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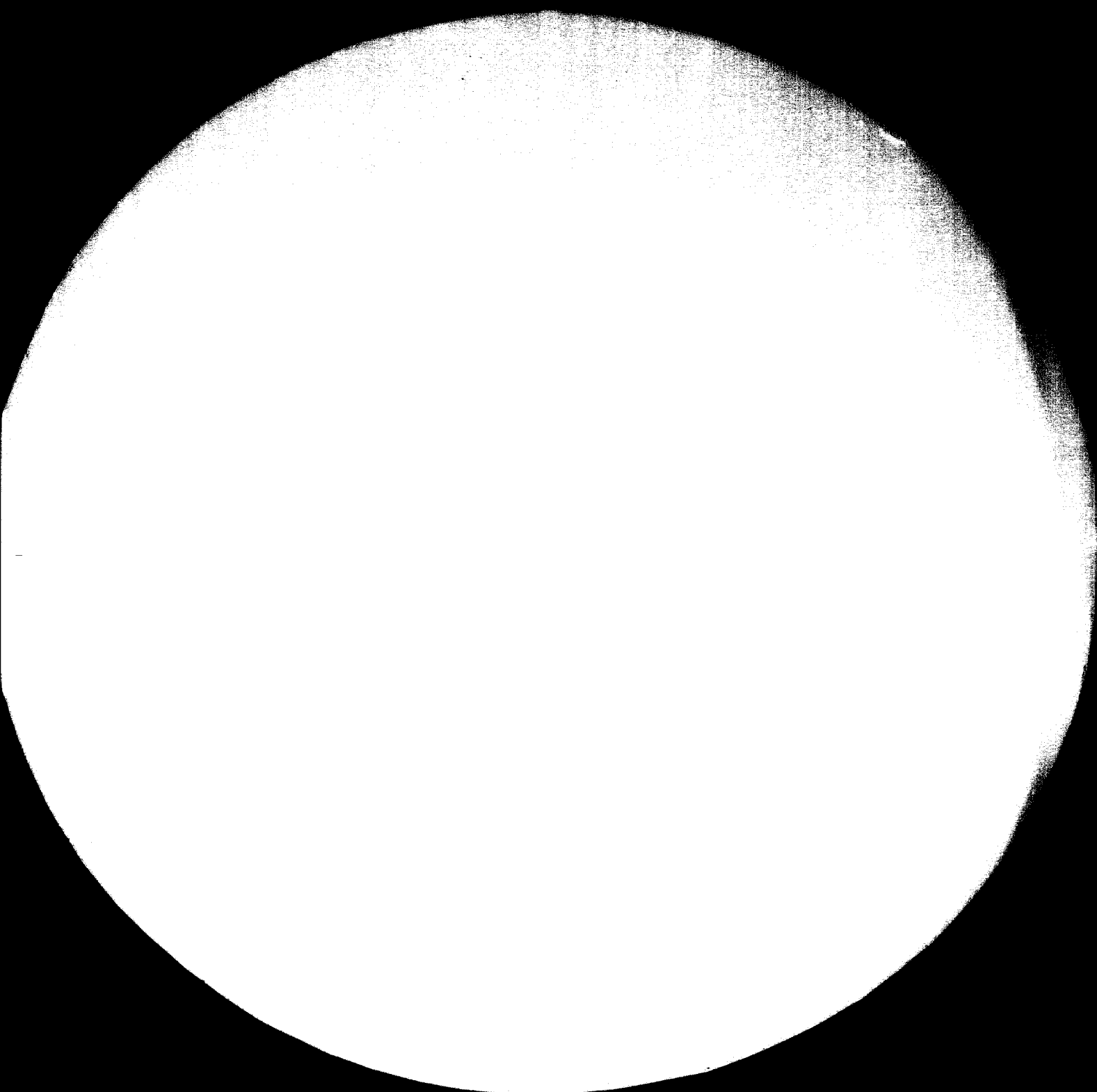

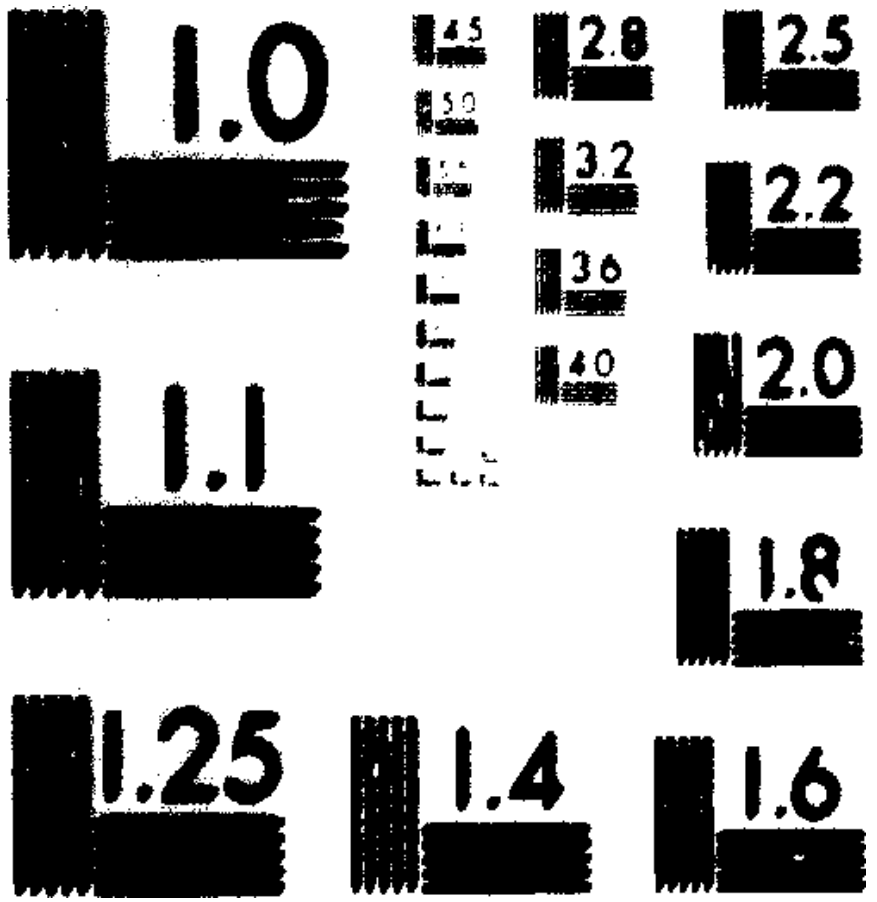

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SEPTEMBER 1980

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FINAL REPORT

Somalia. STUDY ON THE ESTABLISHMENT

OF A LOCAL PESTICIDE FORMULATION PLANT

SOMALI DEMOCRATIC REPUBLIC

Final Report Prepared for

the Government of the Somali Democratic Republic

by

Istvan Bendefy (Dipl. Chemical Engineer)
Expert of the United Nations Industrial Development Organization
Acting as Executing Agency for
the United Nations Development Programme

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" indicates Imperial Gallons = 4,5511
Reference to "tons" indicates metric tons.
Reference to "mesh" indicates U.S. Standard Sieve Apertures.
The monetary unit of Somalia is the Somalian Shilling (So. Sh.).
During the period of the project, the value of So.Sh. was:

US$ 1 = So. Shs. 6.23 selling rate
= So. Sh. 6.35 buying rate

Abbreviations used:

EC	emulsifiable concentrate
G	granules
WP	wettable powder
a.i.	active ingredient
Ha	hectare (10,000 m^2 = 2,471 acre)
HP	horsepower
Kw	kilowatt
S/S	stainless steel
M/S	mild steel
q	quintals (100 kg)

Mention of firm names and commercial products does not imply endorsement by the United Nations Industrial Development Organization (UNIDO).

In tables, apparent arithmetical discrepancies are due to rounding of the basic data.

I. SUMMARY

Agriculture is the backbone of the national economy of Somalia. Agricultural pests cause considerable losses each year both in the crop production and animal breeding. Pesticides are imported ready made consuming foreign currency.

The analysis of pesticide demand by market segments showed that granular and liquid insecticides form a considerable part of the market. A survey of the locally available raw materials and the technical level of the industry revealed the feasibility of the local formulation of the said products. The demand has been estimated to 455 t for the granular and 570 t for the liquid pesticides in 1988. The erection of a Formulation Plant is suggested with capacities to produce 750 t granules and 1000 t liquids/year. It is suggested that the Plant should be located in Mogadiscio on a site at the west boundaries of the town. Batch prodesses are recommended for the production with machinery simple to operate and maintain. It is suggested that the activities should be organized in three main lines such as: Production and Maintenance, Quality Control and Development, Commerce and Administration. Number of employees is estimated to be 104 heads of which 14 should be graduates. The main features of the investment are:

Total fixed investment: 22.3 So.Sh. million
Foreign currency rate: 1.14 $ million.
Payback period/gross profit: 4.8 years
Internal Rate of Return: 16.83%

UNDP assistance is suggested at a value of 1.15 $ million.
The pre-production period is estimated to 39 months, accordingly the earliest possiole start of commercial production would be 1.1.1984.

ACKNOWLEDGEMENT

The expert wishes to acknowledge the whole hearted cooperation extended by the management and the staff of the Ministry of Industry as well as by all the Government officials and organizations in Somalia too numerous to mention who collaborated in different activities and assisted the expert in the work.

Particular mention is made of the help and contribution of Dahir Elmi Warsame, Chemical Engineer, appointed counterpart of the expert. Dr. Abdirizak Osman, dean of the faculty "Industrial Chemistry" at the Mogadiscio Technical University showed great interest in the progress of the activities and contributed with useful information and help.

Mr. Olav Svennevik, Resident Representative, UNDP and his staff were helpful and provided necessary facilities.

Mr. G. D. Rosebery, Pesticides Control Officer, FAO, Rome had shown keen interest in the study and provided valuable help with information and advice, for which the expert expresses his grateful thanks.

Thanks are due to Mr. K. Szabo, UNIDO, Vienna, backstopping officer to the expert, giving all the necessary orientation and advice to promote the project.

Mr. S. Noorani, Industrial Financial Management Expert, provided substantial help when preparing economic and financial evaluation.

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II. INTRODUCTION

II./1. History and background of the Project

In 1977/78 UNIDO carried out a survey of pesticide requirements and a study upon the feasibility of local pesticide formulation units for some types of pesticides having potential local raw material inputs and being in great demand in the country. Based on these recommendations the Government indicated interest in implementing the project with UNIDO/UNDP financial and technical assistance and included the project in the Three Year Development Plan of Somalia.

The present study gives a revision and uptodate completion of the data used as basis of the previous study, selects feasible products for local production considering locally available raw materials and estimates possible demand at the time of the start of production (1984) and five years later. Suggestion was made to erect a unit producing granular pesticides at 750 t/year capacity and a unit producing liquid pesticides at 1000 t/year capacity. Evidence has been presented about economic production and savings in foreign exchange. Recommendation is given for the facilities needed, the site and organization of the plant. Investment costs are estimated and cash flow analyzed. It has been stressed the importance of the creation of a marketing group within the frame of the plant to ensure th e extension of the market and for the introduction of new products. Specifications fo r Tender Document have been prepared.

II. ACTIVITIES

In accordance with a request from the Government of Somali Democratic Republic for assistance in the preparation of tender specifications for the establishment of local pesticide formulation facilities the United Nations Industrial Development Organization, under the United Nations Development Programme, appointed Mr. I. Bendefy as Pesticide Marketing and Formulation Expert to carry out a survey on the subject.

I. Bendefy served in Somalia from 6 July to 25 September 1980.

His terms of reference were to:

1) Review the techno-economic study prepared by an international expert in 1977/78 on the feasibility of setting up a pesticide formulation plant in order to update the figures on pesticide consumption by types of formulation.
2) Determine the formulation units feasible to be included in the propos plant.
3) Prepare tender specifications covering both technical and contractual aspects of the erection of the proposed pesticide formulation plant preferably on a turn-key basis.
4) Prepare an itemized cost estimate on major equipment and other physical installations broken down into local expenditures and import inputs to be covered by convertible currency.
5) Suggest a time schedule for the erection of the plant.
6) Assess further technical assistance requirements by UNIDO during the plant erection, start-up and initial operational period.

In order to collect uptodate information the expert sent a standard letter to a number of supposedly possible suppliers of equipment asking for information quotations. The list of addressees are given in Annex XI. Unfortunately the action met very little response.

The expert's headquarters were in Mogadiscio, office and transport being provided by the Ministry of Industry. Mr. Dahir Elmi Warsame, Chemical Engineer has been appointed as local Counterpart.

Work started with review of demands stated by the previous survey and elaboration of pesticide demands by market segments.

This work has been followed by the survey of locally available raw materials and other possible elements of input. A great number of officials and UN experts were consulted (Annex I) to collect information sufficient to give sound recommendations. Unfortunately information is not readily available and needs thorough cross-checking among different data of different sources.

Three visits have been paid outside of Mogadiscio to the Balad Irrigation Project, the SNAI Sugar Factory, Jowhar and the Agricultural Research Station, Afgoi.

The expert was requested by the Ministry to study and comment the Feasibility Study on a Pesticide Formulation Plant prepared by Ammonia Casale S.p.A. The comments were given under separate cover.

Having all the necessary support and information the expert could met all his terms of reference and prepared a final report containing also the tender specifications.

III. MARKET AND PLANT CAPACITY

III./1. SELECTION OF FEASIBLE PRODUCTS

The selection of feasible products should be based on the availibility of local raw materials and feasibility of operating the equipment.

a) Powder formulations.

Some resources of minerals used generally in pesticide formulations, such as bentonite, feldopates, talc, vermiculite, sepiolite and gypsum are known in the country, but they are only at the survey state. A gypsum quarry is far in the north and sepiolite is mined to produce handicraft objects. Thus powder formulations are considered as not feasible, adding further, that production of wettable powders is not recommended because of the following additional reasons:

- the actual demand is far below an estimated minimal economic capacity of 1000 t/year,
- the domestic input can be only very low being higher concentrated preparations,
- wettable powders need more sophisticated machinery, what would mean high installation expenses, and no sufficient maintenance and repair could be provided,
- energy consumption is high.

b) Granular formulations.

Limestone deposits are avilable in the Mogadiscio area./ NATKO Company operates quarries producing crushed limestone for construction purposes, that is considered suitable to be used for raw material for carrier. The equipment and technology needed for the formulation of granular pesticides is relatively simple not to cause problems eigher in operating eigher in m maintenance.

c) Liquid formulations.

The Iraqui-Somali Refinery at Mogadisho produces destillates of petroleum which can be used as diluents/solvents for the production of liquid pesticide formulations such as oil-solutions and emulsifiable concentrates. Further there is available ethyl alcohol produced locally at SNAI factory Jowhar, that can be utilised as polar organic solvent. The equipment and technology needed for the formulation of liquid pesticides is relatively simple not to cause problems of eigher operating eigher maintenance. Thus the local formulatior of liquid pesticides can be considered as feasible.

d) Furthermore sophisticated formulations, such as flowable, microcapsulated etc. are neither in demand at economic level to produce, nor the equipment is recommended to be erected upon similar reasons given at wettable powders.

e) Local formulation of herbicides is not recommended, even the liquid or granular formulations not because of the danger of cross contamination. (Cross contamination means that insecticide product may incorporate herbicide as impurity and through this kill the crop to be protected). The actual demand for liquid herbicides does not justify the erection of a separate line and it is strongly disagreed to produce herbicides and other pesticides in the same apparatusses. Later possibilities are discussed at III./6.

f) Local formulation of highly toxic active substances, such as carbofuran, methylparathion etc. is not recommended at the initial period of production, only after the personnel of the plant gathered sufficient experience in handling dangerous material. This aspect was kept in mind while selecting feasible products in detail in para. III./3.

Summarizing the above considerations formulation of liquid and granular pesticides is recommended using active substances of low/moderate toxicity.

III./2. ANALYSIS OF PESTICIDE IMPORTS AND PRESENT MARKET

Import data

It is difficult to have an overlook on the imported pesticides in whole being they imported through more separate channels. A general information is shown in the following table:

Imports of pesticides 1972-1978 (Article No.599.2)

1978	tons	th So.Sh.
1972	291	2108
1973	-	-
1974	208	3032
1975	355	2109
1976	90	1168
1977	366	7340
1978	243	18006

Source: Foreign Trade Returns; Yearbooks, State Planning Commission.

CNAT Company is the most important importer of pesticides. The last four years' data have been analysed according to types of function and formulation, as shown below:

Types	1976 tons	1976 th So.Sh.	1977 tons	1977 th So.Sh.	1978 tons	1978 th So.Sh.	1979 tons	1979 th So.Sh.
Pesticides total	48.1	2412.5	115.3	3173.6	77.2	2291.9	109.6	4527.7
Fungicides	4.5	192.8	2.5	69.2	1.0	21.0	25.5	498.7
Insecticides	30.5	1322.9	86.9	1740.7	36.2	1212.9	78.0	2920.1
Powdered	4.1	15.8	8.0	177.6	16.0	517.6	3.0	393.3
granular	5.0	88.0	70.0	1232.0	5.0	79.2	55.0	1104.9
liquid	21.4	1219.1	8.9	331.1	15.2	616.2	20.0	1421.9
Herbicides	13.1	768.0	25.9	1356.9	40.0	1058.0	6.0	905.1
Others	-	128.8	-	7.6	-	-	-	203.8
Share of granular + liquid insecticides		54%		49%		30%		56%

Pesticides imported by Ministry of Livestock	1978 th.l.	1978 th So.Sh.	1979 th.l.	1979 th.So.Sh.	1980 th.l.	1980 th.So.Sh.
Insecticides, liquid	47.5	1881	35	1800	30	4800

From the above figures two important conclusions can be drawn:

a) Pesticide imports show a trend of steady increase in value. This conclusion justifies the decision to erect a local pesticide formulation plant.

b) Granular and liquid insecticides have a considerable share of the imports. This conclusion supports the selection of these two formulations for local production.

Import and distribution channels

The most important channels of importations are:
ONAT Compnay, for crop protection,
Ministry of Livestock, for livestock treatment,
National Banana Board for Banana growers,
BAYL Co., IFCA Co., for use in manufacture,
Projects (like : Balad cotton irrigation project, Custody Corps, LIBSOMA, Settlement Development Agency, Janale Irrigation Project, Crash Programme) and Cooperatives import for their own use either directly, or (partly) through ONAT Company.

SNAI Sugar Factory, for its own needs.
ONAT Company has a storehouse network covering the whole agricultural area with the following capacities:

Mogadiscio	50 t	Erigabo	30 t	Gebiley	10 t
Jamama	400 t	Jowhar	50 t	Burao	10 t
Shalambood	150 t	Bu'ale	20 t	Gelib	10 t
Bardhere	50 t	Baydhaba	10 t	Belet Uene	15 t
Hargeysa	50 t	Afgoy	15 t		
Total:	880 t				

Considering the channels described as future customers of the formulation plant it is assumed that (except BAYL and IFCA Companies) they all may place orders with the formulation plant. Retail for small customers can be based on the activities of ONAT Company for long-term.

