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08160

DP/ID/SER.A/136
13 October 1977
English

ESTABLISHMENT OF A PAINT PILOT PLANT,

SI/LES/77/801

LESOTHO.

Technical report: Design of plant and specifications of equipment

Prepared for the Government of Lesotho by the
United Nations Industrial Development Organisation
executing agency for the United Nations Development Programme

Based on the work of Jerzy M. Soscgnanski,
expert in paint manufacturing

United Nations Industrial Development Organisation
Vienna

id. 77-7393

Explanatory notes

References to dollars ($) are to United States dollars.

The monetary unit of Lesotho is the rand (R). During the period covered by the present report, the value of the rand in relation to the United States dollar was $1 = R 0.867.

A full stop (.) is used to indicate decimals.

A comma (,) is used to distinguish thousands and millions.

References to tons are to metric tons.

A slash (/) between dates representing years indicates a crop year or fiscal year, e.g. 1975/76.

The use of a hyphen (-) between dates representing years signifies the full period involved, including the beginning and end years, e.g. 1975-1980.

The following forms have been used in tables:

A dash (-) indicates that the amount is nil or negligible.

A blank indicates that the item is not applicable.

The following abbreviations are used:

Technical abbreviations

kW	kilowatts
PVA	polyvinyl acetate
V	volume

Organizations

BEDCO	Basotho Enterprise Development Corporation
UNOTC	United Nations Office of Teohnical Co-operation

ABSTRACT

The present report covers the work of a UNIDO consultant (a chemical engineer) during the first phase of a two-phase mission to carry out the preparatory work for the establishment of a small-scale paint plant in Lesotho. This first phase covered the two months during July and August 1977. The findings and recommendations of the expert were as follows:

(a) The market for paint in Lesotho was analysed and the probable profitability of the proposed enterprise was assessed;

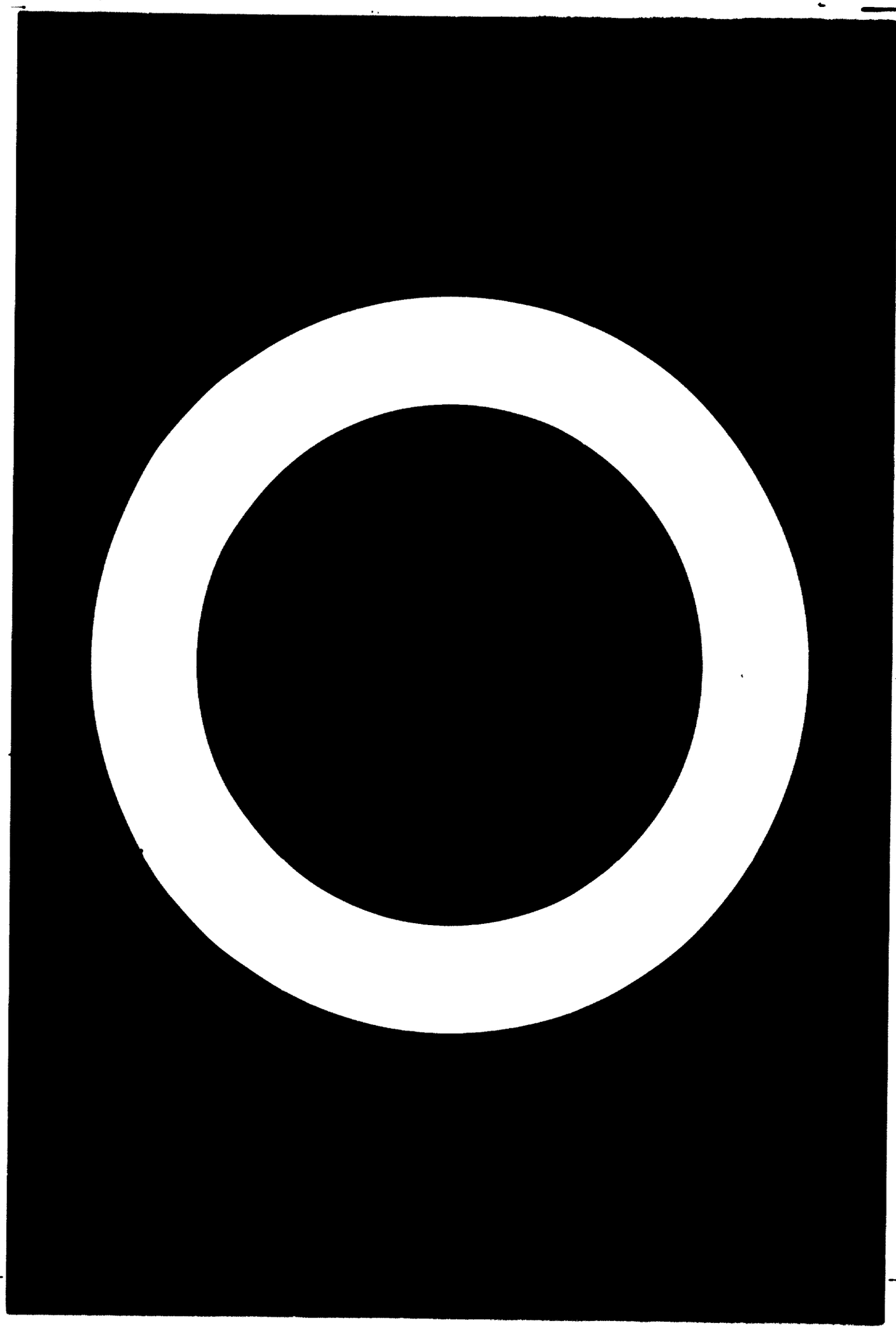
(b) A draft proposal including drawings and a plan for layout of the equipment in the building proposed by the potential investment contractor, as well as a list of the equipment to be purchased, was prepared;

