



TOGETHER
for a sustainable future

OCCASION

This publication has been made available to the public on the occasion of the 50th 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 for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

RESTRICTED

17069-E

DP/ID/SER.A/1052
27 September 1988
ORIGINAL: ENGLISH

REGIONAL NETWORK ON PESTICIDES FOR ASIA AND THE PACIFIC

DP/RAS/85/023

INDIA

Technical report: Pesticides planning including
production diversification*

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 a UNIDO staff member

Backstopping officer: B. Sugavanam, Chemical Industries Branch

United Nations Industrial Development Organization
Vienna

* This document has not been edited.

Contents

	<u>Pages</u>
I. Acknowledgement	2
II. Recommendations	2
III. Introduction	4
IV. Details of Assignment	5
V. Organization of the Mission	6
VI. Pesticide Scenario in India	6
VII. Registration of Pesticides	8
VIII. Future	9
XI. Occupational Health and Safety at Work	12
X. Export of Pesticides	14
XI. Conclusion	15
XII. <u>SUPPLEMENT</u>	
1) Production Diversification in Hindustan Insecticides Ltd (HIL)	16
2) Introduction	16
3) Present Production in HIL	17
4) Production Diversification in HIL	17
5) Conclusions and Recommendations	27

I. Acknowledgement

The author wishes to acknowledge with thanks the assistance provided by the counterpart Mr. Dhus in organizing the programme of the mission and to the staff of Hindustan Insecticides Ltd and Pesticide Development Programme India for providing all facilities for successful completion of the assignment.

My special thanks are due to Mr. Islam, Mr. Satpal, Mr. Ramamoorthy and Mr. Nayyar for the help provided during the mission.

II. Recommendations

1. India should now facilitate introduction of new pesticides according to national requirements.
2. While introducing the new compounds care should be taken that they do not affect the well established companies operating under strict national/international norms producing pesticides of good quality both for local consumption and for export purposes.
3. The repeat registration clause 9(4) of the Insecticide Act should be reviewed to encourage registration of newer and more effective pesticides and their formulations.
4. For any new patented pesticides registered by a company, it should be given proprietary rights, on the data submitted, on a certain time frame (3 to 8 years) depending on the nature (technology, bio-efficacy, patent life etc.) of the pesticides or their formulations.
5. A central committee at national level should be formed to decide on licensing of new manufacturers/formulators nationwide

based on existing plants' unused capacity and the capability of the licensee in pesticide manufacture and formulation.

6. The casual labourers used at the down stream processing such as transportation of finished products, pre-crushing and pre-mixing of ingredients and packaging line need protection measures from being constantly exposed to toxic pesticides. The industry should be made responsible for these contract labourers as the contractor has no responsibility.

7. In selected areas, where highly toxic pesticides are handled, women of child bearing age should not be allowed to work.

8. A long term plan (10 years) should be followed to reduce the usage of large tonnage persistent organo-chlorines and move towards more active and environmentally safe pesticides with greater share of bio-pesticides, mixtures, pesticides of botanical origin and newer type of formulations free of dust and organic solvents.

9. Emphasis also should be made to create an international image by maintaining high national standards and quality so that exports could go up and even contract formulations could be made for multi-nationals.

10. Independent formulators in Europe and USA should be invited to attend an exhibition and for holding discussions with reputable manufacturers regarding opportunities and products available in India for export.

11. The Government should encourage and subsidize pesticides which are safe on environmental grounds such as bio-rationals and also application methods like electrostatic spraying, low tillage farming, seed dressing technologies etc. to reduce overall tonnage of pesticides used.

12. The country should develop a well balanced portfolio of commodity and proprietary pesticides for use in agriculture in order to obtain benefits both from cheap commodity pesticides which have been in use for a long time without any major side effects and from the R&D work carried out in developed countries for the invention of new highly active pesticides with a better safety margin.

III. Introduction

13. India during the last 20 years has seen a remarkable progress in food production inspite of intermitent monsoon failures and drought situation. This was mainly due to various measures taken by the Government such as the introduction of high yielding varieties, increasing fertilizer production under public and private sectors, intergrated farming practices, developing vast network of irrigation schemes and utilization of underground water, a system of good seed distribution and cereal procurement programme to build a buffer stock to take care of lean years. All these measures contributed to India's climb to a position of self sufficiency in food and in certain areas even exporting food grains.

14. The Government in its aim to promote development of pesticides industry in the country, requested UNDP/UNIDO to provide technical assistance to develop a strong base for the development of pesticide formulations in order to encourage and promote indigenous technology using locally available raw materials and also to assist in the transfer of newly adapted technology to local formulators. This base called Pesticide Development Programme India (PDPI) was also destined to serve as a training base for local pesticide industry in offering tailor made training courses in pesticide formulation, quality control , industrial safety and effluent control. It was also anticipated that the programme would combine hands-on training from laboratory scale to pilot plant operations.

15. While the PDPI has been well established with UNDP/UNIDO assistance under DP/IND/80/037 during 1985-1987 period, India also undertook a major responsibility of hosting the Regional Coordinator Unit called Regional Network on Pesticides for Asia and the Pacific (RENPAAP) under another UNDP assisted project DP/RAS/85/023. In many activities of these projects, the regional and the national projects maintained close links for the benefit of the region.

16. Under the regional project, the member countries (Afghanistan, Bangladesh, China, India, Indonesia, Pakistan, Philippines, Republic of Korea, Sri Lanka and Thailand) requested training and expert assistance according to their needs emphasizing in fields ranging from packaging (Afghanistan, Indonesia), instrumentation (Afghanistan, China, Thailand), herbicide efficacy (Republic of Korea) residue analysis (Bangladesh, Sri Lanka), insecticide efficacy (Sri Lanka), occupational health & safety (Philippines), environmental toxicology and effluent control (almost all countries) to production diversification (India). In addition, the project is covering group activities in the areas of pesticide data collection, formulation technology, quality control, residue analysis and environmental aspects of pesticide production and use.

17. Under the umbrella of this regional project, the author undertook the assignment of a consultant in pesticide Planning including production diversification.

IV. Details of Assignment

18. The assignment was agreed for 15 days instead of 1.0 m/m as originally requested for and the terms of reference were to:

- review existing pesticide use and requirements in relation to different types of formulations used in the country;

- identify need of the consumers for new pesticides and to suggest new suitable products to fulfill the needs.
- suggest methodology for laboratory and field testing of new products/formulation and quality assistance methods in pesticide production;
- suggest new uses of conventional products for increasing their life cycle keeping in view stringent environmental rules enacted by the Government;
- suggest marketing strategy in potential areas of pesticides consumption inside and outside the country;
- suggest methods/steps required for safety operations free from the environmental impact on workers and the surroundings.