Pesticide formulation activity in Somalia

There are several industrial enterprises in Somalia producing pesticides for domestic use among others. Two of them was visited and their activities are hereunder reported.

a) Somali Chemical Industries ICS & Toilet Soap Industry

The factory is a private enterprise founded in 1966. The well organised and managed company more than doubled its production within the last 5 years. The main line is:Household Cleaning Chemicals. Main products: BAYL detergent, Shampoo, Liquid detergent, Laundry Soap, Toilet soap and Neotox insecticide, Neotox contains about 0.3% pyrethrin + piperonyl butaxide in kerosene solvent.

Recently the factory could not satisfy the demands due to the shortage of bottles. To solve this problem the investment of a plastic-bottle producing machine is foreseen; the start of operation is planned in 1981/1982. The general managing director stated that the capacity will be sufficient to supply bottles for the pesticide formulation plant. Bottles of four sizes will be produced : 250 g, 500 g, 1 kg and 5 kg capacities. The material chosen is a mixture of polyethylene and polypropylene.

Further it was stated, that the factory is willing to support the new plant by training the personnel at its own facilities.

Production statistics from the last five years:

Year	Detergents tons*	th. So.Sh.	Soaps tons	th. So.Shs.	Neotox tons	th. So.Sh.
1975	1306.3	10375.9	-	-	8.4	59.0
1976	1618.3	12801.5	-	-	2.0	12.7
1977	1805.8	14116.8	419.1	4438.0	5.7	40.0
1978	1970.3	19344.0	352.9	5455.5	4.2	21.8
1979	2294.9	23494.6	743.5	10785.6	0.2	1.5

* tons indicate BAYL detergent only

b) I.F.C.A. Company

The abbreviation stands for Istituto Farmo - Chimico Affini, founded as a joint venture company in 1973. The product lines are: insecticides, cosmetics, detergent liquid soap and solvent for paints.
The insecticides include three products:
ALFACID Liquid kerosene solution, containing 0.5% DDVP and 0.06% pyrethrum active ingredients + 0.02% perfume. Sold in 0.45 l bottles.
Neokiller spray perfumed aerosol spray containing DDVP active substance. Sold in 200 g spray doses.
IFKATOX powder household insecticide powder containing 3.5% dioxacarb active ingredients. Sold in 20 g sachels. The activity is simple packing of the insecticide powder imported in bags.

In January 1979 the Company obtained a land of 13,000 m^2 and now has 2 workshops, 1 big store, laboratory building, 2 offices, bar for the workers, medical service building.

The formulation facilities consist of a 500 l vessel with stirrer, a semi-automatic aerosol filling machine, a semi automatic bottling machine operated by pressurized air, a semi automatic powder filling machine with sealing machines to fill IFKATOX in sachels.

The workers are provided with protective tools (breathing mask, rubber gloves etc.), a doctor makes health control each two weeks. The ambulance room is provided with the necessary medicines.

Also this company claimed the shortage of bottles. They overcame the trouble by buying used bier bottles collected by children and use after being cleaned. They sometimes can buy plastic bottles from SNAI, Jowhar, produced for own use, but the capacity is insufficient.

Production data:	Production value in 1977	So.Sh.	800.000.00
	1978	"	500.000.00
	1979	"	600.000.00

Share of the pesticides: 80 to 90% of the production.

III./3. ESTIMATION OF PESTICIDE DEMAND BY MARKET SEGMENTS

The market segments of pesticide usage consist of three main groups:

- pesticides for crop protection;
- pesticides for livestock protection;
- pesticides for human pests control.

Analysis of the demand of pesticides for crop protection has been carried out crop by crop establishing first the size of crop production. Then pest problems were reviewed (detailed review was given about "Pests damaging the most important crops in Somalia and their control" in the report DP/SOM/72/007 pp.46-53) together with existing control methods with a remark whether the pesticide used is recommended for local formulation, according to the aspects explained in III./1. Where no control has been stated at the time of the survey or the pesticide used proved not to be feasible, alternative recommendations were given for the use of feasible products.

In the conclusion estimated demands were computed on basis of estimated fully saturated market and estimated percentage of possible saturation. While estimating the percentages a number of substantial drawbacks have been considered, such as:

- lack of hard currency
- lack of pest control technology
- lack of specialized personnel at every level
- lack of technical facilities
- ~~lack of technical facilities~~
- lack of existing control practices in numerous cases.

The detailed estimation is shown in Annex II.

III./4. SUMMARY OF DEMAND FORECASTED TO 1984 - 1988

Quantities in tons, broken down also according to package units.

Data base : Annex II.

Product	1984					1988				
a) Granular	bags of			25 kg					25 kg	
Diazinon 10 G		195		195			455		455	
b) Liquidis	Bottles of	18 l	5 l	1 l	0.5 l		18 l	5 l	1 l	0.5 l
Dieldrin 20 EC	31	-	31	-	-	75	-	75	-	-
Malathion 50 EC	14	-	10	3	1	34	-	25	7	2
Diazinon 60 EC	14	-	10	3	1	36	-	27	7	2
DDT 50 EC	36	-	30	6	-	60	-	50	10	-
Dimethoate 40 EC	39	-	30	8	1	65	-	50	13	2
Oil Spray	164	80	80	4	-	169	80	83	6	-
Lindane 20 EC	56	20	30	6	-	117	40	70	7	-
Dicofol 20 EC	2	-	-	1	1	4	-	-	2	2
Fenthion 50 EC	8	-	8	-	-	10	-	8	2	-
Total of liquid:	364	100	229	31	4	570	120	388	54	8

III./5. PLANT CAPACITY AND PRODUCTION PROGRAMME

Season crops are with some exemptions, e.g. sesame grown in both Gu and Der seasons. That means that the pesticides needed should be delivered to the farmers until the beginning of the rainy seasons, when roads in the country become unpassable. Pesticides for the livestock and for per annual crops like banana and citrusses can be produced on an equal quarterly basis. The storehouse capacity of both ONAT Company and the plant is sufficient to receive and store the pesticides production of which has to start well before the season. An economic aspect of the programming is the financing of the products produced for some months' storage. On the other hand the Formulation Plant will supposedly have to face the shortness of time available in cases of delayed supplies of primary materials or other drawbacks knowing that the pesticide produced and delivered after the proper time of application can only be used in the next season.

All the above considerations suggest that the capacity of the plant should be sized generously enough to allow sufficient flexibility in the production programme and meet short term demands.

Accordingly, and based on the forecast presented in the previous paragraph the following capacities are recommended:

Granular Unit

Nominal capacity:	2 batches/shift of 1.5 t x 365 days	= 1095 t
Feasible:	2 x 1.5 t x 250 days	= 750 t

Liquid Unit

Nominal capacity:	1 batch/shift of 2 t x 365 days x lines	= 1460 t
Feasible:	1 x 2 x 2 t x 250 days	= 1000 t

A demonstration production programme has been elaborated for the year 1988 and is presented in Annex IV.

III./6. FUTURE POSSIBILITIES OF DEVELOPMENT

The extension of the market lies in the hands of the Marketing Group and the Formulation Laboratory. The development of the pesticide market as forecasted in the estimations of pesticide demands (Annex II.) may be aimed only in precondition of an efficient extension activity of the marketing group - in coordination with the Ministry of Agriculture. Sales promotion should be made by organizing demonstration treatments offering free of charge chemicals and showing/evaluating the efficacy and economy together with the farmers. Further important means of marketing will be preparation of proper labels for the products with instructions, compiling leaflets about ways of use in Somali Language. New pesticides should be looked for, possible uses experimented, economically evaluated, formula developed and the products introduced into the market. First examples can be taken from the list in Annex III.

New products can be developed by combining two active substances in one formula. Useful combinations may be e.g. to add some phosphoric ester compound such as dimethoate to DDT against cotton insect pests, to combine some insecticide with acaricide or a specific aphicide, or mix a stomach insecticide with one having knock-down effect.

The activity may usefully be extended by importing liquid pesticides in barrels and bottling them into small containers.

Another important possibility lies in the liquid herbicides. The following items may be considered:

Propanil 34 EC. The herbicide has already been used successfully in rice. The total demand to treat 8000 ha at a rate of 10 l/ha would be 80 t.
Molinate 70 EC. Another rice herbicide, used world-wide, but unknown in Somalia. Previous experimentation is necessary. The total demand to treat 8000 ha at a rate of 6 l/ha would be 48 t.

Trifluraline 26 EC. The herbicide is not in use, previous experimentation is necessary. The total demand to treat 5000 hectares at a rate of 4 l/ha would be 20 t.

EPTC 70 EC with Antidote is a maize herbicide recommended for low rain-fall areas. It has not yet been used, previous experimentation is necessary. The demand to treat 15000 ha of controll-irrigated area at a rate of 9 l/ha would be 135 t.

All the crops mentioned are under irrigation. Living labour being short the hand weeding of such size areas seems impossible. Irrigation affects vigorous growth of weeds - as the experience show at the visited areas of cropproduction - thus yields cannot be increased substantially without efficient weed control. There is an urgent need in the expert's opinion to start with a broader scope of herbicide experiments and extension to introduce herbicide treatments in the regular practice. By the time the demand of liquid herbicides will overgrow an economical minimum size, it may be considered to estat ish a separate liquid formulation line for herbicides keeping in mind to avoid eventual cross contamination as mentioned in III./I.

IV. MATERIALS AND INPUTS

IV./1. Materials to be used

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: Industrial Production and Formulation of Pesticides in Developing Countries, Vol. I. p 75-122.

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 advised 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 laboratory. The following technical information should be requested:

- Chemical / physical / toxicological properties
- Analytical method (suitable to the existing facilities) both for the active and the formulated product
- Guidelines for the formulation
- Safety prescriptions for the formulation
- Recommendations for the agriculture.

Possible suppliers are listed in Annex III. For prices see Annex VI.A.

Mineral products

NATKO Construction Company confirmed its previous statement about the possibility to supply limestone granules sized between 0.2 - 0.8 mm. The price has been estimated to 50.0 So.Sh./t delivered to the factory. A sample has been taken from the material and tested on the following characteristics: Humddity:
Bulk Weight:
pH of 1% suspension:

For chemical composition see the Technical Report DP/SOM/72/007, December 1977.
Particle size: between 52 and 14 mesh
295 and 1204 micron

Synthetic silica, a powder with high sorptive capacity is another component of Diazinon 10 G. That can be imported from Degussa (FRG) or Silfrance (Paris) companies.

Solvents

Some of the active materials, such as diazinon, fenthion are readily soluble in petroleum oils, others are soluble only in aromatic or mixed solvents. Xylene was used for the planning, but other high power solvents might also be necessary to be imported, such as cyclchexanone or isobuthanol.
Petroleum products are regularly produced by the IRAQSOMA Refinery.
It has been cleared that the quantity needed does not justify the establishment of a pipeline supply. The solvents should be purchased at SOMPETROL at the prices shown below:

	Price/liter taxed	untaxed
Kerosene	2.80	2.55
Diesel oil (naphta)	2.90	2.30

It was assumed that the exemption of the tax will be granted upon request.
Aromatic content of kerosene is about 19%, flash point min. 37.5 [illegible].
For further characteristics see the quoted report. The refinery has the possibility to produce the destillates with slightly different characteristics upon request.

Emulsifiers

Emulsifier producing companies with broad experience, such as Tensia (Belgium), Atlas (USA), Sumitomo (Japan), Hoechst (FRG) are specialized to produce emulsifiers for pesticides and are ready to assist in developing new formulations. They also have publications with special recommendations upon the use of their products and typical receipts for the formulation of the most common pesticides. Training at these companies may also be possible.
Emulsifiers belonging to different chemical groups are practically grouped into three groups: types of anionic-, kationic- and nonionic character. There are practically always mixtures of different characters used; the selection of the optimal mixture needs much experience and is possible only after all the other componants are known.

Prices of emulsifiers vary from 2.- $/kg to 3.- $/kg. In order to have a simplified model for planning a medium price of 2.50 $/kg was used.

Deactivators

Some Emulsifiable Concentrates, such as Dieldrin 20 EC may need the incorporation of deactivator/decomposition inhibitor into the formula. This aspect has been neglected at the planning; in the practice the problem is to be solved with the assistance of the supplier companies.

Packing materials

Bags of 25 kg are not available locally. Five-layer paper bags must be imported + an inner bag of polyethylene. Alternatives: out net bag made of woven polypropylene, + internal p.e. bag, or sandwich type bag having one cellophan layer among the paper ones+ no internal bag. Estimated price 0.40 $/piece CIF Mogadiscio.

Tins of 18 l can be purchased from SOMPETROL Agency; they are produced from imported steel sheets.

The machinery SOMPETROL ~~has~~ can make cans only with simple push-on caps. They when fixed by a special machine provide perfect closure but after having been removed they cannot be fixed again. It is recommended to consider completing the facilities with suitable machine to produce the tins with screw cap that can be reclosed after partial use. The price is estimated to 12.0 So.Sh.

Plastic bottles are not produced at the moment, but BAYL factory (III./2) plans to install machinery for the local production. The capacity will be enough to supply needs also over the factory demands. The price of the bottles is estimated as follows:

5	1 bottles	So.Shs.	10.00
1	1 bottle	"	2.80
0.5	1 bottle	"	1.80

The bottles must have a different and warning appearance possibly in shape but at least in colour in order of not to be mistaken for some other products, and must be not transparent not to transmit UV light that may cause decomposition.

Cardboard boxes are produced by INCAS Company, Jamama. The capacity is sufficient to supply boxes for the collective packing of bottles. The price for a box is So.Shs. 3.50.

Labels can be printed locally at the National Printing Agency. Prices have been calculated for two sorts of labels, different in size and quality and unit prices were given for two sizes of series, as shown below:

Size and finish	Unit price for min. 5,000.	Unit price for min. 50,000.
Labels printed in offset, 4 colours, size 8 x 17.5 cm. paper 70 gr/m^2	0.60	0.35
Labels printed in letter press, one colour, size 20 x 30 cm. paper 70 gr/m^2	0.80	0.60

Consumption was calculated as follows:

6 labels for boxes of 4 x 5 l

14 labels for boxes of 12 x 1 and 12 x 0.5 l bottles

1 label/bag or bottle.

IV./2. COST ESTIMATE OF MATERIALS INPUT - SUMMARY

For detailed data see annexes VI.A-C

a) Granules

Items	1984 (195 t) th $	1984 (195 t) th So.Sh.	1988 (455 t) th $	1988 (455 t) th So.Sh.
Materials, imported*	173.5	1114.3	404.9	2600.1
Materials, local		9.8		22.8
Packing materials	3.3	21.0	7.7	49.4
Labels		7.2		16.0
TOTAL	176.8	1152.3	412.6	2688.3

b) Liquids

Items	1984(364 t) th $	1984(364 t) th So.Sh.	1988 (568 t) th $	1988 (568 t) th So.Sh.
Materials, imported*	622.4	4050.2	1241.7	7993.5
Materials, local		469.6		608.0
Packing materials		687.3		1139.2
Labels		87.8		142.0
Total	622.4	5294.9	1241.7	9882.7
Total granules	176.8	1152.3	412.6	2688.3
Materials total	799.2	6447.2	1654.3	12571.0

* Value in the $ represents only the value due in foreign currency while the figures in th So.Sh. represents landed value.

IV./3. STORES CAPACITY

Stores capacity for products and ground materials is foreseen according to the plan shown below:

Material	Quantity t	Time span
Granules in the reservoir	50	4 weeks
Solvents, local	32	4 weeks
Solvents, imported	120	6 months
Active materials, emulsifiers, auxiliar	240	6 months
Finished products	150	1 month

The above data refer to the feasible capacity (III./5.).
The storage capacity planned allows further expansion.

IV./4. UTILITIES

Electric power

Supply of electric power is foreseen from the town network. Requirement: 3 phase, 50 cycles, 220/380 V. Built in capacity of electric motors and appliances is 70 KW, maximum load is estimated at 50 KW.
Suggested installed capacity 100 KW to allow future expansion.
Electric consumption costs 0.85 So.Sh./Kwh
Estimate of consumption:

Granular process:	131/Kwh/t
Liquid process:	39 Kwh/t
Auxiliary equipment:	41 Kwh/day
Lighting:	48 Kwh/day

Water

Supply of water is required only for plant cleaning, the kitchen, laboratory, laundry and for sanitary purposes, but not for the technology. The maximal demand in peak is estimated to 2 - 3 m^3/h. A reservoir of 2 m^3 is recommended above the shower room. Daily demand is estimated about 50 m^3. According to the information of the Water Development Agency this quantity may be supplied from the municipal network. The price of water is 3.0 So.Sh./m^3. A bored well has been incorporated in the plans as contingency at 500,000.00 So.Sh. cost if the development of network would be delayed.

Hot Water

Hot water is required for melting solid active materials and to enhance the solution of poorly soluble materials, pre-warm thick flowing materials (e.g. emulsifiers) before drum decanting. The temperature needed is 60 to 80 C^o. A boyler is provided for the purpose with electric heating. To avoid stone building the hot water must run in closed circuit an d should be treated with trisodiumphosphate. Cost for hot water was calculated together with electric consumption.

Drains

System of drainage is required including storm drains leading to a soakaway pit adequate and two septic tanks for toilets.

V. LOCATION AND SITE

V./1. Location

For location of the project it is recommended Mogadiscio, capital of the Somali Democratic Republic.

Reasons for the selection:

Market: The main agricultural area of Somalia lies along the Jubba and Shebelle rivers. Mogadiscio has a central position to this area. Location in the northern agricultural area would mean substantial increase in transport.

Raw material, local: Petroleum solvents are available only in Mogadiscio, limestones are mined at the outskirts of the town. Plastic bottles will be produced also locally.

Raw material, foreign: Mogadiscio has one of the best port facilities and the most frequent liner service, far better, than the two other ports. Consequently the most advantageous entry for the imported goods is here.

General technical level: Mogadiscio offers the highest technical level of the country considering both the material (maintenance, repair, services) and the educational aspect of it (Universites, Institutes, and other Industry).

Infrastructure: All the necessary infrastructure is readily available in Mogadiscio including banking facilities and international travel and telecommunication.

V./2. Site

For the site - opposite to previous considerations + harbour/refinery area - the northern side of the farthest north main road of the town (connecting Afgoy and Balad country-road entries) is recommended(21 Oktobar street).

Reasons for the change:

- There is no justification to establish pipelene connection between the plant and the refinery. That means that the plant is not bound for the refinery area.
- Water supply at the beach is difficult, it would need an own water source either through desalination, either from a farway drilled well against substantial expenses. At the recommended site water will be available from the municipal network.
- Electric power supply would depend on the power station of the refinery. The construction of a powerline (min 1 km) would cost additional 318,000 So.Sh./km. At the recommended site supply is available from the town network.
- The site has easy access to the country, good road connections to every direction.
- In the beach area salty vapours and morning humidity as high as 90% in several months may cause severe corrosion problems. These are expected to be minimal at the site inland, recommended.
- Prevailing winds are blowing off-town direction, so any eventual polluting emission will not be drifted into th e town.
- Being closer to the city the site offers better access for the employees than the remote refinery site.