(c) Specifications for the most suitable paint products suggested for the interior market, as well as of the raw materials for providing the initial one month's production, were drawn up;

(d) A choice of the most suitable machinery and raw material suppliers, on the basis of the quotations from the invited tenders, was suggested;

(e) The original exploratory study (made in 1974) of utilizing the indigenous rock material for paint production was reviewed, and a new approach to this problem is presented;

(f) A new assessment of the required capital investment for the proposed factory was carried out, and terms of reference for starting production were drawn up.



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INTRODUCTION

When the expert began his two-month mission in July 1977, the status of the project was as follows:

(a) Positive recommendations concerning the possibility of establishing a paint factory in Lesotho had been made by another UNIDO expert in 1974;

(b) Financial aid for equipping such a pilot plant had been approved from a Voluntary Contribution from Special Industrial Services (SIS) at a cost amounting to $50,000;

(c) It had been agreed that a technical assistance expert in paint manufacturing was required.

The recommendations given in the feasibility study of 1974 were deemed essential by the Government of Lesotho for the following reasons:

(a) The possibility of increasing employment;

(b) The possible reduction of imports and a contribution to the income of Lesotho's economy (Governing Council, Twenty-Third Session, January 1977 - Country and Intercountry Programming and Projects, New Projects).

Since the original amount of financial aid for the equipment had been approved, suggestions were put forward indicating the necessity of reviewing the project and presenting a more comprehensive justification of the investment cost.

It was also found advisable to embark upon the present evaluation of the market to check the feasibility and viability of the projected plant. In its first phase, the mission therefore, was:

(a) To up-date the previous (1974) market study and, if the findings were positive;

(b) To design for a pilot paint plant of appropriate capacity;

(c) To prepare the specifications of equipment for the plant to invite tenders;

(d) To set out detailed requirements for the plant buildings;

(e) To draw up the plant layout;

(f) To advise on all matters relevant to the establishment of the plant.

Introductory meetings were held with officials on arrival as well as interviews with individuals concerned with the implementation of the project during the period of the mission. A list of the officials met and persons interviewed is attached to the report as annex I.

I. PROJECT ACTIVITIES

The principal activities of the expert during the mission are described below:

(a) Investigating and reviewing the erecting and equipping of the paint factory in 1978; considering the financial aid as approved, and the apparent present lack of any domestic raw materials;

(b) Seeking raw materials from nearby sources abroad and suggesting formulations for paints with marketable qualities according to the consumption patterns of the country;

(c) Investigating European and African machinery markets for reviewing tenders and collecting quotations from potential suppliers and manufacturers;

(d) Preparing the specifications of apparatus chosen within the factory's function and financial constraints;

(e) Settling the baseline of the production by collecting data on the local consumption of various types of paints and determining the proportion of particular paints available on the Lesotho market as well as working out a production programme to meet the market demand;

(f) Calculating the costs of raw materials related to the main paint products in order to estimate the profitability of the enterprise;

(g) Preparing lists:

(i) Of raw materials procurable from the African market to cover the initial period of production;

(ii) Of raw materials manufacturers near Lesotho so as to minimize transportation costs;

(h) Determining the area needed to accommodate the equipment and other facilities and to implement the plan of the plant layout;

(i) Carrying out the raw materials balance with regard to:

(i) The average transportation costs as an element in the calculation of the profitability of the enterprise;

(ii) The raw materials store area in the building to be adapted or built;

(iii) The availability of water for the factory;

(j) Preparing the essential data on water and power supply as well as the required details for the building;

(k) Sampling rock materials, crushing and grinding them to fine powder to test their potentialities as future substitutes for some pigments and extenders (fillers) in the proposed formulations;

(l) Miscellaneous activities having indirect connection with the mission, such as inquiries on packing sizes and prices, inquiries on transportation costs, performing the primary estimation of the enterprise's profitability as well as holding meetings with geologists to settle the line of progress in the utilization of rock material for paints.

II. FINDINGS

With reference to the market study

Inspection of the documentation material available revealed that the arrangements made in preparation for the project had been based on data that were either out of date (for example, investment cost) or had been insufficiently emphasized in the previous report, for example, the unprocurability of domestic raw materials in the initial phase of development of the plant.

