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NATIONAL PESTICIDE DEVELOPMENT CENTRE

DP/INS/89/015

INDONESIA

Technical report: Findings and recommendations*

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

Based on the work of Sushil K. Khetan, consultant in pesticide formulation technology

Backstopping officer: B. Sugavanam, Chemical Industries Branch

United Nations Industrial Development Organization
Vienna

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INTRODUCTION

The author visited Indonesia for 6 weeks commencing 21 August 1990, as a consultant in Pesticide Formulation Technology. The mission, which concerned with providing preparatory assistance for establishment of the National Pesticide Development Centre (NPDC), had the following objectives:

To visit and assess the existing facilities and draw out a broad based scheme for expanding it to become a centre of excellence in the development of pesticides with emphasis on formulation using locally available raw materials and in monitoring and developing effluent control methods in pesticide production.

To take into account the overall situation of the pesticide industry and their present and future need;

To assess the building requirements, equipments and their estimated cost in local and foreign currency;

To advise on the staff requirements, their training needs and the external consultants needed;

To consider the type of R&D that should be carried out in the country to promote import substitution and application technology;

To propose the type of institutional arrangements needed to have maximum interaction between the proposed centre and industries/institutions;

To propose mechanisms for the institute to take up contract work with industries in order to generate revenue to run the pesticide development centre; and

To advise as to how the centre can provide on a regional basis assitance to various countries in the region on effluent control/industrial safety and application technology.

The findings in this report are an outcome of the personal visit to many pesticide formulation plants and meetings with the Director of Agrochemical Industries, Pesticide Association Officials, industry managers, University Professors in Plant Protection Departments, the staff of the institute for R&D of Chemical Industry and the government officials of various related departments. A list of facilities visited and persons met is given in Appendix I. Based on these findings, several recommendations are made here. With regards to institutional arrangements and other related recommendations for the proposed centre, the author has drawn considerably from his personal experiences during the management of Pesticide Development Programme in India (Now Pesticide Development Centre).

The Centre's main thrust is visualised to be the indigenous capability development on different aspects of Pesticide Industry, particularly in adopting and adapting to new technologies in pesticide formulations. Additionally, the Centre is envisaged to have an emphasis on environmental problems and industrial safety related to Pesticides production. A report on the latter aspect has been prepared by Mr. George M. Jett, Consultant in Effluent Control and Industrial Safety, separately.

A separate project document covering salient features of both the reports alongwith a project formulation framework (PFF) giving estimated requirements of various inputs have also been prepared by the author jointly with George M. Jett and B.Sugavanam, as a part of the mission

RECOMMENDATIONS

National Pesticide Development Centre

1. The National Pesticide Development Centre would be ideally located at the institute for R&D of Chemical Industry premises by upgradation of its Pesticide Laboratory, for its manifold advantages. Nevertheless, the pilot plant facility could be located within the premises of Petrokimia Gresik for reasons of safety as well as for readily available utility services there.

2. The Centre needs to be constituted to function as an autonomous body, so that various facilities and services planned to be offered by it, could be availed by the industry-at-large in an equitable manner, maintaining due secrecy etc.

3. Suitable ways and means need to be devised in consultation with the Pesticide Association (AP3I) for its active involvement in all phases of development of the Centre, so that industry may develop a stake in its success for its own long term interest. The services offered should be remunerative to make the centre financially self-sufficient in due course.

4. Some of the senior technical personnel of the Directorate of Agrochemical Industry, who would have direct involvement in coordinating and overseeing the implementation of the project, need to be given an orientation training at the Pesticide Development Centre in India, for better visualization of various requisites.

5. The National Project Staff may comprise of meritorious professionals. In order to get and retain the best available talent, the remuneration package should be brought at par with that offered by the Ministry of Science and Technology, known to be the best offered by the government for technical personnel.

6. The centre should be headed by a competent chemical scientist/chemical engineer with an adequate administrative experience in a developing country environment. Initially it may be desirable to appoint a Chief Technical Advisor (CTA) , recruited by UNIDO, with an expertise in pesticide formulation technology.

7. The institutional arrangement for the centre should be considered in the light of the suggestions made in the body of the report.

Developmental Aspects

8. Control of Brown Plant Hoppers (BPH) has been a difficult problem, as penetration of foliage canopy of standing paddy crops using standard formulation types, has been less than satisfactory. The useful work done by the International Rice Research Institute in Manila, Philippines and experience of Japan in employing innovative formulations (e.g. dust-granule mixture) and other newer developments (surface spreading oil formulation developed by PDC, India) should be closely scrutinised for adoption for local use.

9. Various locally available mineral carriers like Kaolin clay and diatomaceous earth deposits, need to be screened systematically for their suitability for use in pesticide formulations. The useful correlation studies conducted at the PDC, India may be adopted for the purpose.

10. Use of indigenous inputs in the formulation, wherever industry imports now, by providing necessary financial incentive, could bring about indigenisation of much of carrier and surfactants requirements.

11. A suitable incentive/subsidy system for the industry for promoting safer and user-friendly formulations need to be initiated. On the otherhand, registration of products, after a reasonable timeframe, if not introduced in the market and subsequently if not produced indigenously, may be allowed to lapse.

12. Indonesian farmer's preference for convenient to apply and safe formulations is recognised. Development of technologies for flowables, emulsion concentrates and microemulsion concentrates formulations is recommended in this context. Undertaking development of controlled release formulations for specific application is also suggested.

13. University departments with strong programmes on plant protection (e.g. Bogor Agricultural University, Univ. of Caja Madha, Yogjakarta and Padjadjaran University, Bandung) may be closely involved in Pesticide Management in the country. A study on pesticide formulations may also be considered for incorporation in their undergraduate

curriculum. This would expose the students to the concepts of safety, efficacy, economy etc. during plant protection operations.

Standards Development

14. Preparation of pesticide formulation standards to provide a minimal specification of different formulation types are required , particularly for use by local entrepreneurs.

15. Shelf life standards need to be developed by generation of local shelf life data for various pesticide formulations. It is known that shelf life of products comes down considerably in high heat and humid conditions of a tropical climate. A regulatory mechanism would have to be found so that maintaining the quality of formulated products in the market at any time, may be the responsibility of the formulators.

16. Some of the staff involved in preparation of national standards, would benefit by an exposure and interaction with standards making bodies like National Bureau of Standards in U.S.A., Bureau of Indian Standards and similar other organizations.

Effluent Control and Industrial Safety

17. The NPDC may organise regular training courses on effluent control and industrial safety, particularly caterig to local entrepreneurs. Attending these courses may also be made mandatory for all pesticide industry managers.

18. The NPDC may offer technical solutions to specific effluent problems and provide consultancy on the subject to the industry.

19. The pesticide production plants need to be inspected periodically, retaining an element of surprise. The inspection team may consist of at least one senior official each of the Directorate of Agrochemical Industry and the Ministry of Environment.

20. Introduction of state awards on effluent management and industrial safety in Agrochemical Industry on annual basis, would help in emphasizing importance of these aspects in the industry.

21. Suitable steps to enforce pollution control measures and occupational safety need to be employed. Introduction of a card system with a certain number of chances for default is suggested. The card should be punched each time a default is noticed. The card expiry would signal a persistently hazardous plant which may invite a heavy penalty or in an extreme case, closer.

Regulatory Aspects

22. There is a need for single regulatory body for agro-pesticides as well as for public health, hygiene and veterinary products. This would be useful in adopting uniform norms for their registration, production, storage, transportation and distribution as well as in enforcing same code of conduct for quality and safety.

23. In addition to safety and efficacy as criteria for registration of pesticides, relative cost and efficacy for related products for same intended use, would avoide unnecessary proliferation of generic pesticides.

24. Sale and distribution of pesticides needs to be regulated in standard packaging only. The requisite packing sizes could be arrived at by conducting a market survey. The retailers should be pronibited to repack into smaller packings on their own.

25. Deteriorated and/or spurious pesticides need to be detected speedily. Pesticide quality monitoring by periodic sampling from the market may provide a practical solution.

Chapter One

BACKGROUND

1.1 The Country

Indonesia is an archipelagic country made up of five main islands (Sumatra, Java, Kalimantan, Sulawesi and Irian Jaya) and about thirty smaller archipelagoes with 13,622 islands and isles. These islands are scattered along the equator and are stretched over a distance of about 5000 kilometers, in the centre of the Indo-Pacific marine basin. With an estimated 200 million habitats likely by 1995, Indonesia is already the fifth largest populated nation in the world.

1.2 Agriculture Scenario

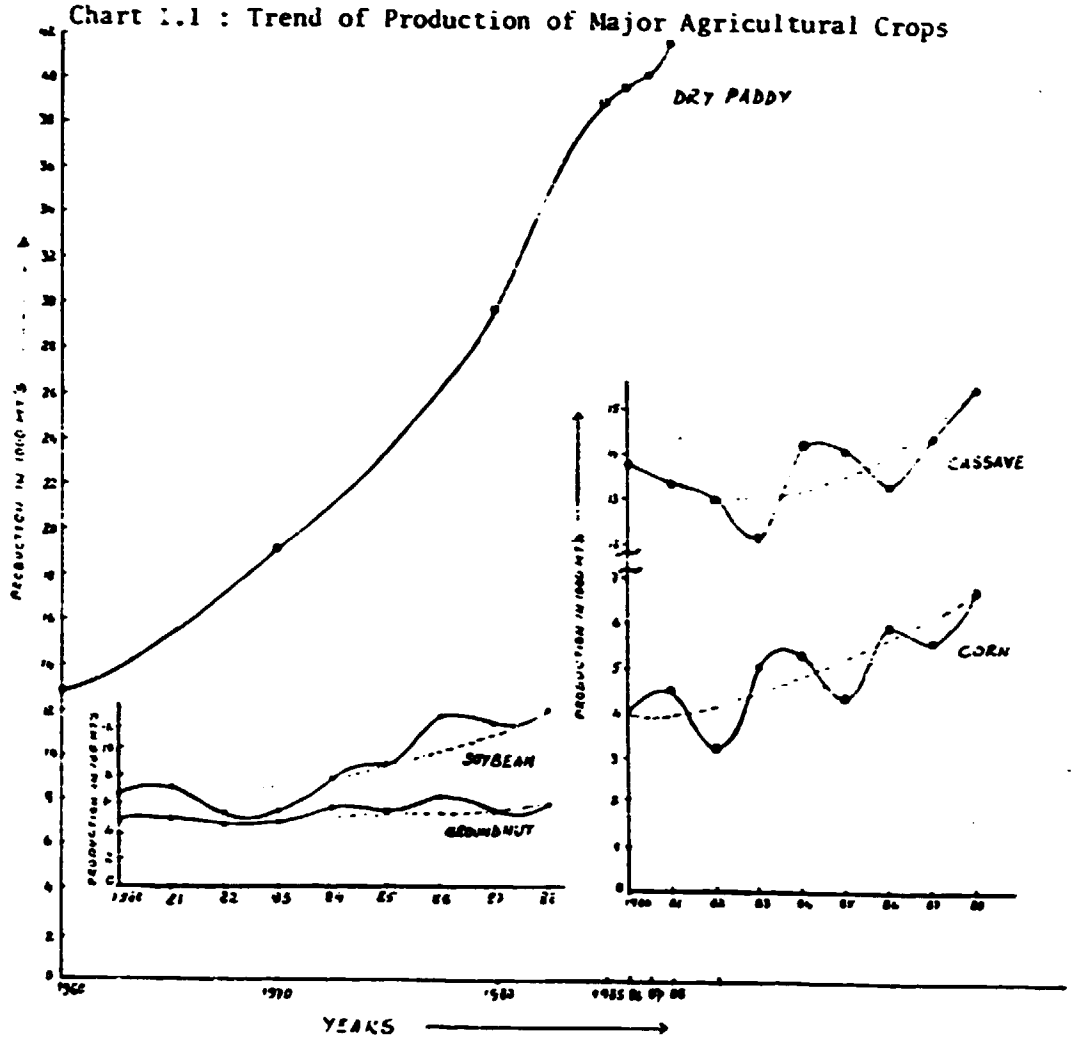
Although Indonesia has experienced a rapid industrial growth in the recent times, agriculture continues to occupy a high priority in its plans of economic development , employing nearly 56% of the labour force. The country has achieved self-sufficiency in the production of rice in 1986, which has increased from 12 million tonnes of dry paddy in 1965 to almost 41.6 million tonnes in 1988 (Table 1.1). Similar trend is also seen in the

Table No.1.1: Harvested Area, Yield and Production of Paddy in Indonesia.

