OCCASION

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

DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as "developed", "industrialized" and "developing" are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

FAIR USE POLICY

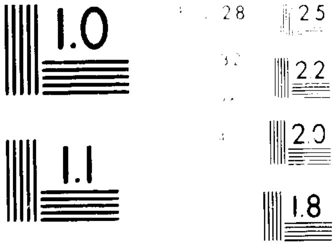
Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

CONTACT

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

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

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


1.0
28
2.5
2.2
1.1
2.0
1.8

MICROCOPY RESOLUTION TEST CHART

13686

U.N.I.D.O.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UGANDA

FEASIBILITY STUDY FOR ESTABILISHMENT OF A PRESTICIDES MANUFACTURING PLANT IN UGANDA

UNIDO PROJECT SI/UGA/82/801

baldo & c. srl
CONSULTING ENGINEERS
MILANO

U.N.I.D.O

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

FEASIBILITY STUDY FOR

ESTABLISHMENT OF A PESTICIDES MANUFACTURING PLANT

IN

UGANDA

UNIDO PROJECT SI/UGA/82/801

FINAL REPORT

MARCH 1984

baldo & c.

CONTENTS

baldo & c.

baldo & c.

INTRODUCTION

Uganda does not have domestic production of pesticides and the needs of the country for these products are met by imports.
The shortage of foreign exchange has obliged the country to severely restrict import of pesticides.
[illegible] in the country.
To overcome this severe situation, the setting up of a pesticides plant in Uganda, which would involve mixing of imported concentrated active ingredients with locally available materials, was decided.
The construction of a pesticides plant in Uganda would provide an important input for the development of the agricultural sector, that accounts for 50% of the G.D.P.
In order to verify the convenience of such a project, UNIDO awarded Baldo & C. with a contract for the preparation of a feasibility study for the "Establishment of a Pesticides Manufacturing Plant in Uganda".
[illegible] duty by visiting Uganda in May 19[illegible].
The report, prepared in agreement with the terms of references, consists of the following main chapters:

1 SUMMARY AND CONCLUSIONS
2 BACKGROUND OF THE PROJECT
3 MARKET STUDY
4 RAW MATERIALS AND OTHER IMPUTS
5 TECHNICAL STUDY
6 FINANCIAL AND ECONOMIC STUDY
7 ANNEXES

CHAPTER 1

SUMMARY AND CONCLUSIONS

1. SUMMARY AND CONCLUSIONS

1.1 The Market

The supply of pesticides to Uganda agricultural sector is presently based on imports only.

In the period 1973-1979 the consumption of pesticides has been increasing at a ratio of 17% per year in terms of quantity, in spite of the reduction of the acreage crop. In 1979 it was 3,799 tons with an application ratio of 1.18 Kg/ha.

After a number of years in which all the imports figures fell to low values because of the difficulties the country had to face, the agricultural sector started to recover and this is affecting the quantity of pesticides to be used.

According to information provided be the Commissioner for Agriculture, the needs of the public sector for 1983 call for over 5,400 tons of insecticides and herbicides.

According to the market survey the private sector could need up to 4,700 T and that would bring the total demand to more than 10,000 tons in 1983.

The potential for use of pesticides in the future is very high. As a matter of fact Uganda has an agriculture based economy and is in need of recovering its potentiality after the crysis of the past decade. The use of agrochemicals is therefore a must to recover the whole sector.

By taking into account that:

- the ten years recovery plan is succesful
- the acreage of land under crop will be as at the beginning of the seventies
- the minimum pesticides application ratio is used the potential demand would reach 15-20,000 tons/year at the end of the decade.

  It is therefore proposed that a project for a formulation plant with an output of 5,400 tons approximately is implemented.

1.2 The production mix and the plant

The new plant will formulate the following pesticides:

- liquid insecticides
- liquid herbicides
- powder insecticides
- wettable powder herbicides
- wettable powder fungicides
- granular insecticides and herbicides

starting from imported active matters and imported, as well as local intermediates and raw materials (the most important local input being Kaolin)
An appropriate technology has been considered in preparing the basic design of the factory that consists of the following main units:

- unit for the formulation of liquid insecticides
- unit for the formulation of liquid herbicides
- unit for the formulation of powder insecticides
- unit for the formulation of powder herbicides and fungicides
- unit for the formulation of granulars

1.3 Economic Considerations

The fixed capital investment is 960 Million Shillings (376 million being the foreign exchange component).
The working capital at full capacity (the factory will reach full capacity at the third year) is 640 million sh.
The operating cost will be in the order of 1,150 Mill. sh.per year (the foreign exchange component being 980 million) and the sales revenues 2,144 Million sh per year.

The internal rate of return has been calculated to be 29.54.

The breack-even point is 26,5%

The implementation of the project can result in net saving of up to 900 million shillings per year in foreign exchange.

1.4 Conclusions

The financial analisys indicates that the project is viable. The Government of Uganda may wish to proceed with implementation of the project.

CHAPTER 2
BACKGROUND OF THE PROJECT

2. BACKGROUND OF THE PROJECT

2.1 Promoters

The project for the establishment of a pesticides formulating factory in Uganda was promoted by a Joint Venture of three Companies:

1. KOKI KAOLINE MINES & MANUFACTURERS Ltd.
   The Base Company, mainly involved in mining and responsible for the idea of establishing a pesticides formulating plant; owner of a Kaolin mine at KIZAKI-KOKI.
2. NILE CHEMICAL INDUSTRIES Ltd.
   The company responsible for:
   - Construction of the factory
   - Production
   - Product development
   - Marketing
3. FOURWAYS EXPORTERS & IMPORTERS Ltd.
   The company financing the project. Presently part of the FOURWAYS Group of Companies.

2.2 History of the project

Desk work was started in 1960 under the business title M/S KOKI-KAOLIN MINES & MANUFACTURERS Ltd. with Head office in Kampala.

The new Company acquired a Kaolin mine located in the KOKI RAKAI District near MASAKA in South Uganda (99 years lease). The main reason of the above acquisition was that Kaolin is considered one of the most suitable raw materials for the formulation of a range of chemical dusts.
It was considered from the very beginning the possibility of utilizing additionnally to Kaolin also diatomite, feldspate, pomices (also available in Uganda.)
In this project the Company had the technical backing of the Uganda Geological Survey Dept. of Entebbe, from 1959 onwards.

During the period 1960-1970 KOKI KAOLIN MINES made a number of businees contracts with MURPHY CHEMICALS (E.A.) Ltd.of Nairobi, SHELL CHEMICALS (E.A.) Ltd. of Nairobi and with the UGANDA DEVELOPMENT CORPORATION OF KAMPALA, respectively on matters concerning the promotion of their products as well as a study of factors which would enable the establishment of a chemical plant. As a matter of fact, a plan for the erection of this factory was submitted to the Uganda Development Corporation, but for political reasons the project was assigned for implementation to AGRO CHEMICALS Ltd. of Israel. When Agro-Chemicals Ltd. was compelled to repatriate, KOKI KAOLIN MINES applied unsuccessfully to take over the plant, which was assigned to the PRISON DEPARTMENT.

In 1974 SHELL CHEMICALS (E.A.) Ltd. started on a feasibility study on behalf of KOKI KAOLIN MINES regarding the establishment of a new formulation plant, but withdrew due to the worsening political situation.

At this point AGROVOJVODINA Ltd. together with ZORKA SABAC, both of Yugoslavia, carried out a prefeasibility study for the above project, but after some preliminary desk work withdrew in 1978 again because of the unfavourable political situation.

Meanwhile in 1976, KOKI KAOLIN MINES, leased a 6.7 acres plot of land at Njeru-Jinjia specifically for this project.

In 1979 MANDA & ASSOCIATES INDUSTRIAL CONSULTANTS of Kampala was assigned with a further feasibility study and conversation started with International Crop Protection Consultants Ltd. (ICI Group) of U.K.

In 1981 an application for financing of the project has been submitted to the Ministry of Planning and Economic Development.

CHAPTER 3

MARKET STUDY

3. MARKET STUDY

The market study is composed by the following chapters:

- Methodology
- Agricultural Production and Trends
- Generalities of the Pesticides, Fungicides and Herbicides used in Uganda
- The supply of pesticides in Uganda
- The proposed Production mix
- Raw materials and their Availability
- Packaging

3.1 Methodology

The market study was carried out in two phases, the first one of which began with a fact finding mission in the country for the collection of data and information on the following:

a) The present market for insecticides, herbicides and fungicides and the balance between supply and demand.
b) The future market for the above products.
c) The present acreages crop by crop and the forecast crop production.
d) The type and quantity of pesticides presently used on each crop and expected tendencies.
e) The advisable range of products suitable for agricultural use in Uganda.
f) The availability of raw materials, utilities and other production inputs in the country.
g) The Government's industrial and agricultural development policy and planning for economic recovery in Uganda.

In addition to the above, other factors have been taken into consideration on the basis of available documentation:

- Custom and Excise Duties
- Financial and Exchange Regulations
- Labour and Social Costs

A number of Governmental Agencies and private companies were visited: a list is attached as annexe 1

The second phase was carried out at home, where all data and information collected from different sources were cross-checked, in order to ascertain their consistency and comparability.

As a result the assessment of the following was made:

- Market of pesticides:
  - . Imports in the past
  - . Present use
  - . Types of pesticides used
  - . Systems of distribution
  - . Levels of price, buyer's credits etc.
  - . Crops presently using pesticides and quantity/hectar ratio determination
  - . Evolution of crops in Uganda according to the present plans for agricultural development
  - . Any other information related to the present market situation and/or that could affect its use in the future
- Technical data and specifications of the pesticides presently used and identification of the active ingredients.
- Evaluation of the present application systems for the pesticides.
- Identification of the raw materials needed to enable local formulation.
- Identification of the possible sources of the raw materials, their quality, price and availability.
- Availability of skilled and unskilled personnel and levels of wages and salaries.
- Availability and costs of utilities (energy, fuel, water etc.)
- Availability of infrastructures as roads, transportation system etc.
- Fiscal system (Excise, duties, taxation profits)

3.2 Agricultural Production and Trends

As shown in the Ten-Year Development Plan (1981-90) published by the Ugandan Ministry of Planning and Economic Development the Agricultural sector contributes around 50% of the GNP and provides 65% of government revenue. Over 20% of the population is engaged in agriculture field and even 20-30%of regularly paid employees are employed in agricultural activity.

The main exports are coffee, cotton, tea and tobacco (in that order). Exports of these products accounted in the years 1966-78 for 80-100% of the total exports (due to the reduction in the export of copper).

Agricultural production is mainly on a small scale with 85 % of holdings under 5 ha and pratically all under 10 ha. There is little mechanization or use of modern technology and only 0,01% of farmers have tractors.

Government's policy is aimed at reorientating agriculture away from subsistence farming towards market orientated production. The country has been divided into agricultural development zones but emphasis will still be laid on the small owner farmers who constitute the majority of producers. Instead of a crop by crop approach however it is hoped that a diversification strategy will enable the potential in terms of land, crops, zootechnology, water, work-force and families of the farms to be realized.

Regional planning authorities are to be made more effective, and statistical services improved by means of a national census to provide reliable figures.

As regards prices policy the Price Advisory Committee will be reorganized to provide information not only on prices paid to farmers but also on prices of production inputs.

A reorganization of management in Agriculture will be carried out. For the management of new and large scale units the establishment of an Agricultural Development Corporation will be considered.

Transport and storage facilities on both a regional and national scale, which are important due to the country's enclaved position, will be included in the government development plan. There is unsufficient investment in Agriculture considering its contribution to the national economy and a fund is to be set up for providing short, medium and long-term loans. Irrigation is at present entirely rainfed and measures for the development of irrigation schemes, in view of the droughts of the last 3 years, are to be adopted.
The medium-term aim is to restore agriculture production to the 1970 levels and in the long-term to transform the present subsistance farming into an agriculture industry aimed at exploiting the country's vast reserves.

3.2.1 Food sub-sector

The main short-term objective is to achieve self-sufficiency in food production. The problem is exacerbated by the high population growth rates. As production of the present staple food crops of matoke, cassava, potatoes, maize, finger millet etc. will be promoted during the reconstruction phase at the same time as the production of non traditional crops is encouraged.
The 1979-80 droughts combined with the adverse effects of the war necessitated a food aid programme costing 35 million shillings for the Karamojer and West Nile Populations.
Urgent allocations, in the order of 305 million shillings (216 of which in foreign currency), are necessary in order to reinstate the food production base (seeds, fertilizer, equipment). An EEC/EDF aid scheme worth 140 m sh. is aimed at revival Ugandan Seeds production, of the prime importance for development progress.
Horticultural production is favoured by the climate and despite recent set-back of initiatives in this field, studies for the development of horticultural production in 1983-85 are to be undertaken.

Rice production should be sufficient for home consumption and create a surplus for export by 1990. The development programme for 1981-85 is budgeted at 85 million Shillings, of which 48 in foreign currency. Collaboration with China has been agreed upon to identify suitable technical and cultivation methods.

Wheat and barley production, currently at 3000 ton p.a. could be increased to 20/30,000 tons. The country's requirements are in the order of 300-350,000 tons (in 1972 55000 tons were imported). A state farm project with assistance from Saudi Arabia at a total cost of 47 m sh. of which 14 m sh. in foreign exchange (Saudi contribution) is underway.

Citrus fruit production was planned in 1965 and 180 ha of the 1000 ha foreseen were planted. Completion of the project is scheduled at a cost of 7 million shilling.

Irish potatoes production is to be recommended at a cost of 3.6 million (0.9 m in foreign currency) shillings.

3.2.2 Agro-industrial crops sub-sector

The agro-industrial crops represent the main source of foreign exchange earnings for the country and include cotton, coffee, tea, tobacco, sugar and lately new crops such as cocoa, cashewnut, jute and kenaf.

3.2.2.1 Cotton

The ten year plan aims to stop the decline in production and to return to a level of 350-400,000 bales/yr. Measures in increase production include: fixing the cotton remunerative cash price on delivery, improving transport facilities, mechanized chemicals distribution, various incentives including encouragement of the textile factories to produce cotton. The cost of the project will be 132 million sh (128 in foreign currency) plus ginnery rehabilitation (30+31 million sh all in foreign currency). Oil seed production is to be encouraged including the production of groundnuts senisim, soyabeans, castor and sunflowers.

3.2.2.2 Coffee

Coffee is the most important foreign currency carrier in Uganda (accounting 1977 for 93% of exports) and supporting half million families.
In 1970 production was at 200,000 tons (declined in 1979 to 137,000 tons). During the reconstruction phase emphasis will be laid on controlling the coffee berry disease by the use of chemicals. The programme is budgeted at 15 million sh (all in foreign currency). A replanting programme for establishing "Robusta and arabic" coffee in the plantation and at the same time improving marketing possibilities will cost 175 million shillings, all in foreign currency.

3.2.2.3 Tea

Tea production totalled 18,000 tons in 1970 and 4000 tons in 1980. Present area cropped is 21,000 ha but quality is very poor. The object is to restore the 1972 production level of 23,000 tons. Cost of the project is 300 million (for recostruction) and 100 m in the medium term (all in foreign currency).

3.2.2.4 Tobacco

Tobacco is the fourth most important crop after coffee, cotton and tea but production levels of 5 million kg. in 1972 fell to 3 million in 1978.
Reconstruction will cost 5 million (4 in foreign currency).

3.2.2.5 Cocoa

Cocoa production was commenced in 1973 to avoid overdependence of coffee and cotton. Reconstruction is costed at 8 million (5.5 million in foreign currency) and medium term costs at 20 million (12 million in foreign currency). Control of cocoa disease is important.

3.2.2.6 Cashewnut

Cashewnut production, also aimed at diversifying export was started on, on basis of UNDP study, in 1981/82 at a cost of 3 million (in foreign currency).
Jute and kenaf production was started with Saudi-Arabian financial aid and technical assistance from Bangladesh with the object of reducing the country's imports.

3.2.2.7 Sugar

Sugar production declined from 144,000 in 1970 to 3000 tons in 1980 due to the break-up of the large estates and lack of spare parts for the factories.

3.2.3 Acreage by crop and agricultural production

The following tables show the trend of agricultural production and land utilization during the last ten years.
In spite of a sharp decrease mainly for industrial crops due to the abnormal political and economic situation it can be assumed that at the end of the Recovery Plan the agricultural production and the utilization of farmland will reach a level very close to the initial one.
On the other hand, the fact that the collapse of agriculture is caused by the reduction of the production of industrial crops cultivated within large plantations makes easier the recovery: the rehabilitation of the large plantations can be made within a shorter delay than convertion of the small farmers used to grow their food crops in the old traditional way.
This means that, together with introduction of mechanization, the use of pesticides and fertilizers will become of primary importance.

3.3 Generalities of the Pesticides, Fungicides and Herbicides Used in Uganda

The means adopted in Uganda for the defence of the cultivation belong to the following categories:

A. Insecticides (and acaricides)

a) for the upper free part of the plant

b) for the underground part of the plant

c) for the stored products

B. Fungicides

a) for the upper free part of the plant

b) for the "soft" products already harvested (bananas, avocados,pears, etc.)

C. Herbicides

a) selective to fight the grass infesting the cultivations (weeds or bushes)

b) total, to fight the undesired vegetation in the uncultivate areas. (Band of roads, trails, railways, canals, etc.)

NOTE: the rodenticides are sometimes considered sanitary products, considering an eventual diffusion of an epidemy caused by rats.
In the products used as sanitary-preventive (human or veterinian) some insecticides are included. Under special formulas they are used in various sites (malaria, tse-tse, etc.).
The specifications (granule density, emulsifiability, wettable capacity) are given by the World Health Organization (O.M.S. W.H.O) (also responsible of their publications).
See "Normes pour les pesticides" OMS 1962 Geneve.

D. Rodenticides

It concerns products against rats and mice, generally used as poison for baits.

3.3.1 Main types of formulations and raw materials

The biocide active matters coming out from the industrial synthesis, prior to their use, should be transformed (formulated) to products adequate for a practical use.

These transformations are commonly called "formulations" and can be divided into the following main types:

Solid

- dry dusts (D)
- wettable powders (WP)
- granules (G)

Liquid

- solutions (S)
- concentrated emulsions (stock emulsions)
- emulsifiable concentrates (EC)
- concentrated suspensions (FW) (flowable)

General data in each type are provided here below.

3.3.1.1 Dry dusts

Dry dusts are formulations used in the ground and they are formed by one or more active matters uniformly distributed in thin inert powder.
Their strenght is quite low ranging from 1 to 10%.
The granulometry is relatively rough being around 74 microns.
Sometimes, (for powders that must be mixed with soil) larger granulometries are used, to avoid useless clouds of dust and for the safety of the workers. Present trend in towards the use of granules for the most toxic products.

baldo & c. srl
CONSULTING ENGINEERS

3.3.1.2 Wettable powder

Wettable powders are composed of mixtures of active matters with inert powder of suitable granulometry coumpound with additives having various properties (wetting, adhesive, etc.) They can reach remarkable concentrations of active matters (80-[illegible]).

After diluition with water to the prescribed amount, they form a suspension of particles tending to sediment after some time. Nevertheless, the suitability for suspension is always such to permit the treatments with a large margin of time.
The granulometry of these products is around 44 microns, obtained by an air mill.

3.3.1.3 Granules

Granules are formulations composed by inert granules of mineral origin having a high capacity of detaining the active matter generally present at low concentration.

Besides their absorbing capacity, the granules must not cake after the preparation. We may include in this category a particular formulation consisting of a <u>granular fertilizer</u> treated with insecticides, used against insect of the soil.

3.3.1.4 Solutions

They are mainly solutions identical or very similar to those used for the concentrated emulsifiers (see here after).
They can also be available as water solutions but only when active ingredients are acceptably water-soluble and, above all, do not degrade trhough hydrolisis.

The water solutions are obviously less expensive but create problems with the packing (plastic) materials.

The oily or water solutions can be used as such or diluted on the field with naphta or water.

The oily solutions prepared to be used with low volume or ultra low volume equipment or with fogging equipment, must have high flash point to avoid the formation of explosive mixtures in the equipment used for distribution.

3.3.1.5 Stock emulsions

Stock emulsions are products having an insecticide action based on white mineral oils (paraffines) with UMR 96-98%.
They have a high oil content (which is the active matter) already emulsionated in water.
After the dilution with water, and before being used, they give origin to a milky liquid (emulsion) formed by very small and even drops of oil that, because of their dimensions and eveness, reduce to the minimum the risk of "burns" on the leaves.
Sometimes active compounds like phosphoric esters are added to these emulsions.
These are typical products for the protection of citrus and of bananas cultivation.

3.3.1.6 Emulsifiable concentrates (EC)

Emulsifiable concentrates are based on one or more active ingredients dissolved with a solvent or solvent mixtures, to which active products (with emulsifying, wetting action, etc.) and stabilizers (to avoid the degrading of the active principle) are added.
The finished product concentrate must be diluted with water before being used and it forms an emulsion that is stable for

several hours, depending on the hardness of the water.
The concentrations vary according to the biocide activity of the active ingredients, the toxic action to the man and to the use they are intended for.
Sometimes, the emulsifiable concentrates are diluted with naphta or used pure with a low or ultra low volume distribution equipment.

1.1.1.7 Concentrated Suspensions

These formulations, also called flowable, have been introduced quite recently, to obtain products having active ingredients in high concentration.
The active principles must be consistent with water but not soluble.
The aspect of the finished product is that of a very fluid cream (better say "paste") composed by very fine active particles of an inert support, floating in water with active matters of various functions (dispersing, wetting, densifying, etc.).
Active ingredients concentrations range from 30 to 80% and the particles dimension is about 10 microns.

3.3.2 Characteristics of different types of pesticides imported to Uganda, by active ingredient.

Active ingredient

BHC : is the common name approved by BS for the mixed isomers of hexachlorocyclohexane, also known as benzene hexachloride. It is a persistent contact insecticide with some fumigant actions, and its activity is determined by the content of the "gamma" isomer. In the formulations, which include EC, WP, dust, smokes, the percentage of gamma -BHC should be given. It is used for controlling vegetables, generally speaking.

ALDRIN : is the common name approved by ISO. It is a non-sistemic and persistent insecticide, effective against soil insects and it is not-phytotoxic. It is compatible with most pesticides and fertilizers but is corrosive because of the slow formation of HCl on storage .
It has many fields of application for the control of many crops (potatoes, vegetables, maize, tobacco, bananas, sugar cane etc.).

SEVIN : "Sevin" is a trade name of Union Carbide for 1 naphtyl methyl carbamate, whose common name, recommended by ISO, is CARBARYL. It is a contact insecticide with slight systemic properties recommended for use against many insect pests of fruit, vegetable, cotton and other crops. The usual formulations are WP or dust.

CHLORDANE : is the common name approved by ISO for a derivative of hexachlorocyclopentadiene. It is a persistent non systemic and contact insecticide. It is formulated as EC, ML, dusts and granules. It is effective against many types of vegetables, maize and coffee.

DDT : is the common name approved by ISO of dichlorodiphenyl trichloroethane. It is a non systemic contact insecticide of high persistence. Many types of formulation are marketed including

EC, WP, dusts and aerosols.

PHOSPHAMIDONE : is the common name approved by ISO for an organic phosphor-derivative. It is known also as the trade name of Dimecron. It is a systemic insecticide rapidly absorbed by the plant; it has only a little contact action. It is effective against sap-feeding insects and other pests including Colorado beetle, rice stemborers, codling moth.

DIELDRIN : is the common name approved by ISO for a derivative of hexachlorocyclopentadiene. Its chemical constitution is similar to Aldrin, with the only addition of an oxygen atom. It is stable to alkali, mild acids and to light. It is a non systemic and persistent insecticide of high contact and stomach activity to most insects. The formulations of Dieldrin include EC, WP, dusts, granules.

LINDANE : is the gamma-isomer of BHC (see BHC)

DICOFOL : is the common name recommended by ISO and approved by BS It is also known under the trade mark of "Kelthane". It is a non-systemic acaricide with little insecticidal activity recommended for the control of mites on a wide range of crops.

MALATHION : is the common name approved by ISO for a phosphoric derivative of diethylmaleate. It is a non-systemic insecticide and acaricide of low mammalian toxicity and moderate persistance. It is widely used for storage of grains. It is formulated as EC, WP, dusts, ULV.

DIAZINON : is the common name approved by ISO for a phosphoric derivative of pyrimidine. It is a non systemic insecticide with some acaridical actions. Main applications are in rice, fruit trees, vineyards, sugar cane, corn, tobacco, coffee. It is known also under the trade names of "Basudin" and "Neocidol".

DIMETHOATE : is the common name approved by ISO for a phosphoric derivative of monomethylacetamide. It is known also under the trade names of Rogor, Fostion, Roxion, Perfection, Cygon etc.
It is a contact and systemic insecticide effective against a wide

range of insects and mites. It is formulated as EC, ULV, granules.

FENITROTION : is the common name approved by ISO for a phosphoric derivative of a methyl-nitrophenol.
Trade marks are also Folithion, Sumitnion. It is a contact insecticide, particularly effective against rice stem borers and a selective acaricide but of low ovicidal activity. Formulations include EC, WP and dusts.

ENDOSULFAN : is the common name approved by ISO for a sulphur derivative of hexachlorocyclopentadiene. It is known also under the trade name of Thiodan, Cyclodan, Beosit, Thimul, Thifor. It is a non systemic contact and stomach insecticide for a wide range of crops. It is formulated as EC, WP, dusts and granules.

BENOMYL: is the common name for a benzymidazol carbamate, known also under the trade name of Benlate. It is a protective and eradicant fungicide with systemic activity, effective against a wide range of fungi, particularly on fruit. Formulations are WP.

MANEB: is the common name for a manganes ditiocarbamate. It is known also under the trade name of Manzate, Dithane M22. It is a protective fungicide against many foliage deseases, particularly the blights of potato and tomato. The usual formulation is WP.

DALAPON : is the common name for Sodium dichloro propionate, known also under the trade name of Dowpon and Radapon.
It is a selective contact herbicide, used to control of annual and perennial grasses.

2,4-D ESTER and AMINE : are derivatives of 2,4D Acid. They are systemic herbicides, widely used for the weeding of cereals and other crops.

PARAQUAT: is the common name for a derivative of bipyridile. Trade names are Gramoxone, Weedol, Preeglone. It is a contact herbicide rapidly inactivated on contact with soil.

FURADAN: is a trade name for CARBOFURAN, which is the common name approved by ISO for a carbamate of a benzofurane. It is a systemic insecticide, acaricide and namatocide, applied to foliage for the control of insects and mites, or applied to the seed furrow for the control of soil and foliar-feeding insects, or broadcast for the control of nemotodes. It is formulated as WP, paste or granules.

ATRAZINE: is the common name apporved by ISO and BS for the aminotriazine. Trade names are, Gesaprim, Primatol. It is selective pre and post-emergence herbicide on many crops including maize, sorghum, sugar cane, pineapple. It is generally formulated as WP.

PROPANIL: is the common name approved by ISO for a dichloropropionanilide. Trade names are Stam, Surcopur, Rogue. It is a contact herbicide recommended for post-emergence use on rice and potatoes. It is formulated as EC.

TRIFLURALIN: is the common name for a fluorinated nitroalkylaniline. Trade name is Treflan. It is a pre-emergence herbicide with little post-emergence activity. When incorporated in the soil it is effective for the control of annual grasses and broad-leaved weeds in cotton, forage legumes, established sugar beet, beans peanuts, brassicas, non-beating vineyards and orange trees and ornamentals.
Formulations include EC and granules.

COPPER OXYCHLORIDE: is the trivial name for basic cupric chlorides. It is used as the active component for Bordeaux mixture. For this purpose it is marketed usually as WP.

MANCOZEB: is the common name approved by BS for a complex of Zinc and Manganese ditiocarbanate. Trade name is Dithane-M 45.
It is a protective fungicide effective against a wide range of foliage diseases.
It is generally formulated as WP.

3.4 The Supply of Pesticides in Uganda

The supply of pesticides (and other phitoprotectors) to Uganda agriculture is based on imports.

A project for the production of pesticides had been implemented by an Israeli company in 1970 but it was forced to give up for political reasons and the machinery already imported was never used and its deterioration is so bad that it can not be utilized anymore.

3.4.1 Past apparent demand

The apparent demand as shown by imports statistics is shown in the following table 5 and graph. In spite of the reduction of the acreage under crop, the consumption of pesticides has been increasing at an average of 17% per year in quantity.

The increase is even larger if considering that the acreage of the land under crop decreased. Therefore the application ratio per ha is the following:

Year	Total acreage under crop ('000' ha)	Application ratio Kg./ha
1973	5,022	0.34
1974	5,369	0.40
1975	5,380	0.49
1976	4,972	0.59
1977	5,427	0.64
1978	5,307	0.75
1979	3,799	1.18

On the other side the largest amount of pesticide is applied to the "cash crop" cultivation (coffee, cotton, etc.).

The application ratic of pesticides (assuming that 80% of the total quantity imported is used for these crops) is therefore the following:

Year	Land under Cash-Crop (000' ha)	Application Ratio (Kg/ha)
1973	1,022	1.35
1974	1,008	1.72
1975	830	2.53
1976	302	7.78
1977	955	2.94
1978	714	4.49
1979	617	5.83

No statistics are available for the years 80-81

TABLE 5 : UGANDA PESTICIDES IMPORTS - 19[illegible]-19[illegible]

ACTIVE INGREDIENT	%	FORMULATION
B.H.C	0.65	Dust
Aldrin	2½	Dust
Aldrin	40	W.P.
White Oil	-	M.L.
Sevin	85	W.P.
BHC	-	E.C.
Clordane	40	M.L.
D.D.T	5	Dust
D.D.T	25	M.L
Phosphamidon	50	M.L
Phosphamidon	20	UVL
Dieldrin	2½	Dust
Dieldrin	0.5	Dust
Dieldrin	18	M.L
Lindane	0.1	Dust
Lindane	20	M.L
Lindane	50	D.P.

QUANTITIES OF FORMULATED PRODUCTS (TONS)

1973	1974	1975	1976	1977	1978	1979
8	9	10	15	20	23	25
3	4	4	4.5	5	5	8
0.2	0.3	0.5	0.7	0.9	1	1
0.2	0.2	0.2	0.3	0.4	0.4	0.4
5	10	15	15	20	25	30
4	5	5	7	7	10	10
5	7	9	10	15	18	20
20	40	50	55	60	70	80
10	15	17	18	20	20	25
6.5	7.5	8	9.5	[illegible]	15	19
0.1	0.2	0.3	1	5	8	10
50	50	69	75	75	80	80
10	15	20	25	30	30	40
10	10	15	18	20	25	30
40	50	60	80	100	120	130
22	25	31	35	39	42	45
13	15	20	20	22	25	25

./.

TABLE 5 / CONT

ACTIVE INGREDIENT	%	FORMULATION
B.H.C	2	Dust
Dicofol	18½	W.P.
Malathion	50	M.L.
Malathion	1	Dust
Malathion	2	Dust
Diazinon	60	E.C.
Dimethoate	40	E.C.
DDT Micronised	75	W.P.
Fenitrothion	50	M.L
Endosulfan	35	M.L.
Organo-Merc.	6½	W.P.
Benomyl	-	W.P.
Maneb	45	W.P.
Cupric Oxide	-	Dust
Zineb	80	W.P
Ethylene dichloride	-	Liq.
Methyl bromide	-	Gas

QUANTITIES OF FORMULATED PRODUCTS (TONS)

1973	1974	1975	1976	1977	1978	1979
33	35	38	40	45	50	60
2	3	3	5	8	10	15
7	7	8	9	10	15	15
22	25	27	30	35	40	45
1	1	2	3	[illegible]	5	5
150	160	170	175	180	185	190
30	50	50	60	70	80	80
720	960	1200	1440	1680	1920	2160
14	19	25	26	27	28	29
4	5	7	10	15	15	20
0.5	0.5	0.7	0.8	1	1	1.5
2	2.5	2.5	2.5	3	3.5	3.5
64	80	90	113	135	160	175
200	200	200	200	250	250	250
5	8	10	12	12	15	15
0.5	0.8	1	1.5	1.5	2	2
0.5	0.5	0.8	1	1.5	1.5	2

27

./.

