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REGIONAL NETWORK ON PESTICIDES FOR ASIA AND THE PACIFIC
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Technical report: Seminar on Environmental Aspects of
production and use of pesticides,
Jakarta, Indonesia, 28 November - 2 December 1988*

Prepared for the Governments of the Member States of the Regional Network
(Afghanistan, Bangladesh, China, India, Indonesia, Pakistan,
Philippines, Republic of Korea, Sri Lanka and Thailand)
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Mr. Abdul Jabbar, Rapporteur, and adopted
by the participants of the seminar on 2 December 1988

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Vienna

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* This document has not been edited.

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1. Schedule of the Seminar
2. List of participants

Abbreviations (as they appear in the report)

RENPAF	- Regional Network on Pesticides for Asia and the Pacific
UNIDO	- United Nations Industrial Development Organization
ESCAP	- Economic and Social Commission for Asia and the Pacific
ARSAP	- Agricultural Requisites Scheme for Asia and the Pacific
CIRAD	- Département du Centre de Coopération Internationale en Recherche Agronomique pour le Développement
GTZ	- Deutsche Gesellschaft fuer Technische Zusammenarbeit
ICI	- Imperial Chemical Industries
FAO	- Food and Agriculture Organization of the United Nations
UNDP	- United Nations Development Programme
CIB	- Central Insecticide Board (India)
OECD	- Organization for Economic Co-operation and Development

I. INTRODUCTION

1. The seminar on "Environmental Aspects of Production and Use of Pesticides" is one of the RENPAP programmes, held in Jakarta from 28 November - 2 December 1988.
2. The Seminar was attended by representatives of the member countries, each from Afghanistan, People's Republic of China, Indonesia, India, Pakistan, Thailand, Sri Lanka and Republic of Korea, from the United Nation's Agencies i.e. UNIDO, ESCAP/ARSAP, from Département du Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), France; Deutsche Gesellschaft fuer Technische Zusammenarbeit (GTZ), Federal Republic of Germany and invitees from the host country and other countries as well. The list of participants is attached as appendix 1 of the report.
3. The proceeding of the Seminar are summarized below:

II. OPENING CEREMONY

4. Mrs. Sri Ambar Suryosumarko, National Co-ordinator, Host Country, in her welcome address enumerated that due to the different varieties of pesticides used in the region, the member countries put emphasis on the environmental aspect of pesticides production and use, and based on this, UNIDO organized the seminar entitled "Environmental Aspects of Pesticides Production and Use". She hoped that the Seminar would allay the undue fears of pesticide damages to the environment and bring out the logical thinking, better understanding and make suitable recommendations to promote environmental safety in the manufacture and the use of pesticides.

5. Mr. Sugavanam of UNIDO expressed his appreciation to the Government of Indonesia for agreeing to host the Seminar and provide all the facilities and explained the purpose of the Seminar and its main aim to make action oriented recommendations which could be incorporated in the 3rd phase of the Regional Project, if approved. He remarked that RENPAP covered almost 1/5th of the earth's surface and almost 1/2 its population. He also mentioned that the Seminar has evoked good amount of interest from the member countries, representatives from Hungary, Egypt, France and two experts from UK and West Germany are participating. He proposed a vote of thanks to all persons concerned and joined the Chief guest in declaring the closing of the opening ceremony.

6. Mr. Sidharta, the Director General of Basic Chemical Industries, Ministry of Industry Republic of Indonesia, in his inaugural address stated that use of pesticides are still needed and with due care in the production and use of pesticides the detrimental effects of pesticide to the environmental and human health can be reduced considerably. The negative impact of pesticide industry can be avoided or at least minimized by proper selection of process technology from the first stage of industrial planning and safety practices during their production. By choosing the right and safe process technology, problems of effluent and accident can be minimized.

III. ELECTION OF CHAIRPERSON

7. Mrs. Sri Ambar Suryosumarko of Indonesia was proposed as chairman and Mr. Wilmot Weeraratna of Sri Lanka and Mr. Abdul Jabbar of Pakistan were proposed respectively as Deputy Chairman and Rapporteur. Proposed officers were agreed by all participants of

the Seminar. In order to make the sessions more active during the course of the Seminar some experts in turn acted as chairperson as well, namely Mr. E. Djohan from Indonesia, Dr. K. Johnson from ICI, UK, Prof. Korte from West Germany, Prof. Matolscy from Hungary and Mr. B. Sugavanam from UNIDO Vienna.