Y E A R	HARVESTED AREA (000 Ha)	YIELD (Qt/Ha)	PRODUCTION (000 TON - DRY PADDY)
1960	7,285	17.70	12,898
1970	8,135	23.75	19,234
1980	9,005	32.93	29,652
1985	9,902	39.42	39,032
1986	9,988	39.77	39,727
1987	9,922	40.39	40,078
1988	10,138	41.11	41,676

production of secondary crop like corn, soyabean, groundnuts and cassave (Chart 1.1).

Chart 1.1 : Trend of Production of Major Agricultural Crops



1.3 Petrochemical Industry

The availabiiity of large oil and natural gas reserves within the country has created an assured potential for the development of an indigenous petrochemical industry. An ambitious plan for several downstream projects are on anvil, which on completion would make the councry self-sufficient in a large number of key raw materials and intermediates*

Brochure "Industri Petrokimia", Pameran Produksi Indonesia 1990,Jakarta (15 Aug.- 15 Sept. 1990)

1.4 Pesticide Scenario

The pesticides market in 1989 is estimated to be around 125 million US Dollars. The market consists of insecticides (61-65%), herbicides (20-28 %) and fungicides and others (11-15%). Cropwise, rice has been the largest consumer of pesticides with an estimated 39% of the consumption, followed by plantation crops (30%), vegetables (21%) and soya and Mungbeans (~ 8%). The market segment for major classes of insecticides, fungicides and herbicides estimated by the industry is as follows.

Insecticides	MT/KL
Organophosphorus	3,500
Carbamates	5,500
Organochlorines	700
Synthetic Pyrethroides	420
Others	80
	10,200

Fungicides	MT/Kl
Dithiocarbamates	2,750
Copper	275
Benzimidazoles	100
Others	50
	3,175

Herbicides	MT/KL
Paraquat	1,350
Glyphosates	1,500
2,4-D Amine	800
Others	900
	4,550

While, most of insecticides and herbicides are being imported in the country as technical products and formulated locally, fungicides are being mostly imported as formulated products and repacked in smaller packages.

The market is dominated by multinational companies sharing over 80 % of the pesticides market between them. Amongst the key performers, Monagro (Monsanto), Hoechst, Bayer Indonesia, Agrocarb (Rhone Poulenc), Ciba-Geigy and ICI are estimated to have around 10% market segment each. Petrokimia Kayaku, a joint venture of the government owned Petrokimia Gresik with Mitsubishi and Nippon Kayaku is estimated to contribute to around 4% of the pesticides market. Others including, Dow, Dupont, shell and FMC are estimated to have around 2-3% of the market share each.

1.5 State of Pesticide Industry

The industry has been reeling under adverse times, due to market shrinkage by as much as 40% and large carry over inventories, resulting in production capacity utilisation for agro-pesticides down to only 20-30% in most cases. The factors attributed to this situation relate to the governments ban on the use of 57 insecticide formulations on paddy and withdrawl of subsidy. Additionally, a number of cases of falsified pesticides in the market also came to light. The impact of these attributes is discussed below.

1.5.1 Ban on the use of 57 Insecticide Formulations on Paddy

Consequent to Brown Plant Hopper (BPH) outbreak on paddy in central Java in 1986, the government banned the use of 57 insecticide formulations comprising of O-P and carbamate systems, on consideration of their ineffectiveness due to resistance development in the pest (see list at Appendix II). As rice is the main staple crop and took the largest share of pesticide consumption, the ban affected the whole of pesticide industry and in many cases made their production capacities redundant. To come out of this situation, some formulators diversified their product range. For example, P.T. Pacific Chemicals, after the

ban on the use of Dursban 20 EC on paddy, has diversified the formulations of chlorpyrifos for specific end uses like mosquito control on outdoors and gardens (Lorsban 480 EC) and as termi[illegible]on wood (Lentrek 400 EC). Drusban 20 EC which is still marketed is recommended for use on soyabean and vegetables and has to carry a warning on its label, stating government ban on its use on paddy. This writer found that some other companies like Bayer Indonesia have begun utilising its pesticide formulation facilities for producing brakefluid and other detergent preparations.

1.5.2 Subsidy Withdrawl on Pesticides

The government has been subsidising the pesticides to an extent of 85% under agricultural intensification programme (BIMAS and INMAS) for attaining self-sufficiency in food grains production. This has been gradually reduced over the years and completely withdrawn with effect from Ist January 1989. A similar subsidy on fertiliser, has been allowed to be continued. In the wake of the government subsidy programme, a very large inventory of pesticides got accumulated. Even though, subsidy was withdrawn nearly 20 months back, large stocks of subsidised products are still on the market selves. The stocks in all probability, are either at the end of their useful shelf-life or well past it. One of the immediate impact is seen on the production of insecticides from a study made by the Ministry of Industry in March 1990. The production figures for insecticides, herbicides and fungicides during 1984-1988 are given in Table 1.2.

Table 1.2 : Production of Pesticides

Year	Insecticides* MT/KL	Herbicides MT/KL	Fungicides MT/KL
1984	37,836	3,978	1,671
1985	48,168	4,032	3,329
1986	51,074	4,319	2,164
1987	48,029	4,421	2,196
1988	21,862	3,189	3,224

* The figures do not include production of household insecticides.

It would be apparent that ban on insecticide formulations and subsequent withdrawl of subsidy made a severe dent on insecticides production in 1988. However, their was apparently a large carry over from previous years, as the reduced production of insecticides did not affect the production of rice, which was reportedly an all time high of 41,676,000 MT in 1988 (Table 1.1). The insecticides production is now reportedly on the recovery path, with 1989 production already touching 32,180 MT/KL. Apparently the market is getting stabilised at a relatively lower production level which could be the base for future growth projections.

1.5.3 Spurious Pesticidal Products under Established Brand Names

Excepting registration of a pesticide, presently there is precious little , that the government is in a position to regulate, owing to lack of requisite infrastructure. Some monitoring of product quality is done by occassional drawal of samples from production facilities and market outlets and analysed in the Plant Protection Laboratories of the Ministry of Agriculture. Yet there appears to be an ample scope for undetected selling of spurious products under established brand names. It was learnt that such spurious products are indeed being detected from time to time. At the Padjadjaran University at Bandung, a case was cited of a mancozeb sample brought to them by the farmers, which was found to be phytotoxic. Similarly a herbicide sample drawn from a sealed original container, was found to have no active material. In some situations, besides the content even container was found to be counterfeit. It was learnt that one of the ways, spurious products got introduced in the market has been through illegal practice of repacking pesticides from original packs into smaller sized packings by retailers to facilitate their sale. In a few situations like these the spurious material gets substituted for the genuine product.

Chapter Two

PESTICIDE INDUSTRY

2.1 Technical Pesticides

Production of technical pesticides was first taken up by the government owned P.T. Petrosida Gresik, a subsidiary of P.T. Petrokimia Gresik. The company produces three technical pesticides namely, diazinon, BPMC and MIPC since 1984. The production technologies were procured from Daewoo, South Korea. Subsequently P.T. Kartini Perintis Agroindustries , Cirebon, a private company, set up a plant in 1986 for the production of monocrotophos, based on a technology obtained from China. This was followed up by putting up an additional production capacity for BPMC and a production plant for carbofuran. Both the process technologies were procured from Japan. Recently, P.T. Multisida Agrolinda has begun an indigenous production of Glyphosate. Besides these technical products, P.T. Indagro at Bogor has been producing Fenthoate. Thus, a total of 7 technical pesticides are being produced indigenously.

As per the projection given by the Directorate of Agrochemicals Ministry of Industry, eventually, there will be 16 companies producing about 28 different technical pesticides; some of them scheduled to begin their production in early 90's.

As many of these proposed plants are coming up in private sector with no linkage with multinationals, the situation would propel the need for development of indigenous formulation technology.

2.2 Pesticide Formulation Industry

P.T. Bayer Indonesia is credited having set up the first pesticide formulation plat in the country in 1972. This led to the entry of a score of multinationals setting up their own

formulation facilities. The government owned Petrochemicals and fertiliser company Petrokimia Gresik entered in the fray in collaboration with two Japanese companies namely Nippon Kayaku and Mitsubishi Corporation. The joint venture formulation company, P.T. Petrokimia Kayaku began producing and marketing its own brand name products in 1977. Subsequently a few more pesticide formulators came up in the private sector. As on now, there are a total of 18 pesticide formulators producing nearly 200 formulations for plant protection.

Although Indonesian pesticide formulation industry is dominated by multinational subsidiaries or joint ventures, it produces only conventional formulations like emulsifiable concentrates (EC), wettable powders (WP), granules (GR) and Ultra Low Volumes(ULV) (Table 2.1). Some of the industry leaders concentrate in producing only simple EC formulations, e.g. P.T. Bayer Indonesia.

Table No.2.1 Trend of Production of Different Pesticide Formulations
(Source: RENPAP Gazette 1988, and Min. of Industry)

	1984	1985	1986	1987	1988
Types/Formulation/MT/KL					
Dusts	1	10	-	-	-
Solution concentrates and soluble powders	1,355	1,263	3,215	3,055	1,611
Emulsifiable concentrates	16,036	15,654	12,028	7,457	8,271
Wettable powders	1,781	2,137	2,244	6,717	4,277
Granules	15,343	23,279	30,115	30,868	9,123
Ultra Low Volumes	282	579	104	203	164
Others	11,974	10,922	11,852	246	228
Total	46,772	53,844	59,560	48,546	23,674

Many formulated pesticidal product are also imported in bulkpack and repacked into smaller sizes for local marketing. Details of specific formulations or their percentage of the total pesticide formulation market are scattered and difficult to ascertain. However it was learnt that many fungicide formulations are imported as such and repacked locally.