V. Organization of the Mission

19. Following the duties assigned as above, the author along with his counter-part Mr. Dhua, Regional Coordinator of RENPAP project organized a work plan to meet number of people involved in the pesticide industry, Government and also visiting some of the pesticide formulation units. This arrangement enabled the author to discuss with many responsible officers in the Government and in the Industry (see annex 1 and 2) and see personally the operation of one small scale formulator and a big scale formulator during the short time of two weeks assignment.

VI. Pesticide Scenario in India

20. Pesticide Industry in India, as a simple-repackaging set ups, date back to pre-war and immediate post-war periods. The real manufacturing started in the 50's when DDT and BHC were

taken up for manufacture as a general purpose insecticides for public health and agriculture outlets. The pesticide industry did not make any progress till 1970 even long after the green revolution of the 50's and the 60's. The new era for pesticide industry actually started in India during the mid 70's and the 80's. Thanks to the Government policies such as compulsory local manufacture of active ingredients after introduction into the country, distribution of half the technical material produced by one producer to other local formulators, tax incentives to start their own R&D units and shorter patent life (~7 years) given compared to international patents life, (~12 years), today India ranks 10th in the international league in pesticide consumption at around \$500 million. It produces almost 95% of its present pesticide usage at around 56186 tons (see annex 3).

21. The production spectrum scans from organochlorines, organo-phosphorus insecticides to more sophisticated pyrethroids and herbicides like isoproturon, paraquat etc. (see annex 3). In spite of this, India lags behind in pesticide usage per unit area compared to many ASEAN and Latin American countries. It still comes out very bad if one takes into account that more than 50% of the technical material is accounted for by DDT and BHC (around 33500 tons) which are banned in a number of developed and developing countries. This is also reflected in low yield per unit area compared to many developing countries of Far East and Latin America. One example is that India plants around 24% of the world's cotton area but produces only about 9% of the output. So the pesticide industry is still destined to grow with more and more emphasis away from organochlorines. The growth during the last five years clearly indicates that emphasis is on fungicides and herbicides in preference to insecticides. This could also be somewhat misleading due to the fact that in the insecticide market, during the same period, there was a big drop in the

consumption of high tonnage products of BHC, DDT, Malathion and Carbaryl while there had been a great increase in the use of other more active insecticides. (Note: One has to observe caution in interpreting market based on tonnage weight due to the fact that newer compounds need lower dosage than the organochlorines and some O-P compounds).

VII. Registration of Pesticides

22. The Central Insecticide Board of the Ministry of Agriculture is responsible for the registration of pesticides in the country. They also register pesticides destined for export. Compulsory registration is part of the Insecticides Act of 1968, with "the main objective to regulate the import, manufacture, sale transport distribution and use of insecticide with a view to prevent risk to human beings and animals and for matters connected therewith". Later the term insecticide included in general all pesticides.

23. Enforcement of registration of pesticides is strictly followed and the author held discussions with the staff of the Insecticide Board at Faridabad.

24. One of the most critical clauses in the act was the Section 9(4) which granted E.P.A. type of 'Me Too' registration to any person who applied for repeat registration by paying a prescribed fee. Then he will be allotted a registration number and granted a certificate of registration on the same conditions on which the Insecticide (pesticide) was originally registered.

25. This clause 9(4) gave a flip to pesticide industry in the past but now it is causing a backlash. The author himself was told by a number of foreign companies that they will not register new compounds in India until the above clause is

repealed giving protection and proprietary property rights on the data submitted for registration.

26. The staff on the Insecticides Board informed the author that this clause 9(4) has been temporarily suspended and they are not taking any repeat registration. They also informed that they have no objection to register pesticide mixtures and bio-pesticides as long as the required data are provided. It is always possible that when clause 9(4) is repealed there might be a rush of new compounds registered by multi-nationals which might alter the balance against the National Companies having limited compounds. The author feels that this could be settled by discussion between the various parties concerned by giving protection for a limited number of years or going into collaboration with one or two national companies in sharing the market and paying royalty if necessary. There are a number of possibilities since the potential Indian market is big.

VIII Future

International Situation

27. The pesticide in the international scene is now at its best of times with a number of new fungicides, insecticides and herbicides introduced with high levels of activities never seen before with greater safety margin to man and his environment. Obviously it is going to be more difficult to introduce new active compounds, but formulation will play a major role in that mixtures will play an important part in getting broad spectrum control and in resistance breaking strategy. The thrust is going to be cost effective phloem mobile nematicides, soil fungicides, selective post emergence herbicides, herbicide safeteners and above all development of plant growth regulators and minimum tillage cultivation systems. In the long run, bio-rationals, herbicide resistance crops and new seed breeds would make in-roads into the markets.

28. It is also conceivable that due to strong restrictions on workers' safety, effluent control and added to public opinion, many pesticides especially those which are persistent and toxic to non-target organisms (bees, earthworm, fish, soil micro-organisms) will disappear from the advanced countries but still would be in use in many developing countries.

Indian Situation

29. Future development of pesticides in the Indian scene very much depends on the type of registration scheme that is going to be adopted by the Government. The present article 9(4) (see item VII) clearly prevents foreign companies coming in for registration with newer, safer and more effective compounds. Moreover, while the growth of pesticide industry during 1975-1985 definitely marked a new era and established firm base for the industry, to-day it is causing bottlenecks for progress.

30. In recent years taking advantage of clause 9(4) of the Insecticide Act, the country has seen pesticide formulators and even basic producers mushrooming everywhere. If this is not checked and contained it will damage the industry in the long run by unhealthy competition and unscrupulous practices contravening the National Standard/Specifications.

31. Today according to the Pesticide Association of India there are around 500 approved formulators out of which 50-60 are basic manufacturers. This amounts to one formulator for every 1.5 million people which is very high when compared with many developed and developing countries for such a low level of pesticide consumption per unit area. While in the past competition led to drop in the price of active ingredients and formulated materials favouring the farmers, but now the author is of the opinion and also shared by everyone he met during the mission, that there is an element of unhealthy competition. For e.g. annex 4 shows 14 producers for malathion, 7 for

pyrethroids and butachlor is also going in the same direction. The author feels that there should be many more small basic producers not given in the list. During a visit to a small scale formulator the author was informed that the firm has plans to manufacture butachlor, fenvalerate, cypermethrin and 2.4D. If this is a typical case then there should be many more who will join the list given in annex 4.

