OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

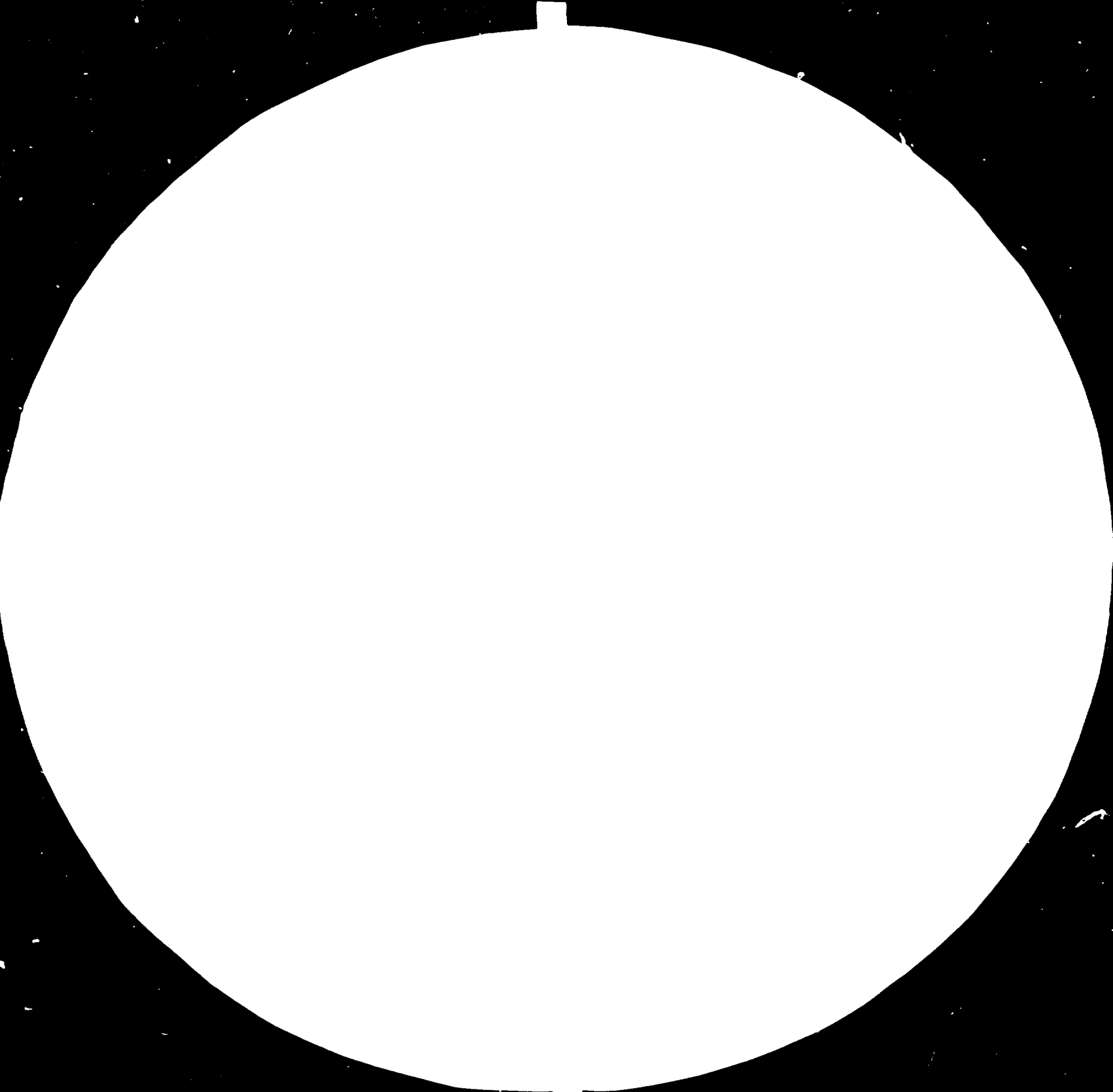
FAIR USE POLICY

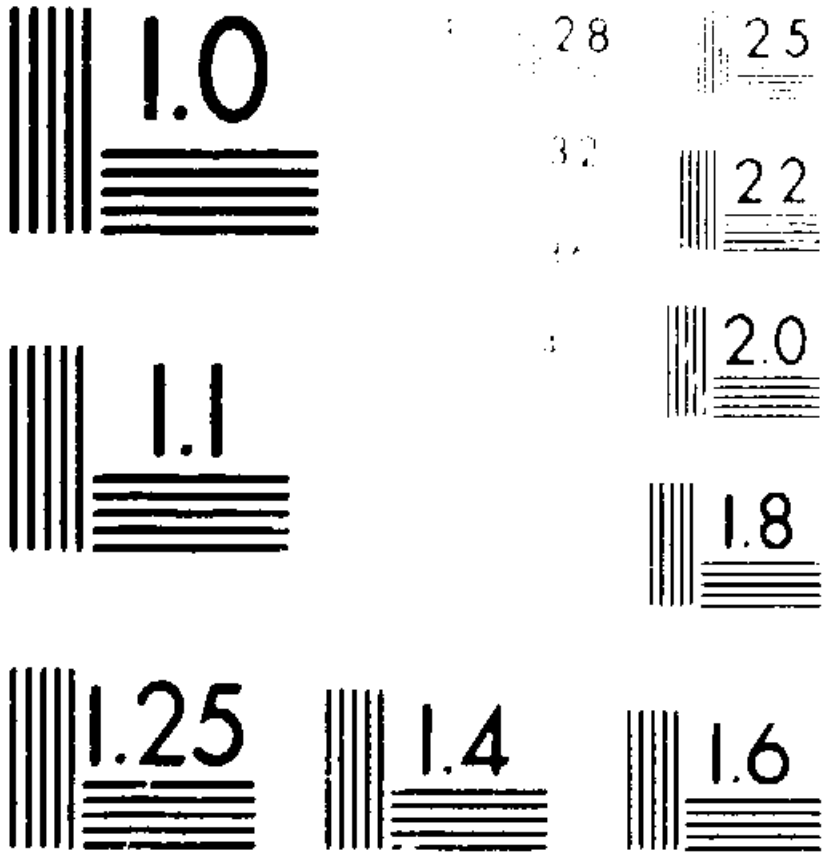
CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

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

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org





RESTRICTED

13908

DP/ID/SER.B/ 468
18 July 1984
English

Burma.

ESTABLISHMENT OF A PILOT PLANT FOR PESTICIDE FORMULATION

DP/BUR/80/011

BURMA

Terminal report*

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

Based on the work of I. Bendefy,
Consultant in Design of Pesticide Formulation Plants

United Nations Industrial Development Organization
Vienna

*This document has been reproduced without formal editing

V.84-88509

EXPLANATORY NOTES

For the purpose of this report, the general term "pests" includes any form of plant or animal life or any pathogenic agent, injurious or potentially injurious to plants or plant products, livestock or man. In addition to insects and other arthropods this definition therefore applies to small vertebrates, nematodes, weeds and plant diseases. Likewise, the term "pesticide" is used generally to include insecticides, fungicides, acaricides, herbicides, molluscicides, rodenticides and other compounds for the control of pests.

Reference to "gallons" indicated Imperial Gallons = 4.546 lit.
Reference to "tons" indicates metric tons
Reference to "mesh" indicates U.S. Standard Sieve Apertures

The monetary unit of Burma is the Kyat (K).
The operational rate of exchange for the United Nations programmes was during the period of the mission -

US$ 1 = K 8.10

Abbreviations used :

P.I.C.	Pharmaceutical Industries Corporation
EC	emulsifiable concentrate
G	granules
DP	dust powder
DC	dust concentrate
WP	wettable powder
ULV	ultra low volume
HYV	high yield variety
a.i.	active ingredient
KW	kilowatt
B.T.U.	British Thermal Unit
s/s	stainless steel
m/s	mild steel

Mention of firm names and commercial products does not imply endorsement by the United Nations Industrial Development Organization (UNIDO)
Apparent arithmetical discrepancies in tables are due to roundings of the basic data.

I. SUMMARY

Project title : Establishment of a Pilot Plant for Pesticides Formulation

Number : BUR/80/011/A/01/37

Purpose : to acquire the experience necessary for the planning and operation of full scale commercial production based on the utilization of locally available diluents, to provide training to technical staff and labour, to promote development of associated industries such as mineral mining and processing, to contribute to coverage of increasing demand for pesticides by selling the pilot products in support of both the agricultural and health sectors.

Duration of the mission in the field : 26 October 1983 - 17 January 1984

Objectives of the mission were to elaborate requirements in physical facilities and costs, revise process flow and layout of the plant, prepare tender specifications suiting the capacities given in the project document, and assist in establishing the organizational requirements of the proposed enterprise.

Additionally the consultant was expected to suggest training programme for the fellows selected and provide a list of books and periodicals to be ordered for the project.

The present study gives an analysis of the pesticide market, evaluation of raw material situation, recommends suitable facilities to meet the capacities set forth in the project document and recommends actions to be made in order to the project be implemented according to the planned schedule.

ACKNOWLEDGEMENT

The consultant wishes to acknowledge the whole-hearted cooperation extended by the management and the staff of the Pharmaceutical Industries Corporation as well as by all the Government officials and organizations in Burma who collaborated in different activities and assisted the consultant in the work.

Particular mention is made of the efficient help of the five man team of counterparts nominated by P.I.C. and headed by U Win Kyi, National Project Director. U Saw Myint, Director of Planning, P.I.C. showed great interest to the progress of the work and was always ready for consultation and efficient help.

Mr. Jerzy B. Gorski, SIDFA, followed the project with continuous attention, provided necessary facilities and help, together with the whole UNDP staff.

Mr. T.J. Crowe, Dr. C.E. Rendell and Mr. J.W. Edmunds of FAO provided quick and efficient assistance and information during the whole project.

The Architecture Group II of Construction Corporation contributed with support in developing the layout and basic design of the plant.

Thanks are due to Mr. K. Szabo and Mr. Myint Maung, UNIDO, Vienna, giving all the necessary orientation and guidance to promote the project.

Marguerite Valerie assisted the project by excellent secretarial service.

TABLE OF CONTENTS

ANNEXES

FIGURES

II. INTRODUCTION

A. History and background of the project

The pesticides pilot formulation plant project has been prepared by UNIDO in cooperation with the Government of Burma over a period of approx. three years. It is based on a sound background following a natural development trend in which demand for pesticides reached a sizeable level. The project document was finally approved by UNDP on 5 April 1983 and thus financing of the foreign currency component of US$ 958,000 has been assured under IPF of the country programme of UNDP.

For the purpose of the execution of this project and the future operation of the pesticide pilot formulation, training and demonstration plant the Pharmaceutical Industries Corporation (P.I.C) has been designated as Government Implementing Agency.

April 1983 has been set forth in the Project Document as tentative start of the activities. Since that time the following progress has been made till the end of October :

- The Government has nominated the National Project Director and assigned a full time project manager who has been given the task of carrying out the necessary project activities which are incumbent on P.I.C.
- Six further members of P.I.C. staff assigned to the project have been selected including the Head of Quality Control, Maintenance Engineer, Head of Biological Quality Control and three Production Superintendents.
- P.I.C. started to collect basic information about
  a) agricultural production, cultivated crops,
  b) pests damaging the cultivated crops,
  c) pesticides imported in recent years both for agricultural and public health uses,
  d) locally available raw materials,

all needed both by the consultant and for the preparation of the Technical and Economic report of P.I.C.

- A suitable site for the project has been selected and approved by the Government.

At the end of June 1983 UNIDO designated Mr. S.R. Panfil, Senior Interregional Adviser for a short mission to overlook the progress of project activities.* While reviewing the subject with officials of P.I.C. it was cleared that the project document does not handle the detailed engineering design of the plant under "Activities" separately and no cost of subcontracting this job to a qualified engineering contractor has been included in the project budget of UNDP contributions.

B. Activities during the mission

According to the provisions of the Project Document (18.(i)/b) UNIDO hired Mr. I. Bendefy as Consultant in Design of Pesticide Formulation Plants to carry out a survey on the subject.

I. Bendefy served in Burma from 26 October 1983 to January 1984.

His terms of responsibility were to :

- Assist in establishing the organizational requirements of the proposed enterprise in the area of (technical) management, labour, quality control and product development.
- Elaborate requirements in physical facilities and costs, showing foreign exchange and local currency components for land, plant, machinery and equipment including technology, utilities, and transportation.
- Revise process flow and layout for the plant, as necessary.
- Prepare tender specifications in technical and contractual terms on equipment (and its installation).

Additionally he was requested to

- Assist in establishing efficient training programme for the fellows selected.
- Assist in selecting appropriate bibliography for the project for both reference and training purposes.

P.I.C. assigned five of the selected staff : U Win Kyi, U Myint Swe, U Aung Mir U Nyo Lay and U Mon Tin Win as full time counterparts . Headquarters were in Rangoon, office and secretarial service provided by P.I.C.

---

* See : Internal Report on Project Implementation Mission, S.R. Panfil, 26 July 1983

The work started by reviewing the pesticide demand using the data collected by the counterpart team and in consultation with FAO. The revision confirmed the capacities set forth in the Project Document for the three formulation lines as sound basis for the planning of the project. WHO and Health Department were consulted both on pesticide consumption for public health and health service within the plant. Health Department official stated that personnel and service will be provided by Health Department.

Mining Corporation 3 was consulted upon availability of mineral raw materials and it became clear that the minerals to be used are not readily available in the wanted ground state. Therefore additional equipment was included into the plant at an estimated nett expense of about 50,000 US$. Milled samples collection was initiated but neither time nor facilities were sufficiently available to conduct detailed investigations/evaluations.

It could be stated that the laboratory should be ready to start working about one year before the trial runs in order to gain time for the elaboration of the local receipts for formulations. For this reason the construction of the laboratory building and purchases of the laboratory equipment should be given high priority.

It was agreed with P.I.C. that subcontracting will cover the following activities only : detailed engineering design and supply of production facilities. Items needed as imported components of the project not forming part of the production facilities (e.g. transformer, forklift truck, laboratory equipment etc.) should be purchased by UNIDO on a piecemeal basis. The laboratory will be installed by P.I.C. using the equipment provided by UNIDO.

The layout of the plant with basic number and functions of the buildings, the general orientation and location at the site were agreed upon to set a basis for the design of buildings and civil works. Basic design of production buildings was developed to be provided for subcontractors for check, whether the equipment to be delivered would fit into the buildings.

According to a work plan all the terms of responsibility could be met during the mission.

C. Recommendations

All the necessary activities needed for the implementation of the project are scheduled in the Activities Bar Chart. In addition to those listed in the Chart it is recommended that

- in preparation for the formulation laboratory work P.I.C. should establish and maintain technical/scientific contacts with possible suppliers of imported materials in order to collect knowledge and information about the products to be formulated;
- the director of the Pilot Plant for Pesticide Formulation should be delegated to the Plant Protection Coordinating Committee in order to maintain proper coordination and information between industry and agriculture;
- possibilities of local training should be exploited by P.I.C. at maximum level;
- evaluation of the local raw materials by the project team should continue with eventual further UNIDO or overseas supplier's assistance - as it might be requested;
- Mining Corporation 3 should apply for UNIDO assistance in order to modernize and extend their facilities for the upgrading of various minerals;
- the subcontractor should receive the following parts of the report :

  VI. Project engineering

  Annex XVII. Tender specifications
- in the case the provision of additional funds takes time, subcontracting and ordering of the following elements should not be delayed by any means :
  1) Import components of local contribution
  2) Laboratory equipment
  3) General equipment
  4) Liquid formulation unit

  These elements will certainly be covered by the present funds
- Gas chromatograph and Spectrophotometer should be purchased from Perkin-Elmer Co. because of three reasons :
  1) FAO laboratory uses the same apparatus and thus determinations will have comparable results and cooperation will be made possible
  2) Perkin-Elmer apparatuses are quite numerous in Burma (see Annex XVI), that means that local training will be possible prior to installation of the equipment
  3) The supplier provides regular service for the equipment, which is essential.

III. MARKET AND PLANT CAPACITY

A. Features of the market

The pesticide market in Burma consists of two components :

- pesticides for agricultural use,
- pesticides for the use in public health sector.

Agricultural pesticides are imported by two companies :

- Agriculture Corporation, and
- Agriculture & Farm Produces Trade Corporation.

The former company has store capacities in all states and divisions of the country and the distribution for the farmers takes place through this network. The second company handles agricultural produces and uses the pesticides for stores' desinfection and to control stores grains' pests.

The pesticides for the public health sector are imported by the Health Department. These products are not distributed, but applied by teams consisting of well trained personnel in the frame of vector control programmes.

The area under cultivated crops is around 25.4 mill. acres (Annex II). The main efforts of the Plant Protection Department are concentrated on paddy and cotton (Annex III) because of the half of the arable land being occupied by paddy and because of the high rate of damage being potentially caused by cotton pests. The next most protection is provided for groundnuts and pulses, but other crops have also numerous insect pests (Annex IV), which may cause considerable losses under favourable conditions for them.

B. Review of the formulation capacities

Data about the imported quantities of pesticides were available covering a period of the past 9 years 1974-83. The analyses of the data confirmed that the capacity for each formulation type set forth in the project document is matching with the demands forseen for the time when the project will start to operate (Annexes V and VI). These capacities and the resulting production is shown in the table below :

Formulation type	Capacity	Production/year
Liquid formulations	1000 Gal/day	10,80,000 lit (240 days)
Dust powder formulations	3 ton/day	480 ton (60 days)
Wettable powder formulations	2 ton/day	360 ton (180 days)
Granular formulations	1 ton/day	240 ton (240 days)

Comparison to market potentials proves that as soon as other factors, such as broader introduction of HYV, availability of sufficient application machinery, further development in the extension service will improve over the present state, even extension of the facilities might be necessary.

C. Possibilities of future development

The work of the new formulation plant should start in the laboratory by development of the local formulation receipts for the range of products planned for the start.

The initial product range has been composed of the most safe to handle pesticides in demand and oriented mainly for the treatment of paddy and cotton as well as the needs of disease vector control programmes. As soon as the personnel of the plant has full control of the facilities and gathered sufficient experience in the formulation techniques as well as the development of new formulations, the extension of the product range should be initiated in the following areas :

- new products to control the damageing pests in further crops, such as pulses, groundnuts, sesammum etc.
- production of specialities, such as acaricides, miticides, as justified by the market research,
- development of combined products to achieve higher efficiency or broaden the range of activity e.g. DDT + carbaryl 1:1 against cotton insects, DDT + lindane 10:1 to combine residual and knockdown effect etc.
- development of products for seed-grain protection with eventual inclusion of fungicides,
- development of products for household use,
- development of higher efficiency but higher toxicity new products,
- development of products for veterinary use, as justified,
- utilizing the packaging facilities for bottling/packing of products imported bulk, but needed in small packages,
- development of fertilizer/soil insecticide compositions, such as phosphate fertilizer containing 1-2% lindane or aldrin

Active substances believed to be suitable for such development work are listed in Annex VII with short characterization and with addresses of suppliers in Annex VIII.

IV. MATERIALS AND INPUTS

A pesticide formulation is a physical mixture of one or more biologically active chemicals with inert ingredients which provides effective control of pests. The functional properties and characteristics of the materials to be used will not be treated hereunder being described in detail in UNIDO publication ID/75 : Industrial Production and Formulation of Pesticides in Developing Countries, Vol. I. p 75-122.

A. Active Materials

All the active technical materials must be imported. Most of those suggested for local formulation are available from more than one producer. At the decision beside one or another supplier factors like quality, price and offered technical assistance should be considered. It is recommended to contact producers of international reputation and request their assistance in developing the local formula and even in training the personnel of the plant and the laboratory. The basic information needed for the individual active substances is as follows :

- Chemical/physical/toxicological properties
- Analytical method (suitable for the existing facilities) both for the active and the formulated product, including quick tests for production control
- Guidelines for the formulation
- Safety recommendations for the formulation and use
- Recommendations for the agricultural/public health use

List of active substances recommended for production at the beginning are included in Annex VI.

Possible suppliers are listed in Annex VIII.

B. Solvents

Some of the active materials are readily soluble in petroleum solvents, others are soluble only in aromatic or mixed solvents. Xylene was used for the planning but other high power solvents, such as cyclo-hexanone, isobutanol or i-amylalcohol might also be necessary to be imported. Petroleum products are readily and in the quantity needed available, being produced locally by Petrochemicals Industries Corporation.

Four samples have been collected during the project showing the following characteristics :

S.N.	Characteristics	Superior kerosene	Naphta	SBP 62/82	SBP 80/135
1.	Specific gravity	0.820-0.8279	0.7562	0.71	0.73
2.	I.B.P. °C			62	80
3.	F.B.P. °C	300	205	82	135
4.	Flash point °F	80/116			
5.	Aromatic content			7% $^{v}/_{v}$	8% $^{v}/_{v}$
6.	Acidity	Almost nil	almost nil	almost nil	almost nil

Petrochemicals J.C. reportedly said it is possible to obtain a fraction with aromatic content of 18% as well.

C. Minerals

Mining Corporation No. 3 produces in its mines - mainly in upper Burma - the following minerals, which might be considered as carriers : Talc I grade, Talc II grade, Bentonite, Industrial Clay, Fireclay, Kaolin, Limestone,

Talc

Talc I deposit is very limited, while Talc II is plenty. Milling facilities are available in Rangoon, but the capacity is covered by actual demands. Meeting the additional demands of the Pesticide Plant would need extension of the milling facilities.

It was agreed that 3-5 kg milled sample will be provided for testing.

Bentonite

Deposit is abundant, but the milling capacity, which is available at the mine only, also needs extension for the new demands. It was agreed that 3-5 kg milled sample will be provided for testing at the mine (it should be collected by P.I.C).

Clays, Kaolin

There is no milling capacity at all for the milling of clays or kaolin. One of the clay deposits is close to the plant site.

It could be agreed that 3-5 kg of milled samples will be provided of each mineral for testing.

Limestone

Crushed and sieved limestone granules would be a good alternative for granular carrier instead of sand just under evaluation, which seems to be too much fine for the purpose. Mining Corporation No. 3 processes 60,000 t/y limestone to produce 40,000 t/y crushed stone selected beyond 20 mm size. The passing fraction should be (further crushed and) further selected to extract the necessary fraction of 0.8 to 1.0 mm, 230 t/y.

It was agreed that Mining Corporation will determine the particle size distribution of the 0-20 mm fraction and will provide 2-3 kg sample of the requested 0.8 - 1.0 mm fraction.

It was suggested that Mining Corporation 3 should approach UNIDO for assistance in surveying and extending the upgrading facilities in order to meet new demands, combined also the kaolin demands of the Pulp and Paper Industry. Mining Corporation No. 3 would prefer the extension of the milling facilities in Rangoon, where they would have the possibility to mill the products of any mine according to actual demands. It was discussed that an air selection could substantially decrease the SiO_2 content of the minerals, which is present in all of the discussed samples in a relatively high ratio and has a disadvantage for any end use

Sand

River sand has been suggested as possible carrier for granules. The particle size of the sand is very low, about 50% is between 420 and 590 microns and about 15% is between 590 and 710 microns. The suitability of these fractions should be checked in advance in cooperation with someone of the diazinon active substance supplier companies.

It is foreseen, that the testing of the minerals cannot be completed during the project; this should be made further by similar and/or UNIDO assistance.

Four samples were available during the project around the particle size wanted. Some characteristics were determined; methods for the evaluation are given in Appendix XII, and results shown below :

S.N.	Characteristic	Bentonite	Talc	Industrial Clay	Sand
1.	Surface acidity	-	-	-	-
2.	pH value of 1% suspension	8.9	6.9	5.7	8.5
3.	Moisture %	14.9	0.1	1.0	4.5
4.	Hygroscopicity %	21.5	0.2	1.8	0.5
5.	* Absorption capacity %	18.4	-	44.0	-
6.	Grindability	-	-	-	-
7.	Particle size microns	around 149	around 74	around 74	590 to 710
8.	Bulk density	0.786	0.576	0.650	1.301
9.	Flowability	-	-	-	-
10.	Abrasiveness				

* Determined by local light diesel oil, spec. grav: 0.862/25°C

D. Emulsifiers

Emulsifiers are key components to produce emulsifiable concentrates and wettable powders with good emulsion/suspension-stability properties. Companies producing emulsifiers since long time and having gathered broad experience in this territory, such as HENKEL (Belgium), ATLAS (Belgium) and HOECHST (FRG) are specialized to produce emulsifiers for the formulation of pesticides and they are ready to assist in developing new formulations. They also have publications with special recommendations upon the selection of the proper emulsifier to match the other components within the formula and even they offer typical receipts for the formulation of the most common pesticide commodities.

The emulsifiers of various chemical composition are grouped into three groups i.e. type of anionic-, cationic- and nonionic character. Practically mixtures of different characters are mostly offered. The selection of the optimal mixture needs much experience and is possible only after all the other components (i.e active substance(s), solvent(s), eventual stabilizer) are known. During the project contacts were established to all the three mentioned companies and information was collected.

E. Stabilizers/deactivators

Many organic active materials are sensitives against several factors such as moisture content of the solvent or the mineral carrier, acidity or even alcalinity. Such properties may cause incompatibility with the active material. In most of these cases application of desactivaters is recommended. Organic chemicals such as ethylene glycol, diethylene glycol, triethylene glycol, diacetone alcohol, isopropanol, urea, hexamethylenetetramine (HMT), monoethanolamine and combinations of glycols with sodium hydroxide have been found to have some value in "neutralizing" the active sites on carrier surfaces. In selecting of the appropriate desactivator/stabilizer for each carrier or solvent and the quantity to be used should be made with advice of the company supplying the active substance and careful study of the stability of the formulated pesticide should support the proper selection.

F. Colouring agent

In the case of strong poisons and considering farmers not very familiar with chemicals it is recommended to apply warning colors when formulating liquid pesticides to provide a striking difference between pesticide product and consumer goods/beverages. Colours such as methylene-blue or methyl-red might be chosen according to their solubility in the solvent involved.

G. Synthetic Silica Powder

This product has a very high sorptive capacity as main characteristic feature due to its fine particle size and great specific surface as well as porous structure. It is used at the production of coated granules to provide free flowing characteristics to the granular formulation and prevent sticking the particles together. At the production of wettable powders the aim of its use is to improve grindability of the primary mixture and the same time improve spontaneous wettability of the product.

E. Packing Materials

The typical unit of the Burmese agriculture is the small farm which is normally not larger than half an acre. Therefore it is desirable to plan the output of the formulation plant in bag sizes close to the quantity needed for one treatment of this area. In this case

- farmers will not be compelled to buy excess quantity over their actual needs,
- excess quantities will not be stored for long at users under little control and causing eventual contamination of the environment or deteriorating fail to perform when applied,
- district centres will not need to cover small demands by dividing big packages and through this cause spillage and contamination.

Liquid pesticides should be packed in half - and one lit. bottles. As neither glass nor plastic bottles are available in Burma, production of the bottles should take place in the plant. The bottles should be re-closable after partial use. The necessary quantity for full capacity and 1 lit bottles is 1.08 mill pieces/year. Preferred is such type of bottling machine which produces the bottles from plastic granules and without intermediate storage produces ready filled sealed bottles.

Granular pesticides should be packed in 5 kg bags with eventual potential to extend the range from 1 to 10 kg. Multiply paper bags are produced in the cement factory but in size of 50 kg net capacity only and no constant availability is confirmed either. Plastic bags of sufficient mechanical strength are suitable for the purpose, they must be produced locally in the formulation plant. Preferred is such type of packing machine which can be fed by polythene sheet or tube, produces bags by welding and fills them. Polythene sheets of 0.05 to 0.1 mm thickness are available within P.I.C. in rolls, range of lay flat width : 100 to 1000 mm.

Dust powders should be packed in one kg bags with option to fill from 0.1 to 5 kg. The small 0.1 kg bags might be needed in case of household insecticide powders in the future. The availability of packing materials has been described above; the same type packing machine is recommended as for the granules.

Wettable powders will be packed on the same line. Bag size is foreseen at 5kg.

Collective packing for the bottles is foreseen in form of wooden boxes. 3x4, 4x4 or 3x5 of 1 lit. bottles and 4x5 or 5x6 of 0.5 lit. bottles can be put in one box. A yearly turnover of 70 to 90,000 boxes can be foreseen.

The boxes must be reusable and bear striking marks of being used to house poisonous and inflammable material.

Cement type bags are recommended for collective packing of granular and powder pesticides' plastic bags carrying 10 to 25 kg. Closure of the bags is recommended by a stiching machine.

Labels can be printed locally. Polythene sheets must be pre-printed before use.