2.3 Potential for Improved Formulations

The dominant multi-national character of the pesticide formulations industry has some of its own advantages. Some of these companies are in the forefront of generation of new technologies and are producing and marketing various advanced formulations for more competing and demanding markets worldover. Their Indonesian ventures have an access to these products and many of these have been registered with the Pesticide Committee and are listed in its publication*. The new generation formulations like suspension concentrates (SC), emulsion concentrates (EW), Water dispersible granules (WG), microemulsions(ME) and controlled release (CR) offer several advantages like convenience, safety, improved efficacy etc. over the conventional formulations.

This writer has come across a number of sophisticated formulations like suspension concentrates (also known as aqueous flowables), water dispersibles granules (also known as dry flowables) and atleast one electrodyn (ED) formulation, in the list of pesticide formulations registered. Some of these formulations are being imported and marketed locally. For example, Ciba-Geigy's herbicide Ametryn is reportedly being marketed as an aqueous flowable (Gesapax 500 FW). Similarly, during the pesticide formulation plant visits, this writer saw a Dupont product in the form of water dispersible granules (Ally 20 WDG), which was being repacked for local market. The plant authorities mentioned that the WG formulation is being preferred by the farmers over the earlier supplies of the product as a wettable powder. There is a near consensus that the Indonesian farmer is reluctant to use powder formulations due to handling inconvenience.

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* "Pestisida untuk Pertanian Dan Kehutanan", Directorate of Food Crop Protection, Ministry of Agriculture, Jakarta, 1989.

During a visit to ICI pestisida plant at Gunung Putri, this writer made inquires of their marketing plans of "Cymbush 30 ED" already registered for use in the country and was told that the decision rests with their marketing division.

It is apparent that many pesticide companies recognised the potential of advanced formulation types, which are inherently safe and convenient for the user. They are also keeping their marketing strategies in a state of preparedness to meet such a requirement. However, the approach appears to be that of "wait and see". It is plausible that when competition grows safety and convenience could well become strong selling factors.

Yet another pointer to the need and potential of more sophisticated formulations was learnt from Professor Sorsomartono of Bogor Agricultural University. He mentioned that in a field trial of chlorpyrifos controlled release (CR) formulation conducted by the East Java sugar cane experimental station, it was found to be effective in providing preventive control against sugarcane borers upto a period of 2 years. Nevertheless the imported formulation from Australia is said to be prohibitively expensive for regular use. It was cited as a typical case needing indigenous development of the formulation, which may come within the acceptable cost parameters.

2.4 Pesticide Formulation for Household Use

Pesticidal products for household use are registered and regulated by the Ministry of Health under the category of "household and hygiene" products. Under its "communicable disease control (CDC)" programme, it also made spraying arrangements for DDT wettable powder and Fenitrothion EC formulations. DDT is being planned to be phased out in a years time and search for a suitable substitute is on.

There are a number of "ready-to-use" formulations for household use like sprayable liquids, aerosols, coils, baits, electrically heated dispensors and insect repellent lotions in the market. A list of products registered with the Ministry of Health is given in Appendix III. However, as in the case of registered agro-pesticides, many of the products listed are not being produced or have been discontinued. Amongst the major household pesticide producers are Bayer (Brand name "Baygon"), S.C. Johnson and Son. (Brand name "Raid") and Rickett and Colemen

(Marketing Colgate Palmolive products under the brand name "Mortein" and "Reckitt"). Shell is also marketing an aerosol product under its brand name "Shelltox". Most of the liquid and aerosol products marketed by Bayer as well as by S.C. Johnson, consist of an insecticide combination of DDVP and propoxur. On the otherhand, "Mortein" products marketed by Rickett and Coleman consisted of synthetic pyrethroid "Bioallethrin-S". Bayer also exported a large portion of their household pesticides production to many parts of South East Asia and the Middle East.

Chapter Three

PESTICIDE FORMULATION ADJUVANTS

3.1 Surfactants

There are two local surfactants producers namely P.T. Polekao Indonesia Chemicals and P.T. Pulosynthetics. The former is a joint venture company with Kao Corporation of Japan and covered nearly 30% market share. Kao Corporation, which itself grew out of technical collaboration with Atlas Chemicals of U.S.A., the well known producer of "Atlox" brand emulsifiers; was producing the same range of products under the brand name "Agrisol". The other surfactant manufacturer, P.T. Pulosynthetics is a Hoechst subsidiary and has another 30% market share. In this case, nearly 12% is produced locally and around 18% supplies are made up of direct import.

The total surfactants market for pesticide industry was reportedly in the range of 1500 MT , which consisted of wetting and dispersing agent, emulsifiers and other additives. The domestic production covered only 40-45% requirements of anionics, esterification products and some wetting and dispersing surfactants like salts of linear alkyl benzene sulphonates. Ethylene oxide condensates are all imported, as at present, there is no indigenous production of ethylene oxide. Similarly, lignin sulphonates wetting agents are also imported.

Besides the domestic production and imported supplies made by the two companies, the industry imported around 500 MT's or 40% of its total needs directly or through local agents of foreign companies. ICI imported its supplies through ICI Australia, Italy or other sources. Similarly P.T. Monagro chemicals presently imported from U.S.A but were hopeful that Hoechst would eventually be able to supply their requirements.

3.2 Carriers and Solvents.

3.2.1 Carriers for Powder and Granular Formulations

For production of wettable powder formulations , a number of mineral and synthetic carriers are used by the industry. Amongst mineral carrier types, Kaolin clay and diatomaceous earth are the choice carriers. Some good quality primary deposits of Kaolin are located on Belitung island in South Sumatra. The process industry is well established and possesses sophisticated technology to produce several grades of Kaolin clays for differnt end uses. A good part is reportedly exported to neighbouring Malyasia, Philippines, Korea and Japan. However, many formulators visited by the writer , were importing their requirement from abroad. Similarly, large deposits of good quality diatomaceous earth are reported at Pulau Samosir in North Sumatra. This resource does not appear to have been tapped by the industry as yet. On the otherhand , precipitated Silica , a carrier of synthetic origin is not being produced locally.The industry is importing the same from Taiwan and Japan.

For the production of coated type granular formulations, the industry employes locally available valconic sand (Andesite type) available on the riverbeds which has been found satisfactory.

3.2.2 Solvents for Emulsifiable Concentrates

For liquid formulations like emulsifiable concentrates, most of the solvents employed by the industry are of imported origin. The indigenous petrochemical industry (Pertamina) produces aromatic solvents like xylenes. However many multinational companies preferred to use C-9 solvents for safety reasons and imported their requirements. Solvent "certrex-46" from Mobil Oil, Singapore was identified as one of the source. A small quantity of aliphatic solvent of local origin (Fuel Oil No.2) was being employed for household formulations, wood preservatives etc.

3.3 Constraints in Increased Use of Indigenous Inputs

The formulators obtained the formulation recipies from either their principals or technical collaborators. This factor necessitated use of imported ingredients, as have been available to the original developers of the formulation. The industry, largely in the multinational sector, appeared to be unenthusiastic about switching over to indigenous inputs, wherever available, for two reasons. The cost of evaluating and developing an indigenous substitute in their principal's facility was high and had to be borne by the product. On the otherhand, wherever there was a capability and facility available to evaluate locally, they were still bound to obtain the principal's endorsement prior to their switching over. Either of the situations did not provide any incentive for the development of local inputs. At least, one of the industry spokesman was quite direct to state that short of statutory requirement, this may be difficult to achieve.

Chapter Four

NATIONAL PESTICIDE DEVELOPMENT CENTRE

4.1 Objectives

The establishment of the National Pesticide Development Centre (NPDC) is visualised to benefit the pesticide formulation industry, by strengthening its technology base and by facilitating increased uses of indigenous raw materials. The pesticide user is expected to be benefited by availability of quality pesticides which are safe and convenient to use and are economical. The centre would also assist the national industry and eventually provide advice and assistance on a regional basis, on the environmental aspects of pesticide production including effluent abatement/treatment and occupational safety of the workers.

4.2 Inputs

It is assumed, that the Government of the Republic of Indonesia inputs for this institution building project would include land , building, national counterparts and supporting staff,local supplies, domestic travel and communications expenses. On the otherhand, the UNDP/UNIDO inputs are expected to cover an appropriate level of technical assistance in the form of procurement and supplies of essential equipments, deputation of international experts to fill up technological gap in specific areas and training of national staff at suitable institutions abroad. A chief technical advisor (CTA) to the project may also be provided for organising and setting up the procedure for project implementation.

4.3 Linkages with Government Departments, Industry and University

In order to achieve its defined objectives, the centre would need to interact with several government departments besides the Directorate of Agro-chemical Industries in the Ministry of Industry. The perceived linkages for the centre are given in Chart 4.1 and discussed below.

4.3.1 Ministry of Agriculture

The Directorate of Food Crop Protection is responsible for regulation of all pesticides produced and marketed in the country. The directorate also monitors pesticide quality and maintains a plant protection laboratory for analysis of samples (For details see Chapter 7).

4.3.2 Ministry of Health

The Directorate of Food and Drugs in the Ministry of Health regulates production and use of pesticides for public health including for household uses. The directorate also has a role in regulating hazardous substances in the country.

4.3.3 Ministry of Environment

The Assistant Minister III, is the incharge of pollution control and Environmental Impact Assessment Committee (AMDAL) in the Ministry of environment. The various activities being carried out by this ministry include setting up of a Environment Management Centre with the assitance of the World Bank, preparation of a comprehensive legislation on environment policy and 4 hazardous waste treatment and incineration studies for different industrial belts like Jakarta-Bogor, Tangrang-Bekasi and Surabaya etc. Based on these studies, the ministry plans to setup centralised waste treatment facilities and incinerators for the industries in those areas.

