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STRENGTHENING OF PESTICIDE DEVELOPMENT CENTRE

DP/IND/89/128

INDIA

Technical report: Findings and recommendations*

Prepared for the Government of India
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Andrzej Kuzia,
consultant on packaging

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Chemical Industries Branch

United Nations Industrial Development Organization
Vienna

* This document has not been edited.

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ABSTRACT

The mission 'Consultancy on Pesticides Packaging' was undertaken within the project - Strengthening of Pesticides Development Centre; DP/IND/89/128 and lasted from September 17th to October 12th 1992. The objective of the mission was to assist the Institute of Pesticides Formulation Technology in developing packaging activities including setting up of laboratory facilities for testing pesticides packages.

Familiarization with the Institute position and interviews with several people from pesticide industry as well as from Indian Institute of Packaging and Indian Standard Institution revealed that there is a real need for establishing packaging laboratory which would concentrate on specific issues concerning package/ pesticide interaction. Neither Indian Institute of Packaging nor any other body is able to perform this job satisfactorily, because both knowledge of pesticide technology and packaging is required. It was found that the range of activities should be limited to shelf life estimation, compliance of pesticide formulation with packaging material and design principles.

The packaging laboratory should be additionally supplied with conditioning system and secondary equipment as for instance balances without which functioning of already purchased facilities is limited.

The staff of IPFT was advised on proper testing methodology, the interpretation and limitations of test results and before others on principles of package designing and assessment. The range of packaging related projects which are to be carried out was proposed. Accomplishing of them in two-year term together with some training would give IPFT necessary strength in order to be indispensable on the field on packaging for pesticides industry.

ACKNOWLEDGEMENT

The author would like to acknowledge the help and assistance given to him by all the staff of IPFT and UNDP, but particularly to Dr. Kawal Dhari, the Director of the Institute and Mr. S. Kumar with whom he worked on a daily basis on packaging related issues.

1. Introduction

This report covers the period from 17th September to 12th October, which Andrzej Kuzia, the author, assigned as pesticide packaging consultant spent with Institute of Pesticide Formulation Technology (IPFT) in Gurgaon, Haryana. IPFT set up by Government of India with the assistance of UNDP/UNIDO is devoted to research, development and implementation in industry of modern pesticides formulations. It was anticipated that enriching of this basic programme with packaging issues would make the Institute offer more attractive.

The objectives of the mission described in Job Description were as follows:

- * assistance in setting up packaging laboratory facilities
- * assistance in starting packaging activities,
- * assistance to Indian pesticide through delivering lectures and participation in workshops

This, clearly outlined duties were successfully accomplished, evidence of which is given in the report.

The body of this report consists of three chapters. Packaging laboratory, Packaging programme development and Other activities. Recommendations concerning each of these issues are given in narrative form in each of the chapters separately. The main of them are repeated in very concise form in chapter Recommendations creating kind of a checklist.

2 Packaging Laboratory

2.1 Findings

Packaging laboratory in IPFT is being organised right now. Equipment ordered so far is already on place, suitable space is available but no decision was made on final situation of the lab and its layout.

Testing equipment which IPFT possess so far is as follows:

- a) Water vapor transmission rate (WVTR) tester, dish method (Buchel - Van der Korput, Holland)
- b) Cobb tester for testing wetter absorption of proper and paperboard (Buchel van der Korput, Holland)
- c) Laborator Heat-sealer, bar type (model HS-2, RDM Test Equipment Co, UK).
- d) Puncture tester, triangular pyramid head (Buchel-Van der Korput, Holland)
- e) Thickness meter, ultrasonic type (model CL202P, Kreutkemer Gmb, Germany)
- f) Impact tester, pendulum type (model 147-A, Buchel-Van der Korput)