J. Stores capacity

The Annex VI shows the product list selected for the start of the production as well as for base of planning. In order to plan the stores capacity, the following typical compositions were developed, showing per cent components for liquids :

S.N.	Raw Material	Fenitrothion 50 EC	Fenitrothion 50 ULV	Phenthoate 50 EC	Phenthoate 50 ULV	Thiometon 25 EC	Endosulfan 35 EC	Cypermethrin 10 EC
1.	Fenitrothion	50	50					
2.	Phenthoate			50	50			
3.	Thiometon					25		
4.	Endosulfan						35	
5.	Cypermethrin							10
6.	Local solvent	20		20		50	38	81
7.	Xylene	22		22		19	20	
8.	Emulsifier	8		8		6	7	9
9.	White Oil		45		45			
10.	Special additive		5		5			
		100	100	100	100	100	100	100

for solid products :

S.N.	Raw material	Diazinon 5G	Temephos 5G	DDT 50 WP	BHC 26 DP
1.	Diazinon	5			
2.	Temephos		5		
3.	DDT			50	
4.	BHC				26
5.	Sand	91	90		
6.	Silica	4	5	4	
7.	Bentonite			40	
8.	Wetting agent			6	
9.	Talc				74
		100	100	100	100

Combining the developed "typical compositions" with the annual production programme yearly purchase plan was sonstructed for the raw materials (Annex. IX, X). The necessary store capacities were calculated in the following steps:

- required quantity for one year
- time to be covered by standby stock
- quantity to be stored
- quantity stored per sq. meter
- required net surface sq. meter
- required store-surface sq. m

Details of the calculation are shown in Annex XI.

The resulting storage plan is as follows :

S.N.	Stored material	Required store surface	Planned store
1.	Technical active substance	208 m^2	A) 400 m^2 closed store
2.	Auxiliary materials	28 m^2	
3.	Silica powder	21 m^2	
4.	Packing material	39 m^2	
5.	Formulated liquid	71 m^2	B) 200 m^2 closed store
6.	Formulated solid	117 m^2	
7.	Xylene	32 m^2	C) 100 m^2 open store
8.	White oil	7 m^2	
9.	Granular carrier	24 m^2	50 m^2 open store *

S.N.	Stored Material	Required store surface	Planned store
10.	Bentonite	31 m^2	100 m^2 open store *
11.	Talc	36 m^2	
12.	Local solvent	24 m^3	D) 3 x 10 m^3 tank

* joined to the production building

J. Utilities

Electric power

The supply of the electric power is foreseen from the national network. Requirement : 3 phase, 50 cycles, 220/400 V. Built in capacity of electric motors and appliances is estimated as below :

Unit	KW built in	Estimated max. parallel load
Liquid	20	14
Granular	35	31
Powder	80	76
Upgrading	40	37
Others	50	45
Total :	225	203

Suggested installed capacity 400 KW to allow future expansion

Water

Supply of water is required for plant cleaning, the kitchen/bar, laundry and for sanitary purposes, but not for technological purposes. The maximal demand in peak is estimated to 3 - 6 m^3/h. A reservoir of 5 m^3 is recommended in form of a water tower. The daily demand is not expected to exceed 50 m^3. A borad well should be installed to provide this quantity. The water must be filtered and partly treated for human consumption.

Hot Water

Hot water is required for melting thick flowing or semi-solid materials (active materials, emulsifiers) before drum decanting, and to enhance the solution of poorly soluble materials by heating the jacket of the production vessel. The temperature needed is 60 to 80°C. A boiler is provided for the purpose with electric heating. The heating system is filled up with water

and only evaporation losses are replaced time to time.

Drains

Effluent water from the workers building, Office building, laboratory building and prodiction staff building should be collected by a drainage system and led into septic tanks.

Water used for the cleaning of the workshops will be collected within the territory of the workshop in a pit and after neutralization/decontamination transferred to the rainwater system.

Rainwater will be collected in open shallow canals and led outside the plant following the slope of the site. All the canals running off the plant will be united and via an oil-trap type concrete basin led into the creek. In any case of necessity solvent or oily effluents can be trapped and any nature of contamination treated and neutralized in the basin. Content of the basin should be checked daily on pureness.

Telephone service

A telephone exchange should be incorporated into the office building with two external and about 30 internal lines.

V. LOCATION AND SITE

The site of the Pilot Pesticide Formulation Plant is located at a distance of about 50 km north of Rangoon and about 10 km east of the main road to Prome at Hmawbi town. The entire area in distant vicinity of Hmawbi town has been reserved for the chemical industry for such production units, which may cause uncontrollable environmental pollution. P.I.C. has already two factories within Hmawbi area, one producing plastic products, another chemicals for the pharmaceutical industry.

The site selected is sized at about 20 acres which will allow for future expansion of the facilities and lies close to an asbestos sheet factory. The access road is ready up to the boundaries of the site. A square plot of 300 x 300 m is foreseen for the plant, which has an elevated position in the area and a similar plot opposite to it is foreseen for residential houses. Technical and transportation infrastructure for the plant is planned to develop concurrently with the implementation. The provisional road to be used for building material transport will not be passable within the rainy season thus limiting the time available.

A visit to the site gave occasion to prove that the site is suitable for the location of the plant. Provision of electricity and water should have a priority in the time schedule of the implementation.

It is recommended, that the line of the final access roads be changed and instead of crossing low marshland, as shown in the provisional site plan they should be led through more elevated parts of the site which might be expected not to be flooded during the rainy season.

VI. PROJECT ENGINEERING

A. Project Layout

The buildings of the Pilot Formulation Plant are situated on an oblong shape plot with the size of 200 x 300 m = 60,000 m^2. The layout is divided into two main areas :

- management buildings' area, and
- production plant area, as shown on Fig. 1

The orientation of the plant should follow the prevailing wind direction of the dry season, toxic and inflammable vapors drawn off-plant direction.

Within the production plant area the following aspects were kept in mind, while developing the plan :

- to keep management buildings in one block and thus decrease the length of the drainage system,
- to collect buildings handling inflammable material in one block but keep necessary safety distances between each other,
- to collect buildings housing driers in another group and ensure the maximum possible distance from the previous block within the production area,
- to keep the shortest distance between the Liquid Formulation Plant and the Local Solvents' Storage Tanks to have short pipeline,
- to place the transformer in a central position among the production units and possibly next to the Powder Formulation Workshop, the greatest consumer of energy,
- to place the Maintenance Workshop close to the Powder and Granular units, where the most of the repair works are expected

The borderline of the production plant area, where very strict safety regulations should be kept, must physically be shown e.g. by a low fence with one single opening. The internal road system should provide easy access tp each building. The whole plant area should be levelled evenly and provided with an 0.5% slope rainwater canal system.

The orientation of the laboratory building should be such that the instrumental analytical room be placed at the northern side.

B. Selection of the Technology & Key Machines

The pesticide formulation technologies consist of several basic procedures, such as weighing, mixing, grinding, homogenising, packing, bottling. At the selection of the machinery relatively simple but efficient and reliable machinery is preferred with the undispensable level of automation only, not to let face the maintenance personnel with unresolvable problems. Another important aspect is safety : ensuring that minimum of the processed material could get out of the machinery and cause pollution. The maximum of this hazard exists at packing and bottling the powders and liquids. Here the non availability of the packing materials was combined with the safety aspects and thus such devices are recommended, which produce the packing material themselves, they fill them and produce filled bottles/bags. This system eliminates the contact of many persons with the toxic material. Batch processes are recommended for the mixing procedures because of the small capacities involved. Continuously working machines will serve the crushing, milling and the drying processes.

Liquid Formulation

The key equipment is a mixing vessel. The material should be stainless steel in the whole plant wherever the active ingredient may contact the structures, with teflon seals. Weighing of the local solvents will be made in measuring tank, the rest of material will be weighed on platform scales. The paddle should be uniformly efficient for mixing liquid toxicants into the solvents or mixing solid ones (e.g DDT, lindane). For bottling into ½ lit, 1 lit, 2 lit and 5 lit plastic bottles BOTTLEPACK machine of WINTER MACHINEN AG is recommended, working on the abovementioned principle. Efficient filtering of the product is essential to get clear transparent solutions. Filters of AMAFILTER Company are recommended with refill cartridges.

For further extension place or even supporting structure should be provided for a second vessel and a third filling tank to be installed in the future (item Nos. 19, 24, 25)

Granular Formulation

The recommended technology will allow both the use of sand and sorptive type granules as well, if they will be available. At the same time provision was made at the upgrading line to have the possibility for the plant to provide sorptive granules for own use.

A rotating-drum type blender is recommended equipped with spray apparatus for the introduction of the liquid toxicant into the blender. The blender should be closed, first of all while the injection takes place, but should allow the inspection of the process, sample checking time to time and manual feeding of silica powder in small portions.

Before packing, a tangentially vibrated round vibroscreen is recommended to return oversize knots selected from free flowing finished product. This type of screen has a mild action and will not rub down the coat built up on to the granules.

The packing machine may be a simple design semi-automatic weighing-packing machine suitable for the use of preferably plastic hose or plastic sheet. The process/machinery is suitable to be adopted for the formulation of solid active ingredients as well by sticking their powdered formulation onto the granules.

Mineral Upgrading

The minerals are available at the moment only in raw size on mine, which is expected not to be greater than 100 mm. Pre crushing is recommended in two steps, first decreasing the size down to 10 mm and in a second step down to 1 mm (18 mesh). For the first step a jaw crusher, for the second a roller crusher is recommended. The 18 mesh mineral will be dried in a rotating drum dryer.

After drying alternative possibility should be provided for the material either a) to be sieved, the fraction between 0.8 and 1.0 mm selected and used as granular carrier, or b) to be led directly into a hammer mill which reduces the particle size down to 200 - 300 mesh (45 - 75 micron).

The sieves should be interchangeable to allow selection of other fractions as well as necessary (e.g. 0.6 to 0.8 mm, 1.0 to 1.2 mm, etc.)

The dry milled mineral should be transported pneumatically to the + 6.00 m level, where they will be fed into the mixer.

Having the option to produce granules in the upgrading compound it might be considered that it is not worthwhile to install a separate dryer for the drying of sand (or other ready to use carrier) but by slight oversizing include this job also into the upgrading line. In this case provision should be made that the drier, the sieve and the elevator between should be very easy to clean thoroughly to prevent getting sand into the powder carrier.

Should it turn out that the supply of the minerals is secured at a smaller particle size - say at 10 or 1 mm size - the upgrading line may start with the roller crusher or even with the dryer only.

Powder Formulation

A coarse grinder should be mounted above the feeding hole of the mixer in order to prevent knots of solid active substances to get into the mixer without being disintegrated.

The mixer should be a strong contraflow type one made of stainless steel having a cooler jacket, because in summer heat the mixture containing DDT etc. active substances may become smeary and difficult to mill; spray nozzle should be provided to enable injection of liquid active materials into the mixer.

The mixer should be mounted above the mill to utilize gravity flow. A similar capacity hopper should be mounted below the mixer not to prevent next mixing until the milling of the previous one is finished.

UP 350 type Ultraplex mill of Alpine Co. has been considered as most suitable for mechanical milling of wettable powders and dust concentrates. It has a wide house, good ventilation and it is hoped that it will provide the lowest possible particle size except of a jet mill and will run undisturbed even under the prevailing hot and humid conditions. Jet milling is not recommended because it would be very costly both to invest and to use at this very little capacity.

The aftermixer/homogenizer should not necessarily be made of stainless steel. Either a contraflow mixer or a Nauta single cone mixer would do a good job. In the case of contraflow mixer a hopper of a similar capacity should be mounted below it with a screwfeeder discharge. Nauta mix is too high to allow it; the discharged mix stored provisionally in bags or containers should be fed directly into the bagging machine.

RCVEMA bagging machine producing bags from sheet and filling/sealing them, is recommended, or similar machine but not inferior in security and providing the packing material for itself.

C. Description of the processes

Numbers within the text refer to numbers in the lists of equipment (Chapter VII and Annex XVII) as well as in the figures.

Formulation of liquid pesticides

The process consists of

- solution/dilution of the technical grade active substance in suitable solvent or solvent mixture
- addition of auxiliary materials, such as stabilizer, emulsifier(s), dispersing agent
- thorough mixing
- bottling, canning.

In the proposed plant

- local solvents are stored in horizontal cylindrical storage tanks, 10 m^3 each (1, 2, 3)
- imported solvents are stored in barrels in an open store, protected against sunshine and rain
- technical active substances and auxiliary materials are stored in a separate closed store
- formulated liquid pesticides are stored in a separate closed store.

The mixing of the liquid formulations takes place in a jacketed stainless steel vessel of 2200 lit capacity (19) batch size 1800 - 2000 lit. Local solvents are transferred by a pump (7, 8) via a flow meter (10) into a preset metering container of 1500 lit capacity (11) and fed by gravity into the mixer. Imported solvents are weighed on a platform scale and transferred by a drum decanting pump (12) into the production vessel. Emulsifiers and liquid active substances are fed the similar way through separate pumps (14, 15). In the case of thick flowing materials they must be heated prior to decanting in the heating chamber connected to the hot water system (29 - 32). Solid active substances are hoisted (18) onto a working platform and fed through the opening on top of the vessel. In the case of poorly soluble materials the content of the production vessel may be heated by hot water. The temperature is recommended not to exceed 60°C. After a fixed time for mixing, the batch can be discharged by pump (20) through a filter (21, 22) to one of the filling tanks (24, 25). The system allows that should any correction or reprocessing be necessary, the content of any of the filling tanks may be returned by a pump (20) into the production vessel.

The filling tanks are mounted on elevated supporting structure and thus the bottling machine (26) may be fed by gravity. Weight-accuracy should be checked on random chosen bottles on a control scale.

Fume extracting fan (33) is operated to collect toxic vapours from the drum decanting and filling machines area. Extracted fumes are detoxicated in a Raschig-tower (35) by sodium hypochlorite solution, situated outside the building.

Hot water heating system : Hot water is heated by a thermo-regulated electric boiler (29) and circulated in a closed circuit by the hot water pump (31). The hot water circulates in the jackets of the production vessel and in the radiator of the heating chamber (32). This radiator is sunk into the floor, the barrels to be heated are rolled onto it and covered by easy hoods, thus forming the chamber. Water should be soft enough not to allow separation and deposition of water hardness.

Evaporated water is replaced time to time in the dilation tank.

Earthing. Pipelines and machines of the liquid unit should be provided with efficient earthing to prevent accumulation of the static electricity.

Suggested process flow and layout is shown in Fig. 2.

Formulation of Granular pesticides

The process is based on technology for coated granules and principally on liquid toxicants. The process consists of

- Drying the raw carrier (sand)
- Charging the carrier into the mixer
- Spraying the liquid toxicant onto the carrier
- Adding silica powder to the mix until free flowing will be achieved
- Sieving the product and returning balls to the process
- Packing the material that passed the sieve

Remarks : this description involves formulation of Diazinon 5G granules. The process should be appropriately modified, if e.g. the active substance is a WP formulation of a solid active substance and the liquid is a sticking agent, or the carrier is saw dust, etc.

In the proposed plant

- granular carrier will be stored in bulk under roof near the drier
- technical active substances and silica powder in a separate closed store
- formulated granules in a separate closed store

It is supposed that washed river sand is available in sized condition consisting of a bulk fraction of min 90% being between 0.6 and 0.8 mm size (30 and 20 mesh). The carrier is fed into the feeding hopper (2) of the dryer by conveyor belt.

The dryer (3) is a rotating cylinder type suitable to evaporate min. 25 to 50 kg water per hour. The drying medium is hot gas stream generated by an oil burner. The fuel oil tank and pump (4, 5) are placed outside the building. The necessary draught is provided by forced ventilation (6). The dry granules are fed by a bucket elevator (8) into one of two silos of 2 m^3 capacity (9, 10).

The quantity of carrier necessary for one batch is weighed on a platform scale. A previous sieving (1) has been provided for just to select rough impurities (8 - 10 mesh).

The weighed carrier is transported by the elevator onto the first floor and fed into the mixer (11). Rotation should start together with feeding.

The active liquid toxicant is transferred from the barrels by a decanting pump (12) into a pre-set container (13). A calibrated measuring cylinder (14) is filled up to mark from the container. The measured quantity of the active material is sprayed by a pump (15) through a nozzle into the rotating drum. During the drum decanting and spraying operations the fume extracting fan must run. The extracted fumes are desactivated in a Raschig tower, placed outside the building, by sodium hypochlorite. The fume extraction system is the same serving for the powder formulation, the mentioned items are registered there.

After a fixed time for mixing, the gate of the mixer is opened and silica powder is fed manually into the rotating drum in small portions until the granules become free flowing. Then the batch is discharged into an open container (17) with a screw conveyor at the bottom. The granules are fed on a vibrating screen (18), the coarse conglomerates selected, disintegrated by manual tools and returned for reprocessing. The granules passing the sieve are fed into intermediate small containers, transported by the elevator

onto the first floor above the packing machine (19) and by this filled into 1 - 5 kg bags. 4 - 5 x 5 kg or 10 - 15 x 1 kg bags may collectively be packed into great multiply paper bags.

The suggested process flow is shown in Fig. 3.

Upgrading of the carriers

The local minerals which are suitable to be used as carriers/fillers, are available in bulk in a size of max. 100 mm. Their average moisture content is expected to be around 5 - 7 per cent.

The process of upgrading consists of the following steps :

- primary crushing of raw mineral,
- fine crushing of raw mineral,
- drying,
- selection of a fraction for gramular carrier,
- milling

In the proposed plant the raw minerals will be stored in bulk under roof near the upgrading facilities. The minerals are first fed by a portable rubber conveyor belt (1) into a jaw crusher (2) reducing the size down to 10 mm. The crushed material will be transferred by a built-in conveyor belt (3) into a roller crusher (4) reducing the size down to 1 mm. The reduced size mineral is transferred by another conveyor belt (5) into the feeding chute of a rotating cylinder type dryer (6) suitable to evaporate 50 to 100 kg water per hour. The drying medium is a hot gas stream generated by an oil burner. The fuel oil tank and pump (7, 8) are placed outside the building. The necessary draught is provided by forced ventilation (9). The dry mineral grains are transported by a bucket elevator (10) into one of two 3 m^3 capacity silos on the first floor (11,12) for intermediate storage. The dry grains are than fed by gravity into a sieve (13) which selects the fraction suitable to be a granular carrier, between 0.8 and 1.0 mm size. The selected granules are collected in intermediate containers, manually transported to the granular formulation line and fed into the silos of 2 m^3 capacity. The fine fraction passing the sieve is fed into a hammer mill (14) which reduces the particle size to 200 - 300 mesh (50 - 70 microns). The milled powder is transported by air in a silo (15) placed on the first floor, with a cyclon on its top. The necessary air draught is provided by a fan (16). The discharge from the silo takes place through an airlock.

Formulation of wettable powders

The process consists of

- mixing of the technical grade active material with upgraded carrier(s), wetting agent, dispersing agent, milling aid etc.
- milling the pre-mix,
- homogenizing the milled pre-mix,
- weighing, packing.

In the proposed plant

- upgraded minerals are stored in silos on the first floor of the workshop building,
- technical active substances and auxiliary materials are stored in a separate closed store

The local fillers will be upgraded to a mesh size of about 200 mesh (74 microns) or finer and dried.

The dry filler is discharged into bags, weighed on a 100 kg capacity platform scale and stored close to the pre-mixer is pre-weighed units.

Mixing of the technical grade active material with the filler(s), wetting agent, dispersing agent, milling aid etc. takes place in the S-1000 type pre-mixer (2). Batch size may vary depending on the bulk weight of the filler from 400 to 600 kg. The materials prescribed for one batch are weighed on a platform scale and in the order fixed in the technologie are fed into the mixer. Eventual coarse parts are disintegrated by a coarse grinder)1) mounted above the feeding hole of the mixer. If the active substance is a liquid, it is transferred from the barrels by a decanting pump (3) into a pre-set container (4). A calibrated measuring cylinder (5) is filled up to mark from the container by gravity. The measured quantity of the active material is sprayed by a pump (6) through a nozzle into the mixer, filled with the carrier. Liquid auxiliary materials can be introduced the same way.

After a fixed time for mixing, the batch is discharged into a hopper of 1000 lit. capacity (8) and from it fed at a continuous rate (9) into the mill (10). The fine milled powder is carried by air into a cyclon + airfilter complex (11, 12) of which it is discharged through rotary valve into bags or intermediate containers.

The milled powder is then fed into the MBX 35 S typ. final blender (24).

Two to three pre-mix batches make one final blend batch. The milled powder is fed into the mixer, while the powder dispersed into the air is exhausted through a hood connected to the exhaust system. After a fixed time for the homogenizing the batch is discharged into intermediate containers or bags, transported by elevator onto the first floor and fed into the packing machine (14).

A central exhaust system serves to keep the air in the workshop clean of dust. Hoods are provided at each point, where dust may be dispersed into the air, such as : feeding of the mixers, the mill, discharge of silos etc. All hoods are connected to a central duct leading through a cyclone and an air filter (15, 16) to the exhaust fan (17). The exhausted air goes for final cleaning/decontamination into a Raschig-tower (19) placed outside the building.

Formulation of dust powders

The process consists of

- mixing of the technical grade active substances with filler and eventual milling aid
- milling of the premix
- diluting of the premix to the final concentration
- bagging, packing

The process begins like as described at the formulation of wettable powders and runs similarly until the milled premix is filled into bags or intermediate containers.

The amount of pre-mix and diluting filler given in the receipt for formulation is weighed and fed into the MBX 35 S typ. final mixer (24). From now on the process goes on again the same way as described at the formulation of the wettable powders.

D. Description of the laboratory

Activities

P.I.C. desires to have a strong laboratory within the plant where chemists, biologists and semi-administrative scientific staff could consult and work closely together. The laboratory of the plant should be heavily engaged in development work.

The staff of the chemical laboratory should be ready prior to the completion of the production facilities with the establishment of the formulation technologies and receipts of the first products. It is recommended to elaborate alternative receipts for each products using auxiliary materials from different sources not to depend on one single source. Further sources of local materials should be reveiled and evaluated upon suitability. Further active substances should be adapted for local formulation, according to suggestions under III C.

Standard analytical methods often need to be modified due to variations occuring in the raw materials, or changing one supplier of the chemical for another. In such cases methods require to be completely changed, or replaced, by another. Methods of analysis developed and provided by manufacturers often need considerable development work for reproducible results to be obtained by others. There is, thus, a method development required.

Part of the laboratory should exercise routine control of formulated products and provide quick intermediate control prior to packing/bottling as well as control purchased raw materials.

For the above purposes the laboratory must be equipped with suitable facilities to perform quantitative determination of active substances by :

- gas chromatography,
- thin layer chromatography,
- UV/visible spectrophotometry,
- traditional chemical methods

as well as to perform laboratory scale formulation and physical tests of formulations.

The list of suggested equipment see in Annex XIII, XIV.

The suggested equipment is meant to cover the needs of the first two years, starting before completion of the plant.

The biological laboratory should assist the development activities of the Chemical Laboratory by giving initiatives for new development subjects, controlling the newly developed formulations upon effectiveness both in small plot and in extended field trials as well as perform routine control of biological activity of the produced pesticides.

Another important function of the laboratory will be the preparation of literature surveys and reports on current pest, and pesticide problems of the country, as well as to handle registration of the new formulations, as soon as legislation will require it.

The list of suggested equipment see in Annex XV.

The laboratory should be given the task of collecting technical information concerning the production, formulation, analysis, application, biological testing and safety aspects of pesticides. A conference room should be provided to organize training courses by the management staff or invited speakers, both for plant personnel and/or customers.

Using the collected information, the laboratory should provide appropriate use-instructions to be printed on the labels.

Using the periodicals provided for the project an efficient information section could provide information about work done abroad to possibly reduce the expensive scientific efforts in Burma. By selecting appropriate information title and summary translations could also be undertaken.

Laboratory building

See under VI E.

Safety in the laboratory

See under VI. F.

E. Specification of buildings and civil works

I. Management and staff buildings

1) Office building

Conventional office building to house the management and adminstrative staff of about 40 persons according to local norms, with changing room for senior staff supervising the plant, room for telephone exchange, toilets.

2) Production staff building

Offices for the heads of production workshops, the head of maintenance and head of stores, altogether five persons with additional administrative help comprising toilet and shower as well.

3) Locker

Ground store building with white and black changing premises with lockers separately for street- and working dress. Showers. Number of personnel changing estimated to be 120 persons. 20% free capacity should be built in. Laundry to be incorporated. Dirty clothes are dropped into the laundry's collecting chanber.

4) Recreation hall

Groundfloor building, comprises rest room, bar offering beverages and with facilities to heat ready food or prepare simple food. Guests area should be parted for those who enter from production area for rest and others entering from management area, bar centered, offering for both sides. Comprising also toilets.

5) Gate house

Ground floor building of 20 m^2, conventional design. Equipped with strong lights directed to the doors. Controls roads in and out and the personel entrance. Windows for both side.

6) Laboratory building

Laboratory building

Most of the rooms of the laboratory must be provided by airconditioning because

- in conditions of average temperature of 30°C in summer and relative humidity of 90% no scientific work can be conducted for long,
- solvents such as ether, benzene, acetone etc. volatilise rapidly at room temperature and can result in explosions,
- even slight volatilization of solvents such as chloroform, carbon

tetrachloride etc. will have long term toxic effects on workers in the laboratory,

- results obtained from analyses involving volative solvents at room temperatures would not be reliable,
- the moisture would also have detrimental effects on both chemicals and samples to be analysed, or stored for longer as reference
- the very costly and sensitive apparatus used for testing of pesticides may be ruined by fluctuating temperature and excessive atmospheric humidity
- reliability of results on such equipment, e.g. IR apparatus also requires airconditioned circumstances.

Accordingly, a two-storey building is recommended to decrease the heat-transfer surface of the building with the following special recommendations :

- windows need to be double glassed,
- insulation should be incorporated below the roof,
- the roof should overlap the outer wall on the sunny side and similar sun shade should be applied over the ground floor,
- the outer walls should be constructed of low heat transfer material,
- incorporation of a second door at the entrance, as airlock,
- window area should be limited by beginning only at 1.20 m above floor level.

It might be considered whether to employ individual wall airconditioners room by room or to install a central airconditioner system.

The chemical laboratory, with its apparatus, also for safety reasons, should occupy the ground floor leaving place for the biological laboratory, conference room, offices and store at the first floor. If any future extension of the laboratory is planned by P.I.C. it would be wise to ensure that the foundations and supporting walls are such that a third floor may subsequently be added. Above the first floor a flat concrete roof should be constructed with insulation with a lightweight roof on it with a vented loft so as to minimize the entry of heat and facilitate the addition of a 2nd floor.

Individual access should be provided to each room from a central corridor starting from the entrance hall/staircase. A second door is incorporated with the front door to act as an air-lock. There should be a cantilever

shelter before the entrance to protect arrivals from rain. The floor should be elevated at + 0.2 m above ground level with a ramp at the entrance. Doors and windows made of woodwork, otherwise non-inflammable materials should be used. The doors should close automatically. The whole building should be surrounded by 0.5 m concrete pavement. Wiring and lighting should be ex-proof in the building.

Ground floor

The ground floor comprises the following rooms :

1. Cooled store for chemicals and samples, 12 m^2
   Services : AC 220 V 50 H_z and aircondition
2. Room of general instrumental analysis, 24 m^2
   Services : AC 220 V 50 H_z, aircond. and water
   Adequate mains socket should be provided
3. Spectrophotometric and GC room, 12 m^2
   Services : AC 220 V 50 H_z and aircond., water
   Main sockets should be provided also for eventual additional instruments. Compressed gases should be dispensed from a distribution system separate from the main building. A single-room building with concrete floor at + 0.1 m above ground, ramp to the door, vented double ceiling roof, size 2 x 3 m, electric ventilators on the ceiling, situated on the north side of the main building houses the cylinders. The cylinders should be held against the wall by individual chains, both those in use, spares and empties. Gases should be dispensed by manifolds with changeover units with a line pressure to the laboratories of approx. 90 psi. Stainless steel is the ideal material for pipe runs. Piping should terminate with point valves attached to the fascia boards within the laboratory with provision for reduction to 1/8" for fittings.

4. Balance room, 6 m^2

   The benches should be vibrationless and should stand on independent concrete slabs so as not to be affected by the vibrations of the building. Services : AC 220 V 50 H_z with adequate sockets and aircond.

5. Washing up room, 6 m^2

   Services : water, mains : AC 220 V 50 H_z

6. General chemical laboratory for formulation and traditional analyses, 36 m^2. Services required : mains of AC 220 V 50 H_z, aircondition and water. Piping and wiring should be placed so as to facilitate eventual control and maintenance. One central mains cut-off switch should be located in the entrance hall and marked. Water pipe branches to each room should be provided with taps so as to enable separation of parts of the system. Two fume cupboards should be placed aside each other at an internal wall with united vent duct which should pass the laboratory wall at ceiling height and continue up to above roof height. The fan should be placed outside the wall. Some free wall area should have a grid on it for fixing apparatus.

   Drains should be made of acid and alkali resistant piping so sloped that waste liquids drain rapidly out of the laboratory and join the septic drainage system, through a pitch-lined concrete basin of 1 m^3 where the wastes are diluted and regularly decontaminated.

7. Physical laboratory, 18 m^2

   Services : AC 220 V 50 H_z and aircond.

8. Changing cabinet, 3 m^2

9. Toilet & shower, 3 m^2

10. Cylinder storage cabinet (outside the building) 6 m^2 (see also at 3).

First floor

11. Insect breeding room, 18 m^2, Services : AC 220 V 50 H_z, water and aircond.

12. Biological laboratory, 18 m^2. Services : AC 220 V 50 H_z, water and aircond. One fume cupboard, similar to room 6. Adequate number of sockets should be provided.

