international collaborative work on ecotoxicology environmental safety

#### 4.9. Republic of Korea

Agricultural Chemical Management Act (ACMA) was first established in 1956. The current law was revised in 1981. Each pesticide is tested 2 or 3 times by the government institutes for their efficacy, phytotoxicity and acute toxicities. Out of around 18 testing institutes, the Agricultural Chemicals Research Institute (ACRI) has a major roles in testing, collecting and evaluating the test data. There are several expert SUB-committees which evaluate the data for Agricultural Chemicals Management Committee (ACMC), membership of later is drawn from Ministry of Health and Social Affairs (MOHSA), Ministry of Environment (MOE), universities, consumer organizations, etc. The ACMC is coordinated by the Ministry of Agriculture, Forestry and Fisheries (MAFF). The division of Plant Protection (DPP), Bureau of Agricultural Production (BAP) is responsible for all the activities in pesticide management.

More than 500 pesticides or 270 active ingredients are currently used in Korea. Only moderately toxic pesticides are introduced from 1991, even though 22 highly toxic pesticides are still in use. Pesticide monitoring in the environment is occasionally done by the several government testing agencies. The awareness on environment has been steadily growing during 1980s and 1990s. The pressure from the consumer organizations, especially on agrochemicals has also increased dramatically during 1990s. Pesticide residues in food are of great concern. It is important to have an ecotoxicology laboratory which can systematically monitor the pesticide residues in food or environment in Korea but it is not possible to set up a new laboratory in the near future because of the strained government budget and limited availability on experts. Monitoring can ben done elsewhere, but often it is difficult to make public because of NGO pressures.

The MAFF has the overall responsibility in managing pesticide such as pesticide testing, evaluation, and registration. We have somewhat unique pesticide registration system. Each formulation is declared legitimate by the

minster of MAFF. Then, any formulators can register and manufacture each declared formulation. Currently 567 different formulations are available. This unique registration system is extensively reviewed and may be revised to be registration system similar to those in Japan or USA. Tests done before declaration include efficacy, phytotoxicity, or acute toxicity. Chronic toxicity or other long-term toxicity tests are not performed in Korea. All pesticides are imported as formulations or technical grades. Several technical grades are also manufactured.

There are around 18 testing centres, all of which are coordinated by the ACRI. The MOHSA establishes the pesticide residue limits on agricultural commodities through a committee on food regulations. MAFF also participates in the process of setting residue limits as a member of a committee on food regulations. The MOE contributes the environmental standards on pesticide residues in soil and water. Before registration those two ministries review data on persistence in environment or health effects of pesticides. The Prior Informed Consent (PIC) system is not yet implemented but MAFF is greatly concerned about PIC system. The new revised ACMA will include PIC system, so restricted or banned pesticides are under the PIC system.

The pesticide use has been steadily increased year by year and this trend may continue in the near future. Herbicide use is increasing because of labor shortage. Insecticide use is slightly declining. Acute fish toxicity is measured using carp. Pesticides highly toxic to fish, i.e., carp is not permitted for use in rice paddy field anymore, but several pesticides registered during the 1980s are still in use. The MAFF is trying to phase out those pesticide. Pesticides highly toxic to fish are widely used on vegetables and fruit trees. Pesticide industries in Korea are divided into producers of technical grades and formulators. The ACMA is mainly concerned with formulators. They have an organization called Korea Agricultural Chemicals Industry Association (KACIA). Pesticide industries are cooperative with the governmental policies. The empty bottles of pesticides are collected by the Korea Resources Recovery Cooperation (KRRC). Pesticide industries pay about 60% of the total costs in the empty bottle collection project.

Ministry of Labor (MOL) is responsible for the safety of workers in the manufacturing level. The communication between MOL and MAFF is important in the regulation of the pesticide manufacturing level. MAFF is responsible for the safety of farmers applying pesticides. The MAFF supports financially when the poor farmers want to buy safety equipments such as masks.

The MOE and MAFF monitor a limited number of pesticide residues in soil and water. An Environmental Research Institute (ERI) of MOE and ACRI of MAFF performs monitoring occasionally. Sometimes MOE asks other institutes to perform residue studies. Environmentally-persistent pesticides such as DDT and heptachlor were banned in early 1970s. Still some organochlorine pesticides such as endosulfan is in use. Most pesticides used in Korea are quickly degraded in the environment with some exceptions.

There is no research facilities solely devoted to the ecological effects of pesticides. A residue analysis laboratory may be needed but seems to be difficult to establish such a laboratory in the near future.

#### 4.10. Sri Lanka

Legislative control of chemical related activities in Sri Lanka can be broadly classified into pesticide and others, according to the chemical

nature. In general, pollution aspects such as industrial effluent are assessed and regulated by the Central Environmental Authority (CEA) which is established under the provisions of National Environmental Act. Safety and hygiene of the workers at factories are looked after by the Division of Occupational Hygiene of the Department of Labour. Apart from the functions of CEA and Occupational Hygiene division all the other pesticide related activities are controlled by the Registrar of Pesticides who is responsible for the implementing the Control of Pesticide (COP) Act.

The main objective of the COP act is to ensure the safety, product quality, efficacy and environmental protection. The regulation mechanism is based on a product registration scheme. Industrial pollution is regulated by mandating to obtain the Environmental protection license issued by CEA.

Toxicity, persistence and environmental adverse effects are considered for pesticide registration. Highly hazardous pesticides are either prohibited or severely restricted. All other pesticides are classified as general or domestic. General pesticides are regulated, in the field, according to the conditions stipulated under the COP Act and domestic pesticides have least control in the market, except for label entries and quality standard etc.

Most of the factories do not possess adequate effluent treatment facilities and the Government through CEA is trying alternate approaches to ensure the safety and environmental protection.

The activities on ecotoxicological research in Sri Lanka are very low at present and Registrar of Pesticides and CEA are in the process of upgrading their facilities.

Experts are available in the fields of analytical environmental chemistry, ecology and ecotoxicological chemistry.

#### 4.11. Thailand

Thailand has about 58.5 million population of this 60% is still in agricultural field using a lot of pesticides in their crops creating problem(s) of eco-toxicity.

The Hazardous Substance Act was launched to substitute the Poisonous Article Act in 1992. There are three ministries that oversee this act which covers all kind of hazardous substances. They are Ministry of Industry, Ministry of Agricultural and Cooperative and Ministry of Public Health. The registration, transportation, manufacturing, storage, sale and waste disposal management are covered in this act. Thailand also has Public Health Act, Environmental Protection Act, Food Act, Factory Act and Labour Protection Act to look after the health and environment of the public and the working conditions and environment.

Having the disease surveillance program and worker's health monitoring program, we found that the amount of pesticides used in Thailand were gradually reduced from 80,879 tons in the year 1989 to 59,578 tons in the year 1991. Incidence rate of pesticide poisoning reduced from 9.28/100,000 pop. in the year 1989 to 6.23/100,000 pop. in the year 1992.

The most frequently reported pesticide poisoning cases are in organophosphate groups (4.77%), carbamate group (16.58%) and paraquat (19.92%).

#### 4.12. Viet Nam

Viet Nam is a rice-based agricultural economy. This sector accounts for 70% of employment and about 1/3rd of exports. About 22% of land area is devoted to agriculture with rice accounting 65% of this area. Despite a number of problems, pesticides are used for crop protection and the amount per hectare is very low.

The pesticide production in Viet Nam is controlled by the Government enterprises. The total pesticide market in Viet Nam is estimated around \$35 million. The insecticides take a major share amounting to around \$20 million. The country suffers from lack of proper quality control laboratories, distribution system, information to farmers, safety devices and in addition outdated and obsolete pesticides are used in the country.