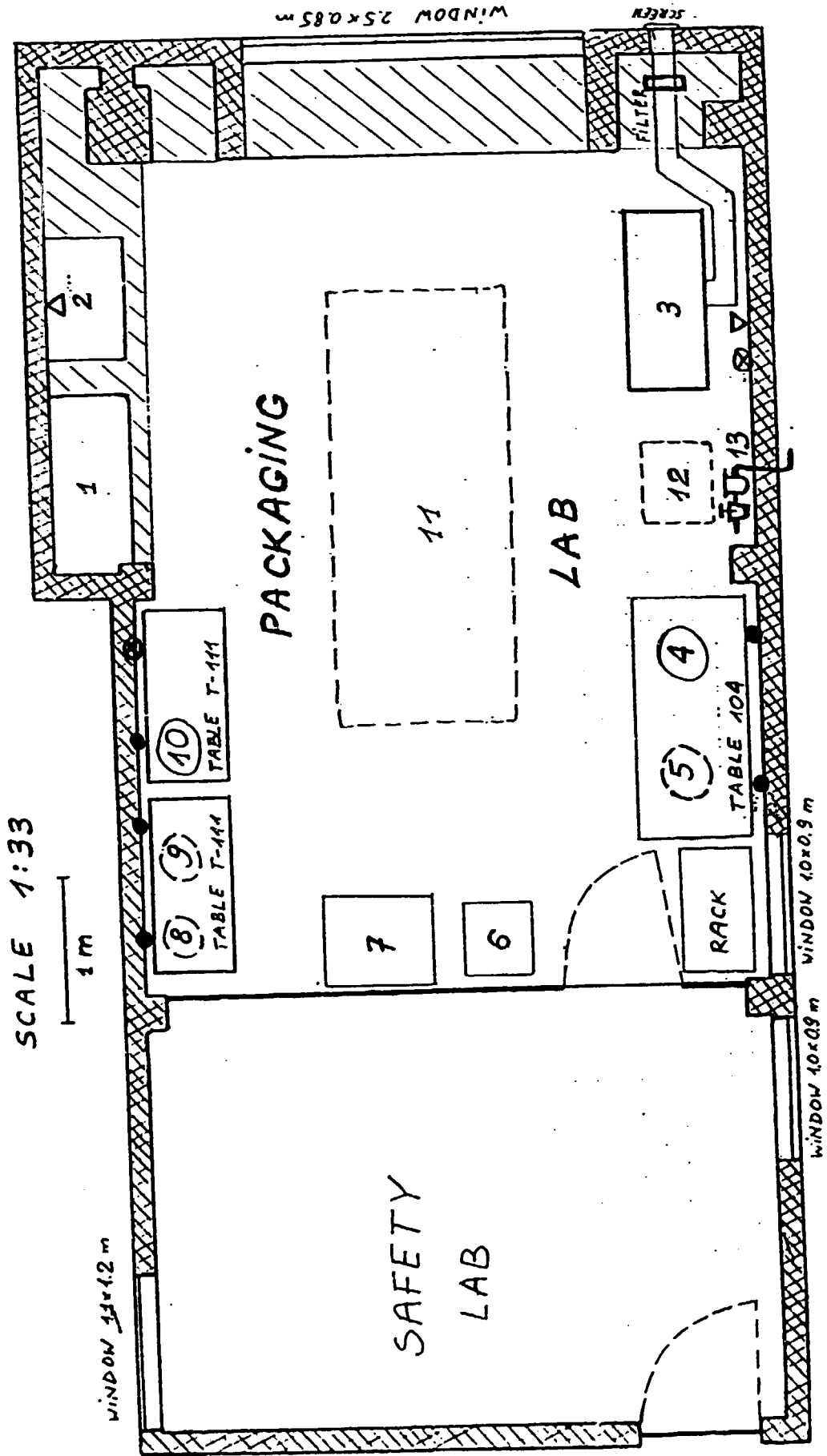
Temperature and humidity chamber (Heraeus Votsch, Germany) was also purchased and is presently used for shelf-life evaluation of certain formulation by Research Department of IPFT.

2.2 Recommendations

2.2.1 Situating of packaging laboratory

The best place for the packaging laboratory and thus recommended is the room in Pilot Plant building, where equipment is apparatuses are stored. Reasons :

- It has relatively low surface area of windows ($\sim 3.0 \text{ m}^3$ after dividing) what assures lower energy consumption while maintaining constant climatic conditions and low cost of second glass insertion. Other location.