TABLE 5 / CONT

ACTIVE INGREDIENT	%	FORMULATION
Ethyl dibromine EDB	-	Liq.
Doizonet	98	Gran.
Organo-Mercury	1	Dust
Dalapon	74	Salt
24-D Ester	60	M.L
24-D Amine	72	M.L
Paraquat	20	M.L
Picloram &		
24-D Amine	-	M.L
Non Ionic Wetter Sp.	90	M.L
Coumarin	-	

GRAND TOTAL

QUANTITIES OF FORMULATED PRODUCTS (TONS)

1973	1974	1975	1976	1977	1978	1979
5	5	5	7	10	12	15
2	2	3	3	5	5	8
25	30	36	36	40	45	45
91	110	165	196	210	250	300
29	60	81	94	103	115	128
40	50	60	80	80	90	90
60	70	80	90	100	150	200
15	20	20	25	[illegible]	30	50
3	4	4	5	5	10	10
2.5	2.5	3	4	8	9	10
1,375	2,174	2,626	2,939	3,513.9	4,014.4	4,502.4

TABLE 1 : PRODUCTION OF FOOD CROPS 1971 - 1983 - PRODUCTION IN '000 METRIC TONS

PRODUCT	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
MAIZE	421	500	419	430	570	674	566	594	353	286	342	393	450		
FINGER MILLET	650	594	643	591	682	567	578	561	381	458	480	528	600		
SORGHUM	348	419	389	345	467	390	344	350	216	299	320	400	470		
RICE	22	16	9	15	16	29	20	26	15	17	14	18	25		
WHEAT	7	7	7	9	14	12	13	14	7	7	8	9	17		
MIXED BEANS	222	237	170	196	325	337	253	291	182	186	240	300	380		
SOYA BEANS	4	7	5	4	4	8	6	6	3	3	5	6	8		
FIELD PEAS	11	15	8	13	12	15	12	14	6	7	8	10	11		
PIGEON PEAS	40	48	31	46	26	37	40	42	19	26	25	28	30		
COW PEAS	45	62	50	64	57	31	32	31	22	16	18	20	22		
GRAINS	2	1	2	3	3	2	1	1	1	1	2	3	4		
GROUNDNUTS	251	234	212	200	194	177	193	187	80	65	80	90	95		
SIMSIM	31	28	31	31	39	33	38	40	16	20	25	35	45		
SWEET POTATOES	1425	1224	1232	1786	1953	2002	1658	1688	576	1200	1300	1600	1700		
IRISH POTATOES	128	162	177	199	221	345	267	293	131	213	175	196	210		
CASSAVA	2417	2650	2132	2350	2992	2838	2993	2928	1294	2072	3000	3300	3800		
PLANTAINS	7557	7634	8126	8879	9106	8137	8531	8855	5924	5699	5900	6600	6875		

TABLE 2 : UGANDA: ACREAGE OF FOOD CROPS 1971-1983 -

PRODUCT	1971	1972	1973	1974	1975
MAIZE	280	415	314	388	475
FINGER MILLET	716	497	636	510	484
SORGHUM	307	318	287	367	311
RICE	24	18	10	17	18
WHEAT	4	3	3	4	6
MIXED BEANS	459	309	359	408	407
SOYA BEANS	4	7	5	6	6
FIELD PEAS	28	36	20	32	29
PIGEON PEAS	91	121	78	115	64
COW PEAS	28	63	49	68	78
GRAINS	4	2	5	6	6
GROUNDNUTS	291	291	222	267	243
SIMSIM	103	91	96	97	122
SWEET POTATOES	495	508	440	506	550
IRISH POTATOES	17	17	20	22	35
CASSAVA	508	371	483	485	618
PLANTAINS	905	916	974	1063	1097
TOTAL	4,264	3,983	4,001	4,361	4,549

AREA IN '000 HA

1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
520	429	450	272	250	260	280	800		
498	527	510	314	279	300	330	360		
320	280	286	183	167	170	200	230		
24	20	24	12	11	12	15	20		
5	6	7	3	3	4	5	8		
435	338	388	227	220	300	280	400		
6	6	6	4	4	5	6	7		
39	30	34	19	17	18	20	22		
80	105	105	58	50	55	60	70		
86	80	80	43	38	40	45	48		
7	4	5	3	3	4	5	7		
215	234	234	122	100	110	120	130		
113	133	137	60	65	70	80	90		
564	467	475	248	231	350	400	420		
48	34	37	21	24	25	28	30		
512	540	528	303	302	300	350	400		
1180	1239	1287	1290	1173	1180	1200	1250		
4,670	4,472	4,593	3,182	2,945	3,205	3,424	4,292*		

* Forecast

TABLE 3 : PRODUCTION OF CASH CROPS 1971-1983 (000

PRODUCT	1971	1972	1973	1974	1975
COFFEE ALL	221.0	183.7	213.7	198.6	198.54
ROBUSTA	159.5	162.2	195.7	182.0	182.0
ARABICA	16.2	20.8	18.0	18.1	17.0
COTTON	84.8	74.8	74.5	50.0	31.9
TEA (MADE)	18.2	18.0	23.1	21.9	21.7
TOBACCO (FLUE) CURED	-	-	3.1	2.2	2.6
COCOA	127.3	273.4	186.6	113.1	141.3
TOBACCO (FIRE CURED)	4.4	5.0	1.9	1.7	1.2
SUGAR	144.0	141.3	121.1	68.5	38.1

Source: Planning Division, Ministry of Agriculture and Forestry

n.a: Not available

tons)

1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
157.1	155.9	121.3	103.8	135.2	234.0	166.6	192.0		
123.1	151.6	119.0	198.3	130.4	125.0	152.3	176.0		
14.0	4.3	2.3	2.3	4.8	9.0	14.3	16.0		
24.7	110.3	39.3	32.3	21.7	27.5	150.0	300.0		
15.4	15.2	10.9	1.8	1.5	1.7	2.4	n.a		
3.6	1.9	1.163	672	310	30	130	1.241		
90.9	196.6	243	150	164	117	122	n.a		
3.7	2.5	1.4	0.8	0.4	0.1	130	1.241		
18.5	11.4	7.8	15.4	15.0	n.a	n.a	n.a		

TABLE 4 : ACREAGE OF CASH CROPS 1971-1983

PRODUCT	1971	1972	1973	1974	1975
COFFEE ALL	245.7	257.1	256.5	234.00	222.4
ROBUSTA	217.2	228.9	227.8	205.7	192.3
ARABICA	28.5	28.2	28.7	28.3	30.1
COTTON	881.6	1042.4	725.9	721.1	546.2
TEA (MADE)	17.5	10.0	10.6	20.4	20.8
TOBACCO (FLUE) CURED	3.4	2.9	3.3	3.3	3.0
COCOA	2.4	3.7	5.1	7.0	9.6
TOBACCO (FIRE CURED)	1.3	2.6	3.6	3.4	3.6
SUGAR	31.8	29.1	17.3	19.0	24.9
T O T A L	1,183.7	1,347.8	1,022.3	1,008.2	830.5
Total Area under Crop	5,448	5,331	5,022	5,369	5,380

1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
223.2	223.8	223.9	223.9	224.2	224.2	224.0	224.0		
190.6	190.8	190.9	190.9	191.2	191.0	191.0	191.0		
33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0		
30.0	677.5	417.0	312.4	121.3	150.3	450.0	600.0		
0.88	1.35	20.9	20.9	21.0	21.0	21.0	21.0		
3.23	3.23	2.4	2.5	2.[illegible]	0.2	1.0	4.1		
11.3	13.6	14.4	14.5	14.5	14.5	14.5	n.a		
3.23	3.23	4.333	5.34	5.34	5.34	1.0	4.1		
29.5	33.2	31.3	37.5	31.0	n.a	n.a	n.a		
302.24	955.9	714.23	617.04	420.14	445 N	741 ~	897 ~ *		
[illegible],972	5,427	5,307	3,799	3,365	3,648	4,160	5,189		

* Forecast

3.4.2 Present apparent demand

The agriculture is presently recovering after the problems that affected its output in the last few years.

The recovery will also influence the import of pesticides and other chemicals for agriculture.

Information has been gathered from the Commissioner for Agriculture as far as the estimated requirement for pesticides in 1983 for tender purpose.

In addition traders and importers have provided information on the potential for the private sector.

The forecast for pesticides use in 1983 can be quantified as follows:

TABLE 6: FORECAST OF PESTICIDE USE IN 1983

PRODUCT	USE	QUAN
Endosulfan 35 EC	Cotton/Vegetables	
DDT 75 WP	Cotton	[illegible]
Copper Fungicide 50 WP	Arabic Coffee	60[illegible]
Copper 45 Dust	Cotton Seeds Dressing	5[illegible]
Fenitrathion 50 ML	Coffee	
Benlate 50 WP	Coffee	
Paraquat Dichloride 20 ML	Various	
Amino-Triazine 50 EC	Maize	
Dalapon 75 S	Various	
Roundup 36 EC	Various	
Dithane 45	Vegetables	
Polyram Combi	Vegetables	
	TOTAL	5[illegible] (5[illegible]

ITY BY PUBLIC SECTOR (TONS)	QUANTITY BY PRIVATE SECTOR (TONS)	TOTAL (TONS)
500	1,500	2,000
,000	300	1,300
-750		700
-100		75
50	30	80
50		50
500	750	1,250
120	120	240
500	1,000	1,500
500	1,000	1,500
150		150
150		150
,420 (,620)	4,700	10,245

Taking 80% of the forecast for the public sector (5,420 tons) and the areas under "cash-crop" (897,000 ha in 1983) it results an application ratio of 4.83 Kg/ha, comparable to the 4.49 Kg/ha of 1978 when the acreage was 714,000 (lower than 1,347,800 ha reached in 1972, but larger than the 420-425,000 ha of the "black period" 1980-1981).

Considering that the acreage for food crops is also recovering (see table 1) from 2,355,[illegible] ha of 19[illegible] to 5,1[illegible] ha of [illegible] (compara-ble to 5.4-5.3 millions of the period 1971-1977) it is reasonable to assume that the consumption of pesticides by the private sector will increase too, provided that a policy of incentives for the purchase of agrochemicals will be developed as a first step toward the modernization of the agriculture.

3.4.3 Future demand

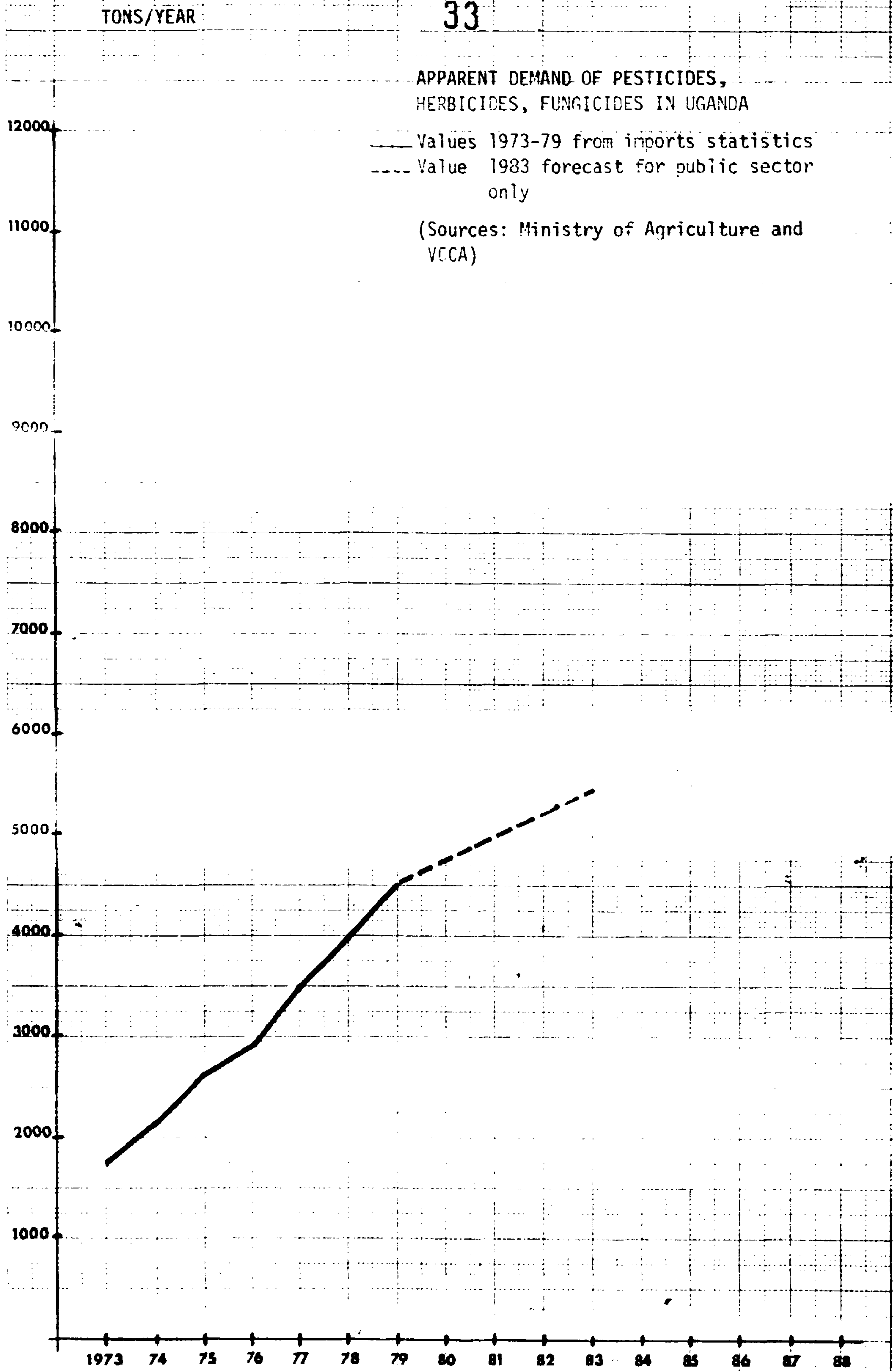
The potential for use of pesticides is very high. As a matter of fact Uganda has an agriculture based economy and is in need of [illegible] its potentiality after the crysis of the past decade. The use of agro chemicals is therefore a must to recover the whole sector.

In 1972, major crops (as far as acreage of the land) were:

Maize:	400,000 ha
Coffee:	257,000 ha
Cotton:	1,000,000 ha
Sorghum:	400,000 ha
Groundnuts:	230,000 ha
Vegetables and pulses:	1,000,000 ha

Considering that the Ten Year Recovery plan is succesful an that the acreage of land under crop will be as before and considering the minimum pesticides application ratio that can be advisable for that

region (Maize: 2 Kg/ha, Coffee 3, Cotton 5, Sorghum 1.5, Groundnuts 8, Vegetables and pulses 1) the potential demand would already be nearly 9,500 tons/year, plus large amount of specific products like the Dieldrin, for plantains, plus cash crops like sugar and tobacco that require high quantities of pesticides and other agrochemicals.
On the other hand, the apparent demand has increased at an interesting rate ([illegible]) during the seventies, showing that the agricultural sector is aware of the importance of these agrochemicals.
It is therefore assumed that the demand of pesticides, herbicides and fungicides at short-medium term be in the order of 10-15,000 tons/year and reaching the 20,000 tons/year at the end of the decade.
These figures include products that can be formulated in the new plant, as well as products that have to be imported as finished product.


TONS/YEAR
APPARENT DEMAND OF PESTICIDES,
HERBICIDES, FUNGICIDES IN UGANDA
Values 1973-79 from imports statistics
Value 1983 forecast for public sector only
(Sources: Ministry of Agriculture and VCCA)
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
1973
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88

3.5 The Proposed Production Mix based on the Market Study

On the basis of the results of the analyses on the past and present situation, taking into consideration that it is reasonable assuming that the products coming out from the new plant covers only a part of the total market demand, the initial proposed production mix is as follows:

	Tons	Field of Application
a) Liquid insecticides		
- Endosulfan 35%	1,000	Cotton and vegetables
- Dimethoate 40%	500	Cotton, aphid, acare
- Phentoate 50% - Fernitrotion 50%	100	Lepidopters of cotton, potatoes, tomatoes
- Dieldrin 18%	30	Termites
b) Liquid Herbicides		
- Trifluralin 48%	500	Cotton, beans, peas, vegetables
- Propanil 36%	60	Rice
c) Powder Insecticides		
- Dieldrin 2.5%	2,000	Bananas
- Endosulfan 3.5%	75	Vegetables
- BHC 5%	25	Vegetables
- Malathion 1%	100	Grain Storage
d) Wettable Powder Herticides		
- Atrazine 50%	120	Maize, Sorghum
e) Wettable Powder Fungicides		
- Copper oxychloride 35%	600	Coffee barry disease
f) Granular Insecticides		
- Furadan 30%	300	Nermatodes
TOTAL	5,410	

The plant is conceived sufficiently flexible as to allow to change the production mix in accordance with the actual demand of the market.

CHAPTER 4

RAW MATERIAL AND OTHER INPUTS

4. RAW MATERIALS AND OTHER INPUTS

4.1 Raw Materials

4.1.1 Inerts

This term includes solid materials of adequate granulometry acting as carriers of the active matters.
They contain mainly clay, talcum, calcium carbonate and other substances.
Most of the international standards allow the use of the following inerts: talcum, Kaoline, bentonite, fossil flour, calcium carbonate, magnesium carbonate, colloidal silica, silicates alkaline silica, aluminas, diatomites, pumix etc.
Even though the above materials are called inerts, they are not completely inert as they can contain impurities such as Fe, As, Mn, etc. which even in small quantities determine the degradation of the active matters. Only the specific laboratory analisys for each formula can indicate: which materials are suitable, which can be used with the addition of a de-activator and which are absolutely not to be used.
In case of extemporary necessity (i.e. invasion of grasshoppers), non-mineral inerts such as vegetable powders, residues of industrial processing (tobacco, etc.) can be used but these inerts are heterogenic materials that do not guarantee the stability of the product for more than few weeks. In Uganda there are only few of the above inerts available: Kaolin, diatomite, calcium carbonate and pomix.
From the geological chart enclosed to the report it is possible to identify the location of the mines and make an evaluation of the actual possibility of utilizing one or more of the minerals available in the country.
It results that first of all Kaolin is of big interest in view

of establishing a formulation plant.

KAOLIN - have been found in several places in the country, but the Kaolin of the quarries of Kisai and Koki near Masaka resulted, during the analysis,particularly suitable for the preparation of pesticides powders. Attached to this study there is a copy of a report on the above deposit. Further analyses made on some representative samples collected during our fact finding mission confirm that the Kaolin is suitable to the purpose.

DIATOMITE - the Diatomite reserves are located in Panyango, in the Pakwach area (West Nile).
Its suitability as inert for pesticide formulates is certified by the attached survey, carried out in 1957 within the General Geological survey of Uganda.

4.1.2 Solvents

Solvents are liquid substances used to dissolve the various active principles in quantities varying to their solubility.
The most widely used solvents for pesticides are: acetone, ethyl acetate, solvents of petrol origin, Kerosene , mineral resin, solvent naphta, isoparaffine (Boiling Point 150-240° C) butylenes (diiso, triiso tetraiso) propylene, trimer and tetramer, cyclohexanone, methylene chloride, esters of phtalic acid, trichloroethane, xylene.
The basic characteristics of the solvents must be the following:

- to have no chemical reaction with the active matter , with the emulsifiers or with other components of the formula,
- to have a flash point suited with the use of the formulation and never lower than 20° C,
- not to be phitotoxic (at the used concentration).

All these products must be imported to Uganda, since no production is available in the country.

4.1.3 Emulsifiers

It concerns substances of tensioactive action, of the type referring to dodecylbenzensulphonate or similar, that allows the mi-

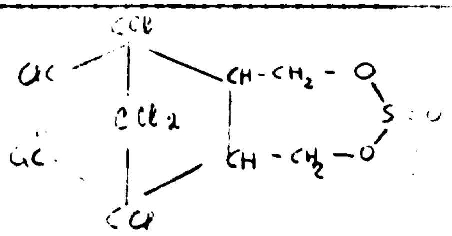
xing of an oil solvent with water equalizing the interfacial tensions of the two phases.
They are present in the mixture, in relatively small amount: 0.5-2%.
In addition to the characteristics already indicated for the solvent like consistency and absence of phitotoxicity, the emulsifiers should not give to the products any "foaming tendency" that can affect the correct operation of the pump of the distribution equipment.
Also emulsifiers must be imported as they are not available within the country.

4.1.4 Active Ingredients

Active ingredient is considered the chemical compound having specific insecticide, herbicide or fungicide functions within a product of which the other components are inert and represent the carrier of the above active ingredient.

The table, herebelow, shows the formula, the phisical properties, the suppliers and the names used for the ingredients suggested for the production mix.

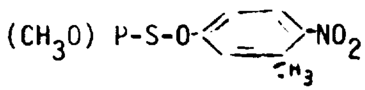
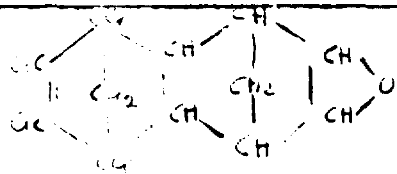
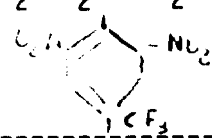
TABLE 7: INGREDIENTS SUGGESTED FOR THE PRODUCTION [illegible]

ACTIVE INGREDIENT (Common Name)	FORMULA AND CHEMICAL NAME	OTHER NAMES
ENDOSULFAN	 a,β-1,2,3,4,7,7-hexachloro-bicyclo [2,2,1]-hepten-2 bisoxymethylen-5,6 sulphite	Thiodan Cyclodan Beosit Halix Thimul Thiror
DIMETHOATE	$(CH_3O)_2$-PSS-$CH_2CONHCH_3$ N-monomethylamide of O-O dimethyldithiophosphorylacetic acid	Rogor Cygon Perfektion Roxion
PHENTHOATE	$(CH_3O)_2$-PS-S-CH-$COOC_2H5$  Ethylester of O-O dimethyldi-thiophosphoryl-phenylacetic acid	Cidial Elsan

PHISICAL PROPERTIES	SUPPLIERS	AVERAGE PRICE US $/Kg. CIF Mombasa
mp=70°-100° Insoluble in H_2O Soluble in Org. Solvents Toxicity 110 LD_{50}	Hoechst Maktheshim	7
mp=48°-50° Sol. H_2O=2,5 g/100 Toxicity=380	Montedison IFICI Am. Cyanamid BASF Boeringer, Chemi-nova	4
Liquid D=1,22 Sol H_2O=24ppm Toxicity=350-400	Montedison Nissan Bayer	6

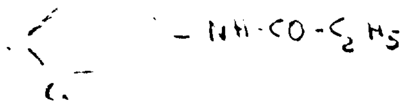
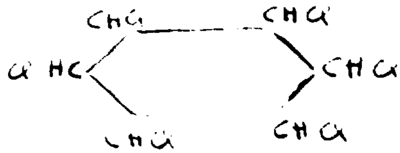
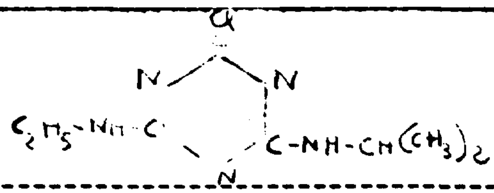
./.

TABLE 7: CNTD

FENITROTHION	 0-0 dimethyl-0-(4nitro-m-tolyl)phosphorothioate	Folithion Sumitnion
DIELDRIN	 1,2,3,4,10,10-hexachloro-6,7epoxy- 1,4,4a,5,6,7,8a octahydro-exo 1,4 endo-5,8 dimethano-naphtatelene	Octalox
TRIFLURALIN	CH_3-CH_2-CH_2-N-CH_2-CH_2-CH_3  2,6 dinitro - N-N - dipropyl-4-trifluoromethyl amiline	Treflan

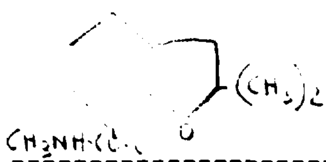
Liquid B.p=140°-145°C at 0,1mm Ins. in H_2O Toxicity=250-740	Bayer Chemirova	5
mp=175°-176°C Toxicity=60	Shell	11,1
mp=48°-49°C Sol. H_2O=less than 1ppm Toxicity=10000	Elanco SIFA Montedison PICI Cortox (Brazil) Geco-Trigo (") Quimica Stella (Argentina) Compagnia Quimica (Argentina)	4

TABLE 7: CONTD

PROPANIL	 N(3,4-dichlorophenyl)propionamide	Stam F 34 Surcopur Roque
BHC	 Hexachlorcyclohexane	benzene hexa-chloride
MALATHION	$CH_3OPS-S-CH-COOC_2H_5$ $CH-COOC_2H_5$ S 1,2 di(etoxycarbonyl)ethyl dimethyl-phosphoro-thiolo-thionate	Mercaptothion Carbofos Cythion
ATRAZINE	 2 chloro-4ethylamino-6isopropylamino-1,3,5 triazine	Gesaptim Primatol Atred

mp=92°-93°C Toxicity=1400	Montedison CIFA IPICI	3,6
Brown powder mixture of various isomers Toxicity=90	Rhone-Poulenc Shinqnung Chem. (Taiwan)	3
Liquid B.p.=156°-157°at 0,7 mm/Hg. Toxicity=1345	Cheminova Montedison Sariaf Sumitomo Cyanamid	2,4
Clourless solid mp=173°-175° Toxicity=3080	Ciba-Geigy IPICI CIFA Montedison	3,2

TABLE 7 : CONTD

COPPER OXYCHLORIDE	$Cu_2(OH)_3Cl$ or $3Cu(OH)_2 \cdot CuCl_2$ Mixture of Basic cupric chlorides	
FURADAN	 2,3 dihydro-2,2 -dimethyl-benzofuran-7yl-methyl-carbamate	Carbofuradan

Green-bluish powder	Caffaro	1,4
White Solid mp=150°-152°C Toxicity=8-14	FMC Bayer Brichimica	15

4.2 Other Inputs (Packaging materials)

The basic characteristics of the most widely used packing materials for pesticides are offered here below.

4.2.1 Packaging for dry products (dust, granules, wettable powders).

These formulations can be packed in multi layers plastified paper bags or of poliethylene.
This type is generally adopted for 5 to 10 Kgs. packages.
Thermowelded plastic bags are preferred for packages of less than 5 Kgs.
This packing is also recommended for wettable powders (that are highly hygroscopic).
In fact, while the dry powders and the granules can (within certain limits) get damp or dry reversibly without loosing their characteristics, if the wettable powders absorb humidity they tend to agglomerate and to irreparably deteriorate.

4.2.2 Packaging for liquid products (solutions, stock emulsions, etc)

For the medium/large capacities (50-100-200 Kgs) the packing in steel containers should be preferred (drums, cans, etc.); for the medium/small capacity (1-5-10-25 Kg.) containers in tin sheets, aluminum and plastic are used.

The metal packings should have an internal lining of synthetic resines (epoxyd, phenolic, etc.) to guarantee good conservation of the products especially in tropical climate.
High density polyethylene (eltex or similar) and isotactic polypropylene are the most widely used materials for plastic containers.
Glass containers can be used up to a size of 5 Kgs. provided that the caps are in a material that cannot be attacked by the solvent being used.
Glass is the best material for the conservation of the mixtures but it is fragile and heavy to transport and to handle.

4.2.3 Availability of packaging materials in Uganda

There are in Uganda:

- One factory producing metal sheets
- One factory producing metal tins
- One plastic factory producing sheets and bags
- One cardboard factory producing also cartons
- One paper bag factory

The above factories are expected to be working under normal conditions.

CHAPTER 5

TECHNICAL STUDY

5. TECHNICAL STUDY

This section is concerned with the description of the characteristics of a new plant to be built for the formulation of pesticides in quantity and types as suggested by the Market Study.

5.1 Project Data

5.1.1 Production Mix

The plant is required to produce, annually:

* LIQUID INSECTICIDES	1,630 T
* LIQUID HERBICIDES	560 T
* POWDER INSECTICIDES	2,600 T
* POWDER HERBICIDES	120 T
* GRANULAR INSECTICIDES AND HERBICIDES	300 T
TOTAL	5,410 t

5.1.2 Working Time

Working days in [illegible] plants are [illegible]; hours per shift are [illegible]; three shifts per day are allowed.

5.1.3 Plant Production Capacity

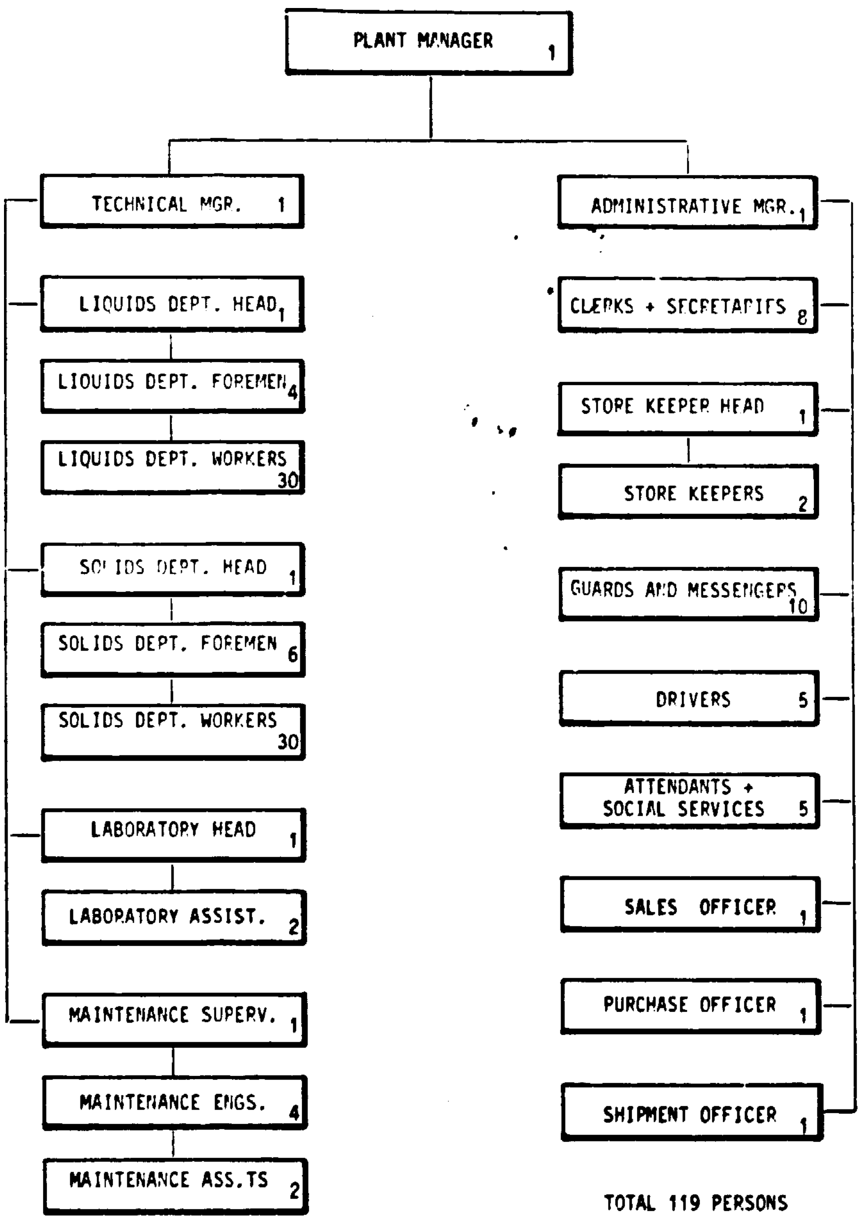
In order to satisfy the production mix and have spare capacity to meet partly or totally the expected market increase, the plant has been designed for a nominal output as shown in the table 1.

TABLE 1 PLANT NOMINAL OUTPUT (TONS)

OUTPUT / PRODUCTS	HOURLY	YEARLY		
		1 shift	2 shift	3 shift
LIQUID INSECTICIDES	1.25	2400	4800	7200
LIQUID HERBICIDES	0.625	1200	2400	3600
POWDER INSECTICIDES	0.68	1300	2600	3900
POWDER HERBICIDES	0.52	1000	2000	3000
GRANULAR INSECTICIDES AND HERBICIDES	0.26	500	1000	1500

5.1.4 Plant Organisation Chart

For operation, the plant shall have an organization as indicated below. The number of persons is the one required for the assumed production mix.



TOTAL 119 PERSONS

5.1.5 Plant Areas

a) Covered Areas — Total 6080 sqm

. Gate House	30 sqm
. Office Building	300 sqm
. Raw materials and Finished Products Warehouse	3000 sqm
. Powder Insecticides Formulation Building	1120 sqm
. Raw Kaolin Deposit	300 sqm
. Powder Herbicides and Granulars Formulation Building	450 sqm
. Liquid Insecticides and Herbicides Formulation Building	200 sqm
. Liquid Insecticides and Herbicides Packaging Building	300 sqm
. Drums deposit	300 sqm
. Electric Cabin and Maintenance Workshop Building	80 sqm

b) Fenced Area — 6.7 acres

5.1.6 Utilities

a) Electricity: 20/0,38/0,22 KV 50 Hz 3 Phase
intalled Power 550 KW

b) Water:

industrial	10 cum/h 2 bars
drinking	3 cum/h 2 bars
hot	3 cum/h 80 °C

c) Compressed air:

65 cum/h at 7 bars
990 cum/h at 12 bars

5.2 Description of the Processing Lines

Five processing lines are foreseen for the production of the pesticides:

a) Liquid insecticides line

b) Liquid herbicides line

c) Powder insecticides and fungicides line

d) Powder herbicides line

e) Granular insecticides and herbicides line

5.2.1 Liquid insecticides line (Flow Sheet 6-130-001) annexe 4

Liquid insecticides are a mixture of solvents, emulsifiers and active matters.
The mixture is formed in the reactor R101 in batches of 10 T each prepared through the following steps:

a) Solvents (5 to 6000 1) from tank D101 are pumped to reactor R101

b) Emulsifiers (700 Kg) are introduced into the reactor R101

c) Active matters (3500 to 4000) kg are introduced into the reactor R 101

d) All ingredients are mixed for about 30 minutes for homogeneization

e) Finished products will be stored in the tanks D103 or D104.

It is foreseen the production of 1 batch per day.
The finished products will stay 1 day in the tanks D103 and D104. After the quality control, the products will be packed in containers of 1 Kg, 5 Kg, 20 Kg by means the semiautomatic filling and sealing machines PX 101/A and PX 101/B.
The steps followed for the packaging are as follows:

i) 1 Kg (11) containers

. Filling and sealing of yellow bottles of 1200 c.c.
. Labelling
. Cartoning of the bottles
. Palletizing of cartons

ii) 5 Kg (51) containers

. Filling of tin plated steel cans, internally enamelled
. Labelling of cans.

. Cartoning (4 cans per carton)

. Palletizing

iii) <u>20 Kg (20l) containers</u>

. Filling of tin plated steel container, internally enamelled

. Labelling

. Cartoning (1 can per carton)

. Palletizing

The following data sheets indicate the main characteristics of the line equipment.

Line equipment unit prices are also given

baldo & c. sas
CONSULTING ENGINEERS

Flow Sheet N° B 130-001

ITEM : TANK

- IDENTIFICATION TAG : [illegible]

- QUANTITY : [illegible]

- TYPE : HORIZONTAL

- CAPACITY : 30 m^3

- MATERIAL : CARBON STEEL

- DRIVE MOTOR :
REDUCER :
VARIATOR :

- FUNCTION DESCRIPTION : SOLVENT STORAGE

baldo & C. s.r.l.
CONSULTING ENGINEERS

Flow Sheet N° 8130 - 001

ITEM

: VESSEL

- IDENTIFICATION TAG : D 102

- QUANTITY : 1

- TYPE : HORIZONTAL (OPEN PARALLELEPIPED)

- CAPACITY : 10 m^3

- MATERIAL : CARBON STEEL

- DRIVE

MOTOR :

REDUCER :

VARIATOR :

- FUNCTION DESCRIPTION : MELTING OF SURFACE ACTING MATTER

baldo & C. s.r.l.
CONSULTING ENGINEERS

Flow Sheet N° B 130-001

ITEM : TANK

- IDENTIFICATION TAG : D 103

- QUANTITY : 1

- TYPE : VERTICAL

- CAPACITY : 11 m^3

- MATERIAL : AISI 304

- DRIVE
  - MOTOR :
  - REDUCER :
  - VARIATOR :

- FUNCTION DESCRIPTION : LIQUID FORMULATION STORAGE

Flow Sheet N° B 130-001

ITEM : TANK

- IDENTIFICATION TAG : D 104

- QUANTITY : 1

- TYPE : HORIZONTAL

- CAPACITY : 11 m^3

- MATERIAL : AISI 304

- DRIVE MOTOR :
  REDUCER :
  VARIATOR :

- FUNCTION DESCRIPTION : LIQUID FORMULATION STORAGE

baldo & c. s.r.l.
CONSULTING ENGINEERS

Flow Sheet N° 3130-001

ITEM : VESSEL

- IDENTIFICATION TAG : D 105

- QUANTITY : 1

- TYPE : VERTICAL

- CAPACITY : 0,2 m^3

- MATERIAL : AISI 304

- DRIVE MOTOR :
REDUCER :
VARIATOR :

- FUNCTION DESCRIPTION : INTERMEDIATE VESSEL FOR DRUMS FILLING

Flow Sheet N° 8130-001

ITEM : PUMP

- IDENTIFICATION TAG : G 101
- QUANTITY : 1
- TYPE : CENTRIFUGAL
- CAPACITY : FLOW 20 m^3/hr, HEAD 20 m.l.c.
- MATERIAL : AISI 316
- DRIVE
  - MOTOR : ADPE 3 kW 2900 RPM
  - REDUCER :
  - VARIATOR :
- FUNCTION DESCRIPTION : SUPPLY OF SOLVENT TO FORMULATION

baldo & c. srl
CONSULTING ENGINEERS

Flow Sheet N° 8130-001

ITEM		:	PUMP
- IDENTIFICATION TAG		:	G 102
- QUANTITY		:	1
- TYPE		:	CENTRIFUGAL, SELF PRIMING
- CAPACITY		:	FLOW 5m^3/hr, Head 20 m.l.c.
- MATERIAL		:	AISI 316
- DRIVE	MOTOR	:	ACRE 1,1 kW, 1450 RPM
	REDUCER	:	
	VARIATOR	:	
- FUNCTION DESCRIPTION		:	SUPPLY OF SURFACE ACTING MATTER TO FORMULATION

baldo & c. srl
CONSULTING ENGINEERS

Flow Sheet N° 8130-001

ITEM		: PUMP
- IDENTIFICATION TAG		: G 103
- QUANTITY		: [illegible]
- TYPE		: CENTRIFUGAL
- CAPACITY		: FLOW 20 m^3/hr, HEAD 20 m.l.c.
- MATERIAL		: AISI 316
- DRIVE	MOTOR	: ADPE 3 kW, 2900 RPM
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		:

baldo & c.