32. The author is of the opinion that the incentives given by the Government in the mid 70's built up a good network of pesticide manufacturing and formulating capability for which they were intended to. However, now the mushrooming effect of too-many producers sharing the cake and some who operate with very little overheads due to negligence to quality controls, to workers' safety and to proper effluent control facilities, offer unfair competition to the well established and well run national/multi-national companies. This unhealthy competition, if allowed, will kill the well established pesticide industry instead of the pest.

33. It is heartening to note that all the persons the author met in Government, industry and agriculture shared the same opinion that the present situation is not healthy for the industry but are not sure about the remedial measures. The author strongly feels that:

- a) the present number of basic producers and formulators are more than enough for the country.
- b) those formulators whose quality products are not upto the national specification, the premises are not kept within a reasonable standard of good house keeping and comforts to workers and no proper effluent control measures should be compelled to meet the requirements or close down.

- c) any new comers should be those who can introduce new products useful to the needs and safer to the environment.
- d) a central committee should decide licensing of newcomers on a national basis taking into account existing installed capacity and the infrastructure facilities. Preference should be given for expansion rather than new enterprises until there is a suitable justification like export orientation or new and effective compounds or novel formulation technology.
- e) what the country needs is a good distribution system with licensed retailers to reach all parts of the country and eliminate the mushrooming effect of manufacturers and formulators.

IX. Occupational Health and Safety at work

34. Recommendations towards occupational health and safety at work being part of the assignment, the author visited two pesticide industries one a small scale operator (Rs. 12 crores annual turnover) and a medium-big scale operator (Rs. 60 crores annual turnover). The main purpose of the visit was to understand the 'modus-operandi, and the efforts taken towards the upkeep, safety and effluent control measures.

35. In general in India there is a great awareness towards quality control, safety aspects and effluent control. While this has been recognized by big well reputed manufacturers, there is a slack in the implementation of workers safety and following simple safety measures applicable to national conditions. This is more so at the down stream processing wherever casual labour (contract) is employed at the transporting, crushing, filling, packaging lines.

36. These casual workers are at the worst of the receiving and in that they are the most exposed to toxic pesticide liquids, dusts and are not protected either by the pesticide manufacturers or by the contractors who supply the labourers.

37. The author actually witnessed men with bare hands filling one litre tin cans of dimethoate with their hands soaked in liquid throughout the eight hour shift in hot and humid conditions with no ventilation. These casual labourers work barefooted even in areas where highly toxic organophosphorus pesticides are used. When asked by the counterpart whether casual labourers with cut in their fingers or legs would be allowed to operate or not the owner said that they they do check these people before starting their work and that they are also checked for blood cholinesterase level once a month. However, it was clear that this was not possible because they are all casual labourers moving from one work place to another. They even handle toxic compounds like phorate (LD_{50} 2-4 mg/kg) granules and monocrotophos without any safety precautions.

38. According to what he saw the author feels that these workers in packaging line, sweeping the floor with traditional brooms, pre-crushing of pesticides and inerts are the most exposed to highly concentrated pesticides under the most difficult conditions. They are much worse off than the labour force who apply pesticides in the open field where they are exposed to diluted form of pesticides, atleast get fresh air and have easy access to water.

39. Even though the author is of the opinion that western style of safety methods will not be applicable to Indian conditions, simple inexpensive modifications such as air-ducting systems for negative ventilation, hoods around filling machines with proper directional ventilation, wearing lightweight aprons and light boots, compulsory washings (shower) after completing the work could reduce this

unnecessary exposure by almost 90% from the present level. The management of the industry owes this responsibility to these poor casual labourers who have no clue as to what they are handling and cannot relate to the exposure when they get problems later on and no employer is responsible for them. The author strongly recommends that the Government should enforce these simple safety measures and force the industry to practice because pesticide industry belongs to a special category and all handlings should be treated with caution.

40. There are statutes and even awareness to safety but conviction and responsibility to implement is lacking.

X) Export of Pesticides

41. The total world pesticide market at the user end is around \$16 billion (1985) and export of pesticides within the developed world and from the developed world to the developing world form a sizable portion. Table 1 below gives the the export of pesticides from India at round \$ 25 million. Considering that the modern Indian pesticide industry is only 10 years old, the export figure in a highly competitive field is an achievement indeed.

<u>NAME OF PESTICIDE</u>	<u>Export of Pesticides</u>			
	(1984-85 to 1987-88)		(Value in '000 Rs.)	
	<u>1984-85</u>	<u>1985-86</u>	<u>1986-87</u>	<u>1987-88</u>
Nicotine Alkaloids	1986.5	511.2	2004.1	1326.5
Nicotine Sulphate	18339.2	31242.6	42010.0	15914.8
Aldrin	-	9644.2	-	-
Aluminium Phosphide	21562.4	10719.6	8409.7	13545.1
Zinc Phosphide	8737.5	2922.8	3949.1	4780.4
Endosulphan tech.	34147.6	28433.8	3771.4	46910.0
Quinalphos	-	36331.0	21.0	2497.4
B H C Dust	-	-	-	232.9
Malathion	-	-	-	37256.0
Pesticides others insecticides n.e.s.	128876.8	277835.1	289000.0	280441.0
Total:-	213650.0	397740.3	349165.3	403907.1

Source:- CHENEXCIL, BOMBAY

42. India can definitely do better if it created an international image by creating first a nationally well organized pesticide industry following strictly national and international norms which could boost the export performance.

43. It is necessary for the industry to reach independent formulators abroad who buy active ingredients from a number of suppliers. It can also supply directly to middlemen in various countries who act as agents in selling pesticides. The most important effect would be to bring pesticides formulators from abroad and organize an export promotion meeting in order to expose the industry to foreign markets and what it can offer (annex 8).

44. Once international reputation is built up, India could be in a position to take up contract formulations work for the multinationals. Unfortunately clause 9(4) of the Insecticide Act is not in anyway helping the image of the pesticide industry abroad.