V./3. CONDITIONS OF THE ENVIRONMENT

A) Physical and Weather conditions

Temperature: (dry bulb) 30C°,(wet bulb) 27 C°

Sunshine: 12 h/day

Relative humidity: 78 %

Wind velocity: 160 km/h

Destructive winds: none

Average soil bearing capacity: 1.5 kg/cm^2

Average rainfall in mm in Mogadiscio - 1966-1973:

Jan	Feb	Mar	Apr	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual average
-	-	-	-	77.8	133.2	99.5	16.3	2.3	14.8	33.3	-	31.4

B) Transport facilities

Inland transport depends fully on road cars, buses and trucks. Mogadiscio and the site itself has sufficient connections by road to any important points, such as: harbour, city, airport, refinery, landroads etc. International transport can utilize the modern loading/unloading facilities and stores of the harbour and the airport. Expenses to be paid in the harbour:

Handling of goods:	So.Sh. 45.0 / ton
Storage through the first 5 days:	free
Storage from 6 to 15 days:	So.Sh. 5.0 /t/day
Loading on trucks	So.Sh. 40.0 / t

Supposing transport of landed goods not later than within 15 days the total charge will be 135.0 So.Sh./t.

C) Waste disposal

Mogadiscio has no sewage system, accordingly wastes disposal must be solved within the plant.

D) Manpower

Manpower of every level is available in Mogadiscio.

E) Fiscal and Legal Regulations

Depreciation rate:

Buildings:	2%
Plant and Machinery	10%
Motor vehicles	15%
Furniture & Equipment	10%

50% of depreciation is due to the Development Fund.

Income tax: 30% of the net profit

Bonus: 1% of the profit

Pension and gratuity contribution: 1 month's salary/year

Idd celebration payment: 2 x ½ month's salary/year

Insurance is not obligatory to the companies.

F) Construction, Erection, Maintenance Facilities

There are private workshops in the town for repair and maintenance of vehicles, electric appliances, furniture etc.

Contractors for construction of building and civil works:

NATKO Company and National Construction Company.

Construction of buildings does not need foreign assistance.

Contractors for erection and mounting of machinery and equipment are also available in limited number, but construction of machinery needs the foreign assistance of foremen and supervising engineer.

VI. PROJECT ENGINEERING

VI./1. Project Layout

The plant layout as shown at Fig.2 has an oblong shape with the size of 60 x 200 m = 12000 m^2. The main objective was when developing the layout to maintain a safe distance between the fire hazardous parts of the plant(12, 13, 15) and the main traffic area as well as the burner in the building 7.

The main gate serves to the road "21 October".

Guard, medical service, white and black clothes changing room with showers, a tailor's shop, laundry, kitchen and bar, resting & dining room and toilets are comprised in a two storied building just at the entrance (1, 2, 3). The storehouses for the raw materials (4) and the finished products (5) were placed along the opposite sides of the plant to ensure smooth internal traffic. At the end of the finished products store a ramp (5b) should be built to enhance the loading of tracks. Both storehouses need spacy gates for free access for the fork lift truck. At the farther end of the store a separate room serves the storage of packing materials (5a). The raw materials store serves the same time for storing investment goods (complete reserves of pumps, motors etc., new acquisitions until erection/mounting). At the end of this store a separated room (4a) is provided for spare parts, wear and tear parts, tools, construction and auxiliary materials. The mechanical and electrical repair-shops (16) join this building housing also the accumulator-loading equipment for the fork-lift truck.

The Workshop building for granules production (6, 7, 8) has a central position between the storehouses and so the shortest possible distance from both of them. Limestone is stored within the complex (8). Parts of the building have different height according to the technology. Another two storied building (9) houses the offices, laboratory, a conference room, toilets. This management building has a central position concerning the whole plant.

An open garage (10) joins to the building. The fire hazardous liquid workshop (12) is at the rear of the ground together with the store place (13) and tank battery (15) for the inflammable liquids. A fire fighting reservoir is nearby (14). The canalisation consists of two main lines connecting the buildings (3) and (9) respectively with the waste water pit (11) with a septic tank in each line. The plant is surrounded by a fence. The telephone exchange is placed into the guards' room (1).

VI./2. Selection of Technology

The pesticide formulation technology do not show great variations using the same principal procedures such as mixing, blending, grinding, homogenizing, bagging, bottling. The variation may be the application of different machines for the same purpose. In the present case a basic selection has already been made by definition of the feasible products (III./1.). For the selected formulations the following considerations are presented:

Technology for granular pesticides

As the demand is below of 50 t/day, no consideration was given to a continuous technology.

The technology must be suitable for the following tasks:

- to distribute a liquid chemical on a carrier evenly,
- to provide free flowing end product.

Because the sorptive capacity of the limestone granules is not enough to provide the flowability wanted, it is necessary to apply a high sorption capacity silica powder for the same purpose. That defines that the mixing machine must guarantee that the loose silica powder (bulk weight about 0.2 kg/l) will be incorporated among the wetted heavy limestone granules (bulk weight about 2.3 kg/l). For this purpose a rotating drum type blender has been considered as most suitable. For the weighing and controls the most simple manual devices are recommended which do not require high skill when operated or maintained. The organization should save physical labour. The recommended technology allows to produce the same quality granules from any pesticide active material that is liquid at room temperature (e.g. malathion). Should economical demand arise for granules from solide or highly toxic active materials (e.g. carbofuran, dieldrin), the equipment should be completed by some additional facilities (melting or solution apparatus, additional safety devices).

Technology for liquid pesticides

The process consists of

- solution/dilution of the technical grade active substance in suitable solvent or solvent mixture,
- addition of deactivator and emulsifier(s),
- thorough mixing,
- bottling, canning.

The production programme foresees 9 products, but numerous further products may be required in the future. Quantities vary from 1 t to 100 t and the active substances may be liquid (malathion, dimethoate) or solide (lindane, dieldrin). Consequently the technology must be versatile enough to meet all the different conditions.

Two main alternatives are generally used:

a) Tanks of horizontal cylinder shape with circulation pump, eventually additional stirrer, capacity range 10 - 30 m^3.

b) Vessels of 0.5 - 5 m^3 with intensive stirrer.

The first alternative offers great homogenous lots (less number of analytical controls), but longer mixing times. Production is blocked until quality control releases the product for bottling. The second alternative needs more operations (measuring, analysing etc.) but mixing times are substantially shorter, eventual corrections are easy to perform, smaller quantity orders may also be accepted and produced (experimental productions for trial) without difficulty. Safety considerations vote for handling less inflammables the same time in the workshop.

The second alternative has been chosen for the formulation plant. Again simple to handle and maintain machinery is recommended. For the bottling/canning a semi-automatic outfit is considered the most suitable.

Cost of technology:

The pesticide formulation technology are part of common knowledge being discussed in the technical literature and emulsifier producing companies having standard receipes for the most of active substance commodities. Exceptions are some details of technology patented that mostly cover only one special product or formulation step. However, it is necessary to acquire the know-how together with the purchase of the active material, but the companies mostly prefer to include the price into that of the goods. Accordingly no sum has been allocated for the acquisition of technology or know-now.

VI./3. Description of the Processes

Formulation of granular pesticides

The diazinon active substance is decomposed in presence of water, therefore, the granules must first be dried.

Fig. 3

Limestone granules stored in the concrete reservoir are fed with a portable rubber-belt conveyor onto the vibrosoreen (1). Coarse fraction is discarded. Throughfall is fed by a bucket elevator (2) into the drier (3). The drying medium is a hot gas stream generated by an oil burner (6). The fuel-oil tank (8) and pump (7) are placed outside the building. The necessary draught is provided by forced ventillation (4). The small particles thrown by the ventillation are precipitated in a cycle (5) and discarded.

From the drier drum outlet the hot granules are forwarded by a second bucket elevator (9) into a cooler drum (12) which is also equipped with a fan (10) and cyclone (11). The cooled granules are discharged by a portable rubber-belt conveyor (13) on the floor.

Fig. 4.

Small containers of min. 450 kg capacity are provided to weigh and charge the limestone (4). They roll on wheels and are discharged through a self-flow (butterfly) valve at the conical bottom. The limestone granules are fed by a bucket elevator (1) into a hopper (2) provided with a screw conveyor discharge. Overfilling is prevented by automatic level control. From the hopper (2) limestone is weighed in containers (4) on a platform scale (3) of 1000 kg capacity. The containers are hoisted by a traveller hoist (5) onto the +9 m floor. The mixer (6) is brought into charging position opening upside and the load is charged in. Three loads make a batch. The mixer is then brought into operating position: axle horisontal, and the spraying apparatus fixed onto the opening. The exhaust fan (not illustrated) is started. The barrels containing the diazinon active material (11) are decanted by pump (12) and pre-set into a container (13). A calibrated measuring cylinder (14) is filled up to mark from the (13) container. The measured quantity of diazinon is sprayed by a pump (15) through a nozzle (16) into the rotating drum. During the drum decanting and spraying operations the fume extracting fan must run.

After a fixed time of mixing the spraying apparatus is removed and silica powder is fed into the rotating drum in small portions until the granules become free flowing. Then the batch is discharged into a silo (7) and from that through the vibroscreen into the bag filling silo.

The coarse conglomerates selected are collected in a container, disintegrated by handtools and returned to the next batch. Bags are filled from the silo (9) up to 25 kg net weight on a platform scale and after closing stacked on standard pallets, until quality control releases them to the store. Itemized description of the equipment see at the tender specification.

Formulation of liquid pesticides. Fig. 5

The mixing of liquid pesticides takes place in two stainless steel vessels(8,9) of 2200 l capacity each, batch size 2000 l. Petroleum solvents are transferred by a petrol-filling station type metering pump (1) into the production vessels. Imported solvents are weighed on a platform scale and transferred by a drum decanting pump (2) into the production vessels. Emulsifiers and liquid active substances are weighed on platform scales and transferred by drum decanting pumps (6,7) into the production vessels. In the case of thick flowing materials they must be heated by the hot water system before decanting. Solid active substances are fed through openings on the top of the vessels. 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^{o}. After a fixed time for mixing the batch can be discharged by pumps (10, 11) through filters (12, 13) to one of the filling tanks (14, 15, 16). The system allows that should any correction or reprocessing be necessary, the content of any of the filling tanks may be transferred by the pump (17) into any of the production vessels (8,9). The filling tanks are mounted on elevated supporting structure and so filling machines (19, 20) are fed by gravity.* * Fume extracting fan is operated to collect toxic vapours from drum decanting and filling machines area (not illustrated).

Extracted fumes are detoxicated in a Raschig-tower by sodium hypochlorite solution, outside the building (not illustrated). After quality control the product may be bottled or canned. Weight-accuracy should be checked on random chosen bottles on a control scale.

* * Barrels may be filled from the filling tanks on a platform scale.

Hot water heating system

Hot water is circulated in a closed circuit by the hot water pump (4) and heated by a termo-regulated electric boyler (3). The hot water circulates in the coils of the production vessels and in horizontal radiators sunk below floor level. The barrels to be heated are rolled onto the radiators and covered by hoods (5). Evaporated water is replaced into the dilatation tank (21).

Itemized description of the equipment see at the tender specification.

Safety aspects

Workers have to be provided with protective clothing and tools, clothes should be changed, cleaned and repaired regularly.

Smoking is allowed only in offices and in the canteen.

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

In the liquid unit only spark-proof bronze or copper hammers can be used.

VI./4. Cost Estimate of Investment

Data base: Annex VII.

1) Civil engineering works	th. So.Sh.
A) Land of 12000 m^2 a 10.- So.Sh.	120.0
B) Site preparation	
Ground levelling, 2000 m^3 a 60.0 So.Sh.	120.0
C) Buildings (detailed description in Annex VIII.)	
a) Complex building (1, 2, 3)	1200.0
b) Stores (4, 5)	2000.0
c) Workshop building - Granular unit (6, 7, 8)	925.0
d) Office/Laboratory building (9)	1050.0
e) Open garage (10)	204.0
f) Workshop building (12)	425.0
g) Open stores (13)	340.0
h) Repairshops (16)	204.0
Buildings, total	6348.0
D) Outdoor works	
a) Roads, 1500 m^2 @ 620.-/m^2	930.0
b) Fencing, 500 m	200.0
c) Canalization	400.0
d) Soakaway pit (11)	50.0
e) Water reservoir (14), 100 m^3	150.0
f) Concrete trays with support for solvent tanks(15) with lightweight roof	150.0
g) Bored water well, complete	500.0
h) Other, not specified, 10%	232.0
Outdoor works, total	2612.0
Civil Engineering, total	9200.0

Estimated import component: 10% th US$ 147.7

VI./A... [illegible]

[illegible]

2) Machinery and Equipment	US$
Production equipment - granular unit	137800
Production equipment - Liquid Unit	182700
Auxiliary equipment - Except Laboratory	179900
Laboratory equipment	64700
Service equipment	41000
Primary stock of spareparts and tools	51500
Total on FOB EMP basis	657600
Contingency	30000
Crating, shipping and insurance 20%	137520
Total CIF value	825120
Local currency equivalent th. So.Sh.	5245.3
Local transport and other expenses 5%	262.3
Auxiliary equipment, local	260.0
Equipment, total th. So.Sh.	5767.6
Erection of the equipment	
15% in foreign currency th. US$	103.0
Equivalent to th. So.Sh.	655.0
35% in local currency th. So.Sh.	2020.0
Estimated total cost of erection	2675.0

3) Test run and pre-production expenses

A) Suggested production for test run:

Diazinon 10G	100 t	34 days
Malathion 50 EC	10 t	5 days
Lindane 20 EC	10 t	5 days
Oil Spray	10 t	5 days

Cost of raw materials: 1030 th. So. Sh.

Interest on Bank borrowing at 11% : 57.0 th. So.Sh. $\frac{1}{2}$ year)

B) Pre-production expenses

	th. So.Sh.
a) Detailed designs, 0.5% of buildings and production equipment	60.0
b) Wages during construction and test run	524.0
c) Interest during construction	3633.0
d) Interest on Bank borrowing	57.0
e) Miscellaneous expenses (travel etc.)	390.0
	4664.0

4) Summary of investment costs

	th. US$	So.Sh. Million
Building and Civil Works	147.70	9.20
Machinery and Equipment	884.12	7.69
Vehicles	110.00	0.75
Pre-production expenses	-	4.66
Fixed investment, total	1141.82	22.30

VII. ESTIMATION OF OVERHEAD COSTS

Considering the relatively small size of the plant and the inferior order rate of overheads related to raw materials' costs no separated cost centres have been created. Should at any time be decided otherwise the recommendation is to organize three cost centres, such as:

- Production of granules
- production of liquids
- service costs

Overhead costs are estimated as follows:

Cost items	1984 th So.Sh.	1988 th. So. Sh.
Wages and salaries (including benefits and social security contributions)	753	753
Auxiliary material and various overheads:		
2% of depreciable investment	352	352
Office supplies	36	36
Water	30	30
Electr'	68	110
Repair 2% of building	67	67
5% of equipment	262	262
15% of vehicles	112	112
Total	1680	1722

Data base: VI./4.
VIII./2.
Annex VI.E.

VIII. Organization and Manpower

VIII./1. Organization

It is recommended that the activities be organized within three main divisions, such as:

- Production and Maintenance
- Quality Control and Development
- Administration and Commerce.

The plant is headed by a General Manager.
The Plant Manager is responsible for the production and the safety in the plant. Three department heads are reporting to him, one for each workshop and one for the repair and maintenance.
The Head of Laboratory is responsible for the perfect quality and for the development both of the market and the new products (see III.6.). He has an analyst and a formulation chemist in the laboratory and a marketing group to meet his responsibilities. The Head of the Marketing Group should be an agronomist with intensive training in pest control and familiar with recent developments of pesticide market.
The Administration and Commercial Manager is responsible for sales and purchases, stores and transportation and all kinds of services except maintenance. Department Heads reporting to him are the Head of Finance for Commercial and Financial matters, the Head of Stores and Forwarding and the Head of General Services recruiting staff and workers, taking care about the general order and good housekeeping in the plant, supervising the watchmen, the clothes changing room and laundry, the kitchen and the medical service.
The organization scheme is shown on the Fig. the table of salaries and qualifications in Annex IX.
The total number of employees at the plant is 104, of which

- Staff 27%
- Skilled 34%
- Unskilled 43%

VIII.2/. MANNING TABLE

Position		Staff	Skill	Unskill	Salary / per head	Year total
GENERAL MANAGER		1	-	-	33600	33600
Secretary I.		1	-	-	5400	5400
PLANT MANAGER		1	-	-	22800	22800
Secretary II.		1	-	-	4200	4200
Head of Granular Unit		1	-	-	21480	21480
Workers		-	6	-	5400	32400
		-	-	7	2400	16800
Head of Liquid Unit		1	1	-	21480	21480
Workers		-	5	-	5400	27000
		-	-	7	2400	16800
Head of Repair and Maintenance		1	-	-	21480	21480
Workers		-	4	-	5400	21600
		-	-	4	2400	9600
HEAD OF LABORATORY		1	-	-	22800	22800
Analyst		1	-	-	18000	18000
Formulation chemist		1	-	-	18000	18000
Clerk		1	-	-	5400	5400
Help		-	2	-	5400	10800
Head of Marketing		1	-	-	21480	21480
Agronomist		2	-	-	18000	36000
Help		-	2	2	5400	10800
ADMIN & COMMERCIAL MANAGER		1	-	-	22800	22800
Secretary II.		1	-	-	4200	4200
Head of Finance		1	-	-	21480	21480
Sales clerk		1	-	-	4200	4200
Purchases clerk		1	-	-	4200	4200
Accounter		1	-	-	5400	5400
Book Keeper		1	-	-	4200	4200
Cashier		1	-	-	5400	5400
Head of Stores and Frowarding		1	-	-	21480	21480
Store Keeper		-	2	-	4200	8400
Help		-	-	2	2400	4800
Forklipt Driver		-	1	-	5400	5400
Help		-	-	3	2400	7200
Drivers		-	5	-	5400	27000
Clerk		1	-	-	4200	4200
Head of General Services		1	-	-	21480	21480
Clerk		2	-	-	4200	8400
Messenger		-	-	1	2400	2400
Nurse		-	2	-	5400	10800
Watchman		-	-	4	2400	9600
Laundry		-	2	-	5400	10800
Help		-	-	4	2400	9600
TTaylor		-	1	-	5400	5400
Help		-	-	1	2400	2400
Changing Room		-	-	2	2400	4800
Kitchen and Bar		-	2	-	5400	10800
Help		-	-	5	2400	12000
Cleaning		-	-	3	2400	7200
Total	104	27	34	43	So Shs.	663960
Idd Celebration payment						44530
Pension and Graduity contribution						44530
Total wages and Salaries						753020

IX. IMPLEMENTATION AND UNDP ASSISTANCE:

When implementing the plant the project implementation management team should be set up with authority to act as counterpart to contractors or consultants. It is recommended that a Project Manager be appointed by UNIDO to head the team. Further need for UNIDO experts to participate in the team: the Head of Laboratory, Formulation Chemist, Analyst.