IV. ADOPTION OF AGENDA

8. Agenda submitted was adopted with small changes due to the absence of the Representative of WHO.

V. COUNTRY PAPERS

9. All delegates of member countries presented their countries papers abstract of which are as follows:

9.1 Afghanistan:

Afghanistan loses between 25 - 35% of its potential crop production to various pests. Use of pesticide reduced significantly the amount of loss caused by plant pests.

Afghanistan imports all its pesticide needs as formulated finished products. The total importation of pesticides during 1976 - 1980 was 11,463MT and the total importation of pesticides during 1985 - 1986 was 6,488MT, different types of pesticide formulations are applicable in Afghanistan.

For developing pesticide registration and implementing pesticide legislation in the country, recently there has been established a pesticide analytical laboratories. For full operation of these laboratories they need further technical and training assistance from FAO/UNDP.

9.2 India:

In India, the Insecticides Act. 1968 and the Insecticides rules 1971 regulate the entire spectrum of safety in the pesticide field. The central Insecticides Board (CIB) and the Registration Committee are formed under the above act. The major function of the CIB is to advise the government on technical matters. The Registration Committee deals with registration of pesticides after thorough scrutiny from all angles. Department of Environment of the Government of India, Central Pollution Control Board and the State Pollution Control Boards are important agencies responsible for protecting the environment.

Insecticides are the most dominant class of pesticides produced and used in India. However fungicides, herbicides, rodenticides, plant growth regulators etc. are also produced and used in the country. Among the crops, cotton consumes maximum quantity of pesticides.

The policy of the Government of India and the seriousness with which government is trying to control pollution is quite evident from the recently enacted Environment (PROTECTION) Act & Rules 1986.

Exemption from income tax, depreciation allowance, investment allowance, exemption from capital gains tax, rebate on cess levied on consumption of water are some of the incentives given by the government of India for encouraging industries to put up effluent treatment plants.

Non availability of proper instruments, reluctance of industries to set up expensive treatment facilities, suppression of information by industry, drawbacks in pollution control laws, limited powers of the pollution control boards are problems worth mentioning as far as monitoring part is concerned.

As regards assistance from international agencies to control pollution, it is suggested that international agencies in association with the developed nations should make available the technological developments in the field of pollution control and waste disposal to the developing countries. These countries should also be provided with adequate financial resources to develop their own procedures for pollution abatement and environment production.

9.3 Indonesia:

According to the authority division stipulated in Government Act, Minister of Agriculture is responsible for the implementation of the provisions dealing with the control of pesticide use. The control of import and distribution of pesticides is the responsibility of the Minister of Trade who should in this regards take into account the proposals and recommendations of the Minister of Agriculture. Regulations concerning specific matters on public and occupational health come within the competence of the Minister of Health and the Minister of Manpower respectively. The Minister of Industry is responsible for the detailed regulation in the production aspects. Under the coordination of the State Minister for Population and Environment, all ministries are involved in preventing environmental damages in general.

Pesticide formulation industries in Indonesia have licence capacity of 133,400 MT/KL per year and produce about 150 formulated products. Manufacturers of technical active ingredients in Indonesia have licenced capacity of 13,300 MT/KL per year.

To encourage the pesticide producers to keep the environment clean, the Government of Indonesia has provided several facilities, e.g. exemption of import duties for producers who will import equipment for pollution abatement.

Some suggestions for assistance from international agencies among others are: consultancy in drafting regulation on safe disposal of pesticides and other hazardous substances, recognition of management of pesticides poisoning especially for non-cholinesterase inhibitor pesticides, assessment of negative impact of pesticides on the environment.

9.4 Thailand

In Thailand the authorities and agencies responsible for environmental aspects of pesticide production and use designated in three different ministries, namely Ministry of Agriculture and Cooperatives, Ministry of Industry and Ministry of Public Health. Pesticide use in Thailand used to be imported in the form of finished products and subsequently technical grade active ingredients were imported and formulated locally. Only two manufacturing plants are existing for manufacturing of herbicide Paraquat. There are approximately 200 kinds of pesticides available in the market under different brand names which were categorized into insecticides, fungicides, herbicides and some other small groups. The most concerned aspect of pesticide use in Thailand is pesticide residues in food and environment and the occupational health hazards. The problem involved in monitoring effluent and hazardous wastes from pesticide industry come mostly from the small local formulating plants which have inadequate facilities for quality control and other safety measures for their workers. For incentives to control effluent and waste, the government has exempted duty and tax for the instruments used for waste disposal. The environmental impact of pesticide use and production should be minimized by means of cooperation from concerned bodies which are government agencies and planning, industry responsibilities and assistance from international agencies to increase knowledge and standardization the good agricultural practices should be sought.