CONSULTING ENGINEERS

Flow Sheet N° 8130-001

ITEM	: PUMP
- IDENTIFICATION TAG	: G 104
- QUANTITY	: 1
- TYPE	: CENTRIFUGAL
- CAPACITY	: FLOW 5 m^3/hr, HEAD 20 m.l.c.
- MATERIAL	: AISI 316
- DRIVE MOTOR	: ADPE 1,5 KW, 2900 RPM
REDUCER	:
VARIATOR	:
- FUNCTION DESCRIPTION	: SUPPLY OF FORMULATED TO PACKING-UP

baldo & c. s.r.l.
CONSULTING ENGINEERS

Flow Sheet N° 8130-001

ITEM : PUMP

- IDENTIFICATION TAG : G 105

- QUANTITY : 1

- TYPE : CENTRIFUGAL, MOVABLE PUMP

- CAPACITY : FLOW 5 m^3/hr, HEAD 20 m.l.c.

- MATERIAL : AISI 316

- DRIVE MOTOR : ADPE 1,1 KW, 1450 RPM
REDUCER :
VARIATOR :

- FUNCTION DESCRIPTION : DIFFERENT USES

baldo & c.
CONSULTING ENGINEERS

Flow Sheet N° 8130-001

ITEM : PUMP

- IDENTIFICATION TAG : G 106

- QUANTITY : 1

- TYPE : CENTRIFUGAL, MOVABLE PUMP

- CAPACITY : FLOW 5 m^3/hr, HEAD 20 m.l.c.

- MATERIAL : AISI 316

- DRIVE
  - MOTOR : ADPE 1,1 kW, 1450 RPM
  - REDUCER :
  - VARIATOR :

- FUNCTION DESCRIPTION : DIFFERENT USES

baldo & c. srl
CONSULTING ENGINEERS

Flow Sheet N° 6130-001

ITEM		: SCALE
- IDENTIFICATION TAG		: K 101, 102
- QUANTITY		: 2
- TYPE		: WITH DIAL
- CAPACITY		: 300 Kg
- MATERIAL		:
- DRIVE	MOTOR	:
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: WEIGHING OF RAW MATERIALS OF LIQUID INSECTICIDES

baldo & c. srl
CONSULTING ENGINEERS

Flow Sheet N° 3130-001

ITEM		:	FAN
- IDENTIFICATION TAG		:	P 101
- QUANTITY		:	1
- TYPE		:	CENTRIFUGAL
- CAPACITY		:	8000 m^3/hr, 50 mm H_2O
- MATERIAL		:	PART. ALUMINIUM
- DRIVE	MOTOR	:	3 KW 1450 RPM
	REDUCER	:	
	VARIATOR	:	
- FUNCTION DESCRIPTION		:	EXHAUSTER FOR LIQUID INSECTICIDES AND HERBICIDES FORMULATION

baldo & c. sas
CONSULTING ENGINEERS

Flow Sheet N° F130-001

ITEM		: FAN
- IDENTIFICATION TAG		: P 102
- QUANTITY		: [illegible]
- TYPE		: CENTRIFUGAL
- CAPACITY		: 8000 m^3/h, 50 mm H_2O
- MATERIAL		: PART. ALUMINIUM
- DRIVE	MOTOR	: 3 KW, 1430 RPM
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: EXHAUSTER FOR LIQUID INSECTICIDES AND HERBICIDES PACKING UP

baldo & C. s.r.l.
CONSULTING ENGINEERS

Flow Sheet N° B130-001

ITEM : FILTER

- IDENTIFICATION TAG : PF 101

- QUANTITY : 1

- TYPE : STRAINER

- CAPACITY : (OF VESSEL) 50 1

- MATERIAL : AISI 304

- DRIVE MOTOR :
REDUCER :
VARIATOR :

- FUNCTION DESCRIPTION : SAFEGUARD FOR PUMP G 103

baldo & c. s.r.l.
CONSULTING ENGINEERS

Flow Sheet N° 5130-C01

ITEM	:	LIQUID WEIGHING FILLER
- IDENTIFICATION TAG	:	PX 101/A, PX 101/B
- QUANTITY	:	2
- TYPE	:	SEMI AUTOMATIC
- CAPACITY	:	600 CONTAINER UP TO 1 1 400 " " " 5 1
- MATERIAL	:	
- DRIVE MOTOR	:	
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	FILLING OF LIQUID INSECTICIDES CONTAINERS FROM 1 TO 20 1.
- REMARKS	:	FILLER ENTIRELY PNEUMATIC. COMPRESSED AIR CONSUMPTION 100 N1/min.

baldo & C. s.r.l.
CONSULTING ENGINEERS

Flow Sheet N° B130-001

ITEM		: REACTOR
- IDENTIFICATION TAG		: R 101
- QUANTITY		: 1
- TYPE		: VERTICAL CYLINDRICAL VESSEL
- CAPACITY		: 11 m^3
- MATERIAL		: AISI 316
- DRIVE	MOTOR	:
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: PRODUCTION OF LIQUID INSECTICIDES
- REMARKS		: WITH MIXER

baldo & c. sas
CONSULTING ENGINEERS

Flow Sheet N° B130-001

ITEM		: MIXER
- IDENTIFICATION TAG		: PA 101
- QUANTITY		: 1
- TYPE		: TURBINE
- CAPACITY		:
- MATERIAL		: AISI 316 (PARTS CONTACTING LIQUID)
- DRIVE	MOTOR	: ADPE 15 KW 1450 RPM
	REDUCER	:
	VARIATOR	: FROM 1450 TO 80 RPM
- FUNCTION DESCRIPTION		: FOR REACTOR R 101

baldo & C. srl
CONSULTING ENGINEERS

Flow Sheet N° 6130-001

ITEM		: HOISTER
- IDENTIFICATION TAG		: S 101
- QUANTITY		: 1
- TYPE		: PNEUMATIC
- CAPACITY		: 1000 Kg -PULL CHAIN LIFT LENGTH 6 m
- MATERIAL		:
- DRIVE	MOTOR	:
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: LIFTING OF RAW MATERIALS FOR LIQUID INSECTICIDES

Flow Sheet N° 3130-001

ITEM : METER

- IDENTIFICATION TAG : PO 101

- QUANTITY : 1

- TYPE : OVAL WHEEL

- CAPACITY : FLOW : FROM 4,2 TO 42 m^3/hr
MAX PRESSURE 16 Kg./cm^2

- MATERIAL : AISI 316 - GRAPHITE

- DRIVE
MOTOR :
REDUCER :
VARIATOR :

- FUNCTION DESCRIPTION : METERING SOLVENTS FOR LIQUID FORMULATION

Liquid Insecticides Line Unit Prices

TAG	sh
D 101	917,105
D 102	518,680
D 103	1,200,345
D 104	1,200,345
D 106	75,555
G 101	429,600
G 102	429,600
G 103	429,600
G 104	429,600
G 105	605,630
G 106	605,630
K 101+102	237,220
P 101+102	345,165
PF 101	127,385
PX 101/A PX 101/B	3,558,335
R 101+PA 101	2,964,420
S 101	296,5[illegible]
PO 101	1,352,700
TOTAL	15,723,435

5.2.2 Liquid Herbicides Line (flow sheet B130-001) annexe 4

Liquid herbicides are a mixture similar to the one of the liquid insecticides.

The production process, also, is similar to the one for the insecticides.

The line differs from the one of the liquid insecticides for its capacity, which is equal to 50 .

The following data sheets indicate the main characteristics of the line equipment.

Line equipment unit prices are also given

baldo & c. s.r.l.
CONSULTING ENGINEERS

Flow Sheet N° B130-001

ITEM : VESSEL

- IDENTIFICATION TAG : D 201

- QUANTITY : 1

- TYPE : VERTICAL

- CAPACITY : 0,2 m^3

- MATERIAL : AISI 304

- DRIVE MOTOR :
REDUCER :
VARIATOR :

- FUNCTION DESCRIPTION : INTERMEDIATE VESSEL FOR DRUMS FILLING

baldo & c.
CONSULTING ENGINEERS

Flow Sheet N° 8130-001

ITEM		:	TANK
- IDENTIFICATION TAG		:	D 202
- QUANTITY		:	1
- TYPE		:	VERTICAL
- CAPACITY		:	11 m^3 ca.
- MATERIAL		:	AISI 304
- DRIVE	MOTOR	:	
	REDUCER	:	
	VARIATOR	:	
- FUNCTION DESCRIPTION		:	LIQUID FORMULATION STORAGE

baldo & c. s.r.l.
CONSULTING ENGINEERS

Flow Sheet N° B130-001

ITEM	:	PUMP
- IDENTIFICATION TAG	:	G 201
- QUANTITY	:	1
- TYPE	:	CENTRIFUGAL
- CAPACITY	:	FLOW 20 m^3/hr, HEAD 20 m.l.c.
- MATERIAL	:	AISI 316
- DRIVE MOTOR	:	ADPE 3 kW, 2900 RPM
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	TRANSFER OF FORMULATED LIQUID FROM R 201 TO D 202

baldo & c. sas
CONSULTING ENGINEERS

Flow Sheet N° B130-001

ITEM		: PUMP
- IDENTIFICATION TAG		: G 202
- QUANTITY		: 1
- TYPE		: CENTRIFUGAL, SELF-PRIMING
- CAPACITY		: FLOW 5 m^3/hr, HEAD 20 m.l.c.
- MATERIAL		: AISI 316
- DRIVE	MOTOR	: ADPE 1,1 KW, 1450 RPM
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: SUPPLY OF SURFACE ACTING MATTERS TO FORMULATION

baldo & C. srl
CONSULTING ENGINEERS

Flow Sheet N° B130-001

ITEM : SCALE

- IDENTIFICATION TAG : K 201, K 202

- QUANTITY : 2

- TYPE : WITH DIAL

- CAPACITY : 300 Kg

- MATERIAL :

- DRIVE
  - MOTOR :
  - REDUCER :
  - VARIATOR :

- FUNCTION DESCRIPTION : WEIGHING OF RAW MATERIALS FOR LIQUID HERBICIDES

baldo & c. srl
CONSULTING ENGINEERS

Flow Sheet N° 3130-001

ITEM		: FILTER
- IDENTIFICATION TAG		: PF 201
- QUANTITY		: 1
- TYPE		: STAINER
- CAPACITY		: (OF VESSEL) 50 1
- MATERIAL		: AISI 304
- DRIVE	MOTOR	:
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: SAFEGUARD FOR PUMP G 201
- REMARKS		: WITH FILTRATION NET

Flow Sheet N° B130-001

ITEM		: LIQUID WEIGHING FILLER
- IDENTIFICATION TAG		: PX 201
- QUANTITY		: 1
- TYPE		: SEMI AUTOMATIC
- CAPACITY		: 600 CONTAINERS UP TO 1 l 400 " " " 5 l
- MATERIAL		:
- DRIVE	MOTOR	:
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: FILLING OF LIQUID HERBICIDES CONTAINERS FROM 1 TO 20 l
- REMARKS		: FILLER ENTIRELY PNEUMATIC. COMPRESSED AIR CONSUMPTION 100 Nl/min.

baldo & c. srl
CONSULTING ENGINEERS

Flow Sheet N° 6130-001

ITEM	:	REACTOR
- IDENTIFICATION TAG	:	R 201
- QUANTITY	:	1
- TYPE	:	VERTICAL CYLINDRICAL VESSEL
- CAPACITY	:	11 m^3
- MATERIAL	:	AISI 316
- DRIVE MOTOR	:	
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	PRODUCTION OF LIQUID HERBICIDES
- REMARKS	:	WITH MIXER (SEE PA 202)

baldo & c. srl
CONSULTING ENGINEERS

Flow Sheet N° B130-001

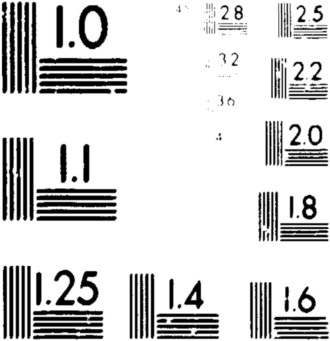
ITEM		:	MIXER
- IDENTIFICATION TAG		:	PA 202
- QUANTITY		:	1
- TYPE		:	TURBINE
- CAPACITY		:	
- MATERIAL		:	AISI 316 (PARTS CONTACTING LIQUID)
- DRIVE	MOTOR	:	ADPE 15 KW, 1450 RPM
	REDUCER	:	
	VARIATOR	:	FROM 1450 TO 80 RPM
- FUNCTION DESCRIPTION		:	FOR REACTOR R 202

Flow Sheet N° B130-001

ITEM		: HOISTER
- IDENTIFICATION TAG		: S 201
- QUANTITY		: 1
- TYPE		: PNEUMATIC
- CAPACITY		: 1000 Kg - PULL CHAIN LIFT LENGTH 6 m
- MATERIAL		:
- DRIVE	MOTOR	:
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: LIFTING OF RAW MATERIALS FOR LIQUID HERBICIDES

Liquid Herbicides Line Unit Prices

TAG	sh
D 201	87,000
D 202	1,300,000
G 201	450,000
G 202	450,000
K 201+202	275,840
PF 201	148,125
PX 201	2,000,000
R 201+PA 202	3,541,685
S 201	344,800
TOTAL	8,597,450


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4

5.2.3 Powder Insecticides Line (Flow Sheet B130-007) annexe 4

The production of the line is as follows:

a) Grinding of Kaolin to 44 microns

b) Grinding of Kaolin to 10÷15 microns

c) Wettable Powders (W.P.) with an active matter (liquid or solid) content up to 50% and 44 microns fineness.

d) Powder concentrates with an active matter (liquid or solid) content up to 50% and 44 microns fineness, to be used for the production of dusts.

e) Dry Dusts obtained by diluting the powder concentrates, in order to leave an active matter content up to 5%;

f) Powders with an active matter content up to 50% and 10 to 15 microns fineness.

g) Packaging of powder insecticides

5.2.3.1 Grinding of Kaolin to 44 microns

Hourly output: 1500 Kg.

The Kaolin coming from the deposit in lumps of 150 mm is introduced into the hammer mill P301 by the belt conveyor T 301. Lumps are reduced to 50÷500 microns, through the backet elevator T 302 the Kaolin is sent to the hopper D 301.

From this hopper, Kaolin can be sent to the pulverizer mill PM 302 by which it is ground to 44 microns.

From the mill the Kaolin is sent to the hopper D 302 and from here can be sent to the wheighing and bagging machine PX 301 were bags of 25 or 50 Kg are filled or to weighing Hopper D 303.

5.2.3.2 Grinding of Kaolin to 10÷15 microns

Hourly output: 300 Kg.

The Kaolin is taken from the hopper D 301 and through the screw conveyor T 304 is sent to the hopper D 303 and from here, through the screw conveyor T 307 is sent to the horizontal mixer P 302.

The screw conveyor T 308 transports the Kaolin to the screw feeder PD 307, from which the fluid jet mill PM 303 is fed.

The product, coming out from the jet mill, is conveyed to the bagging machine PX 304.

baldo & C. srl
CONSULTING ENGINEERS

5.2.3.3 Wettable Powder Production

Hourly production: 500 Kg.

The Kaolin of 44 microns and other igredients required by the specific formula are introduced into the mixer PS 301 where the first homogeneization takes place; the compound is then sent to the mill PM 302 and from here to the bagging machine PX 301.

Should one of the ingredients be liquid, this is introduced into the mixer 301 by means of the pump G 301, only after that all ingredients are already been introduced in the same.

5.2.3.4 Powder Concentrates Production

Hourly production: 500 Kg.

All necessary ingredients required by the specific formula are introduced into the mixer PS 301; after the homogeneization, the compound is sent to the mill PM 302, then to the mixer PS 302 for the final homogeneization and, finally, to the bagging machine PX 301.

In the case the active matter is liquid, proceed as indicated for the W.P.

5.2.3.5 Dry Dust Production

Hourly production: 1000 Kg.

Powder concentrates are introduced into the weighing hopper D 303 together with the deluting product as to form a batch of 1000 Kg. with a proportion as required by the formula. The batch will be sent to the homogeneization in the mixer PS 302 and then to the bagging machine.

5.2.3.6 Production of Powders with active matter up to 50% and 10 to 15 fineness

Hourly Production: 250 Kg.

All ingredients are introduced in the weighing hopper D 303 and from here are sent to the mixer PS 302 for the first homogeneization. The final homogeneization takes place in the mixer PS 303 after that the product has been ground by the jet mill PM 303.

The product is bagged by the machine PX 304 in bags of 25 Kg. In case packaging of 1 or 5 Kg. is required, filling machines PX 302 and PX 303 will be used.

5.2.3.7 Packaging of powder insecticides

Finished products can be packed in containers of 1 Kg, 5 Kg or 25 Kg.

a) 1 Kg. capacity container are formed, filled and sealed by an automatic machine (PX 303) having a max output of 750 Kg/h. The Containers are bags of plastic material. Each bag will have printed the trade name of the product, the content and instruction for the use. The bags coming out form the filling machine will be packed in cartons of 10 bags capacity.

b) 5 Kg. capacity containers already prepared and printed are filled by a filling machine (PX 302) having a max output of 600 Kg/h.
The containers can be bags of paper with an internal line of polythene or totally of polythene.
After filling and sealing, the bags are packed in cartons of 4 bags capacity.

c) 25 Kg. capacity containers are preformed and printed three ply paper bags and are filled by the filling machine PX 302 having a max output of 1500 Kg/h.

The following data sheets indicate the main characteristics of the line equipment.

Line equipment unit prices are also given.

baldo & C. srl
CONSULTING ENGINEERS

Flow Sheet N° 2130-007

ITEM : HOPPER

- IDENTIFICATION TAG : D 301

- QUANTITY : 1

- TYPE : VERTICAL

- CAPACITY (TOTAL) : $3{,}8\ m^3$

- MATERIAL : CARBON STEEL

- DRIVE El. MOTOR :
  REDUCER :
  VARIATOR :

- FUNCTION DESCRIPTION : STORAGE OF GROUND KAOLIN COMING FROM HAMMER MILL (PM 301)

baldo & c. srl
CONSULTING ENGINEERS

Flow Sheet N° 3130-007

ITEM		:	HOPPER
- IDENTIFICATION TAG		:	D 302
- QUANTITY		:	1
- TYPE		:	VERTICAL
- CAPACITY		:	3 m^3
- MATERIAL		:	CARBON STEEL
- DRIVE	El. MOTOR	:	
	REDUCER	:	
	VARIATOR	:	
- FUNCTION DESCRIPTION		:	STORAGE OF GROUND PRODUCT FROM PULVERIZING MILL (PM 302)

baldo & c.
CONSULTING ENGINEERS

Flow Sheet N° B13C-007

ITEM		: HOPPER
- IDENTIFICATION TAG		: D 303
- QUANTITY		: 1
- TYPE		: VERTICAL
- CAPACITY		: 2 m^3
- MATERIAL		: CARBON STEEL
- DRIVE	El. MOTOR	:
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: WEIGHING HOPPER

baldo & c. s.r.l.
CONSULTING ENGINEERS

Flow Sheet N° 3130-007

ITEM : CYCLONE SEPARATOR

- IDENTIFICATION TAG : DC 301

- QUANTITY : 1

- TYPE :

- CAPACITY :

- MATERIAL : CARBON STEEL

- DRIVE EL.MOTOR :
REDUCER :
VARIATOR :

- FUNCTION DESCRIPTION : SEPARATION OF AIR FROM THE GROUND PPODUCT COMING FROM PULVERIZING MILL

- MAIN CHARACTERISTICS : MAX DIAMETER : 1200 mm
TOTAL HEIGHT : 4000 mm

baldo & c. s.r.l.
CONSULTING ENGINEERS

Flow Sheet N° B130-007

ITEM		: PUMP
- IDENTIFICATION TAG		: G. 301
- QUANTITY		: 1
- TYPE		: RECIPROCATING
- CAPACITY		: FLOW 2 ÷ 4 m^3/hr, HEAD 20 m.l.c.
- MATERIAL		: AISI 316
- DRIVE	El.MOTOR	: ADPE 1 KW - 1450 RPM
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: SPRAYING OF THE LIQUID ACTIVE INGREDIENTS

baldo & c. srl
CONSULTING ENGINEERS

Flow Sheet N° B130-001

ITEM : SCALE

- IDENTIFICATION TAG : K 301

- QUANTITY : 1

- TYPE : WITH DIAL

- CAPACITY : 300 Kg.

- MATERIAL :

- DRIVE El. MOTOR :
REDUCER :
VARIATOR :

- FUNCTION DESCRIPTION : WEIGHING OF LIQUID RAW MATERIALS

Flow Sheet N° B130-007

ITEM		: FAN
- IDENTIFICATION TAG		: P 301
- QUANTITY		: 1
- TYPE		: CENTRIFUGAL
- CAPACITY		:
- MATERIAL		: CARBON STEEL
- DRIVE	El.MOTOR	: 110 KW
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: BLOWER FOR THE PULVERIZING MILL (PM 302)

baldo & c. s.r.l.
CONSULTING ENGINEERS

Flow Sheet N° E130-007

ITEM		: FAN
- IDENTIFICATION TAG		: P 302
- QUANTITY		: 1
- TYPE		: CENTRIFUGAL
- CAPACITY		: 5000 m^3/h - 200 mm WATER
- MATERIAL		: CARBON STEEL
- DRIVE	El. MOTOR	: 10 KW - 1450 RPM
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: EXHAUSTER FOR FILTER PF 303

baldo & c. sd
CONSULTING ENGINEERS

Flow Sheet N° B130-007

ITEM	:	ROTARY VALVE
- IDENTIFICATION TAG	:	PD 301, 303, 304, 305, 310, 312
- QUANTITY	:	6
- TYPE	:	AIRLOCK ROTARY VALVE
- CAPACITY	:	
- MATERIAL	:	CAST IRON
- DRIVE el. MOTOR	:	0,5 KW
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	AIRLOCK AND DISCHARGE OF GROUND PRODUCT.

baldo & c. s.r.l.
CONSULTING ENGINEERS

Flow Sheet N° B130-007

ITEM : DRY FEEDER

- IDENTIFICATION TAG : PD 302, 306, 307, 308, 309, 311

- QUANTITY : 6

- TYPE : VOLUMETRIC (WITH SCREW CONVEYOR)

- CAPACITY : 1000 ÷ 3000 l/hr

- MATERIAL : CARBON STEEL

- DRIVE El. MOTOR : 0,75 KW
  REDUCER :
  VARIATOR : N°1

- FUNCTION DESCRIPTION : FEEDING OF FINISHED PRODUCTS TO MILLS (PM 302 AND PM 303) AND PACKING MACHINES (PX 301, 302 303, 304)

baldo & C. s.r.l.
CONSULTING ENGINEERS

Flow Sheet N° B130-007

ITEM		: FILTER
- IDENTIFICATION TAG		: PF 301
- QUANTITY		: 1
- TYPE		: SLEEVE AUTOMATICALLY CLEANING FILTER
- CAPACITY		: 40 SLEEVES - 40 m^2 FILTERING SURFACE
- MATERIAL		: CARBON STEEL
- DRIVE	El.MOTOR	:
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: FOR PULVERIZING MILL (PM 302)

baldo & C. s.r.l.
CONSULTING ENGINEERS

Flow Sheet N° 8130-007

ITEM		: FILTER
- IDENTIFICATION TAG		: PF 302
- QUANTITY		: 1
- TYPE		: SLEEVE AUTOMATICALLY CLEANING FILTER
- CAPACITY		: 24 SLEVES - 24 m^2 FILTERING SURFACE
- MATERIAL		: CARBON STEEL
- DRIVE	El.MOTOR	:
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: FOR FLUID -JET-MILL (PM 303)

Flow Sheet N° B130-007

ITEM		: FILTER
- IDENTIFICATION TAG		: PF 303
- QUANTITY		: 1
- TYPE		: SLEEVE AUTOMATICALLY CLEANING FILTER
- CAPACITY		: 24 SLEEVES - 24 m^2 FILTERING SURFACE
- MATERIAL		: CARBON STEEL
- DRIVE	El. MOTOR	:
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: FILTRATION OF DUST

baldo & C. s.a.
CONSULTING ENGINEERS

Flow Sheet N° B130-007

ITEM : FEEDER

- IDENTIFICATION TAG : PJ 301

- QUANTITY : 1

- TYPE : VENTURI FEEDER

- CAPACITY : UP TO 500 Kg/h

- MATERIAL : CARBON STEEL

- DRIVE
  El.MOTOR :
  REDUCER :
  VARIATOR :

- FUNCTION DESCRIPTION : FEEDING OF FLUID-JETMILL

Flow Sheet N° B130-007

ITEM		: MILL
- IDENTIFICATION TAG		: PM 301
- QUANTITY		: 1
- TYPE		: HAMMER
- CAPACITY		: OUTPUT 1500 Kg/h KAOLIN (FINAL GRANULOMETRY 50 ÷ 500 μ)
- MATERIAL		: CARBON STEEL
- DRIVE	El. MOTOR	: 22 KW
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: GRINDING OF KAOLIN FROM PIECES SMALLER OF 150 mm SIZE TO 50÷500 μ FINENESS

baldo & c. sas
CONSULTING ENGINEERS

Flow Sheet N° B130-007

ITEM : MILL

- IDENTIFICATION TAG : PM 302
- QUANTITY : 1
- TYPE : PULVERIZER
- CAPACITY : OUTPUT 1500 Kg./h OF PURE KAOLIN OR 500 Kg/h OF FORMULATED PESTICIDES
- MATERIAL : CAST IRON AND CARBON STEEL
- DRIVE El. MOTOR : 55 KW
  REDUCER :
  VARIATOR :
- FUNCTION DESCRIPTION : GRINDING OF PURE KAOLIN AND FORMULATED PESTICIDES TO FINENESS 44 μ

baldo & c. s.r.l.
CONSULTING ENGINEERS

Flow Sheet N° B130-007

ITEM	:	MILL
- IDENTIFICATION TAG	:	PM 303
- QUANTITY	:	1
- TYPE	:	FLUID JET
- CAPACITY	:	OUTPUT 300 Kg/h OF PURE KAOLIN OR 250 Kg/h OF FORMULATED PESTICIDES
- MATERIAL	:	HARD STEEL
- DRIVE MOTOR	:	
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	GRINDING OF PURE KAOLIN OF FORMULATED PESTICIDES (FINENESS 10÷15μ)

baldo & c. srl
CONSULTING ENGINEERS

Flow Sheet N° B130-007

ITEM		:	SOLID MIXER
- IDENTIFICATION TAG		:	PS 301, 302, 303
- QUANTITY		:	3
- TYPE		:	HORIZONTAL WITH SINGLE STIRRER
- CAPACITY		:	USEFUL CAPACITY 2000 l.
- MATERIAL		:	CARBON STEEL
- DRIVE	MOTOR	:	N. 2 - 18 KW FOR STIRRER, 2KW FOR EXTRACTOR
	REDUCER	:	
	VARIATOR	:	N. 1
- FUNCTION DESCRIPTION		:	MIXING OF RAW MATERIAL FOR SOLID PESTICIDES FORMULATION
- REMARKS		:	THE MIXER IS EQUIPPED WITH A HOPPER IN THE BOTTOM SO THAT IT IS POSSIBLE TO GET FREE THE MIXING SECTION IMMEDIATELY AFTER THE COMPLETING OF THE WORK. THE HOPPER HAS AN EXTRACTOR SCREW CONVEYOR WITH VARIATOR.

baldo & c. srl
CONSULTING ENGINEERS

Flow Sheet N° B130-007

ITEM : BAG FILLING AND WEIGHING MACHINE

- IDENTIFICATION TAG : PX 301, 304

- QUANTITY : 2

- TYPE : WITH AUTOMATIC STOP ELECTRIC DEVICE

- CAPACITY : UP TO 40 ÷ 60 BAGS/h

- MATERIAL : CARBON STEEL

- DRIVE
  - El. MOTOR :
  - REDUCER :
  - VARIATOR :

- FUNCTION DESCRIPTION : PACKING UP 25 AND 50 Kg. BAGS OF GROUND PRODUCTS

baldo & c. srl
CONSULTING ENGINEERS

Flow Sheet N° B130-007

ITEM		: BAG-FILLING AND WEIGHING MACHINE
- IDENTIFICATION TAG		: PX 302
- QUANTITY		: 1
- TYPE		:
- CAPACITY		: UP TO 100÷150 BAGS/h (FOR THE 5 Kg. BAGS)
- MATERIAL		: CARBON STEEL AND AISI 304
- DRIVE	MOTOR	:
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: PACKING UP 5 AND 25 Kg. BAGS OF FINISHED PRODUCTS.
- REMARKS		: With double screw horizontal deaerator, which discharges the deaerated product directly into the outlet supporting the bag. The bag-holding outlet is supported by a mechanical balance that continously monitors the weight of the product being bagged.

./.

On the end portion of the deaerator there is mounted a small diameter batching screw feeder controlled by a motor speed variator which serves to discharge the last amount of product necessary to attain the final desired weight.
The cycle phases are determined by special electric contacts connected to the balance pointers.
An air pump supplies vacuum necessary to deaerate the product. Potation fo the deaerator screw feeder is controlled by a two-pole motor reduction unit.

Utilities consumptions

Electric energy	:	10 KWh
Compressed air	:	Nl /min 200

baldo & c. srl
CONSULTING ENGINEERS

Flow Sheet N° B130-007

ITEM		: FORM FILL AND SEAL BAGS UNIT
- IDENTIFICATION TAG		: PX 303
- QUANTITY		: 1
- TYPE		:
- CAPACITY		: 12÷20 BAGS/min.
- MATERIAL		: CARBON STEEL AND STAINLESS STEEL
- DRIVE	MOTOR	:
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: PACKING-UP 1 Kg. BAGS OF FINISHED PRODUCTS
- REMARKS		: The unit automatically forms, fills and seals bags from reel-fed thermosealing materials. In particular the unit takes flat film from the reel, forms it over a collar and seals it longitudinally. Product is introduced down the feeding tube. The top of the filled bag and the bottom of the bag being formed are sealed on the

./.

same stroke of the horizontal jaws.
The filled sealed bag is cut away and falls down to the delivery chute.
The unit has infinitely variable speed, safety devices and separate free -standing cabinet for all electrical controls.

Power : 2 KW

The unit is also equipped with a single screw horizontal deaerator working like the one seen for the PX 302.

Flow Sheet N° B130-007

ITEM		: CONVEYOR
- IDENTIFICATION TAG		: T 301
- QUANTITY		: 1
- TYPE		: BELT (5 m LENGTH-0,4 m WIDTH)
- CAPACITY		: 1500÷2000 Kg/h
- MATERIAL		: CAST IRON
- DRIVE	El.MOTOR	: 0,75 KW
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: FEEDING OF KAOLIN TO THE HAMMER MILL (PM 301)

baldo & c. srl
CONSULTING ENGINEERS

Flow Sheet N° B130-007

ITEM		: ELEVATOR
- IDENTIFICATION TAG		: T 302
- QUANTITY		: 1
- TYPE		: BUCKET 10 m LENGTH
- CAPACITY		: 1500÷2000 Kg/h
- MATERIAL		: CARBON STEEL
- DRIVE	El. MOTOR	: 1,5 KW
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: FEEDING OF KAOLIN FROM HAMMER MILL (PM301) TO THE HOPPER (D301)

baldo & C. srl
CONSULTING ENGINEERS

Flow Sheet N° B130-007

ITEM	:	CONVEYOR
- IDENTIFICATION TAG	:	T 303
- QUANTITY	:	1
- TYPE	:	SCREW 100÷150 mm DIAMETER - 4,5 m LENGTH
- CAPACITY	:	1÷2 m^3/h
- MATERIAL	:	CARBON STEEL
- DRIVE El. MOTOR	:	2,2 KW
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	FEEDING OF PULVERIZING MILL (PM302) FROM MIXER (PS 301)

baldo & c. srl
CONSULTING ENGINEERS

Flow Sheet N° B130-007

ITEM	:	CONVEYOR
- IDENTIFICATION TAG	:	T 304
- QUANTITY	:	1
- TYPE	:	SCREW 100÷150 mm DIAMETER, 14 m LENGTH
- CAPACITY	:	1÷2 m^3/h
- MATERIAL	:	CARBON STEEL
- DRIVE El. MOTOR	:	4 KW
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	CONVEYANCE OF KAOLIN FROM THE HOPPER B301 TO THE HOPPER B 303

baldo & c. s.r.l.
CONSULTING ENGINEERS

Flow Sheet N° B130-007

ITEM		: CONVEYOR
- IDENTIFICATION TAG		: T 305
- QUANTITY		: 1
- TYPE		: SCREW 100÷150 mm DIAMETER, 10 m LENGTH
- CAPACITY		: 1÷3 m^3/h
- MATERIAL		: CARBON STEEL
- DRIVE	El.MOTOR	: 3 KW
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: CONVEYANCE OF GROUND PRODUCT FROM MILL PM 302 TO HOPPER D 302

baldo & c. sas
CONSULTING ENGINEERS

Flow Sheet N° B130-007

ITEM		: CONVEYOR
- IDENTIFICATION TAG		: T 306
- QUANTITY		: 1
- TYPE		: SCREW 100÷150 mm DIAMETER, 4,5 m LENGTH
- CAPACITY		: 6÷8 m^3/h
- MATERIAL		: CARBON STEEL
- DRIVE	El. MOTOR	: 2,5 KW
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: CONVEYANCE OF GROUND PRODUCT FROM HOPPER B 302 TO HOPPER B 303

baldo & c. srl
CONSULTING ENGINEERS

Flow Sheet N° B130-007

ITEM	:	CONVEYOR
- IDENTIFICATION TAG	:	T 307
- QUANTITY	:	1
- TYPE	:	SCREW 100÷150 mm DIAMETER, 7 m LENGTH
- CAPACITY	:	6÷8 m^3/h
- MATERIAL	:	
- DRIVE El.MOTOR	:	3 KW
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	CONVEYANCE OF THE PRODUCTS FROM HOPPER D 303 TO MIXER PS 302

baldo & C. sri
CONSULTING ENGINEERS

Flow Sheet N° B130-007

ITEM		: CONVEYOR
- IDENTIFICATION TAG		: T 308
- QUANTITY		: 1
- TYPE		: SCREW 100÷150 mm DIAMETER, 10 m LENGTH
- CAPACITY		: 2÷3 m^3/h
- MATERIAL		: CARBON STEEL
- DRIVE	El. MOTOR	:
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: FEEDING OF FORMULATED PRODUCTS TO PACKING MACHINES AND MILL PM 303

baldo & c. srl
CONSULTING ENGINEERS

Flow Sheet N° B130-007

ITEM		: CONVEYOR
- IDENTIFICATION TAG		: T 309
- QUANTITY		: 1
- TYPE		: SCREW 100÷150 mm DIAMETER, 8,5 m LENGTH
- CAPACITY		: 1÷3 m^3/h
- MATERIAL		: CARBON STEEL
- DRIVE	El.MOTOR	: 3 KW
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: FEEDING OF GROUND PRODUCT FROM MILL PM 303 TO THE PACKING.

