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REGIONAL NETWORK ON PESTICIDES FOR ASIA  
AND THE PACIFIC

DF/RAS/85/023

Technical report: Training Programme on Quality  
Control of Pesticide Formulation,  
New Delhi (India), 12 October - 13 November 1987\*

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  
in co-operation with the World Bank, Food and Agriculture Organization  
of the United Nations and Pesticides Development Programme in India

Based on the work of the Staff of  
Pesticides Development Programme in India (PDFI)

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Vienna

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\* This document has not been edited.

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## 1.0 Introduction

1.1 The Asia and Pacific Regional Training Programme on quality control of pesticide formulations organised under the auspices of Regional Network on Production, Marketing, and control of Pesticides in Asia and Pacific (RENPAF) was held from October 12 - November 13, 1987, at New Delhi, India. The training programme was sponsored by UNDP and executed by the the World Bank under its Pesticides Evaluation and Safety Testing (PEST) Programme in co-operation with and the United Nations Industrial Development Organisation (UNIDO) and the Food and Agriculture Organization of the United Nations (FAO/New Delhi). The programme was conducted by Hindustan Insecticides Limited (HIL) in association with the Pesticide Development Programme India (PDPI), a UNDP/UNIDO assisted country project of the Government of India. The main venue of the programme was India International Centre, close to UNDP offices in New Delhi, while the practical demonstrations and hands-on training were conducted at the Pesticide Development Centre at Gurgaon, about 25 kms. away.

1.2 A total of 12 participants from 6 nations, i.e. China (1), India (4), Indonesia (2), Republic of Korea (2), Sri Lanka (1) and Thailand (1) attended the programme.

## 2.0 Objectives

The training programme was intended to —

2.1 Enable trainee's from Network member countries to carry out comprehensive physical and chemical analysis of pesticide formulations to determine their adherence to defined product specifications ;

2.2 Introduce trainee's to a wide range of traditional and state-of-the-art analytical methods, some of which may be more practical and efficient than those with which they are familiar ;

- 2.3 Increase the productivity and efficiency of Pesticide Laboratories in Member Countries by developing trainees' capabilities to select, install and maintain laboratory instruments in good working order;
  - 2.4 Promote the harmonization of pesticide product specifications in the region ; and
  - 2.5 Enable chemists in Member Network countries to participate more fully in the international collaborative development and testing of pesticide analytical methodology, through the collaborative International Pesticides Analytical Council (CIPAC)
- 3.0 **Inaugural Session**
- 3.1 The programme began with the registration of the participants in the morning of October 12, 1987 followed by a brief business session. Dr. S.P. Dhua, Regional Coordinator, RENPAP, welcomed the participants, followed by Dr. Agi Kiss of the World Bank, who proposed the names of Mr. C.M.D. Dharmasena, Country delegate of Sri Lanka, and Dr. S.K. Khetan of PDPI from the hosts side, to act as rapporteurs of the programme. Dr. Kiss also proposed that the schedule of the training programme may be accepted as the agenda. Dr. K.D. Sharma, country delegate of India seconded the proposal on behalf of the participants. The session ended after Dr. S.K. Khetan gave a detailed account of the proposed training programme.
  - 3.2 The training programme was inaugurated by Mr. R.K. Jaichandra Singh, Honourable Minister of State for Chemicals and Petrochemicals, Government of India. He spoke on the role of pesticides in agricultural productivity and health programme. He projected a growth rate of 3.7 % in food production for developing countries in order to keep pace with their population growth and concurrent pesticides uses were envisaged to grow from 20% of the globe production to 50% by 1993.