Each of the experts should have his local counterpart. The counterpart of the team leader should be the future Head of Repair and Maintenance. The heads of the two workshops should also be appointed and should assist the complete erection of the plant. The local counterparts should be sent for fellowships abroad for 6 month/head possibly before the erection of the equipment. This team should not only remain active during the implementation period, but should ideally form the nucleus of the managerial, technical and operational staff to be put in-charge of operating the plant. The period that covers detail planning, preparation of tender documents, call for tenders, evaluation of tenders, contract negotiations and preparatory work for installation is estimated to be about 10 months. Considering that the plant is composed of relative simple elements of commercial equipment the period between the time when machinery quotations are invited and when final orders are placed is estimated to be not longer than 4 months.

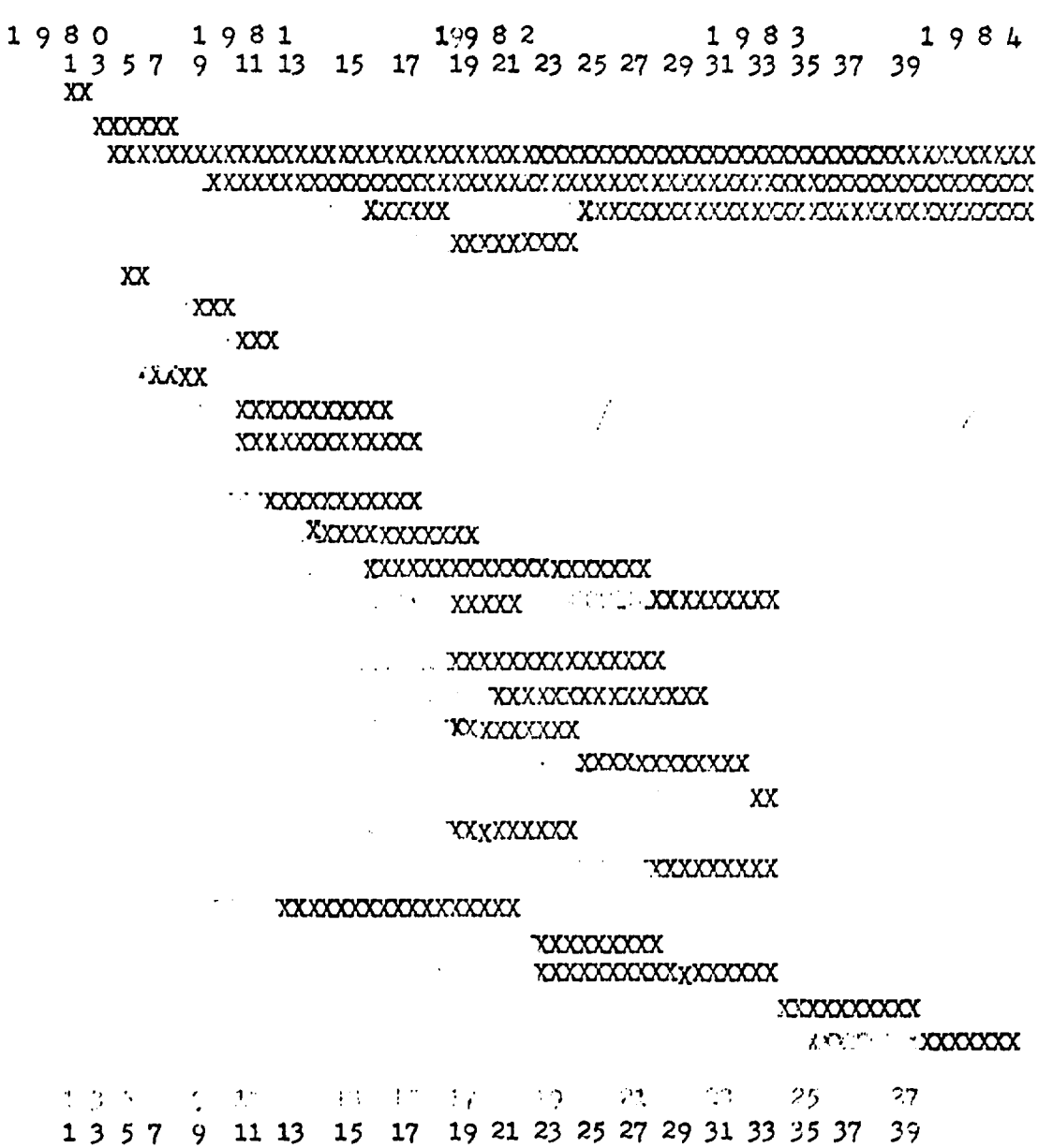
No sooner than the call for tender has taken place the selection and procurement of the site should be organised. As soon as final orders were placed the Plant layout plan should be elaborated within as short as two months and the same time detailed engineering designs and civil engineering design should begin.

First buildings to be erected are one of the stores to receive and store the equipment while construction, office and laboratory building in order that development of local formulas may commence as soon as possible. Next step should be the workshop buildings followed by the rest. Design-work should follow the same sequence.

The detailed time schedule is sub-joined (see next page).

Feasibility evaluation
Project Financing
Appointment of Project Manager
Appointment of Project Team
Apointment of local counterparts
Training abroad of local "
Call for tender
Contract awarding, final orders
Plant layout plan
Selection and procurement of site
Detailed engineering
Civil engineering design
Site preparation: levelling, well, electricity
Foundations
Buildings erection
Outdoor works
Technical installations and equipment of buildings
Structural finishing works
Delivery of equipment
Equipment installation
Control, corrections
Ordering raw materials
Delivery of raw materials
Collection of experimental samples
Development of local formulas
Recruitment of staff and workers
Test runs start up
Regular production

TIME SCHEDULE OF IMPLEMENTATION



The complete pre-investment period is estimated to be 39 months.

Critical points of the period:

End of 8. month: Financing should be cleared.

End of 12 months: Plant layout plan ready.

End of 15 months: water and electricity is avilable at the site.

End of 18 months: One store is ready.

End of 22 months: Laboratory is in service

End of 33 months: Installations ready to start.

The timing of investment costs is estimated as shown below in th. So.Sh. (foreign currency demand in brackets):

Item	1981	1982	1983
Land	120	-	-
Site preparation	120	-	-
Buildings	300	6048 (147.7)	-
Outdoor works	-	1500	1112
Production equipment	809 (126)	1876 (277)	-
Laboratory equipment	-	554 (83)	-
Other equipment	402 (60)	614.6 (2.12)	809 (121)
Primary stock of spareparts	-	-	443 (66)
Local equipment	200	-	60
Erection of equipment	-	(890 (33)	1785 (70)
Yearly installments total th. So.Sh.	1951.0	11482.6	4209.0
th. US$	(186)	(632.82)	(257)
Installments, accumulated	1951.0	13433.7	17642.6
Interest at 11%	214.6	1477.7	1940.7
Interest, total			3633.0

UNDP assistance is needed during the implementation period and the first year of production. The UNIDO project team should consist of the following members:

Team Leader:	Mechanical Engineer with chemical engineering and/or possibly pesticide formulation experience.
Team Members:	Chemical Engineers with broad experience in quality control and formulation techniques.

Further assistance is suggested to backstop the Head of Marketing Department by consultant services.

The consultant expert should be an agronomist with broad experience in pesticide usage and marketing.

The consultant mission should be repeated for several years.
It is recommended finally that one car for the team and the laboratory equipment worth of 80000 US$ CIF Mogadiscio value should be granted to the plant, incorporating also basic literature.
The total value of contributions would be:

Expert services of 166 m/m 1981-84	US$ 835,000
Consultant services 8 m/m 1984	" 39,000
Equipment worth of	" 96,000
Fellowships and study tours of 36 m/m	" 180,000
Total contribution	US$ 1150,000

X. ECONOMIC AND FINANCIAL ANALYSIS

The total fixed investment of the Pesticide Formulation Plant is estimated to 22,300 th.So.Sh. of what foreign currency demand is 1141.82 th. US$ as shown in VI./4.

The construction/pre-investment period is estimated to 39 months. The outflow is estimated yearly as follows:

	So.Sh. Millions
1981	2.25
1982	12.91
1983	7.14

The calculations were made on the 1980 prices basis. Accordingly at 10 or 15% inflation rate the final costs may be estimated as follows:

	So.Sh. millions	
	at 10%	at 15%
1981	2.47	2.58
1982	15.62	17.07
1983	9.51	10.85
	27.60	30.50

Value of the finished products was calculated on the basis of FOB EMP prices adding 300 US$/ton freight costs + landing expenses. Both imported raw materials and finished products were calculated duty free, as the imports are made by the Government. Estimate of the production value is given in Annex VI.D. for 1984 and 1988. For a further five year period the production has been extrapolated by a more moderate growth rate, than in the first period. The turnover is estimated 10.3 M.So.Sh. in the first, 21.4 M. So.Sh. in the 5th and 26.7 M.So.Sh. in the 10th years.

For the sake of smooth production a considerable working capital is needed amounting 3.9 M.So.Sh. in the first and 11.2 M.So.Sh. in the 10th year as shown in Annex X.A.

It is supposed that the plant will operate as a State Company, accordingly no duty on the importation of machinery and equipment has been calculated. Annex X.B. shows the depreciation plan for 10 years.

It is suggested, that the production and profitability be supported by granting a five years exemption of the turnover tax. This tax has been calculated at 30% of the net profit.

It is also suggested that exemption be given from the contribution to the Development Fund at 50% of the depreciation.

Assuming that the above exemptions will be granted, the Projected Profit and Loss Account (Annex X.C.) shows that the operating profit amounts 0.71 M.So.Sh. in the first year and rises to 5.66 in the 5th and 8.08 in the 10th year.

As the financial sources of the project are not yet cleared it has been assumed that a long-term loan will cover the fixed assets while working capital will be financed by Bank Overdraft in the first years. Both were calculated at 11% interest rate. The projected Cash Flow (Annex X.D.) shows the monetary inflows and corresponding outflows for the periods of operations. The return on the total investment has been worked out in Annex X.E. and resulted 16.8%.

Payback period will be 4.8 years on the basis of gross profit, while 7.7 years on basis of net profit as shown in Annex X.F.

The local formulation of pesticides offers considerable savings in foreign currency, the most in cases of low concentration products such as Diazinon 10G, as shown in the sub-joined table:

	1984	1988	1984	1988
Imported pesticides	Diazinon 10 G		Liquid pesticides	
Value in million US$	0.63	1.48	0.97	1.85
Import component of locally formulated product	0.17	0.41	0.80	1.65
Savings, million US$	0.46	1.07	0.17	0.20

INSTITUTIONS AND PERSONS CONTACTED

United Nations Personnel	
Svennevik, O.	Resident Representative, UNDP
Hirad, M.H.	Senior Programme Assistant, UNDP
Lehembre, C.	Programme Officer, UNDP
Noorani, S.	Industrial Financial Management Expert, Ministry of Industry.
Narayanan, N.P.	Irrigation Engineer, Ministry of Planning
Ash, J.	Plant Protection Officer, Ministry of Agriculture.
Mansholt, J.D.	Project Manager, Early Warning System Department, Ministry of Agriculture.
Ministry of Industry	
Ali Khalif Galaydh	Minister
Muse Dude Samater	Director General
Ismail Haji Farah	Director of Dept. of Planning
Mohamed Moallim Hussein	Director of Dept. of Small-scale Industry
Mohamed Mohamoud Adow	Director of Dept. of Personnel
Dahir Elmi Warsame	Counterpart
ONAT Farm Machinery and Agricultural Service Organization	
Ali Abdullahi Wais	General Manager
Mohamed Mahdi	Head of Distribution Section
Ministry of National Planning	
Awil Mohamed	Director of Dept. of Statistics
Abdi Hashi	Director of Dept. of Planning
Ministry of Agriculture	
Dr. Mohamoud Abdi Nur	Assistant Minister of Agriculture
Abdiladif Haji Abdullahi	Director of Dept. of Planning
Abdulkadir Farah	Director of Dept. of Plant Protection and Locust Control.
Abdullahi Mohamed Hersi	Head of Registration
Agricultural Research Station, Afgoi	
Mohamed Said Da'ar	Acting Director of the Station
NATCO Construction Co.	
Mohamud Abdi Arraleh	General Manager

IRAQSOMA Refining Co.	
Ahmed M.S. Daud	Director General & Chairman of Board of Directors
Ministry of Livestock	
Abdirahman Haji Nur	Director General
Hassan Haji Said	Director of Pharmaceutical Unit
Ministry of Health	
Abdullahi Doria	Director of Public Health Dept.
Balad Irrigation Development Project	
Mohamed Hashi Madar	Head of Administration
Hassan Ashur Abyan	Agronomist
National Petroleum Agency	
Hassan Qassim	
Haji Ahmed Hersi	
National Printing Agency	
Mohamed Ahmed	
SNAI Jowhar	
Ali Hussein	Assistant Director of Agriculture Dept.
Hussein Ali Warsame	Agriculture Department
ICS Industries (Bayl)	
Hirei Qassem	General Managing Director
I.F.C.A. Chemicals	
Shu'ayb Hersi	Sales Manager
ENEE (National Agency for Electrical Energy	
Ali Said Arraleh	General Manager
Water Development Agency	
Yussuf Elmi	Director of Drilling Department
Mogadiscio Water Agency	
Ahmed Mohamed Handulle	Technical Director
Ministry of Finance	
Munya Mohamed Abdulla	Department of Ports
Somali Port Authority	
Abdi Hassan	Director of Planning Dept.
National Banana Board	
Nasir Abdulla	Technical Department

Annex II

ESTIMATION OF MARKET DEMAND

Estimated Area under Cultivated Crops by 1984 and 1988
in thousand hectrares

Crop	1984	1988
Maize	125	140
controlled irrigation	14	15
flood irrigation	60	60
Sorghum	350	350
controlled irrigation	1	1
flood irrigation	10	10
Sesame	130	130
controlled irrigation	8	8
flood irrigation	40	40
Peanuts	4	4
Rice	6	8
Cotton	3	5
Banana	8	8
Citrus fruits	0.45	0.50
Sugar cane	7	10
Wheat	2	2
Beans & vegetables	20	25
Total:	655.45	682.50

M A I Z E

a) Production

	Year	Area th ha	Yield th q	Yield q/ha
Estimate a)	1976	72.3	361.9	5
	1977	101.8	610.8	6
	1978	101.8	508.9	5
	1979	106.9		
Estimate b)	1976	112.5	900	8
	1977	125.0	1000	8
	1978	137.5	1100	8

Source: Ministry of Agriculture

b) Pests and Pest Control

Pest	Control
Rust	Seed dressing
Corn earworm, stem borer, Burra stalk borer, Armyworm (cutworm)	Carbofuran 10 G or Diazinon 10 G*
White grubs	Dieldrin 20 EC, Chlordane 74 EC*
Minor pests, such as Snout beetle, False codling moth, Angoumoise grain moth, Two spotted cricket	no control at the moment recommended: Malathion 50 EC*, Dimethoate 40 EC, Fenitrothion 50 EC*
Weeds	Limited control at the moment

* : recommended for local formualtion

c) Estimation of demand	1984	1988
Estimated area under maize	125000 ha	140000 ha
Diazinon 10 G needed for total coverage against minor pests, 10 kg/ha	1250 t	1400 t
Estimated percentage of treated area	10%	20%
Estimated demand of Diazinon 10 G	125 t	280 t
Dieldrin 20 EC needed for the total coverage against white grubs, 5 l/ha	625 t	700 t
Estimated percentage of treated area	2%	5%
Estimated demand of Dieldrin 20 EC	12 t	35 t
Malathion 50 EC needed for total coverage against minor pests, 21/ha	250 t	280 t
Estimated percentage of treated area	1%	3%
Estimated demand of Malathion 50 EC	2 t	8 t

S O R G H U M

a) Production

	Year	Area th ha	Yield th ha	Yield q/ha
Estimate a)	1976	144.8	434.5	3
	1977	186.1	558.3	3
	1978	210.0	630.1	3
	1979	232.9		
Estimate b)	1976	325.0	1300	4
	1977	375.0	1500	4
	1978	400.0	1600	4

Source: Ministry of Agriculture

b) Pests and Pest Control

Pest	Control
Covered smut (grain smut) loose kernel smut	Seed dressing
Stem borers, Durra stalk borer, Armyworm (cutworm), American bollworm	Carbofuran 10 G or Diazinon 10 G*
White grubs	Dieldrin 20 EC* or Chlordane 74 EC*
Minor pests, such as two spotted cricket, sorghum shoot fly, sorghum midge, Scrabs	no control at the moment : Recommended: Malathion 50 EC* Dimethoate 40 EC* Fenitrothion 50 EC*
Weeds	limited control by handwork

* : Recommended for local formulation

c) Estimation of demand

	1984	1988
Estimated area under sorghum	350000 ha	350000 ha
Diazinon 10 G needed for total coverage against minor pests, 10 kg/ha	3500 t	3500 t
Estimated percentage of treated area	2%	5%
Estimated demand of Diazinon 10 G	70 t	175 t
Dieldrin 20 EC needed for total coverage against white grubs, 5 l/ha	1750 t	1750 t
Estimated percentage of treated area	1%	2%
Estimated demand of Dieldrin 20 EC	17 t	35 t
Malathion 50 EC needed for total coverage against minor pests, 2 l/ha	700 t	700 t
Estimated percentage of treated area	1%	2%
Estimated demand of Malathion 50 EC	7 t	14 t

S E S A M E

a) Production

	Year	Area th ha	Yield th q	Yield q/ha
Estimate a)	1976	49.1	147.2	3
	1977	70.5	211.4	3
	1978	88.6	275.6	3
	1979	92.9		
Estimate b)	average	133.0	400.0	3

b) Pests and Pest Control

Pest	Control	[illegible]
Sesame root rot	no control at the moment	-
Leaf spot		
Sesame leaf roller	no control at the moment Recommended: Diazinon 60 EC* Malathion 50 EC* Fenitrothion 50 EC* Dimethoate 40 EC*	[illegible]
WEEDS	Control is not justified	-

* Recommended for local formulation

c) Estimation of demand

	1984	1988
Estimated area under sesame	130000 ha	130000 ha
Diazinon 60 EC needed for total coverage against leaf roller, 2 l/ha, two appl.	520 t	520 t
Estimated percentage of treated area	2%	5%
Estimated demand of Diazinon 60 EC	10 t	26 t

P E A N U T S

a) Production

	Year	Area th ha	Yield th q	Yield q/ha
Estimate a)	1976	1.6	7.9	5
	1977	2.5	9.4	3.7
	1978	1.9	12.6	6.7
	1979	2.4		
Estimate b)	Average	4.0	28.0	7.0

b) Pests and pest control

Pest	Control
Leaf spot	Mancozeb 80 WP Zineb 80 WP
Mealy bugs Egyptian cotton worm American bollworm Thrips	no control at the moment Reommended: Malathion 50 EC* Fenthion 50 EC* Tetrachlorvinphos 24 EC* DDVP 50 EC*
White grubs	Chlordane 74 EC* Dieldrin 20 EC*
Weeds	no control at the moment

* = recommended for local formulation.

c) Estimation of demand	1984	1988
Estimated area under peanuts	4000 ha	4000 ha
Malathion 50 EC needed for total coverage against insect pests, 2 l/ha	8 t	8 t
Estimated percentage of treated area	10%	20%
Estimated demand of Malathion 50 EC	1 t	2 t
Dieldrin 20 EC needed for total coverage against white grubs, 6 l/ha	24 t	24 t
Estimated percentage of treated area	10 %	20%
Estimated demand of Dieldrin 20 EC	2 t	5 t