The plant protection department in the Ministry of Agriculture and Food Industries (MAFI) has eight Divisions. The Pesticide Management and Registration Division implements the new regulation on pesticides. There are four types of registration *viz.* experimental registration for small scale trials, temporary registration for large scale trials, full registration and finally re-registration for existing products with modifications.

Ecotoxicology is very much a new field in the country, but the Government is very much concerned about the issue due to lack of information and facilities and expressed great interest in UNIDO assistance to look into the ecotoxicology and environmental monitoring of pesticides especially those which are toxic and persistent.

### 5. LECTURES

#### 5.1 Industry's Position on Ecotoxicology - Ecotoxicity : Developments in Assessing the Environmental Safety of Pesticides - Dr. W. Wyn Ellis, GIFAP

Eco-testing of pesticides is an essential component of their evaluation, costing companies US\$ 10-20 M per compound. GIFAP fully supports international harmonization of testing guidelines, to avoid the need for report testing and consequences wastage. Testing should follow a step-wise sequence : the need for field ecological studies I) based on the ratio of the toxicity of the organism(s) to the even level of explosive to the pesticide. This is in agreement with US EPA criteria for level of concern. Risk/benefit evaluation is discussed, with benefits categorized as ecological, economic and social. For example, older practices e.g. excessive soil tillage, can cause serious ecological damage; under such circumstances use of pesticides often shows substantial benefits, in views of soil stability and sustainable crop production. Comparison with alternative practices should therefore always be made.

Clearly, integration of different pest control methods, is the best way forward. Extreme approaches, such as over-reliance on pesticides, or organic farming are unlikely to sustain global food production whilst protecting the environment. GIFAP's Safe Use project encourages safe use of pesticides within IPM programmes. Finally, such user education programmes are becoming an increasingly important part of company "competitive edge" strategies.

Based on discussions with a number of delegates Dr. W. Wyn Ellis pointed out that there seems to be an urgent need for, and interest in, a closer

cooperation between international agencies, governments and the private sector, in promoting effective implementation of the FAO Code in the RENPAP region.

Since he could not participate in the group discussions, therefore, he sent the following statement, to clarify GIFAP's current position.

1. With regard to practical implementation of the FAO International Code of Conduct on the Distribution and use of pesticides, there is a need for governments and international agencies to work closely with the private sector to promote safe use of pesticides within existing (and new) IPM programmes, in a coordinated way.
2. Based on GIFAP's experiences with the Safe use Pilot Project in Thailand, we are convinced that this approach can be effective, given the active commitment of agencies with regional or global mandates.
3. GIFAP therefore plans to extend the 3 pilot projects to a regional level, and will be seeking proposals from countries in the RENPAP region, for safe-use activities/projects demonstrating public-private sector collaboration.
4. GIFAP will fund this programme, but expects such support to be matched by participating agencies or their donors.
5. Specifically, we believe that participation of agencies such as FAO, UNIDO and RENPAP is fundamental to the effective implementation of the Code in the Asia-Pacific region.
6. FAO Regional Office for Asia & Pacific (RAPA) has requested GIFAP to joint organize a Regional Expert Consultation on safe use of pesticides in 1995. GIFAP welcomes this, and is therefore hereby calling for the support and participation of RENPAP member countries, UNIDO and other interested parties, in this initiative.
7. GIFAP of course is also ready to consider participation in other relevant initiative that may be identified in this workshop.



### 5.2. Key Note Address "Chemistry, Agriculture & the Environment" - M.L. Richardson

It is unquestionable that agro-chemicals have a vital role to play in increasing crop yields, as globally some 30% of crops are lost to pests of some kind. However, some chemicals especially chlorinated hydrocarbons have been found to be highly persistent and subject to bio-accumulation and bio-magnification etc., whilst at the same time illustrate poor bio-degradation. Their use has led to severe adverse effects in non-target organisms e.g. bees, birds, butterflies etc. and residues are found in water used as drinking water resources. In some less developed and tropical countries, inappropriate use of insecticides can cause adverse health effects to the applicators who are unable to wear adequate protective clothing, and they would suffer from adverse heat effects.

Contaminated crops and indeed other food-stuffs including dairy and meat products are transported for thousands of kilometers to feed others. It is important to remember that the challenge for the future is to find an acceptable compromise between the interests of humanity and integrity of the biosphere on which future generations will have to depend. In the future "a cradle to grave" approach will be necessary. This initially may incur some costs, but the benefits will be significant. There will be gains from improved housekeeping, low disposal cost, and reduced sickness of both employees and of local national and international communities. The only reasonable solution to global pollution cannot be increased regulations of isolated point sources, but rather on increased emphasis on waste reduction and minimization, and the increased in material recycling.

There is no better ally in the service of our environment than strict economies. In today's economic well being, if not adequately managed and communicated to the public, may well be tomorrow's catastrophe. Implementation of product stewardship and duty of care from "cradle to grave" is essential, if tomorrow's catastrophes are to be averted.

### 5.3. Eco-toxicology Monitoring - M.L. Richardson

Ecotoxicology can be defined as the science devoted to the study of the production of harmful effects by substances entering the natural environment, especially effects on population communities and ecosystems; an essential part of ecotoxicology is the assessment of movement of potentially toxic pesticides through environmental compartments and through food webs. Exposure has to be measured by residue techniques e.g. gas chromatography or by generic techniques by the use of Photobacterium phosphoreum NRRL-B-11177. The Microtox test on the Vibrio Fischeri - the Mutatox test.

Ecotoxicology, unlike human toxicology, is more concerned with the effects to population than to individuals. Human toxicology is based on the extrapolation of data from many species to one species, man; whereas ecotoxicology necessitates the extrapolation from a few species to many; are from limited field data to entire ecosystem. Assessment of environmental hazard and risk (requiring monitoring data) is not something that can be done simply by a set of rules; it is a continually developing skill which requires dedicated expertise and expert awareness of the state of relevant knowledge. Some generalization can be made:

1. An estimate must be made of the level at which any potentially hazardous substances will appear in the environment and be taken into living organisms. This can be an estimate of probable exposure; and.
2. Any estimate must be made to the levels likely to be harmful to the organisms at risk. This is an estimate of dose-effect and dose-response relationship under expected conditions of exposure.

A comparison of these two sets of data will indicate the likely safety margin if the chemical under consideration enters the environment following the mode of use or disposal assumed in the initial estimates.

This safety margin should be very large before use and release of a chemical into the natural environment can be justified. Even after every reasonable step has been taken to ensure the safe use of a potentially toxic chemical, it is essential that routine monitoring be carried out after it enters the natural environment.

#### 5.4. What has Quality to do with Biology - Erik K. Kirknel

The use of pesticides is followed by a flood of scientific papers on toxicity data for man and the environment, efficacy tests, data on phytotoxicity, chemoresistance in insects and fungi etc. Up till now GLP has only been required to ensure retrospectivity on limited areas and only few nations have enforced such quality management system. Even if required in regulation of the use of pesticides, few nations have been firm to required data generated by means of GLP.

The European Community (EU) has recently issued directive (93/17 EEC) which requires some sort of quality managing system for a list areas among which efficacy and effects on non-target organisms, is the most important. The quality managing system will be close to the OECD principles of GLP. The reason for the increased interest in quality managing systems is to improve quality, in order to obtain mutual acceptance between nations of data and avoid duplicative testing.

GLP is a quality management tool where documentation and retrospectivity are key words of importance. The paper has given complete text of the OECD principles of GLP and offer comments of implementation of such a system.

It is also emphasized, that any laboratory will benefit on introducing at least standard operating proceedings for the most vital areas. It is often believed to be a future non-obtainable goal for laboratories to work in accordance with GLP. There is often an excuse for not being concerned enough about the quality produced, but rather the quantity.