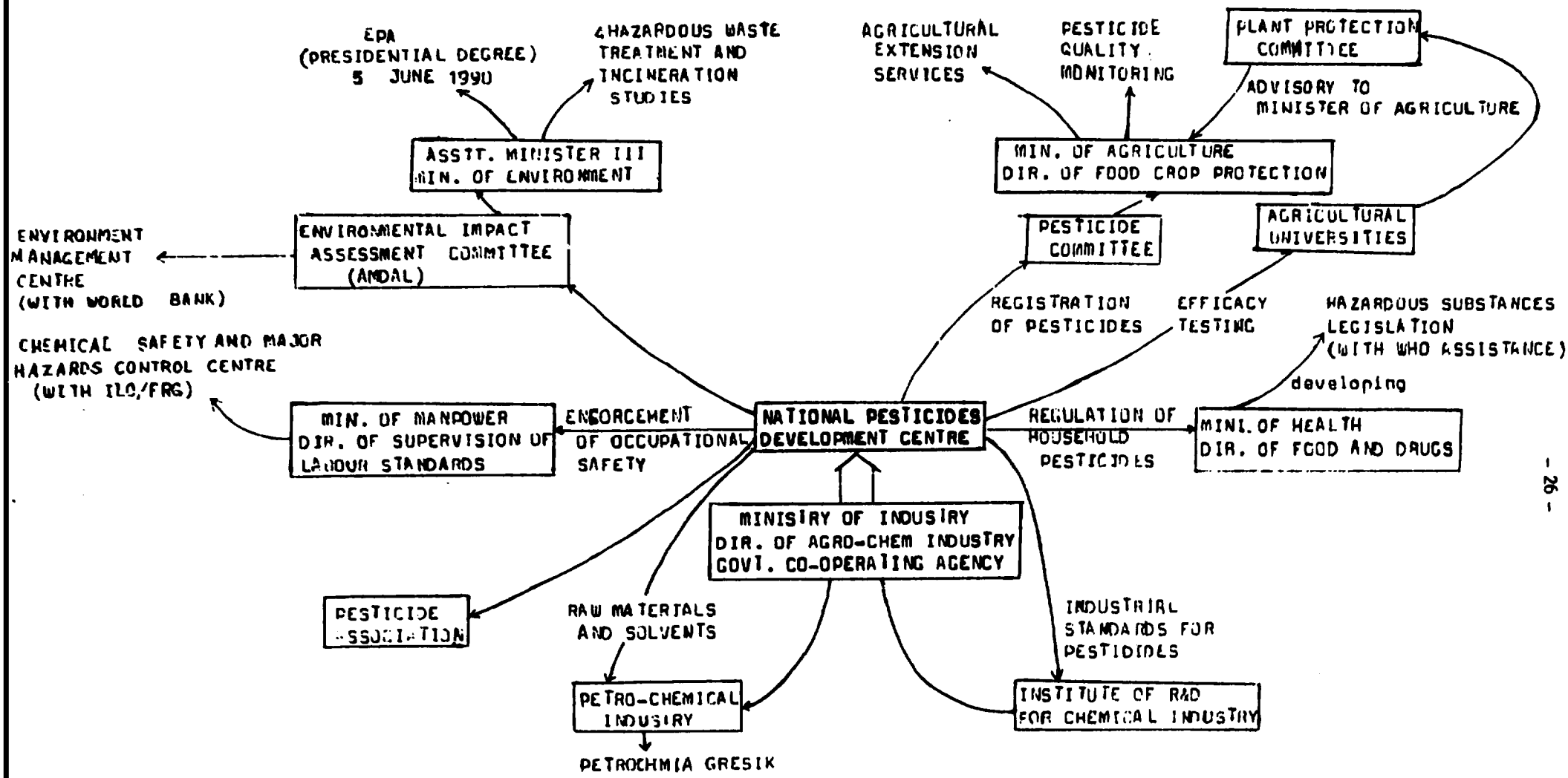


CHART 4.1 PERCEIVED LINKAGES OF NATIONAL PESTICIDE DEVELOPMENT CENTRE, INDONESIA

4.3.4 Ministry of Manpower

The ministry enforces the occupational safety standard requirements of the industrial workers. It also provides chemical safety data, including that of pesticides.

4.3.5 Petrokimia Gresik

A petrochemical industrial unit owned by the Government, producing technical pesticides and their formulations. The company has given active assistance in the preparatory phase of establishing the National Pesticide Development Centre. It has been identified for housing the pilot plant facilities for the Centre. The company would also be providing necessary funds for establishing the centre, on behalf of the government.

4.3.6 Institute for R&D of Chemical Industry

The Institute for R&D of Chemical Industry operating under the Ministry of Industry has the responsibility for developing industrial standards for chemical industry including that of pesticides. It has ongoing R&D projects on pesticide formulations and on effluent treatment (See Chapter 6). The institute would be housing the proposed National Pesticide Development Centre in its present pesticide laboratories.

4.3.7 Agricultural Universities

Agricultural universities in Indonesia undertake contract evaluation of pesticides for their efficacy. Such evaluations are more objective, and provide important input including cost efficacy data for related compounds. They also provide the requisite technical resources and function as "Think Tanks" for adopting relevant technologies and arriving at indigenous solutions to various localised problems.

4.3.8 Pesticide Association

The Indonesian pesticide industry is organized under the umbrella of Assosiasi Perusahaan Perindustrian Pestisida Indonesia (AP3I) and is recognised by the Government for all of its dealing with the industry.

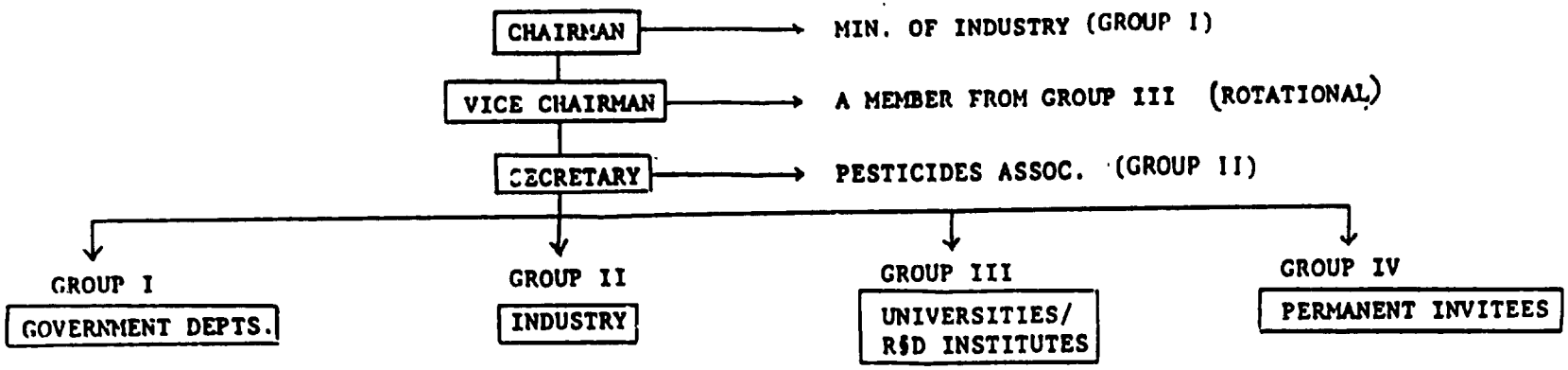
4.4 Institutional Arrangements

The institutional arrangement for the proposed NPDC is visualized as a two-tier structure, i.e. a management body to the National Pesticide Development Centre and the direct operation staff of the Centre.

4.4.1 Steering Committee

The steering body of NPDC would provide the direct link between the different government departments, the industry, agricultural universities/R&D institutions etc. and provide the policy guidelines and oversee that the stated objectives of the project are realized within the given time fame. The constitution of the management committee is based on the linkages of the centre perceived with various relevant bodies as given in 4.3. The steering committee would be headed by the Director of Agrochemical Industries in the Ministry of Industry, who would be assisted by an eminent agricultural/chemical scientist from the university/R&D institutions. The secretary of the committee would be the representative of the Pesticide Association (AP3I). The other members of the committee would comprise of representatives from Ministries of Health, Agriculture, Environment and Manpower, and representatives of the Institute for R&D of Chemical Industry (BBIK) and Petrokimia Gresik, the government owned petrochemical company under the charge of Ministry of Industry. The UNIDO Country Director, Chief Technical Advisor (if appointed) and the Director, NPDC (if other than CTA) would be the permanent invitees to the committee. The composition of the management committee is summarised in Chart 4.2.

Chart 4.2 PROPOSED COMPOSITION OF THE STEERING COMMITTEE
FOR NATIONAL PESTICIDES DEVELOPMENT CENTRE

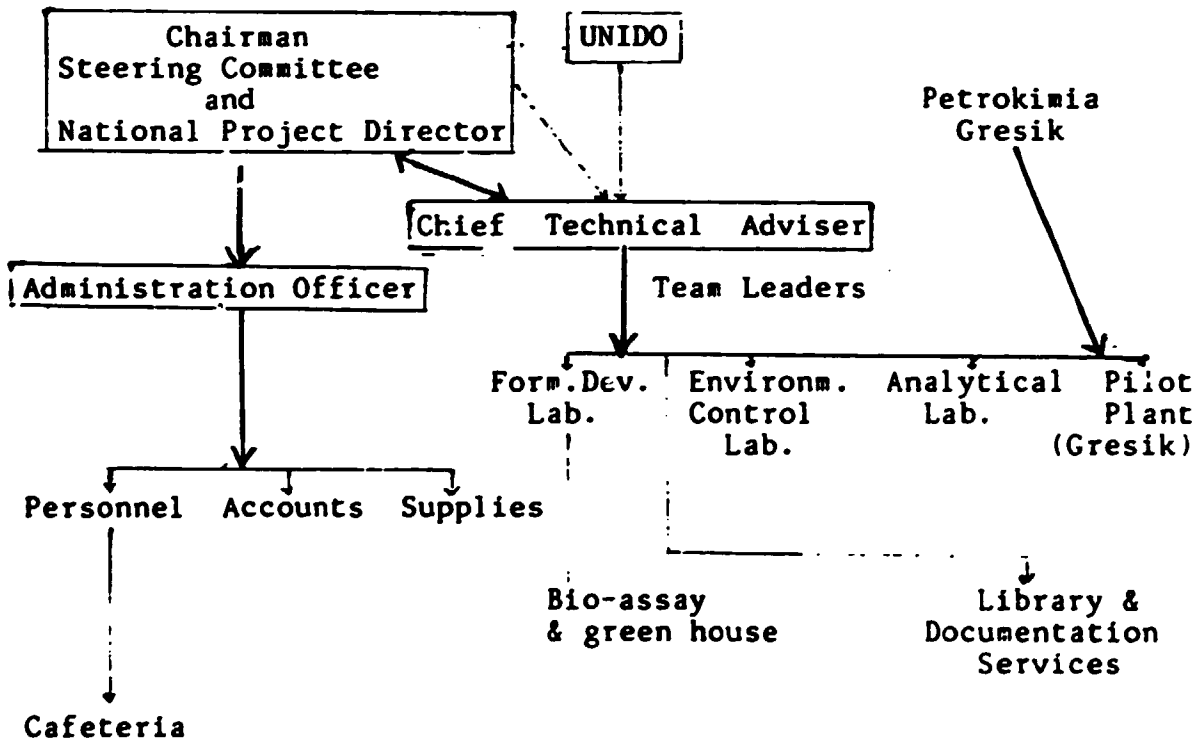


1. MINISTRY OF INDUSTRY
   DIR. OF AGRO-CHEMICAL INDUSTRY
2. MINISTRY OF AGRICULTURE
   DIR. OF FOOD CROP PROTECTION
3. MINISTRY OF HEALTH
   DIR. OF FOOD AND DRUGS
4. MINISTRY OF ENVIRONMENT
   ASST. MINISTER III
5. MINISTRY OF MANPOWER
   DIR. OF SUPERVISION OF
   LABOUR STANDARDS
6. PESTICIDE ASSOC. (API3I)
   CHAIRMAN,
   TECHNICAL COMMITTEE
7. PETROKIMIA GRESIK
   CHAIRMAN,
   SUPERVISORY BOARD
8. AGRICULTURAL SCIENCES MADE BY A CONSORTIUM OF
   i) BOGOR AGRI. UNIV.
   ii) UNIV. OF GAJAH MADA
   iii) UNIV. OF INDONESIA
9. INSTITUTE OF R$D FOR CHEMICAL INDUSTRY
10. UNIDO COUNTRY DIRECTOR
11. CTA (IF APPOINTED)
12. DIRECTOR, NPDC
    (IF DIFFERENT THAN CTA)

4.4.2 Operational Organization

At the operational level, the responsibility of institutional management of the Centre would be that of Pesticide Association and the Directorate of Agrochemicals Industry, so that the whole pesticide industry may equitably share the fruits of development made at the Centre. The institutional management would be headed by the Chairman of the steering committee, also designated as the National Project Director (NPD), who in consultation with the Chief Technical Advisor (appointed by UNIDO), would be directly responsible for the implementation of the project. There would be 4 team leaders for as many laboratories, i.e. formulation development, effluent treatment, analytical and pilot plant, and would directly report to the CTA. As only a non-residential CTA is envisaged, in his absence, one of the team leaders would be in charge for the project. A brief outline of the operational staff is given in Chart 4.3.