Flow Sheet N° B130-007

ITEM : SEWING MACHINE

- IDENTIFICATION TAG :

- QUANTITY : 3

- TYPE : MANUAL

- CAPACITY :

- MATERIAL :

- DRIVE
  - MOTOR :
  - REDUCER :
  - VARIATOR :

- FUNCTION DESCRIPTION : SEWING OF BAGS PNEUMATIC WITH COTTON SEWING THREAD

Powder Insecticides Line Unit Prices

TAG	sh
D 301	103,440
D 302	86,890
D 303+DC 301+P 302	1,379,200
G 301	275,840
K 301	137,920
P 302	206,880
PD 301, 303, 304	413,760
PD 305,310,312	413,760
PD 302,306,307,308,309,311	1,792,960
PF 301,302,303	1,648,145
PJ 301	206,880
PM 301	140,675
PM 302	13,136,720
PM 303	3,992,780
PS 301,302,303	7,236,930
PX 301,304	2,482,560
PX 302	6,399,410
PX 303	6,337,340
T 301	1,379,200
T 302	1,082,600
T 303	1,241,300
T 304	3,448,000
T 305	2,482,560
T 306	1,741,280
T 307	1,792,950
T 308	2,482,560
T 309	2,068,800
TOTAL	65,111,340

5.2.4 Powder Herbicides Line (Flow sheet B130-008) annexe 4

The production of the line is as follows:

a) Wettable Powders (W.P.) with an active matter (liquid or solid) content up to 50% and 44 microns fineness;

b) Powder Herbicides obtained by means of mixing of the ingredients required by the formulas.

c) packaging of powder herbicides

5.2.4.1 Wettable Powders Production

Hourly production 500 Kg/h

The production process is similar to the one described under 5.2.3.3

5.2.4.2 Powder Herbicides Production

All ingredients, having the required granulometry are introduced into the mixer PS 402,in the proportion indicated by the formula, where the homogeneization takes place.
The mixture is then sent to the packing machines PX 401 and 402.

5.2.4.3 Packaging of Powder Herbicides

Finished products can be packed in containers of 1 Kg, 5 Kg or 25 Kg.

a) 1 Kg Capacity Containers, already formed and printed with the trade name, the content and the instructions for the use are of paper with an internal ply of polythene.Bags are filled and sealed by the filling machine PX 402 having a capacity of 450 Kg/h.
The bags coming out from the filling machine will be packed in cartons of 20 bags capacity.

b) 5 Kg. Capacity Containers, already formed and printed with the trade name, the content and the instructions for the use are of paper with an internal play of polythene.
Bags are filled and sealed by the filling machine PX 402, having a capacity of 500 Kg/h.
The bags coming out from the filling machine will be packed in cartons of 4 bags capacity.

c) 25 Kg Capacity Containers, are preformed and printed three ply paper bags and are filled by the filling machine PX 401, having a capacity of 1000 Kg/h

The following data sheets indicate the main characteristics of the line equipment.
Line equipment unit prices are also given.

baldo & c. s.r.l.
CONSULTING ENGINEERS

Flow Sheet N° B130-008

ITEM : CYCLONE SEPARATOR

- IDENTIFICATION TAG : DC 401

- QUANTITY : 1

- TYPE :

- CAPACITY : DIAMETER 1200 mm ca.
  HEIGHT 4000 mm ca.

- MATERIAL : CARBON STEEL

- DRIVE EL.MOTOR :
  REDUCER :
  VARIATOR :

- FUNCTION DESCRIPTION : SEPARATION OF GROUND PRODUCT FROM AIR COMING FROM PULVERIZING MILL.

baldo & c. srl
CONSULTING ENGINEERS

Flow Sheet N° 8130-008

ITEM	:	PUMP
- IDENTIFICATION TAG	:	G 401
- QUANTITY	:	1
- TYPE	:	CENTRIFUGAL
- CAPACITY	:	FLOW 2÷4 m^3/h, HEAD 20 m.l.c.
- MATERIAL	:	AISI 316
- DRIVE EL.MOTOR	:	ADPE 1 KW - 1450 RPM
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	SPRAYING OF LIQUID ACTIVE INGREDIENTS FOR ABSORPTION

Flow Sheet N° B130-008

ITEM : SCALE

- IDENTIFICATION TAG : K 401

- QUANTITY : 1

- TYPE : WITH DIAL

- CAPACITY : 300 Kg.

- MATERIAL :

- DRIVE
  - MOTOR :
  - REDUCER :
  - VARIATOR :

- FUNCTION DESCRIPTION : WEIGHING OF RAW MATERIALS

baldo & c. srl
CONSULTING ENGINEERS

Flow Sheet N° B130-008

ITEM		: FAN
- IDENTIFICATION TAG		: P 401
- QUANTITY		: 1
- TYPE		: CENTRIFUGAL
- CAPACITY		:
- MATERIAL		: CARBON STEEL
- DRIVE	EL.MOTOR	: 11 KW - 2900 RPM
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: BLOWER FOR PULVERIZING MILL (PM 401)

baldo & c. s.r.l.
CONSULTING ENGINEERS

Flow Sheet N° 5130-008

ITEM		: FAN
- IDENTIFICATION TAG		: P 402
- QUANTITY		: 1
- TYPE		: CENTRIFUGAL
- CAPACITY		: 5000 m^3/h 500 mm H_2O
- MATERIAL		: CARBON STEEL
- DRIVE	EL. MOTOR	: 10 KW 1450 RPM
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: EXHAUSTER FOR FILTER PF 402

Flow Sheet N° B130-008

ITEM		: DRY-FEEDER
- IDENTIFICATION TAG		: PD 401,404,405
- QUANTITY		: 3
- TYPE		: VOLUMETRIC (WITH SCREW CONVEYOR)
- CAPACITY		: 1000÷3000 l/h ca.
- MATERIAL		: CARBON STEEL
- DRIVE	EL.MOTOR	: 0,75 KW
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: FEEDING OF PRODUCT TO MILL PM 401 AND PACKING-MACHINES PX 401 and PX 402.

baldo & c.
CONSULTING ENGINEERS

Flow Sheet N° B130-008

ITEM	:	ROTARY VALVE
- IDENTIFICATION TAG	:	PD 402, 403, 406
- QUANTITY	:	3
- TYPE	:	AIRLOCK ROTARY VALVE
- CAPACITY	:	
- MATERIAL	:	CAST IRON
- DRIVE EL.MOTOR	:	0,5 KW
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	AIRLOCK AND DISCHARGE OF GROUND PRODUCT.

baldo & C.
CONSULTING ENGINEERS

Flow Sheet N° B130-008

ITEM

ITEM	:	FILTER
- IDENTIFICATION TAG	:	PF 401
- QUANTITY	:	1
- TYPE	:	AUTOMATIC SLEEVE FILTER
- CAPACITY	:	40 m^2 FILTERING SURFACE 40 SLEEVES
- MATERIAL	:	CARBON STEEL
- DRIVE EL.MOTOR	:	
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	FILTER OF POLVERIZING MILL CPM 401

Flow Sheet N°B132-008

ITEM	:	FILTER
- IDENTIFICATION TAG	:	PF 402
- QUANTITY	:	1
- TYPE	:	AUTOMATIC SLEEVE FILTER
- CAPACITY	:	24 m^2 FILTERING SURFACE 24 SLEEVES
- MATERIAL	:	CARBON STEEL
- DRIVE EL.MOTOR	:	
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	AIR DUST FILTRATION

baldo & c.
CONSULTING ENGINEERS

Flow Sheet N° 5130-008

ITEM	:	MILL
- IDENTIFICATION TAG	:	PM 401
- QUANTITY	:	1
- TYPE	:	PULVERIZING
- CAPACITY	:	500 Kg/h OF FORMULATED POWDER
- MATERIAL	:	CAST IRON AND CARBON STEEL
- DRIVE EL.MOTOR	:	55 KW
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	GRINDING OF HERBICIDE FORMULATED POWDER TO FINENESS 44 μ

Flow Sheet N° B130-008

ITEM	:	SOLID MIXER
- IDENTIFICATION TAG	:	PS 401, 402
- QUANTITY	:	2
- TYPE	:	HORIZONTAL WITH SINGLE STIRRER .
- CAPACITY	:	USEFUL CAPACITY 2000 l
- MATERIAL	:	CARBON STEEL
- DRIVE EL.MOTOR	:	N° 2, 18 KW FOR STIRRER, 2 KW FOR EXTRACTOR
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	MIXING OF RAW MATERIALS FOR SOLID HERBICIDES FORMULATION
- REMARKS	:	The mixer is equipped with a hopper in the bottom so that it is possible to get free the mixing section immediately after the completing of the work. The hopper has an extractor screw conveyor with variator.

Flow Sheet N° B130-008

ITEM	:	BAG FILLING AND WEIWHING MACHINE
- IDENTIFICATION TAG	:	PX 401
- QUANTITY	:	1
- TYPE	:	WITH AUTOMATIC ELECT. STOP DEVICE
- CAPACITY	:	FOR 25 Kg. BAGS UP TO 40÷60 BAGS/h,
- MATERIAL	:	CARBON STEEL
- DRIVE EL.MOTOR	:	
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	PACKING UP 25 AND 50 Kg. BAGS OF FINAL PRODUCT

baldo & c.
CONSULTING ENGINEERS

Flow Sheet N° B130-008

ITEM : BAG-FILLING WEIGHING AND SEALING UNIT

- IDENTIFICATION TAG : PX 402

- QUANTITY : 1

- TYPE :

- CAPACITY : UP TO 600 Kg/h FOR 1 Kg BAGS

- MATERIAL :

- DRIVE EL.MOTOR :
  REDUCER :
  VARIATOR :

- FUNCTION DESCRIPTION : PACKING UP 1 Kg and 5 Kg BAGS OF FINISHED PRODUCT.

- REMARKS : The unit consists of a hopper (500 l about) a vibrating weighing device, a supporting structure for the bags, an heat-sealing machine and a belt conveyor.
  There are required paper bags lined by heat sealing material.

baldo & c. s.r.l.
CONSULTING ENGINEERS

Flow Sheet N° B130-008

ITEM : CONVEYOR

- IDENTIFICATION TAG : T 401

- QUANTITY : 1

- TYPE : SCREW CONVEYOR

- CAPACITY : 1÷2 m^3/h , 100÷150 mm Ø, 5 LENGTH

- MATERIAL : CARBON STEEL

- DRIVE EL.MOTOR : 2,2 KW
  REDUCER :
  VARIATOR :

- FUNCTION DESCRIPTION : FEEDING OF PULVERIZING MILL PM 401 FROM MIXER PS 401

Flow Sheet N° 5130-008

ITEM	:	CONVEYOR
- IDENTIFICATION TAG	:	T 402
- QUANTITY	:	1
- TYPE	:	SCREW CONVEYOR
- CAPACITY	:	1÷2 m^3/h, 100÷150 mm Ø, 8 m LENGTH
- MATERIAL	:	CARBON STEEL
- DRIVE EL. MOTOR	:	3 KW
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	CONVEYANCE OF GROUND PRODUCT FROM MILL PM 401 TO MIXER PS 402

baldo & c. srl
CONSULTING ENGINEERS

Flow Sheet N° B130-008

ITEM	:	CONVEYOR
- IDENTIFICATION TAG	:	T 403
- QUANTITY	:	1
- TYPE	:	SCREW CONVEYOR
- CAPACITY	:	1÷2 m^3/h, 100÷150 mm Ø, 7,5 m LENGTH
- MATERIAL	:	CARBON STEEL
- DRIVE EL.MOTOR	:	3 KW
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	FEEDING OF FORMULATED SOLID HERBICIDES TO PACKING MACHINES

baldo & c. srl
CONSULTING ENGINEERS

Flow Sheet N° 5130-008

ITEM	:	SEWING MACHINE
- IDENTIFICATION TAG	:	
- QUANTITY	:	2
- TYPE	:	PNEUMATIC WITH COTTON SEWING THREAD MANUAL
- CAPACITY	:	
- MATERIAL	:	
- DRIVE EL.MOTOR	:	
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	SEWING OF 25 Kg BAGS

Powder Herbicides Line Unit Prices

TAG	sh
DC 401, P 401, PD 401,402,403, PM 401	
PF 401	15,632,260
G 401	275,840
K 401	137,920
PD 404,405	275,840
PF 402, PD 406	1,648,140
PS 401,402	4,620,320
PX 401	1,241,280
PX 402	3,682,460
T 401	1,310,240
T 402	1,999,840
T 403	1,930,880
TOTAL	32,755,020

5.2.5 Granular Insecticides and Herbicides Line (Flow sheet B130-006) annexe 4

To reduce the investment costs, only one line is foreseen for the production of insecticides and herbicides. From the technical point of view this is possible, since the equipment is very simple and can be easily cleaned. The line is installed in the same building of powder herbicides. The solutions of active matters are produced into the reactor R 501 and then sent to the double-core rotating mixer PS 501 where the granular carrier is previously introduced. Through a nozzle system, the active ingredients are spraied on the granular carriers and adsorbed by them.
When the active matters are produced using solvents, a solvent recovery system will receive the solvents from the mixer PS 501.
The line has a production capacity of 250 Kg/h. All batches will be discharged in drums from which the products will be taken for the hand packaging.
Granular insecticides and herbicides will be packed in bags of 25 Kg, using the floor scale K 502.
Should be required the packaging in containers of 1 Kg or 5 Kg, the filling can be done by means of filling machine PX 402.
The following data sheets indicate the main characteristics of the line equipment.

baldo & c.
CONSULTING ENGINEERS

Flow Sheet N° B130-006

ITEM	:	TANK
- IDENTIFICATION TAG	:	D 501
- QUANTITY	:	1
- TYPE	:	HORIZONTAL
- CAPACITY	:	0,160 m^3
- MATERIAL	:	AISI 316
- DRIVE EL.MOTOR	:	
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	RECOVERY TANK CONDENSED SOLVENT

baldo & c. srl
CONSULTING ENGINEERS

Flow Sheet N° B130-006

ITEM		: TANK
- IDENTIFICATION TAG		: D 502
- QUANTITY		: 1
- TYPE		: VERTICAL
- CAPACITY		: 0,5 m^3
- MATERIAL		: CARBON STEEL
- DRIVE	EL.MOTOR	:
	REDUCER	:
	VARIATOR	:
- FUNCTION DESCRIPTION		: WARM-WATER TANK.

Flow Sheet N° B130-006

ITEM

	:	HEAT EXANGER
- IDENTIFICATION TAG	:	E 501
- QUANTITY	:	1
- TYPE	:	SHELL AND TUBE
- CAPACITY	:	4,5 m^2 SURFACE
- MATERIAL	:	SHELL AISI 316, TUBES AISI 316
- DRIVE EL.MOTOR	:	
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	SOLVENT CONDENSER
- REMARKS	:	TEST PRESSURE 6 Bars.

Flow Sheet N° B130-006

ITEM : CYCLONE SEPARATOR

- IDENTIFICATION TAG : DC 501

- QUANTITY : 1

- TYPE :

- CAPACITY :

- MATERIAL : AISI 316

- DRIVE EL.MOTOR :
REDUCER :
VARIATOR :

- FUNCTION DESCRIPTION : SEPARATION OF POWDER COMING FROM MIXER PS 501

Flow Sheet N° B130-006

ITEM	:	PUMP
- IDENTIFICATION TAG	:	G 501
- QUANTITY	:	1
- TYPE	:	CENTRIFUGAL
- CAPACITY	:	FLOW 2:4 m^3/h, HEAD 20 m.l.c.
- MATERIAL	:	AISI 316
- DRIVE EL.MOTOR	:	ADPE 1 KW, 1450 RPM
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	FEEDING OF SOLVENT TO REACTOR R 501 AND SPRAYING OF DISSOLVED ACTIVE INGREDIENT

baldo & c.
CONSULTING ENGINEERS

Flow Sheet N°B130-006

ITEM	:	LIQUID RING VACUUM PUMP
- IDENTIFICATION TAG	:	G 502
- QUANTITY	:	1
- TYPE	:	CENTRIFUGAL
- CAPACITY	:	FLOW 100 m^3/h at 60 Torr
- MATERIAL	:	CAST IRON
- DRIVE EL.MOTOR	:	5 KW, 1430 RPM
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	VACUUM FOR RECOVERY OF SOLVENT

Flow Sheet N°B130-006

ITEM	:	PUMP
- IDENTIFICATION TAG	:	G 503
- QUANTITY	:	1
- TYPE	:	CENTRIFUGAL
- CAPACITY	:	FLOW 10 m^3/h HEAD 10 m.l.c.
- MATERIAL	:	AISI 304
- DRIVE EL.MOTOR	:	0,5 KW, 2900 RPM
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	FEEDING OF WARM WATER TO THE JACKET OF MIXER PS 501

baldo & c. s.r.l.
CONSULTING ENGINEERS

Flow Sheet N° B130-006

ITEM : FLOOR SCALE

- IDENTIFICATION TAG : K 501

- QUANTITY : 1

- TYPE : WITH DIAL

- CAPACITY : 300 Kg.

- MATERIAL :

- DRIVE EL.MOTOR :
REDUCER :
VARIATOR :

- FUNCTION DESCRIPTION : WEIGHING OF SOLVENT

baldo & c.
CONSULTING ENGINEERS

Flow Sheet N°B130-006

ITEM : FLOOR SCALE

- IDENTIFICATION TAG : K 501

- QUANTITY : 2

- TYPE : WITH DIAL

- CAPACITY : 300 Kg

- MATERIAL :

- DRIVE EL.MOTOR :
REDUCER :
VARIATOR :

- FUNCTION DESCRIPTION : PACKING OF 25 Kg BAGS OF FINAL PRODUCT

Flow Sheet N°B130-006

ITEM	:	ROTARY MIXER AND DRYER
- IDENTIFICATION TAG	:	PS 501
- QUANTITY	:	1
- TYPE	:	HORIZZONTAL
- CAPACITY	:	TOTAL CONTAINER CAPACITY 2000 l
- MATERIAL	:	CARBON STEEL AND AISI 316
- DRIVE EL.MOTOR	:	5 KW 1450 RPM
REDUCER	:	FROM 1450 TO 2,5÷5 RPM
VARIATOR	:	
- FUNCTION DESCRIPTION	:	PRODUCTION OF GRANULAR INSECTICIDES AND HERBICIDES
- REMARKS	:	Consist of a rotary double cone jacketed container, dryied by means of thermoregulated hot water circulating in the jacket. The mixer is equipped with: thermoregulator for hot water, cyclone separator for powder, recovery solvent condensator, recovery tank, vacuum unit. Liquid solution can be sprayed inside without stopping the rotary movement.

baldo & c.
CONSULTING ENGINEERS

Flow Sheet N°B130-006

ITEM

	:	REACTOR
- IDENTIFICATION TAG	:	R 501
- QUANTITY	:	1
- TYPE	:	VERTICAL CYLINDRICAL VESSEL WITH MIXER (SEE PA 501)
- CAPACITY	:	0,3 m^3
- MATERIAL	:	AISI 316
- DRIVE EL.MOTOR	:	
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	SOLUTION OF ACTIVE INGREDIENTS FOR GRANULARS

baldo & c.
CONSULTING ENGINEERS

Flow Sheet N° B130-006

ITEM	:	MIXER
- IDENTIFICATION TAG	:	PA 501
- QUANTITY	:	1
- TYPE	:	WITH PROPELLER
- CAPACITY	:	
- MATERIAL	:	AISI 316 (CONTACT PARTS)
- DRIVE EL.MOTOR	:	ADPE 1 KW 200 RPM
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	MIXER FOR REACTOR R 501

Granular Insecticides and Herbicides Line Unit Prices

TAG	sh
D 501	827,520
D 502	68,960
E 501	2,568,800
DC 501	1,241,280
G 501	620,640
G 502	827,520
G 503	551,680
K 501	137,920
K 502	137,920
PS 501	3,542,435
R 501	137,920
PA 501	137,920
TOTAL	10,800,515

5.3 Utilities

5.3.1 Industrial Water (flow diagram B130-009) annexe 4

Industrial water will be taken from the Nile River by the pump G 601 and sent to a reinforced concrete tank having a capacity of 80 m^3. The tank is divided into two sections; the water coming from the river will enter the first section of the tank and will pass to the second section by over flowing, thus permitting to impurities to sediment. The pump G 602 will feed the industrial water system, while the pump G 603 will feed the potable water system.
The industrial water system will be used also as fire fighting net work. In case of fire, the system will be fed by motor pump G 608.

5.3.2 Drinking Water

Pump G 603 will feed the system making the water flow through the quartz sand filter DF 602 and the reactor R 601 where calcium hypochloride is added. The active carbon filter will remove the calcium hypochloride in eccess.

5.3.3 Hot Water

Hot water is produced by a diesel oil burn boiler and it is used for the heating of drums, granulars production.

5.3.4 Compressed Air

Compressed air is required by the filling machines, pneumatic tools, instrumentation and the jet-mill.

5.3.5 Electric Installations

5.3.5.1 Electric Cabine

A 20 KV overhead line is passing near the plant site. This line will feed the plant through an incoming line connected to the M.V. section of a metal Clad Power Center, which consists:

- M.V. section, containing the disconnecting switches, automatic braker, measuring instruments and protection devices.

. 800 KVA 20/0.38/0.220 KV transformer

. L.V. section, containing the general automatic braker, an automatic braker on each outgoing line, feeding a specific M.C.C. and a specific lighting panel.

The connection between the Power Center, the Motor Control Centers and the Lighting Panels will be made by means of cables of proper section, rubber insulated, layd down either in trenches, conduit pipes or cable trays.

5.3.5.2 Motor Control Center

Motor Control Centers are foreseen one per each production unit. Each M.C.C. will contain disconnecting switches, fuses , contactors push buttons and indicating lamps.

The M.C.C. of liquid pesticides production lines will be of explosion proof construction.

5.3.5.3 Control Panels

Each production line will be controlled by a Control Panel, of synoptic type, in which logic relays, push buttons, and lamps will be installed.

5.3.5.4 Lighting System

Each building will be provided with a lighting panel, fed by a general lighting panel.

Buildings normal lighting will be by means of fluorescent tube fixtures with ballast , starter and capacitor.

The illumination level will be as follows:

. offices, production department, electric cabin gate house — 250 LUX

. warehouse, Kaolin deposit, drums deposit — 100 LUX

External lighting will be by means of Hg 400W lamps fixtures with ballast.The illumination level will be 30 LUX.

The fixtures will be mounted on the top of poles, 12 m high.

The emergency lighting will consist of indipendent lighting fixtures, with battery and battery charger enclosed.

5.3.5.5 Earthing System

A general earthing network will be provided and it will consist of a grid of copper wire connected to a sufficient number of electrodes of at least 3 meter long embedded in the soil. Each electrode connection point will be protected by a concrete pit of 60 cm diameter and 1 meter deep. The pit will have a cover at soil level.

All equipment and steel structures will be connected to the general earth network by means of an insulated copper wire of proper section.

In the case some building is of steel structures a Faraday cage of galvanized steel strip will be provided.

The Faraday cage will be connected to indipendent electrodes.

5.3.5.6 Fire fighting System

Fire fighting system consists of a number of hose cabinets connected to the industrial water distribution main and located in the production buildings, the warehouse and the drums deposit.

An appropriate number of portable CO_2 estinguishers will be provided for the offices, the electric cabin and the maintenance workshop.

5.3.5.7 Data Sheets

The following data sheets indicate the main characteristics of the utilities equipment.

Flow Sheet N° B130-009

ITEM	:	KIER
- IDENTIFICATION TAG	:	B 601
- QUANTITY	:	1
- TYPE	:	DIESEL OIL FIRED
- CAPACITY	:	250,000 K cal
- MATERIAL	:	
- DRIVE EL.MOTOR	:	
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	HOT WATER PRODUCTION

baldo & c.
CONSULTING ENGINEERS

Flow Sheet N° B130-009

ITEM : TANK

- IDENTIFICATION TAG : D 601

- QUANTITY : 1

- TYPE : HORIZONTAL

- CAPACITY : 5 m^3

- MATERIAL : CARBON STEEL

- DRIVE EL. MOTOR :
REDUCER :
VARIATOR :

- FUNCTION DESCRIPTION : STORAGE OF DIESEL OIL FOR KIER

baldo & c. srl
CONSULTING ENGINEERS

Flow Sheet N° B130-009

ITEM	:	TANK
- IDENTIFICATION TAG	:	D 602
- QUANTITY	:	1
- TYPE	:	VERTICAL
- CAPACITY	:	0.5 m^3
- MATERIAL	:	HOT GALVANIZED STEEL
- DRIVE EL.MOTOR	:	
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	PRESSURE TANK FOR INDUSTRIAL WATER (MAX 8 bars)

baldo & c. srl
CONSULTING ENGINEERS

Flow Sheet N° B130-009

ITEM	:	TANK
- IDENTIFICATION TAG	:	D 603
- QUANTITY	:	1
- TYPE	:	VERTICAL
- CAPACITY	:	0.2 m^3
- MATERIAL	:	POLYETHYLENE
- DRIVE EL.MOTOR	:	
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	DISSOLVER FOR THE REACTIVE

baldo & c. srl
CONSULTING ENGINEERS

Flow Sheet N° B130-009

ITEM : TANK

- IDENTIFICATION TAG : D 604

- QUANTITY : 1

- TYPE : VERTICAL

- CAPACITY : 0.5 m^3

- MATERIAL : HOT DIP GALVANIZED STEEL

- DRIVE
  - EL.MOTOR :
  - REDUCER :
  - VARIATOR :

- FUNCTION DESCRIPTION : PRESSURE TANK FOR DRINKING WATER (MAX PRESSURE 8 bars)

baldo & c.
CONSULTING ENGINEERS

Flow Sheet N° B130-009

ITEM : FILTER

- IDENTIFICATION TAG : DF 601

- QUANTITY : 1

- TYPE : AUTOMATIC WITH QUARTZ SAND

- CAPACITY : 15 m^3/h

- MATERIAL : HOT DIP GALVANIZED STEEL

- DRIVE
  - EL.MOTOR :
  - REDUCER :
  - VARIATOR :

- FUNCTION DESCRIPTION : INDUSTRIAL WATER FILTRATION

Flow Sheet N° B130-009

ITEM	:	FILTER
- IDENTIFICATION TAG	:	DF 602
- QUANTITY	:	1
- TYPE	:	AUTOMATIC WITH QUARTS SAND
- CAPACITY	:	15 m^3/h
- MATERIAL	:	HOT DIP GALVANIZED STEEL
- DRIVE EL.MOTOR	:	
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	DRINKING WATER FILTRATION

baldo & c.
CONSULTING ENGINEERS

Flow Sheet N° B130-009

ITEM	:	FILTER
- IDENTIFICATION TAG	:	DF 603
- QUANTITY	:	1
- TYPE	:	ACTIVE CARBON
- CAPACITY	:	15 m^3/h
- MATERIAL	:	HOT DIP GALVANIZED STEEL
- DRIVE EL.MOTOR	:	
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	DRINKING WATER FILTRATION

baldo & c. srl
CONSULTING ENGINEERS

Flow Sheet N° B130-009

ITEM : PUMP

- IDENTIFICATION TAG : G 601

- QUANTITY : 1

- TYPE : VERTICAL

- CAPACITY : 30 m^3/h 50 m.l.c. HEAD

- MATERIAL : CAST IRON

- DRIVE EL.MOTOR : 10 KW-2900 RPM WEATHER PROOF
  REDUCER :
  VARIATOR :

- FUNCTION DESCRIPTION : NILE RIVER WATER INTAKE PUMP

baldo & c.
CONSULTING ENGINEERS

Flow Sheet N° B130-009

ITEM	:	PUMP
- IDENTIFICATION TAG	:	G 602
- QUANTITY	:	1
- TYPE	:	VERTICAL
- CAPACITY	:	15 m^3/h m.l.c. HEAD
- MATERIAL	:	CAST IRON
- DRIVE EL.MOTOR	:	3 KW - 2900 RPM WEATHER PROOF
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	SUPPLY OF INDUSTRIAL WATER

baldo & C.
CONSULTING ENGINEERS

Flow Sheet N° B130-009

ITEM	:	PUMP
- IDENTIFICATION TAG	:	G 603
- QUANTITY	:	1
- TYPE	:	VERTICAL
- CAPACITY	:	15 m^3/h 24 m.l.c. HEAD
- MATERIAL	:	CAST IRON
- DRIVE EL. MOTOR	:	3 KW - 2900 RPM WEATHER PROOF
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	SUPPLY OF DRINKING WATER

baldo & c.
CONSULTING ENGINEERS

Flow Sheet N° B130-009

ITEM : PROPORTIONING PUMP

- IDENTIFICATION TAG	:	G 604
- QUANTITY	:	1
- TYPE	:	RECIPROCATING
- CAPACITY	:	11 l/h 75 m.l.c.
- MATERIAL	:	POLYETHYLENE
- DRIVE EL.MOTOR	:	90 W
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	REACTIVE PROPORTIONING

baldo & c.
CONSULTING ENGINEERS

Flow Sheet N° B130-009

ITEM	:	PUMP
- IDENTIFICATION TAG	:	G 605
- QUANTITY	:	1
- TYPE	:	CENTRIFUGAL
- CAPACITY	:	5 m^3/h 20 m.l.c. HEAD
- MATERIAL	:	CAST IRON
- DRIVE EL. MOTOR	:	1.5 KW 2900 RPM
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	HOT WATER CIRCULATION

Flow Sheet N° B130-009

ITEM	:	PUMP
- IDENTIFICATION TAG	:	G 606
- QUANTITY	:	1
- TYPE	:	CENTRIFUGAL
- CAPACITY	:	10 m^3/h 20 m.l.c. HEAD
- MATERIAL	:	CAST IRON
- DRIVE EL.MOTOR	:	2.2 KW 290 RPM
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	RETURN OF HOT WATER TO KIER

Flow Sheet N° B130-009

ITEM		:	PUMP
- IDENTIFICATION TAG		:	G 607
- QUANTITY		:	1
- TYPE		:	CENTRIFUGAL
- CAPACITY		:	20÷40 l/h 30 m.l.c. HEAD
- MATERIAL		:	CAST IRON
- DRIVE	EL.MOTOR	:	0.5 KW 1450 RPM EXPLOSION PROOF
	REDUCER	:	
	VARIATOR	:	INCLUDED
- FUNCTION DESCRIPTION		:	KIER FUEL FEEDING PUMP

baldo & c.
CONSULTING ENGINEERS

Flow Sheet N° B130-009

ITEM		:	PUMP
- IDENTIFICATION TAG		:	G 608
- QUANTITY		:	1
- TYPE		:	CENTRIFUGAL
- CAPACITY		:	30 m^3/h 50 m.l.c. HEAD
- MATERIAL		:	CAST IRON
- DRIVE	MOTOR	:	DIESEL ENGINE
	REDUCER	:	
	VARIATOR	:	
- FUNCTION DESCRIPTION		:	INDUSTRIAL WATER EMERGENCY PUMP

baldo & c.
CONSULTING ENGINEERS

Flow Sheet N° B130-009

ITEM	:	AIR COMPRESSOR
- IDENTIFICATION TAG	:	P 601
- QUANTITY	:	1
- TYPE	:	RECIPROCATING
- CAPACITY	:	1100 l/m - 7 bars
- MATERIAL	:	
- DRIVE EL.MOTOR	:	11 KW 2900 RPM
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	PRODUCTION OF COMPRESSED AIR FOR PNEUMATIC EQUIPMENT

baldo & c.
CONSULTING ENGINEERS

Flow Sheet N° B130-009

ITEM : AIR COMPRESSOR

- IDENTIFICATION TAG : P 602

- QUANTITY : 1

- TYPE : ROTATING

- CAPACITY : 16.5 m^3/m 13 bars

- MATERIAL :

- DRIVE
  - EL.MOTOR : 110 KW - 2900 RPM
  - REDUCER :
  - VARIATOR :

- FUNCTION DESCRIPTION : SUPPLY OF COMPRESSED AIR FOR MICRONIZER

Flow Sheet N° B130-009

ITEM	:	STIRRER
- IDENTIFICATION TAG	:	PA 601
- QUANTITY	:	1
- TYPE	:	PROPELLER
- CAPACITY	:	
- MATERIAL	:	EBANITATED STEEL
- DRIVE EL.MOTOR	:	0.1 KW
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	MOUNTED ON D 603

baldo & c.
CONSULTING ENGINEERS

Flow Sheet N° B130-009

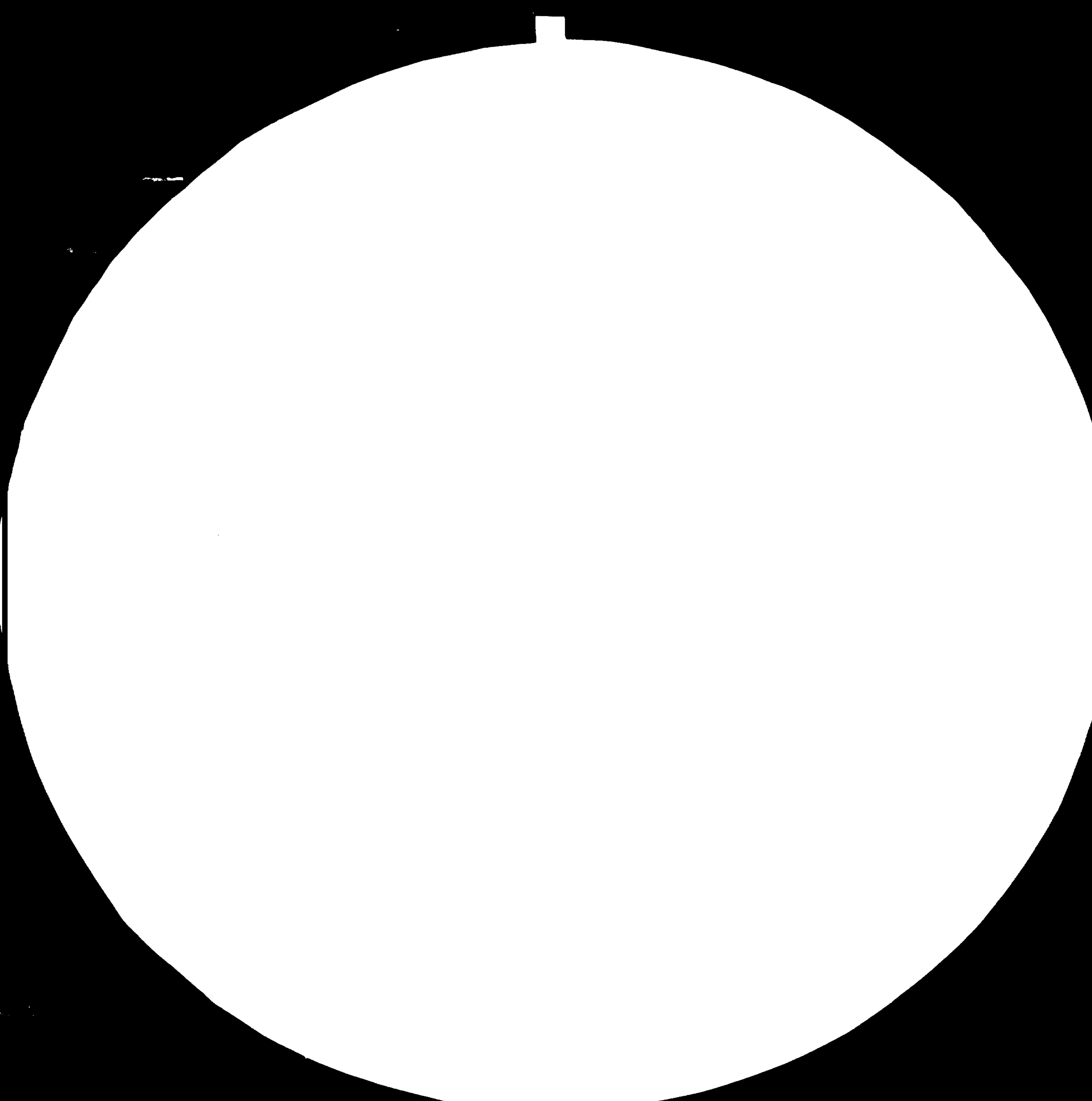
ITEM	:	STIRRER
- IDENTIFICATION TAG	:	PA 602
- QUANTITY	:	1
- TYPE	:	PROPELLER
- CAPACITY	:	
- MATERIAL	:	EBANITATED STEEL
- DRIVE EL.MOTOR	:	0.4 KW
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	MOUNTED ON R 601

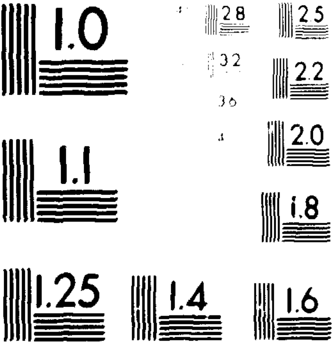
baldo & c.
CONSULTING ENGINEERS

Flow Sheet N° B130-009

ITEM

ITEM	:	REACTOR
- IDENTIFICATION TAG	:	R 601
- QUANTITY	:	1
- TYPE	:	VERTICAL
- CAPACITY	:	5 m^3
- MATERIAL	:	HOT DIP GALVANIZED STEEL
- DRIVE EL.MOTOR	:	
REDUCER	:	
VARIATOR	:	
- FUNCTION DESCRIPTION	:	TREATMENT OF DRINKING WATER





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS
STANDARD REFERENCE MATERIAL 1010a
(ANSI and ISO TEST CHART No. 2)

baldo & c. srl
CONSULTING ENGINEERS

Utilities Unit Prices

TAG	sh
B 601	1,034,400
D 601	137,920
D 602	82,750
D 603	68,960
D 604	82,750
DF 601	386,170
DF 602	386,170
DF 603	206,880
G 601	275,840
G 602	82,750
G 603	82,750
G 604	27.580
G 605	137,920
G 606	137,920
G 607	437,450
G 608	827,520
P 601	800,000
P 602	4,400,000
PA 601	41,375
PA 602	41,375
R 601	413,760
TOTAL	10,089,240

5.4 Laboratory

The analyses laboratory will be equipped with the following:

1 Precision analytical balance, 0,1 mmg sensibility

1 Electrical heater for ballon of 100 ml

2 Electrical heaters for ballon of 500 ml

1 Water still

1 Magnetic stirrer

1 200 l refrigerator

2 Vacuum pumps

2 Measuring burettes of 50ml (graduation 0,1 ml)

5 Precision thermometer 0÷150 °C

2 Bunsen lamps

2 Beakers of 100, 400, 600 ml

1 Laboratory bench, with exhausting hood

1 Set of glassware

1 Cabinet for glassware and reagents

baldo & C.
CONSULTING ENGINEERS

Laboratory Unit Prices	sh
1 Precision balance	135,000
1 Electrical heater for ballon of 100 ml	20,000
2 Electrical heaters for ballon fo 500 ml	50,000
1 Water still	600,000
1 Magnetic stirrer	12,000
1 200 L refrigerator	120,000
2 Vacuum pumpes	350,000
2 Meausuring burettes of 50 ml (graduation 0.1 ml)	12,000
5 Precision thermometers 0÷150 °C	12,000
2 Bunsen lamps	6,000
2 Beakers of 100, 400, 600 ml	6,000
1 Laboratory bench, with exhausting hood	10,000
1 Set of glassware	[illegible]
1 Cabinet for glassware and reagents	20,000
TOTAL	2,663,000

5.5 Maintenance Workshop

A maintenance workshop is foreseen for the carrying out of normal maintenance of the plant.
The workshop is provided with work benches, 1 lathe, 1 wheel grinding machine, 1 motor shear for steel profiles, 1 electric welder, 1 vertical drilling machine, 1 set of mechanical hand tools, 2 sets of electrical hand tools. Amperemeter, Voltmeters etc.