13. Office of the Head of the Laboratory, 12 m^2, airconditioned.

14. Office of the Head of the Biological Laboratory, 12 m^2, airconditioned.

15. Library/conference room, 36 m^2, airconditioned

16. Store, 24 m^2 , Services : AC 220 V 50 H_z.

7. Medical service building

Groundfloor building, size 40 m^2 comprising waiting room 10 m^2, consulting room 15 m^2 and resting room with two beds 15 m^2. Concrete floor at + 0.2 m covered with tiles, rooms airconditioned, walls oil painted up to 1.50 m, glassed windows, lightweight roof at + 3.00 m overlapping the walls for sun-protection, 0.5 m concrete walk around the building.

II. Production buildings

11) Liquid formulation workshop

Ground floor building, size 10 x 20 m, concrete floor with sparkproof (asphalt) layer, floor level at + 0.2 m, walls of fireproof material, height 4 m, lightweight saddle-roof with roof ventilation overlapping the walls for protection against sun, access through ramps and gates suitable for forklift truck transport. Gates at both ends, windows in the side walls not lower than 1.5 m. Rain should not enter ! Electric wiring and lights explosionsproof outfit. Fuses and mains main on/off switch outside the building in a central panel. No aircondition. Lightning protection. 0.5 m wide concrete walk around the building.

Reference drawing No.

12) Powder and Granular formulation workshop

Two stories building with groundfloor extensions at both ends. Size at groundfloor 24 x 42 m, 1st floor 24 x 24 m, extensions 24 x 9 m. Concrete floor at + 0.2 m, walls of fireproof material, height 6 and 11 m respectively, 1st floor at + 6.0 m, supporting columns at 6 x 6 m apart. Partition walls, if any, preferably rectangular to the main axis. Elevator of 1500 kg payload capacity in the middle of the building, access from both sides. Walls painted with washable paint up to 2 m above floor. Access through ramps and gates at the side walls, sized for forklift truck traffic. Windows roundabout at both levels, at the ground floor not lower than 1.5 m. Electric wiring and lights explosions-proof outfit. Fuses and mains main on/off switch outside the building in a central panel. No air-condition. Lightweight saddle-roof with roof ventilation overlapping the walls for protection against sun. Rain should not enter. Lightning protection. 0.5 m wide concrete walk around the building.

Reference drawing No.

III. Stores

A) Store for technical active substances and auxiliary materials

Ground floor building, size 20 x 20 m, concrete floor at + 0.2 m, walls of fireproof material, height 4 m, lightweight roof with roof ventilation overlapping the walls for protection against the sun,

access through ramps and gates suitable for forklift truck transport. Gates in front wall, windows in the side walls not lower than 1.50 m. Electric wiring and lights explosion-proof outfit. Fuses and mains main on/off switch outside the building. No aircondition. Two separate rooms of 20 m^2 (4 x 5 m) each with shelves for a) spare parts and reserves, materials for the repair shop, tools, etc. b) expendable material used in the plant. Lightning protection. 0.5 m wide concrete walk around the building.

Reference drawing No. 7385

B) Store for formulated products

Similar building to A), size 10 x 20 m, with one crosswall separating the internal space into two equal parts with one-one access door at both ends.

C) Store for imported solvents

Open store, size 8 x 12.5 m, concrete floor at + 0.1 m with 5 cm high, 10 cm wide rim to prevent barrels from rolling off, lightweight roof at + 3.1 m well overlapping the floor, access through ramps for forklift trucks from two sides, 0.5 m wide walk around the floor. Electric wiring similar to store A. Lightning protection. One corner is occupied by a 9 m^2 (3 x 3 m) store of solvents for the laboratory. Closed compartment, aircondition, door from outside. Wall protected against barrels with timber slabs.

D) Store for local solvents

Three mild steel tanks of horizontal cylinder shape and 10 m^3 capacity each are placed onto concrete supporting sleepers within separate concrete reservoirs of 12 m^3 min. capacity each, joining to each other, with a smaller concrete basin for the transfer pumps joining to the three. Steel structure catwalk over the three tanks with stairs serving to the pumps. Access to the pumps through concrete stairs. See also reference drawing No. 7387. Vented metal shell sun-protected with silver paint, as the tanks. Sprinkling water cooling. Lightning protection.

IV. Service Buildings

21) Repair workshop

Groundstore building, size 6 x 20 m, concrete floor, floor level at + 0.2 m, walls of fireproof material, height 4 m, lightweight roof

with roof ventilation overlapping the walls for protection against sun, access through ramps and gates suitable for forklift truck transport. Three gates at the front, windows on the both sides not lower than 1.5 m. No aircondition. The accumulator loading facility for the forklift trucks is located at one end of the building so as to allow access for the trucks and provided with sufficient shelter against rain.

22) Garage

Open shelter, concrete floor at + 0.05 m above road level, light-weight roof, no walls but 0.2 m wall instead all round except front. Water tap for car wash.

23) Transformer house

Conventional building of the type, concrete floor at + 0.2 m, with ramp to the gate, vented roof well overlapping the walls. Size 5x5 m.

24) Water well and pump house

Tube well, head surrounded by a concrete platform at + 0.1 m above ground level. Pump house 2 x 3 m size, concrete floor, brick walls, light vented roof.

25) Trestle

Mild steel water reservoir of 10 m^3 capacity standing on steel structure at 12 m height.

26) Emergency shower

Small compound of 12 m^2 comprising two easy to access shower cabinets (swing door) and toilets with hand wash wells.

V. Civic Works

31) Gate and fence

Two gates for lorries coming and going and one personnel entrance gate. Brick/concrete columns and wrought iron gates.

32) Roads

Internal traffic roads bearing the load of 12 ton trucks, 4000 m^2, with sufficient general lighting.

33) Drains with septic tank

Drains collecting septic waste water made of prefabricated concrete tubing Ø 0.2 m with a slope of 2%, 300 running m. ending in septic tank. Connections to buildings 1, 2, 3, 4, 6, 7, 26.

34) Rainwater canals and oil trap

Shallow concrete canals 0.5 x 0.1 m W x D, following the slope of the site, 1000 running m. with a pattern collecting the water from the total surface of the plant and leading into one trunk branch passing the water into a concrete basin trap at the fence, before releasing to the creek.

35) Fire fighting water reservoir basin

Concrete basin of 8 x 4 x 1.5 m L x W x D with sides elevated to + 0.1 m, surrounded with a low fence.

36) Burning pit

A place of Ø 3 x 0.5 m Dia x H size, round wall, surrounded by a fence, off the plant by 200 m, wind off direction.

F. Safety within the plant

The formulation of pesticides involves various hazards such as mechanical injuries, acute intoxication, deterioration of health, fire and explosion, pollution of environment. Utmost care must be taken to prevent occurrence of such accidents. Precaution measures are of two different types :

- personal and organization measures
- technical measures

As for the first group, all employees should be given appropriate training, every person should know the hazards involved in the plant and especially in his work, behaviour in case of emergency, measures of precaution and aid.

The medical service should check employees prior to employment and periodically while working. Only personnel of perfect health condition should be allowed to work. Rotation of workers at posts of various level of exposition may be useful. It is recommended that personnel working at higher exposition level should be given protecting/conditioning food such as milk or fresh fruit.

The good housekeeping is the basis of safety. Machines processing the dangerous materials should be kept tight. As soon as leakages are observed, the leaking sources should be eliminated by fastening bolts or changing gaskets or simply closing openings that should be kept closed. Leaking material should be collected and properly treated. Fume exhausting fans must run through all the working hours. Workers should be given clean working dresses daily and personal protecting tools as often as necessary. It is prohibited to walk barefooted in the workshops.

In general open machines are not allowed to start, running machines are not allowed to be opened. While repairing, the fuses of the machine must be taken out to prevent unintentional start. Stones, wood or metal objects and other alien material must be prevented from getting into the machines. Hazard sources should be marked with international or well understandable pictogrammes.

Use of open flame and smoking should be prohibited within the total production area. All electric equipment should be explosionsproof outfit. In the liquid formulation workshop the floor should be made of sparkproof material; at repairwork only hammers made of copper or bronze are allowed to be used. Fuses should be installed together with the main on/off switch outside the workshop buildings and stores. Zero line should

be connected to the houses of all electric apparatuses. Rubber wheel trucks should be earthed before operations. Pure plastic woven clothing is not allowed to be worn.

Workshops and stores should be provided with sufficient number of manual firefighting CO_2 apparatuses at well accessible places. In the liquid workshop and store additional foam-fire-extinguishers are recommended. Around the workshop buildings and stores sufficient fire fighting hydrant points should be planted with hoses available in glass-fronted locked boxes. Fire brigade should be organized and regularly trained.

Liquid material from eventual leakage should be soaked immediately by sawdust and taken out of the workshop. Burnable waste material including torn bags and dry weeds from the courtyard should be burnt regularly in the burning pit. Effluents from the laboratory and the rainwater trap should be regularly controlled and treated as necessary.

National traffic rules must be respected also in the plant roads, 20 m/h speed limit is recommended. Customer cars should be directed by clear signs to the proper stores. Numbering of buildings with well visible number shields is recommended.

Safety in the laboratory

Through using self closing doors and principally fireproof material except doors and window frames, there would be a reasonable possibility of isolating a fire. In the staircase at both levels fire fighting water mains should be provided with hose attachments so that a fire might be fought in whichever room it would occur. As an added protection hydrant points should be planted at each side of the building, centered, with hoses available in glass-fronted locked boxes. One to two manual fire-fighting CO_2 apparatuses should be mounted on the wall of each laboratory. During the night a watchman should guard the laboratory.

The central mains cut-off switch in the entrance hall should be marked to be turned off in case of emergency. Inflammable solvents should not be stored in the laboratories over the quantity needed for one day. 3 - 5 days amount according to volatility is allowed in the cooled store. Bulk of the stock is stored in the separate Lab. Solvent Store compartment within Imported Solvent Store.

VII. COST ESTIMATION OF INVESTMENT

A. Summary of investment costs

S.N.	Cost element	'000 Ks	'000 US$
1,	Production equipment		
	Liquid formulation unit		354.00
	Granular formulation unit		122.40
	Minerals upgrading unit		117.00
	Powder formulation unit		265.00
	Primary stock of spare parts and reserves		67.50
	Total :		925.90
2.	Detailed engineering design & commission 18%		164.10
3.	Auxiliary equipment	2226.00	248.85
4.	Service equipment	190.48	10.55
5.	Laboratory equipment		100.00
6.	Buildings and civil works	11793.00	
	Total on FOB basis		1449.40
	Contingency 10%		143.50
	Crating, shipping, insurance 16.5%		236.80
	Total CIF value	14209.48	1829.70
	Local currency equivalent	(14523.20)	
	Local transport and other expenses		
	Equipment, total	1000.00	
	Erection of the equipment		
	15% of Ser. No. 1		(136.80)
	(Local currency equivalent)	1094.40	
	Total :	16303.88	1829.70

B. Production equipment - Liquid formulation

No.	Item denomination	No.	US$ unit	US $ Total
1,2,3,	Storage tank 10,000 lit.	3	8,000	24,000
4,5,6,	Screen	3	200	600
7,8,	Kerosene transfer pump	2	1,900	3,600
9,	Kerosene pipework	1	1,800	1,800
10,	Flowmeter	1	200	200
11,	Measuring tank 1500 l.	1	2,500	2,500
12,	Xylene transfer pump	1	1,800	1,800
13,	Xylene pipework	1	800	800
14,	Toxicant decanting pump	1	3,000	3,000
15,	Emulsifier decanting pump	1	3,000	3,000
16,17	Decanting pipework	2	1,300	2,600
18,	Hoist	1	3,700	3,700
19,	Production vessel	1	22,000	22,000
20,	Product transfer pump	1	3,000	3,000
21,22,	Filter	2	1,500	3,000
23,	Production pipework	1	2,200	2,200
24,25,	Filling tank	2	8,200	16,400
26,	Bottling machine BOTTLEPACK 3012	1	217,000	217,000
27,	Labelling machine	1	5,000	5,000
28,	Roller Conveyor	1	300	300
29,	Electric boiler	1	2,200	2,200
30,	Hot water pipework	1	2,000	2,000
31,	Hot water pump	1	1,500	1,500
32,	Heating chamber	1	2,000	2,000
33,	Fan	1	2,500	2,500
34,	Fume extracting ducts	1	1,300	1,300
35,	Raschig tower	1	3,500	3,500
36,	Electric equipment incl. earthing	1	15,000	15,000
37,	Supporting steel structure	1	7,500	7,500
				354,000

C. Production equipment, Granular formulation

S.N.	Item denomination	Piece	US$ unit	US $ Total
1,18	Vibro screen	2	3,500	7,000
2,17	Feeding hopper, 1 m^3	2	3,000	6,000
3,	Dryer cylinder	1	25,000	25,000
4,	Fuel oil tank	1	600	600
5,	Oil pump	1	1,900	1,900
6,	Exhaust fan	1	2,400	2,400
7,	Cyclon	1	2,500	2,500
8,	Bucket elevator	1	4,000	4,000
9,10	Silo, 2 m^3	2	2,500	5,000
11,	Mixer	1	25,000	25,000
12,	Drum decanting pump	1	3,000	3,000
13,	Container	1	1,000	1,000
14,	Measuring container	1	1,000	1,000
15,	Spraying pump	1	3,000	3,000
16,	Pipework	1	3,000	3,000
19,	Packing machine	1	15,000	15,000
20,	Electric equipment	1	13,000	13,000
21,	Supporting steel-structures	1	5,000	5,000
	Total :			122,400

D. Production equipment, Minerals upgrading

S.N.	Item denomination	No.	US $ unit	US $ Total
1,3,5	Rubber conveyor belt	3	2,500	7,500
2,	Jaw crusher	1	4,000	4,000
4,	Roller crusher	1	6,500	6,500
6,	Dryer cylinder	1	25,000	25,000
7,	Fuel oil tank	1	600	600
8,	Oil pump	1	1,900	1,900
9,16	Exhaust fan	2	3,000	6,000
10,	Bucket elevator	1	4,000	4,000
11,12	Silo 3 m^3	2	3,000	6,000
13,	Vibro screen	1	3,500	3,500
14,	Mill	1	33,000	33,000
15,	Powder cyclon with 3 m^3 silo	1	4,000	4,000
17,	Supporting steel-structure	1	4,000	4,000
18,	Electric equipment	1	6,000	6,000
	Total :			112,000
	Rubber conveyor belt for raw material handling	2	2,500	5,000
	Total :			117,000

E. Production equipment, Powder formulation

S.N.	Item denomination	No.	US$ unit	US $ Total
1,	Coarse grinder	1	1,500	1,500
2,	Mixer S-1000	1	54,000	54,000
3,	Drum decanting pump	1	3,000	3,000
4,	Container	1	1,000	1,000
5,	Measuring container	1	1,000	1,000
6,	Spraying pump	1	2,000	2,000
7,	Pipework	1	3,000	3,000
8,	Hopper 1 m^3	1	3,000	3,000
9,	Screw feeder	1	1,500	1,500
10,	Mill UP 315	1	50,000	50,000
11,	Powder cyclon with 3 m^3 silo	1	4,000	4,000
12,16	Air filter	2	8,000	16,000
13,17	Exhaust fan	2	3,000	6,000
14,	Packing machine MVP 280 W	1	70,000	70,000
15,	Cyclone	1	1,500	1,500
18,	Fume extracting ducts	1	2,500	2,500
19,	Gas scrubber	1	3,000	3,000
20,	Supporting steel-structure	1	4,000	4,000
21,	Electric equipment	1	8,000	8,000
22,	Elevator, capacity 2000 kg	1	15,000	15,000
23,	Stitching machine	1	1,000	1,000
24,	Final blender MBX 35 S	1	14,000	14,000
	Total :			265,000

F. Primary stock of spare parts and reserves

Complete reserves

S.N.	Item :	Reserve for :	No.	US $
1.	Pump & motor	L 7, 8, 12	2	3,600
2.	Pump & motor	G 5, M 8	1	1,800
3.	Pump & motor	L 14, 15, 20	2	6,000
4.	Hoist & motor	L 18	1	3,700
5.	Pump & motor	L 31	2	3,000
6.	Fan & motor	L 33, G 6, 20		
		M 9, 16, P 13, 17	1	2,500
7.	Electric boiler	L 29	1	2,200
8.	Pump & motor	G 15, P 6	1	2,000
9.	Stitching machine	P 23	1	1,000
		Total :		25,800

Spare parts

5% of equipment		US $	41,700
	Total :	US $	67,500

Remark : one-one of items 1 and 5 should be mounted on portable frame and provided with rubber hoses and serve as portable pump for solvents and water respectively

G. Auxiliary Equipment

S.N		Item denomination	No.	K Unit	US $ Unit	K Total	(000) US $ Total
	a)	Transport and communications				1312.00	5.00
1.		6½ ton Lorry	2	201.00		402.00	
2.		Mazda Jeep	2	130.00		260.00	
3.		2½ Light Truck	2	150.00		300.00	
4.		Road tanker car	1	350.00		350.00	
5.		Telephone Exchange	1		5.00		5.00
	b)	Utility				114.00	185.40
6.		Electrical power distribution equipt. (Transformer, cable etc.) See Annex XIX	1 set				168.00
7.		Firefighting mobile unit	1		2.00		2.00
8.		Fire extinguisher	60	0.20		12.00	
9.		Water pump and well tubing	1		7.00		7.00
10.		Trestle	1	100.00		100.00	
11.		Drinking Water Unit	2	1.00		2.00	
12.		Air conditioner	24		0.35		8.40
	c)	Repairshop Equipment					20.00
13.		Set of Tools	1				20.00
	d)	Storehouse Equipment				750.00	33.45
14.		Forklift Truck, 3 t with charger	1		7.00		7.00
15.		Forklift hand trolleys	10		0.70		7.00
16.		Standard pallets	1000	0.75		750.00	
17.		Platform scale 1000 kg	1		3.50		3.50
18.		Platform scale 250 kg	5		3.00		15.00
19.		± Control Scale 50 kg	1		0.40		0.40
20.		Lot No. printer	1		0.05		0.05
21.		Vacuum cleaner	1		0.50		0.50
	e)	Miscellaneous				50.00	5.00
22.		Protective clothing (one lot)				50.00	5.00
			Total :			2226.00	248.85

Service equipment

(000)

Sr. No.	Denomination	Qty	Unit Pride		Total	
			K	US $	K	US$
	A) Office equipment				111.48	8.25
1.	Typewriter	5	4.00		20.00	
2.	Calculator	4	0.62		2.48	
3.	Photocopier	1		7.00		7.00
4.	Safe & cash boxes	1	7.00		7.00	
5.	Furniture	1 set			82.00	
6.	Teaching aid equipment					
	- overhead projector & screen	1		0.55		0.55
	- slide projector	1		0.70		0.70
	B) Canteen				8.00	0.80
	Refrigerator	1		0.50		0.50
	Deep freezer	1		0.30		0.30
	Furniture	1 set			8.00	
	C) Medical Service				3.00	
	Furniture	1 set			3.00	
	D) Laundry					1.50
	Washing machine	1		1.50		1.50
	E) Laboratory				62.00	
	Furniture	1 set			62.00	
	F) Locker				6.00	
	Furniture	1 set			6.00	
					190.48	10.55

J. Laboratory equipment

Ser. No.	Denomination	Qty	US $ Unit Price	US $ Total
1.	Microscope	1	1,000	1,000
2.	Refractometer, ABBE	1	1,000	1,000
3.	SARTORIUS analytical balance	1	1,050	1,050
4.	Quick balance	1	100	100
5.	Technical balance	1	20	20
6.	Digital pH/mV meter	2	600	1,200
7.	KARL FISCHER apparatus	1	400	400
8.	Water bath	3	220	660
9.	Thermostat	1	400	400
10.	Magnetic stirrer	1	60	60
11.	Magnetic stirrer, variable	1	85	85
12.	Magnetic stirrer and hotplate	1	160	160
13.	Variable speed stirrer	2	130	260
14.	Sieve set	1	320	320
15.	Sieve shaker	1	820	820
16.	Rotary evaporator	2	1,000	2,000
17.	Ball mill	1	400	400
18.	Melting point apparatus	1	1,000	1,000
19.	Flash point apparatus, ABEL-PENSKY	1	600	600
20.	Flash point apparatus, MARCUSSON	1	500	500
21.	Thin layer chromatography kit	1	1,500	1,500
22.	Glass water-still	2	265	530
23.	Heating mantle	2	65	130
24.	Hotplate	2	55	110
25.	Muffle furnace	1	100	100
26.	Radiant heater "Electric Bunsen"	2	75	150
27.	Infra red lamp	3	22	66
	bulbs	10	10.50	105
28.	Fume cupboard	2	600	1,200
29.	Fume extraction plant	1	1,300	1,300
30.	Refrigerator	1	200	200
31.	Coffee mill	2	20	40
32.	Oven	2	400	800

Ser. No.	Denomination	Qty	US $ Unit Price	US $ Total
33.	Oven	1	500	500
34.	Rinsing device	1	400	400
35.	Dehumidifier	1	700	700
36.	TLC spray cabinet	1	750	750
37.	Constant voltage transformer	2	1,200	2,400
38.	Potentiograph	1	4,300	4,300
39.	Stainless steel tubing	1	3,000	3,000
40.	Sigma 3 B Gas Chromatograph	1	31,100	31,100
41.	Lambda 3 MC Spectrophotometer	1	11,500	11,500
42.	General equipment, specified	-		9,000
43.	General equipment, unspecified	-		8,084
	Total :			90,000
	Bio. Lab. equipment			
44.	Potter spray tower	1	2,000	2,000
45.	Micro applicator	1	750	750
46.	1 ml all glass syringe	5	24	120
47.	Analytical balance	1	1,050	1,050
48.	Quick balance	1	100	100
49.	Olympus stereo microscope	1	1,000	1,000
50.	Environmental chamber	3	200	600
51.	Autoclave	1	1,500	1,500
52.	Oven	1	500	500
53.	General equipment, specified	-		750
54.	General equipment, unspecified	-		1,630
	Total :			10,000
	Grand Total :			100,000

VIII. PERSONNEL AND ORGANIZATION

The management of the plant should cover the following main functions :

- Selection of products to be formulated - in coordination with ordering body;
- Development of the formulation technologie;
- Acquisition of raw materials;
- Production;
- Quality Control;
- Storage and transport;
- Organization and coordination of all functions.

Proposed organization chart is shown in Fig. 8

A. Job description

General Manager

It is the responsibility of the General Manager to coordinate and control all activities. As a member of the Plant Protection Coordinating Committee he maintains official contacts with Agricultural Bodies. Guides the development work of the laboratory. Responsible together with the Head of Laboratory for the good quality of the products. Takes the necessary steps to have a well trained, selected staff.

Deputy General Manager

Assists in activities and shares responsibilities of the General Manager. Especially responsible for the proper condition of the production equipment, the continous maintenance and the general safety of the plant. Maintains contact with the Medical Service. Initiates extensions/modifications of the facilities as justified by market studies. Takes care of continous training of the staff.

Production Manager

The production manager prepares monthly work plans and controls daily manwork, material flow and production workshops' output, level of material wastes. Supervises the general order of the plant with special respect to the proper storage of raw materials and good housekeeping in the workshops, effluents' and waste material treatment. Takes necessary steps for provision of replacement equipment, if necessary.

Head of Planning Department

Maintains contact with customer organizations and prepares yearly purchase and sales plan. Takes care of purchases of auxiliary and other expendable material/equipment. Controls timely inflow of materials and delivery of products. Supervises the maintenance workshop activities.

Head of Laboratory

The head of the chemical laboratory exercises routine control of manufactured products and arriving raw materials. It is important to control stated active content of technical active material purchased in order to develop proper receipts and obtain formulated products of appropriate active content. While manufacturing he performs quick intermediate testing of the products prior to packing or further processing (dust concentrates). Controls proper sampling of the material.

Quickness in control is essential. Simple control methods with approximate results in time are better than to accomplish 0.01% exact results too late.

Develops methods of decontamination/neutralization of waste materials and effluents.

Conducts development work as outlined in VI. d.

Head of Biological Laboratory

Performs routine biological control tests both on the manufactured formulations and the new formulations developed in the formulation laboratory. Maintains professional contacts with the Agriculture, both the authorities and the research organizations. As soon as registration of pesticides will be regulated by law he has to take care about registrations of new products.

Follows the reports of international literature about pest problems and recommended control measures. Prepares surveys and reports on current pest and pesticide situation in the country and initiates new pesticide formulations which offer good market possibilities.

Plans and coordinates the work of the mobile application and marketing group, which has a double role by organizing and performing pest-control experiments on various crops at various parts of the country :

- conveys information to the farmers in form of shows of treatment and evaluations,
- gathers information among the farmers about important pest problems

Prepares proper label-texts for the products including use instructions and warning about hazards in local language as well as leaflets with the same content with illustrations.

Workshop heads

They are responsible for the daily output and good quality. Organize the daily work of the workshop, take care of the timely provision of raw material and delivery of the formulated product to the store, record production figures and irregularities in the diary of the workshop. Supervise the technical facilities regularly and call for repair and maintenance as necessary. Train the personnel, maintain discipline and procure good housekeeping.

Head of maintenance and repair

Responsible for the good condition of the production facilities and efficient work of the Repair Workshop. Prepares yearly maintenance program and organizes the work according to it. Supervises regularly the condition of the production machines of the plant. Supervises the inventory of spare parts and takes care of ordering spare parts or replacements in time. Trains both production and repair personnel on the proper use of equipment. Takes care of respecting safety regulations while repair work.

Head of stores

Responsible for the proper and safe storage of raw - and formulated materials, registers arriving and sold goods. Maintains cleanliness and good order in the stores, directs the transport of material within the plant according to instructions of Workshop Heads. Trains his personnel on proper handling and storage practices.

Heads of Administration and Accounts Department

Traditional duties and responsibilities.

B. Types of work in the plant

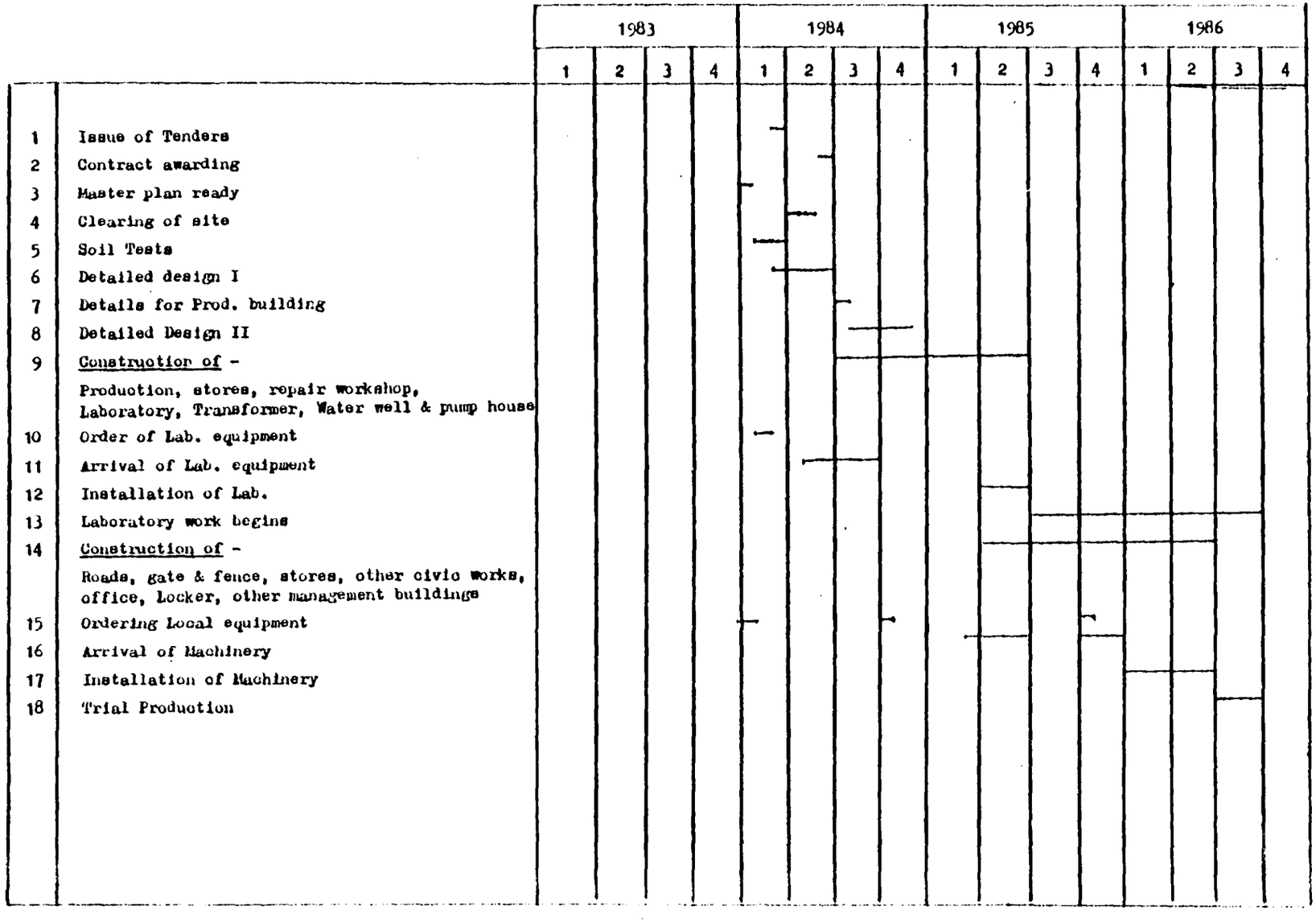
Hereunder a list of typical activities is given as a guidance for distribution of individual protection tools :

1) Transport and handling of material
2) Minerals upgrading
3) Granular formulation
4) Powder formulation
5) Liquid formulation
6) Active substances handling.