#### 5.5. A Review of the Guidelines for Testing the Effects of Pesticides on Beneficial Organisms - Erik K. Kirknel

A review of the development of IOBC guidelines for testing the effects of pesticides on beneficial organisms in OCED is given. This work was initiated by J.M. Franz Dramstadt, Germany, who concluded on basis of the literature, that it was necessary to standardize these test in laboratory experiments in order to increase reproducibility. The idea was, if harmlessness was obtained in laboratory experiments, the pesticide was considered as safe to use in integrated pest control programmes. Very few

pesticides were considered harmless after tested in the lab(s). Therefore other test methods were developed, gradually approaching field experiments. A sequence test was developed starting from laboratory experiments to eventually ending with field experiments. If found harmless in testing test the pesticides was accepted as safe. Otherwise the pesticide proceeded to the next step. If finally not accepted in the field test, it was dropped. There are six group of tests:

1. Laboratory susceptible life stage. Number of developed test methods: 21.5 under development.
2. Laboratory, less susceptible life stage. Number of developed test methods: 6.5 under development.
3. Duration of harmful activity (Persistence test). Number of developed test methods: 6.8 under development.
4. Extended laboratory method. Number of developed test methods: 5.5 under development.
5. Semi-field, initial toxicity. Number of developed test methods: 5.11 under development.
6. Field. Number of developed test methods: 4.10 under development.

This international cooperation has resulted in five joint pesticide test programmes, the first in 1980 and the last in 1991. A long list of results from these test programmes is presented in the paper.

Efforts are underway to prepare internationally accepted guidelines for this area and J.M. Franz's principles from 1974 will probably in the near future constitute the basis for these guidelines.

#### 5.6 Status and Prospects for Eco-toxicological studies in Pakistan - Dr. Umar K. Baloch

The use of pesticides in agriculture in the developing countries in view of ever increasing population is inevitable rather it is an evil of necessity. In the developed world the use of pesticide is much safer because of availability of research facilities and effective implementation of legislation for pesticide control purposes. This is naturally balanced because of low population growth rate and a high rate of literacy. The conditions in the developing countries dictate the circumstances and situation the indiscriminate use of these pesticides. There is very scanty data available on agro-chemical eco-toxicology in view of non-availability of basic amenities for research. The developing countries without the support of international agencies and developed world cannot come to the expectations of developed world because they don't have resources (financial, trained manpower and lab. facilities) to rationalize the safe use of pesticides.

However the need for research on eco-toxicological aspects of agro-chemicals was realized back in 1982 in the first meeting of the Technical Advisory Committee for the Regional Network on Pesticides for Asia and the Pacific where the National Coordinator for Pakistan proposed the establishment of these facilities in the Region and offered to host Region Sub-Network in Pakistan. The facility did not materialize till 1990 when the Government of Pakistan moved a formal proposal for the establishment of Eco-toxicology

Research Centre. The proposal was supported by UNIDO and the Government of Denmark offered the financial support. The Eco-toxicology Research Centre in Pakistan established at Islamabad has now become a reality; the objectives of this centre also include "To cater to the need of the Asian Region in the Field of Eco-toxicology".

#### 5.6. Assessment of Industrial Chemicals of Health and Environmental Relevance - L. Vollner

The German Chemical Act of 1980 stipulates that certain existing chemicals must be reported to the competent authority, if they exhibit properties which indicate they may be hazardous, either alone or in combination with other chemicals. The purpose of the committee, established according to recommendations of the European Community (EC), was to seek appropriate solution for dealing with chemicals which are relevant to health and environment, through the adoption of voluntary measures.

In view of the estimated number of about 100,000 chemicals currently on the market within the EC (now EU), a selection on the basis of quantitative criteria is not feasible. Consequently, a pragmatic approach was developed for carrying out a selection on the basis of the limited data available. Combining different lists of possible hazardous chemicals, discriminating duplicates and certain groups, the great number of about 4500 was placed up to about 40. The remaining once has been investigated for their properties, according their data published upto now.

#### 5.7. Use of Radio-labelled Chemical in Agriculture and Environmental Studies - L. Vollner

The author presented his long-term experience on usage of C-14 - labelled pesticides in such studies, emphasizing the advantages of the low levels detectable, avoiding complex extraction and clean-up procedures e.g. these studies include especially activities of the Institute of Ecological Chemistry, National Centre of Environment Research, GSF, close to Munich, Germany on the field of eco-toxicology.

#### 5.8. Use of Radio-labelled Chemicals in Agriculture and Environment Studies - A. Hussain & L. Vollner

The authors have emphasized the advantages of using radio-labelled pesticides in agriculture. Such studies were conducted under laboratory and field conditions, both in sub-tropical and temperate regions.

Field studies: Dissipation and degradation of C<sup>14</sup>-p.p-DDT (Faisalabad and Peshawar) were studied for one year in soil under field conditions. DDT dissipated more rapidly under the Pakistani sub-tropical climate than reported for temperate regions. More binding to soil of C<sup>14</sup>-DDT was observed at Peshawar than that at Faisalabad. Overall halftives were 144 and 313 days in Faisalabad and Peshawar respectively. The main degradation products of p.p'-DDT extracted from soils at the two locations were p.p'-DDE and p.p'-DDT.

Laboratory studies: The effects of temperatures and solar radiation on the dissipation of C<sup>14</sup>-p.p'-DDT from a loam soil was studied by quantifying volatilization, mineralization and binding. The major DDT loss occurred by volatilization, which was 1.8 times more at 45°C than at ambient temperature (30°C). Mineralization of DDT slowly increased with time but it decreased slightly with increase in temperature. Binding of DDT to soil was found to be

less at higher temperature (35 and 45°C) as compared to ambient temperature. Degradation of DDT to DDE was faster at higher temperatures.

Exposure of non-sterilized and sterilized soils treated with  $C^{14}$ -DDT to sunlight in quartz and dark tubes for 6 weeks resulted in significant losses. Volatilization and mineralization in quartz tubes were more as compared to dark tubes. Further, higher rates of volatilization were found in non-sterilized soils than in sterilized soils. The results suggest that faster dissipation of DDT from soil under local conditions relates predominantly to increased volatilization as influenced by high temperature and intense solar radiation.

Dissipation of  $C^{14}$ -p.p' from water and solid surfaces was also studied. DDT dissipated rapidly from water under out-door conditions with overall half-life of 53 days. The main degradation products were p.p'-DDE and p.p'-DDD. A portion of  $C^{14}$ -residues was found in the sediment plus biomass and on the inner surface of the glass container. This amounted to 7.2 and 6.7% of the initially added radioactivity, respectively. DDT dissipated from clay plates under indoor conditions with an overall half-life of 160 days.

Simulating lower sand layers, which are responsible for ground water filtration. DDT does not move more than 10-15 cm in a 50 cm long column. Only 3% of the total radio-activity applied were leached. A qualitative analysis indicated that this part is a polar degradation production of DDT.

#### **5.9. Pesticide Residues in Foodstuffs in Pakistan - Organochlorine, Organophosphorus & Pyrethroid Insecticides in Fruits & Vegetables - S. Zafar Masud & Nusrat Hasan**

Organochlorine, organophosphorus and pyrethroid pesticides were monitored in samples of fruits and vegetables procured from the main selling points and grower's fields of Karachi (Sindh), North West Frontier Province, Islamabad and Quetta/Pishin districts of Balochistan province of Pakistan during July, 1988 & Sept. 1992. A total of 550 samples were screened out of which 214 samples were found to be contaminated with a variety of pesticides. Seventy-nine samples have been found to contain residues above maximum residue limits (MRL's) proposed by FAO/WHO while for some of the pesticides, no MRL was available but high amounts of residues were found to be present in certain commodities. In the remaining samples, no pesticide residue could be detected.