5.6 Transport Equipment

For the transport of raw materials, finished products and personnel, the following equipment is foreseen:

1 wheel loader with a bucket of 1.5 m^3 nominal capacity used for the transport of Kaolin from the deposit to the powder production lines.

2 diesel engine fork-lifts, for the transport of palletized products, with a capacity of 2 tons and max height of 4 m.

2 diesel engine lorries, having a capacity of 10 T

2 Land Rover type cars.

5.7 Plant location

A plot of 6.7 acres is available at Jinja, within the industrial area. The exact location is indicated in the map, attached as annexe 3
The plot is the property of the promoter and it is available free of charge.
Although no soil investigations have been carried out, the available area, visited during the field mission, appears suitable for the installation of the plant. Its surface is flat and only reduced upgrading works are required.
Its position is ideal for several reason: a) it is close to the railroad trunk connecting the Jinja railroad station to the National railroad network: it means that, should be the case, a connection to this trunk can be executed;
b) it is close to the Nile River, from which the water required for the process for the utilities and for human use can be pumped.

c) a M.V. overhead line is passing near; d) it is connected to the National road network and its vicinity to Jinja town, will permit an easily deplacement of personnel.

baldo & c.
CONSULTING ENGINEERS

Maintenance workshop Unit Prices		sh
3 Workbenches		1,200,000
1 Lathe		5,360,000
1 Wheel grinding machine		800,000
1 Motor shear		800,000
1 Electric Welder		400,000
1 Vertical driller		2,800,000
1 Set mechanical handtools		400,000
2 Sets of electrical handtools		480,000
1 Series of instruments		320,000
	TOTAL	12,560,000

5.8 Civil Works and buildings

5.8.1 Civil works

The plot available has a shape that allows a very rational lay-out of the plant.
The total area will be isolated by a perimetral fencing, the lowest part of which will be in concrete up to 40 cm. above the plant 0.00 level; over the concrete, a plastified net, 2.60 m high, will be installed, except in the front side, where a grid made by square steel bars, will be installed.
The bars will be 2.60 m high and welded with a span of 10÷15 cm, on three longitudinal bars of same section, positioned one in the middle and the other two one meter above and one meter below of the ℄
Two gates are foreseen in the front side: one for the trucks, lorries and cars entrance and one for the personnel entrance. Both gates will be under control of the security personnel: the opening and closing of the main one will be motor operated, with photocell safety control.
Most of the area around the buildings will be compacted up to 95%, according to the AASHO standard and asphalted in order to allow the normal circulation of vehicles.
The remaining area will be covered by grass and trees.
Before the paving, drainage system, embedded piping, ground network etc. shall be laid down, according to the drawings.
Civil works include the water intake and the reinforced concrete tank, foreseen for the industrial and potable water system.

5.8.2 Buildings (See lay-out B 130 - 010) annexe 4

5.8.2.1 Gate house

Close to the personnel entrance, a gate house is foreseen to lodge the security personnel and the weighing bridge remote control, the external lighting control panel and the gates control panel.
The building covers an area of 30 sq. m and is built in concrete (frame) and masonry (external and partition walls).

The roof has a concrete structure, over which a slab of concrete is poured. The external side of the roof is covered by a three plays of bitouminous paper laid over a polyethylene foil. The roof finishing consists of a 1 cm. thick of bitumen.
The internal and external plastering is by means of sand and cement mortar, painted with washable varnish.
The paving will be in anti-dust concrete, cast over a ballast sub-base of 25 cm. thickness.
Doors and windows will be in painted steel frames and transparent flat glass.

5.8.2.2 Administration Building

The administration building covers an area of 300 sqm. Its construction characteristics are those described for the gate house.
The internal finishing will be of higher standard of those of the gate house: locker rooms, rest rooms internal walls will be covered by wall tiles up to 2.5 m from the floor.
The paving will be in concrete, poured over a ballast sub-base of 2 cm. thickness. The concrete will be covered by linoleum foils.

5.8.2.3 Raw Kaolin Deposit (see dwg B 130-011) annexe 4

The raw Kaolin deposit is a shed made in steel structure, covering an area of 300 sqm. The front side has a width of 30 m and an eight of 6 m. The lateral side has a width of 10 m.
Around the lateral sides and backside a reinforced concrete wall, 2.5 m high, is foreseen, to contain the Kaolin. The paving will consist of a slab of concrete, poured over a ballast sub-base of 25 cm thickness.
The floor shall be suitable for a load of 2 tons/sqm.

5.8.2.4 Raw Materials and Finished Products Warehouse (see dwg. B130-011) annexe 4

A three bay building covering an area of 3000 sqm is foreseen for the storage of raw materials, packing materials and finished products.
The building is in steel structure and the roof is of corrugated galvanized steel sheets.

The cladding is in concreteblocks from the 0.00 level up to 6.5m. Above the cladding, all around the building a strip of windows 1.5 m high is foreseen, to allow inside natural lighting.
The doors, sliding type, will be in steel frame and painted steel sheets.
The paving is in concrete, poured over a ballast sub-base; the floor shall be suitable for a load of 1000 Kg/sqm. Inside the building, a series of metallic racks, 6 m high, is foreseen for the proper storage of raw materials and finished products.

5.8.2.5 Powder Insecticides Production Building (see dwg B130.03) annexe 4

The equipment of powder insecticides production line is installed in a two bay building of 1120 sqm.
This building is in steel structure and the roof is of corrugated galvanized steel sheets.
The cladding is partly in concrete blocks (lower part) and partly in galvanized corrugated steel sheets.
The doors, sliding type, will be in steel frame and painted steel sheets.
The paving is in concrete, poured over a ballast sub-base; the floor shall be suitable for a load of 1000 Kg./sqm.

5.8.2.6 Powder Herbicides and Granulars Production Bldg (see dwg B130.005) annexe 4

The equipment of powder herbicides and granulars production lines is installed in a building of 450 sqm. Its construction characteristics are similar to those of the powder insecticides building.

5.8.2.7 Liquid insecticides and Herbicides Formulation Building (see dwg B130.002) annexe 4

Almost all the equipment for the formulation of the liquid insecticides and herbicides is installed in a building of 200 sqm, while some machinery and equipment is installed outside the perimeter of the building.

The building is in steel structure and the roof is of corrugated galvanized steel sheets.
A partition wall in concrete bricks separates the two departments.
No cladding is foreseen: only a strip of 3m of corrugated galvanized steel sheet is installed all around the perimeter just below the roof, to protect the equipment from the sunshine and rain.
The paving is in concrete, poured over a ballast sub-base and it shall be suitable for a load of 500 Kg/sqm.

5.8.2.8 Liquid Insecticides and Herbicides Packing Building (see dwg B130-002) annexe 4

This building covers an area of 300 sqm and its characteristics are the same of the one where the formulation takes place.

5.8.2.9 Drums Deposit Shed (see dwg. B130-011)

The shed covers an area of 300 sqm.: it is in steel structure, with a roof in galvanized corrugated steel sheets. No cladding is provided.
The paving is in concrete, poured over ballast subbase and it shall be suitable for a load of 5000 Kg/sqm.

5.8.2.10 Electric Cabin and Maintenance Workshop Building

The building covers an area of 80 sqm. and it is built in concrete (frame) and masonry (external and partition walls). The roof has a concrete structure, over which a slab of concrete is poured. The external side of the roof is covered by a three play of bitouminous paper laid on a polyethilene foil.
The roof finishing consists of a 1 cm. thick of bitumen.
The internal end external plastering is by means of cement and sand mortar, painted with washable varnish.
The paving will be anti-dust concrete, cast over a ballast subbase of 25 cm/ thickness.
Doors and windows will be in painted steel frames and transparent flat glass.

5.8.3 Civil Works and Building Costs breakdown

5.8.3.1 Civil works

	sh
Soil Investigation	5,000,000
Site preparation	15,000,000
Roads and yards	65,000,000
Fencing	15,000,000
Sewage system	45,000,000
Water intake and tank	15,000,000
TOTAL	160,000,000

5.8.3.2 Buildings

	sqm	sh/sqm	Total
Gate house	30	100,000	3,000,000
Office building	300	134,000	40,000,000
Raw Kaolin deposit	300	10,000	3,000,000
Powder Insecticides prod. bldg.	1120	60,000	67,200,000
Powder Herbicides and granules bldg.	450	60,000	27,000,000
Liquids formulation bldg.	200	45,000	9,000,000
Liquids packaging bldg.	300	45,000	13,500,000
Drums deposit	300	5,000	1,500,000
Warehouse	3000	72,000	216,000,000
Electric cabin	80	100,000	8,000,000
		TOTAL	388,200,000

5.9 Implementation Schedule

The following diagram indicates the various phases and time required for the project implementation.

baldo & c.
CONSULTING ENGINEERS

CLIENT UNIDO VIENNA SITE UGANDA
SUBJECT IMPLEMENTATION SCHEDULE

ESTIMATING
DATE
SIGN Sh /

DESCRIPTION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	UM	Qty	[illegible]	TOTAL HOURS
SIGNING OF CONTRACT	▼																											
SITE TOPOGRAPHICAL SURVEY	X																											
SOIL TESTS	X																											
DESIGN AND DETAIL ENGINEERING	X X	X X	X X	X X	X X	X X	X X																					
EARTHWORKS					X X	X X																						
CIVIL WORKS EXECUTION							X X	X X	X X	X X	X X	X X	X X	X X	X X	X X												
DELIVERY OF EQUIPMENT												X X	X X	X X	X X	X X	X X	X X	X X									
MECHANICAL ERECTION																X X	X X	X X	X X	X X	X X							
ELECTRICAL+INSTR. INSTALL.																	X X	X X	X X	X X	X X							
DELIVERY OF RAW MATERIALS																					X X	X X						
TRIAL TESTS																							X X	X				
COMMISSIONING																								X				

CHAPTER 6

ECONOMIC AND FINANCIAL STUDY

6. ECONOMIC AND FINANCIAL STUDY

From the market study it appears that a considerable amount of pesticides, herbicides and fungicides are presently imported in Uganda and the technical study has shown how some of these products can be formulated locally and which technology is the most appropriate.
In the following paragraphs the investment needed will be estimated and the operational costs assessed in order to study the feasibility of the project from the economic point of view.

6.1 Investment requirements for the new factory

The following notes apply:
All values are expressed in Uganda Shillings.
For the imports the window one exchange ratio has been considered

1 US Doll : 120 Shillings

The following estimates are based on prices in force during the third quarter of 1983. Equipment is considered to be imported with exception of taxes and duties.

6.1.1 The Plant

	sh
Production Buildings	103,200,000
Liquids Packaging building	13,500,000
Warehouse	216,000,000
Drums deposit	1,500,000
Civil works	160,000,000
Offices buildings	40,000,000
Electric cabin building	8,000,000
Gate house	3,000,000
Kaolin deposit	3,000,000
Process equipment	132,987,760
Utilities equipment	10,089,240
Laboratory equipment	2,663,000
Workshop equipment	12,560,000
Water supply installations	8,000,000
Compressed air installations	2,100,000
Electric system	42,600,000
Office and social services furniture	5,000,000
Erection and installation	25,000,000
Freight	4,000,000
Trucks, cars and internal transport	35,000,000
Design, know-how, tech. assistance and training	37,500,000
Total	865,700,000
Contingencies	84,300,000
GRAND TOTAL	950,000,000

In the next pages, investment costs break-down is provided for each production line. The figures of the process equipment correspond to the actual costs estimate. All other figures are expressed in percent of the figures indicated under point 6.1.1 The percentage apportioning has been made proportionally to the production output. The figure of the powder insecticides production building corresponds to the actual cost estimate.

6.1.1.1 Apportioned required investment for the liquid insecticides production line

Annual Production 1630 T

	Percentage	sh
Process equipment		15,723,435
Production building	60	5,000,000
Packaging building	60	7,500,000
Utilities equipment	25	2,522,315
Laboratory equipment	25	665,750
Workshop equipment	25	3,140,000
Warehouse	25	54,000,000
Drums deposit	60	900,000
Civil works	25	40,000,000
Offices building	25	10,000,000
Electric cabin building	25	2,000,000
Gate house	25	750,000
Kaolin deposit	N.A.	
Water supply installation	20	1,600,000
Compressed air installations	20	420,000
Electric system	20	8,520,000
Design, Know-how, tech. assistance and training	20	7,500,000
Erection and installation	20	5,000,000
Freight	20	800,000
Trucks, cars and internal transport	20	7,000,000
Office and social services furniture	20	1,000,000
	Total	174,041,500
	Contingencies	16,947,785
	GRAND TOTAL	190,989,285

6.1.1.2 Apportioned required investment for the liquid herbicides production line

Annual Production 560 T

	Percentage	sh
Process equipemnt		8,597,450
Production building	40	4,000,000
Packaging building	40	6,000,000
Utilities equipment	20	2,017,845
Laboratory equipment	20	532,600
Workshop equipment	10	1,256,000
Warehouse	10	21,600,000
Drums deposit	40	600,000
Civil works	10	16,000,000
Offices building	10	4,000,000
Electric cabin building	10	800,000
Gate house	10	300,000
Kaolin deposit	N.A.	
Water supply installation	20	1,600,000
Compressed air installations	20	420,000
Electric system	20	8,520,000
Design, Know-how, tech. assistance and training	20	7,500,000
Erection and installation	20	5,000,000
Freight	20	800,000
Trucks, cars and internal transport	20	7,000,000
Office and social services furniture	20	1,000,000
Total		97,543,895
Contingencies		9,498,615
GRAND TOTAL		107,042,510

6.1.1.3 Apportioned required investment for the powder insecticides production line

Annual Production 2600 T

	Percentage	sh
Process equipment		65,111,340
Production building		67,200,000
Packaging building	N.A.	
Utilities equipment	40	4,035,695
Laboratory equipment	30	798,900
Workshop equipment	50	6,280,000
Warehouse	50	108,000,000
Drums deposit	N.A.	
Civil works	50	80,000,000
Offices building	50	20,000,000
Electric cabin building	50	5,000,000
Gatehouse	50	1,500,000
Kaolin deposit	90	2,700,000
Water supply installation	45	3,600,000
Compressed air installations	45	945,000
Electric system	45	19,170,000
Design, Know-how, tech. assistance and training	45	16,875,000
Erection and installation	45	11,250,000
Freight	45	1,800,000
Trucks, cars and internal transport	45	15,750,000
Office and social services furniture	45	2,250,000
	Total	431,265,935
	Contingencies	41,925,755
	GRAND TOTAL	473,261,690

6.1.1.4 Apportioned required investment for the powder herbicides production line

Annual production 120 T

	Percentage	sh
Process equipment		32,755,000
Production building	80	21,600,000
Packaging building	N.A.	
Utilities equipment	5	504,460
Laboratory equipment	10	266,300
Workshop equipment	5	628,000
Warehouse	5	10,800,000
Drums deposit	N.A.	
Civil works	5	8,000,000
Offices building	5	2,000,000
Electric cabin building	5	400,000
Gate house	5	150,000
Kaolin deposit	5	150,000
Water supply installation	5	400,000
Compressed air installations	5	105,000
Electric system	5	2,130,000
Design, Know-how, tech. assistance and training	5	1,875,000
Erection and installation	5	1,250,000
Freight	5	200,000
Trucks, cars and internal transport	5	1,750,000
Office and social services furniture	5	250,000
	Total	85,213,780
	Contingencies	8,297,935
	GRAND TOTAL	93,511,715

6.1.1.5 Apportioned required investment for the granulars production line

Annual Production 300 T

	Percentage	sh
Process equipment		10,800,515
Production building	20	5,400,000
Packaging building	N.A.	
Utilities equipment	10	1,008,925
Laboratory equipment	15	399,450
Workshop equipment	10	1,256,000
Warehouse	10	21,600,000
Drums deposit	N.A.	
Civil works	10	16,000,000
Offices building	10	4,000,000
Electric Cabin Building	10	480,000
Gatehouse	10	300,000
Kaolin Deposit	5	150,000
Water supply installations	10	800,000
Compressed air installations	10	210,000
Electric system	10	4,250,000
Design, Know-how, tech. assistance and training	10	3,750,000
Erection and installation	10	2,500,000
Freight	10	400,000
Trucks, cars an internal transport	10	3,500,000
Office and socialservices furniture	10	500,000
	Total	77,634,890
	Contingencies	7,559,910
	GRAND TOTAL	85,194,800

6.1.2 Pre-operational expenses

The pre-operational expenses will include:

- Salaries of personnel hired before the start of production.
  At the moment the construction starts , the plant manager and the production manager should be hired. One year before production starts the following personnel should be hired:

  - Maintenance manager
  - 2 production supervisors
  - 1 electrical engineer
  - 1 mechanical engineer

  Three months before production starts, most of personnel will be hired.
  Assuming that two years are necessary for the implementation of the project, the costs will be:

First pre-operational year	:	265,000 sh.
Second pre-operational year	:	837,000 sh.

- Other expenses for personnel (travel expenses, living expenses/or training abroad etc.) 4,500,000 sh.

- Legal matters connected with the Constitution of the Company, authorization and promotional activity etc.) 4,000,000 sh.

TOTAL 10,000,000 sh.

6.1.3 Summary of total fixed capital expenditure

Total fixed capital expenditure can be therefore summarized as follows:

ITEM	Part to be paid in foreign currency ('000 sh)	Part to be paid in local currency ('000 sh)	Total ('000sh)
Buildings and civil works	-	570,000	570,000(*)
Equipment, freight and erection	337,000	5,000	342,000(*)
Technical assistance	35,000	3,000	38,000(*)
Pre-operational expenses	4,000	6,000	10,000
Total ('000 sh)	376,000	584,000	960,000

(*) NOTE: The figures include 10% contingency and rounding off.

6.1.4 Working Capital

Net working capital will be computed in the next paragraph 6.7 N.W.C. requirement reaches sh 646 million in the fifth year, sh.636 million in the sixth year and sh. 633 million in the seventh year. For all calculations, sh. 640 million will be considered.

6.2 Depreciation and service life of the plant

To determine the depreciation the following facts have been taken into consideration:

6.2.1 Equipment having the characteristics of the ones in use in this kind of plants have an industrial life span of approximately 15 years. As a precautionary measure an industrial life of 12 years has been assumed.

6.2.2 Trucks depreciation has been considered 5 years.

6.2.3 Depreciation of the plant is uniform all together its actual life; i.e. 1986-1997.

6.2.4 Salvage value has been considered low and therefore has not been taken into consideration for further calculations.

6.2.5 Pre-operational expenses will be depreciated in 5 years only.

6.3 Production program

The plant has been designed to produce over 5,000 tons of pesticides per year.
Anyway this output cannot be attained the first production year for a number of reasons:

- personnel has to be trained
- plant has to be commissioned
- the products must find their market share

therefore we have considered that the plant should start the production early 1986 (assuming that the decision to proceed with the project is taken within June 1984 and construction of the plant needs 18-24 months) and needs three years to attain the level of full production.
The following schedule has been therefore taken into consideration for further calculation:

year	Project Status/production
1984	Contracts award
1985	Construction
1986	2,160 tons (40% of full actual capacity)
1987	3,780 tons (70% of full actual capacity)
1988 and following	5,410 tons (100% of full actual capacity)

6.4 Personnel and salaries

The following personnel has been considered:

N.	FUNCTION	COST (sh.)	TOTAL COST (sh.)
1	Plant Manager	300,000	300,000
1	Technical Manager	280,000	280,000
1	Head, Liquid Dept.	240,000	240,000
1	Head, Solid Dept.	240,000	240,000
1	Head, Laboratory	240,000	240,000
2	Laboratory assistants	192,000	384,000
1	Supervisor, maintenance	240,000	240,000
2	Mechanical engineers	192,000	384,000
2	Electric engineers	192,000	384,000
2	Maintenance assistants	80,000	160,000
3	Drivers	96,000	288,000
2	Internal transports Drivers	96,000	192,000
1	Sales officer	240,000	240,000
1	Administrative Mgr	280,000	280,000
1	Purchase officer	160,000	160,000
1	Shipment officer	120,000	120,000
8	Clercks and secretaries	100,000	800,000
10	Foremen	192,000	1,920,000
60	Workers	72,000	4,320,000
1	Store keeper head	120,000	120,000
2	Store keeper	96,000	192,000
10	Guards and messengers	72,000	720,000
5	Attendants, social services	72,000	360,000
119		GRAND TOTAL	12,564,000

6.5 Operational expenses

The following items will be considered to calculate the operational expenses:

- Raw materials
- Consumable materials
- Spare parts
- Utilities
- General expenses

6.5.1 Raw materials and consumable materials

In this paragraph all raw materials (active matters, solvents, Surface Active materials, carriers etc) will be listed together with the packing materials.
The cost of the packaging materials will also be indicated.

6.5.1.1 Endosulfan 35 EC

total production : 1,000 tons/year

a) 400 tons in 1 liter packaging
b) 300 tons in 5 liters packaging
c) 300 tons in 20 liters packaging

Each l. of final products needs:

- 0.35 Kg. Endosulfan
- 0.07 Kg. Surface Active matter
- 0.58 Kg. Xilol

All these quantities must be increased of 1% to take into account losses etc.

Cost for the chemicals	: 355,200,000	sh
Cost for the packaging materials	: 68,544,000	sh
TOTAL	423,744,000	sh

6.5.1.2 Dimethoate 40 EC

total production : 500 tons/year

a) 200 tons in 1 liter packaging
b) 150 tons in 5 liters packaging
c) 150 tons in 20 liters packaging

Each Kg. of final product contains:

- 0.61 Kg. Dimethoate 65% in cycloexanone
- 0.07 Kg. Surface active matter
- 0.32 Kg. Xilol

All these quantities must be increased of 1% to take into account losses etc.

Cost of the chemicals	:	133,200,000	sh
Cost of the packaging materials	:	34,270,000	sh
TOTAL		167,470,000	sh

6.5.1.3 Phenthoate 50 EC

total production : 50 tons/year

a) 20 tons in 1 lt. packaging

b) 15 tons in 5 lt. packaging

c) 15 tins in 20 lt. packaging

Each kilogram of final product contains:

- 0.50 Kg. Phenthoate
- 0.07 Kg. Surface active matters
- 0.43 Kg. Xilol

All these quantities must be increased of 1% to take into account losses etc.

Cost of the chemicals	:	20,705,000	sh
Cost of the packaging materials	:	3,427,000	sh
TOTAL		24,132,000	sh

6.5.1.4 Fenitrothion 50 EC

total production : 50 tons/year

a) 20 tons in 1 lt. packaging
b) 15 tons in 5 lt. packaging
c) 15 tons in 20 lt. packaging

Each Kg. of final product contains:

0.50 Kg. Fenitrothion
0.07 Kg. Surface active matter
0.43 Kg. Xilol

All these quantities must be increased of 1% to take into account losses etc.

Cost of the chemicals	:	17,615,000 sh
Cost of the packaging materials	:	3,427,000 sh
TOTAL		21,042,000 sh

6.5.1.5 Dieldrin 18

total production : 30 tons/year

a) 12 tons in 1 lt. packaging
b) 9 tons in 5 lt. packaging
c) 9 tons in 20 lt. packaging

Each Kg. of final product contains:

- 0.18 Kg. Dieldrin
- 0.07 Kg. Surface active matters
- 0.75 Kg. Xilol

All these quantities must be increased of 1% to take into account losses etc.

Cost of the chemicals	:	9,277,000 sh
Cost of the packaging materials	:	2,056,000 sh
TOTAL		11,333,000 sh

6.5.1.6 <u>Trifluralin 48</u>

total production : 500 tons/year

a) 200 tons in 1 lt. packaging
b) 150 tons in 5 lt. packaging
c) 150 tons in 20 lt. packaging

Each Kg. of final product contains:

- 0.48 Kg. Trifluralin
- 0.07 Kg. Surface active matters
- 0.45 Kg. Xilol

All these quantities must be increased of 1% to take into account losses etc.

Cost of the chemicals	: 142,200,000 sh
Cost of the packaging materials	: 34,270,000 sh
TOTAL	176,470,000 sh

6.5.1.7 Propanil 36

total production : 60 tons/year

a) 24 tons in 1 lt. packaging
b) 18 tons in 5 lt. packaging
c) 18 tons in 20 lt. packaging

Each Kg. of final product contains:

- 0.66 Kg. Propanil 54% in cicloexanone
- 0.07 Kg. Surface active matter
- 0.27 Kg. xilol

All these quantities must be increased of 1% to take into account losses etc.

Cost of the chemicals	: 16,416,000 sh
Cost of the packaging materials	: 4,112,000 sh
TOTAL	20,528,000 sh

6.5.1.8 Dieldrin 2.5 dust

total production: 2,000 tons/year

a) 636 tons in 1 kg. packaging
b) 636 tons in 5 Kg. packaging
c) 728 tons in 25 Kg. packaging

Each Kg. of final product contains:

- 0.025 Kg. Dieldrin
- 0.975 Kg. Kaolin

All these quantities must be increased of 1% to take into account losses etc.

Cost of the chemicals	: 70,320,000 sh
Cost of the packaging materials	: 35,939,000 sh
TOTAL	106,259,000 sh

6.5.1.9 Endosulfan 3.5

total production : 75 tons/year

a) 23 tons in 1 Kg. packaging
b) 23 tons in 5 Kg. packaging
c) 29 tons in 25 Kg. packaging

Each Kg. of final product contains:

- 0.035 Endosulfan
- 0.965 Kaolin

All these quantities must be increased of 1% to take into account losses etc.

Cost for the chemicals	: 2,340,000 sh
Cost for the packaging materials	: 1,308,000 sh
TOTAL	3,648,000 sh

6.5.1.10 B H C 5

total production : 25 tons/year

a) 8 tons in 1 Kg. packaging

b) 8 tons in 5 Kg. packaging

c) 25 tons in 25 Kg. packaging

Each Kg. of final product contains:

- 0.05 Kg. BHC
- 0.95 Kg. Kaolin

All these quantities must be increased of 1% to take into account losses etc.

Cost for the chemicals	:	780,000 sh
Cost for the packaging materials	:	502,000 sh
TOTAL		1,282,000 sh

baldo & c. srl
CONSULTING ENGINEERS

6.5.1.11 Malathion 1

total production : 100 tons/year

a) 32 tons in 1 Kg. packaging

b) 32 tons in 5 Kg. packaging

c) 34 tons in 25 Kg. packaging

Each Kg. of final product contains:

- 0.01 Kg. Malathion
- 0.99 Kg. Kaolin

All these quantities must be increased of 1% to take into account losses etc.

Cost of the chemicals	:	468,000 sh
Cost of the packaging materials	:	1,800,000 sh
TOTAM		2,268,000 sh

6.5.1.12 Atrazine 50

total production : 120 tons/year

a) 50 tons in 1 Kg. packaging

b) 40 tons in 5 Kg. packaging

c) 30 tons in 25 Kg. packaging

Each Kg. of final product contains:

- 0.5 Kg. Atrazine
- 0.45 Kg. Kaolin
- 0.05 Kg. surface active matters

All these quantities must be increased of 1% to take into account losses etc.

Cost of the chemicals	:	24,163,000	sh
Cost of the packaging materials	:	2,593,000	sh
TOTAL		26,626,000	sh

6.5.1.13 Copper Oxychloride 35

total production : 600 tons/year

a) 300 tons in 1 kg. packaging
b) 150 tons in 5 Kg. packaging
c) 150 tons in 25 Kg. packaging

Each Kg. of the final product contains:

- 0.41 Kg. Copper Oxychloride at 85%
- 0.54 Kg. Kaolin
- 0.05 Kg. Surface active matters

All these quantities must be increased of 1% to take into account losses etc.

Cost of the chemicals	:	45,216,000 sh
Cost of the packaging materials	:	14,166,000 sh
		59,382,000 sh

6.5.1.14 Furadan 5

total production : 300 tons/year

a) 150 tons in 1 Kg. packaging

b) 100 tons in 5 Kg. packaging

c) 50 tons in 25 Kg. packaging

Each Kg. of the final product contains:

- 0.05 Kg. Furadan
- 0.002 Kg. Polivinyl Alchool
- 0.946 Kg. Sand

All these quantities must be increased of 1% to take into account losses etc.

Cost of the chemicals	: 31,248,000 sh
Cost of the packaging materials	: 7,362,000 sh
TOTAL	38,610,000 sh

6.5.2 Spare Parts

According to the information provided by operators of similar plants the yearly consumption of spare parts has been estimated in the range of 4,000,000 sh/for the first 5 years of operation and 6,000,000 sh for the remaining years.

6.5.3 Utilities

Main consumption are:

Electrical energy: 630,000 Kwh/year X 14 sh	=	8,820,000 sh
Gasoil for the boiler: 50 tons/yearX90 sh/lt	=	4,500,000 sh
Diesel oil for the trucks: 50 tons/yrX90sh/lt	=	4,500,000 sh
TOTAL		17,820,000 sh

6.5.4 General Expenses

Energy for lighting	500,000 sh
Insurances	1,000,000 sh
Sales expenses	4,500,000 sh
Telephone and telex	1,500,000 sh
Bank operation costs	150,000 sh
Legal expenses	150,000 sh
Office supplies	2,000,000 sh
Travelling	10,000,000 sh
TOTAL	19,800,000 sh
Round off	20,000,000

6.5.5 Technical Assistance

For the first years of operation the plant will need technical assistance provided by two expatriates with wide experience in the formulation of pesticides, the plant operation and its maintenance.
The total cost, including living allowance is estimated in 18,000,000 sh/year. This technical assistance is deemed necessary for the first three years of operation.

6.5.6 Total Operational Expenses

YEAR	RAW MATERIALS	UTILITIES	PERSONNEL	GENERAL EXPENSES	SPARES	TECH.ASS.	TOTAL
1986	440,000	8,000	13,000	20,000	4,000	18,000	503,000
1987	770,000	13,000	13,000	20,000	4,000	18,000	838,000
1988	1,100,000	18,000	13,000	20,000	4,000	18,000	1,173,000
1989	1,100,000	18,000	13,000	20,000	4,000	-	1,155,000
1990	1,100,000	18,000	13,000	20,000	4,000	-	1,155,000
1991	1,100,000	18,000	13,000	20,000	6,000	-	1,157,000
1992	1,100,000	18,000	13,000	20,000	6,000	-	1,157,000
1993	1,100,000	18,000	13,000	20,000	6,000		1,157,000
1994	1,100,000	18,000	13,000	20,000	6,000	-	1,157,000
1995	1,100,000	18,000	13,000	20,000	6,000	-	1,157,000
1996	1,100,000	18,000	13,000	20,000	6,000	-	1,157,000
1997	1,100,000	18,000	13,000	20,000	6,000	-	1,157,000

All values of this table are expressed in '000 sh.

At full production the operational expenses will be 1,155,000 sh/year and the portion in foreign exhcange will be 980 Million Shillings.

6.6 Selling Prices and Revenues

The production mix of the plant has been described in the previous paragraphs; some considerations on the selling prices and the forecast revenues are provided herebelow.
Although, for multi-product project, the method of allocating unit overhead costs to direct materials and direct labour costs, by means of different percentage surcharges is not generally accepted, such calculation has been made for the third year of operation, when the plant is considered to be at full production.
The results of such calculation will be compared with the international prices or prices applied in Uganda.

6.6.1 Endosulfan 35 EC

The international price is 576 sh/Kg.
The calculated production cost is 475.75 sh/Kg.
To be competitive the value of 530.4 sh/Kg is considered for the revenue calculation.
T.R. 530.4 X 1000,000 = 530,400,000 sh/year.

6.6.2 Dimethoate 40 EC

The selling price of this product (low quantities) in Uganda was 1.192 sh/l in 1982.
At present, the international price ranges between 470 and 630 sh/l.
The calculated production cost is 388.3 sh/l.
For the revenues calculation the value of 610 sh/l is considered.
T.R. 610 X 500,000 = 305,000,000sh/year.

6.6.3 Penthoate 50 EC

In 1979-1980, before the shilling devaluation, the selling price in Uganda was 47.5 sh/l. No data are available for the years 1980-1983.
At present, the international price ranges between 550 and 650 sh/l.
The calculated production cost is 535.4 sh/l.
For the revenues calculation the value of 605 sh/l is considered.
T.R. 605 X 50,000 = 30,250,000 sh/year.