Ser. No.	Recommended protecting tools :	Type of work : 1	2	3	4	5	6
1.	Working clothes	+	+	+	+	+	+
2.	Cap		+	+	+	+	+
3.	Rubber sole boots	+	+	+	+	+	
4.	PVC apron					+	+
5.	Gloves, leather palm	+	+		+		
6.	Gloves, rubber			+		+	+
7.	Goggles				+	+	+
8.	Face shield		+	+			
9.	Respirator, dust		+	+	+		
10.	Respirator, vapours					+	+
11.	Rubber boots						+

IX. IMPLEMENTATION BAR CHART

A revised and completed bar chart for the activities of the implementation is suggested hereunder :



INSTITUTIONS AND PERSONS CONTACTED

United Nations Personnel

Mr. Erling Dessau	Resident Representative, UNDP
Mr. Kevin Mc.Grath	Assistant Res. Rep., UNDP
Mr. Jerzy B. Gorski	Senior Industrial Development Field Adviser, UNDP
U Sao Eso Hom	Programme Officer, UNDP
Mr. Terence J. Crowe	Plant Protection Officer / Team Leader, FAO
Dr. C. Hugh Rendell	Pesticide Application Officer, FAO
Mr. J.W. Edmunds	Consultant, FAO
Dr. Sadananda Pattanayak	Epidemiologist/Team Leader, WHO
Mr. Fleming D. Aaen	Food and Beverage Production Expert, ILO

Pharmaceutical Industries Corporation

U Ba Nyunt	Managing Director
U Saw Myint	Planning Director
U Ban Yi	Deputy Planning Director
U Win Kyi	National Project Director, counterpart
U Myint Swe	National Project Manager, "
U Aung Min	Production Manager, "
U Mon Tin Win	Head of Bio. Laboratory, "
U Nyo Lay	Head of Maintenance, "

Agriculture Corporation

U Than Lynn	Deputy General Manager
U Saw Benny Tun	Deputy General Manager

Health Department

Dr. Nyunt Hlaing	Deputy Director

Construction Corporation
Architecture Group II

U Kyu Kyaw	Group Leader
U Tin Myat	Deputy Group Leader

Mining Corporation No. 3

U Kyaw Aung	Deputy Director
U Aung Nyunt	Deputy Director

Annex. II

Sown Acreage of Main Crops in Burma
1981/82

Serial No.	Crops	Area (thousand acres)	%
1	Paddy	12600	49.6
2	Wheat	260	1.0
3	Maize	470	1.9
4	Beans and pulses	2050	8.0
5	Groundnut	1500	5.9
6	Sesamum	3500	13.8
7	Sunflower	260	1.0
8	Cotton	590	2.3
9	Jute	150	0.6
10	Rubber	200	0.8
11	Sugarcane	270	1.1
12	Tobacco	150	0.6
13	Other crops	3400	13.4
	Total :	25400	100.0

Annex. III

Utilization of Insecticides

(1981/82, provisional figures)

Ser.No.	Crops	Insecticides '000 Lbs	Gallons
1	Paddy, Wheat, Maize	841	46206
2	Groundnut	321	2321
3	Sesamum	16	2012
4	Cotton	526	33097
5	Jute	2	265
6	Pulses	563	1598
7	Potatoes	31	290
8	Sugarcane	29	100
9	Sunflower	5	162
10	Vegetables	-	603
11	Millet	15	-
12	Others	30	2164
	Total :	2379	88818

Rate of growth

Year	Insecticides Utilized Lbs	Gallons
1977/78	786015	108606
1978/79	822815	134443
1979/80	1130017	81449
1980/81	1352940	149768
1981/82	2378355	88818

Annex IV

Insect pests and diseases in Burma

A) Insect Pests

Common Name	Scientific Name
Paddy	
Rice Swarming Caterpillar	Spodoptera mauritia BOISDUVAL
Rice gall midge	Orseolia oryzae WOOD-MASON
Rice case worm	Nymphula depunctalis GUENEE
Rice hispa	Dicladispa armigera OLIVIER
Rice stem borers :	
- yellow stem borer	Tryporyza incertulas WALKER
- pink stem borer	Sessamia inferens WALKER
- dark-headed stem borer	Chilo Polychrysa MEYRICK
- striped stem borer	Chilo suppressalis WALKER
Rice ear bug	Leptocorisa acuta THUNBERG
Rice ear cutting caterpillar	Mythima separata WALKER
Rice grain-nibbling caterpillar	Cirphis unipuncta HAW
Rice leaf binding caterpillar	Parnara mathia (Fb.)
Rice leaf butterfly	Melanitis ismene (Cram)
Rice stem gall fly	Pachydiplosis orizae (W.M)
Red hairy caterpillar	Dasychira securis)Hb.)
Wheat	
Aphid	Rhopalosiphum maidia Fitch
Termite	Odontotermes abesus Ramb.
Sorghum	
Army worm	Mythimna separata WALKER
Chafer grub	Lachnosterna sp.
Maize	
Leaf eating caterpillar	Spodoptera litura (F.)
Aphid	Rhopalosiphum maidia Fitch
Pink stem borer	Sesamia inferens WALKER

Common Name	Scientific Name
Sesamum	
Common hairy caterpillar	Diacrisia oblique WALKER
Chafer grub	Anomala antiqua GULL
Deaths head moth	Acherontia styx WESTWOOD
Leaf roller	Antigastra cataluanalis Dup.
Sunflower	
Leaf roller	Archips micaceana WALKER
Leaf eating caterpillar	Spodoptera mitura
Groundnut	
Common hairy caterpillar	Diacrisia obliqua WALKER
Leaf miner binder	Biloba subsecivella ZELLER
Chafer grub	Anomala antiqua GULL
Hoppers	Empoasca sp.
Peas and Beans	
Flea beetle	Luperodes suturalis Mota
Common hairy caterpillar	Diacrisia obliqua WALKER
Cut worm	Agrotis ipsilon HUFNAGEL
Lady-bird beetle	Epilachna dodecastigma HUBNER
Boll worm	Heliothis armigera (HUBNER)
Spotted pod borer caterpillar	Maruca testulalis GEYER
Bruchids	Bruchus phaseoli GULL
	Bruchus chinensis L.
Leaf eating caterpillar	Prodenia litura (Fabr.)
Leaf roller	Archips micaceana WALKER
	Orgyia turbata (Butlr)
	Episomus sp.
Red spider mite	Tetranychus bioculatus (W.M)
Aphids	
Jassids	

Common Name	Scientific Name
Cotton	
Cotton leaf roller	Sylepta derogata F.
Spotted boll worm	Earias vittella F.
Pink boll worm	Pectinophora gossypiella SAUNDER
American boll worm	Heliothis armigera HUBNER
Red cotton bug	Dysdercus cingulatus F.
Cotton aphid	Aphis gossypii
Cotton jassids	Empoasca Spp.
Leaf roller	Archips micaceana WALKER
Red spider mite	Tetranychus bioculatus (W.M)
Sugarcane	
Chafer beetle	Alissonotum impressicolle ARROW and Lachnosterna SP.
Pink stem borer	Sesamia inferens WALKER
Striped shoot borer	Chilo infuscatellus SNELL
Jute	
Jute apion	Apion corchori MARSHALL
Semi-looper	Anomis sabulifera GUENNE
Common hairy caterpillar	Diacrisia obliqua WALKER
Potato	
Cut worm	Agrotis ipsilon HUFNAGEL
Lady-bird beetle	Epilachna 28-punctata F.
Green bug	Nezara viridula L.
Potato tuber moth	Phthorimaea operculella ZELLER
B) Diseases	
Paddy	
Rice blast	Pyricularia oryzae
Bacteria leaf blight	Xanthomonas oryzae
Ufra disease	Ditylenchus angustus
Sesamum	
Phyllody	(caused by a MLO)
Stem rot	Macrophomina phaseolina

Common Name	Scientific Name
Groundnut	
Cercospora leaf spot	Mycosphaerella arachidis
Cotton	
Bacterial Blight	Xanthomonas malvaecarum
Sugarcane	
Red Rot	Physalospora tucumanensis
Smut	Ustilago scitaminea
Potato	
Laye blight of potato	Phytophthora infestans

联合国粮食及农业组织 | FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS | ORGANISATION DES NATIONS UNIES POUR L'ALIMENTATION ET L'AGRICULTURE | ORGANIZACION DE LAS NACIONES UNIDAS PARA LA AGRICULTURA Y LA ALIMENTACION

PLANT PROTECTION AND QUARANTINE
PROJECT BUR 81 007

Ref:

Phone : 31121, 33405
Cable : FOODAGRI RANGOON
Telex : FOODAG BM 21505

Mail Address: C/o UNDP
P.O. Box 650
Rangoon BURMA

Mr. I. Bendefy
UNIDO Consultant
c/o UNDP
Rangoon

02 November 1983

Dear Mr. Bendefy,

LOCAL FORMULATION OF PESTICIDES

We believe that satisfactory pest control on over 98% of the crops in Burma can be achieved if the Agriculture Corporation holds stocks of five insecticides, each available in EC formulation for general farmer use and a smaller quantity of ULV formulation for emergency use and other special campaigns.

Rice Insecticides

Our criteria for choosing a general purpose rice insecticide are as follows:

1. It should give satisfactory control of the common Burmese rice pests
2. It should be of low mammalian toxicity
3. It should have a low toxicity to fish
4. It should be cheap i.e. a commodity - not a speciality product
5. It should not be liable to cause outbreaks of Brown Plant Hopper by killing beneficial species.

We have chosen fenitrothion (Sumithion) and phenthoate (Elsan) as the two materials coming closest to our needs.

..... 2/-

Mr. I. Bendefy - 02 November 1983

Cotton Insecticides

Although cotton occupies a relatively small acreage it consumes a large proportion of the pesticide used in Burma. We believe that it is essential to have a spray programme based on three products - a highly selective material for sucking pests and two products from different chemical groups for bollworm control., All three pesticides should be of low toxicity to mammals and bees.

The three products selected are thiometon (Ekatin), endosulfan (Thiodan) and one or other of the synthetic pyrethroids - either cypermethrin (Cymbush), deltamethrin (Decis) or fenvalerate (Sumicidin).

Other Crops

Pests of groundnuts, sesamum, jute, pulses etc. can be controlled either with a "rice" insecticide or a "cotton" insecticide.

A small quantity of 40% aldrin WP and 85% carbaryl WP would also be useful but it would be better to import these since the foreign exchange savings from local formulation would be negligable.

There may be some demand in the future for sand-based granules for rice pest control. Diazinon, carbofuran or quinalphos are possible active ingredients.

..... 3/-

Mr. I. Bendefy - 02 November 1983

	SUMMARY		Estimated requirements, 1984	
	50% fenitrothion	EC	200 000	litres
	50% fenitrothion	ULV	10 000	"
	50% phenthoate	EC	200 000	"
	50% phenthoate	ULV	10 000	"
	25% thiometon	EC	50 000	"
	12.5% thiometon	ULV	2 000	"
	35% endosulfan	EC	75 000	"
	25% endosulfan	ULV	5 000	"
either	10% cypermethrin	EC	45 000	"
	1.8% cypermethrin	ULV	5 000	"
or	2.5% deltamethrin	EC	45 000	"
	0.5% deltamethrin	ULV	5 000	"
or	17.5% fenvalerate	EC	45 000	"
	3.5% fenvalerate	ULV	5 000	"

C.H. Rendell
(Pesticide Application Officer)

T.J. Crowe
(Team Leader)

Annexure VI.

REVIEW OF THE FORMULATION CAPACITIES

Introduction

Burmese economy is dominated by Agriculture, accounting for nearly 40% of the Gross Domestic Product, 90-95% of exports and almost 70% of total employment. Crop production contributes about 70% of the total agricultural output with paddy accounting for half of this percentage. The national 20-year development plan (1973-1993) foresees an annual growth rate of 5.9% in GDP and 4.8% in agriculture. Since 1976 an annual growth of 6% has been realized for both.

According to B.M. Lazarevic * insect pests in the sixties were not so serious a problem as they were in some neighbouring countries. This might have been partly due to the traditional farming and indigenous seed and varieties still largely used in the country. Traditional crop varieties had unconsciously been selected for pest and disease resistance over many years. Most of the crops were grown in the monsoon and the harvest was followed by a long fallow period. From the total area of 20.32 mill. acres sown in 1965-66 with different crops and fruits only 576 thousand acres were reported attacked by insect pests and of that 393 thousand acres were protected by insecticides (1.9%).

A major change came in 1977, when new high yielding varieties (HYV) of paddy began to be introduced on a "whole-township" basis. The programme has proved extremely successful in raising yields**. To date 82 townships out of a total of 287 rural Townships are now growing HYV. The technique is now being used to expand the production of other crops such as cotton, wheat, maize, groundnuts, sesamum and sunflowers.

Also in recent years there has been a great increase in multiple cropping. The expansion of irrigated areas has permitted crops to be grown at each season of the year.

Experience in other Asian countries has shown that the introduction of HYV and the expansion of multiple cropping inevitably leads to a great change in the status of various pests and diseases. Consequently the Government decided to strengthen the plant protection services and set up an entirely

---

* FAO report TA 2837 "The study of agricultural pests and their control" (1970)

** Khin Win, et al, 1981, IRRI Research Paper No. 55

new Plant Protection Section with the Extension Division of the Agriculture Corporation. The activities became operational on 15 March 1980 and provide today a reliable basis for the rational increase of chemical pest control built in into int grated pest control programmes.

In addition to the agricultural usage the application of pesticides as cockroach, mosquito and other pest killers is indispensable for the successful implementation of the environmental health programme, public health protection and disease control (malaria and other vector borne diseases). Safe insecticides are needed also for the population to enable keeping the household free of insect pests.

Analysis of pesticides' imports

The analysis of pesticides' imports using the data covering the years 1974 through 1983 has been carried out in order to review the formulation capacities set forth in the project document BUR/80/011/A/01/37.

COMMODITY	Total import in 9 years		Maximum import within 1 year		Importer
GRANULES					
Diazinon 10G	5	t	5		Agri.Corpn
Thimet 10G	10	t	10		"
Abate 1G	9.5	t	5		Health Dept
Total :	24.5				Average : 3t/y
DUSTS					
Aldrin 2.5 DP	500	t	500	t	Agri.Corpn
Aldrin 5 DP	2800	t	1000	t	"
Elsan 5 DP	10	t	10	t	"
Lindane 13 DP	930	t	300	t	"
Damfin 2 DP	62	t	52	t	Agri.Trade
Lindane 26 DP	62	t	57	t	"
Total :	4364	t			Average : 485t/y
WETTABLE POWDERS					
Carbaryl 85 WP	1360	t	600	t	Agri.Corpn
DDT 75 WP	230	t	180	t	"
DDT 75 WP	1788	t	283	t	Health Dept
Total :	3378	t			Average : 375t/y

CONCENTRATED LIQUIDS (incl. ULV)			
Dimecron 50 SCW	58.4 th.l	23.4 th.l	Agri.Corpn
Dino 750 SCW	5 "	5 "	"
Malathion 90 EC	1024 "	341 "	"
Damfin 950 EC	17.7 "	10 "	Agri.Trade
Nuvan 100 EC	5.2 "	5.2 "	"
Nuvan 100 SC	4.5 "	2.3 "	"
Malathion 96 ULV	19.8 "	11.3 "	Health Dept
Total :	1134.6 th.l		Average : 126 th.l/y
EMULSIFIABLE CONCENTRATES			
DDT 25 EC	501 th.l	228 th.l	Agri.Corpn
Diazinon 40 EC	7.5 "	5 "	"
Elsan 50 EC	57 "	34 "	"
Endrin 29.5 EC	1092 "	273 "	"
Endrin 20 EC	364 "	364 "	"
EPN 50 EC	68.5 "	45.5 "	"
Fenthion 50 EC	7 "	3 "	Health Dept
Baygon Oil 20 EC	7.5 "	3 "	Agri.Trade
Baythion Oil 500 EC	6.5 "	5 "	"
Total :	2111.0 th.l		Average : 235 th.l/y
FUMIGANTS			
Methyl Bromide	831 t	241 t	Agri.Trade
Al. Phosphide	2.6 t	1.2 t	"
Total :	833.6 t		Average : 93 t/y

The foregoing figures are commented as follows :

Fumigants

Fumigants do not need formulation of the kind, planned, accordingly they were not considered at the planning of capacity.

Dusts and Wettable Powders

Field strength dusts dominate at present the imports of pesticides. Figures show considerable fluctuation year to year and do not indicate a trend of increase. The steady growth may be observed at utilization figures, see Annex. III.

Trends of up to date pest control practice considering environment pollution and human health hazard aspects suggest a shift of product usage from DP formulations of persistent organo-chlorines to less hazardous active substances and more convenient formulations (see Annex.V). Considering further factors such as traditions of pest control practices, justified use of the products on limited areas and the overall growth of pesticide consumption, a constant quantity of the average imports (480 t/y) is suggested as a basis for the planning of the dust formulation capacity.

Formulation of Carbaryl 85 WP is not recommended for local implementation due to the little or no percentage of possible local material inputs.

The Health Department has a relatively stable demand of DDT 75 WP. The average shown is 225 t/y. It is recommended that the product should be formulated at a strength of 50 WP, accordingly the demand to be increased to 340 t/y and this quantity be taken as basis for the capacity planning.

The project document foresees for the powder formulation a capacity of 8 t/day DP or 2 t/day WP production. The below table of possible production programmes for one year shows that this capacity matches the demands shown above.

Dust powder 8 t/day		Wettable powder 2 t/day	
days	tons	days	tons
0	0	240	480
40	320	200	400
60	480	180	360
100	800	140	280
240	1920	0	0

On the above basis DDT 50 WP and Lindane 26 DP have been selected as products to be manufactured and for planning purposes.

Liquid Formulation

Imports of liquid pesticides show a total average of 360 thousand liters/year but of this some concentrated products need no formulation. For local

formulation only the type of emulsifiable concentrates and the low concentration ULV products may be considered, of which the average import amounts to 240,000 l/y.

The recommendations given in the above cited letter from Plant Protection and Quarantine Project foresee a quantity of about 6,00,000 litres/y. This means that the one thousand I.G/day capacity fixed in the project document (equalling 10,80,000 l/y) covers also the growth of the demand for considerable time, which can be forecasted as soon as the project will be onstream.

Calculating an average rate of 0.3 lit/acre the total capacity covers 3,600 thousand acres (for one spraying) that is 14% of the total cropped area in the country. Considering the certainly occuring growth of the demand for liquid pesticides a provision for possible extension is recommended at the preparation of the plans for the plant.

Products given in the cited letter have been taken as examples for the production and basis for the planning.

Granules

The use of granular pesticides offers the following advantages to the users :

- readiness to use : they not require to be mixed with water. non-availability of water in many areas and inconvenience of the transportation of 150-250 lit water per acre stands across use of 10-20 kg/acre granules,
- relative safety due to the low concentration, non-volatility and non-inflammability,
- easy distribution,
- no danger of air-drift.

In spite of these advantages the actual imports are very low and eventual. The fact may be ascribed to the fact that due to the low concentration the transport costs referred tp the unit active ingredient are relatively high. It can certainly be assumed that as soon as a local formulation will start, the demand will grow rapidly. Accordingly the capacity of 1 ton/day totalling 240 t/y production set forth in the project document can be considered as justified for a pilot production. Supposeing the use of e.g Diazinon 5G against rice pests at a rate of 15 kg/acre one year's production covers 16,000 acres, 0.13% of the total area under paddy.

Diazinon 5G has been selected as suggested first production, together with some quantity of Temphos 5G used against disease vectors.

Summary

Summarizing the proposed comments and considerations the following production programme is suggested both for starting the production in the plant and for planning purposes (quantities below 10 t were neglected) :

Dust Powders :	Lindane 26 DP	480 t
Wettable Powders :	DDT 50 WP	360 t
Emulsifiable Concentrates :	Fenitrithion 50 EC	335,000 lit
	Fenitrothion ULV	17,000 lit
	Phenthoate ULV	17,000 lit
	Thiometon 25 EC	85,000 lit
	Endosulfan 35 EC	125,000 lit
	Cypermethryn 10 EC	75,000 lit
Granules :	Diazinon 5 G	230 t
	Temephos 5 G	10 t

Annex VII

ACTIVE SUBSTANCES RECOMMENDED FOR DEVELOPMENT

S.N.	Common Name Formulation	Producer	Use	Toxicity p.o. LD 50 mg/kg
1)	Aldrin 25-40% WP 2.5-5% DP 1.5% fertilizer mix	Shell Int. Co.Ltd	Non systemic and persistent insecticide, effective against soil insects and not phytotoxic	67
2)	Chloropropylate 25% EC	Ciba-Geigy AG	non systemic contact acaricide suitable for use on fruit, nuts, tea, cotton, vegetables and ornamentals	5000
3)	Chlorpyrifos-methyl 24½ EC	Dow Chem. Co.	broad range insecticide effective by contact, ingestion and by vapour action but non systemic. Used in stored grain, to control mosquito(adult), flies, aquatic larvae, household pests and various foliar crop pests	1630-2140
4)	Cyanophenphos 25% EC 1.5% DP	Sumitomo Chem. Co.	effective insecticide against rice borer and gall midges, cotton bollworm in tropical areas and against lepidopterous larvae and other insect pests of vegetables in temperate zones	89
5)	Dichlorvos (DDVP) 50% EC	Ciba-Geigy AG Shell Int. Co. Bayer A.G. etc.	contact and stomach insecticide with fumigant and penetrant action. Used in household and public health, against stored grains pests, for crop protection against sucking and chewing insects	56-108

S.N.	Common Name Formulation	Producer	Use	Toxicity p.o. LD 50 mg/kg
6)	Dicofol 18.5% WP	Rohm & Haas Co.	non systemic acaricide with little insecticidal activity. Recommended for the control of mites on a wide range of crops	668 - 882
7)	Dioxacarb 40-50 WP	Ciba-Geigy AG	Contact and stomach insecticide used in the household and against many sucking and chewing foliage pests including aphids, has rapid "knockdown" action	60 - 80 dermal 3000
8)	Etrimfos 50% EC 5% G	Sandoz A.G.	broad range non systemic insecticide against Lepidoptera, Coleoptera, Diptera and to variable extent Hemiptera	1800
9)	Formothion 24-33% EC	Sandoz A.G	Contact and systemic insecticide, against wide range of sucking and some chewing insects	365-500
10)	Malathion 25-50 EC	Sumitomo Ch.Co. American Cyanamid Co.	non systemic insecticide and acaricide against wide range of agricultural, horticultural and household pests	2800
11)	Methacrifos 1-2% DP	Ciba-Geigy AG	Used mainly on stroed grain pests	678
12)	Salithion 25% EC 25% WP 5% G	Sumitomo Ch. Co.	wide range insecticide for use against rice gall midge and cotton bollworm	180

Annex VIII

Addresses of Suppliers of raw materials

AMERICAN CYANAMID COMPANY

P.O. Box 400, Princeton, New Jersey 08540, U.S.A.

fenitrothion, malathion, temephos

ATLAS CHEMICAL INDUSTRIES N.V

Everslaan 45, 8-3078 Everberg, Belgium

Tlx : 26153 ICIEU B

Emulsifiers

BAYER A.G.

5090 Leverkusen Bayerwerk, F.R.G.

fenitrothion, thiometon, DDVP

CIBA-GEIGY A.G

CH-4002, Basle, Switzerland

diazinon, chlorpropylate, DDVP, dioxacarb, methacrifos

THE DOW CHEMICAL COMPANY

Midland, Michigan, 48640, U.S.A

chlorpyrifos - methyl

HOECHST A.G

P.O. Box 800320, D-6230 Frankfurt am Main 80, F.R.G

endosulfan, emulsifiers

ICI = IMPERIAL CHEMICAL INDUSTRIES LTD

Fernhurst, Haslemere, Surrey GU27 3JE, England

cypermethryn

JOHNS - MANVILLE INTERNATIONAL

P.O.B. 5108 Denver, Colorado, U.S.A.

high sorptivity silica

MONTEDISON S.P.A

Via Bonfadini 148, 20138 Milan, Italy

phenthoate

NISSAN CHEMICAL INDUSTRIES LTD.

Kowa Hitotsubashi Building, 7-1, 3 Chome, Kanda-Nishiki-cho, Chiyoda-ku,

Tokyo, Japan

diazinon, phenthoate

ROHM AND HAAS COMPANY

Independence Mall West, Philadelphia, Pennsylvania 19105, U.S.A.

dicofol

ROUSSEL UCLAF

163, avenue Gambetta 75020 - Paris, France

decamethryn

SANDOZ A.G.

CH - 4002 Basle, Switzerland

thiometon, etrimfos, formothion

SHELL INTERNATIONAL CHEMICAL COMPANY LTD

Shell Centre, London SE 1 7 PG, England

cypermethryn, fenvalerate, aldrin, DDVP

SUMITOMO CHEMICAL CO. LTD

15, 5-chome, Kitahama, higashi-ku, Osaka, Japan

fenitrothion, fenvalerate, diazinon, malathion, lindane, cyanofenphos, salithion

TENZIA S.A.

62, Avenue des Tilleuls - 4000 Liege, Belgium

emulsifiers

Annex. IX

Raw Material Purchase Plan (liquid products)

(for store capacity planning)

(000 litres)

		Fenitrothion		Phenthoate		Thiometon	Endosulfan	Cypermethrin	Total
		50 EC	50 ULV	50 EC	50 ULV	25 EC	35 EC	10 EC	
1.	Fenitrothion	167.5	8.5						176
2.	Phenthoate			167.5	8.5				176
3.	Thiometon					21.25			21.25
4.	Endosulfan						43.75		43.75
5.	Cypermethrin							7.5	7.5
6.	Local solvent	67.0		67.0		42.5	47.5	60.75	284.75
7.	Xylene	73.7		73.7		16.15	25.0		188.55
8.	Emulsifiers	26.8		26.8		5.1	8.75	6.75	74.20
9.	White Oil		7.65		7.65				15.30
10.	Special additives		0.85		0.85				1.70
		335	17	335	17	85	125	75	989

Annex. X

Raw Material Purchase Plan (solid products)

(for store capacity planning)

(tons)

S.N.	Raw Material	Diazinon 5G	Temephos 5G	DDT 50 WP	BHC 26 DP	Total	
1.	Diazinon	11.5	-	-	-	11.5	
2.	Temephos	-	0.5	-	-	0.5	
3.	DDT	-	-	180	-	180	
4.	BHC	-	-	-	104	104	
5.	Granular carrier	209.3	9.0	-	-	218.3	
6.	Silica powder	9.2	0.5	14.4	-	24.1	
7.	Bentonite	-	-	144	-	144	
8.	Wetting agents	-	-	21.6	-	21.6	
9.	Talc	-	-	-	376	376	
	Total :	230	10	360	480	1080.0	

Annex. XI

Stores' capacity planning

S.N.	Stored Material	Unit	Requirement for one year	Planned storage time	Quantity to be stored	Qty stored per m^2	Required net surface (m^2)	Required store surface m^2
1.	Technical Active Substance	ton	720.5	4 months	240	1.5	160	208
2.	Local solvents	th/lit	284.75	1 month	24			
3.	Xylene	"	188.55	6 months	95	1.5	63.3	82
	White Oil	"	15.30	6 months	8		5.3	7
4.	Auxiliary materials	ton	97.50	4 months	32	1.5	21.3	28
5.	Granular carrier	"	218.30	6 weeks	27	1.5	18	23.4
6.	Bentonite	"	144	6 weeks	18		24	31
7.	Talc	"	376	6 weeks	42		28	36
8.	Silica Powder	"	24.1	4 months	8	0.5	16	20.8
9.	Packing material						30 *	39
10.	Formulated liquids	th/lit	989.0	1 month	82	1.5	55	71
11.	Formulated solids	"	1080.0	1 month	90	1.0	90	117

* estimated

EVALUATION METHODS FOR SOLID CARRIERS

I. SURFACE ACID STRENGTH (pKa)

This technique is based on the ability of the surface of the filler to convert an absorbed neutral base colour indicator to its conjugated acidic form, the colour change of the indicator being used to determine the pKa. The six indicators used together their values are shown in the table below :-

Indicator	pKa	Basic colour	Neutral colour	Acid colour
Benzene-azo-α-naphtylamine	+ 4.5		red	purple
4-Phenylazo-1-naphtylamine	+ 4.3	yellow		red
N,N-Dimethyl-p-phenyl-azoaniline ("Dimethyl-yellow", or "Butter-yellow")	+ 3.3	yellow	yellow	red
p-Phenylazoaniline	+ 2.8	yellow		orange
4-O-tolylazo-o-toluidine	+ 2.0	yellow		red
4-Phenylazodiphenylamine	+ 1.5	yellow	yellow	purple
N,N-Dimethyl-p-1-naphtylazoaniline	+ 1.2	yellow		blue
4,4', 4"-Methylidinetris (N,N-dimethylaniline)	+ 0.8	yellow		blue
Dicinnamalacetone (1:9-diphenylnona-1:3:6:8-tetraen-5-one)	-2.2	yellow	yellow	red
Benzalacetophenone "Chalcone"	- 5.6	colour-less	colour-less	yellow
Antrachinone	- 8.2	colour-less	colour-less	yellow

Method : Prepare 0.1% w/v solutions of the above indicators in benzene. Add one drop of the indicators respectively to eleven portions of the filler placed on a white tile. The colour change occurs when the absorbed neutral base indicator changes to its conjugated acidic form. Observe the test portions from the negative to the positive and of the scale and the pKa of the filler corresponds to the pKa of the first indicator producing a colour change. An acidic filler will exhibit a pKa value towards the negative end of the scale.