- 3.3 Dr. Agi Kiss of the Environmental and Scientific Affairs Office of the World Bank dealt with the need of 'cradle-to-grave' responsibility of pesticides to be shared by all including pesticide manufacturers, formulators, government regulators and users. She also outlined the objective of the programme as acquiring new skills and knowledge and exchanging and sharing of the information with colleagues in neighbouring countries, to the benefit of all.
- 3.4 The address of Mr. Gamil M. Hamdy, UNDP resident representative in India, was read by Mr. Matiul Islam, UNIDO's Senior Industrial Development Field Adviser. He cited the combined efforts and collaboration of four UN agencies for the benefit of member states of the region and commended the programme as a model for regional cooperation, as also cooperation among the UN agencies, towards this common objective.
- 3.5 Dr. E. Bojadziewski, FAO Chief of the mission in India gave an account of the role of FAO, in consultation with appropriate UN agencies, in formulating an international code of conduct on the distribution and use of pesticides.
- 3.6 Mr. Shyamal Ghosh, Joint Secretary, Chemicals, Ministry of Industry, Government of India emphasised the importance of quality assurance in pesticides and gave an account of India's own efforts in this direction.
- 3.7 On behalf of the host organisation, Dr. S.P. Dhua, Chairman and Managing Director, Hindustan Insecticides Limited and Regional Coordinator of the Network Project, elaborated on the objectives of the PEST programme and described a brief outline of the training programme.

#### 4.0 Country papers

Country papers highlighting the current status of the quality control of pesticide formulations were presented by the respective delegates :

#### 4.1 P.R. China

China has enacted 'Regulation for Pesticide Registration' in recent years. This has enabled standardisation of analytical methods for many different pesticides. The quality control of pesticidal materials have greatly improved and for organophosphorous systems like dimethoate, parathion methyl and malathion the quality has reached or approached international level.

#### 4.2 India

Present level of pesticides consumption in India is to the tune of 70,000 MT. For quality control 'Bureau of Indian Standards' have laid down basic requirements in the form of standards on individual pesticide and their specific formulations. India has also enacted an Insecticides Act 1968 which became operative in 1971, which regulates import, manufacture, sale, transport distribution and use of these chemicals for the sake of prevention of risks to human beings or animals. For the quality control and residue monitoring a number of pesticides analysis laboratories have been established in different States and Union Territories. The environment (Protection) Act, 1986 has been enacted recently.

#### 4.3 Sri Lanka

In Sri Lanka 'Pesticides Act' was enacted in 1980. A Pesticide Registrar was appointed in 1983, who implemented the Act. All pesticides were imported or sold in Sri Lanka needed to be registered.

Delegates from Republic of Korea, Indonesia and Thailand did not make any presentation due to lack of information to them in this regard.

## 5.0 Technical Sessions

The technical sessions consisted of 15 lecture sessions and as many laboratory sessions, which were conducted in forenoons and afternoons respectively. In addition, visits to Bureau of Indian Standards and the Central Insecticides Laboratory of the department of Plant Protection, Quarantine and Storage, Ministry of Agriculture, Government of India, located in and around Delhi, were also made. An outstation visit to South India, covering the research laboratories of Ralli's India, a major pesticide manufacturer in private sector at Bangalore in the State of Karnataka and the Central Plant Protection Training Institute (CPPTI) and the International Crop Research Institute for Semi Arid Tropics (ICRISAT), both at Hyderabad in Andhra Pradesh, was also made.

The course began with a key-note session, in which participants were brought face-to-face with background information on pesticides, formulation technology and the state of quality control in the pesticide industry along with their future trends, as a preamble to quality control of pesticide formulations. A lecture on quality as a route to survival underlined the importance of the theme of the programme.

Subsequent two technical sessions were devoted to various factors that influenced the quality of pesticide formulations. These included the quality of formulation carriers and adjuvants and the impact of the processing method used. The particle size of pesticide products was also correlated with their bioactivity, assigning it an important role in complex balance of quality assurance of pesticide formulations. Similarly, good quality of packaging can ensure long shelf life and safe transportation, thus contributing to maintenance of the quality. This aspect was covered by a presentation on common tests of packages for crop protection products.

The experimental demonstrations in the afternoons were synchronised with respective lectures held in the preceding forenoons. For quality control of clays, the participants were exposed to measurements of pka, suspensibility, determination of bulk density and measurement of average particle size and particle size distribution using Fischer sub-sieve sizer and micron photo sizer equipments. Similarly, for quality assurance of surfactants and solvents,



experimental component consisted of determination of properties like HLB value, cloud point, flow point, surface tension and refractive index.

The next two technical sessions were devoted to specifications for pesticide formulations for quality control and standards development with reference to Indian experience. Presentation on quality as perceived by regulatory agencies and on shelf life requirements of pesticide formulations were also made. A presentation on international collaborative testing of analytical methods of pesticide analysis provided an overview of methodology for arriving at the official methods of analysis. The relevant experimental demonstration consisted of checking on physico-chemical properties of formulations like wettable powders and suspension concentrates, including determining suspensibility, viscosity, moisture content, grit matter and wettability etc.