9.5 Republic of Korea

Pesticide is one of indispensable means of a steady production of agricultural food by controlling harmful pests, insects and weeds.

However, due to its high biological activity, large scale consumption of the pesticide has led to public concerns to provoke greatly on the potential hazard during its production and use.

In this respect, Korean government and scientists have made continuous efforts on the pertinent management of pesticide production and use as well as on the environmental protection from hazardous pollutants before the issue of agrochemical Management Law and Environment Preservation Law promulgated in 1957 and 1977 respectively.

Environment Preservation Law enacted to prevent hazard due to environmental pollution and control and preserve the natural or living environment properly. Enforcement decree and implementing regulations for the law prescribe widely the standards of waste discharge and environmental quality as well as necessary provisions and management authorities.

The control of the effluent and waste during local pesticide production is applied correspondingly to the category of industrial chemical manufacturing facilities by the Environment Preservation Law in Korea. Therefore the effluent standards and discharge control facilities required for the pesticide manufacturing are also included in the category without specific prescriptions confined to the pesticide production.

Considering the high biological activity and large scale production of local pesticides, it is proposed that specific items for

discharge and monitoring of the effluent from the manufacturing plants should be included.

For the establishment of the effluent standards and discharge control facilities required for the pesticide manufacturing, and good agriculture practice, it is suggested that cooperative and integrated monitoring programmes should be necessary on both of administrative and scientific sides. And international cooperation is also needed to exchange related information on scientific matters and governmental policies to solve the local problems of environmental pollution during pesticide production and use.

9.6 People's Republic of China

China is a big agricultural country. The agricultural production plays an important role in the national economy. In order to raise the crop output a huge amount of pesticide are applied every year. Over 133 million hectares are treated with pesticide and an average 1,35 kg of active ingredient is applied annually per hectare of cultivated area.

Meanwhile China is one of the largest pesticide manufacturers in the world as well. The output of pesticide and the number of factories are extremely considerable. There were 203 pesticide factories in China by the end of 1986, but more than 400 at least up to now according to incomplete statistics. The factories produce about 140 active ingredients and 300 formulations of pesticides every year.

The output of pesticide is 150,000 - 200,000 tons (calculated in active ingredient) or a million tons (calculated in formulation) annually. Most of them are applied domestically except a small amount for export. In addition China imports some pesticide yearly.

Based on the above figures, the environmental protection of pesticide production and use is significant and indispensable in China. At present the state government attaches great importance to environmental pollution. Many legislations about environmental aspects have been issued since the seventies. Some of them concern pesticide production and use.

In 1980 and 1983 agricultural authority compiled China's Agricultural Environmental Quality Report based on 200 monitoring reports from different monitoring stations, institutes and universities. These authorities also carried out the investigation of organo-chlorine pesticide contamination in soil of agricultural and pastoral area, in agricultural and livestock products and in human body.

Since 1983 China stopped producing BHC and DDT and implement Guideline for Safety Application of Pesticide and the over standard ratio of organo-chlorine residue in grain produced in China has been reduced from 16-20% to about 7.4%.

National Environmental Protection Agency (NEPA) is the head of environmental protection system. There are 840 monitoring stations and 69 research institutes in NEPA. Also every province set up NEPA individually.

Ministry of Chemical Industry has Environmental Protection Division officially and Environmental Production Monitoring Centre about 30 research institutes in the system.

Ministry of Agriculture found Energy and Environmental Protection Department officially and Agro-Environmental Protection Centre of China which control 110 monitoring stations located provincially.

Because environmental protection work started rather late in China and moreover due to the big number of pesticide factories and wide usage of pesticides, China's government cannot control the pollution created by pesticide production and use perfectly now.

9.7 Pakistan:

The Pesticide business in Pakistan started in 1954 with the import of 254m tonnes of formulated product. After the transfer of pesticide sale and distribution business to private sector in Pakistan, the pesticide consumption has increased to 4368 m tonnes of active ingredient in 1987 with a market value of about 19 million US dollars. The sprayed area has increased from 1.8 million hectares to 5.5 million hectares.

152 active ingredients are registered for pesticide use. 7 acaricides, fungicides, 27 herbicides, 80 insecticides, 2 nematocides, 2 rodenticides and 2 fumigants. Apart from some amount of DDT and BHC local manufacture is not carried out. However, 14 formulation plants with annual capacity of 58.426 m tonnes exist. By 1986, 38% of pesticide sold in Pakistan were locally formulated. At present with little manufacturing industry the control of effluents is regulated through the Agricultural Pesticide Ordinance 1971. However the Government incentives in this regards are almost non existant.