XI. Conclusion

45. Indian pesticide industry has become a viable organization, thanks to the Government measures taken during the 70's and 80's. It is now at the cross roads and careful planning is necessary to bring the industry to provide international image for both better quality products and better export possibilities. It should have a 10 year plan to phase out old timers and replace them with modern pesticides and newer formulations. The aim should be for an overall reduction in tonnage with increased bio-efficacy by moving to more active compounds with greater cost effectiveness.

XII. SUPPLEMENT

1. Production Diversification in Hindustan Insecticides Ltd

The production diversification mentioned in the terms of reference was mainly intended to be addressed to the Hindustan Insecticides Limited (HIL), a Government of India undertaking.

2. Introduction

HIL is one of the oldest establishments in the country and was intended to produce DDT during the 50's to combat malaria and also pests in agriculture. This objective still remains and forms a major part of HIL's business. However, the pesticide scene in the country changed fast during the mid 70's and the 80's with HIL facing stiff competition. Its obsolete product range could not compete with the more efficient multi-national and national enterprises. In spite of a number of organizational changes and operating four different production units, (see annex 5) today HIL has all its eggs in one basket namely organochlorines such as DDT, BHC and endosulfan.

The author held discussions with the staff of the Marketing Department, the R&D Department and the Production Unit in Delhi to get their views prior to making recommendations. Being a public enterprise its objective and method of operation and approvals are quite different compared to its competitors. In India, HIL as a national enterprise is in a most unenviable position of competing with the private industry which has a better organization and more freedom to take decision on product range, product diversification and getting licence from foreign companies. With all these handicaps the company turned a loss making operation into a profit making one in 1986-1987 as given in its annual report for 1987.

3. Present Production in HIL

HIL has four production units and has a total capacity to formulate 65000 tonnes (table 2) and with a capacity to manufacture DDT, BHC, endosulfan, dicofol, malathion with plans to manufacture monocrotophos and butachlor (see also annex 5).

Table 2 - Formulation Capacity of HIL

Delhi Plant - 10,000 tonnes
Rasayani Plant - Bombay - 23,000 tonnes
Udyogamandal Plant, Cochin - 15,400 tonnes
Rajamandri Plant - Andhra Pradesh - 17,000 tonnes

At the present time the manufacturing of active ingredients are mainly in favour of organochlorines and malathion.

4. Production Diversification at HIL

Production diversification or product diversification within HIL depends on so many factors. The author has selected following strategies which could be considered.

Class 1 - High Profit Margin

- i) Getting exclusive rights to some proprietary compounds from companies which do not have strong representation in India in the area of pesticides.
- ii) Getting sharing of rights for compounds which are either proprietary or commodity but have not entered the Indian market.

Class II - High to Medium Profit Margin

Manufacture of pesticides (mainly commodities) which have a good market in India and will increase in future usage.

Class III - Medium to Low Profit Margin

On this group IIL should try to go for more modern type of formulations and introduction of bio-pesticides.

Table 3 gives in detail some of the pesticides which could be considered with the course of action to be taken by various parties. Basic feasibility studies should be done before taking investment decision.

It is also necessary to rehabilitate some of the old units and modernize them with smaller and more compact units and also establish a good pilot plant/R&D laboratory. In both cases UNIDO could be of assistance in getting funds under IPF or under non IPF funds.

The DDT units should be amalgamated into one unit and action should be taken to replace it with other pesticides which are more effective in public health and accepted by WHO/Government. Any DDT production should be for manufacture of dicofol and export the rest directly to other countries which use them or through WHO.

The unit at Rasayani producing malathion should be converted into a multipurpose unit to produce a selected number of phosphorylating agents which could be used for production of insecticides (see annex 7).

CLASS 1 - HIGH PROFIT MARGIN

TABLE: 3 - SELECTION OF PESTICIDES FOR POSSIBLE MANUFACTURE (LIST NO: 1)

(I) INSECTICIDES (F) FUNGICIDES
(H) HERBICIDES (A) ACARICIDES
(R) RODENTICIDES

No.	Compound (Type)	Outlets	Company-Strength in India on Pesticides	Intermediates* (see annex 6)	Registered in India	Remarks	Probability of Getting Technology and rights
1.	Actellic (I)	Public health, stored products fruits and vegetables	ICI - (Weak)	13, 14, 21	No	Should negotiate with ICI for sharing rights and markets	Low to Medium
2.	Aliette (F)	Downey mildew on fruits, vegetables, rubber etc	Rhone Poulenc - (weak)	22, 23	No	Should negotiate with Rhone Poulenc - UNIDO can assist	Medium to High
3.	Avenge (H)	Post emergence on wheat	Cyanamid - (weak)	16, 25, 26	No	Negotiate with Cyanamid	Low to Medium
4.	Avermetin (I)	General purpose and nematicide	Merck - (strong)	<u>Fermentation - Streptomyces avermitilis</u>	No	Negotiate with Merck	Low
5.	Newer Pyrethroids (I)	General	ICI or FMC - (weak)	-	No	Negotiate with ICI or FMC for formulation rights	Low

* Intermediates will change depending on process

CLASS 1 HIGH PROFIT MARGIN

No.	Compound (Type)	Outlets	Company Strength in India on Pesticides	Intermediates*	Registered in India	Remarks	Probability of Getting Technology and rights
6.	Brodifacoum (R)	Rodenticide	ICI - (weak)	-	No	Negotiate with ICI for market sharing	Low
7.	Molinate (H)	Rice	Stauffer (ICI) (weak)	50, 51	No	Patent free. Make in pilot plant or negotiate with ICI. Hungary might provide know-how.	Medium to High
8.	Thiobencarb (H)	Rice	Kumiai - (weak)	28,29,30,31	Yes	Hungary might provide know-how or negotiate with Kumiai along with other compounds	Medium to High
9.	Prochloraz (F)	Rice, wheat and other crops	Shering - (weak)	-	No	Negotiate with Shering	Low to Medium
10.	Fusilade (H)	Grass selective	ICI - (weak)	-	No	Negotiate with ICI	Low

CLASS 1 HIGH PROFIT MARGIN

No.	Compound (Type)	Outlets	Company Strength in India on Pesticides	Intermediates *	Registered in India	Remarks	Probability of Getting Technology and rights
11.	Phenthoate (I)	Rice, cotton, vegetable	Farmoplant - (weak)	see annex 7	Yes	Could be made at Rasayani. UNIDO can negotiate with Farmoplant, Italy	High
12.	Phosphomedon (I)	Rice, cotton potatoes	SPA, Italy - (weak)	18, 19, 20	Yes	Could be made at Rasayani. UNIDO can negotiate with SPA	High
13.	Phosalone (I)	Rice	Rhone Poulenc	see annex 7	Yes	Could be made at Rasayani. Negotiate along with Aliette if necessary	Medium to High
14.	Butachlor (H)	Wheat	-	-	Yes	Already in progress	