R I C E

a) Production

	Year	Area th ha	Yield th q	Yield q/ha
Estimate a)	1976	2.8	56.6	20
	1977	4.4	88.6	20
	1978	9.0	180.2	20
	1979	4.8		
Estimate b)	1976	2.7	54	20
	1977	4.2	84	20
	1978	6.0	120	20
	1979	6.8	136	20

b) Pests and Pest Control

Pest	Control
Leaf spot Blast	no control at the moment
Stem borer	no control at the moment Recommended: Diazinon 60 EC*
Weeds	Propanil 34% EC

* = recommended for local production

c) Estimation of pesticide demand

	1984	1988
Estimated area under rice	6000 ha	8000 ha
Diazinon 60 EC needed for total coverage against stem borer, 2 l/ha, two appl	24 t	32 t
Estimated percentage of treated area	10%	20%
Estimated demand of Diazinon 60 EC	2 t	6 t

C O T T O N

a) Production

Year	Area th ha	Yield th q	Yield q/ha
1976	0.9	3.6	4
1977	4.6	18.5	4
1978	3.0	12.0	4
1979	3.1		

Source: Ministry of Agriculture

b) Pests and pest control

Pest	Control
Cotton root rot	Seed dressing
Pin bollworm, American bollworm, Spiny bollworm, Red Cotton stainer, cotton seed bug, cotton jassids, cotton aphid, leaf eating semi loopers	Nuvacron 500, DDT + Carbaryl tankmix Alternative recommendation: DDT 50 EC + Dimethoate 40 EC*, or Formothion 50 EC* Cyanophenphos 50 EC*
Weeds	hand-weeding at the moment

* : recommended for local formulation

c) Estimation of demand

	1984	1988
Estimated area under cotton	3000 ha	5000 ha
DDT 50 EC needed for total coverage against insect pests, 3 l/ha x 8 treatment	72 t	120 t
Estimated percentage of treated area	25%	50%
Estimated demand of DDT 50 EC	36 t	60 t
Dimethoate 40 EC needed for total coverage against insect pests, 3 l/ha x 8 treatment	72 t	120 t
Estimated percentage of treated area	25%	50%
Estimated demand of Dimethoate 40 EC	36 t	60 t

B A N A N A

a) Production

Year	No. Farms producing	Cultivated surface ha	Producing surface ha	Not yet producing surface ha	th quintals exported
1971	136	7160	5195	1965	1030
1972	145	8120	5540	2580	1339
1973	139	9130	7140	1990	1119
1974	140	8990	7056	2735	1073
1975	129	8340	6120	2220	818
1976	116	7420	5320	2100	725
1977	122	6380	4550	1830	538
1978	117	6830	4600	2230	571

b) Pests and pest control

Pest	Control
Banana leaf spot	Banana oil spray *
Fruit rot	Benlate dip
Banana stem borer	Gammaesano 10% dust
White grubs	Alternative recommendation: Lindane 20 EC*
Root nematodes	Nemagon
Coconut leaf scale	no control
Weeds	handwork

* = recommended for local formulation

c) Estimation of demand

	1984	1988
Estimated area under banana	8000 ha	8000 ha
Oil spray needed for total coverage against leaf spot, 10 l/ha, two treatm./year	160 t	160 t
Estimated percentage of treated area	100%	100%
Estimated demand of Oil Spray	160 t	160 t
Estimated area of new plantation	1250 ha	1400 ha
Lindane 20 EC needed for total coverage, against soil insects, 5 l/ha	6 t	7 t
Estimated percentage of treated area	100%	100%
Estimated demand of Lindan 20 EC	6t	7 t

CITRUS FRUITS

a) Production

The area under citurs fruits is estimated to extend to 450 - 500 ha. Other fruits: mango, papaya etc. are not included in the report, however grown in the country, because they do not need insect control.

b) Pests and Pest Control

Pest	Control
Gummosis	no control at the moment
Greasy leaf spot	no control at the moment
Purple scale, Armoured scales, Rust mite, Red spider, Citrus leaf miner, organge dog, minor pests	no regular control at the moment Recommendation: regular spray schedule according to F.W. Lyon's work, including Malathion 50 EC*, Dicofol 20 EC* and Oil Spray.
Weeds	Weeding is made by handwork.

* = recommended for local formulation.

c) Estimation of demand

	1984	1988
Estimated area under citrusses	450 ha	500 ha
Malathion 50 EC needed for total coverage against insect pests, 19 l/ha	8 t	10 t
Estimated percentage of treated area	30 %	60%
Estimated demand of Malathion 50 EC	2 t	6 t
Dicofol 20 EC needed for total coverage against mites, 1.2 l/ha, 4 appl.	2 t	3 t
Estimated percentage of treated area	30%	60%
Estimated demand of Dicofol 20 EC	1 t	2 t
Oil Spray needed for total coverage against leaf spot, 5 l/ha, 6 appl.	13 t	15 t
Estimated percentage of treated area	30%	60%
Estimated demand of Oil Spray	4 t	9 t

SUGAR CANE

a) Production

SNAI plantation in Jowhar extends to 7000 ha. No further extension is planned, even not the total surface is cultivated. The plantation of the new sugar factory at Juba River is planned to be 20000 ha. Cultivation started this year.

b) Pests and Pest Control

Pest	Control
Pineapple disease	Hot water treatment
Loose smut	Mercury fungicide
Stem borer Leaf hoppers Aphids	no control
Weeds	Gesapax Combi at the new plantations

c) Estimation of demand

Insect pests cannot appear in great population due to the practice that extracted canes are burned as fuel in the factory. No control measures have been undertaken until now, neither are considered to be justified.

Being no experience still available about the new plantation it is assumed that the above Jowhar practice applies at Juba as well.
Thus no pesticides are needed and planned for sugar cane.

VEGETABLES and Other not specified crops

a) Production

Year	Beans th ha	Vegetables th ha	Total
1976	18.0	-	18.0
1977	18.8	4.9	23.7
1978	21.8	3.6	25.4
1979	10.3	3.7	14.0

Source: Ministry of Agriculture.

A great variety of vegetable and other crops, such as beans, tomatoes, potatoes, onions, lettuces, carotte, cucumber, tobacco etc. are often heavily damaged by insects, aphids, mites and other pests. The total area under the above crops is estimated to be 20 - 25 th ha in 1983 and 1987 respectively. Because of the great variety of both crops and pests and the relatively small size of the area (about 3% of the total cultivated area) detailed investigation of the subject has not been carried out, but the following estimation was made; The total coverage of the above area by any insecticide EC at a rate of 2 l/ha would need 40 - 50 tonnes of the insecticide for one treatment. In general one treatment is not sufficient, 2 - 5 may be needed.

Considering the limited pest control practices at present the following rough forecast is suggested:

	1984	1988
Malathion 50 EC	2 t	4 t
Diazinon 60 EC	2 t	4 t
Dimethoate 40 EC	2 t	4 t
Dicofol 20 EC	1 t	1 t

the products being selected from among those already suggested for the treatment of major crops.

BIRD CONTROL

Birds, and amongst them mainly Quelea Quelea - weaver bird - cause heavy damages to most kinds of cereal crops before harvest. Chemical control is a regular practice using fenthion (Lebaycid) pesticide spray. The quantity used annually amounts 40 barrels = 8 tons (Source: Ministry of Agriculture, Bird Control Units).

Future demand is estimated as below:

1983	1987
8 t	10 t

STORED GRAINS

A special team of FAO carried out a survey in the recent years highlighting the status and the problems of grain food storage in the country. The findings are summarized in their report :" A policy and action plan for strengthening national food security in Somalia" (World Food Security Country Report ESC/FSAS/SOM. May 1978).

According to the report phostoxin is used exclusively for the fumigation of grain by ADC and pest control operators are trained to apply it. There is no reason for a change of fumigant. Phostoxin is not recommended for local production.

Since 1971 ADC has used 3,308.5 kg Phostoxin 2,125 kg Malathion 25 WP and 1400 kg Malathion 50 EC for the protection of grain stocks. These quantities related to the 481,974 tonnes of grain handled by ADC from 1971 to 1976.

In view of the variety of insect pests associated with stored grain in Somalia, including cockroaches and served both species, and the observation by Champs and Dyte that some are showing resistance to malathion and definite resistance to Lindane, it is recommended in the report that pirimiphos methyl (Acetellic) be used for spraying stacks of emergency grain. Total requirements 76 litres / year.

Since the local formulation of such a small quantity is not considered to be economical spraying with Dimethoate 50 EC is recommended and the future demand is estimated as below:

1984	1 t
1988	2 t.

PEST CONTROL ON LIVESTOCK

a) Estimated population of animals in thousands of heads

	POPULATION*		
Animal	minimum	Maximum	Heads**
Cattle	37000	5000	3700
Camel	3400	4500	5300
Sheep	6300	8400	9400
Goats	6100	8100	15300
Total	19500	26000	33700

Sources: * Technical report on the Meat Production Industry, Project DP/SOM/72/007
** Special Statistical Issue, State Planning Commission, Oct. 1979.

b) Animals treated against ectoparasites 1970-1979

Year	'000 heads	Year	'000 heads
1970	555	1975	13795
1971	294	1976	9277
1972	2291	1977	6854
1973	6907	1978	8542
1974	12164	1979	6737

Source: Ministry of Livestock

c) Pesticides imported - specifications

Name	Active ingredient		Sale price So.Sh./l	Dilution rate 1 / 1 water	Cost/1000 l liquid
Pfizertox	Lindane	20%	31.80	1.25 : 1000	39.75
Coopertox	Permethrin	25%	40.00	3.75 : 1000	150.00
Asuntol	Coumaphos	16%	120.00	1.10 : 1000	132.00
Bacadip	Quintiofos	30%	160.00	0.72 : 1000	115.00

d) Pesticides imported - quantities and value

Pesticide	1978		1979		1980	
	Quantity th.l.	Value th.So.Sh.	Quantity th.l.	Value th.So.Sh.	Quantity th.l.	Value th.So.Sh.
Pfizertox	45	1431	-	-	-	-
Coopertox	-	-	30	1200	-	-
Asuntol	-	-	5	600	-	-
Bacdip	2.5	450	-	-	30	4800
Total	47.5	1881	35	1800	30	4800

e) Future demand

According to the information given by the Ministry of Livestock the quantity of pesticides imported is limited by the avilable foreign currency. The total need was stated to be 22 to 25000 gal./year. The future demand is estimated in accordance with the above statement as follows:

1984	50 t
1988	110 t

However only one product - containing 20% Lindane like Pfizertox - has been used as a model for planning purposes, the technical facilities will allow the formulation of any of the products imported actually.

Remark: the recommended rate for pfizertox is 110 ml/cattle. Simple multiplication of the rate by the statistical data (a) amounts smaller figures than the demand indicated. Notwithstanding the fact the above estimation was accepted considering obvious significant losses of the liquids.

HUMAN PESTS' CONTROL

Pesticide demand for the human health consists of two elements:

- antimalaria programme,
- household insecticides.

a) Antimalaria programme uses only 10 to 15 t/year DDT 75% WP, that is not feasible to produce locally. There is no inclination to change it to EC formulation. (Source: Ministry of Health).

b) Household insecticides are partly imported, partly being produced by local companies. They are able to satisfy the market and there is no reason to create unnecessary competition for a relatively small segment of the market, tha t also has special requirements in size of bottles, packages, labelling etc. as shown in the previous paragraph. After some time of successful activity may be considered to enter this market as extension of produc-tion range.

SUMMARY OF DEMAND FORECASTED FOR 1984
and No. of batches / year

Target	Diazinon 10 G	Diazinon 60 EC	Dieldrin 20 EC	Mala-thion 50 EC	DDT 50 EC	Di-methoate 40 EC	Oil Spray	Lindane 20 EC	Dicofol 20 EC	Fenthion 50 EC	Total Liquids
Maize	125	-	12	2	-	-	-	-	-	-	
Sorghum	70	-	17	7	-	-	-	-	-	-	
Sesame	-	10	-	-	-	-	-	-	-	-	
Peanuts	-	-	2	1	-	-	-	-	-	-	
Rice	-	2	-	-	-	-	-	-	-	-	
Cotton	-	-	-	-	36	36	-	-	-	-	
Banana	-	-	-	-	-	-	160	6	-	-	
Citrus	-	-	-	2	-	-	4	-	2	-	
Sugar cane	-	-	-	-	-	-	-	-	-	-	
Stored grain	-	-	-	-	-	1	-	-	-	-	
Vegetable & oth.	-	2	-	2	-	2	-	-	-	-	
Bird control	-	-	-	-	-	-	-	-	-	8	
Livestock	-	-	-	-	-	-	-	50	-	-	
Human health	-	-	-	-	-	-	-	-	-	-	
Total	195	14	31	14	36	39	164	56	2	8	364
No. of batches	130	7	16	7	18	20	82	28	1	4	183

SUMMARY OF DEMAND FORECASTED FOR 1988

and No. of batches / year

Target	Diazinon		Dieldrin	Mala-thion	DDT	Di-methoate	Oil spray	Lindane	Dicofol	Fenthion	Total liquids
	10 G	60 EC	20 EC	50 EC	50 EC	40 EC		20 EC	20 EC	50 EC	
Maize	280	-	35	8	-	-	-	-	-	-	
Sorghum	175	-	35	14	-	-	-	-	-	-	
Sesame	-	26	-	-	-	-	-	-	-	-	
Peanuts	-	-	5	2	-	-	-	-	-	-	
Rice	-	6	-	-	-	-	-	-	-	-	
Cotton	-	-	-	-	60	60	-	-	-	-	
Banana	-	-	-	-	-	-	160	7	-	-	
Citrus	-	-	-	6	-	-	9	-	2	-	
Sugar cane	-	-	-	-	-	-	-	-	-	-	
Stored grain	-	-	-	-	-	1	-	-	-	-	
Vegetable & other--	-	4	-	4	-	4	-	-	2	-	
Bird control	-	-	-	-	-	-	-	-	-	10	
Livestock	-	-	-	-	-	-	-	110	-	-	
Human Health	-	-	-	-	-	-	-	-	-	-	
Total	455	36	75	34	60	65	169	117	4	10	568
No. of batches	304	18	38	17	30	33	85	59	2	5	287

Information about pesticides recommended fo
and list of possible suppliers

Common name	Trade names	Toxicity*
Chlordane	"Octachlor"	457 - 590
Cyanophenphos	"Surecide"	89
DDT	"Gesarol"	113 - 118
DDVP	"Nogos" "Vapona"	56 - 108
Diazinon	"Basudin"	300 - 850
Dicofol	"Kelthane"	668 - 842
Dieldrin	-	46
Dimethoate	"Rogor"	320 - 280
Fenitrothion	"Sumithion" "Cytel" "Folithion"	250 - 500
Fenthion	"Lebaycid" "Queletox"	190 - 315
Formothion	"Anthio"	365 - 500
Lindane	"Gammexane"	88 - 91
Malathion	"Cythion"	2800
Permethryn	"Coopex"	430 - 4000
Tetrachlorvinphos	"Gardona	4000 - 5000

* Acute peroral toxicity on rat mg/kg.

Annex III

or local formulation

Short description
Persistant, non systemic stomach and contact insecticide
Used against rice borer, cotton bollworm, lepideptorous larvae.
Non systemic stomach and contact insecticide of high persistence.
Contact and stomach insecticide with fumigant and penetrant action.
Non systemic insecticide with some acaricidal action.
Non systemic acaricide with little insecticide action.
Strong stomach and contact insecticide of high persistence, non systemic.
Contact and systemic insecticide and acaricide.
Contact insecticide.
Contact and stomach insecticide with penetrant and persistent action.
Contact and systemic insecticide.
Stomach insecticide with some fumigant action.
Non systemic insecticide and acaricide.
Contact insecticide against leaf and fruit eating pest
Selective insecticide controlling lepidopterous and dipterous pests.

Annex III.

Addresses of suppliers

American Cyanamid Company, Agricultural Division, P.O. Box 400, Princeton, New Jersey 08540, USA.

Fenitrothion, Malathion.

Bayer AG. PI-AT Beratung, 5090 Leverkusen Bayerwerk, Federal Republic of Germany.

DDVP, Fenitrothion, Fenthion.

Ciba - Geigy AG, CH - 4002, Basle, Switzerland.

DDVP, Diazinon

Montedison SPA, DIAG/C.R.A., Via Bonfadini 148, 20138 Milan, Italy.

Dimethoate

Rohm and Haas Company, Independence Mall West, Philadelphia, Pennsylvania, 19105, USA.

Dicofol

Sandoz AG, Agrochemicals Division, CH - 4002 Basle, Switzerland.

Formothion

Shell International Chemical Company Limited, Shell Centre, London SE 1 &PG, England.

DDVP, Dieldrin, Lindane, Tetrachlorvinphos

Sumitomo Chemical Company Limited, 15.5-chome, Kitahama, higashi-ku, Osaka, Japan

Cyanophenphos, Diazinon, Lindane, Fenitrothion.

Velsicol Chemical Corporation, Commercial Development Department, 341 East Ohio Street, Chicago, Illinois 60611, USA.

Chlordane

Wellcome Research Laboratories (Berkhamsted), Berkhamsted Hill, Berkhamsted, Hertfordshire HP4 2QE, England.

Permethryn.

PRODUCTION PROGRAMME 1988

Product	Total	Jan	Feb	Mar	Apr
Gran. Diazinon 10 G	455	66	66	32	
Liqu.Dieldrin 20 EC	75			45	
Malathion 50 EC	34			20	
Diazinon 60 EC	36		6		
DDT 50 EC	60		20		
Dimethoate 40 EC	65		25		
Oil Spray	169	40			40
Lindane 20 EC	117				
Dicofol 20 EC	4				
Fenthion40 EC	10				
Total liquid:	570	40	51	65	40

* Maintenance and repair

ANNEX IV

May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
66	66	66	27				66
			30				
			14				
			30				
	20	20					
		40					
	40			29	20		
40				37			40
4							
10							
54	60	60	74	66	20	*	40

ANNEX V.

Typical composition of products (per cent)
used for planning purposes.

Raw material	Diazinon 10 G	Diazinon 60 EC	Dieldrin 20 EC	Malathion 50 EC	DDT 50 EC	Dimethoate 50 EC	Oil spray	Lindane 20 EC	Dicofol 20 EC	Fenthion 50 EC	Spill.
Diazinon	10	60	-	-	-	-	-	-	-	-	1%
Dieldrin	-	-	20	-	-	-	-	-	-	-	1%
Malathion	-	-	-	50	-	-	-	-	-	-	1%
DDT	-	-	-	-	50	-	-	-	-	-	1%
Dimethoate	-	-	-	-	-	40	-	-	-	-	1%
Lindane	-	-	-	-	-	-	-	20	-	-	1%
Dicofol	-	-	-	-	-	-	-	-	20	-	1%
Fenthion	-	-	-	-	-	-	-	-	-	50	1%
Limestone	87	-	-	-	-	-	-	-	-	-	15%
Silica	3	-	-	-	-	-	-	-	-	-	3%
Emulsifier	-	7	9	8	8	8	10	9	9	8	1%
Kerosene	-	33	26	17	12	12	-	30	71	42	3%
Xylene	-	-	45	25	30	40	-	41	-	-	3%
Diesel oil	-	-	-	-	-	-	90	-	-	-	3%

ANNEX VI.A

Cost estimate of materials input - A.