The import, manufacture, formulation, sale, distribution and use of pesticides is controlled by the Agricultural Pesticides Ordinance 1971. Through the Agricultural Pesticide Rules 1973, the Agricultural Pesticide Technical Advisory Committee (APTA) advises the Central Government on technical matters arising out of the administration of this ordinance.

Pakistan Agricultural Research Council being the main body responsible for agricultural research in Pakistan is assigned the task of monitoring the pesticide. At the moment the pesticide research is conducted at 3 Federal and various provincial institutes.

International collaboration and assistance is sought for the establishment of Ecotoxicology Research Centres and other projects on the environmental safety arising out of the use of pesticides. It is suggested that FAO, UNIDO or other organizations help Pakistan in creating awareness in the people associated with pesticide production, sale and use, and expertise involved with the environmental protection.

9.8 Sri Lanka

There are about ten private organizations and one government cooperation, engaged in the import and distribution of pesticides. All the pesticides are either imported in the finished form or as active ingredients for local formulation. An act to control the import and distribution of agrochemicals was passed by Parliament in 1980. Under this legislation, the registrar of pesticides has wide powers in allowing imports and to impose all the rules and regulations with regard to labelling, storage and distribution. A formulary committee consisting of the government officers representing the departments involved in the use of pesticides advises the registrar on all the matters. The distribution is undertaken by co-operative societies, agrarian services centres and agents of the importing organization. The responsibility for the recommendation of various products lies with the Department of Agriculture and the research institutes dealing with tea rubber and coconuts while the Ministry of Health recommends house hold insecticides.

To tackle the problems of environmental pollution, there are two Ministries, Industries and Labour. Under the ministry of local Government, a high powered committee has been formed to look into pollution caused by any agency. The functions of this committee is not confined to pollution caused as a result of agrochemicals. In order to reduce pollution, the department of agriculture has taken certain steps to reduce the use of chemicals. Integrated pest control, timely cultivation, keeping the surrounding areas clean to prevent breeding of pests, and planting in rows to enable weed control using a weeder, are some of the practices adopted.

Pollution of the environment is caused at the formulation stage in factories and at the application stage in the field. To prevent pollution at the formulation stage factories should follow certain guide lines in discharging effluent.

9.9 Philippines:

The Philippines has sufficient substantial laws that governs the production and use of pesticide in relation to its effect to man and the environment. There are however constraints that, in a way, adversely effect effective implementation, to wit:

1. Overlapping of functions and jurisdiction by different government agencies tasked with similar power to regulate and especially oversee the use of pesticide.
2. Lack of manpower with technical expertise to monitor the use of pesticide and the lack of adequate education on the part of the end users. This can be attributed to logistic and budgetary constraint.

International bodies like UNIDO is therefore requested to extend additional help to remedy the forgoing identified constraints and problems by way of helping augment availability of technical expertise, facilities and equipment.

VI. AGENCIES REPORT

10.1 UNIDO Report:

UNIDO's work in the area of pesticides was mentioned and its commitment to the promotion of quality assurance, industrial safety, effluent control and environmental safety was emphasized. Various publications by UNIDO in the area of environmental protection, pesticide formulation were displayed.

10.2 RENPAP Report

On behalf of RENPAP, UNIDO presented the report and mentioned that when UNIDO proposed the project it was the first innovative approach to deal with the various aspects of pesticides on a regional basis. The various activities covered in the first and second phases were mentioned. The report emphasized the importance of the network to the region and the establishment of a RENPAP secretariat with technical coordinator roles played by different countries to promote technical co-operation among developing countries.

10.3 ESCAP - ARSAP Report

Mr. Hegenbarth informed about their original programme to cover fertilizers, pesticides, farm machine but now concentrate mainly on pesticide safety and information. He mentioned about the manual - Agro Pesticides their Management and Application - Illustrated Safety Guide in a number of languages including Chinese and Burmese. He also described their cooperation with CIRAD (France) and IHDF (Netherlands) on pesticide poisoning at farm level. He displayed a copy of their Regional Agro-pesticide Index.

10.4 CIRAD Report

Mr. Deuse informed about their involvement in better labelling of pesticide containers and their work in collaboration with FAO International Code of conduct. He showed some of the experimental labels developed in collaboration with Rhone-Poulenc Agrochemie. This could become an international label written in English, French and Spanish.