CLASS 2 HIGH TO MEDIUM PROFIT MARGIN

Compound (Type)	Outlets	Company-Strength in India on Pesticides	Intermediates*	Registered in India	Remarks	Probability of Getting Technology and rights
5. Dicolol (A)	General Acaricide	-	-	Yes	Already in progress	
6. Methoxychlor (1)	General	-	11,33	Yes	Manufacture locally	
7. Propanil (H)	Wheat	-	36, 40, 41		Manufacture locally if not already taken by other companies	
8. Dalapon (H)	General Grass weed killer	-	36, 37	Yes	Manufacture locally	
9. Bronopol (B,F)	Seed dressing cotton	Schering - (weak)	54, 55, 56	No	Patent free, but negotiate with Schering. Can be locally manufactured	Medium

CLASS 2 HIGH TO MEDIUM PROFIT MARGIN

No.	Compound (Type)	Outlets	Company-Strength in India on Pesticides	Intermediates*	Registered in India	Remarks	Probability of Getting Technology and rights
20.	Tetradifon (A)	Cotton, Tea, vegetables	IPC (Italy) (weak)	8,9,10	Yes	Prepare locally or negotiate with IPC. UNIDO can assist	High
21.	Trichlorfon (1)	General	-	11,12	Yes	Prepare locally	
22.	DDVP (1)	Household pests Glass house crops	-	11,12,13	Yes	Prepare locally	
23.	Acephate (1) and Tamaron	Vegetables etc.	-	14,15,16	Yes	Only formulation	
24.	Monocrotophos (1)	General	-	-	Yes	Already in progress	

CLASS 2 HIGH TO MEDIUM PROFIT MARGIN

No.	Compound (Type)	Outlets	Company-Strength in India on Pesticides	Intermediates*	Registered in India	Remarks	Probability Getting Technology and rights
25.	Lindane (1)	Seed dressing and soil	-	57	Yes	Manufacture locally. UNIDO can get technology	
26.	Ethion (1)	General	-	See annex 7	Yes	Could be made at Rasayani, only formulate if necessary	
27.	Dimethioate (1)	General	-	See annex 7	Yes	UNIDO can get technology	High
28.	Carboxin (F)	Seed dressing	-	-	Yes	Already in progress	
29.	Padan (1, F)	Rice	Takeda - (weak)	-	Yes	Negotiate with Takeda	Medium to High

CLASS 2 HIGH TO MEDIUM PROFIT MARGIN

No.	Compound (Type)	Outlets	Company-Strength in India on Pesticides	Intermediates*	Registered in India	Remarks	Probability of capturing the technology and rights
30.	Kitazin (F,1)	Fice	Kumiai - (weak)	46,47	Yes	Manufacture at Rasayani, negotiate with Kumiai	Medium to High
31.	Hostathion (1)	General	Hoechst - (strong)	see annex 7	Yes	Only formulate if necessary	
32.	Hinosan (F)	Rice	Bayer - (strong)		Yes	Only formulate	
33.	Nitrofen (H)	Rice	VEB Chemiekombinat (weak)	34,35	-	Manufacture or negotiate. UNIDO can assist	High
34.	Chlorothalonil (F)	General	SPA - (weak)	48, 49	Yes	Manufacture/negotiate UNIDO can assist	High

CLASS 111 MEDIUM TO LOW PROFIT MARGIN

No.	Compound (Type)	Outlets	Company-Strength in India on Pesticides	Intermediates*	Registered in India	Remarks	Probability of Getting Technology and rights
35.	Methyl Parathion - Micro-encapsulated	General	Pennwalt - (weak)	-	Yes	Negotiate with Pennwalt	Medium to High
36.	Bt - <u>israelensis</u> - <u>kursaki</u>	Agriculture/ public health	-	-	Yes(?)	Manufacture. UNIDO can assist	Medium to High
37.	Pheremones	Cotton			-	Selection depends on products availability and costs.	
38.	Electrodyne	General	ICI - (weak)	-	-	Negotiate to share market	Low to Medium
39.	Alboneium oil (V)	Virucide and preventive spray	ICI - (weak)	Alboneium oil	No	Negotiate with ICI	Medium

5. Conclusions and Recommendations

- i) HIL should come out of their dependence entirely on commodity organo-chlorine pesticides.
- ii) The unit in Delhi should be modernized and concentrate on formulation of pesticides involving high technology including aerosols without fluorocarbons.
- iii) They should carry out basic feasibility studies on pesticides selected from table 3 and carry out required R&D work and negotiate with companies for exclusive or shared rights.
- iv) The Indian market is very complicated because of severe competition to share the market by a number of big and small companies.
- v) HIL should develop a better organized registration scheme for pesticides using facilities of PDPI and other institutions.
- vi) Strong measures should be taken to introduce safety standards (adapted to Indian conditions) to reduce workers' exposure to pesticides both at the manufacturing and formulation ends.
- vii) Rasayani unit should be converted into a multipurpose plant for the manufacture of organo-phosphorus pesticides.
- viii) A modern R&D unit in pilot plant technology should be established at Gurgaon Centre.

ix) Negotiations should be carried out with foreign companies which have low profile in India but can offer pesticides useful to Indian market. Some companies are given below

- Rhone Poulenc (France)
- Rhom and Hass (West Germany)
- Farmopiant (Italy)
- VEB Chemiekombinat (East Germany)
- Chemocomplex (Hungary)
- Nitrochemie (Hungary)
- Takeda (Japan)
- Ishihara (Japan)
- Nihon Tokushu Noyaku Seizo (Japan)
- Nippon Kayaku Co.Ltd (Japan)
- ICI (UK)
- Kwizda (Austria)
- FMC Corporation (USA)
- Neviki Research Institute (Hungary)

Persons met by the mission

UNDP/UNIDO

Mr. A.S. Geair - Deputy Resident Representative
Mr. Islam - SIDFA
Mr. Ramamoorthy - UNDP
Mr. Satpal - UNDP

Hindustan Insecticides Ltd/PDPI

Mr. S.P. Dhua - Chairman & Managing Director
Mr. S.P.S. Sawhney - Director, Marketing
Mr. Kamal Dari - Marketing Dept.
Mr. Deshmuk - Marketing Dept.
Mr. S.K. Khetan - PDPI