LEGEND

1. Fuming Chamber
2. Sink
3. Air conditioner with air intake (screen outside and changeable filter inside. Filter should be textile or hair type or foam with open pores)
4. Heat sealer
5. Temperature oven (foreseen)
6. Impact tester
7. Puncture tester
8. Analytical balance (foreseen)
9. Technical Balance (foreseen)
10. WVTR tester
11. Space for future development (e.g. table T-2001 and rack for samples storage)
12. Drop table (foreseen)
13. Compressed air intake equipped with filter and pressure control

Equipment like Cobb test, thickness tester and other which is foreseen to purchase (dial gauges etc) are kept in the drawers and put on the tables only when necessary.

//// Alcoves

- Electric Socket (single phase)
- ⊗ Electric Socket (three phase)
- ▽ Water tap.

has two windows of approximate areas 4.2 m^2 each.

- * Window is heading north (low heat exposure)
- * Easy connection to compressed air, source of which is directly downwards,
- * No direct entrance (after erecting the wall), what provides better insulation from outdoor conditions resulting in lower energy consumption.

2.2.2 Laboratory layout

Recommended room ought to be divided by the wall according to the enclosed drawing, thus creating safety lab space and packaging lab space. Erected wall will decrease required conditioned volume to $80-85 \text{ m}^3$ (after filling with instruments and furniture)

Preferred type of wall construction is one with wood skeleton, two plywood facings and insulation like mineral wool inside. Approximate total thickness - 50 mm. The windows in the packaging lab should have double glass. Floor type - PVC tiles.

Constant climatic condition during testing of packages and packaging materials are required : 23°C and 50% RH (ISO 187-1990 and ISO 281 - 1977), thus equipping laboratory with air conditioning system is inevitable.

The positioning of air conditioner as well as the rest of the equipment already acquired and those recommended (2. 2.3), is proposed on the attached drawing.

Sensor of air conditioner should be located on the opposite wall. Due to conditioning of the laboratory, door should be equipped with the sill and with the gasket of foamed material all around.

According to the growing needs laboratory ought to be provided with some storage area like hanging cupboards, racks, etc. Alcove under the window is a good place to have a cupboard in.

2.2.3 Equipment

In order to perform its duties, packaging laboratory should be additionally supplied with the equipment listed in Annex I. The need of air conditioning system was already explained in previous section. The balances and oven are needed also for accomplishing tests on already possessed devices like WVTR and Cobb testers. The remaining are simple all-purpose packaging lab equipment. There are also two additional pieces of equipment, which are rather not to be purchased but simply ordered in a small factory or workshop.

These are:

- * frame for testing compression resistance
- * drop table

The detailed explanation of the purpose of each item, kind of test they are used for and construction principles were given to the staff of IPFT.

There is no need for installing more sophisticated testing facilities before the start up of pesticide related packaging projects. Such a necessity may, however, arise later as a conclusion of completed projects or industry suggestions. Therefore, in 1.5-2 year period needs for testing equipment should be revised. Possible candidates in this phase 2 stage are for instance tensile tester with different set-ups, Elmendorf/ tear tester or dart-drop tester.

It should be emphasized that modern equipment already possessed by IPFT like gas chromatograph can be also utilized for packaging tests. Methodology of solvent permeability testing with the use of GC was discussed with the staff and related literature supplied.

3. Packaging programme development

3.1 Findings

It was soon realised that undertaking of packaging related projects in IPFT is even more important today than setting up lab facilities, because little was done in this area, whereas both type of activities have to be synchronised in order to meet the needs of pesticide industry.

Three problems were identified in the area:

- * What range of packaging testing and research should be performed by IPFT?
- * What types of projects should be carried out?
- * How to start it and gain experience?

3.2 Recommendation

3.2.1 Range of activities

On the base of discussions held with the staff of IPFT and with the experts from other institutions (see point 4), it was found that Institute should concentrate only on the problems where both knowledge of packaging matter and pesticide formulations is important.

The said problems are:

- * Shelf life evaluation of pesticide formulation in design package
- * Pesticide/package compatibility studies for instance of solvent based formulation and various types of containers and closing systems.
- * Performance evaluation of pesticide packaging (toughness, tightness, safety in use etc.)
- * Disposal problems of pesticide packages.

There is no need for doubling the activities of Indian Packaging Institute in Bombay by undertaking wide packaging programme like for instance testing of packages according to UN recommendations. On the other hand, however, mentioned Institute has no experience and will not have in evaluation of package/pesticides compliance.

3.2.2 Types of projects to be undertaken.

The following types of projects are most suitable to be performed by the IPFT.