The analytical aspects were covered during next 6 technical sessions and same number of experimental sessions. In addition to standard chemical methods of analysis, automation in chemical analysis was discussed to provide an exposition to use of micro processors in titrimetry ensuring repeatability of the results and eliminating human error to a great extent. The experimental demonstration consisted of manual and auto titrimetry taking iodometry as a case study for the analysis of carboxin, a wheat fungicide and seed dressing agent.

Amongst the spectroscopic methods both infrared and ultra-violet techniques were discussed giving their theory and practical applications to pesticide analysis. In experimental demonstration, the candidate pesticide taken was again carboxin, which could be analysed by both UV and IR techniques. This also provided the participants to get a feel of comparative adequacy and sensitivity of different methods of analysis. A methodology for qualitative and quantitative analysis using IR technique was also demonstrated.

Similarly, Gas-liquid chromatographic (GLC) and high pressure liquid chromatographic (HPLC) techniques were discussed in great detail covering theory, instrumentation and their proper techniques and uses along with practical examples of pesticide analysis. During laboratory sessions, analysis

of methyl parathion using internal standard method by GLC and subsequently by HPLC were demonstrated. Later participants had a hands-on experience in analysing butachlor and carboxin by HPLC and comparative analysis of methyl parathion using GLC and HPLC techniques. A laboratory demonstration on gas chromatograph using a mass spectral detector was also conducted.

The bioassay technique could provide, a direct approach for quality control of pesticide formulations, as the product is tested against target pests which the formulation is supposed to control. A presentation on significance of bioassay techniques, in pesticide analysis gave its advantages over other methods.

The importance of good laboratory practices in a quality control laboratory handling toxic materials can not be undermined. A lucid account on the subject of safety and responsibility in laboratory management was provided by the World Bank consultant from US Environmental Protection Agency.

In the presentation on instrument maintenance, the participants were exposed to useful life curve of the equipments and preventive and corrective methods of maintenance.

A concluding paper dealt on the impact of pesticides on the environment.

## 6.0 Recommendations

On the concluding day of the training programme, the participants arrived at the following recommendations by consensus :

### 6.1 Safety of analysts

It was discussed and found that the Analyst is often unaware about the potential toxicological hazards of various pesticidal systems he analyses in an enclosed laboratory and can be subjected to toxic exposures jeopardising his/her health. It was also recommended that necessary information may also be collected from us, EPA and also to take due note of good laboratory practices.

## 6.2 Collaborative analysis

The participants were of the view that in order to follow reliable analytical procedures, participation in collaborative analysis with international bodies like AOAC and CIPAC would be useful.

6.3 There was a good deal of discussion on the method of handling of pestiaccidal products after deterioration on storage as there were two prevalent views i.e. whether the product should be distructed or reformulated. The participants were of unanimous view that necessary strategy should be worked out in cooperation with GIFAP.

6.4 Participants were of the view that the developments made in the PDPI laboratories on the Quality Control specifications for mineral clays and emulsifier systems can be used by the member countries for developing their own quality control parameters for these formulation inputs. It was also decided that the participating countries may also be sent the PDPI news letter when published for keeping them informed about the developments taking place at the PDPI.

6.5 In view of certain delays in communications from UNIDO/HIL and the participating countries it was recommended that the plans and recommendations for the next course may be started early so that delays may be avoided.

## 7.0 Concluding session

After the presentation of the recommendations by Dr. S.P. Dhua, Regional Co-ordinator, RENPAP, a comment on the content and organisation of the training programme was made by Dr. Wade Van Valkenburg, UNIDO adviser, who commended the efforts.

Mr. H.K. Khan, Secretary, Chemicals and Petrochemicals, Ministry of Industry, Government of India, delivered the valedictory address. He expressed satisfaction that this training was the first major activity undertaken by India after assuming the role of co-ordinator of the regional network. He also expressed his gratitude to the international agencies

such as the World Bank, FAO and UNDP for putting together this programme and to UNIDO for its initiative in enabling India to stage this programme. He also expressed hope to conduct more such programmes, workshops and group meetings in India in the coming future.