Chart 4.3 Institutional Framework for the Operational Organisation for National Pesticide Development Centre



4.5 Location of the NPDC

After visiting the two possible sites, it was found that based on facilities available and also taking into consideration the safety aspects , an arrangement of setting up the R&D facilities by strengthening the pesticide laboratory of the Institute for R&D of Chemical Industry near Jakarta (location map 4.5.1) and carrying out pilot plant scaling up operations at P.T.Petrokimia Gresik facility (location map 4.5.2) would be ideal. Locational advantages of setting the R&D facilities at Jakarta as against possible location at Gresik are summarised as follows.

- Centrally located for the pesticide formulators, most of whom are in and around Jakarta city.

- Vicinity to capital city, providing access to the government departments as well as to UNDP office.

- Being near to a metropolis city , would be sufficiently attractive to draw professionals of desired quality to work for the centre.

- The centre envisages to become a focal point to deal with environmental aspects of pesticide production and use both nationally as well as regionally. Closeness to a well connected international airport and availability of good hotels in neighbourhood is desirable for international experts, regional trainees etc.

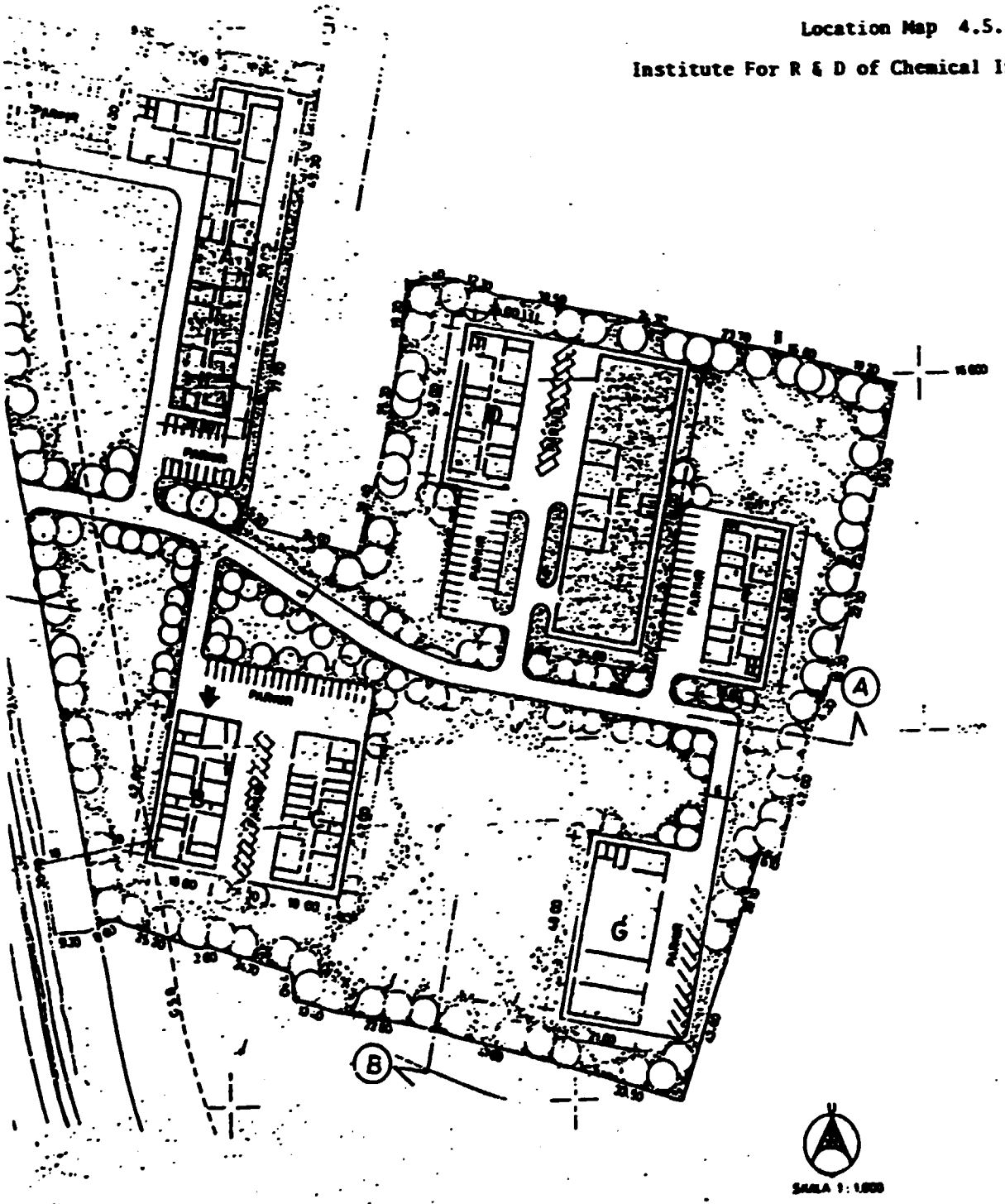
- Readily available builtup laboratory space, which can be made as per needs with minor modifications.

- Just sufficiently away from pesticide and other contaminating industries for valid bio-assay and field trial studies.

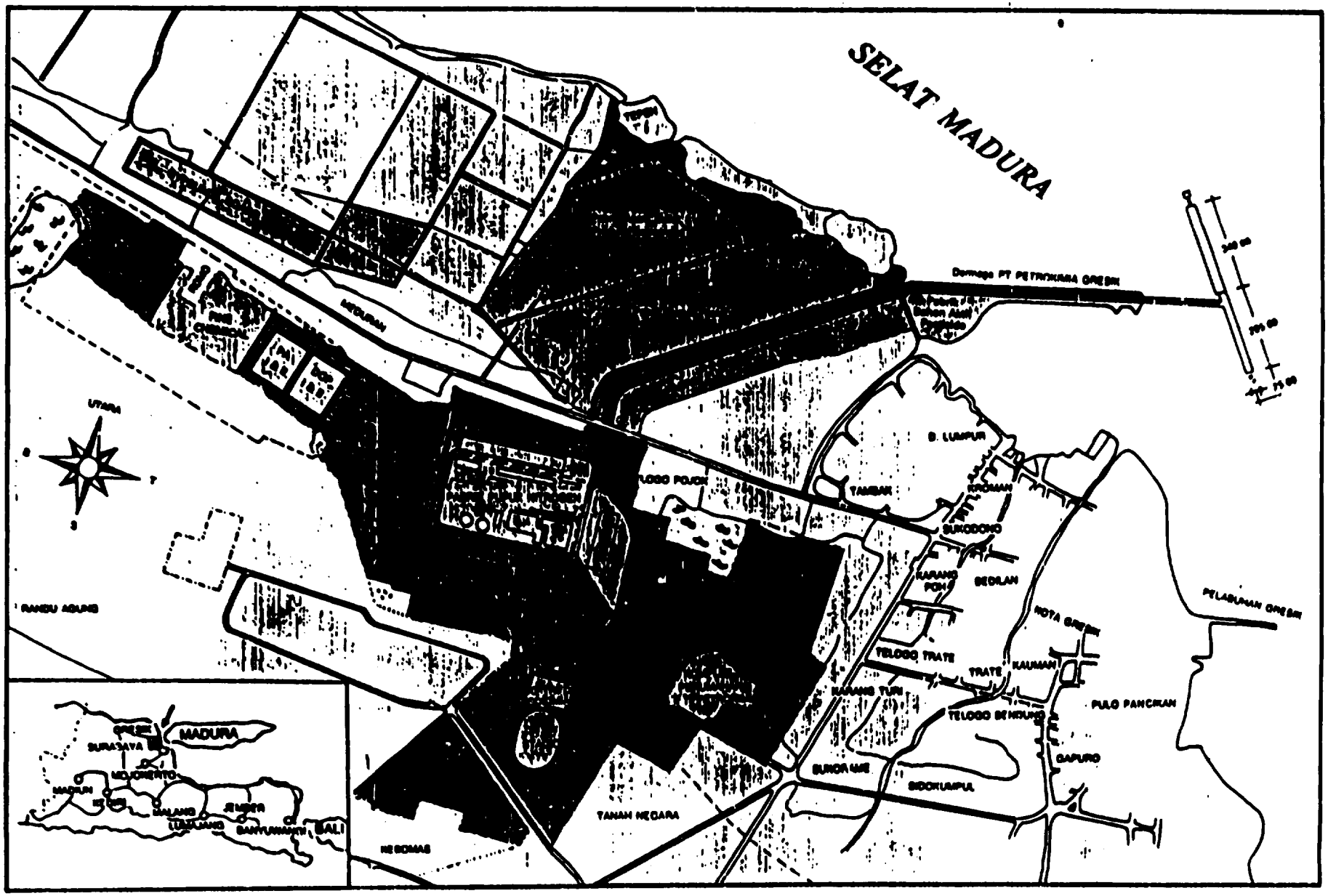
- The campus spreadover in 5 hactares offers ample scope for future expansion.

Location Map 4.5.1

Institute For R & D of Chemical Industry



Peta Kota Gresik &
Lingkungan Industri PT. PETROKIMIA GRESIK (Persero)



Location Map 4.5.2

- Seemingly independent location; would not inhibit pesticide industry-at-large to take full advantage of this national facility.

- Proximity to the institute for R&D of Chemical Industry could provide mutually complementary facilities to maximise the use of national resoruces. For example, a centralised library and pesticide data centre and time sharing on sophisticated equipments by both the research bodies.

- The centre can be developed as a truly autonomous body deciding its own manpower structure, designations, grades without any constraints associated to a government department or its owned industry.