II. pH value of Suspension : Prepare a 1% shake from the filler with distilled water and allowing 10 to 30 minutes for sedimentation determine the pH of the pure liquor.

III. Moisture content : Weigh 50 g of filler into a 6 inch clock glass and dry in an oven at 105 ± 2°C until of constant weight.

IV. Hygroscopicity : Fillers which have been dried to constant weight during the moisture content determination are exposed to a standard humidity and allowed to pick up moisture again of constant weight.

Method : Place the clock glass from the previous determination in a humidistat having a constant humidity of 95% at 20°C. A saturated solution of sodium sulphate is placed in the bottom of a desiccator to achieve this relative humidity. Allow the filler to pick up moisture until a constant weight.

V. Absorption Capacity : This method measures the total uptake of a standard type of oil (e.g. light diesel oil or liquid paraffin B.P.) and is expressed in grams oil per 100 g filler. Determination should be carried out both on the dried filler (105°C to constant weight) and on the moist filler, which had attained constant weight after exposure in air at 20°C and relative humidity of 95%/

Method : Weigh 10 g filler into a 3 cm G-3 sintered glass crucible (porosity 15 to 40 microns) and connect to a vacuum system at 80 - 100 mm mercury pressure. Introduce excess light diesel oil on to the filler bed and draw it through by means of the vacuum. Continue filtering until no excess oil remains on the filler bed. Wipe the exterior of the crucible clean and re-weigh.

VI. Grindability : A preliminary method is recommended, in which the filler is submitted to wet sieve analysis prior and after milling in a household coffee grinder. For the wet sieve analysis see CIPAC MT 59.3 page 981.

Method : Fill a household coffee grinder up to 2/3 of its total capacity with the filler, operate the grinder for one minute, the difference in residue on 44 micron (350 mesh) and 63 micron (240 mesh) sieves before and after milling is expressed as a percentage of the initial residue weight before milling. Use mean value of five subsequent determinations.

VII. Particle size : Use initial values of wet sieve analyses prior to milling from the previous determination to characterize particle size.

VIII. Flowability : For testing flowability see CIPAC MT 44, page 948.

IX. Bulk density : For testing bulk density see CIPAC MT 33, page 907.

X. Abrasiveness : Special apparatus would be needed. In general SiO_2 content is guiding concerning abrasiveness.

Annex. XIII

LIST AND SPECIFICATION OF GENERAL LABORATORY EQUIPMENT

(Chemical Laboratory)

S.N.	Denomination		Qty
1.	Beaker, squat form with spout	25 ml	20
2.	" "	50 ml	50
3.	" "	100 ml	100
4.	" "	250 ml	100
5.	" tall form with spout	400 ml	50
6.	" "	600 ml	20
7.	" "	1000 ml	10
8.	Flask, flat bottom, 'PYREX'	250 ml	10
9.	" "	500 ml	10
10.	" "	1000 ml	20
11.	Conical flask, wide mouth	100 ml	20
12.	" "	250 ml	50
13.	" "	500 ml	30
14.	" "	1000 ml	10
15.	Conical flask, ground, stoppered socket 14/23	50 ml	10
16.	" "	100 ml	20
17.	" "	200 ml	20
18.	" socket 19/26	250 ml	20
19.	" "	500 ml	10
20.	" "	1000 ml	5
21.	Volumetric flask, stoppered	50 ml	5
22.	" "	100 ml	25
23.	" "	250 ml	10
24.	" "	500 ml	5
25.	" "	1000 ml	5
26.	Boyling flask, short neck, ground socket 24/29	100 ml	5
27.	" "	250 ml	10
28.	" "	500 ml	10
29.	" "	1000 ml	5
30.	" three neck, side neck sockets 14/23	500 ml	5
31.	" "	1000 ml	5
32.	Measuring cylinder	10 ml	5
33.	"	25 ml	5
34.	"	50 ml	5
35.	"	100 ml	10
36.	"	250 ml	5
37.	"	500 ml	5
38.	"	1000 ml	2
39.	"	2000 ml	2
40.	Graduated cylinder, stoppered	100 ml	50
41.	" "	250 ml	50

S.N.	Denomination		Qty
42.	Pipette, bulb form, adjusted two graduations	1 ml	5
43.	" "	2 ml	5
44.	" "	5 ml	10
45.	" "	10 ml	10
46.	" "	20 ml	5
47.	" "	25 ml	5
48.	" "	50 ml	5
49.	Pipette, bulb form, unadjusted, single graduation	5 ml	5
50.	" "	10 ml	10
51.	" "	20 ml	10
52.	" "	25 ml	5
53.	" "	50 ml	10
54.	" "	100 ml	10
55.	Graduated pipette, straight form	1 ml	10
56.	" "	2 ml	10
57.	" "	5 ml	10
58.	" "	10 ml	10
59.	" "	25 ml	5
60.	Micro burette	2 ml	2
61.	"	5 ml	5
62.	"	10 ml	5
63.	Burette, Schellback	25 ml	5
64.	"	50 ml	10
65.	Burette, automatic zero, 2 lit reservoir	25 ml	3
66.	" "	50 ml	5
67.	Evaporating glass basin, round bottom in pack of 26	Ø 65 mm	3
68.	" "	Ø 90 mm	3
69.	Crystallising glass basin, flat bottom in pack of 24	Ø 70 mm	1
70.	" "	Ø 100 mm	1
71.	Watch glasses with flat bottom in pack of 10	Ø 50 mm	5
72.	" "	Ø 65 mm	5
73.	" "	Ø 75 mm	5
74.	" "	Ø 100 mm	5
75.	Dreschel's gas washing bottle	250 ml	2
76.	Glass bowl, rectangular, 300 x 200 x 200 mm		3
77.	Chromatography column with stopcock, socket and cone 14/23		3
78.	Buchner filter flask, socket 14/23	250 ml	5
79.	Filter tube		10
80.	Filter cone, india rubber		10
81.	Test tube 150 x 16 mm, pack of 12		15
82.	Condenser, Liebig, 500 mm		5
83.	Condenser with worm condenser tube, 200 mm		2
84.	Soxhlet condenser, cone 29/32		5
85.	Soxhlet extractor, 40 ml, socket 29/32, cone 24/29		5

S.N.	Denomination			Qty
86.	Extraction thimbles, fat free paper, seamless, 10 x 50 mm, pack of 25			10
87.	Filter funnel, plain	Ø 50 mm		10
88.	" "	Ø 75 mm		10
89.	" "	Ø 100 mm		10
90.	" "	Ø 150 mm		5
91.	" ribbed	Ø 75 mm		10
92.	Powder funnel	Ø 75 mm		10
93.	Separating funnel, ground, cone 14/23	100 ml		10
94.	Separating funnel, globular	100 ml		5
95.	" "	250 ml		5
96.	" "	500 ml		3
97.	Dropping funnel, cylindrical	100 ml		2
98.	Filter flask with side tube	250 ml		5
99.	" "	500 ml		5
100.	" "	1000 ml		5
101.	Wash bottle, polythene	500 ml		10
102.	Weighing bottle, ground cap	Ø 50 mm		20
103.	Desiccator, internal	Ø 250 mm		5
104.	Crucible for flashpoint apparatus			10
105.	Gooch crucibles G 3			5
106.	" " G 4			10
107.	" " G 5			5
108.	Buchner funnel	Ø 70 mm		3
109.	"	Ø 90 mm		3
110.	"	Ø 110 mm		3
111.	Porcelain evaporating basin	Ø 60 mm		20
112.	" "	Ø 75 mm		20
113.	" "	Ø 90 mm		20
114.	" "	Ø 130 mm		20
115.	" crucible, squat type	Ø 30 mm		10
116.	" "	Ø 40 mm		10
117.	" "	Ø 50 mm		10
118.	" mortar and pestle	Ø 80 mm		3
119.	" "	Ø 110 mm		3
120.	" "	Ø 150 mm		3
121.	" "	Ø 180 mm		3
122.	Dean and Stark water estimation capacity 10 ml cone 24/29, socket 19/26			10
123.	Density Bottle, unadjusted, with capilliary stopper			5
124.	Pycnometer, Nicol			5
125.	Fenske viscometer set of 11			1
126.	Reagent bottles, narrow mouth, stoppered		50 ml	20
127.	" "		100 ml	100
128.	" "		250 ml	200
129.	" "		500 ml	20
130.	" "		100 ml	20

S.N.	Denomination	Qty
131.	Reagent bottles, wide mouth, stoppered 100 g	100
132.	" " 250 g	200
133.	" " 500 g	20
134.	Glass rod, 5 x 200 mm, pack of 100	2
135.	Chromatography tamping rod	10
136.	Burette clamp	10
137.	Apparatus clamp	10
138.	Flask clamp	10
139.	Pipe clamp	10
140.	Bosshead for laboratory stand	50
141.	Ring without boss	10
142.	Ring, retort stand ø 75 mm	10
143.	Retort stand, 500 mm rod	10
144.	Retort stand, 750 mm rod	10
145.	Test tube stand PVC 12 holes	5
146.	" hardwood, 9 holes	5
147.	" holder	10
148.	Pipette stand for 24 pipettes of assorted size	2
149.	Mohr clamp	10
150.	Hoffman clamp	10
151.	Cork borer set ø 5-19 mm	1
152.	Cork roller	1
153.	Assorted cork stoppers	1 kg
154.	Assorted rubber stoppers, solid	2 kg
155.	Flask support, compressed cork ring ø 45/75 mm	2
156.	" " ø 80/115 mm	2
157.	" " ø120/155 mm	2
158.	Double ended spatula, nickel, 150 mm	5
159.	Squeeze rubber bulb	5
160.	Red rubber tubing, internal ø 5 mm	5 m
161.	" 6.5 mm	5 m
162.	" 8 mm	5 m
163.	" 10 mm	5 m
164.	" pressure tubing 5 mm	3 m
165.	" " 8 mm	3 m
166.	Microscope slides with circular cavity in centre, 76x26x1.2 mm, pack of 10	20
167.	Microscope slide covers, pack of 100	2
168.	Thermometer, stirring, °C scale, length 150 mm - 10 to 50 x 1°C	5
169.	" - 10 to 110 x 1°C	5
170.	" stirring, °C scale, length 300 mm - 10 to 50 x 0.5°C	5
171.	" - 10 to 110 x 1°C	5
172.	" - 10 to 250 x 1°C	2
173.	" - 10 to 360 x 2°C	2
174.	" refrigerator - 30 to 40 x 1°C	2
175.	" red reflector - 10 to 110 x 1°C	5

SN	Denomination	Qty
176.	Safety spectacles with side shields, plastic	20
177.	Chemical goggles, wide angle, plastic	20
178.	Face shields, transparent, non-inflammable	10
179.	Apron, polythene, light, pack of 100	1
180.	Apron, PVC, heavy duty, chemo resistant	10
181.	Respirator, dust, with gauze filter pads	50
182.	Gauze filter pads, refill, pack of 25	10
183.	Gloves, polythene, disposable, pack of 100	
	small	5
	standard	5
184.	Gloves, vinyl, lightweight, non slip grip	
	men's medium size	20 pairs
	women's medium size	20 pairs
185.	Gloves, rubber, raised surface, heavyweight	
	medium size	50 pairs
186.	Scoop, polythene, rigid with handle, length 120 mm	5
187.	" " length 200 mm	5
188.	Filter pump	5
	Clear rigid polystyrene with PVC non-return valve, riffled inlet and outlet tubes. Ultimate vac. 50 torr. Vacuum nozzle of ø 8 mm	
189.	Syphon	10
	Comprises durable polyethylene squeeze bulb on vertical limb with flexible side limb for dispensing from bulk liquids in drums safely. Height 500 m, length of flexible limb 540 mm	
190.	Triangle, pipeclay	
	Iron wire, pipe clay stem 50 mm pack of 10	1
191.	Crucible tong with bow, iron 200 mm	2
192.	Beaker tong, circular jaws, 300 mm stainless steel	2

Annex XIV

SPECIFICATION OF LABORATORY INSTRUMENTS

No.	Denomination	Qty

1) Microscope

Eyepieces paired, Widefield 10 x
Objectives in x 10 NA 0.25 achromat
Individual x 40 NA 0.65 achromat
Centring mounts x 100 NA 1.25 achromat
Condenser Abbe NA 1.25
Illumination 20 W tungsten lamp
200-240 V a.c
Complete in portable box with instructions — 1

2) Refractometer, ABBE — 1

Refractive index scale 1.300 - 1.700 x 0.001
Minimum sample 0.5 cm^3
Temperature range 0-75°C
Protected thermometer
Complete with one spare thermometer
with dust cover and instructions

3) SARTORIUS analytical balance, single pan — 1

Constant load weighing system
Capacity : 160 g
Pan Ø : 117 mm
Readability (micrometer) 0.1 mg
Optical scale 1 g
Complete with masses lamps and instructions

4) Quick balance, single pan — 1

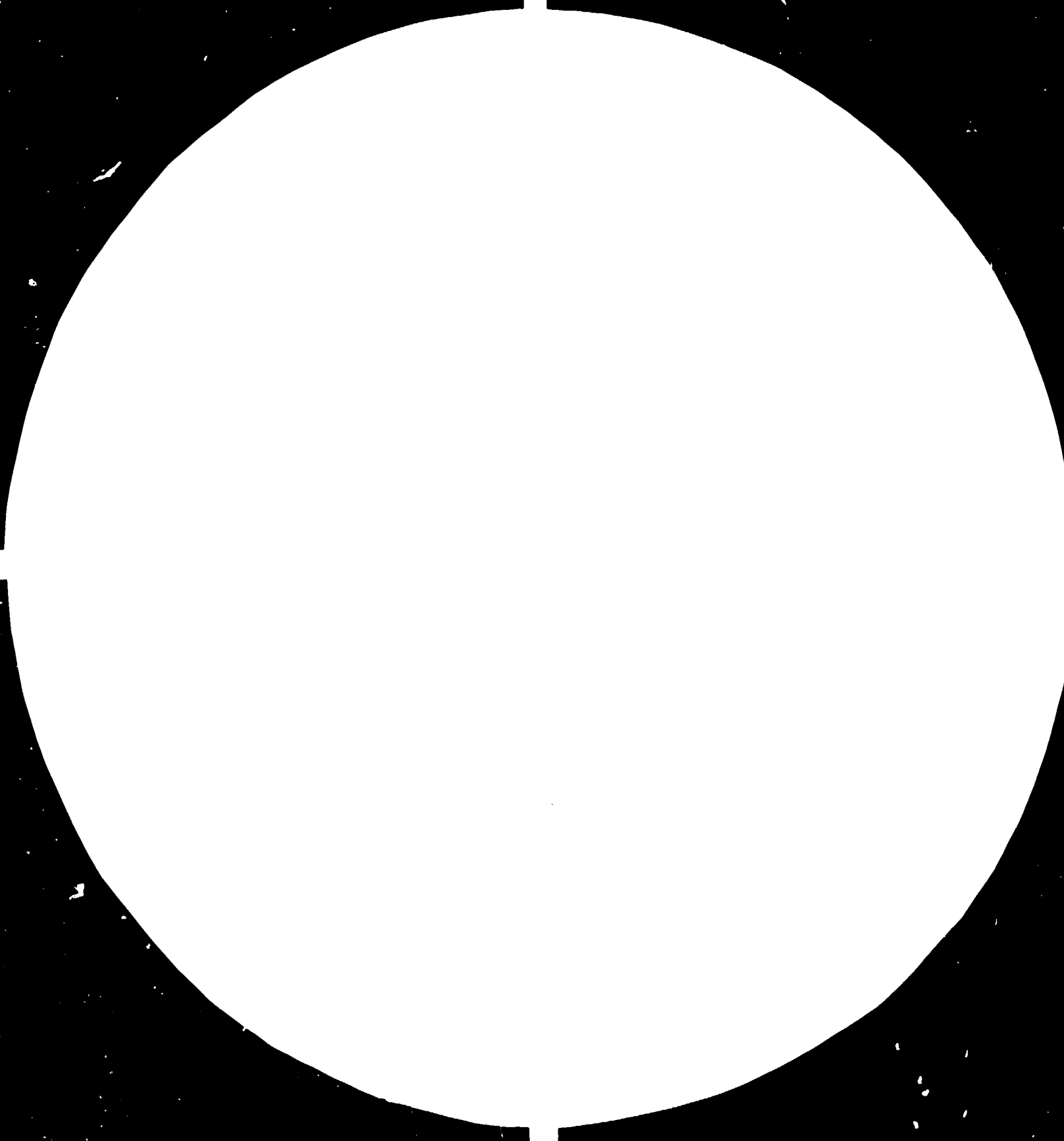
Capacity 2610 g, sensitivity 0.1 g with beams graduated 0 to 500 x 100 g, 0 to 100 x 10 g and 0 to 10 x 0.1 g. With zero adjustments and flat stainless steel pan Ø 150 mm, damped beam movement, 2 x 1 kg and 1 x 500 g attachment masses, complete with dust cover

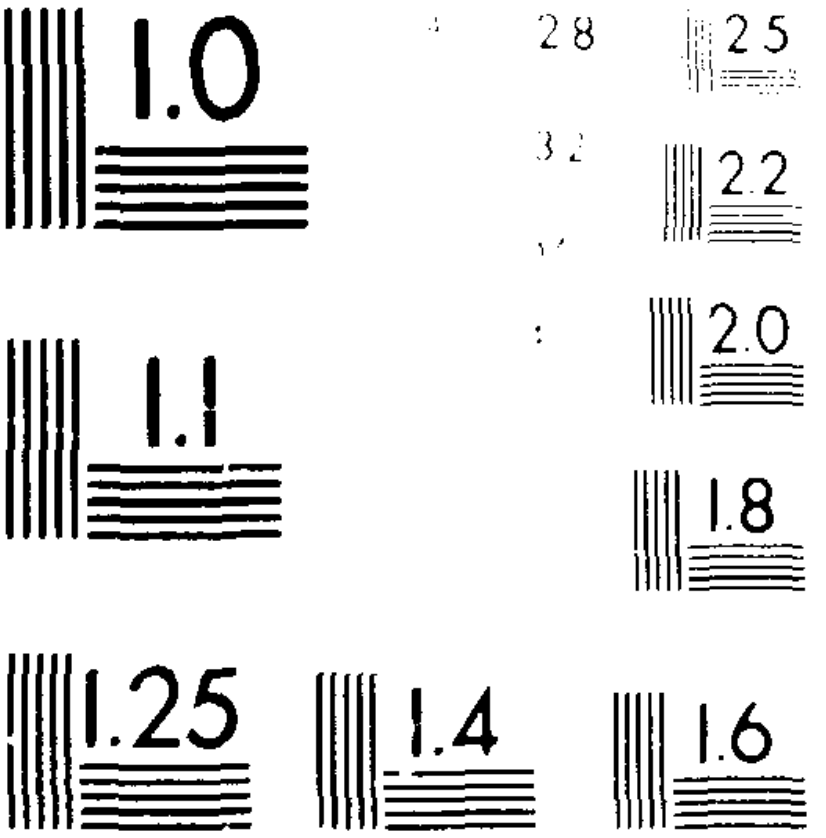
5) Technical balance, removable top pan — 1

Capacity : 13 kg
Beams : 0-12 kg x 0.5 kg
0-500 g x 10 g
Taring : 0-500 g
With 300 x 180 x 25 mm length x width x depth pan
With zero adjustment and beam locking device

No.	Denomination	Qty
6)	Digital pH / MV meter Ranges : 0 to 14 pH 0 to ± 1999 MV 0 to 100°C (using temperature probe) Accuracy : 0.01 pH ± 1 digit mV 0.1 % ± 1 digit 0.5°C ± 1 digit Recorder output : 0 to 140 mV (pH) 0 to ± 200 mV (mV) 0 to 100 mV (°C) Karl Fischer output : 10 u A With plastics bodied combination electrode, electrode holder and support stand and buffer powders, for 200-240 V 50 H_z single phase a.c with 5 spare combination electrodes and buffer powder, complete with instructions	2
7)	KARL FISCHER apparatus For 220 V 50 H_z single phase supplies, comprising two 25 ml burettes, titration vessel with twin platinum electrode, two 500 ml reagent bottles, potentiometer and microamperemeter, magnetic stirrer, mounted on a stand, with instructions	1
8)	Water bath Bath capacity : 10 lit. for 220 V a.c supply. Working area 400 x 240 mm, six holes, with adjustable constant level device, energy regulator, pilot lights, protective thermo-regulator, instructions	3
9)	Thermostat Thermostatically constrolled and stirred bath with 15 lit capacity stainless steel tank, with heater, stirrer and temperature sensor, thermometer (0 to 80°C x 1°C), lid, raised shelf, test tube rack for 44 test tubes of 12 mm diameter. Heater rating 1.5 KW Temperature control ± 0.05°C Water depth 85 to 150 mm Working area 380 x 205 mm For use on 220 V 50 H_z supplies	1

No.	Denomination	Qty
10)	Magnetic Stirrer Constant speed stirrer with mains on/off switch and indicator lamp, with 25 mm polypropylene coated stirrer bars, two, stirrer bar retriever, speed 600 r.p.m., for 220 V, 50 H_z supply	1
11)	Magnetic Stirrer Continuously variable stirring speed stirrer with mains on/off switch and indicator lamp, rotary speed control within speed range 50 - 1300 r.p.m., with two 25 mm stirrer bars, polypropylene coated, for 220 V, 50 H_z supply	1
12)	Magnetic Stirrer and Hot Plate Similar to item 11 with a cast aluminium hotplate mounted above the stirrer, with energy regulator for the hotplate with indicator light, hotplate rating 400 W, with a removable 13 x 500 mm laboratory rod fitting in a socket at the rear of the casing and with two 25 mm polypropylene coated stirrer bars, for use on 220 V 50 H_z supplies	1
13)	Variable speed stirrer High speed (5500 r.p.m. max), high torque motor driven paddle stirrer, with a continuously variable speed control and a four blade stainless steel paddle held in a 8 mm capacity chuck, with mains on/off switch mounted on a 100 x 13 mm support rod, height adjustable, stirring paddle 200 x 45 mm, shaft length x propeller diameter. Motor rating 60 W for use on 220 V 50 H_z supplies	2
14)	Sieve set Set of brass sieves mounted in 200 mm diameter chrome plated brass frame, with lid and receiver with apertures as given below : microns 2000, 1180, 1000, 850, 710, 600 500, 425, 355, 300, 250, 212, 180, 150, 125, 106, 90, 75, 63, 45	1





No.	Denomination	Qty
15)	Sieve Shaker Imparting combined motion of a circular one and superimposed on this a high speed vertical vibratory motion of small amplitude. Accommodates 8 sieves of 200 mm diameter, with integral 0 to 60 min. time switch, for use on 220 V 50 H_z a.c. supplies	1
16)	Rotary evaporator With variable speed motor, rotary seal, vapour tube, angled single coil condenser, continous feed adapter, 100 ml florentine evaporator flask, 1000 ml round bottom receiver flask, adjustable stand, instructions. For supplies of 220 V, 50 H_z. Complete with oil bath	2
17)	Ball mill For grinding approximately 0.5 litre of material. With 50 mm diameter rubber covered rollers which accommodate a porcelain container of 140 mm diameter and 180 mm length, about 1 lit. capacity with ground cover and fittings. With electric motor and gear, pot speed 80 r.p.m. approx. For mains supplies on 220 V 50 H_z, 15 W. With 3 kg porcelain ball spares	1
18)	Melting point apparatus Electrically heated, with 15W lamp, thermometer, cooling plug and 5 pack of capillary tubes. For mains supplies on 220 V 50 H_z	1
19)	Flash point apparatus, ABEL-PENSKY Electrically heated, with gas test jet. Comprises water bath fitted with heater, with variable transformer for heating control, with thermometer °C for both oil cup and water bath and instructions. One spare thermometer of each.	1
20)	Flash point apparatus "open cup" Electrically heated, with gas test jet. Comprises sand bath fitted with heater with variable heating control with thermometer °C and instructions. One spare thermometer	1

No.	Denomination	Qty
21)	Thin layer chromatography kit Comprising : 1 Automatic plate leveller 1 Spreader 2 Racks for plates 200 x 200 mm 1 Spotting template 1 Scriber 2 Developing tanks/desiccators with lids 2 Glass plates 200 x 50 mm 2 Glass plates 200 x 100 mm 10 Glass plates 200 x 200 mm 1 Spray, complete 1 Micropipette, 0.005 ml Subdivided 0.001 ml 1 Micropipette, 0.010 ml Subdivided 0.0025 ml with reserves of plates 100 each with short and long wave U.V. lamp for detection	1
22)	Glass water still With output of about 4 lit/h. Glass and PTFE, single distillation, Glass still body, silica sheeted 3 KW immersion heating element, water cooled condenser, cooling water returned to still body. With automatic cut-out if water supply falls and preset constant level device, for 220 V 50 H_z supplies. With wall mounting bracket	1
23)	Heating mantle For heating flasks from 50 to 250 cm^3 held in a replaceable conical flexible heating element with asbestos knitted fibre cover. With energy regulator and pilot lights, support rod (12.7 mm diam) bracket and support rod, for 220 V 50 H_z supplies, 100 W	2
24)	Hotplate, circular Enclosed type, cast iron plate and base with vitreous enamel body, continous heat control, stand on three cast iron feet. Diameter 160 mm, rating 1 KW, for 220 V 50 H_z supply	2
25)	Muffle furnace Round vertical muffle with a hole of 65 x 150 mm diameter x depth with cover electrically heated without temperature control, max. temperature 1000° C, for mains supplies 220 V 50 H_z, 0.5 KW	1

No.	Denomination	Qty
26)	Radiant heater "Electric Bunsen"	2
	With nickel-chromium heating element within refractory cavity, ventilated metal case, operating temperature 300 - 1000° C, mains supply 200 V 50 H_z, 400 W	
27)	Infra red lamp	
	holder and mounting	3
	bulb 220 V 300 W	10
28)	Fume cupboard	2
	1500 mm wide x 775 mm deep x 2100 mm high, height to work top 90 mm, mounted on wall bench cantilever frame support. Glassed, counterpoised sash and ends. Protected back and roof. 230 mm extract hole with duct on roof. Work top covered with glassed porcelain tiles, with sink of polypropylene 100 x 300 mm, fluorescent tube top lighting	
	Services : Water tap, front control	
	Water swan-neck, front control	
	Waste outlet	
	Electric sockets, three, light switch	
29)	Fume extraction plant	1
	Comprising a centrifugal pattern fume extract fan moulded from resin bonded glass fibres, fitted with a multi-blade polypropylene impeller direct coupled to a 0.18 KW, 1425 r.p.m. ex proof motor working at AC 220 V 50 H_z 3 phase supply, a system of rigid PVC ducting to connect with fume cupboards to fan via flexible coupling and from the fan to pass through the roof terminating in a high velocity discharge.	
	Plant complete with a cantilever fan support shelf, push button starter, supporting clips and brackets with a condensate bottle to be connected to the fan scroll by a polythene tube	

No.	Denomination	Qty
30)	Refrigerator Net capacity 110 Lit with thermostatically controlled internal temperature, internal light, AC 220 V 50 H_z	1
31)	Coffee mill Household type, with stainless steel blades, AC 220 V 50 H_z	2
32)	Oven With temperature range 40 - 200°C with fluctuation ± 0.5°C. Internal dimensions 330 x 480 x 330 mm H x W x D, with 2 shelves, AC 220 V 50 H_z, rating 800 W	2
33)	Oven With temperature range 40 - 250°C with fluctuation ± 0.5°C. Internal dimensions 400 x 480 x 380 H x W x D, with 3 shelves, AC 220 V 50 H_z. Rating 1.0 KW	1
34)	Rinsing device For cleaning and rinsing apparatuses with water connection, table top with tiles, 1250 x 775 x 900 mm L x D x H, 2 ceramic basins 500 x 400 x 250 mm	1
35)	Dehumidifier With moisture removal capacity of 20 pints/day, automatic humidity sensor control, AC 220 V 50 H_z supply	1
36)	TLC spray cabinet plus blower 220 V, complete with 3 m exhaust hose, flexible, 127 mm dia	1
37)	Constant voltage transformer 2500 VA, - 20% to + 10%, 220 V, 50 H_z	2
38)	Potentiograph E 536/1, complete with 1 Micro-Processor-Dosimat-Titrating-Stand E 655 + 1 Exchange unit E 552, cylinder contents 20 ml and set of spare parts, as per proforma invoice Donau AG, Zurich	1

No.	Denomination	Qty
39)	Stainless steel tubing connecting cylinder store to instrumental laboratories, complete with manifolds and accessories	1
40)	SIGMA 3B Gas Chromatograph with FID, NPD and ECD, R 100 recorder and accessories, according to proforma invoice attached	1
41)	LAMBDA 3 MC Spectrophotometer with R 100 recorder and accessories acccrding to proforma invoice attached	1

UNITED NATIONAL
DEVELOPMENT PROGRAMME
attn. Mr. Bendefy
P.O. Box 650

R A N G O O N

Burma

P R O F O R M A -
Faktura/Invoice Nr. -Page 1- Zürich. 7th December 1983 RM/me
Your inquiry Ref. OT 945

Code	Stk. Qty.	Open to your final order we shall supply you:	a SFr.	SFr.
		M E T R O H M - Products		
2.536.0110	1	POTENTIOGRAPH E 536/1, complete with 1 MICRO-PROCESSOR-DOSIMAT-TITRATING-STAND E 655 & 1 EXCHANGE UNIT E 552, Cylinder Contents 20 ml		10'105.--
		Recommended Spare Parts:		
6.3006.220	1	Exchange Unit (20ml) with automatic cook actuation E 552-20		358.--
6.3006.210	2	Exchange Unit (10ml) E 552-10	358.--	716.--
6.3006.223	1	Exchange Unit (20ml) E 552-20B (Brown G)		374.--
6.0308.000	1	Double platinum electrode EA 235		89.--
6.0102.000	2	Glass pH electrode EA 109	76.--	152.--
6.0711.000	2	Silver chloride electrode EA 427	105.--	210.--
6.0203.000	2	Combined Glass Electrodes EA 121	97.--	194.--
6.0402.000	2	Combined Platinum Electrodes EA 217	102.--	204.--
6.0404.000	2	Combined Silver Electrodes EA 246	111.--	222.--
6.1415.220	2	Titration vessel bottom half, 20 ml, EA 875-20	26.--	52.--
6.1415.250	2	ditto, 50 ml, EA 875-50	26.--	52.--
6.1418.220	2	ditto, with thermostatic jacket EA 876-20	74.--	148.--
6.2231.000	20	Rolls Recording Paper à 22 m EA 998/1	11.--	220.--
6.2232.000	20	Rolls Recording Paper à 52 Size DIN A3 with perforation EA 998/2	12.--	240.--
6.2234.001	20	Fibre pen, blue, long EA 1008/1	9.--	180.--
6.1527.220	3	Teflon piston, 20 ml EA 869-20	18.--	54.--
6.1527.210	2	Teflon piston, 10 ml EA 869-10	18.--	36.--
				13'606.--

Price complete, incl. export-packing, franco SWISS BORDER, excl. insurance

Delivery: 4 weeks after receipt of your order

Despatch: as per your instructions

P84/RM

./..