#### **5.10 Pesticides & Pesticide Residues in Pakistan - Muhammad Mumtaz**

Annual use of pesticide in the country is about 5,000 MT a.i. and when spread over an estimated 20 million ha. culturable land comes about 250 g/ha per annum as against 2.50 kg/ha in EEC countries. There are however, hot spots like cotton and vegetable where intensive use of insecticides is a cause of great concern and some residues are feared to be leaching down to the shallow aquifer which are sources of drinking water. In addition insecticides like dimethoate reported to be affecting at-least 5% species in the presence of only 300 mg/ha per annum justifies the establishment of Ecotox research in Pakistan which is mainly using insecticides (83% of the total pesticide consumed) and dimethoate is a key pesticide for cotton. Although IPM is being introduced, chemical control of pest is the predominant strategy and use of pesticide is expected to increase further to contain crop losses.

Mr. Mumtaz presented the or. monitoring the fate of DDT residue in paddy eco-system (straw, panicles and soil) and fate of monocrotophos, fenitrothion, endosulfan, phorate and disulfoton in cotton plant.

### 5.11 Terrestrial Ecology - A Vital Component of Ecotox Research - Dr. M.A. Matin & Mr. Ather Rafi

Eco-toxicology is the study of pollutants in eco-systems and consequently the study of the inter-action of the one upon the other. Our environment has two basic compartments. (i) Biotic- all the life systems including flora and fauna (including human-beings) (ii) Abiotic - the surrounding environment which comprises everything other than life systems (air, soil, water) Ecotoxicology is then a blend of toxicology (science of toxic chemicals) and ecology (science of the environment). Within the biotic compartment of the environment, our concern is the terrestrial habitats especially the beneficial organisms. Our major emphasis is agricultural habitats and again the major priority is to deal with the effects of pesticides on the beneficial macro-fauna such as:

- i. non-target beneficial arthropods (e.g. insects and mites predators and parasitoids of insect pests of field crops, pollinators and other beneficial arthropods).
- ii. non-target beneficial soil macro-fauna (e.g. annelids especially earthworms)
- iii. non-target avian and some mammalian fauna (associated with the agro-ecosystem).

The primary ecological problems posed by pesticides being the disruption of natural ecological balance of the populations of species and inter-acting and inter-dependant balance of the community in the agro-ecosystem. Some prevalent ecological problems have been pest resurgence (helping enemies), pest upset (creating new enemies), over killing of soil beneficial (affecting natural development of habitats), and disruption of the food web (by friggering a chain reaction). The solution of the problems be in:

- i. Strict observance of primary protection standards - the amount of toxicants in the target that must not be exceeded.
- ii. Establishment of environmental quality standards
- iii. Proper monitoring scheme and facilities through regular measurements of chemical residues both in the substrate as well as target and non-target organisms and the evaluation of biological effects
- iv. Identification of selective chemicals and/or dosage to augment our natural friends.
- v. Development of awareness by educating public in general and the agri-personnel in particular.

### 5.12 Bioremediation of Pesticide Contaminated Agroecosystem - M. Yousaf Hayat & Shahida Akhtar

The agricultural activity based heavily on the usage of pesticides to increase crop yield proved to be a potential source of ground water

contamination. Potentially harmful amounts of these pesticides especially chlorinated pesticides and related recalcitrant breakdown products are introduced into our water supplies by crop application, accidental spillage, improper disposal of pesticide rinse water, surface run off, and possibly by soil adsorption delayed entry into ground water. The contaminated ground water in our daily consumption causes health hazards such as gastro-intestinal disorders, carcinogenesis, coronary and reproductive system diseases (Hallenback and Cunningham, Burns, 1985). Cleanup of pesticide rinse waters and pesticide contaminated agro-ecosystem by existing physico-chemical technologies is a highly expensive proposition.

Bioremediation (the controlled biodegradation of toxic chemical) has been used for many years to remove contaminants from different petroleum contaminated soils. Recent biotechnology advances in microbial ecology and genetic engineering suggest that bioremediation has a broader applicability and may provide a practical cost effective system for clean up of a variety of organic contaminants for agro-ecosystem.

## 6. SUMMARY OF PANEL DISCUSSIONS

The participants of the workshop discussed three topics under separate panels. These panels discussed the following topics.

- Panel 1. Ecotoxicology related to water (aquatic toxicology, ground water contamination) - Group I
- Panel 2. Terrestrial ecology & soil contamination - Group 2
- Panel 3. Need for assistance to Asia and the Pacific countries in monitoring movement and fate of xenobiotics in the ecosystem. (All participants)

The first panel started with a brain storming session to bring out various points needed to address the topic of ecotoxicology related to water. It identified the following areas(not in order of priority ) such as:

- i. Strong technical inputs
- ii. Country capacity building
- iii. Sustainability
- iv. Inputs from manufacturers for adopting "cradle to grave"
- v. Access to information
- vi. Regional role of Ecotoxicology Research Centre in Pakistan once established
- vii. Disaster/Emergency planning
- viii. Training
- ix. Legislative requirements
- x. Surveillance-monitoring
- xi. Industries/Government role
- xii. Public participation and awareness.

Having identified the elements for discussion the panel took up problems faced by member countries. It was mentioned that the countries are generally aware of the problems but many do not have the legislative measures, standards and guidelines.

The panel also pointed out the general lack of awareness and capability in understanding risk assessment procedures and also the lack of availability of data on ecotoxicology for chemicals of concern.

The panel concluded that the goal should be to promote research on ecotoxicology and to formulate/implement laws and regulations and measures to prevent environmental problems associated with xenobiotics in the ecosystem. To achieve these goals the panel concluded that the needs are :

- to understand practical way of "risk assessment"
- access to data on ecotoxicology including communication system on "risk" and survey data.
- provision of technical capability for ecotoxicology monitoring with facilities and skilled staff.

The second panel also raised the point of harmonized legislative measures for RENPAP member countries with standardized guidelines on ecotoxicology. The panel stressed the importance of proper waste disposal of pesticides at the production and user ends with greater attention given to public awareness. The panel noted that extension service facilities already available in member countries could be used to disseminate information on ecotoxicology of pesticides (used in the field) for proper advice and adopting precautions as appropriate. The panel specially recommended setting up of a working group to develop test guidelines for evaluation of the effects of local non-target organisms and as in regional harmonization of legislative measures and to recommend ways and means of implementation.

Based on the first and the second panel discussions the third panel discussed the various suggestion and formulated recommendations (page 49-50).

## 7. CONCLUSIONS AND RECOMMENDATIONS

### 7.1. Conclusions

The workshop as intended, gave an excellent opportunity to member countries of the region to discuss among themselves and with experts the importance of ecotoxicology monitoring of chemicals of concern. The workshop recognized the problems the region is likely to face with increase in the consumption of chemicals especially pesticides and fertilizers. The workshop also concluded that ecotoxicology being multifaceted field would need interministerial coordination and also inputs from international agencies and non-governmental organizations to assist the member countries in hazard identification, risk assessment/reduction and management of risks associated with the large use of agrochemicals and then extend the experience gained to other industrial pollutants. The workshop also noted that persistence of pesticides in the environment in the temperate region would be different from the tropical region especially for organochlorine pesticides and each member country as far as possible should make use of data on ecotoxicology already available. The meeting also concluded that member countries should have capability to conduct laboratory assays to monitor ecotoxicology of pesticides with the technical assistance from Eco-toxicology Research Centre in Pakistan. Also monitoring environment matrices so as to make early warning systems to avoid any catastrophic incidents was considered important. While the meeting dealt at length on occupational safety of workers in working place (during production and application), it was concluded that this topic was covered elsewhere and was outside the scope of the workshop. The meeting also concluded that Pakistan should play a lead role in the establishment of



facilities, training and dissemination of information for member countries of the region by virtue of taking lead in establishing Eco-toxicology Research Centre with UNIDO and Danish Government assistance. Access to information available on ecotoxicology for chemicals of concern should be made available to member countries.