However, it has been found that a school is located right next to Pesticide Laboratory of BBIK. Therefore, any large scale operation involving toxic chemicals is not considered desirable. Taking this into consideration, the pilot plant facilities may be more suitably located in the proximity of the laboratory block of Petrokimia Kayaku at Gresik, where requisite utility services are readily available and safety aspects are well covered.

4.6 Laboratory Space and Equipments

The pesticide laboratory building at the institute for R&D of Chemical Industry has about 1300 sq.mt. covered area which provides good laboratory space for conducting R&D activities. Additionally a greenhouse/glass house (about 250 sq.mt. covered space) would be required for the purpose of testing and growth room facilities. A pilot plant facility for scaling up laboratory formulations would require around 200-250 sq.mt. covered space at the Petrokimia Gresik.

The laboratory already has a few analytical equipments which are required to be supplemented substantially. A recommended list of equipments for pesticide formulation laboratory, analytical development labotoratory, safety and effluent control laboratory and pilot plant and also some of the suggested office equipments and training aids is given in AppendixIV .

Chapter Five

EFFLUENT CONTROL AND INDUSTRIAL SAFETY

In the proposed activities for the National Pesticide Development Centre, effluent control and industrial safety aspects in pesticide industry are visualised to have a predominant role. A detailed account of various plant visits is given in the report of Mr. George M. Jett, who and the author visited many of these together.

This writer found (as reported earlier) that many pesticide formulation plants are either subsidiaries or joint ventures with multinational companies and it was observed that by and large they maintained good manufacturing practices (gmp), including occupational safety of the workers and have requisite arrangements for effluent abatement/treatment. P.T. Bayer Indonesia Plant facilities were comparable to their Bayerwerks plant in Germany, which the author had an opportunity to visit earlier. However, some of the exceptions noticed were in those plants, managed by a few local private companies. A typical example is the Cirebon plant of P.T. Alpha abadi. It was found to be grossly negligent in taking minimum safety precautions. The writer witnessed young girl workers subjected to very high toxic exposure. The formulation plant producing monocrotophos EC formulation is located in a warehouse with insufficient ventilation and nonexistent exhaust facility. The semi-automatic filling machines were being operated by these workers with bare hands, soaked in the formulation, unaware of potentially hazardous exposure. The formulation was spilled all-over the bench and floor. The workers did not change their clothes or took bath but merely washed their hands with soap at the end of the day. No bathing facility or safety showers were noticed in the vicinity of the plant. At least one case of fatal lowered cholinesterase activity was leaint from the staff nurse.

The formulation facility located along with manufacturing plant for carbofuran, BPMC and monocrotophos technical , had an effluent treatment system, seemingly operational but monitoring and control appeared to be inadequate. The treated water with some residual activity was collected in pits which were regularly flushed by the tidal waves of the sea.

Chapter Six

PESTICIDE FORMULATION R&D AND NATIONAL STANDARDS DEVELOPMENT

6.1 The Institute for R&D of Chemical Industry

The institute for R&D of Chemical Industry (Balai Besar Industry Kimia) under the Directorate General of Basic Chemical Industry, Ministry of Industry is entrusted with the task of undertaking industrial R&D projects and developing national standards related to chemical industry including pesticides. This institute is amongst nine such institutions for different industrial sectors, set up by the Ministry, whose activities are being coordinated by the Agency for Industrial Research and Development. The institute is ideally located on the outskirts of Jakarta, on the way to Bogor, a 30 minutes drive from the Ministry building.

6.1 Pesticide Formulation R&D.

In 1983, the institute was given the responsibility to take up R&D projects in the field of pesticides, in a bid 'to support and secure a well planned and orderly development of local pesticide industries'. The pesticide laboratory of the institute has taken good advantage of the UNDP/UNIDO sponsored on-going Regional Network on Pesticides for Asia and Pacific (RENPAP) by deputing a good number of scientists in various specialised training programmes on pesticide formulation technology and quality control of pesticide formulations offered under this project, thereby exposing them to advanced concepts and techniques. The laboratory nevertheless, remains scarcely equipped, inadequately manned and its resources remain underutilised. The author was given a list of the R&D project related to formulations undertaken by the laboratory, as follows-

- Research on indigenous materials as carriers including non-minerals such as coconut shells , corncob etc.
- Wettable powder formulation from indigenous materials
- Study of quality parameters for solid formulations
- Study of surface active agents and emusifiers for pesticide formulations.
- Formulation of emulsifiable concentrate
- Change of physico-chemical characteristics of pesticide formulations on storage
- Study on non-edible oil (Kapok seed oil) for ULV formulation
- Research on pesticide-fertiliser combination
- Study on newer formulations
- Quality control of active ingredients and formulation products.

However, as some of the key personnel have been shifted, these projects appeared to be in a state of dormancy.

The pesticide laboratory was also told to be engaged in monitoring the quality of effluents from pesticide industry and studying effectiveness of waste treatment from pesticide formulation plants.

6.3 National Standards for Pesticides

There are a total of 31 standards on pesticides till 1989 (See list at Appendix V). Out of these 20 standards are for technical pesticides (out of a total of 56 technical pesticides registered) while four standards relate to insecticide formulations, namely chlorpyrifos EC, carbofuran granules, MIPC WP and BPMC EC, as against nearly 200 different pesticides formulations in use in the country.

Other standards relate to testing methods of physico-chemical characteristics of pesticide formulations like EC, WP,Dusts,Granules, Water Soluble Concentrates and Oil Concentrates. As on now, there are no standards on specifications of physico-chemical properties of these formulations.

Chapter Seven

PESTICIDE REGULATION

7.1 Pesticide Committee

The Ministry of Agriculture, Directorate of Food Crop Protection regulates production, marketing, storage and uses of pesticides through the mechanism of registration. For the task, the ministry has constituted a Pesticide Committee which is headed by the Director of Food Crop Protection and has members from several related ministries. A list of members is given in Appendix VI . Safety and efficacy of pesticides are the main consideration for granting registration by the committee. For safety, one of the parameters considered is LD50 value of the pesticide. Phorat was cited as an example, which has been denied registration as its LD50 was considered very low.

7.2 Registration Requirements

The committee required extensive data on composition, physico-chemical properties, stability, bioefficacy, toxicity, long term effects and effects on fish , birds and animals etc. The packaging level is required to have date of production, but there is no specific requirement to declare shelf life of the product. The Directorate of Food Crop Protection has a mechanism of drawing samples from the production facilities, as well as from the market. These samples are analysed in their own, rather well-equipped plant protection laboratories. In the event the samples are found below standard specification, the formulator is required to withdraw the material and reformulate the same. The process has also led to the knowledge of some spurious products being sold in well established brand name pesticide containers.

7.3 Formulation Standards

The pesticide committee followed the FAO and CIPAC specifications. No specific need has been found for national standards for pesticide formulations. The member-secretary of Pesticide Committee appeared to be surprised at the existence of the four national standards on specific pesticide formulations (See page). Nevertheless he viewed that general standards on physico-chemical specifications for different formulation types would be desirable.

7.4 Proliferation of Pesticides

There are 56 technical pesticides registered till now but actually 35-40 only are being marketed at present. The pesticide committee felt obliged to grant registration to all pesticides on the sole criteria of efficacy and safety. The question of relative efficacy was considered by the Plant Protection Committee, constituted separately to advise the ministry on suitability of different pesticides for use by the farmers. The member-secretary, Pesticide Committee, did not favour proliferation of the same pesticide formulation in different brand names produced by different formulators.

7.5 Household Formulations

Pesticide formulations for household use come under a different status. Some of the products that were not registered by Pesticide Committee for various reasons, according to the member-secretary, have found their way by registering with the Ministry of Health. Details of various products and production of household pesticides are also kept by the ministry of Health and these are not maintained by the Ministry of Industry, which regularly kept all data on agro-pesticides production.

7.6 Plant Protection Committee

The Plant Protection Committee also a constituent of the same Ministry, consists of eminent plant protection scientists from Universities and Research Institutions (See list at Appendix VII). It has an advisory role to the minister of agriculture on suitability of pesticides in agriculture and their continued use, covering such aspects as relative cost efficacy, resistance development etc. However the ban imposed on the use of 57 pesticide formulations on paddy by the decree of the President was not based on the advice of this committee.

APPENDIX I

Facilities Visited and Personal Contacts Made

I UNDP/UNIDO Jakarta

- Mr. Jan Kemp. Resident Representative
- Mr. G.L. Narasimhan, UNIDO Country Director
- Mr. George M. Jett (EPA), UNIDO Consultant
- Ms Paivi Korvenmaa, Jr. Professional Officer, UNIDO
- Mr. Mario T. Mustafa, Sr. Programme Assistant, UNDP

II Ministry of Industry

1. Directorate General of Basic Chemical Industry

Mr. Wardijasa, Director General
Mrs. Sri Ambar Suryosunarko, Director for Agrochemicals Industry
Ms. Hariyati, Directorate of Agrochemical Industry
Mr. Agus Wahyudi, Directorate of Agrochemical Industry

2. P.T. Petrokimia Gresik

Mr. L. Sidharta, Presideent Comiseries
Mr. Agus Widartono, Product and Marketing Research Manager
Mr. Sidi Pranyoto, Superintendent, Product Research
Mr. Yudho Sugiyarto, Superintendent, Field Exptl.Stn.
Ms. Siti Zainab, Sr. Supervisor (Admn. & Finance)
Ms. Endang Sukesi Susilowati,Sr. Supervisor (Plant Prot.)

3. P.T. Petrosida Gresik, (Jl. Jend A. Yani, Gresik)

Mr. Sutedjo, President Director
Mr. Fatimano Mendorfa, Director Production
Mr. Suwardi, Director R&D
Mr. Marjoto, Director Marketing

4. Institute for R&D of Chemical Industry
   (Pekayon-Pasar Rebo, Jakarta Timur)

   Mr. Imam Hidayat
   Ms. Robiatun
   Ms. R. Susilowati
   Ms. Sri Pudji Rahayu
   Mr. Tri Widianto

III. Pesticide Formulation Industry

1. P.T. Petrokimia Kayaku
   (Plant - Jl. Jend. A. Yani, Gresik)

   Mr. Sarbini Prawirowidago, President Director
   Mr. Amirul Djujus Aziz, Director Production
   Mr. Shin-ichi Sakai, Director R&D

2. P.T. Bayer Indonesia
   (Plant - Jakarta Industrial Estate, Pulogadung, Jl. Rawa Sumur No.12, Jakarta).

   Mr. Manfred Adria.., Plant Manager

3. P.T. ICI Pestisida Indonesia
   (Plant - Gunung Putri, Bogor)

   Mr. Thomas Widyatmodjo, Works Manager
   Ms. Indrawati L., Production Manager

4. P.T. Monagro Kimia
   (Plant - Kawasan Industri Manis, Desa Jatake Jatiuwung, Tangerang)

   Mr. Djufri Latif, Public Reelations Manager
   Mr. Budi Sarwono, Plant Manager
   Mr. Hendrawan Rusli, Chief of Laboratory

5. P.T. Maskitani
   (Plant - Kamp Jati Desa Jatimulya, Bekasi)

   Mr. Arifin S. Idham, Technical Director
   Mr. Hadi Taufik Rahayu, Plant Manager

6. P.T. Dharma Ardha Forma
(Plant - Cibitung Km. 46, Bekasi)

Mr. Hisjam Djawahir, Plant Manager
Mr. E. Muchlis, Quality Assurance Manager

7. P.T. Kartini Printis Agro Industries
(Plant - Jl. Raya Mundu, Pesisir No.23-25, Cirebon)

Mr. Deni P.Satari, Asstt. Plant Manager
Mr. Beni Septiono, Chem. Engr.