Central Insecticide Board, Faridabad

Mr. M.L. Saini, Secretary, Central Insecticide Board and
Registration
Committee
Mr. D. Kanungo, Medical Toxicologist, Central Insecticide
Board
Mr. R. Gupta, Registrar

Government

Mr. Malhotra, Director, Ministry of Industry
Mr. Suri, Joint Secretary, Ministry of Industry
Mr. Mansingh, Director, Dept. of Industrial Development,
Ministry of Industry

Others

**Mr. B. S. Paramar, Head, Division of Agricultural
chemicals, Ind. Agr. Res. Institute**

Mr. Bahal, Pesticide Association, India

Visited two pesticide formulation companies

Schedule of Mission Activities

22.07.1988 Departure from Vienna
23.07.1988 Arrival in Delhi
24.07.1988 and
25.07.1988 Holidays in Delhi
26.07.1988 Meeting with Dr. Dhua (HIL), Dr. Khetan (PDPI),
Dr. Kiss (World Bank) and Mr. Islam (SIDFA) on
PEST programme.
27.07.1988 Discussion with Dr. Dhua and organizing the
mission activities. Discussion with PDPI on
evaluation report.
28.07.1988 Discussion with Marketing Dept. of HIL
29.07.1988 Visit to Indian Agricultural Research Institute,
New Delhi and discussion with Dr. Paramal.
30.07.1988/
31.07.1988 Week end, fell ill with stomach upset.
01.08.1988 Discussion with Dr. Dhua. Visit to Ministry of
Industry to discuss with Mr. Suri and Mr.
Mansingh.
02.08.1988 Visit to Central Insecticide Board and
discussion with the staff
03.08.1988 Visit to PDPI and visit to a formulation factory
(small scale) at Gurgaon
04.08.1988 Visit to Pesticide Association of India and
discussion with the secretary.
05.08.1988 Visit to a formulation factory (medium-scale) in
Delhi.
06.08.1988 Visit to PDPI centre
07.08.1988 to
08.08.1988 Discussions with Dr. Dhua, writing report, final
visit to project site.
09.08.1988 Visit to PDPI and departure for Vienna
10.08.1988 Arrival in Vienna.

**Production of Technical Grade
Pesticides in India**

(1984-85 to 1987-88)

(in tonnes)

<u>Product</u>	<u>1984-85</u>	<u>1985-86</u>	<u>1986-87</u>	<u>1987-88</u> (estimated)
<u>INSECTICIDES</u>				
1. B.H.C.	28646	25669	25406	26 000
2. D.D.T	7337	5218	8113	9 000
3. Malathion	3377	4372	2653	3 500
4. Parathion	2110	1510	1223	1 500
5. Metasystox	133	324	230	350
6. Fenitrothion	82	99	79	100
7. Fenthion	223	215	271	300
8. Dicofol	6	1	3	-
9. Phenthoate	-	-	-	-
10. Dimethoate	709	1147	1145	1 500
11. D.D.V.P.	500	514	433	550
12. Quinalphos	659	861	568	1 200
13. Monocrotophos	1074	1861	1900	2 000
14. Carberyl	1265	45	53	50
15. Phosphamidon	955	1103	1090	1 500
16. Lindane	-	-	-	-
17. Phosalone	-	198	70	250
18. Thimet/Phorate	1208	1168	1470	1 300
19. Ethion	253	353	237	300
20. Endosulphan	2669	2565	2183	2 500
21. Fenvalerate	236	504	346	550
22. Cypermethrin	26	155	129	500
Total :-	51,468	47,885	47,602	52,950
<u>FUNGICIDES</u>				
23. Captafol	11	62	73	80
24. Captan	126	50	51	100

25. Copper Oxchloride	1184	877	1202	1 500
26. Thiocarbonates	2272	2416	2884	3 000
27. Nickle Chloride	-	-	-	-
28. Organo-Mercurials	143	191	170	300
29. Carbendazin (Bavestin)	193	194	141	200
30. Galixin	17	36	31	-
Total :-	3946	3828	4552	5180

HERBICIDES

31. 2,4-D	767	830	813	900
-----------	-----	-----	-----	-----

WEEDICIDES

32. Isoproturon	441	727	917	1 200
33. Paraquate (Gramaxon)	125	174	250	300
34. Dalapon	90	25	3	Neg.
35. Basalin	8	2	25	30
36. Diurone	123	60	143	150
Total :-	787	988	1338	2580

PLANT GROWTH REGULANTS

37. Cycocil/Libocin	35	2	-	-
38. Alpha Naphthalene Acetic Acid	-	-	-	-
Total :-	35	2	-	-

RODENTICIDES

39. Rotafin	5	4	3	Neg.
40. Zinc Phosphide	350	279	426	500
Total :-	355	283	429	500

Ctd...3/-

FUMIGANTS

41. Aluminium Phosphate	1091	996	1343	1 500
42. Methyl Bromide	57	56	66	100
43. Ethylene Dibromide	54	54	43	50
Total :-	<u>1202</u>	<u>1106</u>	<u>1452</u>	<u>1 650</u>

ANTIBIOTICS (AGRO)

44. Aureofungin	-	-	-	-
45. Strepticycline	-	-	-	-
Total :-	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>
Grand Total :-	<u>58,560</u>	<u>54,922</u>	<u>56,186</u>	<u>62860</u>

SOURCE: Department of Chemicals & Petrochemicals,
Ministry of Industry

Approved Indian Manufactureres

Product category	Company	Capacity (tonnes)	
Insecticides	B.H.C.	IEL	5200
		HIL	3000
		Kanoria Chemicals	19000
		Mico Farms	6000
		Pesticides & Brewers	1500
		Tata Chemicals	7200
	D.D.T	HIL	9088
	Malathion	Cyanamid	1400
		Excel	500
		Pesticides & Brewers	500
		Pesticides India	500
		Punjab United	1000
		HIL	1800
		Ind. Frmers Fert. Co. operative	1000
		Khatau Junkar	1000
Shivalik Rasayan		500	
MP United Chemicals		1000	
Ficom Organics		1650	
Himachal Pesticide Uttar Rasayan Udyog	1000 600		
Parathion	Bayer India	2614	
	Rallis India	150	
Metasystox	Bayer India	260	
Fenitrothion	Bayer India	500	
	Cyanamid	300	
	Rallis India	300	
Fenthion	Bayer India	360	
Dimethoate	Rallis India	1300	
	Shaw Wallace	240	
	Mico Farms	150	
DDVP	Ciba-Geigy	476	
	Sudarshn Chemicals	50	
	Lupin Labs.	200	
Quinolphos	Sandoz India	736	
	Sundarshan Chemicals	200	
	Gujarat Insecticides	400	