## 7.2. Recommendations

- 7.2.1. Having taken into account generally the lack of legislative measures governing environmental aspects relating to chemicals of concern. The workshop *recommends*:
- Support be given through RENPAP. International Agencies and respective governments to establish or strengthen environmental aspects of legislative measures to member countries.
- 7.2.2. The workshop having noted the existing variations in legislative measures and regulatory standard and having taken into account problems resulting from these differences *recommends*:
- RENPAP should assist in providing a mechanism to work towards their harmonization of legislation and regulatory standards and a working group be established to consider appropriate means to achieve this goal. To facilitate such harmonization Governments of member countries be encouraged to promote interministerial coordination/ communication(Refer also to recommendation 6.)
- 7.2.3. Having realized the importance of "risk assessment" pertaining to ecotoxicology for the member countries of RENPAP the workshop *recommends*:
- assistance be provided to governments in order that they might improve their capability to conduct "risk assessment" relevant to the conditions in their respective countries.
- 7.2.4. The meeting having discussed the importance of the availability of reliable data pertaining to ecotoxicology to member countries *recommends*:
- the selection and prioritization of chemicals and to assess the availability of information from various sources such as UNEP/IRPTC, IPCS/EHC etc. and use of the RENPAP data base for dissemination of this information.
- In order to assist the region in such a prioritization the workshop *recommends* that individual member countries submit to Ecotoxicology Research Centre/ RENPAP a list of chemicals of concern
- 7.2.5. The workshop having taken into consideration the existence of extension service in most countries *recommends*:
- the countries should work towards ensuring that in addition to information on the safe and efficient use of pesticides information on their environmental impact and effects should also be provided to the end users eg. farmers.
- 7.2.6. The workshop having realized the importance of effective use of limited resources in the region strongly *recommends*:
- formation of a working group to consider and advise on priorities for work on ecotoxicology in the region and that RENPAP should prepare terms of reference for such a working group as soon as

possible.(please refer to recommendation 2). Industry representatives should be included in such a working group.

7.2.7. Having realized the significance and importance attached to the Ecotoxicological Research needs of the Asian Region the workshop **recommends:**

- the international agencies to support strengthening of facilities/capabilities of Ecotoxicology Centre in Pakistan to be able to provide needed leadership to the Region.

7.2.8. Having considered that all member countries sooner or later should have facilities for ecotoxicology/ environmental monitoring the workshop **recommends:**

- each country identify the necessary resources (financial and skilled personnel) to initiate/strengthen such activities.

8.

**EVALUATION OF THE WORKSHOP**

Evaluation of the workshop was carried out according to UNIDO Standard Questionnaire. Twenty two participants returned the questionnaire and the salient features of their answers are summarised below:

1	Duration of Workshop	Too Long		Just Right		Too Short	
		2		18		2	
2	Did training correspond to your present need	To a small extent		To a large extent		Very large extent	
		4		10		4	
3	General Technical Level of Workshop	Too low		Adequate		Too high	
		2		16		4	
4	Most valuable topic covered	Ecotoxicology monitoring	GLP	Pakistan Ecotoxicology work	Panel discussion	Country Paper	Env. assessment
		10	10	6	2	3	4
		Radio labelled	Key note address	Field visit	Ind. position on safety		
		1	2	1	1		
5	Least valuable	Country Paper			Visit to Labs.		
		2			3		
6	Any topic not adequately covered	Yes			No		
		1			2		
7	Did you have sufficient time for professional exchange of views with:	Workshop Faculty			Fellow Participants		
		Yes		No	Yes		No
		16		6	16		5
8	Participating in Workshop benefitted professionally	To sufficient extent		To great extent		Very great extent	
		12		7		3	

## 9. VALEDICTORY SESSION

The valedictory session was chaired by Dr. Zafar Altar, Chairman of PARC and Secretary, Food, Agricultural and Livestock, Government of Pakistan who invited the Workshop Chairman to summarize the outcome of workshop and the recommendations adopted. The chairman expressed his extreme satisfaction over the outcome of the workshop and offered his organization's services for the benefit of promoting ecotoxicology/environmental monitoring in the region. He presented a national gift to each participant as a token of appreciation from the Government of Pakistan.

**Programme**  
**ECO-TOXICOLOGY WORKSHOP**  
**Islamabad**

Venue: Pakistan Agricultural Research Council  
 20. G-5/1. P.O. Box 1031. Islamabad

Sunday - 27 March 1994

- 09.00 Registration
- 09.30 Election of Chairman/Vice-Chairman/Rapporteur  
         Adoption of Agenda  
         Details on Arrangements, topics for detailed discussions and  
         formation of discussion groups
- 10.30 Tea Break
- 12.00 Country papers (in alphabetical order)
- 13.00 Lunch Break
- 14.00 Country papers (continue)
- 15.00 Industry's Position on Ecotoxicology by Dr. W. Wyn Ellis. GIFAP Project  
         Head "Safe Use Project" in Thailand
- 18.00 Inauguration of Eco-toxicology Research Centre, Pakistan
- 18.10 Recitation from the Holy Quran
- 18.15 Introduction by Dr. Umar Khan Baloch, DDG & National Project Director,  
         Eco-toxicology Research Centre
- 18.20 Welcome by Dr. Zafar Altaf, Chairman, PARC & Secretary,  
         Food, Agriculture & Livestock, Govt. of Pakistan
- 18.25 Statements from UNDP/UNIDO representative - Dr. B. Sugavanam
- 18.30 Address by Nawab Muhammad Yousaf Talpur Minister for Food, Agriculture  
         & Livestock, Government of Pakistan
- 18.35 Inaugural address by Sardar Farooq Ahmad Khan Leghari, President,  
         Islamic Republic of Pakistan
- 18.45 Vote of thanks by Prof. (Dr) Muhammad Hanif Qazi, Member (Crop  
         Sciences), PARC
- 18.50 Refreshments

Monday - 28 March 1994

- 09.00 Key Note Address by Mr. Mervyn L. Richardson BASIC, UK - UNIDO  
         Consultant
- 10.00 IOBC-Test Methods for Beneficial Anthropods by Mr. Erik K. Kirknel,  
         Danish Institute of Plant and Soil Science, Denmark, UNIDO Consultant
- 10.45 Tea Break
- 11.15 Status and Prospects for Ecotoxicology studies in Pakistan, Dr. Umar K.  
         Baloch, Dy Director General, PARC and National Coordinator of RENPAP.
- 12.00 Discussions
- 13.00 Lunch Break
- 14.00 Assessment of Industrial Chemicals of Health and Environment Relevance,  
         Mr. Lajos Vollner, Gessellschaft fuer Strahlen und Umweltforschung,  
         Muenchen

Tuesday - 29 March 1994

- 09.00 Ecotoxicology Monitoring - Mr. M.L. Richardson
- 10.00 Good Laboratory Practices (GLP) for Pesticide Eco-toxicology by Mr.  
         Erik K. Kirknel, UNIDO Consultant
- 10.45 Tea Break

- 11.15 Presentations by Scientists, Ecotoxicology Research Centre, Islamabad  
 - Dr. M.A. Matin  
 - Mr. Mohammad Muntaz  
 - Dr. Yousaf Hayat Khan