UNITED NATIONAL
DEVELOPEMENT PROGRAMME
attn. Mr. Bendefy
P.O. Box 650

R A N G O O N

Burma

P R O F O R M A -
Faktura/Invoice Nr. -Page 2- Zürich, 7th December 1983 RM/me

Your ..quiry Ref. OT 945

Stk.. Qty.		à SFr.	SFr.
	Payment: by remittance		
	Origin: SWISS Customs tariff: 9028.40.2		
	DONAU Export AG		
P.S.	We are ready to grant you 5 % discount when ordering!		

A / 3M

PLEASE REFER TO OUR QUOTATION NO.

83-330

TO United Nations Development Program
P.O.Box 650
Rangoon
Burma

TERMS: CONFIRMED IRREVOCABLE LETTER OF CREDIT ON ANY PRIME NEW YORK BANK — F.O.B. NORWALK, CONN. UNLESS OTHERWISE SHOWN

DATE OF QUOTE	QUOTE EXPIRES ON	YOUR REFERENCE	EST. SHIPMENT DATE FROM NORWALK MFG. SITE A.R.O.
Dec.30,'83	Mar.30 '84		Estimated 3-4 months upon receipt of L/C and U.S. Export License

Item No.	QTY.	PART NO.	DESCRIPTION	UNIT PRICE	TOTAL
				US$	US$
1	1	0331-9701	Sigma 300 Gas Chromatograph for operation on 230V, 50/60 Hz. Consisting of :		
		0331-0030	Basic Sigma 300 GC for isothermal and dual-ramp temperature programmed operation with automatic cool-down and restabilization, comprising column oven operating to 450 degrees C and closed loop temperature control of the detector and injector thermal zones with keyboard entry of all temperature and time parameter	6,520.00	6,520.00
		0331-5030	Dual heated 1/4" injector	865.00	865.00
		0331-A138	FID/Npd/ECD	11,190.00	11,190.00
		0331-8280	Dual ionization detector gas controls including two 0-60 psig hydrogen pressure regulators and gauges, and a single 0-60 psig air pressure regulator and gauge. Dual digital flow controllers, calibrated 5-100 cc/min. complete with 0-100 psig pressure regulator for accurate flow calibration	1,565.00	1,565.00
			Instrument Configuration Total :		20,140.00
2	1	C005-0005	Model R-100A Microprocessor Chart Recorder. Digital pen movement an stepper motor chart drive. Ten input voltage ranges : 1,2,5,10,20,50,100,200, 500 mV and 1V. Remote Stop/Start with twelve forward chart speeds: 1,5,10,15,20,30,60,80,120,160,240,480 mm/min. and one reverse speed 1000 mm/min. Also Pen remote and Chart Remote with chart steps driven by pulse from an external pulse generator. Zero adjustment	1,395.00	1,395.00

Please Address All Further Correspondence Directly To

WILLIAM LEE
AUTHORIZED SIGNATURE

PERKIN-ELMER INTERNATIONAL, INC.
ATTN William Lee
STREET
CITY, STATE, ZIP CODE
TELEPHONE NO

ANY ORDERS RECEIVED AS A RESULT OF THIS QUOTATION ARE SUBJECT TO ACCEPTANCE AT THE FACTORY IN NORWALK, CONN. ACCEPTANCE WILL BE ON THE BASIS OF THE TERMS AND CONDITIONS APPEARING ON THE FACE AND ON THE BACK HEREOF

ORIGINAL QUOTATION CUSTOMER

1 0986-02

Continuation Quotation No. 83-330

ITEM NO.	QTY.	PART NO.	DESCRIPTION	UNIT PRICE US$	TOTAL US$
			~~100%~~ of span. Remote operation by external contact closure: Auto Advance, Auto Return, Stop/Run, Event Marker, L/R Zero. Includes signal cable, power cable, one roll of chart paper, two pens, fuses for 120V abd 240V operation and operating directions		
	2	0023-0090	Pressure Regulator	270.00	540.00
	1	0023-0091	Pressure Regulator	270.00	270.00
	1	0332-8000	Installation Kit	220.00	220.00
	1	0023-0522	Two-stage Soap Bubble Gas Flow Meter	91.00	91.00
	4	0330-2221	Glass Liner Replacement	31.00	124.00
	10	0009-0652	Septum kit fairprene 50/pkg	60.00	600.00
	4	0023-0255	Syringe 1.0 ul	90.00	360.00
	~~2~~	~~0023-0256~~	~~Syringe 5 ul~~	~~75.00~~	~~150.00~~
	2	0023-0258	Syringe 10 ul	74.00	148.00
	10	0023-0262	Replacement neddles age	25.00	250.00
	2	0223-0117	Filter drier assy	180.00	360.00
	1	0332-0014	Deoxo Filter	215.00	215.00
	50	C005--0612	Chart Paper	18.90	945.00
	50	CP28-5040	Felt Tip Pen Red	3.60	180.00
	1	0332-3901	FID maintenance Kit	260.00	260.00
	1	0332-3900	Detector Evaluation Kit	315.00	315.00
	1	0330-0250	Sigma NPD Bead	190.00	190.00
	~~5~~	~~0211-2323~~	~~Vial Chrom Test C~~	~~5.65~~	~~28.25~~
	4	0009-7908	Packed Glass Column, 6 ft.	180.00	720.00
	4	0009-1585	3 ft. empty GlassColumn	70.00	280.00
	4	0009-1586	Empty HP Column 6ft Glass	94.00	376.00
	50	0990-3916	1/4" Graphite Ferrule	23.00	1,150.00
	2	SPECIAL	100g Gas Chrom Q 80-100 Mesh	160.00	320.00
	2	SPECIAL	100g Gas Chrom Q 100-120 Mesh	160.00	320.00
	1	0009-0395	Column packing OV-1 25g	125.00	125.00
	2	0009-0394	OV-17 Free Drug Packing	125.00	250.00
	1	0009-0398	3% OV-225 on Chrom WHP	125.00	125.00
	2	SPECIAL	5g Silicone OV-1	25.00	50.00

Quotation No 83-330

Page 3 of 3

Item No.	QTY	PART NO.	DESCRIPTION	UNIT PRICE	TOTAL
				US$	US$
31	2	SPECIAL	10g Silicone OV-17	30.00	60.00
32	2	SPECIAL	5g Silicone OV-225	35.00	70.00
33	1	SPECIAL	50g Silicone DC-11	25.00	25.00
34	1	SPECIAL	50g 5% OV-1 on 100-120 Mesh Gas Chrom Q	125.00	125.00
35	1	SPECIAL	50g 5% OV-17 on 100-120 Mesh Gas Chrom Q	125.00	125.00
36	1	C618-2000	Lambda 3B Recording System. Includes C618-0437 Lambda 3B Spectrophotometer and C005-0002 R100 Microcomputer Controlled Strip Chart Recorder	11,310.00	11,310.00
37	1	C030-0300	Pair of Cells, Silica, 10mm	190.00	190.00
38	10	C005-0610	Chart Paper	18.90	189.00
			FOB Norwalk, CT, USA		42,591.25
			Estimated Airfreight Handling/ Insurance Charges		2,500.00
			Total CIF Burma		45,091.25

Remarks :

1) Terms : Irrevocable Letter of Credit in favour of Perkin Elmer International, Norwalk, Connecticut 06856,U.S.A.
2) Warranty : one Year from date of delivery
3) Prices inclusive of commissioning by a Perkin Elmer engineer based in Singapore

SPECIFICATION OF BIC. LAB. EQUIPMENT

S.N.	Denomination	Qty
1)	Potter spray tower *	1
	Laboratory spraying apparatus complete with Carbon Vane compressor unit, with Muffler unit and manometer	
2)	Arnold manual microapplicator *	1
	Variable drop size micrometer syringe applicator on stand with additional 10 cc syringe complete with holder for droplets up to 50 ml	5
	and packet (12) of needles 3/10 x 25 mm	5
3)	1 ml all glass syringe	5
	graduated in 0.1 ml divisions	
4)	Analytical balance	1
	Constant load weighing system Capacity : 160 g Pan ∅ : 117 mm Readability (micrometer) 0.1 mg Optical scale 1 g Complete with masses lamps and instructions	
5)	Quick balance, single pan	1
	Capacity 2610 g, sensitivity 0.1 g with beams graduated 0 to 500 x 100 g, 0 to 100 x 10 g and 0 to 10 x 0.1 g. With zero adjustments and flat stainless steel pan of ∅ 150 mm, damped beam movement, 2 x 1 kg and 1 x 500 g attachment masses, complete with dust cover	
6)	Olympus stereo microscope, model X	1
	With 45° inclined reversible binocular tube, paired G 10 X and G 20 X eyepieces, objectives 1X and 2X, trans-illuminator base, spare bulbs	
7)	Environmental chamber	3
	Observation and breeding chamber for insects with thermostatic temperature control between 25 and 40°C halved in two levels, heating by 60 W electric bulb, fluctuation ± 0.5°C. Dimensions 530 x 330 x 220 mm H x W x D	

* these items can be purchased from one single supplier :
BURKARD Manufacturing Co. Ltd
Woodcock Hill Industrial Estate Richmansworth Herefordshire WD3 1 PJ

S.N	Denomination	Qty
8)	Autoclave Atmosphere pressure electric autoclave for sterilization, stainless steel, internal 590 x 280 mm depth x diam. 220 V 50 H_z	1
9)	Oven With temperature range 40 - 250°C, fluctuation $\pm$ 0.5°C Internal dimensions 400 x 480 x 380 H x W x D, with 3 shelves, AC 220 V 50 H_z Rating 1.0 KW	1
10)	Forceps s/s straight, with fine points, length 125 mm	2
11)	Forceps s/s curved, with fine points, length 125 mm	2
12)	Forceps s/s straight, with blunt tips, length 125 mm	2
13)	Forceps s/s entomological, curved ends, length 115 mm	2
14)	Forceps s/s feather light, length 110 mm	2
15)	Illuminated magnifier with dry cells, length 150 mm, magnification 10 X	2
16)	Pocket measuring magnifier Magnification 8 X, Graticule 20 x 0.1 mm	2
17)	Dissecting scissors, fine points, s/s length 110 mm	2
18)	Needle, hardwood handle needle length 33 mm, handle length 100 mm	2
19)	Needle, lancet shaped in hardwood handle needle length 48 mm	2
20)	Section lifter, aluminium overall length 150 mm with 50 mm bent up blade	2
21)	Tubes, sample soda glass, straight sides, flat bottom, with corks pack of 100 75 x 25 mm H x Dia	15
22)	Tubes, sample soda glass, straight sides, flat bottom, with corks pack of 100 100 x 25 mm H x Dia	15
23)	Graph paper pad Log 3 cycles x probability, A 4	100

No.	Denomination	Qty
24)	Fume extraction plant Comprising a centrifugal pattern fume extract fan moulded from resin bonded glass fibres, fitted with a multi-blade polypropylene impeller direct coupled to a 0.18 KW, 1425 r.p.m. ex proof motor Working at AC 220 V 50 H_z 3 phase supply, a system of rigid PVC ducting to connect with fume cupboards to fan via flexible coupling and from the fan to pass through the roof terminating in a high velocity discharge. Plant complete with a cantilever fan support shelf, push button started, supporting clips and brackets with a condensate bottle to be connected to the fan scroll by a polythene tube	1
25)	Dehumidifier With moisture removal capacity of 20 pints/day, automatic humidity sensor control, AC 220 V 50 H_z supply	1

LIST OF PERKIN ELMER INSTRUMENTS IN BURMA.

SR.NO.	DEPARTMENT	NAME OF INSTRUMENT	REMARK.
1.	AFPTC	SIGMA 3B G.C. 1.No.	
2.	No.(3).MINING.	LAMBDA 3 UV/VIS SPECTROPHOTOMETER	
3.	CENTRAL RESEARCH	G.C.DETECTOR MODEL F.11.	
		UV/VIS MODEL 552	
4.	PHARMACEUTICAL	MODEL 881 G.C.	
	INDUSTRIES CORPN.	MODEL 241 POLARIMETER	
		IR SPECTROPHOTOMETER	
5.	ECAMS	AAS MODEL 432	
6.	NATIONAL HEALTH LAB.	SIGMA 3B G.C.	
		AAS SPECTROPHOTOMETER WITH AIR COMPRESSOR	
		UV/VIS MODEL 552	
		RECORDER 561	
		RECORDER 023	
7,	CHEMISTRY DEPT.	IR SPECTROPHOTOMETER MODEL 598.	
	RASU		

Annex XVII

TENDER SPECIFICATION

Construction of a Pilot Plant for Pesticides Formulation at a plant site of about 5 ha at about 60 km North of Rangoon where two production buildings will be available for the purpose (see attached drawings).

The following capacities of one shift, per day, are required :

Liquid formulation	1000	l.G./day
Granular formulation	1	mt/day
Powder formulation		
dust powders	8	t/day, or
wettable powders	2	t/day

The plant site is near an existing asbestos fibre products plant with all technical infrastructure. The formulation plant must be onstream at full capacity within 27 months after definite order is given (test run three months included). The necessary machinery should be installed and all information and instructions to local personnel.

Terms of reference

A) SERVICES TO BE SUPPLIED BY CONTRACTOR

1. Supply of all machinery and equipment specified in the attached specifications assembled and erected on the site as parts of production units of the Pilot Plant for Pesticide Formulation
2. Supply of all necessary detailed engineering drawings to enable local erection of the equipment excluding design of buildings
3. Supply of foundations drawings showing loadings where applied and relevant dimensional details but excluding the detailed design of foundations
4. Written statement whether the foreseen buildings need to be modified or not and if yes, detailed note about the requested modification not later than one month after signing of the contract
5. Finalized General Arrangement Drawings of the production equipment indicating equipment items and reference drawings in six copies
6. Electric wiring to and between all motors, starters and devices up to the central panel aside the production building and schematic wiring diagram showing position of motors, etc. for maintenance purposes. Cable connections to the transformer.

7. Arrangement Drawings of machinery and equipment in six copies
8. Spare-parts list and recommended spares to cover a period of two years
9. Operating and maintenance instructions for each item of equipment with illustrations in five copies.

   Note : Supply of electricity at the site will be 3 phase, 50 cycles 400 volts
10. The contractor shall provide tools, special tools and specialized equipment necessary for the complete installation of machinery and equipment and for the facilities for inspection of equipment during and after manufacture
11. Services of supervisory and commissioning engineer(s) for the time of erection and trial run
12. Services of the commissioning engineer beyond the time specified upon request of PIC against compensation to be agreed upon separately
13. Men hours of skilled construction workers and foremen sufficient for construction and supervision during the erection and for the training of the local personnel on the operations of the plant (Local accommodation and transport shall be borne by the contractor).
14. Ground painting of equipment and seaworthy packing of the goods delivered
15. Marking of all the goods delivered corresponding to reference drawings and/or specifications
16. All materials and services not specified in the tender specifications but necessary to the proper run of the plant

B) SERVICES TO BE SUPPLIED BY P.I.C., BURMA

1. All necessary civil engineering works including detail design of construction and foundations
2. Electric Lighting
3. Supply of water
4. Buildings to house the equipment, as shown in attachment drawing
5. Written statement that the request for modification of the buildings as per A 4 will be met, within two weeks after contractors statement had been received
6. Adequate care and storage of equipment during the period of construction
7. Local personnel necessary for the erection of the plant
8. Provision that the layout and the plans meet the local safety regulations
9. Provision that actions meet the time schedules

C) TERMS AND GUARANTEES

1. The contract will be governed by General Conditions of Purchases as practiced by UNIDO Purchase and Contract Service, Division of Industrial Operations
2. Prices should be specified for each item or groups of equipment giving full details of all included materials
3. Indication is needed whether packaging is included
4. Parity should be CIF Rangoon
5. Give alternative offer by seafreight and airfreight, if applicable
6. Indicate if given prices are estimated or definite
7. Indicate validity of the offer
8. Indicate reference list
9. Indicate if test runs can be made in your facilities
10. Indicate whether any kind of follow up service is available
11. Guarantee that all the machinery supplied is newly made and has never been used
12. Guarantee that all the machinery supplied and plans developed meet the international standards of safety
13. The period for the guarantee commences the day when a protocol upon successful trial run is signed. That very day is considered as the performance date of complete delivery and the last negotiated installment of the price will be due on that day. Plant components separable may have different dates of performance
14. The contractor shall guarantee that, should any defect in the material or workmanship of plant or plant component manufactured by him occur within 12 months after the day defined in the previous paragraph, he will exchange the defective part free of charge
15. If the plant or plant component supplied or installed by the contractor fails to conform to the express terms of the contract, he shall have the option of bringing the plant into conformity with the contractual requirements or of taking it back and refunding the price
16. The contractor will not be liable for damages as for loss of profit of any other consequential loss
17. Guarantee that all suppliers involved in the contract will meet the above requirements

Liquid Formulation unit

Item	Denomination and Specification	Qty
1,2,3	Storage tank, m/s, capacity 10,000 lit each with inspection manhole, sampling and measuring hole at the top, flanged connections for inlet, outlet and bottom outlet. Ex-proof respiration. Silver paint, metal sun-shade at 50 mm distance of the shell	3
4,5,6	Strainers in the outlet lines of each tank. AMAFILTER model 72 S - 12	3
7,8,12	Transfer pump, cast iron and bronze, leakproof, capacity 20m^3/h, ex-proof motor	3
9,	Pipework with valves, bends, tees and fittings, m/s	cca 60 m
10,	Flowmeter with digital output, accuracy 0.1 l, solvent resistant material, flanged connections	1
11,	Measuring tank, m/s, capacity 1500 lit, flat bottom, diameter : height = 1 : 5, calibrated level indicator, flanged 6/4" connections for inlet, bottom outlet and respiration	1
13,	Pipework with valves, bends, tees and fittings, m/s	cca 20 m
14,15,20	Transfer/decanting pump 100 lit/min capacity, s/s and teflon leakproof, exproof motor	3
16,17	Decanting pipework with valves, bends, tees and fittings, s/s	cca 10 m
18,	Traveller-hoist, elevation capacity 500 kg, with two electric motors, starters and motors exproof outfit	1
19,	Production vessel, s/s, capacity 2200 lit, with heating/cooling jacket at the lower half connected both to hot- and cold water supply, four inlets and sampling/thermometer hole at the top, man-hole with hinged lid for solid material dosage, outlet at the bottom, agitator driven by totally enclosed squirrel cage ex-proof motor	1
21,22	Filter, AMAFILTER model 24 AFW4A-2 with cartridges EK 10A10S	2
23,	Pipework with valves, bends, tees and fittings, s/s	cca 15 m

Item	Denomination and specification	Qty
24,25	Filling tank, s/s, horizontal cylinder shape, capacity 2200 lit, with manhole and flanged connections for inlet and outlet	2
26,	Bottling machine "BOTTLEPACK" producing 0.5 lit or 1 lit plastic bottles from granules and then fills them, produces ready filled sealed bottles, Capacity : 60 x 1 lit/hour	1
27,	Labelling machine with the capability of labelling 1000 bottles/hour	1
28,	Roller conveyor for rubber band conveyor with elevated sides, 400 x 3000 x 700 mm W x L x H. exproof motor	1
29,	Electric boiler, capacity 500 lit, with thermo-regulation, max. temp. 60°C, thermometer 0°-80°x1°C, dilatation tank 20 lit, heater capacity 3000 W	1
30,	Pipework, m/s, with valves, bends, tees and fittings cca	50 m
31,	Pump, hot water circulation, cast iron and bronze, 20 m^3/h, with waterproof and exproof motor	1
32,	Melting equipment consisting of a 5 m^2 radiator sunk into the floor, with hoods covering the barrels to be heated	1
33,	Exhaust fan, capacity 1000 m^3/h producing 250-300 mm H_2O under pressure, m/s, exproof motor	1
34,	Set of fume extracting ducting complete with suitable hoods at drum decanting points and vessel chargeing, interconnecting duct to Raschig tower	1
35,	Gas scrubber complete with recirculating tank and pump with waterproof and exproof electric motor, constructed of glass fibre reinforced polyester, fill : porcelain Raschig rings. Suitable to clean 1000 m^3/h air	1
36,	Electric equipment : wiring, starters, fuses etc. complete exproof outfit, with central panel outside the building	1
37,	Set of steel supporting structure, not forming part of the building	1

Granules Formulation unit

Item	Denomination and Specification	Qty
1,18	Vibroscreen preferably with round sieve and vibrating tangentially, sieve of steel with 1 mm apertures, exproof motor	2
2,17	Rectangular hopper of 1 m^3 size, m/s, with screw conveyor or other suitable means to provide even rated and adjustable discharge	2
3,	Rotating dryer cylinder with oil burner, electric motor and drive, evaporation capacity 100 kg water/h, m/s	1
4,	Fuel oil tank, capacity 300 l, m/s, with wall-mounted hand-pump for filling up from barrel	1
5,	Oil pump to feed the burner, cast iron and bronze, leakproof, exproof motor, AMAFILTER model 72 S-12 strainer in the suction line	1
6,20	Exhaust fan, capacity 1000 m^3/h, producing 250-300 mm H_2O under pressure, m/s, with electric motor	2
7,	Cyclon to trap particles withdrawn from the dryer, m/s	1
8,	Bucket elevator, height 4 m, capacity 1 t/h, m/s, electric motor and drive, discharge chute	1
9,10	Dry sand silo, 2 m^3, conical bottom, bag/container filling device (spherical valve)	2
11,	Rotating mixer drum, preferably closed type but easy to clean. Gravity feed, gravity discharge, 1000 lit capacity, useful load 350 kg, with internal baffles, drive, with internal spray line for introducing liquids for impregnation, with inspection door in spout suitable for manual feeding, exproof motor, m/s	1
12,	Drum decanting pump 100 lit/min capacity, s/s and teflon, leakproof, exproof motor	1
13,	Preset container, capacity 250 l, s/s, connections for inlet, outlet and respiration, connecting pipes with window	1

Item	Denomination and Specification	Qty
14,	Measuring container, capacity 50 lit, s/s with level indicator glass pipe (protected in brass tube with slot), inlet, outlet, respiration connections, calibration 0.5 lit/cm	1
15,	Spraying pump, s/s and teflon, 15 lit/min, 5 atm, leakproof, exproof motor	1
16,	Pipework s/s, with valves, tees, bends and fittings	ca 20 m
19,	Semi automatic packing machine to fill plastic or paper bags of 1 to 5 kg net content min. 5-10 bags/min complete with conveyor belt displacing the filled bags and plastic bag sealing device	1
21,	Fume extracting ducting with hoods at drum decanting and spray nozzle, connection to Raschig tower, m/s	1
22,	Gas scrubber complete with recirculating tank and pump with waterproof and exproof motor constructed of glass fibre reinforced polyester, fill : porcelain Raschig rings, suitable to clean 1000 m^3/h air	1
23,	Electric equipment : wiring, starters, fuses, etc. complete with central panel outside the building	1
24,	Set of steel supporting structure, not forming part of the building	1

Minerals Upgrading Unit

1,3,5	Rubber conveyor belt 0,6 x 4.0 m W x L, with electric motor, 2 KW same portable outfit	3 2
2,	Jaw crusher, output 1.5 t/h, feed size 100 mm output size 10 mm, with electric motor	1
4,	Roller crusher, output 1.5 t/h, feed size 10 mm output size 1 mm, with electric motor	1
6,	Dryer cylinder, rotating drum type with oil burner evaporation capacity 200 kg water/h, electric motor and drive	1
7,	Fuel oil tank, capacity 300 l, m/s, with wall-mounted hand pump for filling up from barrel	1

Item	Denomination and Specification	Qty
8,	Oil pump to feed the burner, cast iron and bronze, leak-proof, exproof motor, AMAFILTER model 72-S-12 strainer in the suction line	1
9,16	Exhaust fan, capacity 1000 m^3/h, producing 250-300 mm H_2O under pressure, m/s	2
10,	Bucket elevator, height to 10 m, capacity 1.5 t/h, m/s, electric motor drive, Y discharge chute	1
11,12	Silo 3 m^3, conical bottom, variable speed screw feeder	2
13,	Vibroscreen with round sieve and vibrating tangentially, with set of steel sieves of apertures 0.6, 0.8, 1.0 and 1.2 mm, electric motor	1
14,	Hammer mill, output 1.5 t/h, feed size 1 mm, output size 200 to 300 mesh, with electric motor	1
15,	3 m^3 silo with surmounted cyclon with airlock to select milled particles from carrier air-stream. With hemispherical valves at the conical bottom	1
17,	Set of steel supporting structure, not forming part of the building	1
18,	Electric equipment : wiring, starters, fuses, etc. complete with central panel outside the building	1

Powder Formulation Unit

1,	Coarse grinder to desintegrate knots, caked material before feeding into the mixer, with electric motor and drive	1
2,	Mixer, Type Drais S-1000, with contraflow mixer ribbons, s/s, with cooler jacket, electric motor and drive, capacity 1000 lit	1
3,	Drum decanting pump 100 lit/min capacity, s/s and teflon, leakproof, with exproof electric motor	1
4,	Preset container, capacity 250 lit, s/s, connections for inlet, outlet, respiration, connecting pipes with window	1

Item	Denomination and Specification	Qty
5,	Measuring container, capacity 100 lit, s/s, with level indicator glass pipe (protected in brass tube with slot), inlet, outlet, respiration connections, calibration 0.5 lit/cm	1
6,	Spraying pump, s/s and teflon, 15 lit/min, 5 atm, leakproof, exproof motor	1
7,	Pipework s/s, with valves, tees, bends and fittings	cca 20 m
8,	Hopper of 1 m^3 capacity, m/s	1
9,	Variable speed double screw feeder with drive, electric motor	1
10,	Alpine UP 315 Ultraplex mill complete with drive and electric motor	1
11,12, 13,	Dust separation system consisting of a cyclon mounted on the top of a silo (3 m^3 capacity) and connected through an airlock, an air filter type "Micropulsair" complete with air compressor and timer to clean filter bags by periodical jets through nozzles, exhausting fan to produce the necessary under-pressure. The whole batteries placed on the first floor and connected to the outlet of the UP 315 mill. Electric motors exproof	1
14,	Packing Machine ROTHEA type MVP 2907 with minimum output of 8 ton/day of 1 kg bags, suitable to use local polythene sheet. Maximum bag size 3 to 5 kg depending on product bulk weight	1
15,16, 17,18,	Air filter system consisting of a cyclone with an airlock at the bottom, an air filter type "Micropulsair" described under item 12, an exhaust fan with electric motor and fume extracting ducting connected to all hoods in the workshop building where dust may be dispersed in the air. Some flexible connections should be provided to the ducts serving as vacuum cleaning in the workshop	1
19,	Gas scrubber complete with recirculating tank and pump with waterproof and exproof electric motor, constructed of glass fibre reinforced polyester ; fill : porcelain Raschig rings. Suitable to clean 1000 m^3/h air	1

Item	Denomination and Specification	Qty
20,	Set of supporting steel structure, not forming part of the building	1
21,	Electric equipment : wiring, starters, fuses, etc. complete, exproof outfit, with central panel outside the building	1
22,	Elevator led by fixed rails for transport of material capacity 2000 kg, with platform space to carry fork-lift hand trolleys, gear and electric equipment protected from dust and exproof outfit	1
23,	Electric stitching machine for sealing paper bags, suspendable with balance weight	1
24,	Final blender LBX 35 S NAUTA LBX (complete with drive and electric motor)	

Primary stock of complete reserves should be provided together with the production equipment according to the following list :

S.N.	Item	Reserve for :	No.
1.	Pump & motor	L 7, 8, 12	2
2.	Pump & motor	G 5, M 8	1
3.	Pump & motor	L 14, 15, 20	1
4.	Hoist & motor	L 18	1
5.	Pump & motor	L 31	2
6.	Fan & motor	L 33, G 6, 20, M 9, 16, P 13, 17	1
7.	Electric boiler	L 29	1
8.	Pump & motor	G 15, P 6,	1
9.	Stitching machine	P 23	1

Remark : one-one of items 1 and 5 should be mounted on portable frame and provided with rubber hoses and serve as portable pump for solvents and water respectively

SUPPLIER COMPANIES CONTACTED

A) Production equipment

Theo Kneubuhler and Co. AG (FRG)
c/o Anglo Swiss Trading Co. Pte. Ltd, Singapore
Tlx : STECO RS 22041
- Packing machine for granules

Schubert and Co. "SCHUCO", Denmark
Tlx : 33411 SCHUCO DK
- Bottling machine for liquids

Paxall Ltd. Alite Division
Icknield Way, Letchworth, Herts, SG 6 1 ER, England
Tlx : 82368
- Packing machine for granules

Rovema Verpackungsmaschinen GmbH
P.O. Box 20 D-6301 Fernwald 2. FRG
Tlx : 482816 A ROVA D
- Packing machine for powders

A. Winter Machinery Ltd.
CH-8640 Rapperswil, Alte Jonastrasse 50, Switzerland
Tlx : 875075 WIMA CH
- BOTTLEPACK bottling machine

Erwin Behm Verpackungsbedarf GmbH FRG
Diessemer Strasse 59-71, 4150 Krefeld, POB 320
Tlx : 853862 BEHN D
- Bagging machine

Librawerk Pelz & Nagel GmbH & Co. KG
POB 3729 D-3300 Braunschweig FRG
Tlx : 0952866
- Automatic weighing and bagging scales

Cellier S.A., France
B.P. 177 - Rue de Maroc
73104 Aix-Les-Bains
Tlx : 980053 F INOXEL
Stainless steel vessel and other equipment for liquid formulation

Pallmann K.G., FRG
P.O.B. 61 Wolfslochstrasse 51
6660 Zweibrucken

Tlx : 451135 Z PAZW D

- Mills

Christy and Norris Ltd. G.B.