11. Comment from Malaysia

It was emphasized that pesticides should be able to perform as intended and at the same time not cause undesirable side effects to man and the environment. Following RENPAF 2nd Regional Meeting on Harmonization of Pesticide Registration Requirements in Manila in 1986, a Regional Workshop on the Harmonization of Bio-efficacy Test Protocols, jointly organized by the Department of Agriculture, the FAO and GTZ was held in Kuala Lumpur, Malaysia, from 31 October to 4 November 1988. The participants of the meeting made a number of recommendations including adoption of 10 agreed efficacy protocols as their national protocols. It is hoped that countries in the region will co-operate and collaborate in the effects to harmonize efficacy test protocols for use in the region.

VII. LECTURES

12.1 Effluent Limitation Guidelines in Pesticide Production and Formulation, B. Sugavanam (UNIDO).

The paper reported methods used for determining effluent limitations for different types of pesticides giving examples of EPA methodology. The paper covered water, solid and air treatment with importance to the survey and environmental audit of pesticide plants

in the region. He proposed following recommendations for effluent limitations:

1. National (Regional) survey of pesticide production facilities and their waste treatment methods.
2. Assist in framing regional guidelines on limiting effluents based on the study.
3. Promote periodic Environmental audit (reviews) with uniform methodology and self reporting scheme for pesticide production units.
4. Set up two regional laboratories to monitor environmental aspects pesticide production and use and also carry out bench and pilot scale studies.
5. Alloting funds to monitor soil, aquatic species, birds and for environmental audits.
6. Provide assistance (financial advisory) in waste reduction and recycling of waste.

12.2 Perspectives of environmentally safety pesticides, Prof. Matolsky

High application dosages, necessitated by low biological activity, long lasting chemical contamination caused by exaggerated chemical stability and damaging non target organisms due to insufficient selectivity are the major drawbacks of the presently used pesticides from the environmental aspect. Research within the limits of the conventional pesticides can bring about only fragmental improvements in this regard and the fundamental solution of the environmental problems necessitates new chemistry, new modes of action and new research strategies.

Among the main pesticide classes fungicides are the least problematic, due to the significant differences in the biochemistry between man and fungi. Moreover, application dosages continuously decreased throughout the past decades, primarily as a result of modern systemic fungicides.

Herbicide application dosages went down from the 10 kg/ha range of the early fifties to the g/ha values, enabled by the discovery of the sulphonylureas. Yet continued research is needed to decrease the persistency of these products.

The traditional insecticides represent the greatest environmental threat among the pesticide classes, due to the relatively narrow margin of biochemical differences between man and insects. Latest discoveries on insect specific biochemical, physiological and behavioral functions enable the deployment of rational research strategies in developing chemicals selectively interfering with these functions.

Juvenoids, the synthetic mimics of the natural insect juvenile hormones, represent no environmental hazard, yet their narrow range of activity and the necessity of critical timing has restricted their use to special, cases though.

Latest research in insect biochemistry led to the discovery of neuropeptides and other substances playing a vital role in the transmission of highly specific nerve impulses of insects. The final goal of research in this line is to create the theoretical background for a rational design of compounds blocking these insect specific nerve functions.

None of these insect specific activities were suitable to reach wide acceptance in insect control. Further research is needed to bring about their employment in insect control practice. At the same important applications in selective insect control should be encouraged.

A new class of insect juvenile hormone mimics has been developed by us in Hungary and investigations needed for practical application are in progress.

Anti-juvenile hormones, acting by inhibiting the biosynthesis or function of insect juvenile hormones, represent promise, in spite of the fact that compounds described to act on this way cannot meet the demands of practical application.

Disrupting the behavioral pattern of insects is one of the most promising means of environmentally compatible insect control. Application of synthetic sex attractants (pheromones) in monitoring insect gradation enables that insecticide application should be reduced to situations of actual necessity.

Latest results in the field of antifeedants, compounds rendering plants unattractive for insects, led to the discovery of compounds with high biological potential.

Benzoylureas, acting by inhibiting the cuticle formation of insects are continuously explored. At the present time there is a great demand in revealing novel insect-specific activities.

In pursuing these goals, we initiated cooperative research with two universities in the United States within the frame of our UNDP/UNIDO, supported project. These cooperations led to the discovery of compounds selectively inhibiting the insect tissues needed for respiration, as well of substances disrupting the developmental cycle by inhibiting egg laying.

11.3 Pilot Plant Experience, Dr. Lotfi Khattab

The size of importation of pesticides is to the order of 100M US\$ per year in Egypt. There is no commitment of any specific long range needs but organo-phosphorus pesticide are needed.