12.30 Lunch Break

- 14.30 Visit to Labs of the Institute of Pesticide Ecology, Ecotox Research Centre and other Programmes at National Agricultural Research Centre

Wednesday - 30 March 1994

- 09.00 Use of Radio Labelled Chemicals in Agricultural and Environmental Studies - A General Overview - Dr. L. Vollner

- 09.45 Radio-labelled Residue Studies by Dr. Altaf Hussain & Dr. L. Vollner

- 10.00 Video by Dr. M.L. Richardson

10.30 Tea Break

- 11.00 -Country paper (India) by Mr. M.M. Srivastava

-UNIDO activities

-RENPAP activities

12.30 Lunch Break

13.30 Panel discussions

Panel 1 Ecotoxicology related to water (aquatic toxicology, ground water contamination)

Moderators: Mr. Richardson/Dr. Sugavanam

Panel 2 Terrestrial Eco-toxicology and soil contamination

Moderators: Dr. Kirknel/Dr. Baloch

15.30 Tea break

16.00 Panel presentation

Thursday - 31 March 1994

09.00 PANEL DISCUSSIONS

Panel 3 - Assistance to Asian countries on Ecotoxicology Monitoring

Moderators: - Dr. L. Vollner/Dr. S.P. Dhua

11.00 Panel presentation

13.00 Lunch break

15.00 Draft report with recommendations

16.00 Concluding remarks

**Participants to the  
workshop on Eco-toxicology  
Islamabad  
27-31 March 1994**

**Bangladesh**

1. Mr. Md. Luqman Hakim, Chief (Cane Production & Support Services), Bangladesh Sugar & Food Inds. Corpn., Adamjee Court Bldg. 115-120 Motijhee C/A. Dhaka Ph.230481
2. Mr. Mohammad Sayedul Haque, General Manager (Production), Chittagong Chemical Complex, P.O. Barabkund, P.S. Sitakind, Distt. Chittagong. Ph- 224343; Telex-633253 CCD DT CABLE CHEMICALS

**India**

3. Dr. Kawal Dhari, National Project Coordinator, Institute of Pesticide Formulation Technology, Sector-20, Udyog Vihar, Gurgaon-122 016 Haryana. Ph.(011)8341319, 341010
4. Mr. Manmohan Srivastava, Director, Deptt. of Chemicals & Petrochemicals, Ministry of Chemical & Fertilizers, 308, Shastri Bhawan, Dept. of Chemicals & Petrochemicals Ph (011)383686

**Indonesia**

5. Dewi Ratna Wulan, Staff Director Agrochemical, Deptt. of industries, Jl. Gatot Subroto Kav 52-53, Jakarta Ph.62-21-5253260
6. Mr. Abdullah Nawawi Raksawiguna, Director of Narcotics and Hazardous Substances Control, Ministry of Health of Republic of Indonesia, Jalan Percetakan Negara No.23 Jakarta, Ph.62-21-4207683, 4245523 Fax-62-21-4207683, 4243605

**Iran**

7. Mr. Mesgaran Karimi Bagher, Head of the Ecological Research Center Office in Gorgan, Deptt. of Environment, Iran Ph-225132.34 Fax-225133
8. Mr. Ojani Nasser, Specialist in Technical Division (Engineer), Ministry of Agriculture (FDPPC Deptt) of Iran, No.73 Zartostl Street Tehran Ph-659722 Fax-655669 Tlx-212814/219213

**Republic of Korea**

9. Dr. Yong-Hwa KIM, Head Environmental Toxicology Laboratory, Korea Research Institute of Chemical Technology, P.O. Box 107, Yu Soung, Dae Jeon 305-606 Ph-82-42-860-7490 Fax-82-42-860-7488
10. Dr. Yang-won KIM, Assistant Director, Ministry of Agriculture, Forestry and Fisheries, Kyungkido Kwacheonst Changangdong, Secul. Ph-82-2-503-7255

**Malaysia**

11. Dr. Mohd Yusoff Adon, Chief Assistant Director of Health (Workers and Environmental Health), Ministry of Health, Block E, 2nd Floor, Komplek Pejabat, Jalan Dungun, Bukit Damansara, 50490 Kuala Lumpur Ph-03-2540088 Fax-03-2561566
12. Ms. Nursiah Tajol Aros, Agriculture Officer, Dept of Agriculture, Jalan Gallagher, 50480 Kuala Lumpur Ph-03-2983077 Fax-03-2983646



**Myanmar**

13. Mr. Myint Swe, Dy. General Manager, Myanmar Agriculture Service, Pesticide Formulation Plant, Kanetchaung PO, Hwambi, Yangon Myanmar, Ph-48257

**Nepal**

14. Dr. Bhimsen, K.C., Chief Plant Protection Officer, Deptt. of Agriculture Development (DOAD), Plant Protection Division, DOAD, Harihar Bhawan, Lalitpur, Kathmandu Ph-524352
15. Mrs. Ram Baden Pradhan, Director, Plant Protection, Deptt. of Agri. Development, HMG, Ministry of Agriculture, Harihas Bhairan, Lalitpur, Kathmandu Ph-524225

**Philippines**

16. Mr. Francisco C. Cornejo, Administrator, Fertilizer and Pesticide Authority, Building # 2, NIA Complex, EDSA, Quezon City metro, Manila, Ph-965877
17. Dr. Elpidio F. Rimando, Supervising Science Research Specialist, Deptt. of Environment and Natural Resources, Ecosystems Research and Development Bureau, ERDB 4030 College, Laguna Ph-2229, 2269 Fax-362-094-3628 Tlx-40860 PARRS PM

**Sri Lanka**

18. Dr. G.K. Manuweera, Senior Asstt. Registrar of Pesticides, Office of Registrar of Pesticide, P.O. Box 49, Peradeniya Ph-94-8-88076; 88135 Fax-94-8-88135
19. Mr. K.H. Muthukudda Arachchi, Senior Environmental Officer, Central Environmental Authority, Maligawatte, Colombo-10 Ph-44945516 Fax-446749

**Thailand**

20. Dr. Wilawan Juengprasert, Director of the Division, Division of Occupational Health, Deptt. of Health, Ministry of Public Health, Thailand-10200, Ph-02-2822911 & 2812466 Fax-02-2825176
21. Ms. Suwimol Lerdwerasirikul, Scientist 7, Division of Agricultural Toxic Substances, Department of Agriculture, Bangkok-10900 Ph-65-2-5793577 Fax-662-5614695

**Viet Nam**

22. Mr. Nguyen Duc Trong, Doctor of Medicine, Institute on Labour Protection, 1-Yetkieu-Hanoi

**UNIDO**

23. Dr. B. Sugavanam, Sr. Industrial Development Officer, UNIDO, P.O. Box 300, Vienna, Austria, Ph-21131 x 3940
24. Dr. S.P. Dhua, Regional Coordinator, RENPAP, United Nations Industrial Development Organization, 55, Lodi Estate, UNDP, New Delhi Ph.4629112 Fax.91-11-462012

25. Dr. Umar Khan Baloch, Workshop Coordinator, Pakistan Agricultural Research Council, P.O. Box 1031, Islamabad Ph.829669 & 819051 Fax-812968 Tlx-4604 PARC PK
26. Dr. Erik K. Kirknel, Senior Scientist, Ministry of Agriculture, Plant + 80iw Science, Flaukkebjerg, 4200 Slagelse, Denmark Ph + 4553586300 Fax +4553586371
27. Dr. Lajos Vollner, Consultant UNIDO/UNDP, GSF-National Centre for Environmental Res. Ingolstadter Landstr. D-85758 Neuherberg-Germany, Ph-0049-89-31782236 Fax-0049-89-3178-2231
28. Dr. Mervyn Lewis Richardson, Basic Lon Kekubf of UNIDO, 6 Birliv Dd, Kickmansworth, Herts wd32ul GBR Ph +44 923779187 Fax + 44923774187