Raw materials imported.

Data base : III./4. and Annex V.

a) Granular products

Material	Unit price $/t FOB EMP	1984 t	1984 th $	1989 t	1989 th $
Diazinon technical	7950	19.7	156.62	46	365.7
Silica powder	1500	6.1	9.15	14.1	21.15
Total		25.8	165.77	60.1	386.85
Freight	300		7.74		18.03
Total CIF value			173.50		404.88
Equivalent in So.Sh.			1102.97		2573.82
Bank commission 0.7%			7.72		18.02
Import licence fee (3 lots @ 37)			0.11		0.11
Handling in the harbour			3.48		8.11
Landed value:			1114.28		2600.06

b) Liquid products

Material	Unit price $/t FOB EMP	1984 t	1984 th $	1984 t	1984 th $
Diazinon techn.	7950	8.5	67.57	21.8	173.31
Dieldrin techn.	9400	6.2	58.28	15.0	141.00
Malathion techn.	2200	7.1	15.62	17.2	37.84
DDT techn.	1670	18.2	30.39	30.3	50.60
Dimethoate techn.	3850	15.6	60.06	26.0	100.10
Lindane techn.	14650	11.3	165.54	23.6	345.74
Dicofol techn.	3300	0.4	1.32	0.8	2.64
Fenthion techn.	5250	4.0	21.00	5.1	26.77
Emulsifier	2500	33.1	82.75	50.7	126.75
Xylene	1000	68.9	68.90	138.30	138.30
Total		173.3	571.43	328.8	1143.05
Freight	300		51.99		98.64
CIF Value			622.42		1241.69
Equivalent in So.Sh.			3956.72		7893.42
Bank commission 0.7%			27.69		55.25
Import licence fee(12 lots @ 37)			0.44		0.44
Handling in the harbour			23.39		44.38
Landed value:			4008.24		7993.49

Co[redacted]estimate of materials input. B/. [redacted]

Annex VI.B.

Labels
Data base : III./4. and Annex VI.C.

Pack type	Label size	Unit price So.Sh.	1984 Quantity	1984 Cost	1988 Quantity	1988 Cost
25 kg bags	20 x 30 cm	0.80	9000	7200	20000	16000
18 l tins	20 x 30 cm	0.80	7000	5600	8000	6400
5 l bottles	20 x 30 cm	0.80	63000	50400	105000	84000
1 l bottles	8 x 17.5 cm	0.60	41000	24600	66000	39600
0.5 l bottles	8 x 17.5 cm	0.60	12000	7200	20000	12000
	Total cost:			95000		158000

Raw materials, local
Data base: III/4 and ANNEX V.

Raw material	Unit price So.Sh.	1984 Quantity	1984 th. So.Sh.	1988 Qunntity	1988 th So.Sh.
Limestone	50.- /t	196	9.8	455	22.8
Kerosene	2.55 /l	47.6	121.4	97.1	247.6
Diesel oil	2.30 /l	151.4	348.2	156.7	360.4
Solvents total			469.6		608.0

Cost estimate of materials input - C

Packing materials

Data base: III/4.

Packing material	Net Content	Unit Price	Unit per ton	1 9 8 4 Product t	No. of pack
Bags	25 kg	0.40 $*	42	195	8200
	Equivalent value in th. So.Sh.:				
	Landed value of bags:				
		So.Sh.			
Tins	18 l	12.00	58	100	5800
Bottles	5 l	10.00	202	229	46300
"	1 l	2.80	1010	31	31300
"	0.5 l	1.80	2020	4	8100
Cartoon boxes	4 x 5 l	3.50	51	229	11700
"	12 x 1 l	3.5	84	31	2620
"	12 x 0.5 l	3.50	168	4	670

Packing materials for liquids, total

* CIF Mogadiscio price

Annex VI.C.

Value	1 9 8 8 product t	No. of pack	Value
3280 $	455	19200	7680 $
20.85			48.82
21.07			49.36
th.So.Sh.			th.So.Sh.
69.6	120	6960	83.5
463.0	388	78400	784.0
87.6	54	54500	152.6
14.6	8	16200	29.2
41.0	388	19800	69.3
9.2	54	4540	15.9
2.3	8	1350	4.7
687.3			1139.2

Annex VI.D.

Estimate of production value

Products packed in 5 - 25 l units

Data base : III./4.

Pesticide	Unit price $/t FOB EMP	1984 t	1984 th $	1983 t	1983 th $
Diazinon 10 G	2950	195	575.25	455	1342.25
Freight	300		58.5		136.25
Total CIF value			633.75		1478.75
Equivalent in th So.Sh.			4028.75		9400.41
+ Bank commission 0.7%			28.20		65.80
+ Import licence fee (4 lots @ 37)			0.15		0.15
+ Handling in the harbour			26.32		61.42
Landed value:			4083.42		9527.78
Liquid products:					
Dieldrin 20 EC	3150	31	97.65	75	236.25
Malathion 50 EC	2250	14	31.50	34	76.50
Diazinon 60 EC	12100	14	169.40	36	435.60
DDT 50 EC	1240	36	44.64	60	74.40
Dimethoate 40 EC	2950	39	115.05	65	191.75
Oil Spray	850	164	139.40	169	143.60
Lindane 20 EC	4000	56	224.00	117	468.00
Dicofol 20 EC	1400	2	2.80	4	5.60
Fenthion 50 EC	4450	8	35.60	10	44.50
		364	860.04	570	1676.20
Freight	300		109.20		171.00
Total CIF value			969.24		1847.20
Equivalent in th.So.Sh.			6161.46		11742.65
+ Bank commission 0.7%			43.13		82.20
+ Import licence fee(16 lots @ 37)			0.59		0.59
+ Handling in the harbour			49.14		76.95
Landed value			6254.32		11902.39
Landed value + Granules			4083.42		9527.78
Total production value			10337.74		21430.17

Annex VI.E.

COST ESTIMATE OF UTILITIES

Data base III./4. and IV./2.

Electric power

1984: Consumption of granular process:	195 x 131	= 25545
" " liquid process:	364 x 39	= 14196
" " auxiliary equipment:	250 x 41	= 10250
" for lighting:	365 x 48	= 17520
Total:		67511

Cost: 67511 x 0.85 = 57.4 th. So.Sh.

1988: Consumption of granular process:	455 x 131	= 59605
" " liquid process:	570 x 39	= 22230
" " auxiliary equipment:	250 x 41	= 10250
" for lighting:	365 x 48	= 17520
Total:		109605

Cost: 109605 x 0.85 = 93.2 th.So.Sh.

Water: 40 m^3 x 250 days = 10000 m^3/year

3 x 10000 = 30 th. So.Sh.

Annex VII.A.

Cost estimate of equipment - A.

Production equipment - granular unit

Item	Denomination	No.	US$ Unit	US$ Total
G 1.	Bucket elevator, 3 m height	2	2600	5200
G 2.	Dryer cylinder	1	20000	20000
G 3.	Fuel oil tank	1	500	500
G 4.	Oil pump	1	1500	1500
G 5.	Cooler cylinder	1	15000	15000
G 6.	Fan	3	1900	5700
G 7.	Cyclon	2	1000	2000
G 8.	Bucket elevator, 5 m height	1	3000	3000
G 9.	Silo	3	4800	14400
G 10.	Mixer drum	1	22000	22000
G 11.	Vibroscreen	2	3000	6000
G 12.	Drum decanting pump	1	2500	2500
G 13.	Container	1	2900	2900
G 14.	Measuring container	1	1900	1900
G 15.	Spraying pump	1	2500	2500
G 16.	Pipework	1	2500	2500
G 17.	Spray nozzle set	1	300	300
G 18.	Fume extracting ducting	1	1000	1000
G 19.	Traveller hoist	1	3000	3000
G 20.	Rubber belt conveyor	2	2000	4000
G 21.	Weighing containers	6	1400	8400
G 22.	Gas scrubber	1	2500	2500
G 23.	Electric equipment	1	10000	10000
G 24.	Supporting steel structures	1	1000	1000
	Total - Granular Unit			137800

Annex VII.B.

Cost estimate of equipment B.

Production equipment - Liquid Unit

Item denomination	No.	US$ Unit	US$ Total
L 1. Storage tank	4	6500	26000
L 2. Metering pump	2	5600	11200
L 3. Pipework	2	1400	2800
L 4. Production vessel	2	18000	36000
L 5. Solvent pump	1	1500	11500
L 6. Pipework	1	600	600
L 7. Decanting pump	2	2500	5000
L 8. Pipework	2	1000	2000
L 9. Transfer pump	3	2500	7500
L 10. Filter	2	1500	3000
L 11. Pipework	3	1800	5400
L 12. Storage tank	3	6600	19800
L 13. Filler for cans	1	15000	15000
L 14. Filler for bottles	1	18600	18600
L 15. Electric boiler	1	1700	1700
L 16. Pipework	1	1500	1500
L 17. Water pump	1	1200	1200
L 18. Melting equipment	1	2500	2500
L 19. Fan	1	1900	1900
L 20. Fume extracting ducts	1	1000	1000
L 21. Gas scrubber	1	2500	2500
L 22. Electric equipment	1	10000	10000
L 23. Steel supporting structure	1	6000	6000
Total - liquid unit			182700

Annex VII.C.

Cost estimate of equipment - C

Auxiliary equipment

Item	No.	$/unit	$ total
a) Transport:			44000
5 t lorry	2	22000	44000
Landrover	2	16000	32000
Car	1	12000	12000
b) Utility			
Transformer	1*		
Accumulator loading unit for the forklift truck	1	2000	2000
Water reservoir 2000 l	1	3000	3000
c) Repairshop equipment			
Set of tools	1	25000	25000
d) Warehouse equipment			
Forklift truck, 3 t	1	22000	22000
Forklift hand trolleys	5	2000	10000
Standard pallets	500**		
Rubber belt conveyor, 4 m	2	2000	4000
Platform scale 1000 kg	2	3000	6000
Platform scale 500 kg	5	2000	10000
e) Laboratory equipment see VII. E.			64700
f) Communication			
Telephone exchange PABX ESK 2-10	1	4500	4500
g) Air condition			
Air conditioner	12	450	5400
Total			244600

* Auxiliary equipment - local

in So. Sh.			
Transformer	1		200000
Standard pallets	500	120	60000
Total			260000

Annex VII.D.

Cost estimate of equipment - D.

Service equipment

Item	No.	$ / unit	$ total
a) Office equipment			
Typewriter	7	300	2100
Calculator	3	300	900
Xerox	1	6000	6000
Safe	1	400	400
Furniture			20000
b) Canteen			
Deep freezer	1	500	500
Refrigerator	1	600	600
Cooking rail	2	250	500
c) Medical service			
Furniture			2000
Tools			600
d) Laundry			
Washing machine	2	600	1200
e) Taylor			
Sewing machine	1	300	300
f) Plant security			
Fire extinguishers	60	40	2400
Fire fighting pump	1	3500	3500
Total			41000

Primary stock of spare-parts, wear and tear parts

5% of equipment except vehicles:	25900
10% of vehicles:	8800
Complete reserves - as shown below:	16800
Total	51500

Complete reserves

Item	Reserve for:	No.	US$
Pump	G 4., L 5.	1	1500
Pump	G 12., L 7.	1	2500
Pump	G 15.	1	2500
Pump	L 9.	1	2500
Pump	G 22., L 17.	1	1200
Fan	G 6., L 19.	1	1900
Traveller hoist	G 19.	1	3000
Electric boiler	L 15	1	1700
Total - Complete reserves			16800

Annex VII.E.

Cost estimate of equipment E.

Auxiliary equipment - Laboratory Equipment

Item	Denomination	No.	US$ Unit	US$ Total
1.	General equipment(glassware)	1	2500	2500
2.	IR Spectrophotometer	1	20000	20000
3.	Gas Chromatograph	1	17000	17000
4.	Microscope	1	2500	2500
5.	Thermostat	1	1000	1000
6.	Refrigerator	1	500	500
7.	Water bath	2	150	300
8.	Water determination apparatus (Karl Fischer)	2	200	400
9.	Analytical balance, sensitivity 0.1 mg. capacity 200 g	1	1200	1200
10.	Quick balance, sensitivity 0.1 g, capacity 2 kg	2	600	1200
11.	Technical balance, sensitivity 2 g, capacity 5 kg	1	600	600
12.	Digital pH - MV meter complete with temperature compensatinn	2	1500	3000
13.	Magnetic stirrer	2	1500	300
14.	Laboratory glass stirrers complete with electromotor and flexible drive	5	120	600
15.	Sieving machine with sieve set	1	600	600
16.	Rotary evaporator with thermoregulated water bath	1	1200	1200
17.	Porcellain ball mill with adjustable - rate drive, on rolls	1	1000	1000
18.	Viscometer set (Oswald)	2	150	300
19.	Specific gravity measuring device	1	300	300
20.	Melting point apparatus	1	1200	1200
21.	Flash point apparatusses, Abel - Pensky	1	600	600
	Pensky - Martens	1	600	600
22.	Water distiller, capacity 2 l/h, automatic contr.	1	1800	1800
23.	Fume cupboard complete with fan	1	3000	3000
24.	Stainless steel solution vessel 50 l, with stirrer, for pilot production.	1	3000	3000
	Total - Laboratory equipment			64700

Annex VIII.

DESCRIPTION OF BUILDINGS

a) Complex building (1, 2, 3) 280 m^2, 35 x 8 m

Ground floor:	- Guard and telephone exchange (1)	20 m^2
	- Medical Service (2)	20 m^2
	- Resting/dinning room	80 m^2
	- Laundry	60 m^2
	- Kitchen & Bar, toilets	100 m^2
1st floor:	- White/black clothes changing room with showers	220 m^2
	- Tailor's shop	20 m^2
	- Open balcony for drying the clothes	40 m^2

b) Stores (4, 5) 500 m^2 each, 10 x 50 m

- Storehouse for raw materials (4) with a separated room for spareparts, auxiliary materials etc. (4a). Concrete floor, height 4 m, gates for forklift trucks.
- Storehouse for finished products (5) with separated room for packing material (5a). Concrete floor, height 4 m, gates for forklift trucks, ramp (5b) at the lower end.

c) Workshop building (6, 7, 8)

- Building-section for the granular process (6), three-stored, 8 x 15 m, height 13 m, concrete floor. 1st floor at + 6 m, carrying about 3 t dynamic load. 2nd floor mild steel structure at + 9 m, carrying about 1 t static load.
- Building-section for the drier (7), ground store building 8 x 20 m, height 5 m, concrete floor. Foundation for the drier according to the supplier's instruction.
- Double concrete reservoir (8) for the limestone granules 3 x 4 m each, with 1 m high concrete side walls, light weight roof at 4 m, concrete floor.

d) Office/Laboratory building (9)

- Ground-store 250 m^2, 20 x 12.5 m, offices, stairs, toilets.
- 1st floor: Laboratory rooms 120 m^2
  Conference room 100 m^2.

e) Open garage (1)

- Concrete floor 120 m^2, 6 x 20 m, two side walls, roof at 4 m.

f) Workshop building (12) 250 m^2, 10 x 25 m

- Two parted open store for the imported solvents, 100 m^2 each, 8 x 12.5 m, one side wall aside the workshop, concrete floor with spark-proof (asphalt) layer, light-weight roof at +4 m.

h) Repairshops (16)

- Groundstore building 120 m^2, 6 x 20 m
concrete floor, height 4 m, light-weight roof.

Table of salaries and qualifications.

Annex IX

Position	Qualification	Division and grade	Salary /month	House allow.	Responsib. allow	Total /month	Income /year
General Manager	Engineer or Economist	A 1	1800	500	500	2800	33600
Plant Manager	Chemical Engineer	A 3	1200	300	400	1900	22800
Head of Granular Unit	Mechanical Engineer	A 5	1090	300	400	1790	21480
Head of Liquid Unit	Chemical Engineer	A 5	1090	300	400	1790	21480
Head of Repair & Maint.	Mechanical Engineer	A 5	1090	300	400	1790	21480
Head of Laboratory	Chemical Engineer	A 3	1200	300	400	1900	22800
Formulation chemist	Chemical Engineer	A 7	800	300	400	1500	18000
Analyst	Chemical Engineer	A 7	800	300	400	1500	18000
Head of Marketing	Pest Control Engineer *	A 5	1090	300	400	1790	21480
Agronomist	Agronomist	A 7	800	300	400	1500	18000
Admin.& Commec.Manag.	Graduated Economist	A 3	1200	300	400	1900	22800
Head of Finance	Graduated Economist	A 5	1090	300	400	1790	21480
Head of Stores & Forw.	Graduated Economist	A 5	1090	300	400	1790	21480
Head of General Service	Lawyer	A 5	1090	300	400	1790	21480
Secretary I.		B 4	450	-	-	450	5400
Secretary II.		C 4	350	-	-	350	4200
Accountant		B 4	450	-	-	450	5400
Cashier		B 4	450	-	-	450	5400
Bookkeeper		C 4	350	-	-	350	4200
Storekeeper		C 4	350	-	-	350	4200
Clerk		C 4	350	-	-	350	4200
Nurse		B 4	450	-	-	450	5400
Skilled Worker			450	-	-	450	5400
Unskilled Worker		3	200	-	-	200	2400

* Agronomist with special training in pest control.

Working capital requirements

	1	2	3	4	5
Raw materials *	2040	2868	3695	4522	5350
Finished products	860	1090	1320	1550	1770
Credit sales	860	1090	1320	1550	1770
Cash in hand	80	80	80	80	80
Work in progress	41	52	63	74	85
Total	3881	5180	6478	7776	9055

* Imported materials: stock of 6 months
Local materials: stock of 1 month

Annex X.A.

6	7	8	9	10
5605	5860	6115	6370	6624
1870	1955	2045	2130	2220
1870	1955	2045	2130	2220
80	80	80	80	80
90	94	98	102	107
9515	9944	10383	10812	11251

Economic and Financial Analysis

Depreciation Schedule

Annex X.B

B A S I C	Value So.Shs.Million	R a t e (Straight Line)
1) Building § Civil works	9,20	2%
2) Machinery § Equipment	7,69	10%
3) Vehicles	0,75	15%
4) Pre production expenses	4,66	10%

Years	1	2	3	4	5	6	7	8	9	10
AD 1)	0,184	0,184	0,184	0,184	0,184	0,184	0,184	0,184	0,184	0,184
AD 2)	0,769	0,769	0,769	0,769	0,769	0,769	0,769	0,769	0,769	0,769
AD 3)	0,112	0,112	0,112	0,112	0,112	0,112	0,075	-	-	-
AD 4)	0,466	0,466	0,466	0,466	0,466	0,466	0,466	0,466	0,466	0,466
Total	1,531	1,531	1,531	1,531	1,531	1,531	1,494	1,419	1,419	1,419

Projected Profit and Loss Accounts

Years	1
1. Production (T/year)	
a) Granules	195
b) Liquids	364
2. Sales revenue (So.Shs. Million)	10,33
3. Cost of sales	
a) Raw materials	6,45
b) Wages & Salaries	0,75
c) Overheads	0,35
d) Utilities	0,10
e) Repair	0,44
f) Depreciation	1,53
Total cost of sales	9,62
4. Operating profit (2-3)	0,71
5. Financial Charges	
a) 11% interest on long Term loan	2,45
b) 11% interest on Bank borrowing	0,43
Total Interest Liability	2,88
6. Profit before tax (4-5)	(2,17)
7. Tax at 30%	-
8. Profit after tax (6-7)	(2,17)
9. Proposed Dividend	-
10. Reserve	(2,17)
11. Accumulated reserve	(2,17)

Economic and Financial Analysis

Annex X.C.