Egyptian National Research Council carried out bench scale preparations of some organophosphorus pesticides.

ISMADYE "Dyestuffs and Chemical Co." had the experience and facilities to implement a flexible pilot plant.

It was decided that a turnkey pilot plant should be built in Egypt with funds 1.3M US\$ from UNDP and the assistance of UNIDO and 2 M pounds from the Government.

ISMADYE and UNIDO decided to change the approach to decrease the cost, as ISMADYE had the technical experience in scaling up of bench scale preparations.

They decided to make a contract for the know-how fees, the design engineering and start up supervision.

ISMADYE took the responsibility of erection, designs of the civil work modification, training on site, preparation for the start up.

UNIDO took the responsibility of purchasing, contracting and acting as a technical coordinator.

UNIDO after signing the project in May 1983, located the owner of know-hows for the required 2 pesticides Dimethoate and Malathion. A "Spanish contractor" took the responsibility of know how, engineering and start up.

Achieved objectives

We are pleased to say that a highly accomodative accomplishment had been gained.

1. Trouble shooting of the installation problems.

2. Work planning
3. Tendering of equipment and tools
4. Inspection of equipment and tools and also materials
5. Prospects and basis of making detailed engineering
6. Effluent Control and re-use of H_2S produced in reaction.

The project by this method costed 2.2 M US\$. But if we went through a turnkey project the cost would have been more than 6M US\$.

11.4 Lecture by Dr. F. Korte

11.4.1 BOUND PESTICIDE RESIDUES IN SOIL PLANTS AND FOOD WITH PARTICULAR EMPHASIS ON THE APPLICATION OF NUCLEAR TECHNIQUES

Although so-called bound residues have been detected for all classes of chemicals investigated so far, their quantitative levels have wide ranging differences, depending on the chemical structure of the pesticide. Phenols and nitrogen-containing pesticides exhibit the highest binding rates. The portion of bound residues in soil and plants increases with time and varies with environmental conditions (soil and plant type, climatic conditions, etc). So far the chemical identity of bound residues has only been elucidated for a limited number of model substances by using various liberation techniques. Most information is available on anilines: models have been developed demonstrating their copolymerization into natural macromolecules (humic acids, lignin). Misinterpretation of natural products assimilated from totally degraded pesticides to bound xenobiotic residues, can only be excluded by the sophisticated separation and identification procedures of all residues.

Studies on the persistence of bound residues showed differing mineralization rates, depending on the chemical structures of pesticides, research on the bioavailability revealed that for all pesticides low amounts of soil-bound residues are taken up by plants, and that plant - bound residues are eliminated rather quickly by mammals in the faeces.

11.4.2 STUDIES ON THE LEACHING BEHAVIOR OF ¹⁴C-LABELLED ORGANIC POLLUTANTS UNDER OUTDOOR CONDITIONS/

The leaching behavior of 28 chemicals from soil was studied under outdoor conditions. The four model compounds investigated in detail form hydrophilic conversion products which appear in leached water. Maximum concentration was after 1-2 years. Then, concentration decreased, but traces of radioactive substances were except for the approach with ¹⁴C-Chloroaniline still detectable after 10 years or more. From these experiments it can be concluded that it is not sufficient to direct attention to unchanged pesticides or industrial chemicals in ground water only.

Additionally, special regard has to be directed to their capability to form water soluble conversion products which cannot be detected with the analytical method developed for the original compound, should be considered.

11.4.3 ECOLOGICAL CHEMISTRY STATE OF THE ART

The initially small field of ecological chemistry, has over a period of 15 - 20 years developed into an important scientific discipline. During this period it has demonstrated a large number of problems and finding of a complete solution for them will be partly the task of future generations. In the meantime, the significance of this discipline has been recognized world-wide and stimulated many scientists to contributions by describing the chemical quality of

the environment. This is the reason that, today, we are confronted with a flood of analytical data which are not easy to comprehend. What is actually needed at the present is not a steady expansion of the already available voluminous data basis, but rather carefully selected model studies, that will contribute to the improvement of the existing structure and the compilation of priorities for all synthetic substances which we introduce into our environment. Only when this has been successfully accomplished, we can embark upon rational, meaningful and a still pragmatic environmental research in order to study the chemical changes in our environment. The necessary sequel to this is the prediction of consequences. To achieve these aims one should place priorities to problems and not to individual substance in order not to waste all our means and intelligence on investigations of limited significance.

The ecological research should be carried out in a dual way. On the one hand, biological and eco-medical as well as technological counter measures are to be developed for already detected acute effects of chemicals on the environment. On the other hand, however, chronical effects in the long run, which are influenced by the level and duration of exposure of persistent chemicals in the environment, are to be investigated by eco-logical chemists.