#### FAO

29. Murray, William (Bill), Plant Protection & Production Division (AGP), Food & Agriculture Organization of the UN, FAO, AGP-C-751, Viale delle terme di Caracalla, Rome 00100, Italy, Ph-39-6-5225.3222 Fax-39-6-5225-6347

#### Industry

30. Dr. Wyn Ellis, Safe Use Project Leader, GIFAP, Kasetsart University Alumni Bldg, 50 Pahonyothin Rd., Bangkok 10900, Thailand Ph-662 579 7837 Fax-662 579 9914
31. Mr. Zafar Iqbal, Regional Manager, FMC, Pansota House, Mahmoodabad Colony, Khanewal Road, Multan Ph-061-553927
32. Mr. Tariq Alauddin, Plant Manager, CIBA (Pakistan) S-53 Site, Karachi Ph-256494 Fax-2561577

#### Pakistan

33. Dr. Altaf Hussain, Principal Scientific Officer, Nuclear Institute for Agriculture & Biology, Faisalabad Ph-654221-30 Fax-92-411-654213 Telex-43356 NIAB-PK
34. Dr. Sved Zafar Masud, Principal Scientific Officer, Tropical Agricultural Research Institute, Karachi Ph-470809
35. Dr. Said Khan Khalil, Assoc. Prof. Deptt. of Plant Protection, NWFP Agricultural University, Peshawar Ph-40230-39 Ext.229
36. Dr. Farmanullah, Asstt. Professor, Deptt. of Plant Protection, NWFP Agricultural University, Peshawar Ph-40230-39 Ext.229

#### Eco-toxicology Research Centre, PARC, Pakistan, Fax-812968 Tlx-5605 PARC PK

37. Dr. Umar Khan Baloch, Dy. Director General & National Project Director, Ph.829669 & 819051
38. Mr. Muhammad Mumtaz, Principal Scientific Officer, Ph.82005-369.
39. Dr. M.A. Matin, Senior Scientific Ph.82005-272
40. Dr. Yousaf Hayat Khan, Senior Scientific Officer Ph.82005-376
41. Mrs. Shahida Akhtar, Senior Scientific Officer Ph.819051-2415
42. Dr. Sima Tahir, Scientific Officer Ph.82005-369
43. Mr. Ather Rafi, Scientific Officer Ph.82005-777
44. Mr. Tahir Anwar, Scientific Officer Ph.82005-369
45. Mr. Muhammad Ashiq, Asstt. Scientific Officer Ph.82005-369

## INAUGURAL ADDRESS

By

Sardar Farooq Ahmed Khan Laghari  
President of Islamic Republic of Pakistan

Mr. Minister. Excellencies. Distinguished Delegates. Ladies and Gentlemen!

Cliches are distasteful because they are oft repeated, but in renewing my contacts with agricultural scientists I can say that it is a matter of pleasure and great privilege. Pleasure because I have and I am in the primary production system and my hereditary avocation has been and is agriculture. It is a matter of privilege because one feels that it is with scientific vigour that we can make this world a better place to live in. Today's agenda is very relevant to the one world we have, to the cause of humanity and to our very breathing. Since technological progress is a continuous and never ending process, there is a need and desire to implement this in our part of the world. This present Eco-Toxicology Workshop forms part of this new dimension. It has been rather late in coming but I hope that in the years to come it will make up its belated entry through extra vigour and energy.

2. In 1980 when the shift in the pesticide's sector was made, from the public to private sector, a number of incentives were provided to the multinationals by providing them a level field and a propitious environment. That was done in order to ensure that productivity in the agriculture sector increased substantially. The use of pesticides did indeed improve this productivity and an analysis of facts provides substantial evidence. But then somewhere along the line, the balance was lost and today you see resistance has developed in certain pests where the use of pesticides has been inappropriately high. It is visible in the cotton area, in the Brown Hopper population in the rice fields. In using excessive pesticides, we have endangered the balance which nature has brought between predators, paratoids, and parasites. The emergence of white fly as a primary parasite is indicative of this effect.

3. Although agriculture sector in Pakistan has made good progress during the last decade but it did not fulfill its promise because of natural calamities. Biotic and abiotic stresses have seriously reduced production of crops which cannot be overcome without adequate research and development efforts. I am informed that generally almost one third of crop productivity is lost to pest attack. For example during the year 1993 when cotton crop was victim of cotton leaf curl virus a decline of 27 per cent in cotton production was experienced while during 1994 the loss is anticipated to equal one third of production. The banana crop due to Banana Bunchy top virus has been reduced to almost half. Thus we should focus our attention on change to broaden the base of pest management. We must analyze ecological relationships in our agro-ecosystem which in turn will require much more research and supervision directed at development of integrated pest management system with rational use of pesticides. Allocation of substantial resources has to be made for upgrading R&D infrastructure for crop protection. Simultaneously, I am concerned that research findings be transferred to the end-users effectively to bring an effective change.

4. Environment is to be saved at all cost and I hope that the toxic residues that have been left in the soil by excessive use of pesticides would be monitored, its impact evaluated and prescriptions provided to regenerate natural life balance. I am already aware that the adverse affects are manifested in the phased elimination of wildlife in our world. Wildlife provides a very important balance in the natural scheme of things and we must very zealously protect what has been provided to us by nature.

5. I must state that the Government of Pakistan accords a very high priority to the issue of safe use of pesticides and trust that you will come up with the needed recommendations and support for follow-up.

6. I understand the Government of Denmark and United Nations Industrial Development organization (UNIDO) have helped us in initiating this Institute of Pesticide Ecology of Eco-Toxicology Research Centre. This venture has become a challenge for future generations.

7. I wish to thank all those who initiated the establishment of this Institute. I hope I have contributed in some little way by taking this first step of inaugurating this Institute. I am also pleased to inaugurate this workshop.

I wish you well and God speed!

**PAKISTAN PAENDABAD**

## ADDRESS

BY

NAWAB MUHAMMAD YOUSAF TALPUR  
FEDERAL MINISTER FOR FOOD, AGRICULTURE & LIVESTOCK

Mr. President, Distinguished Delegates, Ladies and Gentlemen

It is my proud privilege to address this gathering of scientists. On behalf of the Government of Pakistan and on my own I extend a hearty welcome to the delegates attending the "Eco-toxicology workshop". Their agenda is relevant to humanity and the environment. This is of significance to the world in general and the developing countries in particular.

Factor productivity analysis would have us believe that the scientific model constitutes the be all and end all of productivity. When this model was being developed in the mid sixties in Pakistan, it held promise, as yields had been stagnant and population increases were cause for concern. One component of this model was the use of pesticides - and these were indiscriminately used, thus endangering everyone. The world can ill afford this luxury of a toxic laden world. No matter who is involved or who he is involved, the repercussions are wide ranging.

The emergence of pests of economic importance, like white-fly, jassids, bollworm in cotton and brown hopper in rice is attributed to this. The natural world of predators, parastoids and parasites was destroyed. Man had once again done what he should have guarded - the natural ecological balance.