8. P.T. Pacific Chemicals Indonesia
(Plant - Tenjung Morawa Km. 9.5, Medan, N.Sumatra).

Mr. Alfred Effendy Sitompul, Production and Maintenance Supervisor
Mr. Ibnu Oebit, Laboratory Supervisor
Mr. M. Siregar, HR and Admn. Supervisor

9. Pesticide Association

Mr. Djati Soeroso, President
(P.T. Yunawati, Jl. S. Parman, 109 Jakarta)

IV. Formulation Adjuvants Manufacturers/Suppliers

1. P.T. Polekao Indonesia Chemicals
(Office - Skyline Bldg., 16th Floor, 9, Jl. M.H. Thamrin Jakarta)

Mr. Takashi Fujino, Vice President-Executive
Mr. Kiyoshi Hamaoka, Director Marketing

2. P.T. Pulosynthetics
(Office - Artamas Bldg. IV, 3rd Floor, Jl. A. Yani No.2, Jakarta).

Mr. D. Kretschmer, Surfactants and Auxilliaries Dept.

3. P.T. Kaolin Industri Utama
(Office - Jl. Teuku Cikditiro 56, A, Jakarta)

Mr. Kayanto, Sales Manager

V. Agricultural Universities

1. Bogor Agricultural University (IPB) - Department of Plant Pests and Diseases.

   Dr. Soemartono Sosromarsono, Professor of Entomology
   Dr. Aunu Rauf, Entomologist
   Mr. R.A. Toerangadi Soemawinata

2. University of Gaja Madha, Yogjakarta

   Dr. Kusumbogo Untung, Professor of Entomology and Advisor to the Coordinating Minister on Agriculture.

3. Padjadjaran University, Bandung - Plant Protection Dept.

   Mr. Herman Soeriaatmadja, Head of Dept.
   Dr. E. Santosa

VI. Other Relevant Government Departments/Ministries

1. Ministry of Agriculture, Dept. of Food Crop Protection

   Mr. Mulyani Soekardi, Member Secretary, Pesticide Committee

2. Ministry of Health

   Mr. Janahar Murad

3. Ministry of Environment

   Mr. Robert Breeze, Advisor - Hazardous Waste Management, Environment Management Dev. in Indonesia (EMDI).

APPENDIX II

List of 57 Insecticide Formulations Banned for use on Paddy

Name of Product	Active Ingredient(s)
Agrothion 50 EC	Fenitrothion
Azodrin 15 WSC	Diazinon + BPMC
Basmiban 20 EC	Chlorpyriphos
Basminon 60 EC	Diazinon
Basudin 60 EC	Diazinon
Bayrusil 250 EC	Quinalphos
Bayrusil 5 G	Quinalphos
Basudin 10 G	Diazinon
Brantasan 450/300 EC	Diazinon + BPMC
Carbavin 85 WP	Carbaryl
Cytrolane 2 G	Methyl Phosfolan
Dharmasan 60 EC	Phenthoate
Dharmathion 50 EC	Fenitrothion
Diazinon 60 EC	Diazinon
Dicarbone 85 S	Carbaryl
Dimaphen 50 EC	Fenitrothion
Dimecron	Phosphamidon
Dursban 20 EC	Chlorpyriphos
Dursban 15/5	Chlorpyriphos + BPMC
Dyfonate 5 G	Fonofos
Ekalux 25 EC	Quinalphos
Ekalux 5 G	Quinalphos
Ekamet 5 G	Etrimfos
Elsan 60 EC	Phenthoate
Elstar 45/30 EC	Phenthoate + BPMC
Eumulthion TM	Trichlorofon + Azinphos-Methyl
Folimat 500 SL	Omethoate
Fomadol 50 EC	Malathion
Gusadrin 150 WSC	Monocrotophos
Hostation 40 EC	Triazophos
Karbathion 50 EC	Fenitrothion
Lannate 25 WP	Methomyl
Lebayeid 550 EC	Fenthion
Lirocide 650 EC	Fenitrothion
Miral 2 G	Isazophos
Monitor 200 LC	Methamidophos
Nogos 50 EC	Dichlorvos

Nuvacron 20 SCW	Monocrotophos
Ofunack 40 EC	Pinidafenthion
Padan 50 SP	Cartap
Pertacide 60 EC	Phenthoate
Petroban 20 EC	Chlorpyrifos
Phylodol 50 EC	Dichlorphos
Reldan 24 EC	Chlorpyrifos-methyl
Sematron 75 SP	Acephate
Sevin 5D	Carbaryl
Sevin 5G	Carbaryl
Sevin 85 S	Carbaryl
Sumibas 75 EC	BPMC + Fenitrothion
Sumithion 51 EC	Fenitrothion
Sumithion 2D	Fenitrothion
Surecide 25 EC	Cyanofenphos
Tamaron 200 LC	Methamidophos
Thiodan 35 EC	Endosulfan
Trithion 4 E	Carbophenothion
Trithion 95 EC	Carbophenothion

APPENDIX III

LIST OF REGISTERED HOUSEHOLD INSE CTICIDE FORMULATIONS
(Source : Ministry of Health)

I. Liquid Insecticide Formulations

	MANUFACTURER	PRODUCT NAME	ACTIVE MATERIAL
1.	Fa Argus Industries	Golden Dragon	Pyrethrins/DDVP
2.	P.T. Agung Sakti Bersaudara	HANA Insect Killer	Bioallethrin-S/ DDVP
3.	P.T. Agrocarb Indonesia	WHIP-O Liquid	Fenthrothion/DDVP
4.	P.T. Bayer Indonesia	BAYGON Oil Spray	Propoxur/DDVP
		MAFU Oil Spray	DDVP
5.	P.T. Colgate Pamolive Ind.	MORTEIN	Bioallethrin-S
6.	P.T. Famastar Jaya Nusantara	STARTOX	Bioallethrin-S/ DDVP
7.	P.T. Obor Mas Djaya	TOTAL	Bioallethrin-S/ DDVP
8.	Special Insecticide Manuf.	OK Inect Killer	DDVP
9.	P.T.S.C. Johnson & Son.(Ind.)	RAID,RIS	Propoxur/DDVP
		PERISAI	Bioallethrin
		BOLT liquid Residual	DDVP
		BOLT Liquid airbone	Chlorpyrifos/ DDVP
10.	P.T. Shugamawan Jaya	ACA Insect Killer	
11.	P.T. Tensia Manufacturing Ind.	BOP Insect Killer	
12.	P.T.Vita/Viva Cosmetics	MUSKITAN	Muskitox
13.	P.T. Whelock Marden Indonesia	SHELLTOX	Tetramethrin/ DDVP

II. Aerosols

1.	PT Agung Sakti Bersaudara	HANA	Bioallthrin-S/ DDVP
2.	PTE Aerosol Manufac.Services	SIGMA/TOTAL	
3.	PT Bayer Indonesia	BAYGON	Propoxur
		MAFU	DDVP
4.	PT Colgate Palmolive Ind.	MORTEIN	Bioallethrin-S
5.	Special Inseticide Manuf.	OK	DDVP

6.	PT S.C. Johnson & Son (Ind.)	RAID	Propoxur/DDVP
7.	PT Whelock Maerden Indonesia	SHELLTOX	DDVP

III Powder Insecticide Formulations

1.	PT Bayer Indonesia	BAYGON Fly Bait	Propoxur
		BAYGON Dust	Propoxur
2.	PT Wirda Kesri	ABATIS	Temephos 1-SG

IV. Coil Insecticides

1.	PT Baniandoni	BEBEK ANGSA,KODOK MOSFLY, UNTA	Bioallethrin
2.	PT Bintang Utara k.o.a.n	IKAN MAS	Bioallethrin-S
3.	CV Central Bukit Moria	ANGKER OMBAK LAUT	
4.	PT Globina Karya	HEMAT	
5.	Menara Laut Perusahaan	IBU, IKAN MAS, NYUNYA,SILUMAN, TAWON,SARINAH	Bioallethrin-S
		KINGKONG	Bioallethrin
		MENARALAUT	Allethrin
6.	P.T. Obor Mas Djaya	ANTELOPE	DDVP
		DOUBLE RABBIT	Bioallethrin
		DOUBLE CAT, NEW KING,OBOR BARU	
7.	Fa Pollen & Co.	ANGSA, BINTANG GAJAH, DRAGON PHOENIX, MOON DEER RING LION, RODA TERBANG, STAR ELEPHANT	Bioallethrin
		FLYING SWAN	Mosthrin
8.	P.T. Kuda Raya	KUDA,NANAS,ZEBRA	

9.	P.T. Perindoni	MOSFLY,KODOK MOON LION GOOSE DUCK	Bioallethrin Mosthrin F Mosthrin
10.	P.T. Supra Tusaman Abadi & Co.	BADAK BELALANG,ROBIN BALON, KERETA API	Bioallethrin Bioallethrin-S Allethrin
11.	Singapore Mosquito Inc. Coil	BUMI GAJAH,HERO, KIPAS,LION,SUPER	Bioallethrin
12.	P.T. Samdi Arta Sakti	NURI, ORYX	
13.	P.T. Sinar Platago	BAYGON	Propoxur/ Fenflutrin
14.	P.T. Trisa Nila Industry	KAPTEN	Mosthrin
15.	PT Walet Kencana	MOON RABIT, PERKUTUT TANI, POLAR BEAR	
16.	Surya Dharma	PERAHU	

V Insect Repellents

1.	PT Bayer Indonesia	AUTAN Lotion AUTAN Spray AUTAN Tissue AUTAN Gel	Diethyl Toluamide
2.	PT Colgate Palmolive	RECKITT Bite Free Lotion	
3.	PT S.C. Johnson & Son	OFF Aerosol OFF Cair	
4.	PT Jopurin	SAKTI Tissue	
5.	PT Obor Mas Djaya	ANTELOPE Tissue '	
6.	PT Eglin Pharma	PERISA SAKTI	
7.	PT Herlina Indah Cosmetics	SARI PUSPA Lotion	