Over the last twenty years we have largely recognized the nature of the problems and now the time is ripe to tackle the problem complex in a scientific way. It is the duty of all scientists engaged in chemistry to contribute to the definition of this problem so that political decisions in this field could be instituted correctly and early enough for the benefit of all mankind.

12.4.4 CONTROLLED RELEASE FORMULATION OF PESTICIDES

Thermoplastic polymers, mainly ethylene-vinyl acetate co-polymers (EVA), were used to prepare controlled release formulation of pesticides. EVA films with the incorporated herbicides desmetryn and atrazine success fully suppressed weed growth in field trials with white cabbage and sweet corn, respectively, at amounts of application comparable or even lower than those necessary with conventional techniques. The transfer of desmetryn from polymer films into the vapour phase was determined in the laboratory and found to be negligible compared with the release into water coming into contact with the films. Other examples of experimental applications of EVA formulation were control of aquatic weeds with the herbicides terbutryn and simetryn, root application of carbofuran in rice and cotton cultivation and the combined attraction and elimination of tsetse flies.

12.5 Liquid effluent and waste water, by Dr. K. Johnson

i) Effluents

Liquid effluents produced in the formulation of agrochemicals are toxic and highly polluting.

System for containment within the factory are essential. Treatment processing consisting of a combination of chemical and physical adsorption have been developed and are available. Detoxified effluents of consistent high quality are produced.

ii) Waste disposal

A range of wastes are produced during the production of agrochemicals. Every efforts should be made to minimise these at source by recycling and reuse.

Now recoverable wastes should be classified into non-toxic and toxic types for appropriate methods of disposal (i.e. Landfill-Burial -Incineration).

All wastes must be properly packed and labelled and all waste sent from the factory for disposal must be accurately recorded.

It is advisable to appoint a designated person to supervise and manage all areas of liquid and solid waste disposal.

13. Visit to pesticide formulation plant

The participants of the Seminar were shown the effluent and environmental control being practiced to its best at the ICI (Indonesia) - pesticide formulation plant at Bogor. Mr. Thomas Widyatmodjo, Works Manager and Mrs. Ety Indrawatti, Production Manager briefed about the procedures and steps taken to ensure safety of the workers and more so to prevent any pollution of the environment. With its high quality effluent treatment plants, the plant is a model for the pesticide formulation/manufacturing industry in Indonesia.

VIII CONCLUSIONS

After discussing country papers presented by each delegate it seems that the countries have to some extent rules and regulations for the control of the effluent and monitoring residues. Most of the countries have the set up to a management system but do not seem to have the mechanism for implementation of the monitoring procedures. The meeting also expressed the necessity for harmonization of the requirements for environmental control involving pesticides on line with OECD and similar international organizations. Such a regional approach should lead to a better exchange of information among the countries of the region in a more effective and efficient way in

controlling pollution from gases, liquid and solid waste emission from production and use of pesticides.

The meeting discussed the importance of alternate strategy of overall reduction of pesticides consumption covering non-toxic agent, formulation and application technology. The meeting also expressed its concern about indoor air pollution from pesticides and other chemicals, which is often much higher indoors than outdoors.

Having visited the ICI plant the participants felt that all possible safety measures were being applied and the factory would serve as a reference for the others.

IX. RECOMMENDATIONS

1. Having considered the lack of data on different producers and formulators in many countries of the region, their size of operation, effluent treatment methods adopted:

It is recommended:

- To have a survey of all pesticide producers on a country basis, type of compounds produced, the size of operation, limit of operation, limit of effluent generated, methods adopted for treatment of effluent and waste disposal.

2. Having considered that such a survey it would be useful to the whole region:

It is recommended:

- UNIDO should set guideline for effluent limitation based on Best Practical technology (BPT) currently available.

3. Having considered that all producers of pesticides should have their own facilities for the treatment of effluents.

It is recommended:

- Any producers identified by the survey who do not have the facility, however small they are, should be persuaded and assisted to install this equipment,
4. Having considered that some producers have little experience in waste management or methods of disposal.

It is recommended:

- Guideline advice be given on methods of waste reduction and re-use.
 - Disposal of non-recoverable toxic wastes is often difficult. Some producers may have excess capacity (i.e., incineration) and sharing of those facilities should be encouraged possibly with the assistance through government subsidy.
5. Having recognized the efficiency of absorption process by activated carbon and lack of availability of suitable carbon in the region.