- * recommendation of package type and design for own formulations (together with design sample)
- * recommendation and specification of the package for the new industrial product or when there is a need for changing packaging

system.

- * expertises giving explanation of not adequate package performance.
- * recommendations on packaging system for export of pesticides based on international regulations.

Recommendation and/ or specification for pesticide package should be based on complete performance checking procedure, example of which is given in attached chart.

3.23 Start-up

In order to start packaging activities and gain experience required for the attraction of industry attention accomplishment of own (budget sponsored) projects is needed. The suitable projects can be for instance:

- * Creating of the data bank on actual pesticide packages utilised in the India with respect to the product packed.
- * Creating of the date bank of packages manufacturers and their production profiles which are suitable for pesticides.
- * Evaluation of given package (e.g. those with Selar RB produced by Mipak, Bombay) for different types of liquid formulations. Such a project should include numerous testing procedures and some statistical evaluation. There is a dual purpose of own projects.
- * gaining the knowledge concerning pesticide packaging issues throughout the country and
- * familiarisation with testing methodology and performance.

4. Other activities and issues.

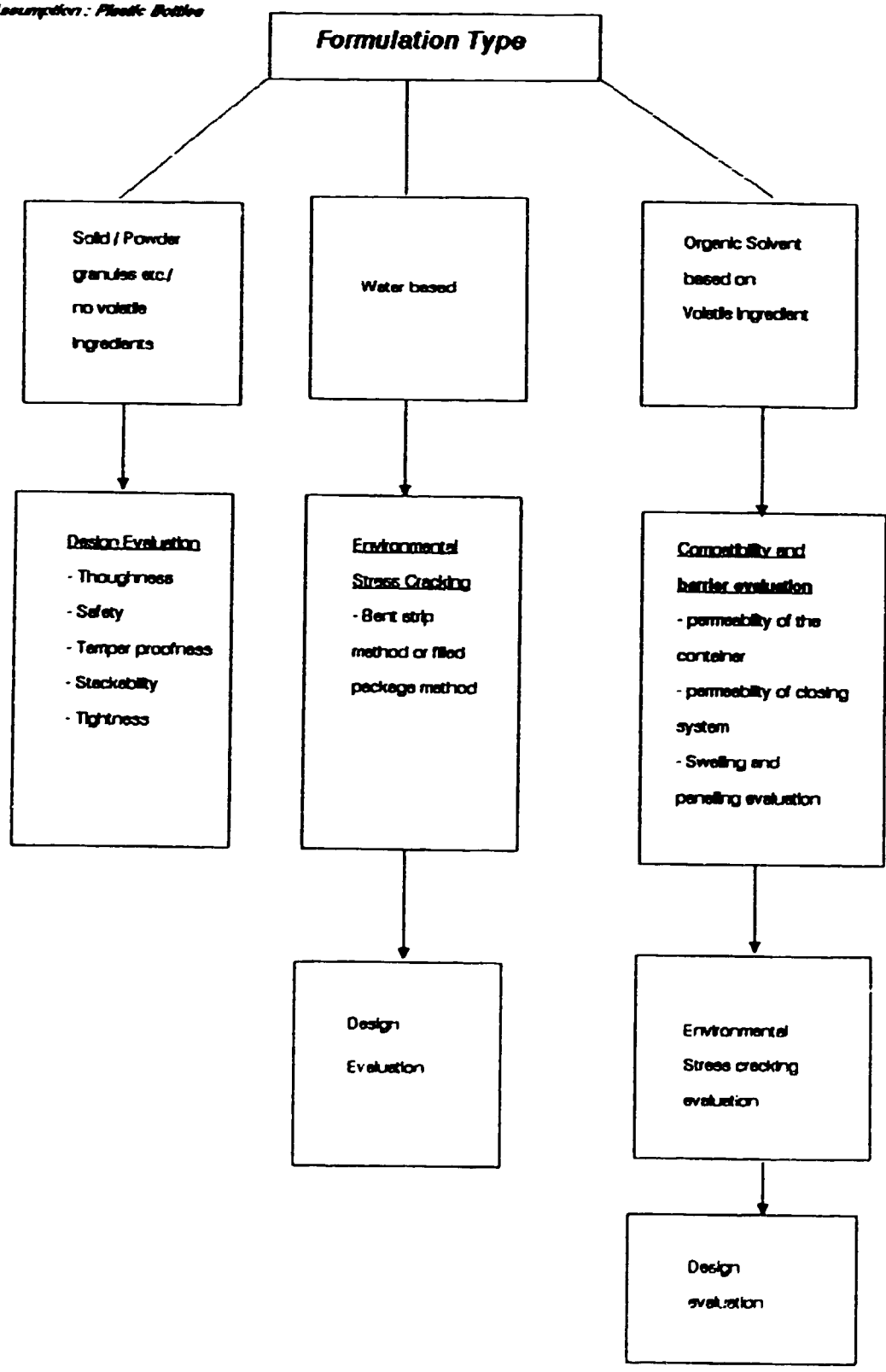
Author took part in two seminars, where he delivered lectures related to pesticide packaging.