6.6.4 Fenitrotion 50 EC

In 1979-80, before the shilling devaluation, the selling price in Uganda was 47.5 sh/l. No data are available for the years 1980 - 1983.

At present, the international price ranges between 722 and 864 sh/l.

The calculated production cost is 473.5 sh/l.

For the revenues calculation the value of 800 sh/l is considered.

T.R. 800 X 50,000 = 40,000,000 sh/year.

6.6.5 Dieldrin 18

In 1982 the selling price in Uganda was 846.3 sh/l.

At present, the international price is 760 sh/l.

The calculated production cost is 427.13 sh/l.

For the revenues calculation the value of 719.35 sh/l is considered.

T.R. 719.35 X 30,000 = 21,580,000 sh/year.

6.6.6 Trifluralin 48

This product was never marketed in Uganda.

At present, the international price is 1,000 sh/Kg.

The calculated production cost is 414.7 sh/Kg.

For the revenues calculation the value of 904 sh/Kg is considered.

T.R. 904 X 500,000 = 452,000,000 sh/year.

6.6.7 Propanil 36

There are no records available in Uganda.

At present, the international price is 450 sh/kg.

The calculated production cost is 405.8 sh/Kg.

For the revenues calculation the value of 450 sh/Kg is considered.

T.R. 450 X 60,000 = 27,000,000 sh/year.

6.6.8 Dieldrin 2.5 dust

In 1979-1980 the selling price in Uganda was 80 sh/Kg.

No data are available for 1983.

The calculated production cost is 113 sh/Kg.

For the revenues calculation the value of 200 sh/Kg is considered.

T.R. 200 X 2,000,000 = 400,000,000 sh/year

6.6.9 Endosulfan 3.5

There are no records available in Uganda.

The calculated production cost is 108 sh/Kg.

For the revenues calculation the value of 150 sh/Kg. is considered.

T.R. 150 X 75,000 = 11,250,000 sh/year

6.6.10 BHC

There are no records available in Uganda.

The calculated production cost is 112 sh/Kg.

For the revenues calculation the value of 150 sh/Kg. is considered.

T.R. 150 X 25,000 = 3,750,000 sh/year.

6.6.11 Malathion 1

There are no records available in Uganda.

Tha calculated production cost is 83.4 sh/Kg.

For the revenues calculation the value of 150 sh/Kg. is considered.

T.R. 150 X 100,000 = 15,000,000 sh/year.

6.6.12 Atrazine 50

There are no records available in Uganda.

The international price is ranging between 140 and 343 sh/Kg.

The calculated production cost is 274.3 sh/Kg.

For the revenues calculation the value of 320 sh/Kg. is considered.

T.R. 320 X 120,000 = 38,400,000 sh/year.

6.6.13 Copper Oxychloride 35

There are no records available in Uganda.

The international price is ranging between 310 and 360 sh/Kg.

The calculated production cost is 151.2 sh/Kg.

For the revenues calculation the value of 300 sh/Kg. is considered.

T.R. 300 X 600,000 = 180,000,000 sh/year.

6.6.14 Furadan

In 1982 the selling price in Uganda was 168 sh/Kg.
At present, the international price ranges between 340 and 370 sh/Kg.
The calculated production cost is 221 sh/Kg.
For the revenues calculation the value of 300 sh/Kg is considered.
T.R. 300 X 300,000 = 90,000,000 sh/year.

NOTE : For the production cost calculation, see next pages

ENDOSULFAN 35 EC

A) Total production: 1000 tons/year

a) 400 tons 1 liter packaging
b) 300 tons 5 liter " "
c) 300 tons 20 liter " "

B) Composition of 1 Kg. Of product

a) Endosulfan	0.35 Kg.
b) Surface Active Matter	0.07 Kg.
c) Xilol	0.58 Kg.

C) Cost of raw material

a) Endosulfan	852 sh/Kg.
b) Surface Active Matter	240 sh/Kg.
c) Xilol	63 sh/Kg.

D) Cost of 1 Kg. of raw materials

a) Theoretical
(0.35X852)+(0.07X240)+(0.58X63)= 351.6 sh

b) Actual
Theoretical cost is increased of 1% to take into account losses etc.

351.6X1.01=355.116 → round off 355.2 sh

E) Total cost of raw materials

1,000,000 X 355.2 = 355,200,000 sh

F) Cost of packaging material

a) 1 liter container	110 sh/each
b) 5 liter container	234 sh/each
c) 20 liter container	700 sh/each

G) Total cost of packaging material

a) 400,000 X 110 =	44,000,000
b) $\frac{300,000}{5}$ X 234 =	14,044,000
c) $\frac{300,000}{20}$ X 700 =	10,500,000
Total	68,544,000 sh

H) Electric energy consumption

a) production	26 KWh/t
b) packaging of 1 Kg.	17 KWh/t
c) packaging of 5 Kg.	6 KWh/t
d) packaging of 20 Kg.	4 KWh/t

I) Cost of electric energy

a) production	1000X26X14 =	364,000
b) packaging of 1 Kg.	400X17X14 =	95,200
c) packaging of 5 Kg.	300X6 X14 =	25,700
d) packaging of 20 Kg.	300X4 X14 =	16,800
	Total	501,200 sh

j) Direct labour required

Production: 10 tons/day X 100 days

a) technical manager	12.5% of annual cost
b) liquid dept. head	45% of annual cost
c) 3 foremen	100 days
d) 20 workers	100 days

K) Direct labour cost

a) technical manager	35,000
b) liquids dept. head	109,800
c) 3 foremen	240,000
d) 20 workers	600,000
Total	984,800 sh

L) Indirect labour cost 1,018,210 sh

M) Utilities

a) electric energy (water, compressed air)	102,000
b) gasoil for boiler	2,025,000
c) diesel oil for trucks	810,000
Total	2,937,000 sh

N) Spare parts		720,000 sh
O) General expenses		3,600,000 sh
P) Technical assistance		3,240,000 sh
Q) Depreciation		10,381,375 sh
R) Interest		28,620,000 sh
	Total	475,746,585 sh

COST OF 1 KG. = 475,75 sh

baldo & c.
CONSULTING ENGINEERS

DIMETHOATE 40 EC

A) Total production: 500 tons/year

a) 200 tons 1 liter packaging
b) 150 tons 5 liter packaging
c) 150 tons 20 liter packaging

B) Composition of 1 Kg. Of product

a) Dimethoate 65% in cycloxane	0.61 Kg.
b) Surface active matter	0.07 Kg.
c) Xilol	0.32 Kg.

C) Cost of raw material

a) Dimethoate	371 sh/Kg.
b) Surface active matter	240 sh/Kg.
c) Xilol	63 sh/Kg.

D) Cost of 1 Kg. of raw materials

a) Theoretical
(0.61X371)+(0.07X240)+(0.32X63) = 263.8

b) Actual
Theoretical cost is increased of 1% to take into account losses etc.

263.8 X 1.01 = 266.4

E) Total cost of raw materials

266.4 X 500,000 = 133,200,000 sh

F) Cost of packaging material

a) 1 liter container	110 sh/each
b) 5 liter container	234 sh/each
c) 20 liter container	700 sh/each

G) Total cost of packaging material

a) 200,000 X 110 =	22,000,000 sh
b) 30,000 X 234 =	7,020,000
c) 7,500 X 700 =	5,250,000
Total	34,270,000 sh

baldo & C.
CONSULTING ENGINEERS

H) Electric energy consumption

a) production	26 KWh/t
b) packaging of 1 Kg.	17 KWh/t
c) packaging of 5 Kg.	6 KWh/t
d) packaging of 20 Kg.	4 KWh/t

I) Cost of electric energy

a) production	500X26X14 =	182,000 sh
b) packaging of 1 Kg.	200X17X14 =	47,600 sh
c) packaging of 5 Kg.	150X 6X14 =	12,600 sh
d) packaging of 20 Kg.	150X 4X14 =	8,400 sh
	Total	250,600 sh

j) Direct labour required

Production: 10 tons/day X 50 days

a) technical manager	6.5% of annual cost
b) liquid dept. head	30% of annual cost
c) 3 foremen	50 days
d) 20 workers	50 days

K) Direct labour cost

a) technical manager	18,200 sh
b) liquids dept. head	54,000
c) 3 foremen	120,000
d) 20 workers	300,000
Total	492,200 sh

L) Indirect labour cost 500,760

M) Utilities

a) electric energy (water, compressed air)	52,000 sh
b) gasoil for boiler	1,035,000
c) diesel oil for trucks	414,000
Total	1,501,000 sh

N) Spare parts	368,000 sh
O) General expenses	1,840,000 sh
P) Technical assistance	1,656,000 sh
Q) Depreciation	5,445,970 sh
R) Interests	14,628,000 sh
Total	194,152,530 sh

COST OF 1 KG = 388.3 sh

PENTHOATE 50 EC

A) Total production: 50 tons/year

a) 20 tons 1 liter packaging
b) 15 tons 5 liter packaging
c) 15 tons 20 liter packaging

B) Composition of 1 Kg. Of product

a)	Penthoate	0.5 Kg.
b)	Surface active matter	0.07 Kg.
c)	Xilol	0.43 Kg.

C) Cost of raw material

a)	Penthoate	732 sh/Kg.
b)	Surface active matter	240 sh/Kg.
c)	Xilol	63 sh/Kg.

D) Cost of 1 Kg. of raw materials

a) Theoretical
(0.5X732)+(0.07X240)+(0.43X63) = 410 sh

b) Actual
Theoretical costs is increased of 1% to take into account losses etc.
410 X 1,01 = 414.1 sh

E) Total cost of raw materials
50,000 X 414.1 = 20,705,000

F) Cost of packaging material

a)	1 liter container	110 sh/each
b)	5 liter container	234 sh/each
c)	20 liter container	700 sh/each

G) Total cost of packaging material

a)	20,000 X 110 =	2,200,000
b)	3,000 X 234 =	702,000
c)	750 X 700 =	525,000
	Total	3,427,000

baldo & c. CONSULTING ENGINEERS

H) Electric energy consumption

a) production	26 KWh/t
b) packaging of 1 Kg.	17 KWh/t
c) packaging of 5 Kg.	6 KWh/t
d) packaging of 20 Kg.	4 KWh/t

I) Cost of electric energy

a) production	50X26X14 =	18,200 sh
b) packaging of 1 Kg.	20X17X14 =	4,760
c) packaging of 5 Kg.	15X6 X14 =	1,260
d) packaging of 20 Kg.	15X4 X14 =	840
	Total	25,060 sh

j) Direct labour required

Production: 10 tons/day X 5 days

a) technical manager	0.7 of annual cost
b) liquid dept. head	3% of annual cost
c) 3 foremen	5 days
d) 20 workers	5 days

K) Direct labour cost

a) technical manager	2,000
b) liquids dept. head	6,000
c) 3 foremen	12,000
d) 20 workers	30,000
Total	50,000

L) Indirect labour cost 51,360

M) Utilities

a) electric energy (water, compressed air)	5,235
b) gasoil for boiler	103,500
c) diesel oil for trucks	41,400
Total	150,135

N) Spare parts	36,800 sh
O) General expenses	184,000 sh
P) Technical assistance	165,600 sh
Q) Depreciation	510,560 sh
R) Interests	1,462,800
Total	26,768,315 sh

COST OF 1 KG = 535.4

FENITROTION 50 EC

A) Total production: 50 tons/year

a) 20 tons 1 liter container
b) 15 tons 5 liter container
c) 15 tons 20 liter container

B) Composition of 1 Kg. Of product

a) Fenitrotion	0.5	Kg
b) Surface active matter	0.007	Kg
c) Xilol	0.43	Kg

C) Cost of raw material

a) Fenitrotion	610 sh Kg
b) Surface active matter	240 sh Kg
c) Xilol	63 sh Kg

D) Cost of 1 Kg. of raw materials

a) Theoretical
(0.5X610)+(0.07X240)+(0.43X63)= 348.8

b) Actual
Theoretical cost is increased of 1% to take into account losses etc.

348.8X1.01 = 352.3

E) Total cost of raw materials

50,000 X 352.3 = 17,615,000

F) Cost of packaging material

a) 1 liter container	110 sh/each
b) 5 liter container	234 sh/each
c) 20 liter container	700 sh/each

G) Total cost of packaging material

a)	20,000 X 110 =	2,200,000
b)	3,000 X 234 =	702,000
c)	750 X 700 =	525,000
	Total	3,427,000sh

H) Electric energy consumption

a) production	26 KWh/t
b) packaging of 1 Kg.	17 KWh/t
c) packaging of 5 Kg.	6 KWh/t
d) packaging of 20 Kg.	4 KWh/t

I) Cost of electric energy

a) production	50X26X14 =	18,200 sh
b) packaging of 1 Kg.	20X17X14 =	4,760
c) packaging of 5 Kg.	15X6 X14 =	1,260
d) packaging of 20 Kg.	15X4 X14 =	840
	Total	25,060 sh

j) Direct labour required

Production: 10 tons day X 5 days

a) technical manager	0.7 % of annual cost
b) liquid dept. head	3 % of annual cost
c) 3 foremen	5 days
d) 20 workers	5 days

K) Direct labour cost

a) technical manager	2,000 sh
b) liquids dept. head	6,000
c) 3 foremen	12,000
d) 20 workers	30,000
Total	50,000 sh

L) Indirect labour cost 51,360 sh

M) Utilities

a) electric energy (water, compressed air)	5,235
b) gasoil for boiler	103,500
c) diesel oil for trucks	41,400
Total	150,135 sh

N) Spare parts	36,800 sh
O) General expenses	184,000 sh
P) Technical assistance	165,000 sh
Q) Depreciation	510,560 sh
R) Interests	1,462,800 sh
Total	23,677,800 sh

COST OF 1 KG = 473.5

DIELDRIN 18

A) Total production: 30 tons/year

a) 12 tons 1 liter container
b) 9 tons 5 liter container
c) 9 tons 20 liter container

B) Composition of 1 Kg. Of product

a) Dieldrin	0.18 Kg
b) Surface active matter	0.07 Kg
c) Xilol	0.75 Kg

C) Cost of raw material

a) Dieldrin	1,345 sh/Kg
b) Surface active matter	240 sh/Kg
c) Xilol	63 sh/Kg

D) Cost of 1 Kg. of raw materials

a) Theoretical

(0.18X1345)+(0.07X240)+(0.75X63) = 306.2

b) Actual

Theoretical cost is increased of 1% to take into account losses etc.

306.2X1.01 = 309.26

E) Total cost of raw materials

30,000 X 309.26 = 9,277,000 sh

F) Cost of packaging material

a) 1 liter container	110 sh/each
b) 5 liter container	234 sh/each
c) 20 liter container	700 sh/each

G) Total cost of packaging material

a) 12,000 X 110 =	1,320,000
b) 1,800 X 234 =	421,200
c) 450 X 700 =	315,000
Total	2,056,200 sh

H) Electric energy consumption

a) production	26 KWh/t
b) packaging of 1 Kg.	17 KWh/t
c) packaging of 5 Kg.	6 KWh/t
d) packaging of 20 Kg.	4 KWh/t

I) Cost of electric energy

a) production	30X26X14 =	10,920 sh
b) packaging of 1 Kg.	12X17X14 =	2,856
c) packaging of 5 Kg.	9 X6 X14 =	756
d) packaging of 20 Kg.	9 X4 X14 =	504
	Total	15,036 sh

j) Direct labour required

Production: 10 tons/day X 3 days

a) technical manager	1.7 of annual cost
b) liquid dept. head	1.75% of annual cost
c) 3 foremen	3 days
d) 20 workers	3 days

K) Direct labour cost

a) technical manager	2,000 sh
b) liquids dept. head	4,200
c) 3 foremen	7,200
d) 20 workers	18,000
	31,200 sh

L) Indirect labour cost 47,510

M) Utilities

a) electric energy (water, compressed air)	3,200 sh
b) gasoil for boiler	63,000
c) diesel oil for trucks	25,200
Total	91,400 sh

N) Spare parts	22,400 sh
O) General expenses	112,000 sh
P) Technical assistance	100,800 sh
Q) Depreciation	170,185 sh
R) Interests	890,400 sh
Total	12,813,930 sh

COST OF 1 KG = 427.13

TRIFLURALIN 48

A) Total production: 500 tons/year

a) 200 tons 1 liter packaging
b) 150 tons 5 liter packaging
c) 150 tons 20 liter packaging

B) Composition of 1 Kg. Of product

a) Trifluralin	0.48 Kg
b) Surface active matter	0.07 Kg
c) Xilol	0.45 Kg

C) Cost of raw material

a) Trifluralin	492.5 sh/Kg
b) Surface active matter	240 sh/Kg
c) Xilol	63 sh/Kg

D) Cost of 1 Kg. of raw materials

a) Theoretical
(0.48X492.5)+(0.07X240)+(0.45X63) = 281.55

b) Actual
Theoretical cost is increased of 1% to take into account losses etc.
281.35X1.01 = 284.37

E) Total cost of raw materials

500,000 X 284.37 = 142,200,000 sh

F) Cost of packaging material

a) 1 liter container	110 sh/each
b) 5 liter container	234 sh/each
c) 20 liter container	700 sh/each

G) Total cost of packaging material

a) 200,000 X 110 =		22,000,000 sh
b) 30,000 X 234 =		7,020,000
c) 7,500 X 700 =		5,250,000
	Total	34,270,000 sh

H) Electric energy consumption

a) production	26 KWh/t
b) packaging of 1 Kg.	17 KWh/t
c) packaging of 5 Kg.	6 KWh/t
d) packaging of 20 Kg.	4 KWh/t

I) Cost of electric energy

a) production	500 X 26 X14 =	182,000 sh
b) packaging of 1 Kg.	200 X 17 X14 =	47,600
c) packaging of 5 Kg.	150 X 6 X14 =	12,600
d) packaging of 20 Kg.	150 X 4 X14 =	8,400
	Total	250,600 sh

j) Direct labour required

Production: 5 tons/day X 100 days

a) technical manager	10.7% of annual cost
b) liquid dept. head	19% of annual cost
c) 1 foreman	100 days
d) 10 workers	100 days

K) Direct labour cost

a) technical manager		30,000 sh
b) liquids dept. head		54,000
c) 1 foreman		80,000
d) 10 workers		300,000
	Total	464,000 sh

L) Indirect labour cost 500,760

M) Utilities

a) electric energy (water, compressed air)		52,000 sh
b) gasoil for boiler		1,035,000
c) diesel oil for trucks		414,000
	Total	1,501,000 sh

N) <u>Spare parts</u>		368,000 sh
O) <u>General expenses</u>		1,840,000 sh
P) <u>Technical assistance</u>		1,656,000 sh
Q) <u>Depreciation</u>		9,685,720 sh
R) <u>Interests</u>		14,628,000 sh
	Total	207,364,080 sh

COST OF 1 KG = 414.7

PROPANIL 36

A) Total production: 60 tons/year

a) 24 tons 1 liter packaging
b) 18 tons 5 liter packaging
c) 18 tons 20 liter packaging

B) Composition of 1 Kg. Of product

a) Propanil 54% in cicloexanone	0.66 Kg
b) Surface active matter	0.07 Kg
c) Xilol	0.27 Kg

C) Cost of raw material

a) Propanil	359.2 sh/Kg
b) Surface active matter	240 sh/Kg
c) Xilol	63 sh/Kg

D) Cost of 1 Kg. of raw materials

a) Theoretical

(0.66X359.2)+(0.07X240)+(0.27X63) = 270.89

b) Actual

Theoretical cost is increased of 1% to take into account losses etc.

270.89X1.01 = 273.6

E) Total cost of raw materials

60,000 X 273.6 = 16,416,000 sh

F) Cost of packaging material

a) 1 liter container	110 sh/each
b) 5 liter container	234 sh/each
c) 20 liter container	700 sh/each

G) Total cost of packaging material

a) 24,000 X 110 =	2,640,000 sh
b) 6,600 X 234 =	842,400
c) 900 X 700 =	630,000
Total	4,112,400 sh

H) Electric energy consumption

a) production	26 KWh/t
b) packaging of 1 Kg.	17 KWh/t
c) packaging of 5 Kg.	6 KWh/t
d) packaging of 20 Kg.	4 KWh/t

I) Cost of electric energy

a) production	60X26X14 =	21,840 sh
b) packaging of 1 Kg.	24X17X14 =	5,712
c) packaging of 5 Kg.	18X 6X14 =	1,512
d) packaging of 20 Kg.	18X 4X14 =	1,008
	Total	30,072 sh

j) Direct labour required

Production: 5 tons/day X 12 days

a) technical manager	1.25 of annual cost
b) liquid dept. head	2.5 % of annual cost
c) 1 foreman	12 days
d) 10 workers	12 days

K) Direct labour cost

a) technical manager		3,500 sh
b) liquids dept. head		6,000
c) 1 foreman		9,600
d) 10 workers		36,000
	Total	55,100 sh

L) Indirect labour cost — 55,640 sh

M) Utilities

a) electric energy (water, compressed air)		6,800 sh
b) gasoil for boiler		135,000
c) diesel oil for trucks		54,000
	Total	195,800 sh

N) Spare parts	48,000 sh
O) General expenses	240,000 sh
P) Technical assistance	216,000 sh
Q) Depreciation	1,076,190 sh
R) Interests	1,908,000 sh
Total	24,353,202 sh

COST OF 1 KG = 405.8

baldo & c.
CONSULTING ENGINEERS

DIELDRIN 2.5 DUST

A) Total production: 2,000 tons/year

a) 636 tons 1 Kg. packaging
b) 636 tons 5 Kg. packaging
c) 728 tons 25 Kg. packaging

B) Composition of 1 Kg. Of product

a) Dieldrin	0.025 Kg
b) Kaolin	0.975 Kg

C) Cost of raw material

a) Dieldrin	1345 sh/Kg
b) Kaolin	1.2 sh/Kg

D) Cost of 1 Kg. of raw materials

a) Theoretical
(0.025X1345)+(0.975X1.2) = 34.8 sh

b) Actual
Theoretical cost is increased of 1% to take into account losses etc.
34.8 X 1.01 = 35.16 sh

E) Total cost of raw materials
35.16 X 2,000,000 = 70,320,000 sh

F) Cost of packaging material

a) 1 liter container	38.4 sh
b) 5 liter container	72 sh
c) 25 liter container	81.5 sh

G) Total cost of packaging material

a) 636,000 X 38.4 =	24,422,000 sh
b) 127,000 X 72 =	9,144,000
c) 29,120 X 81.5 =	2,373,000
Total	35,939,000 sh

H) Electric energy consumption

a) production	140 KWh/t
b) packaging of 1 Kg.	12 KWh/t
c) packaging of 5 Kg.	25 KWh/t
d) packaging of 25 Kg.	6.7 KWh/t

I) Cost of electric energy

a) production	2000X140X14 =	3,920,000 sh
b) packaging of 1 Kg.	636X12X14 =	106,845
c) packaging of 5 Kg.	636X25X14 =	222,600
d) packaging of 25 Kg.	728X6.7X14 =	68,285
	Total	4,317,730 sh

j) Direct labour required

Production: 16 tons/day X 125 days

a) technical manager	35.7 of annual cost
b) Solids dept. head	60 % of annual cost
c) 6 foremen	125 days
d) 30 workers	125 days

K) Direct labour cost

a) technical manager		100,000 sh
b) Solids dept. head		146,000
c) 6 foremen		1,725,000
d) 30 workers		1,125,000
	Total	3,096,880 sh

L) Indirect labour cost 1,891,760 sh

M) Utilities

a) electric energy (water, compressed air)		196,500 sh
b) diesel oil for trucks		1,552,500 sh
	Total	1,749,100 sh

N) <u>Spare parts</u>		1,518,000 sh
O) <u>General expenses</u>		7,590,000 sh
P) <u>Technical assistance</u>		6,900,000 sh
Q) <u>Depreciation</u>		37,735,830 sh
R) <u>Interests</u>		54,855,000 sh
	Total	225,913,300 sh

COST OF 1 KG = 113 sh

ENDOSULFAN 3.5

A) Total production: 75 tons/year

a) 23 tons 1 Kg packaging
b) 23 tons 5 Kg packaging
c) 29 tons 25 Kg packaging

B) Composition of 1 Kg. Of product

a) Endosulfan	0.035 Kg
b) Kaolin	0.965 Kg

C) Cost of raw material

a) Endosulfan	852 sh/Kg
b) Kaolin	1.2 sh/Kg

D) Cost of 1 Kg. of raw materials

a) Theoretical
(0.035X852)+(0.965X1.2) = 30.9
b) Actual
Theoretical cost is increased of 1% to take into account losses etc.
30.9X1.01 = 31.2

E) Total cost of raw materials

75,000 X 30.9 = 2,340,000 sh

F) Cost of packaging material

a) 1 liter container	38.4 sh
b) 5 liter container	72 sh
c) 25 liter container	81 sh

G) Total cost of packaging material

a) 23,000 X 38.4 =	883,200 sh
b) 4,600 X 72 =	331,200
c) 1,160 X 81 =	93,960
Total	1,308,000 sh

H) Electric energy consumption

a) production	140 KWh/t
b) packaging of 1 Kg.	12 KWh/t
c) packaging of 5 Kg.	25 KWh/t
d) packaging of 25 Kg.	6.7 KWh/t

I) Cost of electric energy

a) production	75X140X14 =	147,000 sh
b) packaging of 1 Kg.	23X12 X14 =	3,865
c) packaging of 5 Kg.	23X25 X14 =	8,050
d) packaging of 25 Kg.	29X6.7X14 =	2,720
	Total	161,635 sh

j) Direct labour required

Production: 16 tons/day X 5 days

a) technical manager	1.8% of annual cost
b) Solids dept. head	2.7% of annual cost
c) 6 foremen	5 days
d) 30 workers	5 days

K) Direct labour cost

a) technical manager		5,000 sh
b) Solids dept. head		6,480
c) 6 foremen		69,000
d) 30 workers		45,000
	Total	125,480 sh

L) Indirect labour cost 83,460 sh

M) Utilities

a) electric energy (water, compressed air)		7,100 sh
b) diesel oil for trucks		56,250
	Total	63,350 sh

N) Spare parts	55,000 sh
O) General expenses	275,000 sh
P) Technical assistance	250,000 sh
Q) Depreciation	1,467,505 sh
R) Interests	1,987,500 sh
Total	8,116,930 sh

COST OF 1 KG = 108 sh

BHC

A) Total production: 25 tons/year

a) 8 tons 1 Kg packaging

b) 8 tons 5 Kg packaging

c) 25 tons 25 Kg packaging

B) Composition of 1 Kg. Of product

a) BHC	0.05 Kg
b) Kaolin	0.95 Kg

C) Cost of raw material

a) BHC	595 sh/Kg
b) Kaolin	1.2 sh/Kg

D) Cost of 1 Kg. of raw materials

a) Theoretical

(0.05X595)+(0.95X1.2)= 30.89

b)Actual

Theoretical cost isincreased of 1% to take into account losses etc.

E) Total cost of raw materials

25,000 X 30,89 = 780,000 sh

F) Cost of packaging material

a) 1 Kg. container	30.4 sh
b) 5 Kg. container	72 sh
c) 25 Kg. container	81 sh

G) Total cost of packaging material

a) 8,000 X 38.4 =	306,000 sh
b) 1,600 X 72 =	115,000
c) 1,000 X 81 =	81,000
Total	502,000 sh

H) Electric energy consumption

a) production	140 KWh/t
b) packaging of 1 Kg.	12 KWh/t
c) packaging of 5 Kg.	25 KWh/t
d) packaging of 25 Kg.	6.7KWh/t

I) Cost of electric energy

a) production	25X140X14 =	49,000 sh
b) packaging of 1 Kg.	8X12 X14 =	1,365
c) packaging of 5 Kg.	8X25 X14 =	2,800
d) packaging of 15 Kg.	25X67 X14 =	2,345
	Total	55,490 sh

j) Direct labour required

Production: 16 tons/day X 3 days

a) technical manager	0.7 of annual cost
b) Solids dept. head	0.9% of annual cost
c) 6 foremen	3 Days
d) 30 workers	3 Days

K) Direct labour cost

a) technical manager	2,000 sh
b) Solids dept. head	2,160
c) 6 foremen	41,400
d) 30 workers	27,000
	72,560 sh

L) Indirect labour cost 27,820 sh

M) Utilities

a) electric energy (water, compressed air)	1,300 sh
b) diesel oil for trucks	11,550
Total	12,550 sh

N) Spare parts		11,000 sh
O) General expenses		55,000 sh
P) Technical assistance		50,000 sh
Q) Depreciation		838,575 sh
R) Interests		379,500 sh
	Total	2,802,495 sh

COST OF 1 KG = 112 sh

MALATHION 1

A) Total production: 100 tons/year

a) 32 tons 1 Kg packaging
b) 32 tons 5 Kg packaging
c) 34 tons 25Kg packaging

B) Composition of 1 Kg. Of product

a) Malathion
b) Kaolin

C) Cost of raw material

a)	Malathion	0.01 Kg
b)	Kaolin	0.99 Kg

D) Cost of 1 Kg. of raw materials

a) Theoretical
(0.01X345)+(0.99X1.2) = 4,63
b) Actual
Theoretical cost is increased of 1% to take into account losses etc.
4.63 X 1.01 = 4,68

E) Total cost of raw materials

100,000 X 4.68 = 468,000 sh

F) Cost of packaging material

a)	1 Kg. container	38.4 sh
b)	5 Kg. container	72 sh
c)	25 Kg. container	81 sh

G) Total cost of packaging material

a)	32,000 X 38.4 =	1,228,800 sh
b)	6,400 X 72 =	460,800
c)	1,360 X 81 =	110,160
	Total	1,800,000 sh

H) Electric energy consumption

a) production	140 KWh/t
b) packaging of 1 Kg.	12 KWh/t
c) packaging of 5 Kg.	25 KWh/t
d) packaging of 25 Kg.	6.7 KWh/t

I) Cost of electric energy

a) production	100X140X14 =	196,000 sh
b) packaging of 1 Kg.	32 X12 X14 =	5,375
c) packaging of 5 Kg.	32 X25 X14 =	11,200
d) packaging of 25 Kg.	34 X6.7X14 =	3,190
	Total	215,765 sh

j) Direct labour required

Production: 16 tons/day X 7 days

a) technical manager	3.5 of annual cost
b) Solids dept. head	3.6% of annual cost
c) 6 foremen	7 days
d) 30 workers	7 days

K) Direct labour cost

a) technical manager		10,000 sh
b) Solids dept. head		8,640
c) 6 foremen		96,600
d) 30 workers		63,000
	Total	178,240 sh

L) Indirect labour cost 111,280 sh

M) Utilities

a) electric energy (water, compressed air)		10,000 sh
b) diesel oil for trucks		78,000
	Total	88,750 sh

baldo & C.
CONSULTING ENGINEERS

N) Spare parts		77,000 sh
O) General expenses		385,000 sh
P) Technical assistance		350,000 sh
Q) Depreciation		1,886,790 sh
R) Interests		2,782,500 sh
	Total	8,343,325 sh

COST OF 1 KG = 83.4

ATRAZINE 50

A) Total production: 120 tons/year

a) 50 tons 1 Kg packaging

b) 40 tons 5 Kg packaging

c) 30 tons 25 Kg packaging

B) Composition of 1 Kg. Of product

a)	Atrazine	0.5 Kg
b)	Kaolin	0.45Kg
c)	Surface active matter	0.05Kg

C) Cost of raw material

a)	Atrazine	373,65 sh/Kg
b)	Kaolin	1.2 sh/Kg
c)	Surface active matter	240 sh/Kg

D) Cost of 1 Kg. of raw materials

a) Theoretical

(0.5X375.65)+(0.45X1.2)+(0.05X240) = 199.36 sh

b) Actual

Theoretical cost is increased of 1% to take into account losses etc.