Monocrotophos	Ciba-Geigy	435
	Sudarshan Chem.	150
	NOCIL	600
	Lubin Labs.	350
Carbaryl(?)	Paushak	2000
	Union Carbide	5000
Phosphomidon	CibaGeigy	920
	Sudarshan Chemicals	200
Lindane	Mico Farms	30
Phosalone	Volrho	1000
Thimet(Phorate)	Cyanamid India	595
	Pesticides India	600
Ethion	Rallis India	50
	Shaw Wallace	100
	Pesticid India	200
Endosulphan	Bharat Pulverising	1200
	Excel Ind.	1200
Fenvalerate	Searle India	150
	Gujarat Insecticides	200
	United Phosphorus	150
	Rallis India	100
Cypermethrin	IEL	100
	Bharat Pulverising	100
	NOCIL	100
	Gharda Chem.	25

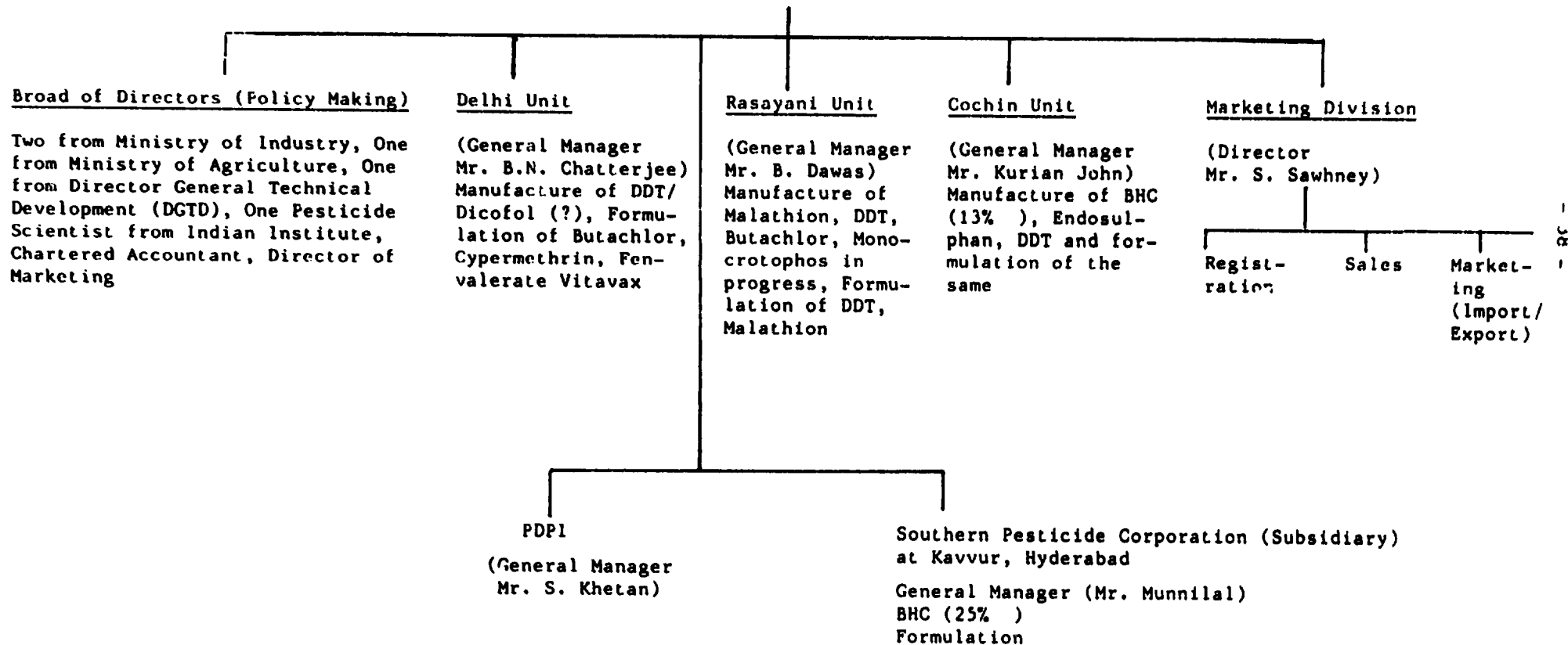
FUNGICIDES

Copper oxychloride	TataChemicals	1500
	Travancore Cochin Chem.	960
Captafol	Rallis India	100
Captan	Rallis India	100
Dithiocarbamates	IEL	300
	Excel Ind.	300
Mancozeb	Indofil Chem.	2500
Dimethylzinc	Ciba Geigy	384
Nickel chloride	Bharat Pulverising	300
Phenylmercury acetate	Excel Ind.	47
	United Phosphorus	140

Carbendazim	BASF	135
	Gujarat Ind.	200
	JKBM	300
Calixin	BASF	30
HERBICIDES		
2,4-D	Agromore	435
	Atul	1200
	Bharat Pulverising	300
	Gujarat Distillery	200
Isoproturon	Lupin Labs.	180
	Gharda Chem.	300
	Triti Chem.	1200
Gramaxone	IEL	500
Dalapon	MISE	50
	Indian Org.Chem.	75
Basalin	BASF	200
Diuron	Agromore	50
Butachlor	Searle India	1500
	HIL	-
Glyphosate	Excel Ind.	-
P.G.R.s		
Cycocel	BASF	30
	Hico Products	50
	Sarabhai Chem.	100
NAA	Excel Ind.	10
	Paushak	10
FUMIGANTS		
Aluminium Phosphide	Bharat Pulverising	120
	United Phosphorus	1000
	Swadeshi Chem.	400
	Excel Ind.	300
Methyl bromide	Tata Chemicals	300
Ethylene dibromide	Excel Ind.	100
	Tata Chemicals	108