It is recommended:

- Government of the region should provide incentives to import good quality carbon until such time similar quality materials are available within the region through local production.

6. Having considered the importance of harmonization of requirements for environmental control.

It is recommended:

- An exchange of information within the region should be established as a means of sharing practical experience in environmental aspects of pesticide production and use.

7. Having considered the importance of training and awareness, adoption of Good Laboratory Practice (GLP) and Standard Operation Procedure (SOP) in order to improve production facilities so as to minimize waste generation.

It is recommended:

- Training and expert advisory service should be provided on national and regional basis to promote intercountry cooperation in these areas.

8. Having considered Indonesia as being a large producer of pesticides and having conducted the seminar successfully.

It is proposed:

- Indonesia to act as technical coordinator within the framework of RENPAP on the environmental aspects of pesticides production and use.

9. Having recognized that production and use of pesticides is on the increase in the region.

It is recommended:

Wherever possible standards operated by OECD be adopted in the region to avoid disruption in the international trade.

UNDP/UNIDO should assist the establishment of Centres for coordination, monitoring of effluent quality implementation in soil, air, aquatic and wildlife environment.

SCHEDULE OF THE SEMINAR

Monday 28 November 1988

- 08.15 - Depart from Kemang Hotel to the Ministry of Industry building.
- 09.00 Registration of Participants
- 09.30 Inaugural Session
- Welcome address by Ms. Ambar Suryosunarko
 - Address by Regional Coordinator of RENPAP
 - Address by UNIDO
 - Official opening of the Seminar followed by inaugural address by Mr. Bachrum S. Harahap, Head, Agency for Industrial Research and Development, Ministry of Industry.
- 10.00 Coffee Break
- 10.30 Return to the Kemang Hotel
- 11.00 Plenary lecture - Ecodiagnostic and Ecoterapy - Challenge for the future by Prof. F. Korte, Institute for Ecological Chemistry, Munich, W. Germany.
- 12.30 Lunch Break
- 14.00 Election of Chairperson, Deputy Chairperson and Rapporteur - Adoption of Agenda Arrangements.
- 15.20 Coffee Break
- 15.40 - 17.00 Country Papers

TUESDAY, 29 November 1988

- 09.00 Country papers/Agency reports
- 10.30 Coffee Break
- 11.00 Lecture and Workshop Session
Effluent control in work place covering recycling and re-use, collection and containment, treatment chemical absorption process plant requirements, waste disposal aspects, user-end field techniques for pesticide ef-

fluent/wash water.

(Led by Dr. K. Johnson of ICI, UK, Agrochemicals Division).

- 12.30 Lunch Break
- 14.00 Lecture and workshop session (Cont.) Led by Dr. K. Johnson.
- 15.20 Coffee Break
- 15.40 - 17.00 Lecture and workshop session (Cont.) Led by Dr. K. Johnson.

WEDNESDAY, 30 November 1988

- 09.00 Effluent Limitation, Guidelines for pesticide manufacture. Mr. B. Sugavanam (UNIDO) Short paper from Egypt pilot plant experience. (UNIDO) Mr. L. Khatib, DCC, Egypt
- 10.30 Coffee Break
- 11.00 Toxicological aspects of pesticide used in the region (WHO) cancelled.
- 12.30 Lunch Break
- 14.00 Visit to ICI (Indonesia) Pesticide Formulation

THURSDAY, 1 Desember 1988

- 09.00 - Perspectives of Environmentally Safe Pesticides (Prof. G. Matolsey, Hungarian Academy of Science).
- Short paper from UNIDO on Bio-efficacy Mr. B. Sugavanam, UNIDO
- 10.30 Coffee Break
- 11.00 Lecture and Workshop Session
Environmental aspects at user end covering pesticides in soil and water, longrange transport of pesticides, waste management with special reference to pesticides, present knowledge of indoor pollution.
(Led by Prof. F. Korte).

- 12.30 Lunch Break
- 14.00 Lecture and workshop session (Cont.) Led by Prof. F. Korte.
- 15.20 Coffee Break
- 15.40 - 17.00 Lecture and workshop session (Cont.) Led by Prof. F. Korte.

FRIDAY, 2 December 1988

- 09.00 Effluent chemical including pesticides from industrial accidents. (Basel, Seveso, etc)
- 10.30 Coffee Break
- 11.00 Group Discussion - Regional Cooperations-guidelines/recommendations.
- 12.30 Lunch Break
- 14.00 Discussion of report
- 15.20 Coffee Break
- 15.20 - 17.00 Final draft report Closing Remarks.

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