2	3	4	5	6	7	8	9	10
260	325	390	455	480	505	530	555	580
415	467	518	570	600	630	660	680	700
13,11	15,88	18,65	21,43	22,49	23,56	24,62	25,69	26,75
7,97	9,50	11,03	12,56	13,16	13,75	14,35	14,95	15,55
0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75
0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35
0,11	0,12	0,13	0,14	0,14	0,15	0,15	0,16	0,16
0,44	0,44	0,44	0,44	0,44	0,44	0,44	0,44	0,44
1,53	1,53	1,53	1,53	1,53	1,49	1,42	1,42	1,42
11,15	12,69	14,23	15,77	16,37	16,93	17,46	18,07	18,67
1,96	3.19	4.42	5,66	6,12	6,63	7,16	7,62	8,08
2,45	2,45	1,96	1,47	0,98	0,49	-	-	-
0,57	0,71	0,85	1,00	0,87	0,58	0,26	-	-
3,02	3,16	2,81	2,47	1,85	1,07	0,26	-	-
(1,06)	0,03	1,61	3,19	4,27	5,55	6,90	7,62	8,08
-	-	-	-	1,28	1,66	2,07	2,29	2,42
(1,06)	0,03	1,61	3,19	2,99	3,89	4,83	5,33	5,66
-	-	-	-	-	-	-	-	-
(1,06)	0,03	1,61	3,19	2,99	3,89	4,83	5,33	5,66
(3,23)	(3,20)	(1,59)	1,60	4,59	4,48	13,31	18,64	24,30

Economic and Financial Analysis.

(So. Shs. Million)

Projected Cash Flow

Items	Initial period	Year 1	Year 2	Year 3
Inflows				
1. Term loan	22,30	-	-	-
2. Bank Overdraft	1,03	2,85	1,30	1,30
3. Profit before tax	-	(2,17)	(1,06)	0,03
4. Depreciation	-	1,53	1,53	1,53
Total inflow	23,33	2,21	1,77	2,86
Outflows				
1. Fixed Assets	22,30	2,21	1,77	-
2. Current Assets	1,03	-	-	-
3. Loan Payment	-	-	-	4,46
4. Tax Paid	-	-	-	-
5. Cash & Bank Balance	-	-	-	(1,60)
Total outflow	23,33	2,21	1,77	2,86
Accumulated Cash & Bank Balance	-	-	-	(1,60)
Outstanding	1,03	3,88	5,18	6,48

Annex X. D.

Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
-	-	-	-	-	-	-
1,30	1,28	(1,15)	(2,56)	(2,56)	(3,02)	-
1,61	3,19	4,27	5,55	6,90	7,62	8,03
1,53	1,53	1,53	1,49	1,42	1,42	1,42
4,44	6,00	4,65	4,48	5,30	6,71	9,50
-	-	-	-	-	-	-
-	-	-	-	-	-	-
4,46	4,46	4,46	-	-	-	-
-	-	1,28	1,66	2,07	2,29	2,42
(0,02)	1,54	(1,09)	(1,64)	3,23	4,42	7,08
4,44	6,00	4,65	4,48	5,30	6,71	9,50
(1,62)	(0,08)	(1,17)	(2,81)	0,42	4,87	11,92
7,78	9,06	7,91	5,35	2,33	-	-

(So.Shs.Million)

Discounted Return of Total Investment — Annex X.E

Year	Fixed Assets Working Capital	Gross Profit	Depreciation	Total Cash Flow	DF at 16%	Present Value	DF at 17%	Present Value
-2	2,25			(2,25)	1,000	(2,25)	1,000	(2,25)
-1	12,91			(12,91)	0,862	(11,13)	0,857	(11,02)
0	8,17			(8,17)	0,743	(6,07)	0,730	(5,96)
1		0,71	1,53	2,24	0,640	1,43	0,624	1,39
2		1,96	1,53	3,49	0,552	1,93	0,533	1,86
3		3,19	1,53	4,72	0,476	2,25	0,456	2,15
4		4,42	1,53	5,95	0,410	2,43	0,389	2,31
5		5,66	1,53	7,19	0,535	2,53	0,333	2,39
6		6,12	1,53	7,65	0,305	2,33	0,284	2,17
7		6,63	1,49	8,12	0,262	2,12	0,243	1,97
8		7,16	1,42	8,58	0,226	1,94	0,208	1,78
9		7,62	1,42	9,04	0,195	1,76	0,177	1,60
10		8,08	1,42	9,50	0,168	1,60	0,151	1,43
						0,87		-0,18

$$IRR = 16 + \frac{0,87}{1,05} = 16,83\%$$

Economic and Financial Analysis

Annex X.F.

Payback periods (So.Sh. millions)

a) Payback period before tax:

Year	Gross Profit	Depreciation	Total Cash flow	Accumulated Cash flow
1	0.71	1.53	2.24	2.24
2	1.96	1.53	3.49	5.73
3	3.19	1.53	4.72	10.45
4	4.42	1.53	5.95	16.40
5	5.66	1.53	7.19	23.59
6	6.12	1.53	7.65	31.24
7	6.63	1.49	8.12	39.36
8	7.16	1.42	8.58	47.94
9	7.62	1.42	9.04	56.98
10	8.08	1.42	9.50	66.48

Total Fixed Investment: 22.3

Payback period: 4.8 years.

b) Payback period after tax:

Year	Net Profit	Depreciation	Total Cash flow	Accumulated cash flow
1	(2.17)	1.53	(0.64)	((0.64)
2	(1.06)	1.53	00.47	0.17
3	0.03	1.53	1.56	1.39
4	1.61	1.53	2.14	3.53
5	3.19	1.53	4.72	8.25
6	2.99	1.53	4.52	12.77
7	3.89	1.49	5.38	18.15
8	4.83	1.42	6.25	24.40
9	5.33	1.42	6.75	31.15
10	5.66	1.42	7.08	38.23

Payback period: 7.7 years

Annex XI.

ADDRESSES OF SUPPOSED SUPPLIERS OF MACHINERY

(contacted during the project)

Sturtevant Engineering Co.,
Hamlys House, Highgate North 19, London/England.
(Not producing Formulation Machinery any more).

Simpson Maschinen AG. 6300 Zug, Switzerland. (no answer)

Werner + Pfleiderer Maschinenfabrik,
Theodorstrasse 10, D-7000 Stuttgart/FRG (no answer)

SEM, Societe Europeanne de Melange
F-94230 Cachan - 70 Ave. Dumotel, France. (no answer)

Gunther Papenmeyer GmbH, + Co.
P.O. Box 8026, D-7930 Detmold, FRG. (no answer)

Elsen Rstrasse 7/9, D-4790 Paderborn, FRG.

Gebruder Lodige Maschinenban GmbH
Elsen ..... Paderborn
(Special mixer offered.)

EKATO, Ruhr und Mischtechnik GmbH.
P.O. Box 110/20, D-7860 Schopfheim, FRG. (no answer)

Maschinenfabrik Gustav Eirich, P.O.Box 1160, D-6969 Hardheim, FRG
(Special mixer offered)

Draiswerke GmbH, P.O. Box 310220, D-6800 Mannheim 31 - FRG.
(Special mixer offered)

Chemineer Ltd. -
7 Granmer Road, West Meadows, Derby DE26 XT - England. (no answer)

ALPINE AG. - P.O. Box 101109 - D8900 Augsburg 1 - FRG. (negative answer)

S.I.A.P.A., Galliera, Bologna - Italy
Head Office, via Yser 16, 00198 Roma, Italy
(Interest in possible supply of equipment stated, but no "turn-key" plant)

Kenics - Europe,
89 Avenue Franklin Roosevelt, B-1050 Brussels, Belgium. (negative answer)

Gellier, Rue de Maroc, 73102 Aix-les-Bains/France. (no answer)

Patterson-Kelley Co., East Stroudsburg - 18301 Pennsylvania, USA.
Representation : Vogelbusch GmbH., Meutnermarkhof G. 40, A-1110 Wien
(Special mixer and drier offered)

Annex XII.

TENDER SPECIFICATIONS

A) SERVICES SUPPLIED BY MINISTRY OF INDUSTRY, SOMALIA

1) All necessary civil engineering work including detail designs of construction and foundations.
2) Supply of electricity at 3 phase, 50 cycles, 220/380 Volts.
3) Electric lighting
4) Supply of water
5) Electric wiring to and between all motors, starters and devices.
6) Constructional personnel for the complete erection of the plant.
7) Adequate care and storage of equipment during process of erection
8) Buildings to house the equipment
9) Accommodation and transport, suitable office and telephone/telex facilities for the commissioning engineer together with a d.s.a. in local currency equivalent to 40 US$/day.
10) Payment of 50 US$/day above the provisions of the previous paragraph from departure from the home country until returning.

B) SERVICES SUPPLIED BY CONTRACTOR

1) Supply of all necessary drawings to enable local erection of [illegible] equipment and structure.
2) Supply of foundations drawings showing loadings where applied and relevant dimensional details but excluding the detailed design of foundations.
3) Finalised General Arrangement Drawings of the Plant, indicating plant items and reference drawings.
4) Arrangement Drawings of machines and equipment in triplicate.
5) Spare-parts list and recommended spares to cover a period of two years.
6) Operating and maintenance instructions for each item of equipment with illustrations in five copies.
7) Facilities for the inspection of equipment during and after manufacture.
8) Services of supervisory and commissioning engineer for the time of erection and trial run according to the conditions A/9.

9) Services of the commissioning engineer beyond the time specified upon request of the Ministry according to the conditions A/10.

10) Men hours of foremen sufficient for supervision of the construction and for the training of the local personnel on the operations in the plant.

11) Ground painting of equipment and seaworthy packing of the goods delivered.

12) All materials and services not specified in the tender specification but necessary to the proper run of the plant.

C) GUARANTEES

1) 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 10% of the price will be due on that day.

2) The contractor shall guarantee that should any defect in the material of workmanship of plant or plant component manufactured by him occur within 12 months after the date defined in the previous paragraph, he will exchange the defective part free of charge.

3) 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.

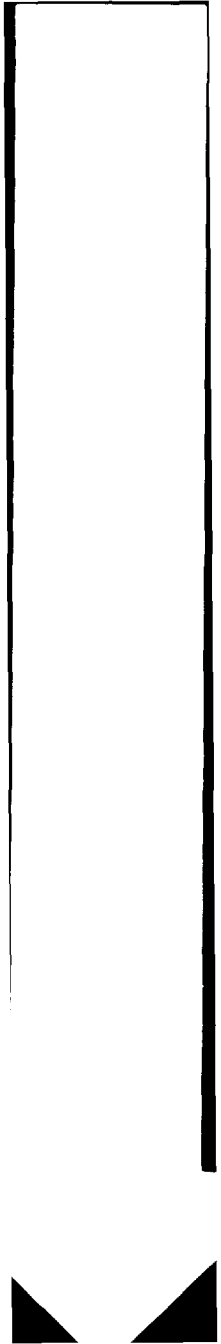
4) The contractor will not be liable for damages as for loss of profit or any other consequential loss.

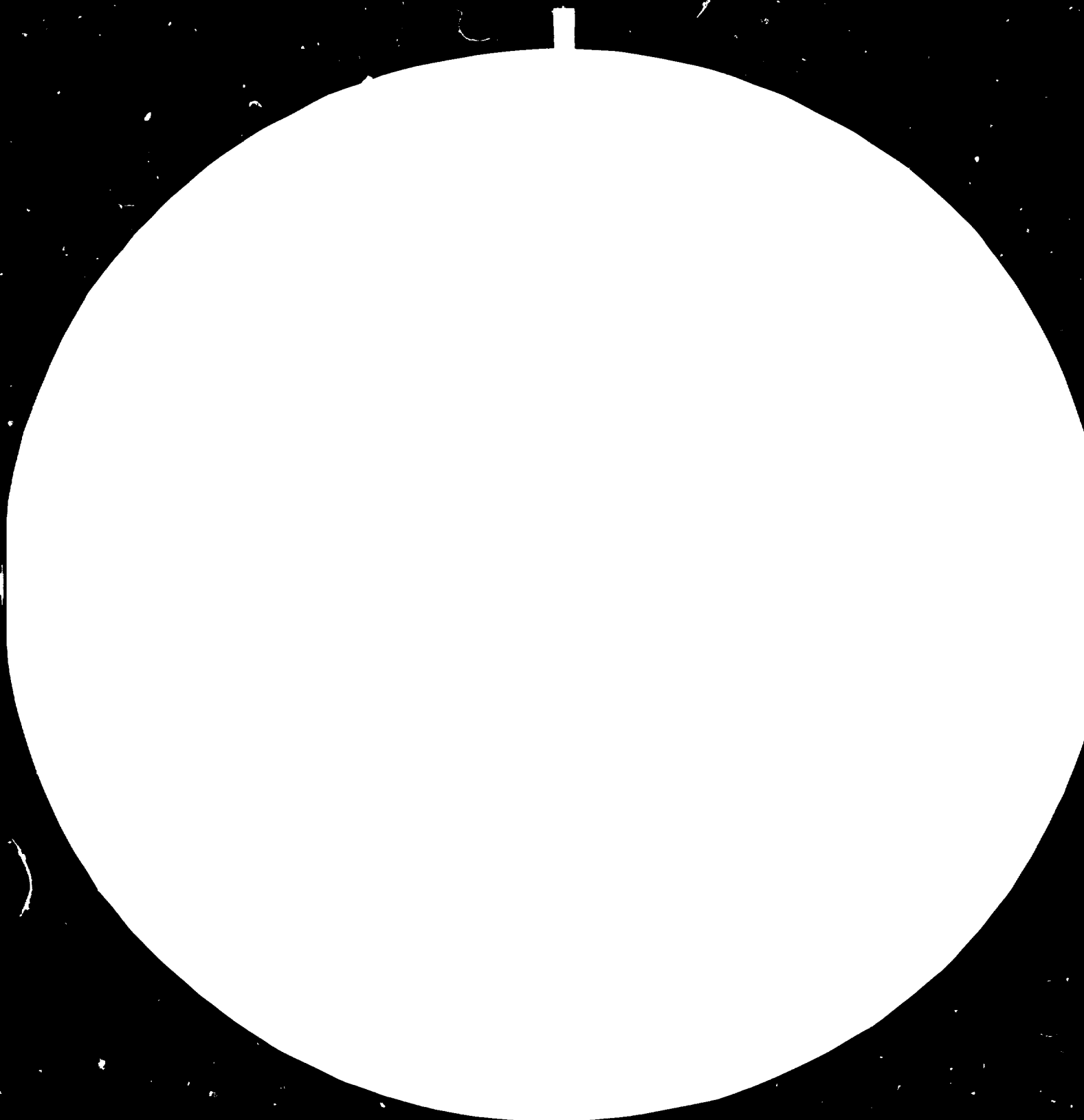
D) SPECIFICATION OF PRODUCTION EQUIPMENT

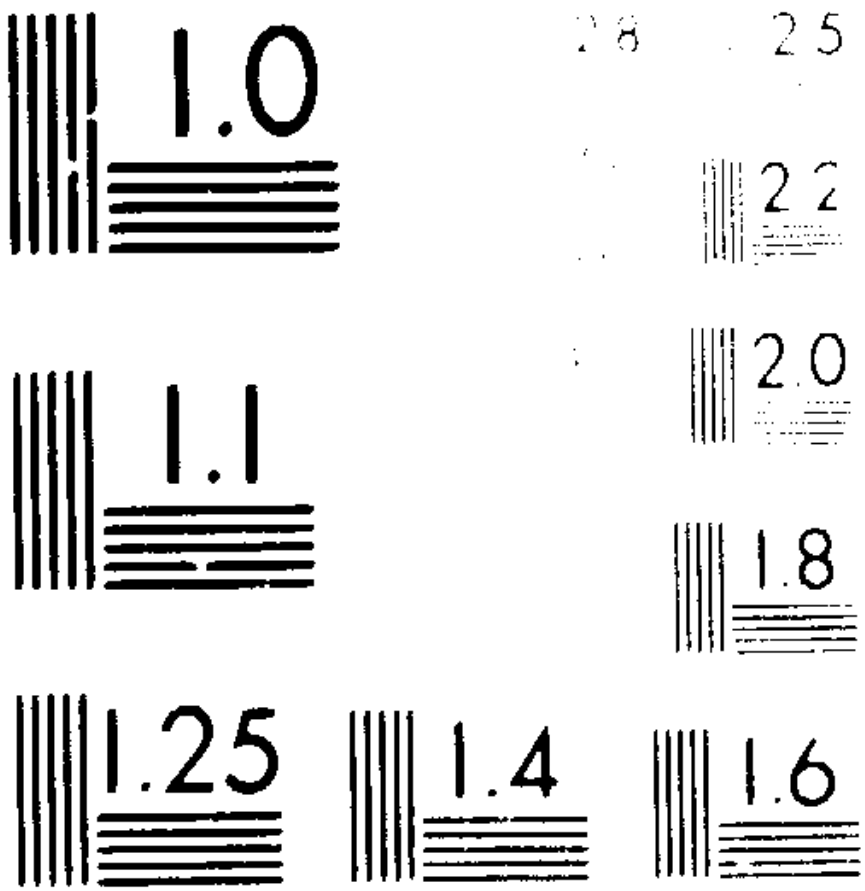
a) Granular formulation unit

	Item Denomination and Specification	No. of pieces	Electric motor HP	HP total
G1	Bucket elevator, height 3 m, capacity 1 t/h, M/S, electric motor	2	3	6
G2	Rotating drier cylinder with oil burner, electric motor and drive, evaporation capacity 100 kg water/h, M/S	1	10	10
G3	Fuel oil tank, capacity 200 l, M/S	1		