ORGANOGRAM OF HINDUSTAN INSECTICIDES LTD

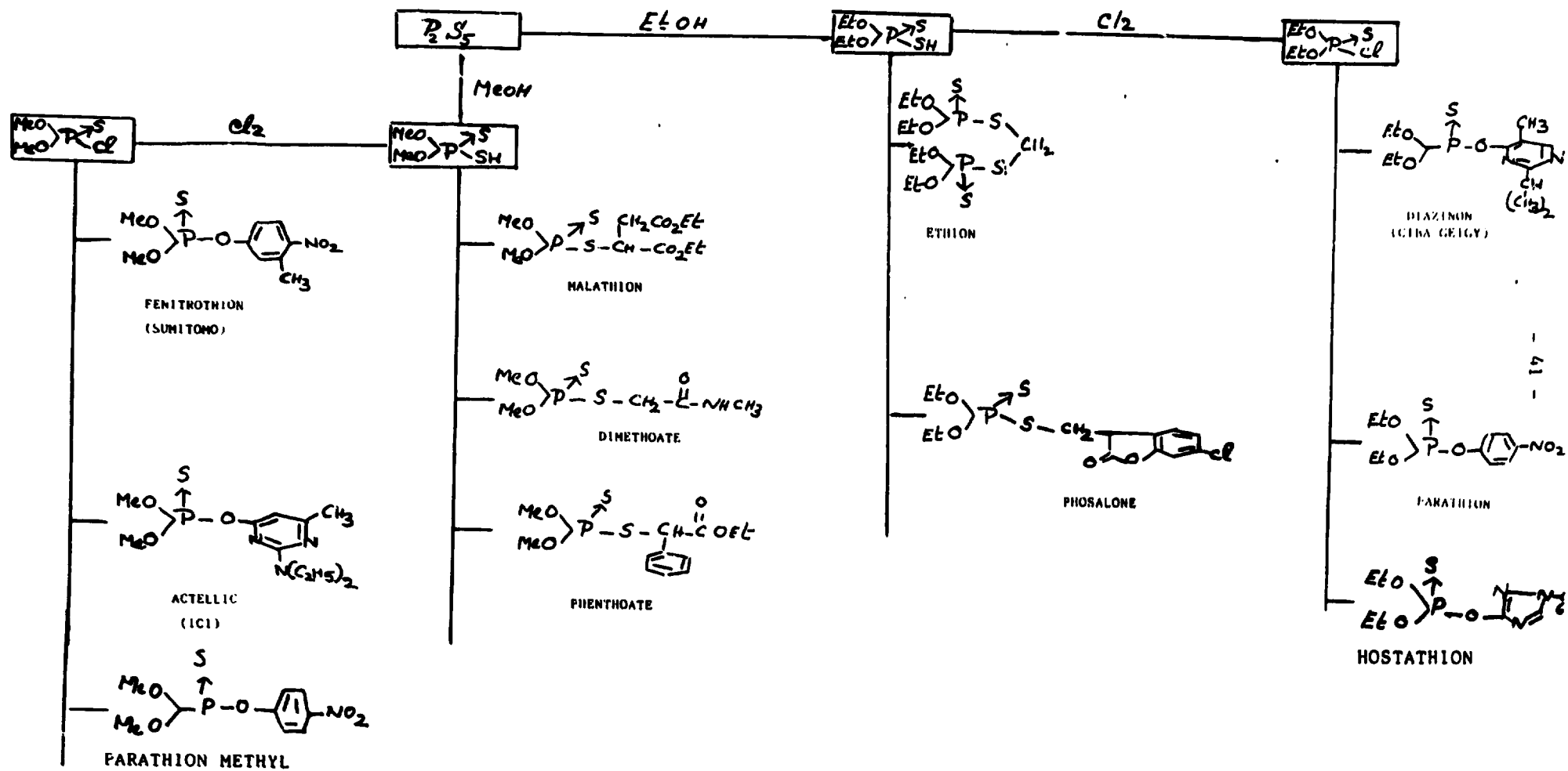
CHAIRMAN & MANAGING DIRECTOR (DR. S.P.DHUA)



INTERMEDIATES

1. O,O-Dimethyl dithiophosphoric acid
2. Sodium carbonate
3. Ethyl -bromo- phenyl acetate
4. 2,6-Diethylaniline
5. Formaldehyde
6. -Chloroacetyl chloride
7. Methanol
8. 1,2,5-Trichlorobenzene
9. chlorosulphonic acid
10. Chlorobenzene
11. Chloral
12. O,O-Dimethyl phosphite
13. Sodium hydroxide
14. O,O-Dimethyl phosphorochlorothioate
15. Ammonia
16. Dimethyl sulphate
17. Acetyl chloride
18. Acetoacetic acid diethylamide
19. Sulphuryl chloride
20. Trimethyl phosphite
21. 2-N-Diethyl 3-methyl-5- hydroxypyrimidine
22. Aluminium hydroxide
23. O-Ethyl chloro phosphonate
24. Sodium ethoxide
25. Benzoylacetophenone
26. N,N-Dimethylhydrazine
27. Aniline

28. 4-Chlorobenzyl thiol
29. Carbondioxide
30. Carbon disulphide
31. Diethyl amine
32. D.D.T.
33. Anisole
34. 2,4-Dichlorophenol
35. 4-Nitrochlorobenzene
36. Propionic acid
37. Chlorine
38. 4-Aminobenzenesulphonamide
39. Methyl chloroformate
40. 3,4-Dichloroaniline
41. Thionyl chloride
42. Benzene hexachloride
43. Acetoacetanilide
44. Sulphuryl chloride
45. 2-Mercaptoethanol
46. O,O-Diisopropyl phosphorochloridate
47. Benzyl thiol
48. Tetrachloroisophthalic acid chloride
49. Phosphorus oxychloride
50. Hexamethylene diamine
51. Thioethyl formyl chloride
52. 2-Amino-5-chlorophenol
53. Urea.
54. Parafarmaldehyde
55. Nitromethane
56. Bromine
57. BHC



Annex 8

AN EXAMPLE TO NOTE

Recently an Austrian formulator was impressed by the quality of lindane manufactured by a company in Lucknow (India) and ordered 7 tonnes. But the suppliers could not meet the deadline because the Letter of Credit did not reach his bank in time and when a new one was issued the bank in Lucknow was on strike. As the pesticide demands are seasonal the Austrian customer in order to meet his clients' demands is looking for another supplier. These type of incidents unfortunately damage the credibility eventhough it is not the fault of the manufacturer who is an experienced exporter of lindane. The whole system, i.e. the Government and Industry, should be geared to meet the customers' demands. An opportunity lost to one country is an opportunity to another country in the area of export.