APPENDIX IV

RECOMMENDED LIST OF EQUIPMENTS FOR NPDC

1. Analytical laboratory unit

		Suggested Source	Cost ($)
i)	Mechanical, analytical balance	Mettler/Sartorius	3,000
ii)	Microbalance	Mettler/Sartorius	6,000
iii)	Gas-liquid chromatograph with FID and FPD detectors	Perkin-Elmer/ Hewlett-Packard	45,000
iv)	High Pressure liquid chromatograph	Waters	50,000
v)	FT Infrared spectrophotometer	Perkin-Elmer	25,000
vi)	UV-Visible spectrophotometer	Carry/Beckman	20,000
vii)	Memo-titrator	Mettler	7,500
viii)	TLC equipment		5,000
ix)	Medium Pressure liquid chromatograph	Buchi	6,500
x)	Hydrogen and Nitrogen generators	Chrompack	15,000
xi)	Top loading deep freeze cabinet	Heraeus-Votsch	12,000
xii)	Oven		3,000
xiii)	Ultra-sonic bath	Sonorex	1,500
xiv)	Cryostat	Haake	3,000
xv)	Rotary evaporator	Büchi	6,000
			208,000

2. Formulation Development Laboratory Unit

		Suggested Source	Cost ($)
1)	Ploughshare mixer (Lodige type, lab. model)	Gebruder	5,000
ii)	High sheer homogenizer (Silverson type, lab. model)	Silverson	2,000
iii)	Terbula shaker mixer	Willy A. Bechofen	1,000
iv)	Dynomill (laboratory model)	Willy A. Bechofen	10,000
v)	Fluidized bed granulator (laboratory model)	Aeromatic	14,000
vi)	Erweka multi-purpose processor with motor drive and universal gearing and attachments a) coating pan, b) palletizer, c) ribbon blender and d) extruder	Erweka	7,000
vii)	Mini-spray dryer with compressor	Buchi	15,000
viii)	Hammer mill	Condux	3,500
ix)	Universal mill	Alpine	10,000
x)	Micronizer (4") (horizontal type with air compressor)	Sturtevant	8,000

xi)	Mini motor mill	Eiger	8,000
xii)	Particle size analyser with small sample adopter	Malvern	60,000
xiii)	Tropic climate tester	Heraeus	25,000
xv)	Biological microscope with manual photographic attachment	Olympus	3,000
xv)	Laboratory sample divider with feeding devise	Retsch	2,000
xvi)	Surface Tensiometer	Kruss	1,000
xvii)	Synchro-lectric viscometer (U-speed) with small sample adopter	Brookfield	2,000
xviii)	Flash Point Apparatus (open cup and close cup)		3,000
xix)	Cryostat	Haake	3,000
xx)	Electronic top pan balance (5 kgm)	Mettler	2,500
			185,000

3. Pilot Plant Unit

i)	Fluid energy mill (8") with air compressor	Microjet	25,000
ii)	Dynomill with product pump, grinding elements and accessories	Willy A. Bechofen	30,000
iii)	Silverson agitator/pump concentrate mixer	Silverson	5,000
iv)	Fluidized bed granulator with air compressor	Aeromatic	60,000
v)	Lodige mixer with variable speed drive and jacketted mixing drum for temp. control	Gebruder	15,000
vi)	Pumps, motors, other minor accessories		5,000
			140,000

4.	Safety and Effluent Control Laboratory Unit	
i)	Dust concentration and explosion limit tester	3,000
ii)	Vapour concentration and flash point meter	5,000
iii)	Portable gas concentration level detection equipment	5,000
iv)	Anaerobic biological treatment system (1 300 lit/hr)	15,000
v)	Rotary kiln type waste incinerator (intended for test incineration)	25,000
vi)	Personnel safety gadgets	10,000
vii)	Industrial sweeping and scrubbing equipments	5,000
viii)	Activated carbon cartridges for outgoing effluent scrubbing	2,000
		70,000
	Total	653,000

Office Equipment and Training Aids

1.	Electronic typewriter	Panasonic/ Brother/Canon	1,000
2.	Photocopier with reduction and enlargement facility	Reico/Xerox	3,000
3.	Slide projector	Kodak	1,000
4.	High illumination overhead projector and laser pointer		2,000
5.	Conference audio system with 29 2-way microphone/ speakers and a chairman unit and hand microphone	Philips	10,000
6.	Video recording camera, TV and VCR system	Sony/National	5,000
7.	Computer with laser printer, graphics and software to operate as DTP system	IBM/Olivetti	15,000
			37,000
	Total		690,000

APPENDIX V

List of Indonesian Industrial Standards (SII) for Pesticides

1.	Brodifacoum technical		- 1989
2.	Paraquat technical		- 1989
3.	Carbofuran granule)		- 1988
4.	Chlorpyriphos EC) Formulation Standards		- 1988
5.	MIPC WP)		- 1988
6.	BPMC EC)		- 1987
7.	Methods of test physico-chemical formulation pesticides EC	2113	- 1987
8.	Methods of test physico-chemical formulation pesticide WP	2109	- 1987
9.	Methods of test physico-chemicl formulation pesticide D	2111	- 1987
10.	Methods of test physico-chemical formulation pesticide G	2110	- 1987
11.	Methods of test physico-chemical formulation pesticide WSC	2114	- 1987
12.	Methods of test physico-chemical formulation pesticide OC	2112	- 1987
13.	Monocrotophos technical	2120	- 1987
14.	Endosulfan technical	2116	- 1987
15.	Fenitrothion technical	1668	- 1985
16.	Fenthion technical	1669	- 1985
17.	Carbofuran technical	1670	- 1985
18.	Phenthoate technical	1884	- 1986
19.	Bioallethrin technical	1416	- 1985
20.	Permethrin technical	1885	- 1986
21.	Cypermethrin technical	1886	- 1986
22.	Coils insecticide	1113	- 1984
23.	BPMC technical	1165	- 1984
24.	MIPC technical	1164	- 1984
25.	Diazinon technical	0840	- 1983
26.	$CuSO_4$ technical	1173	- 1984
27.	Maneb technical	0424	- 1981
28.	Carbaryl technical	0513	- 1981
29.	2,4-D technical	0423	- 1981
30.	Dalapon technical	0343	- 1980
31.	Dalapon Salt	0428	- 1981

Appendix VI

LIST OF MEMBERS OF PESTICIDE COMMITTEE

I. Chairman and also member : Dr Ir M Satta Wigensantana
Director, Food Crop Protection, Directorate General of Food Crops, Department of Agriculture.

II. Vice Chairman and also member : Drs H Abdullah Nawawi R. SKM
Directorate General for Drugs and Food Control, Department of Health

III. Secretary and also member : Mulyani Soekardi
Directorate Food Crop Protection Directorate General of Food Crops, Department of Agriculture.

IV. Members

1. Dr Ir S Wardoyo
Agricultural Research and Development Agency , Department of Agriculture.

2. Dr Ir Soepadiyo Mangoensoekarjo
Indonesian Research and Development of Estate Crops Association

3. Ir B Soepadmo
Indonesian Research and Development of Estate Crops Association

4. Dr Ir J Soejitno
Agricultural Research and Development Agency , Department of Agriculture.

5. Dr DM Tantera
Agricultural Research and Development Agency , Department of Agriculture.

6. drh Ng Ginting
Agricultural Research and Development Agency , Department of Agriculture.

7. drh Syamsul Bahri Siregar
Directorate General of Husbandry, Department of Agriculture.

8. Dr Atmadja Hardjamulia MS
   Agricultural Research and Development Agency , Department of Agriculture.

9. Dr Ir M Suhardjan
   Directorate General of Estates, Department of Agriculture.

10. Suyadi P SH
    Legal and Organization Bureau, Department of Agriculture

11. Drs Janahar Murad
    Health Research and Development Agency, Department of Health

12. Dr Soesilo Soeryosembodo
    Directorate General Prevention and Habitation Health Care, Department of Health

13. dr Sofyan Mukti MSc
    Directorate General Prevention and Habitation Health Care, Department of Health

14. dr Soekarno
    Directorate General of Man Power Control, Department of Man Power Affair

15. Nabiel Makarim MPA. MSM
    State Minister for Population and Environment Office

16. Dr Ir Nana Supriana MSc
    Research and Development of Forestry Product Agency, Department of Forestry

Appendix VII

LIST OF MEMBERS OF PLANT PROTECTION COMMITTEE

I. Chairman and also member : Dr Ir Kasumbogo Untung
Lecturer of Entomology, Faculty of Agriculture, University of Gadjah Mada

II. Vice Chairman and also member : Prof Dr Ir Soemartono Sosromarsono
Lecturer of Entomology, Faculty of Agriculture, Bogor Agriculture University.

III. Secretary, not a member : Head of Sub Directorate Monitoring and Prediction, Directorate of Food Crops Protection

IV. Members

1. Ir Tb Suhaedi Wiriaatmadja
Assistant III of Ministry Coordinator for Economic, Financial and Industrial Affairs and for The Supervision of Development

2. Prof Dr Triharso
Lecturer of Plant Pathology, Faculty of Agriculture, University of Gadjah Mada

3. Ir A Hidir Satraatmadja
Lecturer of Plant Pathology, Faculty of Agriculture, Bogor Agriculture University.

4. Dr Ir Ida Nyoman Oka
Expert of Entomology, Senior Researcher for Food Crops Research Station of Bogor.

5. Dr Ir Dewa Made Tantera
Expert of Plant Pathology, Researcher for Food Crops Research Station of Bogor.

6. Dr Ir Sidarto Wardojo
Expert of Entomology, Researcher for Estate Research Station of Bogor

7. Dr Ir Soepadyo Mangoensoekaryo
Expert of Weed Researcher for Estate Research Station of Medan

8. Dr Zaenudin Harahap
   Expert of Plant Breeding, Researcher for Food Crops, Research Station of Bogor.

9. Dr Ir Sadji Partoatmodjo
   Expert of Entomology, Expert for Research and Development of Agriculture Agency

10. Prof Dr Ir Jafarudin
    Lecturer of Plant Pathology, Faculty of Agriculture, University of Andalas

11. Ir Dwidja Putera
    Lecturer of Plant Pathology, Faculty of Agriculture, University of Udayana

12. Dr Ir Djiman Sitepu
    Expert of Plant Pathology, Reseacher for Herb and Medicine Plant Research Station of Bogor.

Appendix VIII

UNIDO'S SUBSTANTIVE COMMENTS

DP/INS/89/015

NATIONAL PESTICIDE DEVELOPMENT CENTRE

Technical report of Mr. Sushil K. Khetan

Introduction

At the request of the Government of Indonesia, UNIDO assigned two consultants, one on pesticide formulation and another one on effluent control. The report deals with the pesticide formulation aspects only.

Comments

Pesticide formulation technology has been changing rapidly and the aim of the producers are to make it safer and more effective. Countries like Indonesia has a good infrastructure for the manufacture of active ingredients and formulation. However, the industry very much uses standard formulation technology and the country has no expertise to assist the industry to adapt to the new technologies and also in increasing local inputs (raw materials).

The recommendations of the report clearly advocate establishment of an integrated national pesticide development centre to cater to the needs of the pesticide industry to introduce newer and safer formulation and also in waste management which would ultimately benefit the end user.

Based on the report UNIDO has submitted a project document for the establishment of a National Pesticide Development Centre in Indonesia.