199.36X1.01 = 201.36

E) Total cost of raw materials

120,000 X 201.36 = 24,163,000 sh

F) Cost of packaging material

a)	1 Kg.	container	38.4 sh
b)	5 Kg.	container	72 sh
c)	25 Kg.	container	81 sh

G) Total cost of packaging material

a)	50,000 X 38.4 =	1,920,000 sh
b)	8,000 X 72 =	576,000
c)	1,200 X 81 =	97,200
	Total	2,593,000 sh

H) Electric energy consumption

a) production	194 KWh/t
b) packaging of 1 Kg.	5 KWh/t
c) packaging of 5 Kg.	4 KWh/t
d) packaging of 25 Kg.	5 KWh/t

I) Cost of electric energy

a) production	120X194X14 =	325,920 sh
b) packaging of 1 Kg.	50X5 X14 =	3,500
c) packaging of 5 Kg.	40X4 X14 =	2,240
d) packaging of 25 Kg.	30X5 X14 =	2,100
	Total	333,760 sh

j) Direct labour required

Production: 4 tons/day X 30 days

a) technical manager	2.25 of annual cost
b) Solids dept. head	3.5 % of annual cost
c) 2 foremen	30 days
d) 7 workers	30 days

K) Direct labour cost

a) technical manager		6,300 sh
b) Solids dept. head		8,640
c) 2 foremen		111,000
d) 7 workers		63,000
	Total	188,940 sh

L) Indirect labour cost 111,280 sh

M) Utilities

a) electric energy (water, compressed air)		11,300 sh
b) diesel oil for trucks		90,000 sh
	Total	101,300 sh

baldo & C. sri
CONSULTING ENGINEERS

N) Spare parts	88,000 sh
O) General expenses	440,000 sh
P) Technical assistance	400,000 sh
Q) Depreciation	1,316,410 sh
R) Interests	3,180,000 sh
Total	32,915,690 sh

COST OF 1 KG = 274.3 sh

COPPER OXYCHLORIDE 35

A) Total production: 600 tons/year

a) 300 tons 1 Kg packaging
b) 150 tons 5 Kg packaging
c) 150 tons 25 Kg packaging

B) Composition of 1 Kg. Of product

a)	Copper oxychloride at 85%	0.41 Kg
b)	Kaolin	0.54 Kg
c)	Surface active matter	0.05 Kg

C) Cost of raw material

a)	Copper oxychloride	151.13 sh/Kg
b)	Kaolin	1.20 sh/Kg
c)	Surface active matter	240 sh/Kg

D) Cost of 1 Kg. of raw materials

a) Theoretical
(0.41X151.13)+(0.54X1.2)+(0.05X240) = 74.61

b) Actual
Theoretical cost is increased of 1% to take into account losses etc.
74.61 X 1.01 = 75,36

E) Total cost of raw materials
600,000 X 75.36 = 45,216,000

F) Cost of packaging material

a) 1 Kg. container
b) 5 Kg. container
c) 25 Kg. container

G) Total cost of packaging material

a)	300,000 X 38,4 =	11,520,000 sh
b)	30,000 X 72 =	2,160,000
c)	6,000 X 81 =	486,000
	Total	14,166,000 sh

H) Electric energy consumption

a) production	210 KWh/t
b) packaging of 1 Kg.	12 KWh/t
c) packaging of 5 Kg.	25 KWh/t
d) packaging of 25 Kg.	6.7 KWh/t

I) Cost of electric energy

a) production	600X210X14 =	1,764,000 sh
b) packaging of 1 Kg.	300X12 X14 =	50,400
c) packaging of 5 Kg.	150X25 X14 =	52,500
d) packaging of 25 Kg.	150X6.7X14 =	14,070
	Total	1,880,970 sh

j) Direct labour required

Production: 8 tons/day X 75 days

a) technical manager	11% of annual cost
b) Solids dept. head	18% of annual cost
c) 3 foremen	75 days
d) 15 workers	75 days

K) Direct labour cost

a) technical manager		32,000 sh
b) Solids dept. head		43,200
c) 3 foremen		517,500
d) 15 workers		337,500
	Total	930,200 sh

L) Indirect labour cost 556,400 sh

M) Utilities

a) electric energy (water, compressed air)		58,365 sh
b) diesel oil for trucks		461,250
	Total	519,615 sh

N) Spare parts	451,000 sh
O) General expenses	2,255,000 sh
P) Technical assistance	2,050,000 sh
Q) Depreciation	6,427,190 sh
R) Interests	16,297,500 sh
Total	90,749,875 sh

COST OF 1 KG = 251.2 sh

FURADAN

A) Total production: 300 tons/year

a) 150 tons 1 Kg packaging
b) 100 tons 5 Kg packaging
c) 50 tons 25 Kg packaging

B) Composition of 1 Kg. Of product

a)	Furadan	0.05 Kg
b)	Polivinyl alchool	0.002 Kg
c)	Sand	0.948 Kg

C) Cost of raw material

a)	Furadan	2030.25 sh/Kg
b)	Polivinyl alchool	240 sh/Kg
c)	Sand	1.2 sh/Kg

D) Cost of 1 Kg. of raw materials

a) Theoretical
(0.05X2030.25)+(0.002X240)+(0.948X1.2)= 103.128

b) Actual
Theoretical cost is increased of 1% to take into consideration losses etc.
103.128 X 1.01 = 104.16

E) Total cost of raw materials
300,000 X 104.16 = 31,248,000 sh

F) Cost of packaging material

a)	1 Kg.	container	38.4 sh
b)	5 Kg.	container	72 sh
c)	25Kg.	container	81 sh

G) Total cost of packaging material

a)	150,000 X 38.4 =	5,760,000 sh
b)	20,000 X 72 =	1,440,000
c)	2,000 X 81 =	162,000
	Total	7,362,000 sh

H) Electric energy consumption

a) production	40 KWh/t
b) packaging of 1 Kg.	5 KWh/t
c) packaging of 5 Kg.	4 KWh/t
d) packaging of 25 Kg.	5 KWh/t

I) Cost of electric energy

a) production	300X40X14 =	168,000 sh
b) packaging of 1 Kg.	150X5 X14 =	10,500
c) packaging of 5 Kg.	100X4 X14 =	5,600
d) packaging of 25 Kg.	50X5 X14 =	3,500
	Total	187,600 sh

j) Direct labour required

Production: 4 tons/day X 75 days

a) technical manager	11% of annual cost
b) Solids dept. head	10% of annual cost
c) 4 foremen	75 days
d) 12 workers	75 days

K) Direct labour cost

a) technical manager		32,000 sh
b) Solids dept. head		24,000
c) 4 foremen		510,000
d) 12 workers		270,000
	Total	836,000 sh

L) Indirect labour cost — 556,400 sh

M) Utilities

a) electric energy (water, compressed air)		57,000 sh
b) diesel oil for trucks		450,000
	Total	457,000 sh

baldo & c. srl
CONSULTING ENGINEERS

N) Spare parts		200,000 sh
O) General expenses		1,000,000 sh
P) Technical assistance		800,000 sh
Q) Depreciation		7,754,485 sh
R) Interests		15,900,000 sh
	Total	66,301,445 sh

COST OF 1 KG = 221

6.7 Working Capital Calculation

The following assumption have been done

a) Accounts receivable: 30 days at production cost minus depreciation and interest.

b) Inventory

local materials	:	30 days
imported materials	:	120 days
work in progress	:	not applicable
finished products	:	90 days at factory costs plus administrative overheads

c) Cash in hand : 15 days (see separate calculation in this paragraph)

d) Accounts payable : 30 days, for raw materials and utilities

In the following tables the annual production cost estimates and the working capital requirement are shown.

baldo & c.
CONSULTING ENGINEERS

Annual Production Cost Estimate

PERIOD	CONSTRUCTION		START UP			FULL CAPACITY	
Year	1	2	3	4	5	6	7
Production programme	-	-	40%	70%	100%	100%	100%
Costs (Millions sh)							
Raw Materials (local)			48	84	120	120	120
Raw materials (imported)			392	686	980	980	980
Labour			13	13	13	13	13
Utilities			8	13	18	18	18
Spare parts			4	4	4	4	4
General Expenses			20	20	[illegible]	20	20
Technical assistance			18	18	18	-	-
Operating cost			503	838	1,173	1,155	1,155
Financial cost			173	165	159	83	8
Depreciation			85	85	85	85	85
Total Production costs			761	1,088	1,417	1,323	1,248

Note: see following paragraphs for financial costs calculation

Calculation of working capital

Requirements (Million sh)

Items	Minimum Days of coverage	Coefficient of turn-over	Start-up years 3	Start-up years 4	Full capacity years 5	Full capacity years 6	Full capacity years 7
1. **Current assets**							
A. Accounts receivable	30	12	42	70	98	96	96
B. Inventory							
Local materials	30	12	4	7	10	10	10
Imported materials	120	3	131	229	327	327	327
Spare parts	180	2	2	2	2	2	2
Finished products	90	4	126	210	293	289	289
C. Cash in hand (See separate calculation)			10	9	9	5	2
D. Total			315	527	739	729	726
2. **Current liabilities**							
A. Accounts payable			37	65	93	93	93
3. **Working capital**							
A. Net working capital			278	462	646	636	633
B. Increase in working capital			-	184	184	(10)	(3)

baldo & c.
CONSULTING ENGINEERS

Cash in hand calculation (Million sh)

	Years				
	3	4	5	6	7
Total production costs	761	1,088	1,417	1,323	1,248
less: raw materials	440	770	1,100	1,100	1,100
Utilities	8	13	18	18	18
Depreciation	85	85	85	85	85
	228	220	214	120	45
(needs for 15 days)					
Required Cash balance	9.5	9.1	8.9	5	1.9

6.8 Total Initial Investment Costs

ITEM	INVESTMENT CATEGORY	VALUE (Million sh)
1	Initial Investment Costs	950
2	Pre-production Capital expenditure	10
3	Working capital	640
		1,600

6.9 Total Investment cost ('Million sh)

	Construction years		Production years		
	1	2	3	4	5
Fixed Investment cost	467	483	-	-	-
Pre-production expenditures	3	7	-	-	-
Working Capital Increase	-	-	278	184	184
	470	490	278	184	184

GRAND TOTAL 1,690,000,000 sh

6.10 Total Initial Assests

Fixed Investment cost	950,000,000
Pre-production expenditure	10,000,000
Current assets at full capacity	730,000,000
	1,690,000,000 sh

6.11 Total Assets (Millions sh)

	Construction years		Production years		
	1	2	3	4	5
Fixed investment costs	467	483	-	-	-
Pre-production expenditures	3	7	-	-	-
Current assets increase	-	-	315	212	212
Total assets	470	490	315	212	212

Total assets: 1,700,000 sh.

6.12 Project financing

The following assumptions have been done:

6.12.1 Sources of finance

All values expressed in million sh.

Equity	640
Supplier's credit	286
Commercial banks	681
Current liabilities	93
	1,700

6.12.2 Sources of initial funds

Year	1	2	3	4	5
Equity capital	470	170			
Suppliers credit		286			
Commercial bank		680			
Current liabilities			37	28	28
TOTAL	470	1,136	37	28	28

6.12.3 Cash flow table for financing planning

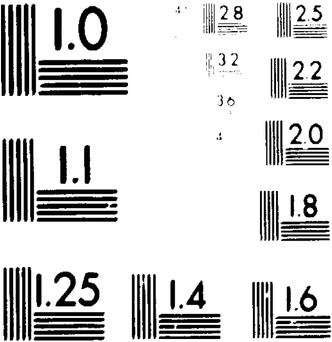
A table with the cash flow for the financing planning is provided in the next page.

The following assumptions have been made:

a. Supplier credit repayment in 5 equal installments, the first being the first production year.

b. Interest on supplier credit 13% annum

c. Loan from local concerned bank at 20% annum, repayment in two equal installment, with two years grace.



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS
STANDARD REFERENCE MATERIAL 1010a
(ANSI and ISO TEST CHART No. 2)

CASH FLOW TABLE FOR FINANCIAL P

YEAR	SALES REVENUES	FINANC. RESOURCES	TOTAL INFLOW	TOTAL ASSETS	OPERATING COSTS
1	-	470	470	470	-
2	-	1,136	1,136	490	-
3	857	37	894	315	503
4	1,500	30	1,530	212	838
5	2,144	30	2,174	212	1,173
6	2,144	-	2,144	-	1,155
7	2,144	-	2,144	30	1,155
8	2,144	-	2,144	-	1,157
9	2,144	-	2,144	-	1,157
10	2,144	-	2,144	-	1,157
11	2,144	-	2,144	-	1,157
12	2,144	-	2,144	30	1,157
13	2,144	-	2,144	-	1,157
14	2,144	-	2,144	-	1,157

ANNING (Million sh)

INTERESTS	PAYMENT	SURPLUS DEFICIT	COMULATIVE CASH BALANCE
-	-	-	-
-	-	646	646
173	57	139	507
165	57	253	760
159	397	228	988
83	397	509	1,497
8	57	894	2,391
-	-	987	3,378
-	-	987	3,356
-	-	987	5,343
-	-	987	6,330
-	-	957	7,287
-	-	987	8,294
-	-	987	9,261

6.13 Net Income statement

In the table the following information are provided for each year of operation.

- Sales revenue
- Operating cost
- Financial cost
- Depreciation
- Total costs
- Gross profit
- Tax
- Net profit

Note that tax has been considered to be 50% of the gross profit and applicable from the very beginning.
It is obvious that if a tax holiday can be granted for few years, the economic result would considerably increase.

NET INCOME STATEMENT (Million [illegible]sh)

YEAR	SALES	OPERATIONS COSTS	FINANCIAL COSTS	DEPRECIATION
1986	857	503	173	85
1987	1,500	838	165	85
1988	2,144	1,173	159	85
1989	2,144	1,155	83	85
1990	2,144	1,155	8	85
1991	2,144	1,157		83
1992	2,144	1,157		83
1993	2,144	1,157		83
1994	2,144	1,157		83
1995	2,144	1,157		83
1996	2,144	1,157		83
1997	2,144	1,157		83

TOTAL COSTS	GROSS PROFIT	TAX	NET PROFIT
761	96	48	48
1,088	462	231	231
1,417	727	363	364
1,323	821	410	410
1,248	896	448	448
1,240	904	452	452
1,240	904	452	452
1,240	904	452	452
1,240	904	452	452
1,240	904	452	452
1,240	904	452	452
1,240	904	452	452

6.14 Discounted Cash flow analysis

The following two tables show the cash flow and the DCF analysis.
The IRR is 29.54%

CASH FLOW TABLE (Values:

YEAR	SALES	EQUITY	REPAYMENT	INTEREST	TAX
1984	-	470	-	-	-
1985	-	170	-	-	-
1986	857	-	57	173	48
1987	1,500	-	57	165	231
1988	2,144		397	159	363
1989	2,144		397	83	410
1990			57	8	448
1991					452
1992					452
1993					452
1994					452
1995					452
1996					452
1997	2,144				452

million sh)

REPLACEMENT	OPERATIONAL COSTS	TOTAL	CASH-FLOW
-		(470)	(470)
-		(170)	(170)
	503	781	76
	838	1,291	209
	1,173	2,092	52
	1,155	2,045	99
30	1,155	1,698	446
	1,157	1,609	535
	1,157	1,609	535
	1,157	1,609	535
	1,157	1,609	535
30	1,157	1,639	505
	1,157	1,609	535
	1,157	1,609	535

I.R.R. Calculation by DCF

YEAR	CASH FLOW	PRESENT VALUE (30%)	PRESENT VALUE (28%)
1984	(470)	(361.5)	(367.18)
1985	(170)	(100.59)	(103.75)
1986	76	34.59	36.24
1987	209	73.18	77.86
1988	52	14	15.13
1989	99	20.51	22.51
1990	446	71.08	79.22
1991	535	65.58	74.25
1992	535	50.45	58
1993	535	38.80	45.31
1994	535	29.85	35.40
1995	505	21.67	26.11
1996	535	17.66	21.61
1997	535	13.59	16.88
		+ 450.96	+ 508.52
		- 462.09	- 470.94
		- 11.13	+ 37.58

$$\text{I.R.R.} = 28 + \frac{37.58\ (30-28)}{37.58 + 11.13}$$

$$= 28 + \frac{37.59 \times 2}{48.71}$$

$$= 29.54\%$$

6.15 Pay Back period calculation

(Values in Mil.sh.)

YEAR	NET PROFIT	INTEREST	DEPRECIATION	TOTAL
1986	48	173	85	306
1987	231	165	85	481
1988	364	159	85	608
		GRAND TOTAL		1,395

the fixed capital investment is 960 Million sh., therefore the pay-back period is slightly lower than 2.5 years.

It is worth to note that profit tax has been considered to be paid from the very beginning.

In case some tax vacation is granted for the first year of operation, the pay-back period can be considerably reduced.

6.16 Break-even point

6.16.1 When the plant is in full pruduction, the fixed costs (administrative personnel, general expenses, depreciation and interest) will be: 269,840,000 sh while the proportional costs (raw materials, utilities, spare parts and production personnel will be 1,128,720,000 sh

6.16.2 Then the following equation is used for the break-even point calculation:

$$\text{Break-even point} = \frac{\text{fixed expenses}}{\text{revenues-proportional expenses}}$$

$$= 26.56\%$$

6.17 Sensitivity analysis

6.17.1 A number of sensitivity tests have been carried out, by computing the IRR under changing circumstances.

The variables taken into consideration are:

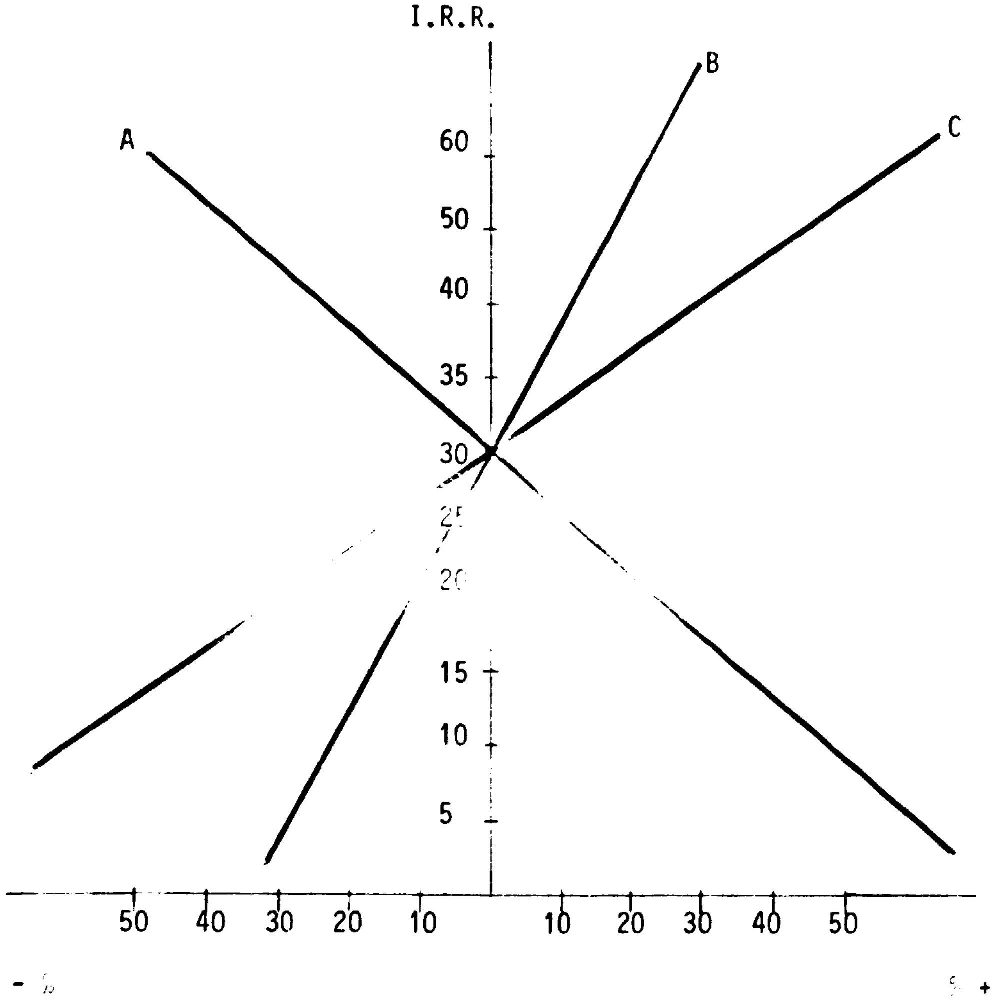
a. increase in the cost of raw materials	30%
b. decrease of the selling price	30%
c. decrease of the production	30%

6.17.2 The results of the test are the following:

Case a.	IRR	:	17.09%
Case b.	IRR	:	3.19%
Case c.	IRR	:	19.14

A graph with the sensitivity analysis is also attached.

SENSITIVITY ANALYSIS



A : CHANGE IN COST OF RAW MATERIALS

B : CHANGE IN SELLING PRICE

C : CHANGE IN PRODUCTION VOLUME

CHAPTER 7

ANNEXES

ANNEXE 1

LIST OF GOVERNMENTAL AGENCIES AND COMPANIES

VISITED DURING THE FIELD MISSION

baldo & C. srl
CONSULTING ENGINEERS

ANNEXE 1

LIST OF GEVERNMENTAL AGENCIES AND COMPANIES VISITED DURING THE FIELD MISSION

- Ministry of Planning - Economic Development
- Ministry of Industry
- Ministry of Health
- Ministry of Agriculture and Forestry
- Ministry of Commerce
- Department of Geology
- UCCU - Uganda Control Co-operative Union
- Advisory Board of Trade
- Town and rural Council
- Experimental and Demonstration Farm (**)
- Mining and quarry companies
- Agricultural Chemicals Importers and Dealers
- Twiga Chemical Industry Ltd. (ICI Group)
- Uganda Associated Industries Ltd.
- Wellcome (U) Ltd.
- Mackenzie Technical Service Ltd.
- Wellcome Nairobi
- BASF E. Africa Ltd. (BASF - West Germany)
- Hoechst E. Africa Ltd.
- Pfizers (K) Ltd. Nairobi
- F.MC (E. Africa) Ltd. Nairobi (East & Central Africa)
- Megadi Soda Co. (Twiga/ICI Nairobi)
- Ciba-Geigy Ltd. Nairobi
- Murphy Chemicals (E. Africa Ltd.) Nairobi
- Research Bodies

  East African Pesticides Research Organization - Arusha, Kawanda, Serere, Entebbe, UTRO.

ANNEXE 2

REPORT ON THE KISAI KAOLIN DEPOSIT

ANNEXE 2

(·) THE KISAI [illegible] DEPOSIT, KOKI

by

P. F. Neal

INTRODUCTION

The presence of a white material on the upper slopes of some of the hills in northern Koki has long been known to the local people and exploited by them as a source of whitening. Early in July, 1959 a sample of this material was brought to the Geological Survey and subsequently identified as a [illegible] shale with a chemical analysis of approximately 69.70 per cent silica, 17.9[illegible] per cent alumina and [illegible] per cent ferric iron oxide. A size analysis on the same sample gave -

+76 (200 B.S.)	0.63 per cent
-76 + 44 microns	2.65 per cent
-44 + 10 microns	46.71 per cent and
- 10 microns	50.59 per cent.

Following a provisional visit paid by Dr. C.G.B. Du Bois in August 1959 (1) the writer was directed to make a full investigation of the deposit with special emphasis on the quantity and quality of material available for exploitation. The investigation extended over the three months from September to December, 1959 and the analyses were done in the Geological Survey Laboratories in Entebbe during January and February of 1960.

[illegible]

[illegible] in the [illegible] Koki County, Masaka District, at latitude 0° 35' 2[illegible]" S. and longitude 31° 22' 30" E. Its map reference is UC 193346 on 1:50,000 Sheet 87/II, Rakai. The locality falls within the Geological Survey Sheet 87, Rakai (Scale - 1:100,000).

Access, at the time of operations, was by a rough, dry weather, motorable track striking north from the Rakai - Lyantonde road about a quarter of a mile west of the Gombolola Headquarters at Buyamba. This track, clearly indicated on the 1:50,000 sheet, is followed for five and a half miles, and then a second track, striking west, is taken for a further half mile.

[illegible] means of access is from the north through [illegible] and [illegible] but this is mostly a rough track and is only negotiable by Landrover in dry weather.

[illegible] consider the possibility of extending this road through to them, thereby saving 20 - 30 miles probably, in your journey from the deposits to Masaka."

GEOLOGY

Kisai Hill lies close to the axis of an open syncline extending from Lake Kachira in the west to the unconformity between the Karagwe - Ankolean and Toro Systems in the east. This syncline, formed of sediments of Karagwe - Ankolean age, has been described in detail by Phillips (2) and consists of purple, grey and pale coloured shales and mudstones bounded by quartzites, and plunges gently to the south.

Flat-topped hills capped by laterite form noteworthy topographic features in this part of Kigezi County. The hill tops, which lie on a general level of 4,[illegible] to 4,700 feet form part of the Kabale Erosion Surface and it is immediately [illegible] (height 4,[illegible] feet) that the kaolin deposit is found.

The shales and mudstones of Kisai Hill differ from the surrounding sedimentary rocks only in that they are leached. Leaching has produced a pale coloured rock varying from pure white to shades of buff. Iron staining is of frequent occurrence with the development of bands, specks and irregular patches of purple, brown, orange, grey and black material. Fine iron-rich bands occur which, on examination under the binocular microscope, are seen to consist of concentrations of comparatively coarse quartz of which the individual grains have been stained by iron oxides. These coarser quartz-rich bands appear to have formed a trap to circulating iron-rich solutions.

[illegible] of quartz.

The mechanism of leaching is not clear. The chemical composition of the end product of leaching has been given above. It differs from that of a normal shale by a reduction in iron and other bases with a consequent increase in the silica and alumina content. The presence of a hard lateritic cap on the top of the hill suggests that much of the iron migrated upward in a manner similar to the formation of a hard pan: the bases however were probably removed by downwards leaching. The entire process was probably the result of seasonal changes of temperature and rainfall.

EXPLORATION

[illegible] It is [illegible] feet in length [illegible] and fairly steep [illegible]. Natural exposures of leached [illegible] are found in several places on the north and [illegible] [illegible] to determine the variation in quality of the material.

Samples were taken from channels down the sides of the pits and from steps cut in the floors of the trenches. Channel samples were also taken from the natural exposures.

CHEMICAL ANALYSIS

Seventy-one samples of kaolin taken from over Kisai Hill were analysed for alumina, silica and iron. The results are given in Appendix II but are summarised below.

Silica. The silica content varies between 63 per cent and [illegible] per cent with an overall average of 73.18 per cent..

Alumina. Alumina varies between 10 per cent and 23 per cent with an average of 16.6[illegible] per cent.

Iron. The amount of iron present varies between 0.5 per cent and 4.[illegible] per cent [illegible] 10.3 per cent. The overall average is 1.6[illegible] per cent Fe_2O_3.

Alumina content of the samples shows a definite tendency to increase downwards. At the top of the hill the value is generally below 16 per cent but there is a progressive increase in alumina at depth, especially towards the north where a stratification in alumina content can be plotted.

The distribution of the iron is more irregular and is, as discussed above, probably dependent on local conditions of deposition and the trapping of migrative iron solutions in coarser bands and horizons.

[illegible]

[illegible] Samples were broken down by rolling between sheets of paper on a soft-board sheet. Thirty grams of material were weighed and screened through a 200 B.S. sieve. Ten grams of -200 B.S. material were then weighed, agitated in a column of water and allowed to settle for prescribed periods to give fractions of minus 10 microns, 10 to 44 microns and 44 to 76 microns (200 mesh).

Although the results (Appendix III) show considerable variation in detail, in general almost 95 per cent of the entire deposit is less than 76 microns, nearly 75 per cent is less than 44 microns and nearly 20 per cent less than [illegible] follows:-

+ 76 microns	[illegible] per cent
- 76 + 44 microns	21.62 per cent
- 44 + 10 microns	53.71 per cent
- 10 microns	19.4[illegible] per cent

RESERVES

[illegible] assessment of the tonnage of such an irregularly shaped [illegible] as Kisui must, of necessity, be approximate and certain assumptions must be made. One such assumption is the [illegible]ence of a horizontal level above which leaching has taken place. From the numerous pits and trenches excavated at all levels of the hill the writer considers that within the limits of knowledge and accuracy a horizontal level conforming to the 4,475 feet contour may be taken as the base horizontal level of the deposit. All pits and trenches above this level show the presence of leached shales.

The area of this base level is that which contains all pits and trenches containing leached shales and is about 500,000 square feet.

The upper limit of the deposit is marked by the contact between the leached shales and the laterite cap. Pitting has shown this to approximate to the 4,630 feet level. The area enclosed by this contour, as calculated by Simpson's Rule, is approximately 55,000 square feet.

According to G. G. Knott and J. S. Mackay (3) the approximate solidity of an irregular prismoidal form may be calculated from the following formula

$$V = 1/6\ (B.L. + b.l + 4M.)\ h$$

where V is the volume, B.L. the area of the basal level, b.l. the area of the upper level, M. the area of the [illegible] section parallel to [illegible] [illegible] the area of the middle section [illegible] the 4,555 [illegible] [illegible] is approximately [illegible] square feet.

Thus the volume of the deposit is -

$$1/6\ (500,000 + 55,000 + 4(363,000)\ )\ 155$$

or 51,647,500 cubic feet.

From the weight of a cut cube of material of known size one cubic foot of leached shale weighs approximately 100 lbs. Thus the total reserves of material are approximately 2,314,000 tons.

CONCLUSIONS AND RECOMMENDATIONS

In order to commence production of kaolin in a limited [illegible], as must be envisaged at first, a suitable [illegible] hill must be worked. [illegible]

1. [illegible]
2. Chemical analysis
3. [illegible]
4. [illegible]

With these factors in mind the writer suggests [illegible] at or near the horse-shoe shaped [illegible] in the north-west. Size analyses from samples taken there average:-

	+ 76 microns	2.94 per cent
−76	+ 44 microns	14.75 per cent
−44	+ 10 microns	66.91 per cent
	− 10 microns	15.39 per cent.

Chemical analyses of the same samples average:

Alumina	18 per cent
Silica	70.5 per cent
Iron	1.5 per cent.

There is no overburden and this point is the nearest accessible point to the motorable track. About [illegible] long tons should be available. Further blocks of ground may be delineated by reference to the attached analyses and maps.

REFERENCES

(1) Du Bois, C.G.B., 1959 "The Kisai Kaolin Occurrence Koki, Masaka District. Unpublished Report Geol. Surv. Uganda C.G.B.Du [illegible]

(2) [illegible]

(3) [illegible] and Mackay, J.S. [illegible] W. & R. Chambers Ltd.

APPENDIX I

Koki Kaolin Mines and Manufacturers

The entire deposit at Kisai is on land owned by Mr. Emmanuel Wamala Mukasa (M.R.V. 441 F. 11. FO.26629) who, with Mr. Charles B. Mutagwanya and Mr. Stanley Mukasa, has formed a company, the Koki Kaolin Mines and Manufacturers, Registration certificate No. [illegible]. Mr. Mutagwanya is the managing partner and all communications concerned with the property should be addressed to him c/o Koki Kaolin Mines and Manufacturers, Postmaster, Mengo Post-Office, Uganda. ~~[illegible]~~
P. O. Box 384 Masaka. (Since June 19[illegible]).

Mr. Emmanuel Wamala Mukasa retired and
Mr. Joseph [illegible] [illegible] was admitted in 1960

Chemical analys[illegible]

Me 394 - Me 473

Lab. Serial Nos: 21443 - 21522.

Sample Mark	SiO_2%	Al_2O_3%	Fe_2O_3%	Sample Mark	SiO_2%	Al_2O_3%	Fe_2O_3%
Me394	73.0	18.0	1.9	Me433	71.0	15.0	1.1
Me395	73.0	19.0	1.7	Me434	71.59	19.56	1.5
Me396	72.0	19.0	0.7	Me435	76.0	14.0	1.8
Me397	75.0	16.0	1.1	Me436	76.0	14.0	[illegible]
Me398	82.0	14.0	1.9	Me437/8	76.0	16.0	[illegible]
Me399	81.0	14.0	0.5	Me439/40	73.0	16.0	3.6
Me400	74.0	14.0	0.9	Me441/2	72.0	17.0	4.6
Me401	74.0	15.0	1.0	Me443/4	74.0	18.0	2.5
Me402	79.0	15.0	0.9	Me445/6	71.0	19.0	1.8
Me403	72.0	15.0	2.8	Me447	70.0	17.0	1.2
Me404	73.0	18.0	1.2	Me448	70.0	19.0	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Me408	74.0	16.0	1.2	Me452	66.0	18.0	10.3
Me409	74.0	20.0	1.3	Me453	75.0	15.0	1.3
Me410	74.0	19.0	1.7	Me454	73.0	16.0	3.5
Me411	71.0	19.0	2.2	Me455	71.0	17.0	2.7
Me412	70.0	19.0	1.7	Me456	72.0	17.0	1.2
Me413/4	74.0	11.0	0.9	Me457	72.0	13.0	1.9
Me415/6	75.0	14.0	2.2	Me458	79.0	17.0	[illegible]
Me417/8	73.0	16.0	2.0	Me459	76.0	13.0	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	75.0	17.0	1.3	Me462	76.0	20.0	[illegible]
Me421	74.0	23.0	1.2	Me463	72.0	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	1.4	[illegible]	[illegible]	[illegible]	[illegible]
Me443	70.0	23.0	1.7	Me465	74.0	19.0	0.6
Me424	75.0	16.0	3.4	Me466	74.0	18.0	3.2

Continued

Sample No.	% - 10μ	% + 10μ - 44μ	% + 44μ - 200BS.	% + 200[illegible]
ME.424	15.64	59.65	19.41	5.30
425	17.28	53.83	23.32	5.57
426	46.56	43.80	8.94	0.70
427	11.68	61.75	23.19	3.38
428	7.48	40.35	28.45	23.72
[illegible]	13.34	62.59	22.30	1.77
[illegible]	3.44	38.35	[illegible]	[illegible]
[illegible]	7.50	67.42	21.51	3.5[illegible]
432	11.88 (7.18)*	56.16 (63.17)*	21.97 (21.98)*	9.99 (7.67)*
433	24.36	52.12	17.95	5.57
434	7.12 (12.42)*	60.02 (64.06)*	27.83 (17.59)*	5.03 (5.93)*
435	24.80	56.22	18.28	0.70
[illegible]	21.57	55.77	21.18	1.[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
440	29.78 (32.66)*	46.13 (51.88)*	17.11 (13.88)*	6.98 (1.58)*
441	25.49	52.08	21.24	1.19
442	13.32	45.80	28.60	12.28
443	21.97	57.31	13.95	6.37
444	11.71	65.51	20.53	2.25
445	18.06	62.82	17.75	1.[illegible]
[illegible]	14.64	58.78	25.00	1.[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	70.05	[illegible]	[illegible]
[illegible]	[illegible]	70.33	[illegible]	5.[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

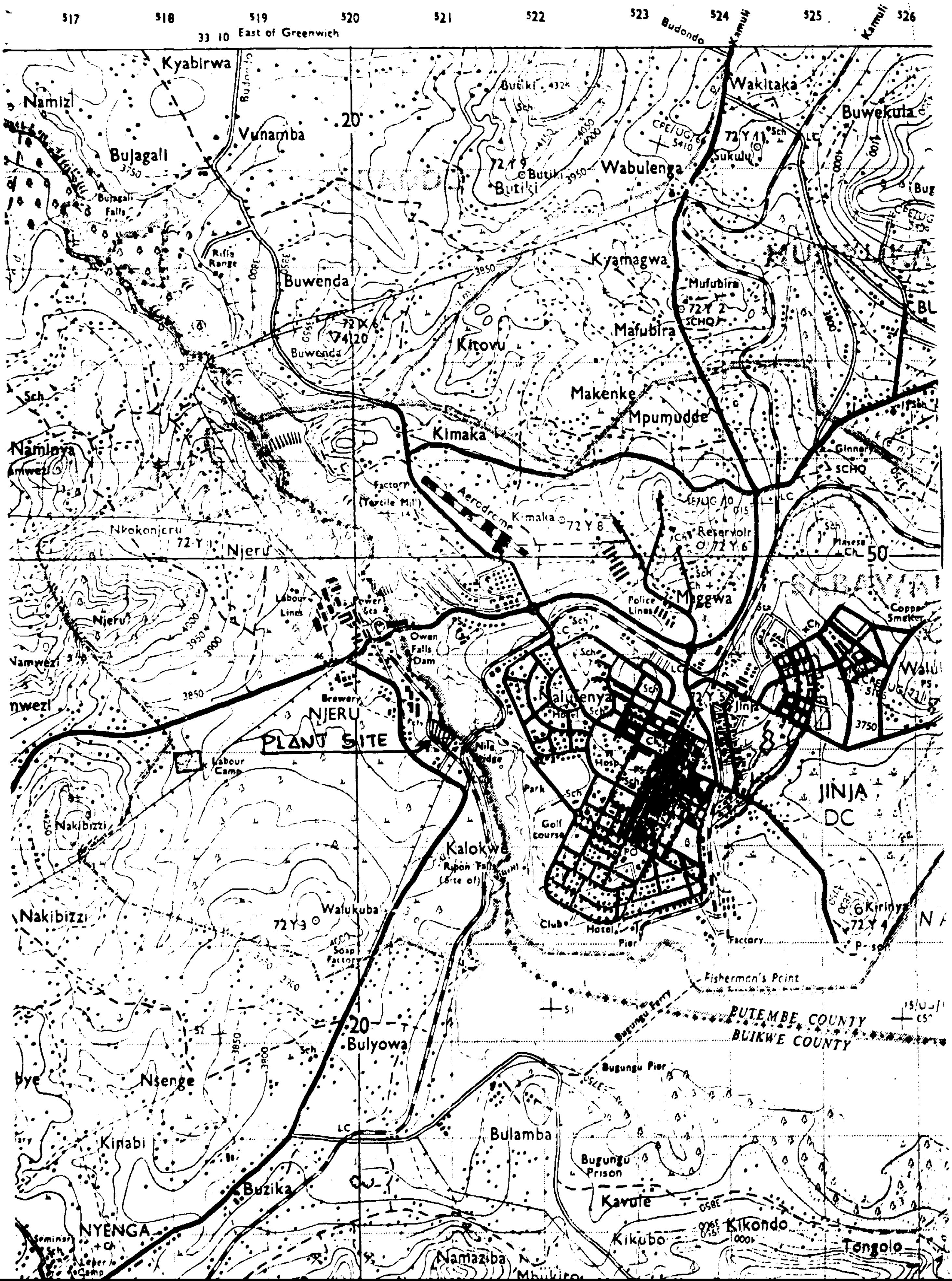
Continued

ANNEXE 3

MAP SHOWING THE PLANT SITE

ANNEXE 3

Sheet 72/1



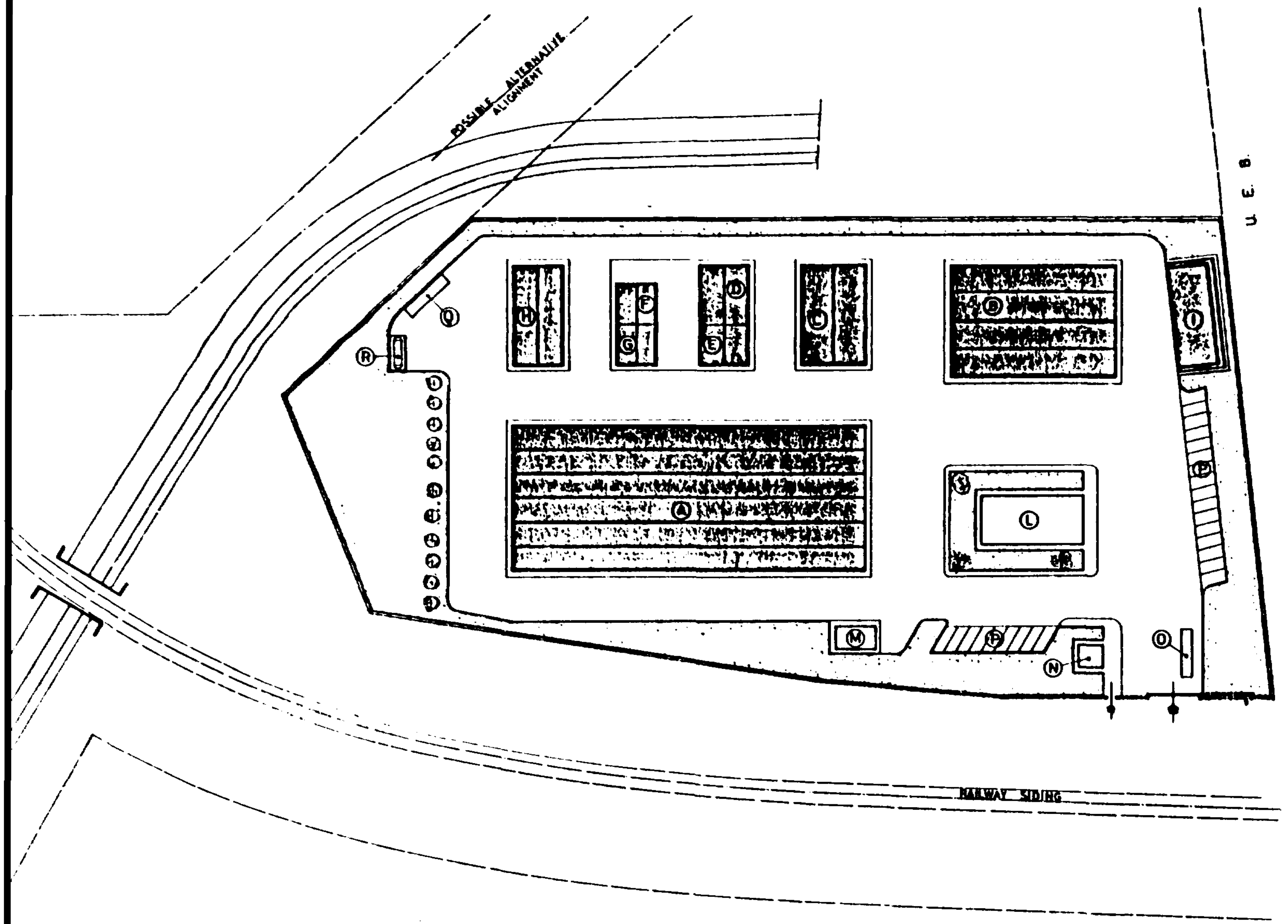
ANNEXE 4

DRAWINGS

baldo & C.
CONSULTING ENGINEERS

Annexe 4: Drawings and Diagrams.