Item	Denomination and Specification	No. of Pieces	Electric Motor HP	HP Total
G4	Oil pump 20 m/h, M/S and bronze, leekprof, explosionproof motor	1	2	2
G5	Rotating cooler cylinder, electric motor, M/S	1	10	10
G6	Exhaust fan, capacity 1000 m/h, M/S, electric motor	3	3	9
G7	Dust extracting cyclon, M/S	2		
G8	Bucket elevator, hight 5m, capacity 1 t/h, M/S, electric motor	1	3	3
G9	Silo with screw conveyor discharge, capacity 1,2 m^3, electric motor, M/S	3	1	3
G10	Rotating mixer drum of ab.3200 lit capacity, useful load 1,5 t, with internal baffles, drive, explosionproof motor turnable within 100, M/S	1	20	20
G11	"Pennvalt" vibroscreen 14 mesh, 1204 micron, diam. 600mmØ, electric motor	2	0,5	1
G12	Drum decanting pump 25 1/min, S/S, and teflon, leekprof, explosionproof motor	1	2	2
G13	Preset container, capacity 4501, S/S connections for inlet, outlet, overflow and respiration	1		
G14	Measuring container, capacity 200 1, S/S with level indicator windows or glass pipe, four flanged connections			
G15	Spraying pump 15 1/min, 5 atm, S/S and teflon, leekproof, explosionproof motor	1	2	2
G16	Pipework 3/8" ab. 30m, S/S, with valves, bends, tees and fittings	1		
G17	Spray nozzle, set of five, bronze	1		
G18	Set of fume extracting ducting complete with hoods at drum decanting and spray nozzle, connection to scrubber, M/S	1		
G19	Traveller hoist, elevation capacity 1000 kg, with 2 electric motors	1	3	3
G20	Portable rubber belt conveyor, electric motor	2	3	6
G21	Weighing containers of 0.25 m^3 capacity, rolling on wheels, with loop for hoisting, M/S	6		
G22	Gas scrubber, complete with recirculating tank and pump with waterproof electric motor, 0,5m Ø, height 2m, M/S, fill Rasching rings	1	2	2
G23	Electric equipment	1		
G24	Supporting steel structures	1		
	Total HP Rls Granular Unit			79






1.0
2.8
2.5
2.2
1.1
2.0
1.8
1.25
1.4
1.6

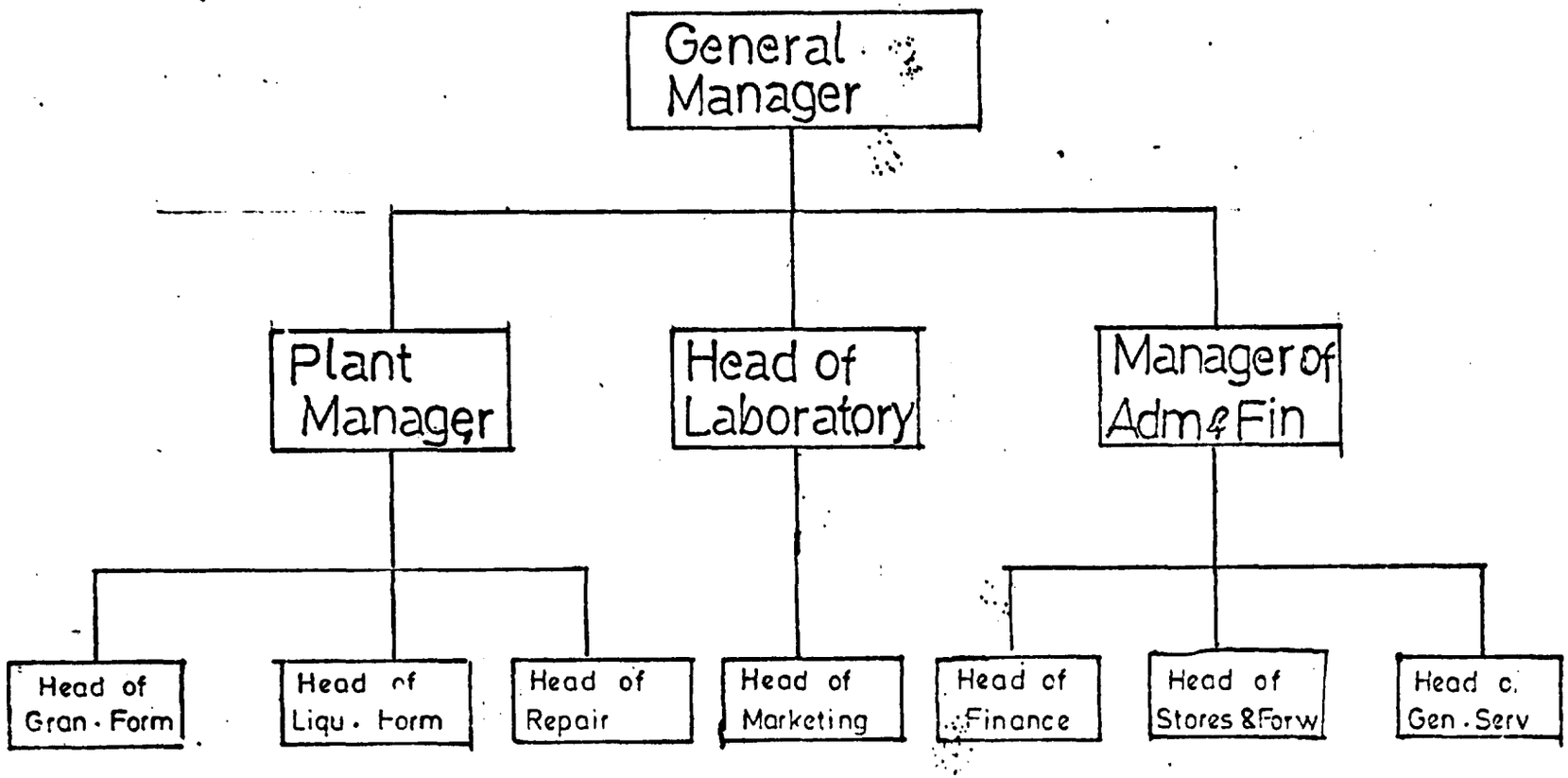
b) Liquid Formulation Unit

Item	Denomination and Specification	No.of pieces	Electric motor HP	HP Total
L1	Storage tank, M/s, capacity 10000 1 each, with inspection manhole, flanged connections for inlet , and bottom outlet.	4		
L2	Petrol station type solvent metering pump 20 m^3/h, M/S, S/S and bronze, leekproof, explosionproof motor	2	2	4
L3	Solvent pipework 1" ab.60m with valves, bends, tees and fittings, M/S	2		
L4	Production vessel, S/S, capacity 2200 1, with heat-transfer coil or jacket connected both to warm and cold water supply, Four inlets at the top, access through hinged lid, outlet at the bottom, agitator driven by totally enclosed squirrel cage explosionproof motor	2	1	2
L5	Aromatic solvent pump 20 m^3/h, M/S, and bronye, leekproof, explosionproof motor	1	2	2
L6	Aromatic solvent pipework 6/8" ab. 20m with valves, bends and fittings, m/s	1		
L7	Drum decanting pump 25 1/min, S/S and teflon, leekproof, explosionproof motor	2	2	4
L8	Pipework $^3/_8$" ab. 10m with valves, bends and fittings, S/S	2		
L9	Transfer pump 20 m^3/h, S/S and teflon, leekproof, explosionproof motor	3	2	6
L10	Filter, candle type, filter area o.3 m^2, cotton cloth filter quick-open lid, S/S	2		
L11	Pipework 6/8" ab. 10m, with valves, bends and fitting S/S	3		
L12	Intermediate storage tank, S/S, capacity 2200 1, with inspection manhole and flanged connections for inlet and outlet	3		
L13	Automatic filler for containers of 5-20 kg with min. output of 100 cans/h of 20 kg 200 cans/h of 10 kg 400 cans/h of 5 kg	1		
L14	Automatic filter for bottles of o.5-1kg with S/S contact parts, complete, with min. output of 600 bottles/h of 1 1 1000 bottles/h of 0.5 1			
L15	Electric boyler, capacity 500 1, capacity of heater 1500 W, with thermoregulation	1		

Item	Denomination and Specification	No. of pieces	Electric motor HP	Electric motor HP total
L16	Water circulation pipework 1", ab. 50 m, M/S, with valves, bends and fittings	1		
L17	Water circulation pump, M/S, 20 m^3/h, waterproof and explosion proof motor	1	2	2
L18	Melting equipment consisting of a heating pipe system, 5 m^2, and hoods	1		
L19	Exhaust fan, 1000 m^3/h, M/S, explosion proof motor	1	3	3
L20	Set of fume extraction ducting complete with suitable hoods for drum decanting points, mixer inlet and interconnecting duct to scrubber	1		
L21	Gas scrubber complete with recirculating tank, and pump with water proof electric motor, 0.5 m, height 2 m, M/S, fill (Raschig rings)	1	1	1
L22	Electric equipment	1		
L23	Set of steel supporting structure not forming part of the building	1		
	Total HP Liquid Unit			24

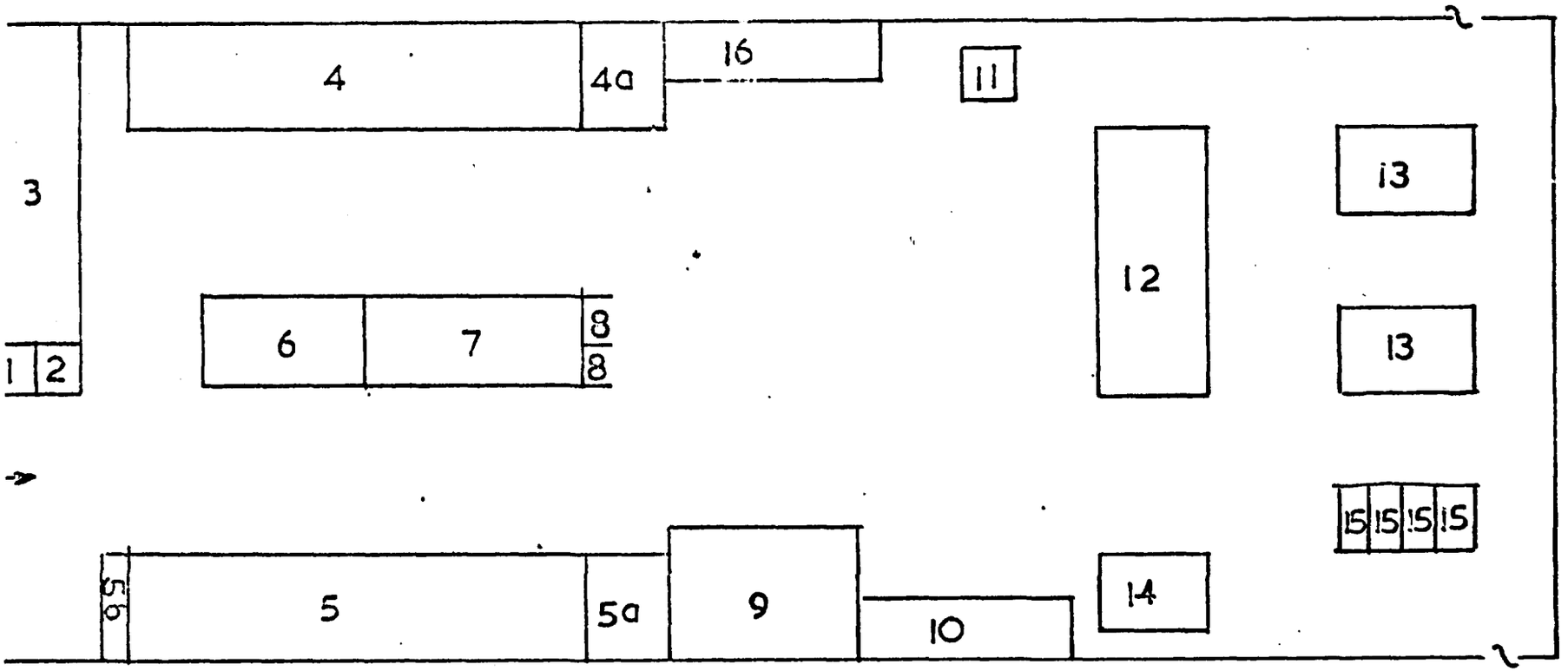
Fig·1

Organization Chart



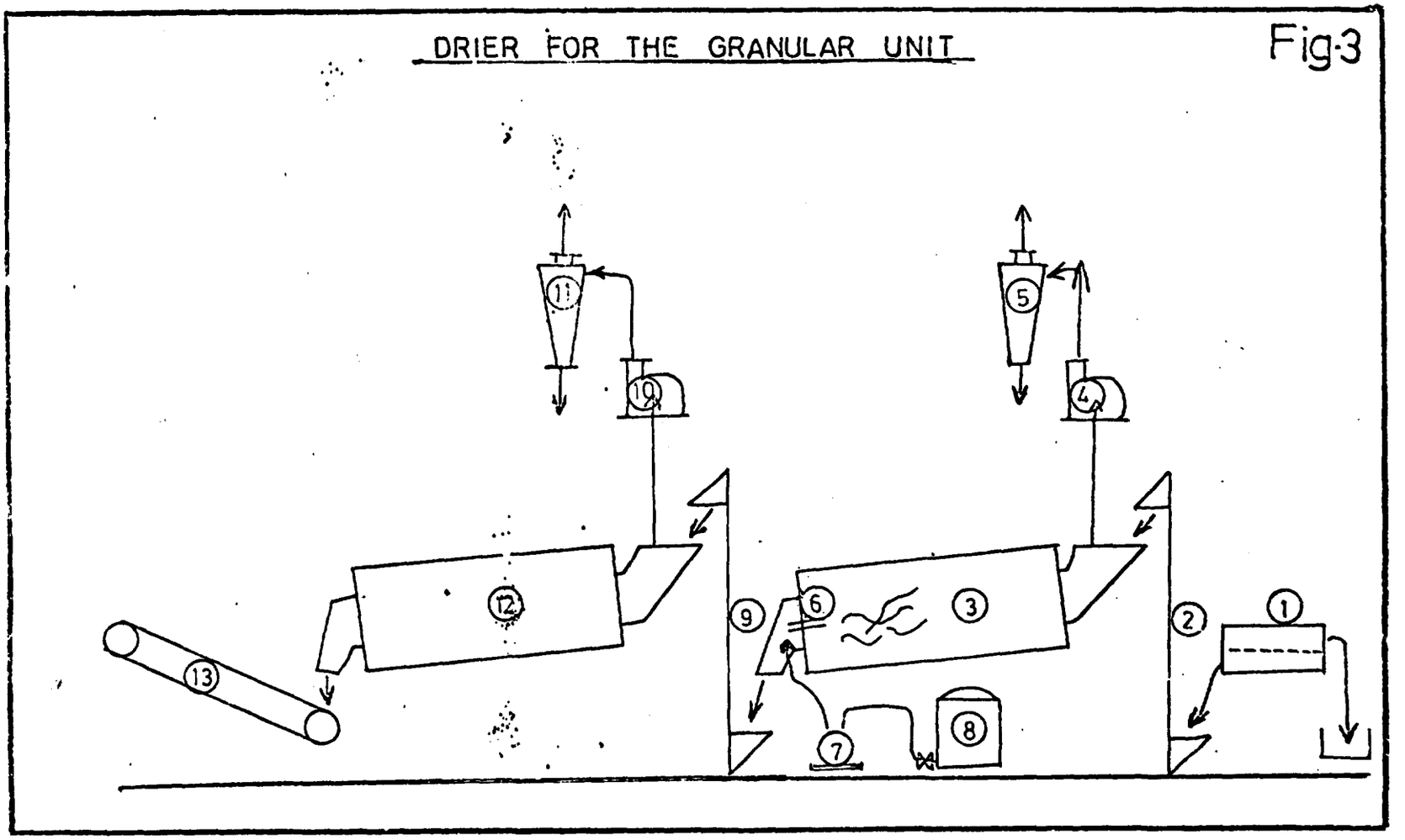
Fig

Pesticide Formulation Plant, Layout



DRIER FOR THE GRANULAR UNIT

Fig-3



Fig·4

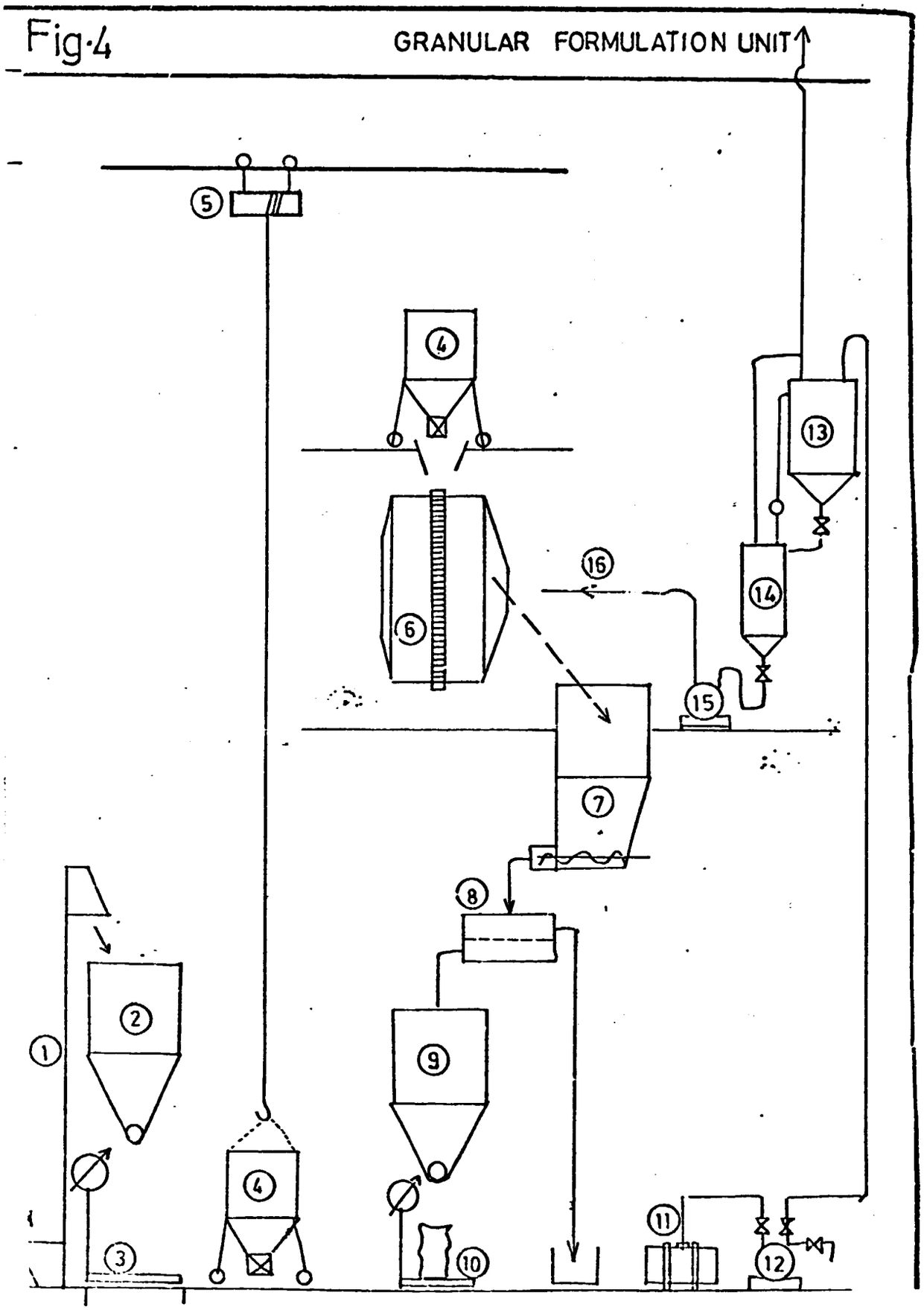


Fig-5

LIQUID FORMULATION UNIT