Several constraints pose challenge to agriculture growth in this country. Insects, pests, diseases and weeds are major calamities which devastate crops. During the last three years our agriculture has been in the grip of viral diseases seriously effecting the production of cotton, banana, tomatoes and chillies. This obviously is a warning that we have decided to accord a very high priority to the pest management system in general and safe use of pesticides in particular. Because out-break of viral diseases are reported to have helped the development of resistance in their insect vector hosts (hoppers, white-fly and aphids). To understand the dynamic of pesticide residues in the eco-system is a difficult job. The assessment of their hazards must be based on knowledge of complex factors. Pesticide kill indiscriminately, contaminate food, water, soil, micro and macro organisms, invertebrates and vertebrates, leaving very persistent residues. This is specially true in countries like ours.

We are in the process of establishing facilities for studying the toxic effects of agro-chemicals in nature. The establishment of "Eco-toxicology Research Centre in Pakistan" is the first step towards promoting our plans. I may add that this Government has high priority for sustainable agriculture. A considerable amount of thinking has been done in drawing up requirements in the Task Force report on agriculture. This Government hopes that structural and directional changes will be developed to make agriculture more meaningful.

Our thanks for establishing these facilities are due to the Government of Denmark, United Nations Industrial Development Organization (UNIDO) and United Nations Development Programme (UNDP). I hope this support would continue.

I once again thank you all for participation particularly the President of Pakistan, the delegates to the workshop and Pakistan Agricultural Research Council.

**INTRODUCTION**

BY

DR. UMAR K. BALOCH

Mr. President, Mr. Minister, Mr. Secretary, Distinguished Delegates, Ladies and Gentlemen

It is my proud privilege and honour for the agricultural scientist community to have you here. I am sure your patronage will boost the scientific out-put to benefit the farming community. The science of pesticides is only 50 years old when insecticidal activity of DDT brought a new era in the man's ability to control both pests in agriculture and vector born diseases in health.

The term eco-toxicology was conceptualized only 25 years back, as a natural extension from toxicology, (the science of effects of poisons on individual organisms) to the ecological effects of toxicants. However the transition from the study of single organism to that of eco-system has brought complexities which yet are not fully appreciated even in the developed world. However, the term eco-toxicology in the developing countries is certainly new comer and the facilities for studying the eco-toxicological effects like resurgence of new pests, development of resistance, contamination of soil, water and air, destruction of predators, parasites and other non-target organisms including wild-life are extremely wanting. The major reason for this is the craze for needed food production to feed the hungry million as a result of population explosion in the Asian countries and the lack of awareness both at the level of policy planning and the general public.

I must mention here my experience while conducting my experiments I observed one of our labourer who was sipping the pesticide formulation and boasting that "if it cannot effect me what will it do to insects": without realizing long term effects. Although I tried to prevent him and explained him now and then the consequences of poisoning but one day he was brought unconscious to my home. We treated him and made him walk to his home but he developed ailments and died in six months. This he did not believe pesticides to be the cause of is ailment even at the movement of death.

I observed similar instance in Nigeria where DDT and BHC powder was sold next to what and corn flour on the same mat; and saw million of natural enemies, mammals, birds, fishes dead during the aerial pest control operations and field sprays. I also experienced people killing fishes in the water streams by poisoning through pesticides and this hurt me immensely.

It inspired me to work towards creating facilities for eco-toxicology through Regional Network on Pesticides for Asia & the Pacific which I initiated in 1982 and the dream has become true today in the form of Eco-toxicology Research Centre which you inaugurated Mr. President.

This workshop is a follow-up of the activities on eco-toxicology which Pakistan offered to member countries of the Regional Network on Pesticides for Asia and the Pacific. The project is financed by UNDP and executed by UNIDO. Fifteen members countries (Afghanistan, Bangladesh, China, India, Indonesia, Iran, Republic of Korea, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Thailand and Viet Nam) are participating in the project. In addition to 13 delegates from the member countries UNIDO, FAO & GIFAP are also participating. We have three experts Mr. Erik K. Kirknel from Denmark, Dr. M.L. Richardson from U.K. and Dr. Lajos Vollner from Germany who are known for their leadership in the field of eco-toxicology.

In the next five days we are going to identify issues relevant to the field of eco-toxicology to assist member countries of the Region through a harmonized approach for ensuring environmental protection. This will help for reducing the health and environmental risk emanating out of indispensable use of pesticide for increasing crop production. I believe most of you would have heard the proverb used by the pesticide scientists "Pesticide are an evil of necessity" and this is more than true in our countries.

The workshop will also help promote information Network between the governments, producers, traders and users on the eco-toxicological aspects and the use of important agro-chemicals particularly pesticides.

I thank you Mr. President, the distinguished delegates, ladies and gentleman for the interest you have shown. This is a big inspiration for me and my colleague to work for protection of humanity and nature. Thank you again.

**Pakistan Painsdabad**

**VOTE OF THANKS**  
**PROF. (DR.) MUHAMMAD HANIF QAZI**  
**MEMBER (CROP SCIENCES)**  
**PARC, ISLAMABAD**

Sardar Farooq Ahmad Khan Laghari  
 President of the Islamic Republic of Pakistan

Mir Mohammad Yousaf Talpur  
 Federal Minister for Food, Agriculture and Livestock

Dr. Zafar Altaf  
 Secretary,  
 Ministry of Food, Agriculture and Livestock and  
 Chairman, Pakistan Agricultural Research Council

**Distinguished participants**

Fellow scientists and  
 Ladies and Gentlemen

It is a matter of great pride for me to thank you Mr. President, on behalf of the scientists of the Pakistan Agricultural Research Council for gracing this occasion with your presence today and inaugurating the Eco-Toxicology Centre and the Workshop.

Sir, your patronage is an indication of the Government of Pakistan's resolve to protect the people and the environment from hazards of toxic chemicals in way of establishing an institution of Ecotoxicology at Islamabad and a network of laboratories in the country. This should enhance the image of Pakistan internationally and raise the morale of scientists at home. We thank you Mr. President for this.

My special thanks go to the Federal Minister for Food, Agriculture and Livestock, Mir Mohammad Yousaf Talpur. Sir, your maiden visit to NARC coincided with the inauguration of the Ecotoxicology Centre, is a good omen for us and we look forward to more guidance from you in future as well.

Dr. Umar Khan Baloch has worked very hard to get the Ecotoxicology Centre established during the past six years, since I have been Member (Crop Sciences) in PARC. It is only through the relentless support, guidance and dynamic leadership of Dr. Zafar Altaf that we are able to witness inauguration of this centre today. We are most thankful to him.

The financial support provided by UNDP and the Government of Denmark through the United Nation Industrial Development Organization (UNIDO) is acknowledged with gratitude.

I wish to thank the delegates from member countries of the Regional Network on Pesticides use for Asia and the Pacific for being with us here today.

I also wish to complement all those who dedicated themselves behind the scene to make this conference a success.

Once again, I thank you all for participation and specially thanks to you Mr. President, for kindly presiding over this session.

Thank you and God Bless



UNIDO COMMENTS

The UNDP/UNIDO system for the first time organized a major workshop on 'Ecotoxicology' which is now becoming more and more important in view of man's dependence on chemicals for his survival. In this agrochemicals which are intentionally introduced into the environment need to be monitored so as to avoid any long term side effects to the ecosystem and also in averting major catastrophes.

While the awareness to ecotoxicology is already taken a strong concern in developed countries, the topic has been rather new to developing countries. In that the workshop turned out to be an eye opener to the member countries on the importance of ecotoxicology and environmental monitoring.

The workshop itself dealt with many topics dealing with establishment of suitable laboratories, type of work to be carried out under national/international standards and above all proper information collection and dissemination to the member countries on ecotoxicology of chemicals of concern that enter into the environment due to normal production/use or during accidents.

The three panels gave the opportunity to discuss different problems in the area and the recommendations would lead to a better management of ecotoxicology aspects related to toxic chemicals in the environment. The experience of the Asian network would eventually benefit agricultural resource management in a sustainable way.