First, organised in form of a workshop by IPFT and Excel Industry Ltd., held in Bombay , 25-26/09/1992 is described in Annex III.

Second, the training course organised by IPFT covered in packaging related part by Annex IV.

EXAMPLE OF PERFORMANCE CHECKING PROCEDURE

Assumption: Plastic Bottles



Author held also several discussion with the experts outside the IPFT, which helped him to assess the possible role of IPFT in packaging related issues. The most important were:

Place/date	Person interviewed	Subject of Discussion
Indian Packaging Institute, Bombay 24/09/92	Mr. K.B. Gupta, Joint Director	Activities of Institute, its equipment, possible range of testing by IPFT
Mipak Plastics Pvt. Ltd., Bombay 24/09/92	Mr. Kailash Murarka, Managing Director	State-of-art of plastic containers produced by Indian manufacturers.
Excel Industries Ltd., Bombay, 26/09/92	Mr. C.M. Deshpande, General Manager Mr. D.B. Mehta, Quality & Packaging Manager Mr. S.P. Iyer, Marketing Manager	Industry needs on the field of packaging, forms of cooperation with IPFT on this field
Indian Standard Institution, New Delhi, 02/10/92	Mr. Sen.	The possible role of IPFT in regulatory procedures of pesticide packages.

During the course of these meetings it was found that advantageous for IPFT would be at least the membership of library of the Indian Standard Institution and of Indian Institute of Packaging thus gaining access to informations and literature concerning packaging. Also subscription of at least Indian Packaging journal is recommended.

When sufficient knowledge of packages and packaging systems applied in the country is gained as well as some testing experience, the short fellowship abroad within UNDP project for staff members can be advantageous. Beside visiting packaging laboratory with some experience on chemical products packaging testing, visiting of International Packaging Fairs as Interpack is recommended. It is the best occasion to be fully accustomed with up to date filling lines and packages for pesticides.

5. **Recommendations**
- 5.1. The location and layout of the packaging laboratory should follow the attached drawing and indications given in 2.2.1 and 2.2.2
- 5.2. In order to start and perform packaging tests laboratory should be additionally supplied with the equipment listed in Annex I.
- 5.3. Packaging activities of IPFT should be devoted closely to the issues where interaction between the content and the package take place as described in 3.2.1 and 3.2.2.
- 5.4. Budget sponsored packaging project should be undertaken on the onset of packaging activities of IPFT in order to gain experience and be later serviceable for pesticide industry. Examples of such projects are given in 3.2.3.
- 5.5. Membership of the Indian Standard Institution Library and Indian Packaging Institute is recommended in order to have rapid access to packaging information.
- 5.6. Subscription of Indian Packaging journal is advised to be updated on packaging issues at home and abroad.
- 5.7. After familiarisation with domestic pesticide packaging systems short fellowship to pesticide packages testing lab for staff members can be considered.