Tlx : 99266 CRISTY G

- Mixers, hoppers, various equipment for solid formulations

Alpine AG. FRG , 89 Augsburg 1, POB 101 109 FRG

Tlx : 053802 Z ALPIN D

- Ultraplex mill, pre-grinder, feeders, air-filter etc.

Draiswerke FRG, Mannheim-Waldhof,

Tlx : 462139 DRAIS D

- Mixer

Forplex S.A. France
60, rue de Vieux Pont de Sevres 92106 Boulogne - Billancourt

Tlx : 270084 F

- Grinders

Bizerba Werke FRG
POB 107, 7460 Balingen 1

Tlx : 763622A B 12 D

- Scales

Nautamix Haarlem, Holland, POB 773

Tlx : 41167

- Mixer

Chemo Komplex
Hungarian Trading Company of Machines and Equipment
for the Chemical Industry
H-1062 Ne pkoztarsasag - u 60
Budapest, Hungary

- Engineering Company

Munson Machinery Co., Inc. USA
210 Seward Ave
Utica, New York, 13503

Tlx : 937344

- Mixer

Amafilter B.V.
POB 396, 1800 AJ Alkmaar
Kwakelkade 28
Tlx : 57291 AMAL NL

- Filters

Austroplan
Austrian Engineering Co. Ltd
Linke Wienzeile 234
A-1153 Vienna / Austria
Tlx : 132997 ALAW A

- Engineering

B) Laboratory Equipment

Weldsil Engineering Ltd
Barton Industrial Estate
Barton-le-clay, Bedfordshire, UK
Tlx : 826692 WLDSIL G

- Stainless steel piping for gaschromatograph

METRIMPEX Hungarian Trading Co. for Instruments
1051 Budapest Munnich F. u. 21, Hungary
Tlx : 225451 H

- Laboratory instruments

Donau Export Ag Zurich, Switzerland
Birmendorferstrasse 483, CH-8055 Zurich, POB 149
Tlx : 53664 DONAU CH

- Laboratory instruments

Perkin-Elmer Far East Pte Ltd
70 Bendemeer Road,
02-02 Hiap Huat House, Singapore 1233
Tlx : 2972411/2

- Gas chromatograph, Spectrophotometer

ILW Intermed Export Import
DDR 1020 Berlin
Schicklerstrasse 5/7, POB 17
Tlx : 114571 ILWD

- Laboratory instruments

Philip Harris Ltd. England
Lynn Lane, Shenstone, Staffs. WS14 0EE, England
Tlx : 336498

- Laboratory equipment

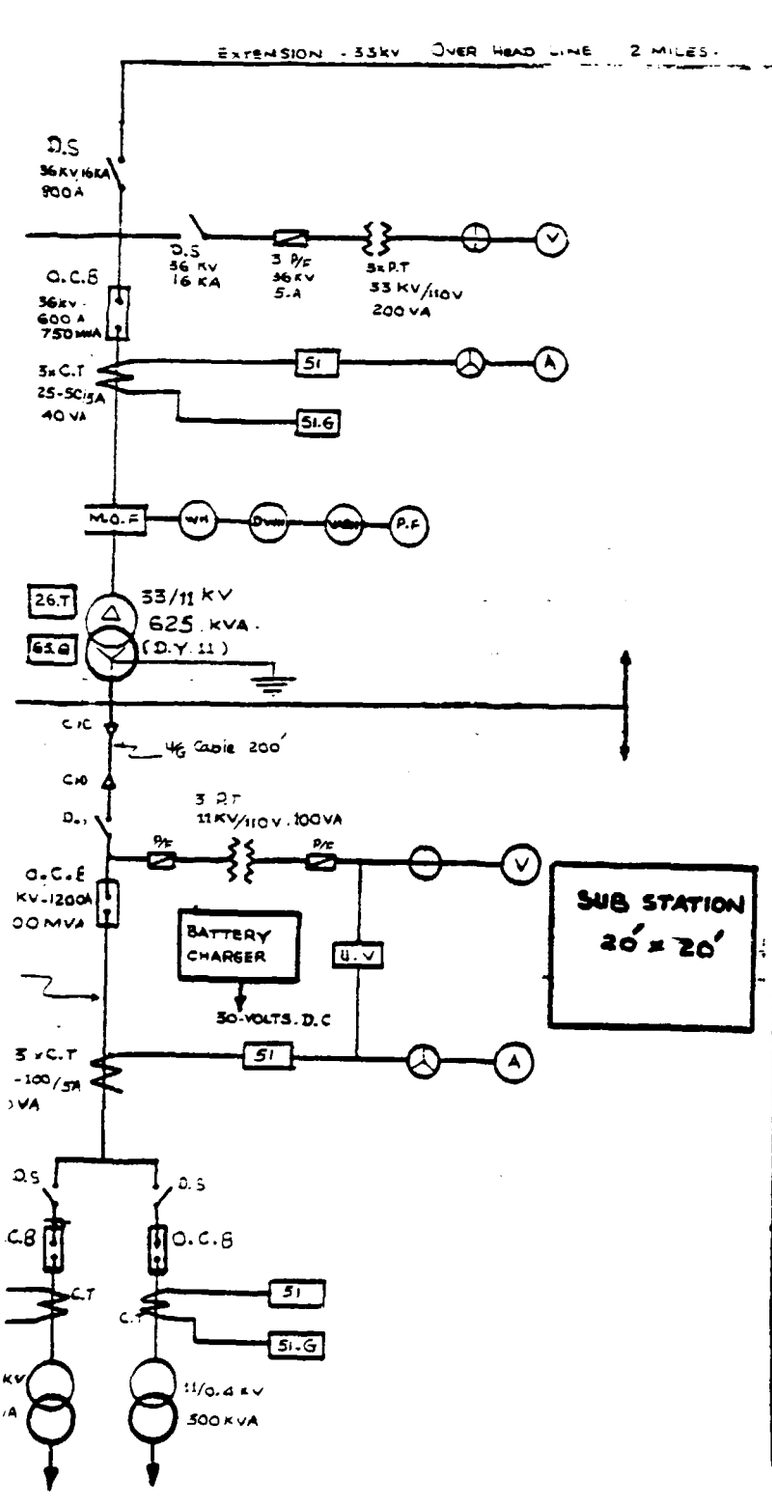
MATERIAL REQUIRED FOR CONSTRUCTION OF 33 KV SUB-STATION AND 33 KV OVERHEAD LINE AT PESTICIDE FORMULATION PLANT (KWAMBI)

S.N.	Description	Unit	Qty
1.	33KV Outdoor type minimum Oil Circuit breaker, nominal voltage 36 KV, nominal current 600A, rupturing capacity 750 MVA, Symmetrical with support structure with meter spring operating mechanism 230 V, 50 H_z with tripping and closing coils 30 V.D.C. (Control cubicle attached)	No.	1
	3 Nos. - Current Transformer ratio 25-50/5A for O/C and E/F relay and meter		
	1 No. - Ammeter with scaled 0-50 A with Selector		
	1 No. - Flush mounting draw out type three pole O/C relay inverse and definite minimum time lag		
	1 No. - Flush mounting draw out type single pole earth fault relay inverse definite minimum time lag		
	1 No. - Tripping Push button		
	1 No. - Closing Push button		
	1 No. - Volt meter scaled 0-36 KV with volt meter selector switch		
	1 No. - Kilo watt hour meter with M-D-I		
	1 No. - Target indicator relay for Bucholz and Temperature relay indication (26T, 63 Q)		
	1 No. - Power Factor Meter		
	1 No. - Signal Lamp		
2.	Three pole outdoor type 800 Amps 33 KV disconnecting switch complete with extension red guide bearing and manually operated handle (For line)	No.	2
3.	Three pole outdoor type 600 Amp, 33KV disconnecting switch complete with extension red guide bearing and manually operated handle (For P.T. and L.A.)	No.	2
4.	33KV drop out fuse complete with insulator and fuse holder	Set	1
5.	33KV outdoor type voltage transformer ratio 33KV/110V, 200 VA with one set of fuse	No.	3

S.N.	Description	Unit	Qty
6.	33 KV outdoor type lightning arrester discharge current 10 KA	No.	3
7.	Transformer 33/11KV, 625 KVA, Vector group DY 11, (out door type)	No.	1
8.	Underground cable 11KV, copper conductor, cross-linked Polyethylene Insulated Power Cable with armourmed size 3 x 70 mmsq.	Ft.	300
9.	Three Pole Switch gear Cubicle Indoor type minimum Oil draw out circuit breaker nominal voltage 12KV, nominal current 1200 A, rupturing capacity 500 MVA, symmetrical at 11 KV with meter spring operating mechanism 250 V, 50 H_z with tripping and closing coils 30 V D.C. with auxiliary signal contacts	No.	1
	1 No. - Projecting mounting non draw out type three pole O/C relay		
	3 Nos. - Current Transformer 50-100/5A		
	1 No. - Ammeter scaled 0-100 Amps with selector switch		
	1 No. - Volt meter scaled 0-12 KV with selector switch		
	1 No. - Three phase watt hour meter with M.D.I.		
	1 No. - Three Pole earthing disconnecting switch		
	1 No. - Three Pole cable end box		
	1 No. - Tripping push button		
	1 No. - Closing push button		
	2 Nos. - Signal Lamps		
	1 Set - 11KV, potential Transformer ratio 11KV/110V, 100 VA for volt meter and under voltage relay		
	3 Nos. - Potential Transformer Fuse		

S.N.	Description	Unit	Qty
10.	Three Pole 11 KV Switchgear Cubicle Indoor type minimum Oil draw out circuit breaker nominal voltage 12KV, nominal current 800A, rupturing capacity 500 MVA, symmetrical at 11KV, with meter spring operating mechanism 230V, 50 H with tripping and closing coils 30V D.C. with auxiliary signal contacts	Nos.	2
	1 No. - Projecting mounting non-draw out type three pole O/C relay		
	1 No. - Projecting mounting non-draw out type single pole E/F relay		
	3 Nos. - Current Transformer ratio 25-50/5		
	1 No. - Three pole earthing disconnecting switch		
	1 No. - Three pole cable end box		
	1 No. - Tripping push button		
	1 No. - Closing push button		
	2 Nos. - Signal Lamps		
11.	Transformer 11/0.4 KV, 300 KVA, vector group DY 11 (indoor type)	Nos.	2
12.	Battery charger 30 volt D.C.	No.	1
13.	Storage Battery	Lot	1
14.	Earthing System	Lot	1
15.	L.T. Distribution Board with circuit Breaker	Lot	1
16.	Conductor A.C.S.R. 70 sq mm	Ton	2-6
17.	Insulator pin type 33KV with spindle	No.	220
18.	Insulator Tension 33KV Disc Type for A.C.S.R. 70 sq.mm	Set	30
19.	Aluminium Binding Wire S.W.G. No. (9)	Lb.	60
20.	Channel Iron (5" x 2½" x ¼") length 9'-4" No.100	Ft.	1000
21.	Parallel groove connector for A.C.S.R. 70 mm sq.	No.	60
22.	Torsion sleeve joint for A.C.S.R. 70 mm sq.	No.	9
23.	Copper Wire 35 mm sq. for earthing	Lb.	300
24.	Wire G.I. 7/16	Lb.	750

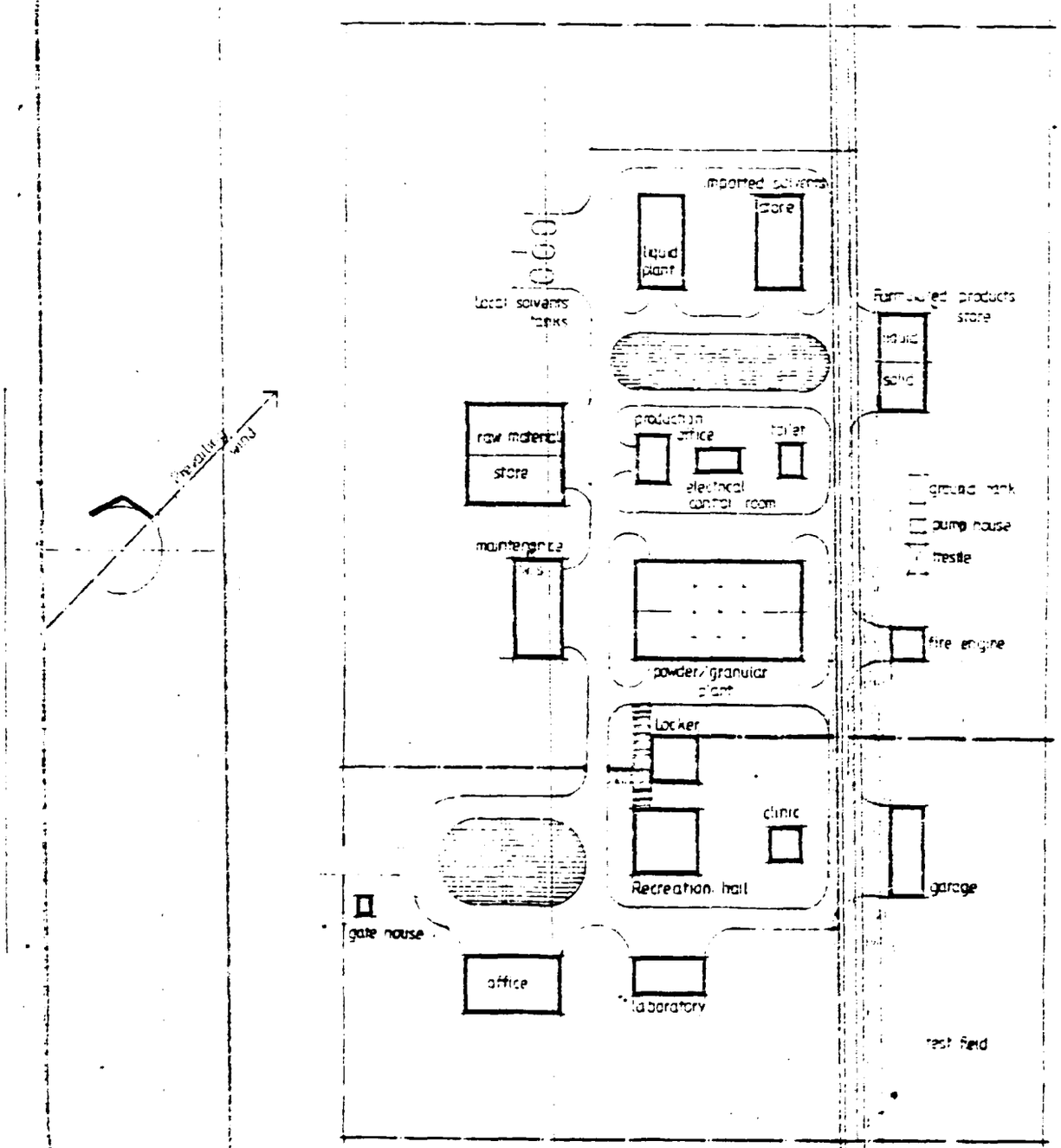
ONE LINE DIAGRAM FOR PESTICIDE FORMULATION PLANT (HMAWBI).



LEGEND:

SYMBOL	DESCRIPTION:
D.S.	- DISCONNECTING SWITCH.
O.C.B	- OIL CIRCUIT BREAKER
C.T	- CURRENT - TRANSFORMER.
P.T	- POTENTIAL TRANSFORMER.
L.A	- LIGHTNING ARRESTOR.
M.O.F	- METERING OUTFIT
C.H.D	- CABLE HEAD
⏚	- EARTH.
51	- OVER CURRENT RELAY.
51. G	- OVER CURRENT GROUND RELAY
26. T	- TEMPERATURE RELAY
63 G	- PRESSURE RELAY
W H	WATT HOUR METER
D W H	- DEMAND - WATT-HOUR METER
V A R H	- RELATIVE VOLT AMPERE HOUR METER
(P.F)	- POWER FACTOR METER
P/F ▭	- POWER FUSE
⊖	- VOLTMETER SWITCH
(V)	- VOLT METER
⋔	- AMMETER - SWITCH
(A)	- AMMETER
U.V	- UNDER VOLTAGE RELAY

FIG. 1



PROJECT: PESTICIDES FORMULATION PLANT [Hmawbi]	SCALE: 1"=100'0"	DATE: 30 12 1983
	DRP LOR	STR CHC
TITLE: layout plans	CKD BY	DRN BY
	DRWG NO: P.F.P / P-1	

ARCHITECT GROUP II Construction Corporation

7287

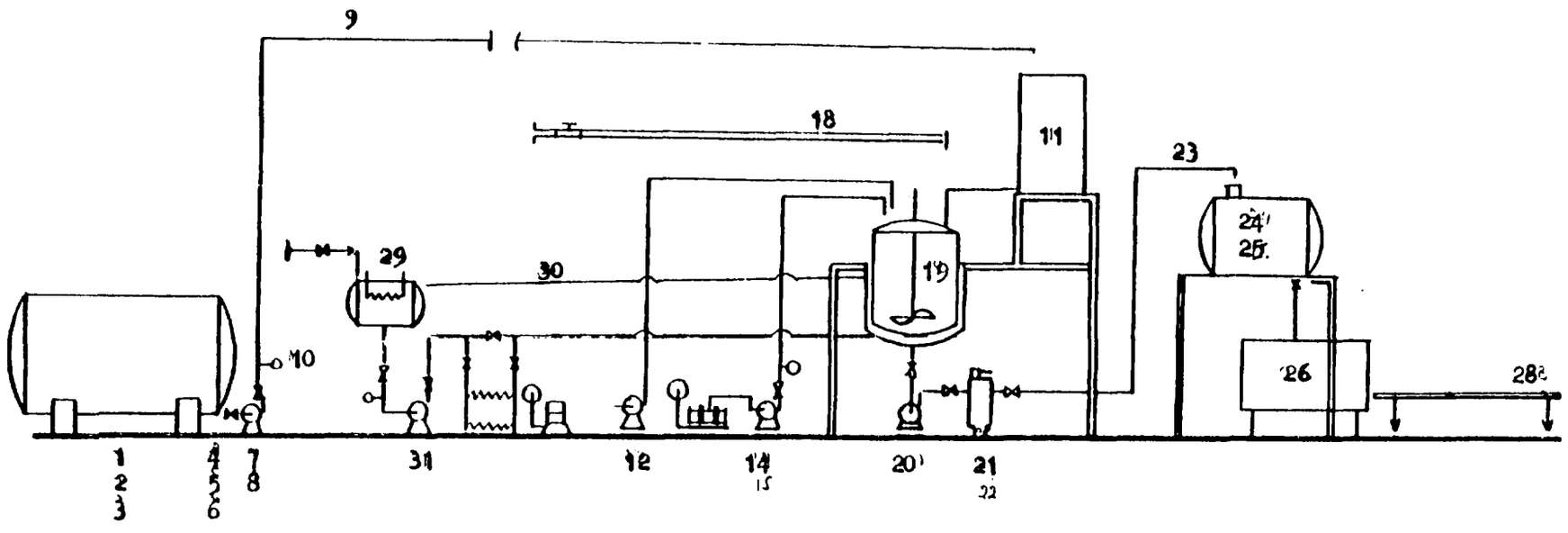
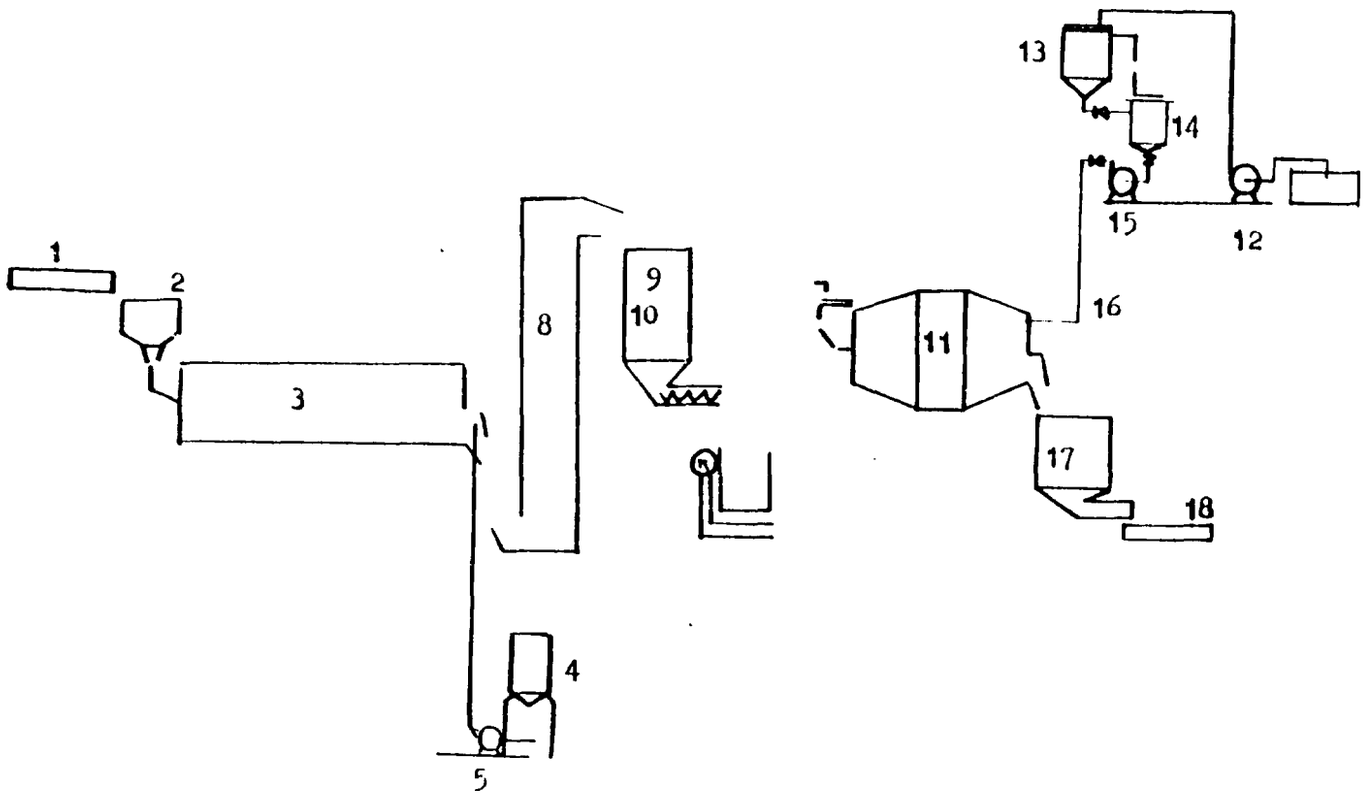


FIG. 2

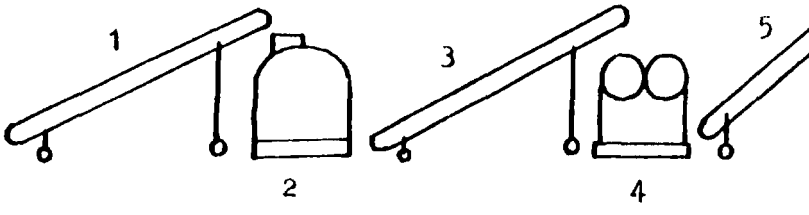
PILOT PLANT FOR PESTICIDES FORMULATION

LIQUID FORMULATION SECTION. FLOW DIAGRAM



PILOT PLANT FOR PESTICIDES FORMULATION

GRANULAR FORMULATION SECTION FLOW DIAGRAM.