Subsequently, Mr. Henry J. Nardy, Deputy Resident Representative, UNDP addressed the participants and distributed certificates of participation in the course. He also presented mementoes to each of the participants and the international faculty members. The function came to an end after proposing a vote of thanks by Dr. S.K. Khetan of Pesticide Development Programme India to all those who contributed to the success of the training programme.

**List of Participants in the UNDP/World Bank  
Pesticide Evaluation and Safety Testing (PEST) Training Course on  
Quality Control of Pesticide Formulations**

(October 12 - November 13, 1987)

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Training Programme on  
QUALITY CONTROL OF PESTICIDE FORMULATIONS

Proceedings

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Inaugural Session

- A 1 Address - Dr. S.P. Dhua, coordinator RENPAP
- A 2 Address - Dr. Agi Kiss, World Bank
- A 3 Address - Mr. Gamil M. Hamdy,  
Resident Representative UNDP
- A 4 Address - Dr. E. Bojadzievski, COM, FAO
- A 5 Address - Mr. Shyamal Ghosh, Jt. Secretary, (Chemicals)
- A 6 Inaugural address - Shri R.K. Jaichandra Singh  
Minister of State for Chemicals  
and Petrochemicals

Country Papers

- B 1 China
- B 2 India
- B 3 Sri Lanka

Key - Note Addresses

- C 1 Pesticides of Future - S.K. Mookerjee
- C 2 Trends in Pesticide  
Formulation Technology - S.K. Khetan
- C 3 Quality Control in Pesticide Industry - K.D. Pahari
- C 4 Quality - A route to survival - W.Van Valkenburg

**Technical Sessions**

**Factors affecting quality of  
Pesticide formulations**

- D 1 Quality of Formulation Adjuvants
- D 2 Quality Assurance Parameters for clays
- D 3 Processing of pesticide formulations and its impact on quality
- D 4 Methods of packaging and its effect on quality of pesticides
- D 5 Particle size as a quality control parameter of the biological activity of pesticide formulations

**Specifications and standardisation**

- E 1 Quality Control parameters related to physico-chemical properties of pesticide formulations
- E 2 Statistical Quality Control and Sampling Techniques
- E 3 Shelf - Life of pesticide formulations
- E 4 Process of standard making - Indian experience
- E 5 Pesticide Analysis from Regulatory agency view point
- E 6 International collaborative testing of analytical methods of pesticide analysis

**Analytical Methods**

- F 1 Chemical Analysis of Pesticide Formulations
- F 2 Automation in Chemical Analysis
- F 3 Spectroscopic Methods of Analysis — Theory and Applications in Pesticide Analysis
- F 4 Gas - liquid Chromatography — Theory and Applications in Pesticide Analysis
- F 5 High Performance Liquid Chromatography — Theory and Applications in Pesticide Analysis
- F 6 Significance of Bioassay Techniques in Pesticide Analysis

**Safety, Laboratory Management  
and Instrument Maintenance**

- G 1 Safety and responsibility of laboratory management
- G 2 Instrument maintenance in quality control laboratory

**Concluding Session**

- H 1 Veledictory Address - Shri H.K. Khan  
Secretary, Chemicals and Petrochemicals

**Abbreviations**

- FAO** : Food and Agricultural Organisation of the United Nations
- UNIDO** : United Nations Industrial Development Organisation
- RENAP** : Regional Network for the Production, Marketing and Control of Pesticides in Asia and Pacific
- HIL** : Hindustan Insecticides Limited, (Hans Bhavan, Bahadur Shah Zafar Marg, New Delhi-110 002)
- PDPI** : Pesticide Development Programme India (Udyog Vihar, Gurgaon-122 016, Haryana, India)
- IARI** : Indian Agricultural Research Institute (Pusa Complex, New Delhi)
- BIS** : Bureau of Indian Standards (Manak Bhavan, Bahadur Shah Zafar Marg, New Delhi 110 002)
- CIL** : Central Insecticides Laboratory (NH-4, Faridabad)
- NCL** : National Chemical Laboratory (Pune, Maharashtra)
- IIT** : Indian Institute of Technology, (Hauz Khas, New Delhi-110 016)