Annexure I

Equipment Required for Packaging Laboratory

Name	Purpose	Specifications	Availability
1. Airconditioning system with independent temperature and humidity control	To maintain stable climatic conditions/ during testing according to ISO-187 and 291	Temp : 23°C ± 1.0 RH : 50% ± 5% Air volume to be conditioned 85m ³	If not available locally ATE GmbH (Germany)
2. Analytical Balance	To measure weight increase in WVTR test and Cobb tests, grammage of packaging materials, moisture pickup and many others	Range : 0-200g Readability: 0.1mg Luminous display	Sartorius GmbH /Germany/ Mettler /Switzerland/
3. Technical (industrial) balance	Weight loss of filled containers in permeability tests, weight of packages and its distribution, gravimetric volume assessment.	Range : 0-5000g Readability: 0.1g Luminous display	Supplier as above
4. Laboratory oven	Accelerated test for barrier properties tighness of containers and environmental stress cracking, Drying of silica gel for WVTR test.	Temperature range 20-200°C Accuracy : ± 1°C of temp setting Explosion proof make. Venting openings on top.	Local supply
5. Dial thickness meter	Thickness measurements of packaging materials	Range : 0-5mm Readability: 1µm Flat measuring faces with diameter 2.5-10 mm load on the foot: 0,5-1,0N	H.E. Messmer Ltd (UK) Daventest Ltd(UK) Testing Machines Inc. (USA)
6. Torque meter	To measure torque required for tight screwing and unscrewing of bottles caps.	Range : 10 Nm Accuracy : 0.2 Nm	As above
7. Sample cutters - circular cutter 50 cm ² - Strip cutter	Preparing samples for WVTR Preparing samples for other tests		Lorentzen & Wettr (Sweden)

Annexure II

LITERATURE SUPPLIED AND RECOMMENDED

Author supplied IPFT with the following literature:

1. Recommendation on the transport of dangerous goods - VII edition, United Nations, New York, 1991
2. ISO/EN Standards on requirements and operation of testing laboratories:
 - ISO guide 38
 - ISO guide 25
 - EN 45001 : 1989
3. ISO standards concerning testing of packages and packaging materials.

Plastics

ISO 4593 - 1979
ISO 4599 - 1986
ISO 2556 - 1974
ISO 1184 - 1983
ISO 7765 - 1988
ISO 6383/2 - 1983
ISO 1133 - 1981
ISO 8286 - 1987
ISO 8295 - 1986
ISO 483 - 1988

Transport Packages

ISO 2247-1985
ISO 2875 - 1985
ISO 2874 - 1985
ISO 2234 - 1985
ISO 2248 - 1985
ISO 2876 - 1985
ISO 2233 - 1986
ISO 9318 - 1986
ISO 4178 - 1980
ISO 4180/1 - 1980
ISO 4180/2 - 1990

Paper

ISO 7965/1 - 1984

4. Handbook of the International Association of Packaging Research Institutes.
5. Various technical brochures and leaflets

The following literatur is recommended to purchase in the short time:

1. ISO standards related to packages

Paper & Paperboard

ISO 535 - 1976
 ISO 3036 - 1975
 ISO 2520 - 1974
 ISO 536
 ISO 1974 - 1990
 ISO 2759 - 1983
 ISO 1924/1&2 - 1985
 ISO 287/1985
 ISO 2493 - 1973
 ISO 534 - 1988

Conditioning

ISO 187 - 1990
 ISO 291-1977

Plastics

ISO 3915 - 1981
 ISO R 1195 - 70
 ISO 4600 - 1986
 ISO 6252 - 1986
 ISO 8604 - 1988
 ISO 4607 - 1978
 ISO 4611 - 1987

Transport

ISO 780 - 1985
 ISO 2244 - 1985
 ISO 8768 - 1986
 ISO 2872 - 1985

Closure

ISO 9317 - 1989

2. IMDG Code

3. ASTM standards related to packaging, list of which will be supplied by author directly to IPFT.

PROCEEDINGS OF WORKSHO ON PACKAGING AND FORMULATION
TECHNOLOGIES OF PESTICIDES ORGANISED BY EXCEL
INDUSTRY AND IPFT IN BOMBAY

INTRODUCTION TO NEW GENERATION PESTICIDE FORMULATIONS

International Trends in Packaging (September 25, 1992)

MORNING SESSION

SESSION CHAIRMAN: MR. A KUZIA

9.45 - 10.00	Course outline : A Kuzia
10.00 - 10.45	International trends in packaging and their relation to pesticide packages. A. Kuzia
10.45 - 11.00	Discussion
11.00 - 11.30	Safety & labeling requirements - S. Kumar
11.45 - 12.15	IMDB Code - A Kuzia
12.15 - 12.30	Discussions
12.30 - 12.50	Water soluble package - S Kumar

AFTERNOON SESSION

14.00 - 15.00	Standards and testing of packages - K B Gupta
15.00 - 15.15	Discussion
15.25 - 16.00	Bulk packages - A Kuzia
16.00 - 16.30	Automatic filling lines for liquids & solids - K B Gupta
16.30 - 17.00	FFS machines and materials - A Kuzia
17.00 - 17.30	General discussion.
17.30	End of the session.