B130-010 Factory Lay-out
B130-001 Liquid Insecticides and Herbicides flow sheet
B130-002 Liquid Insecticides and Herbicides buildings. Plan view and Sections
B130-003 Powder Insecticides Production Building Plan View and Section C-C
B130-004 Powder Insecticides Production Building Sections A-A & B-B
B130-005 Powder Herbicides Granulars Building Plan View and Sections
B130-006 Granular Insecticides and Herbicides Flow-sheet
B130-007 Powder Insecticides Flow-sheet
B130-008 Powder Herbicides Flow-sheet
B130-009 Water supplying Flow-sheet
B130-011 Warehouse, Drums & Kaolin deposit Plan view and Sections.
B130-012 Electric Cabin One line Diagram

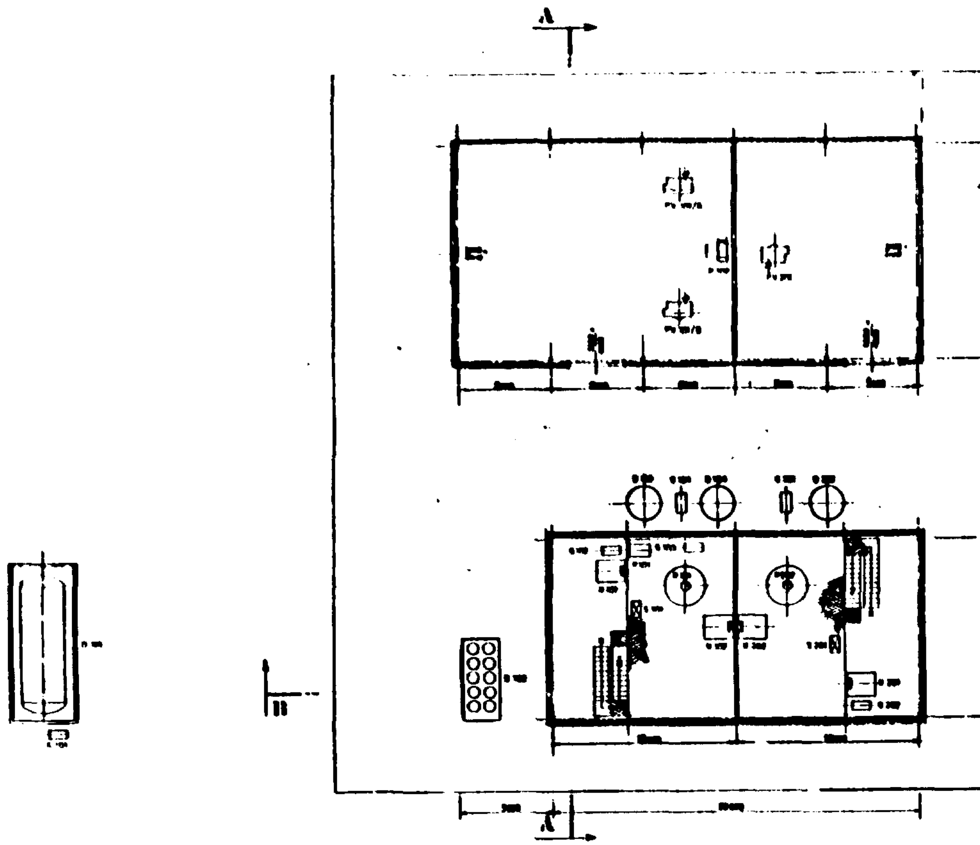


LEGEND

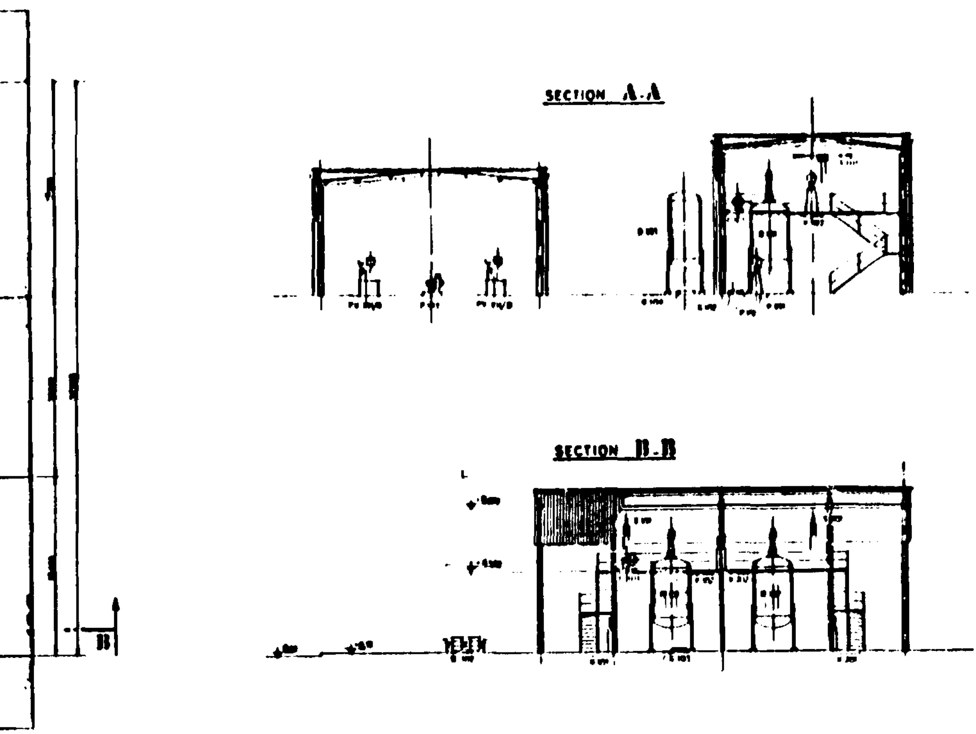
- (A) – RAW MATERIALS AND FINISHED PRODUCT WAREHOUSE
- (B) – POWDER INSECTICIDES FORMULATION PRODUCTION BUILDING
- (C) – POWDER HERBICIDES AND GRANULARS FORMUL. & PACKING
- (D) – LIQUID INSECTICIDES PACKING
- (E) – LIQUID HERBICIDES PACKING
- (F) – LIQUID INSECTICIDES FORMULATION
- (G) – LIQUID HERBICIDES FORMULATION
- (H) – DRUMS DEPOSIT
- (I) – RAW KAOLIN DEPOSIT
- (L) – ADMINISTRATION BUILDING
- (M) – MAINTENANCE WORKSHOP & ELECTRIC CABIN
- (N) – GATE HOUSE
- (O) – WEIGHING BRIDGE FOR IN AND OUTGOING LORRIES
- (P) – CAR PARKING AREA
- (Q) – WATER TANK
- (R) – SOLVENT TANK
- —— FENCING

UNIDO – VIENNA	B-130
PESTICIDES FORMULATION PLANT	
FACTORY LAYOUT	1 : 500
	B-130-010

SOME FIGURES
OF THIS DOCUMENT
ARE TOO LARGE
FOR MICROFICHING
AND WILL NOT
BE PHOTOGRAPHED.



PLAN VIEW



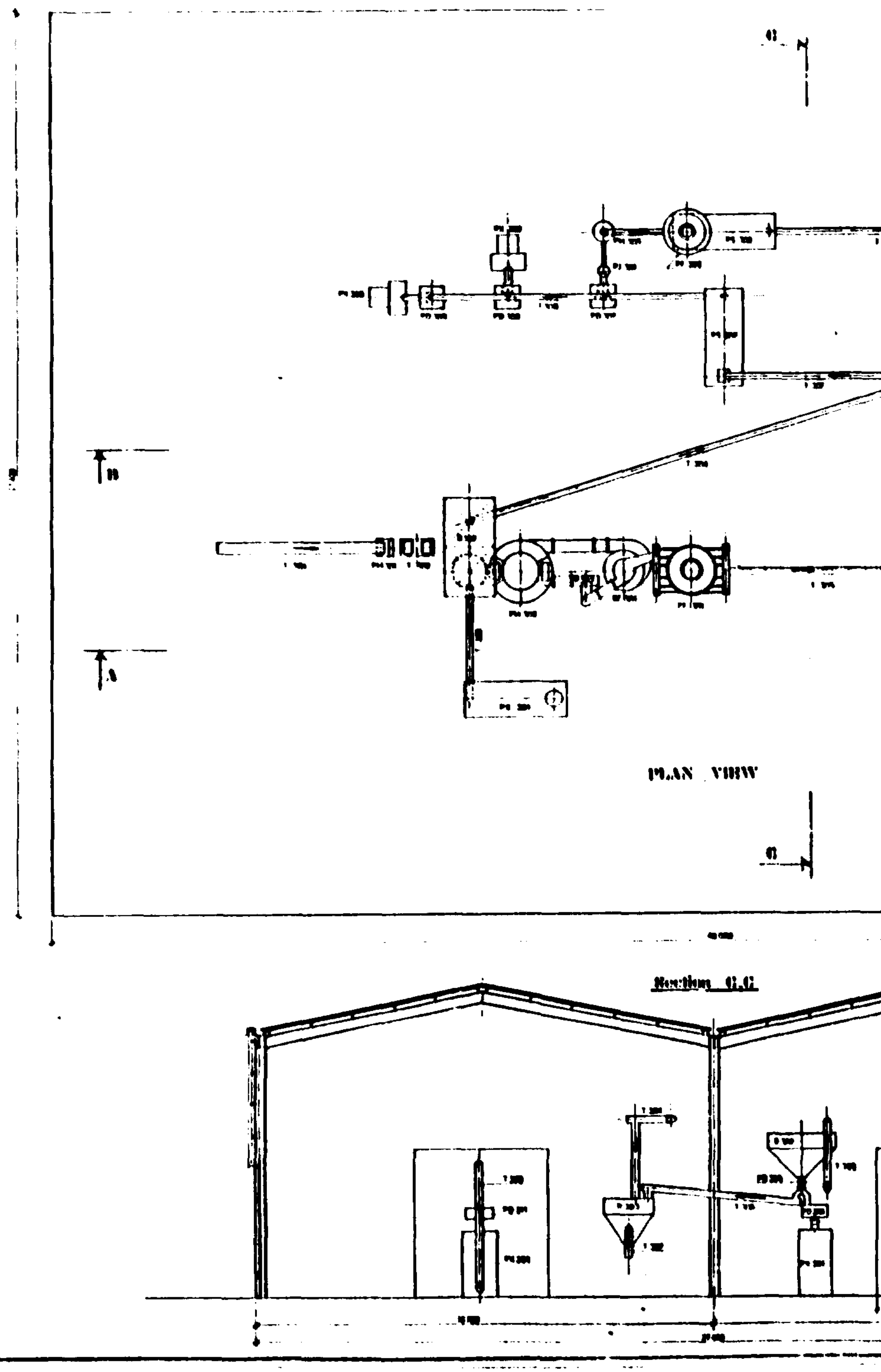
REFERENCE DRWNG

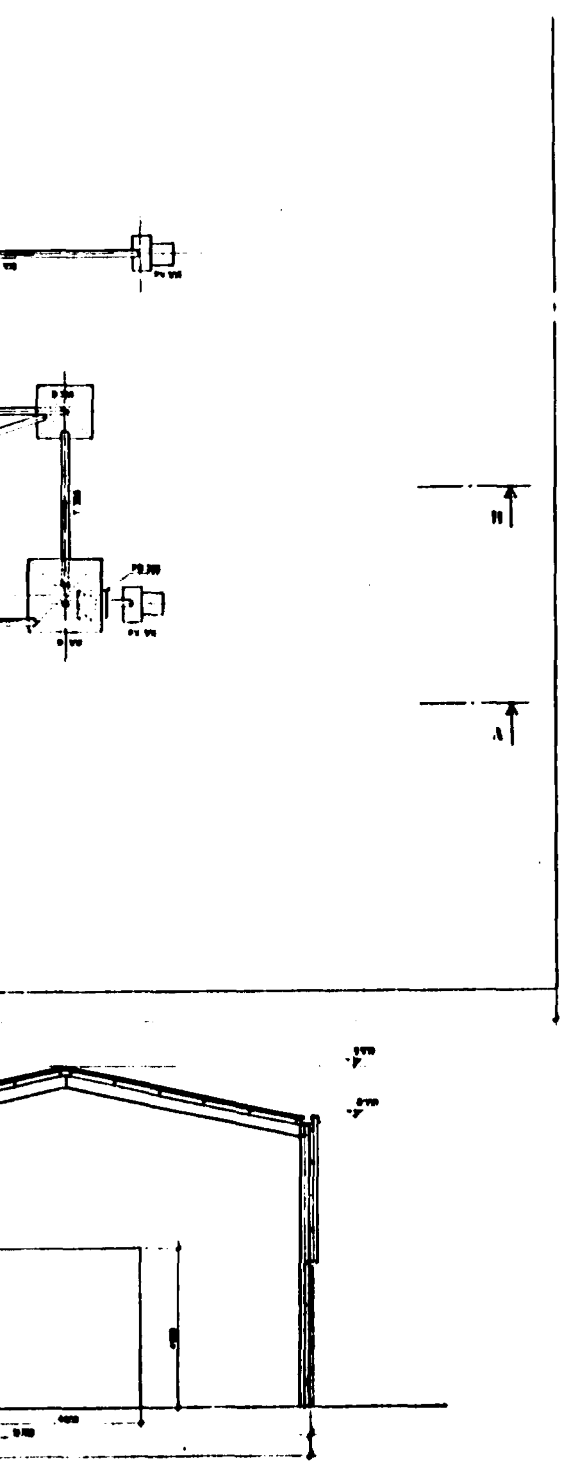
UNIDO - VIENNA

B.130

PLAN VIEW and SECTIONS

B.130.002


PLAN VIEW
Section G.G

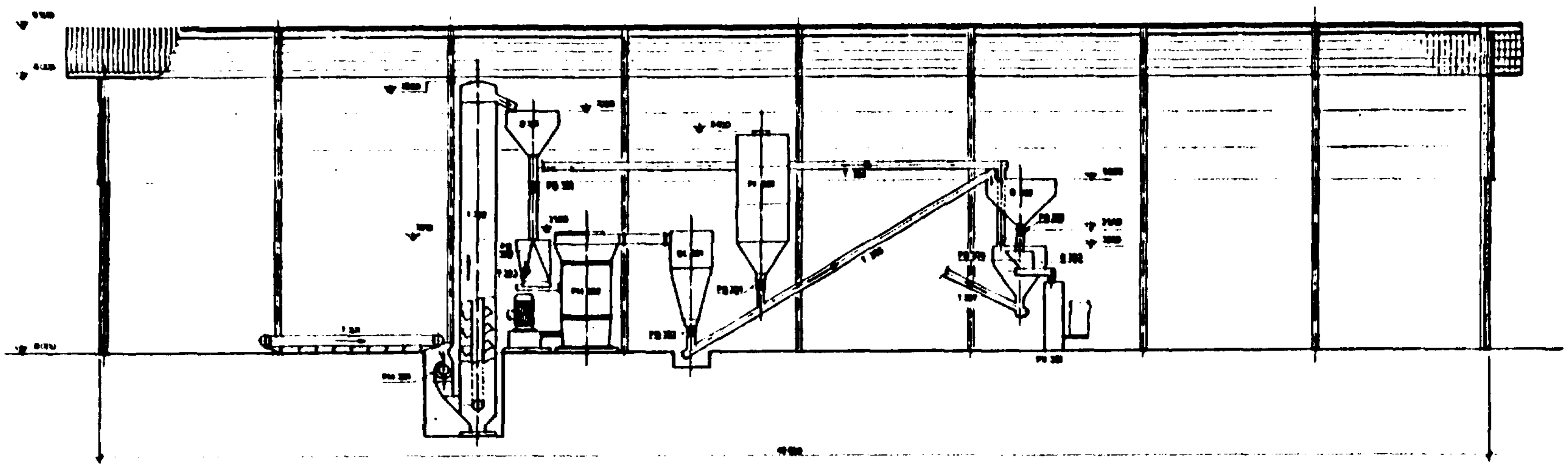


REFERENCE DRWGS

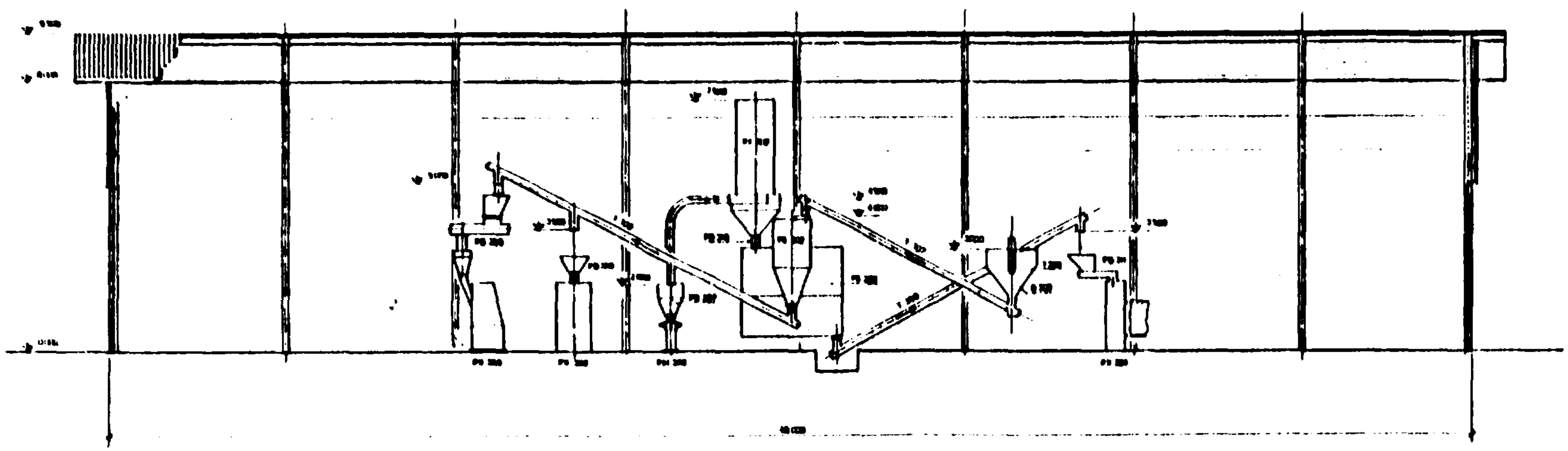
FOR SECTIONS A-A & B-B SEE DWG B 130 004
FOR FLOW SHEET " " B 130 001

UNIDO . VIENNA	B.130
POWDER INSECTICIDES FORMULATION PRODUCTION BUILDING	
PLAN VIEW AND SECTION (1.0)	1:50
	B.130.003

Section A-A



Section B-B



REFERENCE DRWGS

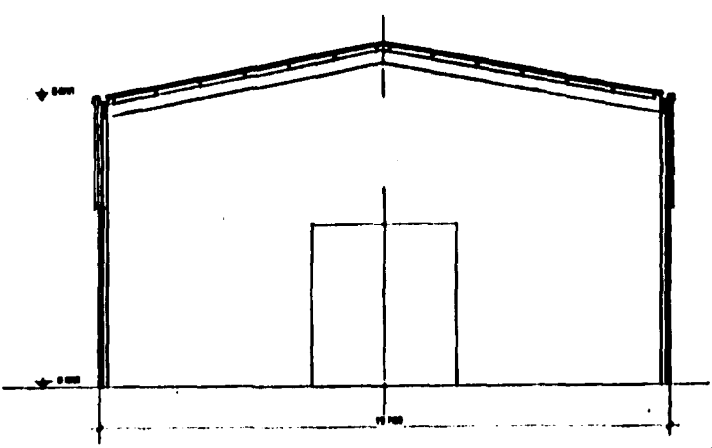
UNIDO - VIENNA

POWDER INSECTICIDES FORMULATION PRODUCTION BUILDING

SECTIONS A-A & B-B

B 130

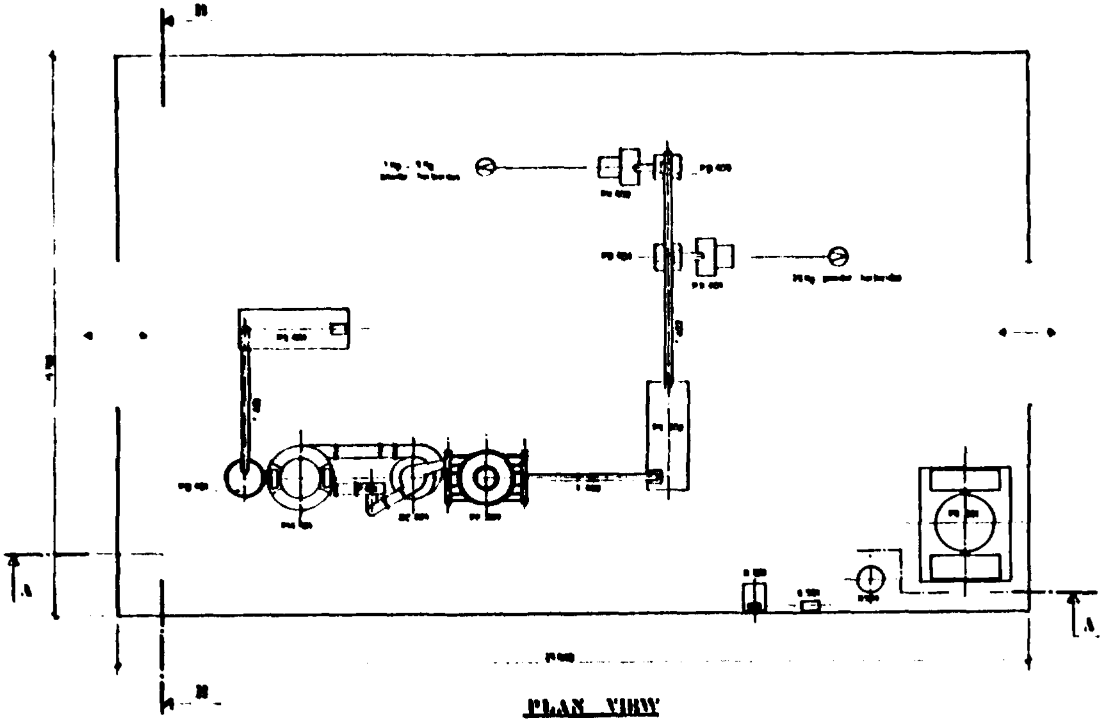
B 130.004



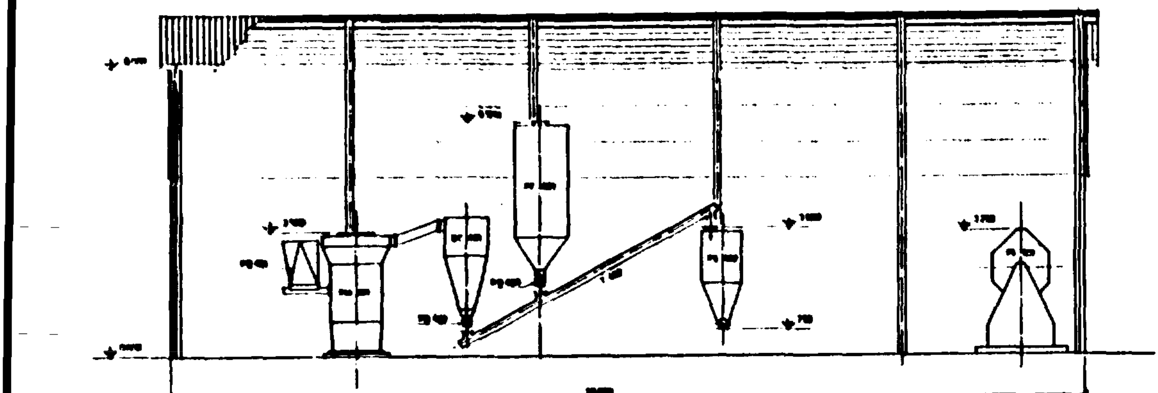
Section B.B

REFERENCE DRWGS

UNIDO _ VIENNA	B.130
PLAN VIEW and SECTIONS	1 : 50
	B.130.005

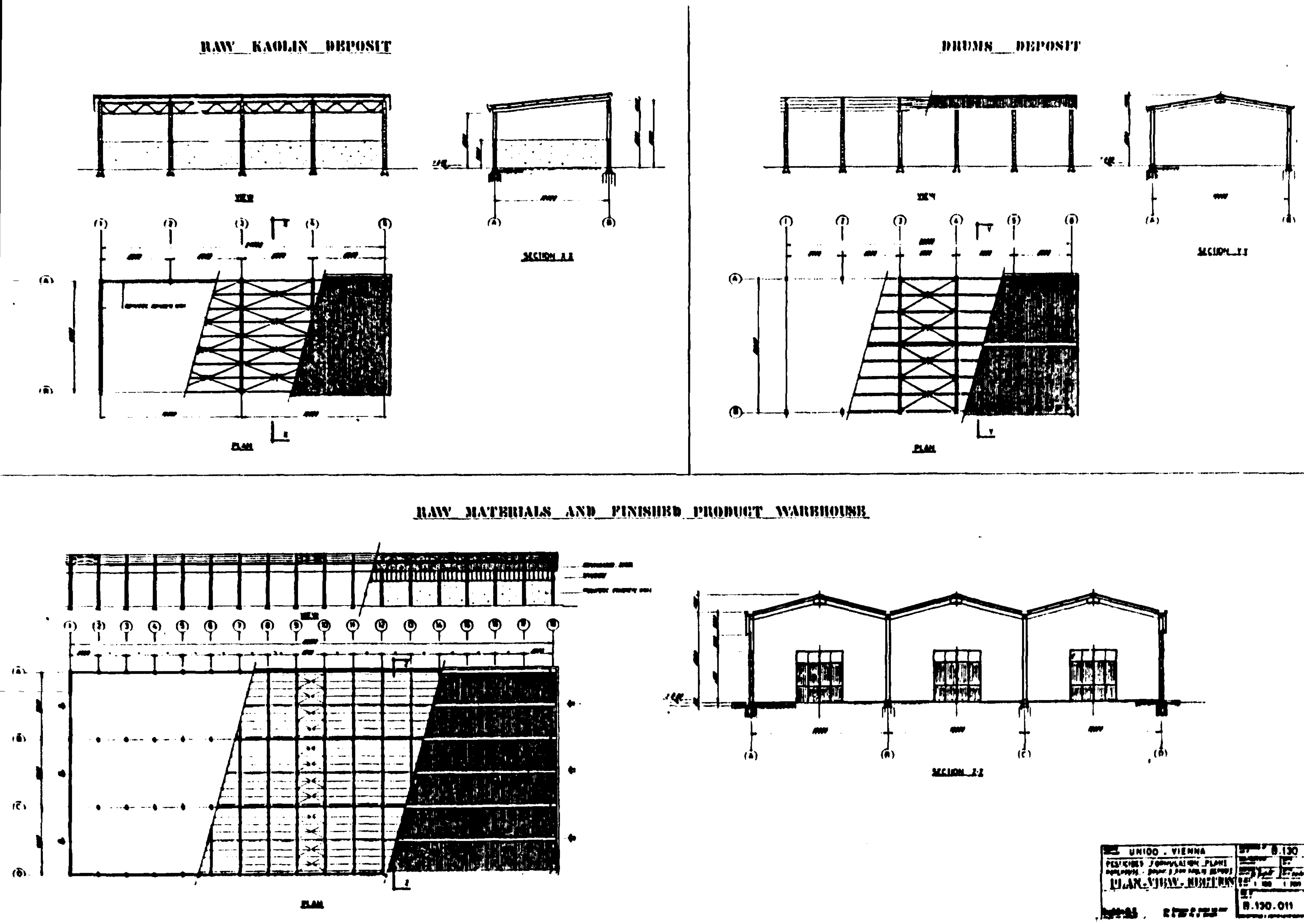


PLAN VIEW



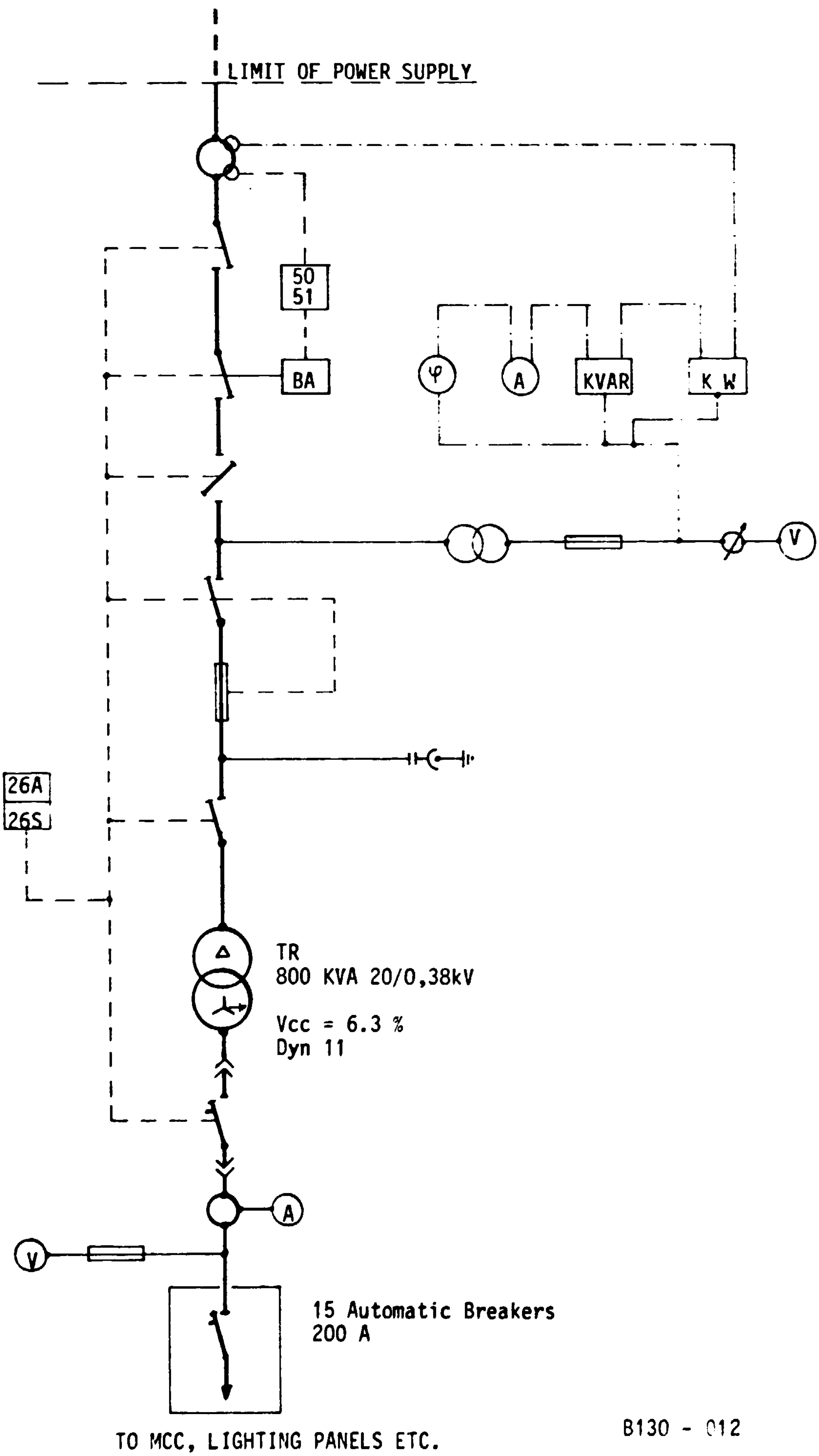
Section A-A

SOME FIGURES
OF THIS DOCUMENT
ARE TOO LARGE
FOR MICROFICHING
AND WILL NOT
BE PHOTOGRAPHED.


RAW KAOLIN DEPOSIT
VIEW
SECTION X-X
PLAN
DRUMS DEPOSIT
VIEW
SECTION Y-Y
PLAN
RAW MATERIALS AND FINISHED PRODUCT WAREHOUSE
VIEW
PLAN
SECTION Z-Z
UNIDO . VIENNA
PESTICIDES FORMULATION PLANT
PLAN-VIEW-SECTION
B.130
B.130.011

baldo & c. srl
CONSULTING ENGINEERS

ELECTRIC CABIN ONE LINE DIAGRAM



B130 - 012