1
2
3
4
5

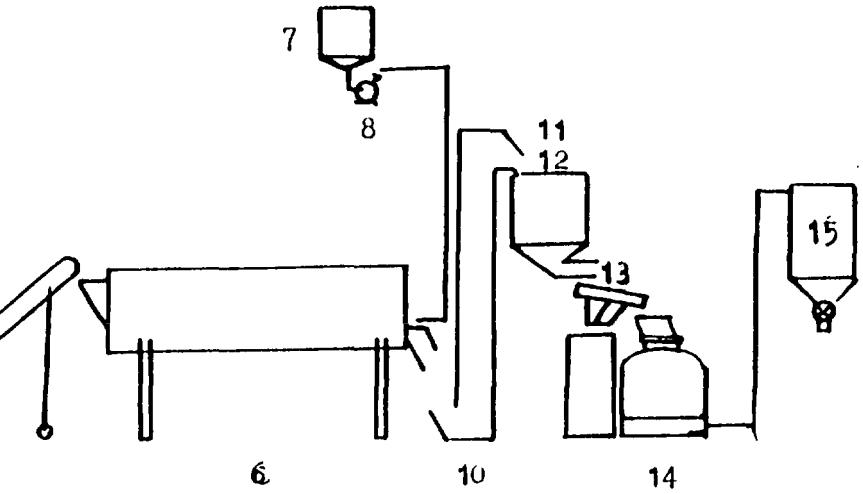
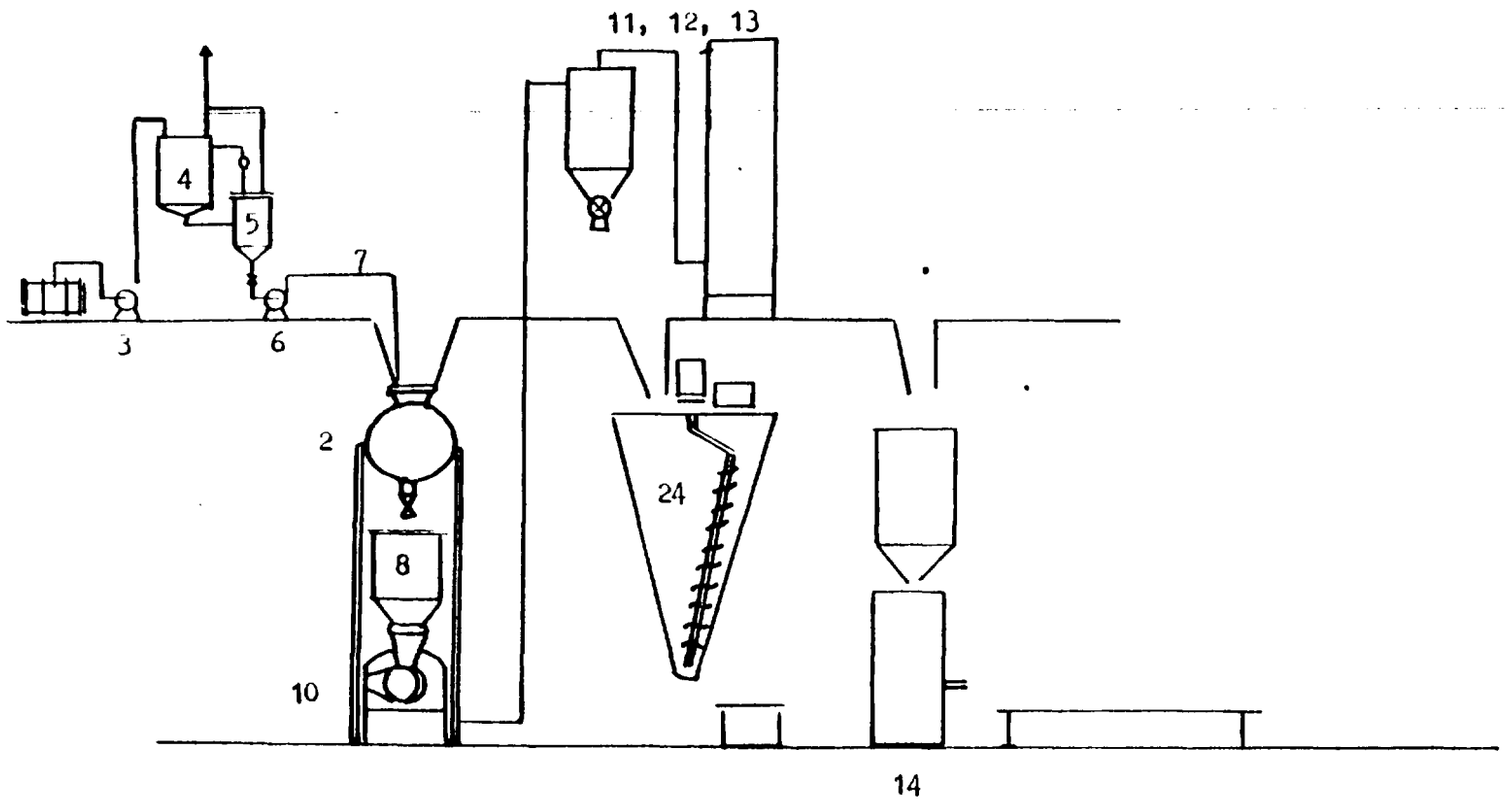


FIG. 4

PILOT PLANT FOR PESTICIDES FORMULATION

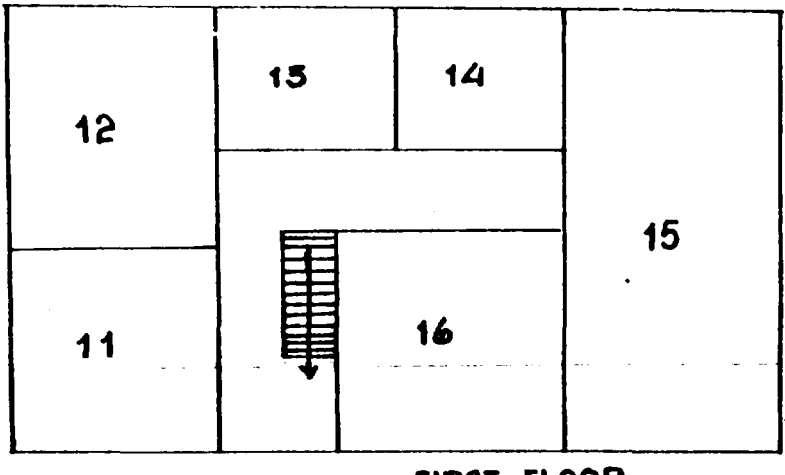
CARRIER UP GRADING SECTION.



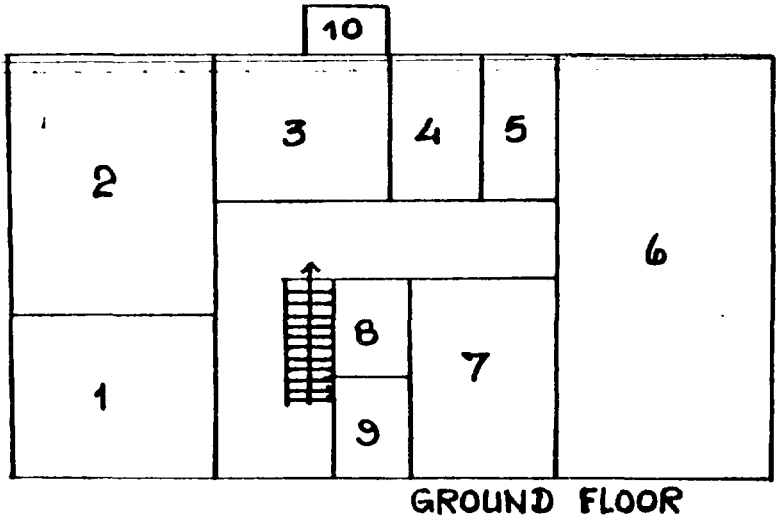
PILOT PLANT FOR PESTICIDES FORMULATION

POWDER FORMULATION SECTION
FLOW DIAGRAM.

FIG. 5



FIRST FLOOR



GROUND FLOOR

LEGEND

1 COOL STORE

2 INSTRUMENT ANALYTICAL ROOM

3 SPECTRO AND GC ROOM

4 BALANCE ROOM

5 WASHING UP

6 GENERAL CHEMICAL LAB

7 PHYSICAL LAB

8 CHANGING CABINET

9 TOILET & SHOWER

10 GAS CYLENDER STORAGE

11 INSECT ROOM

12 BIOLOGICAL LAB

13/14 OFFICE

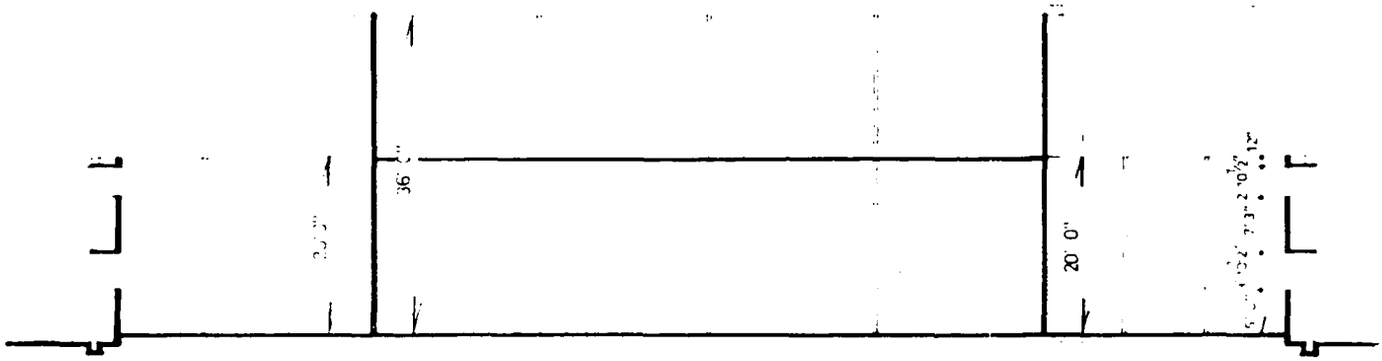
15 LIBRARY

16 STORE

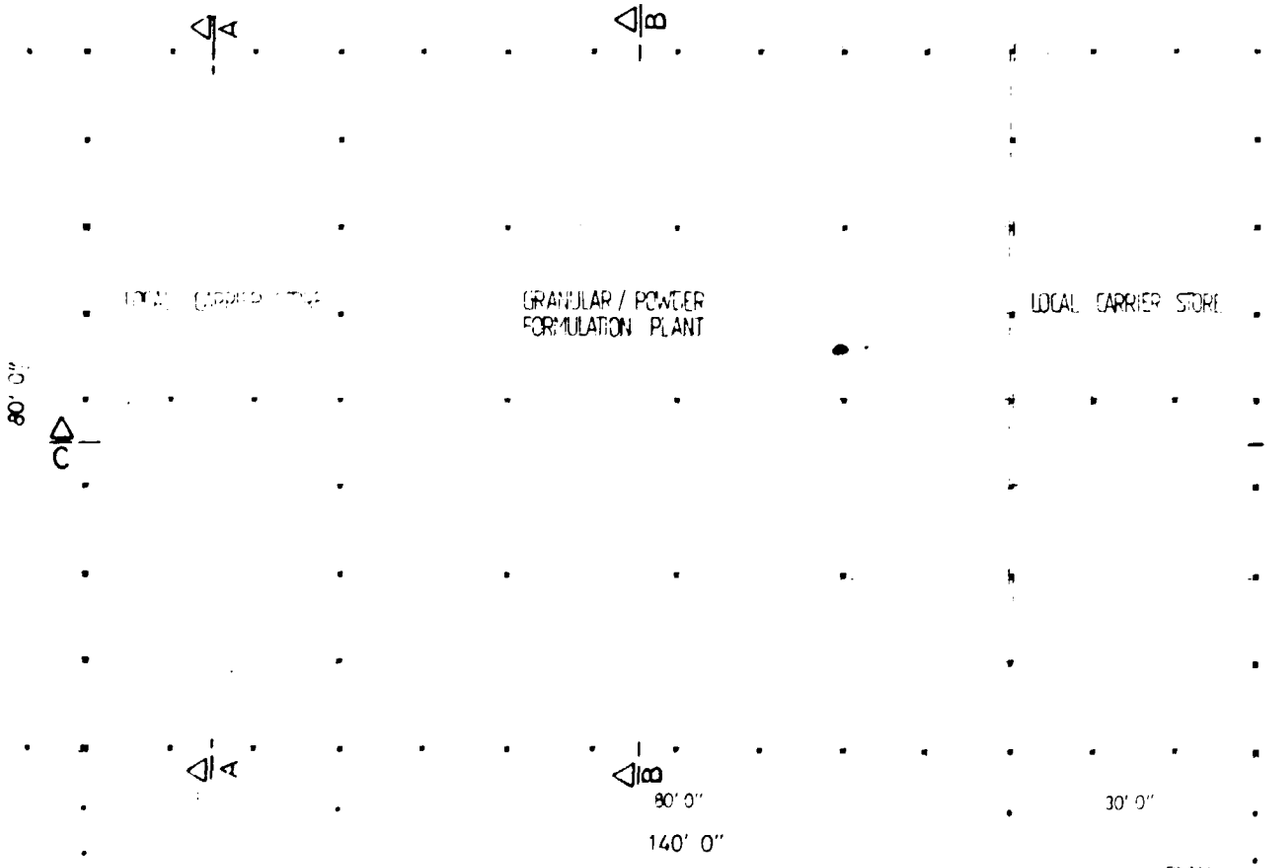
FIG. 6

PILOT PLANT FOR PESTICIDES FORMULATION

LABORATORY BUILDING
ROOM ARRANGEMENT DIAGRAM



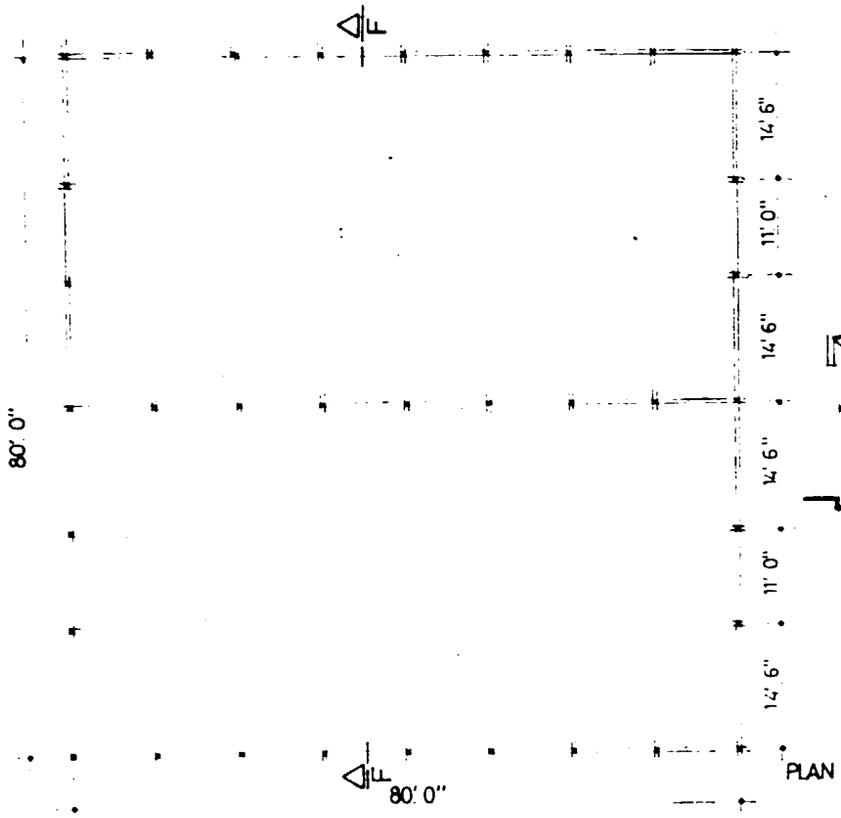
SECTION - C : C

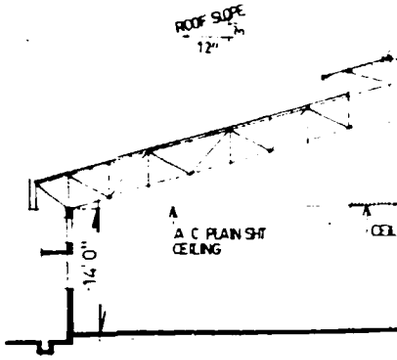


PLAN

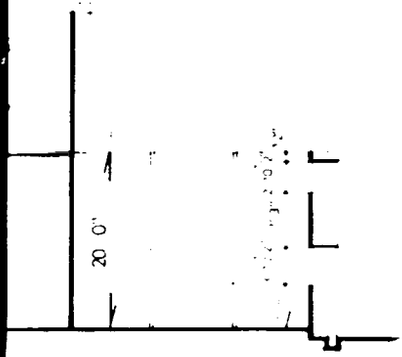
GRANULAR / POWDER FORMULATION PLANT AND LOCAL CARRIER STORE.

SECTION 1

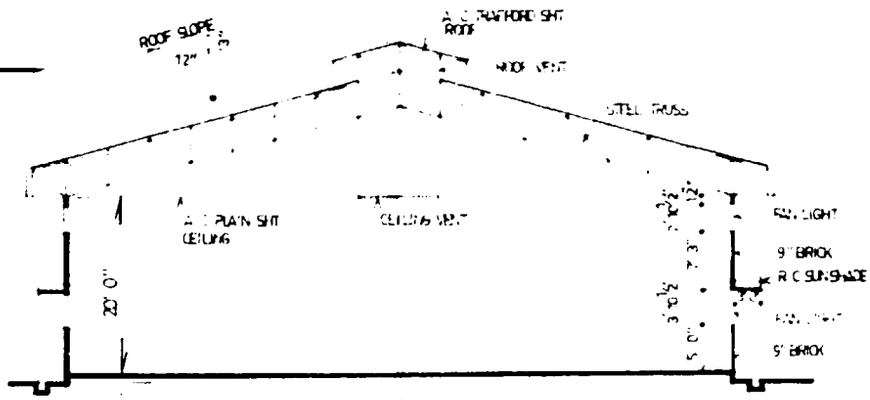




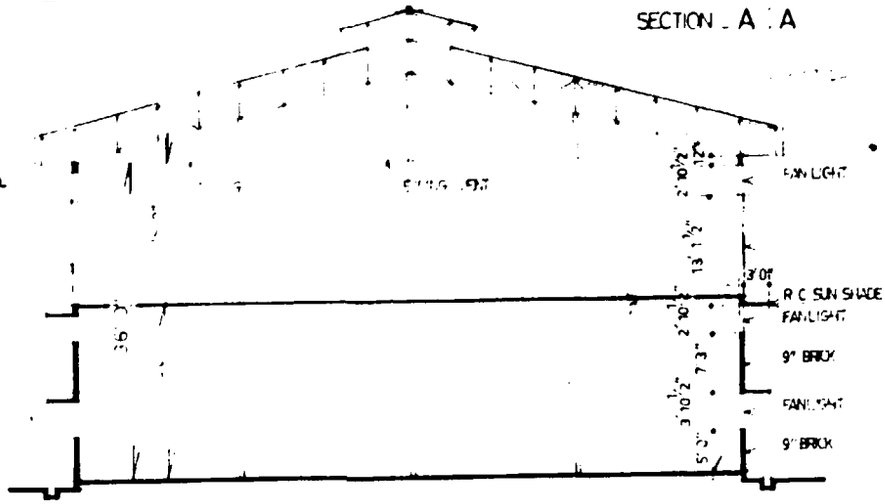
TECHNICAL ACTIVE SUBSTANCE / AUXILIARY MATERIAL STORE



SECTION _ C : C



SECTION _ A : A



SECTION _ B : B

30' 0"

PLAN

STORE

LIQUID FORMULATION

40' 0"

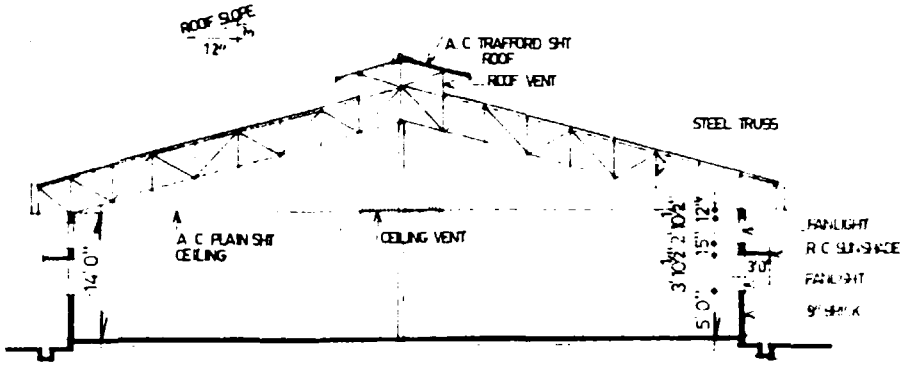
40' 0"

IMPORTE
OPEN STO

SECTION 2

PESTICIDES FORMULATION PLANT

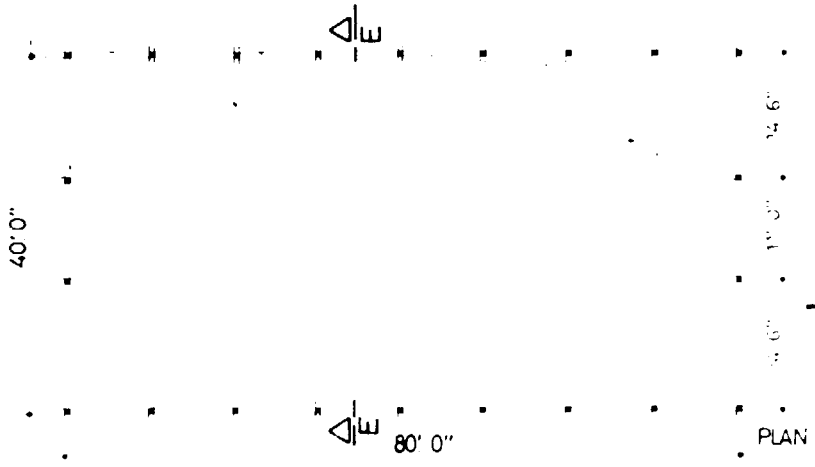
PROPOSE



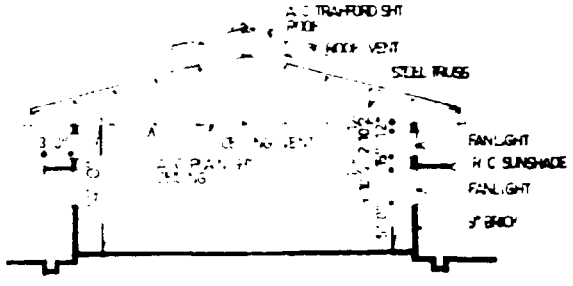
SECTION _ F F

PLAN

STORE

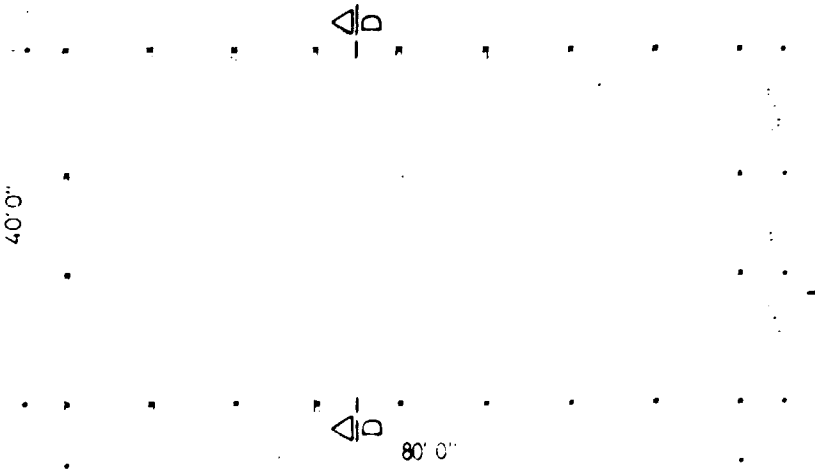


PLAN

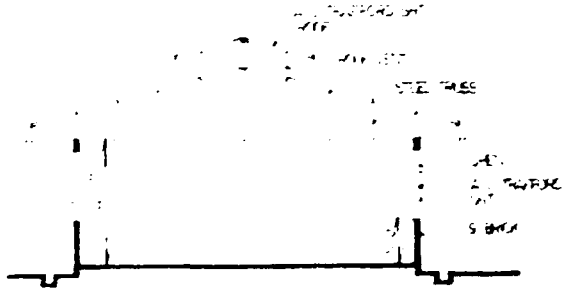


SECTION _ E E

LIQUID FORMULATION PLANT / FORMULATED PRODUCT STORE



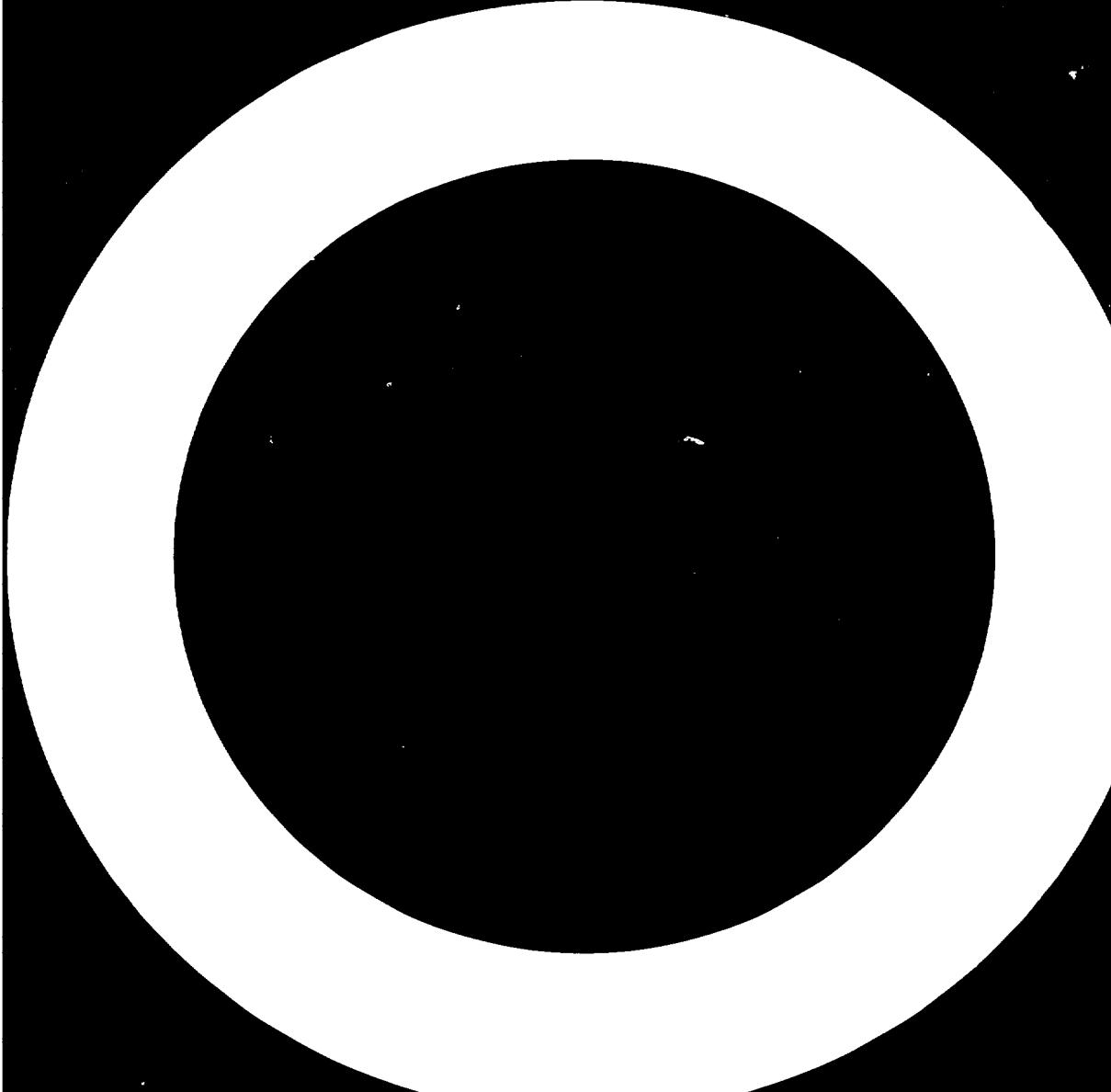
PLAN



SECTION _ D D

SECTION 3

IMPORTED SOLVENTS STORE
OPEN STORE



ORGANISATION CHART

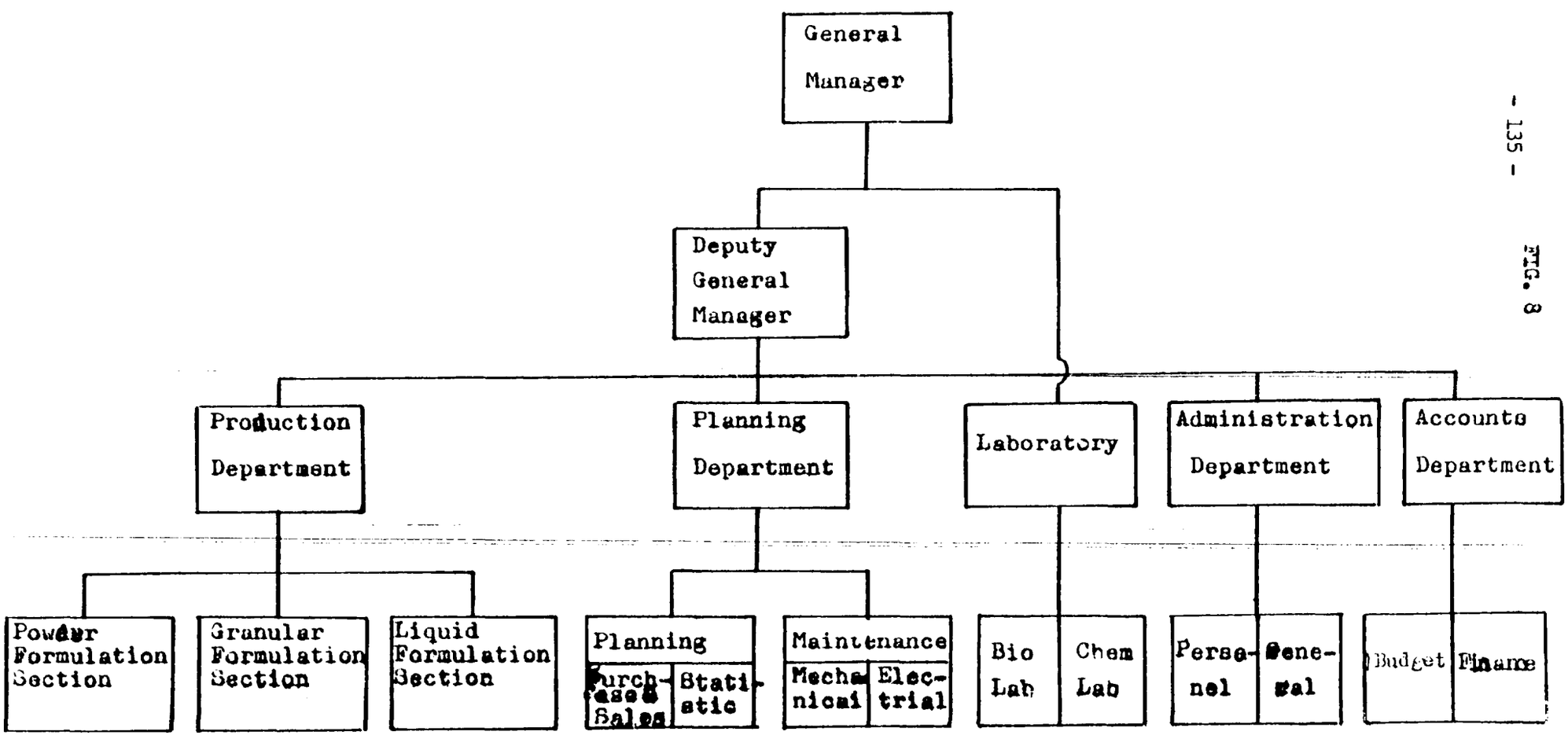


FIG. 8