INTRODUCTION TO NEW GENERATION PESTICIDE FORMULATIONSInternational Trends in Packaging (September 25, 1992)MORNING SESSIONSESSION CHAIRMAN: MR. A KUZIA

9.45 - 10.00	Course outline : A Kuzia
10.00 - 10.45	International trends in packaging and their relation to pesticide packages. A. Kuzia
10.45 - 11.00	Discussion
11.00 - 11.30	Safety & labeling requirements - S. Kumar
11.45 - 12.15	IMDG Code - A Kuzia
12.15 - 12.30	Discussions
12.30 - 12.50	Water soluble package - S Kumar

AFTERNOON SESSION

14.00 - 15.00	Standards and testing of packages - K B Gupta
15.00 - 15.15	Discussion
15.25 - 16.00	Bulk packages - A Kuzia
16.00 - 16.30	Automatic filling lines for liquids & solids - K B Gupta
16.30 - 17.00	FFS machines and materials - A Kuzia
17.00 - 17.30	General discussion.
17.30	End of the session.

INTRODUCTION TO NEW GENERATION PESTICIDE FORMULATIONS

Second Day (September 26, 1992)

9.30 - 9.45	Inaugural formalities (if any)
9.45 - 10.45	Pesticide Formulations - An Overview Dr. A.R. Woodford
10.45 - 11.00	Discussions
11.10 - 12.00	Suspension Concentrates Dr. P.K. Ramdas
12.00 - 12.10	Discussions
12.10 - 13.00	Concentrated & Micro emulsions Dr. P.K. Patanjali
13.00 - 13.10	Discussions
14.00 - 14.50	Water Dispersible Granules Dr. P.K. Ramdas
14.50 - 15.00	Discussions.
15.10 - 16.10	Controlled Release Formulations Dr. A.R. Woodford
16.10 - 17.30	General Discussion. Felicitor : Mr. A.C. Shroff

INSTITUTE OF PESTICIDE FORMULATION TECHNOLOGY

Registered Under Societies Act XXI, 1860 (Registration No. S-21944 /1991)

Institute of Pesticide Formulation Technology

Two days seminar on Packaging and Formulation
Technology of Pesticides.

--- Organised by
Excel Industries
Bombay.

Date: Sept. '25-26, 1992.

1. International trends in Packaging

In this lecture main trends prevailing in packaging technology will be discussed. These include:

- packaging waste issue and its influence on future developments also in pesticide sector
- increasing role of barrier packages
- designing of packages for "Value in Use"
- explanation of various types and technologies related to PET containers.

Also short comments on temperproof closures and implementation of ISO 9000 standard in packaging industry will be given.

2. Safety & labelling requirements

In the packaging safety lecture, we shall discuss safety aspects relating to :

- i) General conditions
- ii) Storage
- iii) Loading & unloading
- iv) Waste disposal of containers

The labelling aspects will be covered as per Central Insecticide Act.

3. IMDG Code

Explanations what is the IMDG code is, what does it contain and how to comply with it are given. Requirements concerning packages their testing and marking of the containers are discussed. Proper labelling for shipment.

4. Water soluble films/ packages

Historical development, properties, specifications, water solubility characteristics, water solubility of seams, effect of pH on solubility, sealing nature with respect to humidity.

Two types KA and KB/N based on German Company SYNTAWA will be discussed.

The advantage and disadvantage of Packaging the Pesticide product in water soluble films/ packages will be discussed.

5. Bulk packaging

Three categories of Bulk shipment i.e. transportation packages, intermitient bulk containers (IBC's) and multimodel bulk containers are explained. Special attention is given to construction and design at transport packages from metal and plastics. Examples of IBC's are also presented.

6. FFS machines and materials

Various types of packaging FFS machines are illustrated and their field of application outlined, Single and multilayer materials used commonly on FFS machines are listed. Preferred machine and materials for pesticides are discussed.

LIST OF PARTICIPANTS FOR PACKAGING & PESTICIDE FORMULATION
SEMINAR HELD AT AMBOLI - 25 & 26 SEPT. 1992

1.	Mr. Andrei Kuzia	:	SPEAKER
2.	Dr. A R Woodford	:	—
3.	Dr. P K Patanjai	:	Gurgaon
4.	Dr. Ramdas P K	:	I.P.F.T.
5.	Dr. S Kumar	:	I.P.F.T.
6.	Mr. K B Gupta	:	I.I.P (SPEAKER)
7.	Mr. Nandkumar Jagtap	:	Jogeshwari
8.	Mr. Rudrader DasGupte	:	Jogeshwari
9.	Mr. C D Makwana	:	Bhavnagar
10.	Mr. M D Harsoru	:	Bhavnagar
11.	Mr. P S Pandya	:	Bhavnagar
12.	Mr. M P Mistry	:	Jogeshwari
13.	Mr. R D Bhilare	:	Amboli
14.	Mr. Kishor Zare	:	Amboli
15.	Mr. Sangappa C Uppaladinni	:	UPL - Vapi
16.	Dr. R N Patel	:	UPL - Vapi
17.	Mr. L P Gupta	:	UPL - Ankaleshwar
18.	Mr. R Rayarathe	:	UPL - Vapi
19.	Mr. P S Dave	:	Jogeshwari
20.	Mr. N R Mistry	:	Jogeshwari
21.	Mr. J T Rodrigues	:	Jogeshwari
22.	Mr. Prakash S Karkera	:	Jogeshwari
23.	Mr. Ghanshyam M Makwana	:	Amboli
24.	Mr. H S Jagdale	:	Jogeshwari

25.	Mr.K A Khan	:	Jogeshwari
26.	Dr.Rajan Shirsat	:	Jogeshwari
27.	Mr.P G Butala	:	Roha
28.	Mr.U P Potdar	:	Roha
29.	Mr.Busane	:	Roha
30.	Mr.Dilip Shah	:	Amboli
31.	Mr.Rakesh Saraiya	:	Parul
32.	Mr.P K Amin	:	Parul
33.	Mr.Mahesh Bhatt	:	Jogeshwari
34.	Mr.P M Jadhav	:	Jogeshwari
35.	Mr.Sachin Jadhav	:	Lote Parshuram
36.	Mr.Srikhant Bhagvat	:	Lote Parshuram
37.	Mr.Parvez Kaiser	:	Roha
38.	Mr.K Simhachalam	:	HCS Ltd. Hyderabad

**Training Programme on
Pesticide Formulation Technology
October 8-17, 1992**

Schedule

Thursday, October 8th

- 10.00 Registration
Inaugural Session
- Chairman Mr. Vinay Kohli
- 10.15 Welcome Address and Course Outline
Dr. Kawal Dhari, National Project Coordinator
- 10.25 Inaugural Address
*Mr. Vinay Kohli
Dept. of Chemicals & Petrochemicals, Govt. of India*
- 11.00 Pesticide Formulation - An Overview
Dr. A.R. Woodford, UNIDO Expert
- 11.45 Discussion
- 12.00 Factors Controlling the Proper Pesticides
Packaging Selection
Mr. Andrzej Kuzia, UNIDO Expert
- 12.45 Discussion
- Technical Session I*
- Chairman Mr. Andrzej Kuzia
- 14.00 Dust and Wettable Powders
*Dr. Krishna Moorthy, General Manager (R&D)
Montari Agrochemical Research Station*
- 15.00 Discussion
- 15.30 Size Reduction & Blending Techniques
Mr. S. Kumar, IPFT

UNIDO Comments

The report deals with an important topic of packaging of toxic and hazardous materials. The author has given the lay out plan for the establishment of the packaging laboratory and the equipment needed for the laboratory. The report gives a wide variety of activities that could be taken up by the packaging laboratory and offer the services to private parties.

The workshop which was covered by the author clearly indicates the level of interest shown by the private companies. The discussions held by the author with many private and Government bodies clearly indicate the scope of work IPFT could do for the benefit of the packaging industry.

The report gives ISO standards for materials, testing of packages and transport of packages.