Using the data presented in various documents, the project did not appear viable because the cost of equipment for manufacturing paints and for processing the rock material into standardized powder exceeded the potential income of a small factory.

When erecting a small factory, especially in the light of the country's economy, the crucial factors are the costs of buildings and equipment. This is particularly so when considering paint manufacture. This fact entailed the revaluation of the previous study with respect to the factory's ability to recruit labour and its ability to increase income despite the present lack of indigenous raw materials.

The mission reported here was an attempt to assess the viability of the project according to three main criteria. In order of importance, they are:

(a) The market for paints in Lesotho;

(b) The raw material costs of the paints to be manufactured. To be profitable, these must be in the order of 50% of the market price of the paints. (This figure is commonly used as an index of the profitability of a small enterprise in this branch of production.);

(c) The possibility of obtaining equipment needed for processing the raw materials into paint products.

The market for paints in Lesotho

The market has been scrutinized as far as possible on the basis of records at the following centres:

(a) The Ministry of Planning, Department of Statistics and some other governmental units;

(b) The Ministry of Finance, which holds the contract records of the contractors representing, inter alia, the architectural branch;

(c) The Ministry of Works, whose Department of Building and Department of Works are the top representative users of paints and paint-derivatives in the country;

(d) The wholesalers and retailers in Maseru which supply government units on a large scale and individual customers on a smaller scale.

The general record obtained from the Department of Statistics of the Ministry of Planning shows that the market for paints in Lesotho is increasing year by year: R 114,000 in 1971, R 144,000 in 1972, R 147,000 in 1973, R 200,000 in 1974 and R 273,000 in 1975. (The report for 1976 had not yet been completed.) Although the available statistical figures cover only the period 1971 to 1975, they can be extrapolated up to 1980, since expansion has been by successive and even steps except for the year 1973. Thus, the marketable quantity of paint products in the year 1980 has been calculated as being the worth R 833,000 for an average yearly increment of 25%. This figure must be lowered, however, because any calculation of an average price must include data from wholesalers' and retailers' records for the years 1976 and 1977 which show increases of 13% per annum. This is shown in table 1 in which the value of production to be scheduled corresponds with a quantity amounting to 582,000 litres in 1980.

Table 1. Market analysis of paint products in Lesotho: 1975-1980

	1975	Increment	1976	Increment	1977	Increment	1978	Increment	1979	Increment	1980
Value (R 1 000)	273	68	341	85	426	117	533	133	666	167	833
Average price [a] (R) per litre	0.79	0.09	0.89	0.11	1.01	0.12	1.13	0.14	1.27	0.16	1.43
Potential capacity of the plant [b] (1 000 litres)			-		-		471	52	527	58	582

a/ Calculated as an average price of the paint products used in most substantial quantities and proposed to be produced in the first (production development) phase.

b/ Assumed in order to cover the market demand.

If operations start by the end of June 1978 the market demand is estimated at a level of about 500,000 litres. The initial months of the development phase, however, should be assumed to cover only approximately 60% of the likely market demand. This level of production might be taken as the production programme for the initial period of the development phase 1978-1980 (table 2), meeting mainly the demand for paint qualities used in the building branch.[1/] The rest, amounting to 40% of the market demand, is for specific products, the technology for which is difficult to master by unskilled labour that lacks experience in the various specializations of paint manufacturing (printing inks, special kinds of putties and adhesives etc.). There are several adhesives that could be produced locally in the initial period of development, although they are not included in the production programme for this phase.

Table 2. Paint production programme for the initial period of the development phase: 1978-1980

	Share (per cent)	Year (litres)	Month (litres)
PVA paints for general purpose	40	120 000	10 000
Interior acrylic (higher quality) emulsion paints	12	37 500	3 125
Exterior acrylic (higher quality) emulsion paints	12	37 500	3 125
High-gloss alkyd resin paints (white and light-shaded colours)	10	30 000	2 500
High-gloss alkyd resin paints (bright colours)	2	6 000	0 500
Roof primers for galvanized steel surfaces	7	21 000	1 750
Roof paints (red, blue, green)	7	21 000	1 750
Stoep enamel for interior timber (light oak, dark oak, mahogany)	2	6 000	500
Varnishes	3	9 000	750
Silver paints	1	3 000	250
Thinners	3	9 000	750
Total	100	300 000	25 000

1/ This programme consists of producing a certain proportion of paints for the main consumers, as calculated from bills of quantities. The main representative consumers are the Ministry of Works, Department of Buildings and Building Maintenance.

The raw material costs

These costs were investigated basically for the eight most common types of paints and three others that are relatively easy to manufacture (varnish, silver paint, thinners) by the unskilled labour available at the beginning of the operation. The formulations for each type can be treated as bases for similar products, and small changes of colour shades should not bring any considerable difference in the costs calculated. A set of calculations (annex II) provides preliminary evidence of the factory's profitability. This can be clearly seen comparing the raw materials costs with current market prices (both to the Government and to the retailers) which are shown in table 3.

It has not been possible to calculate the percentage usage of distemper-powder mix from the bills of quantities, since the product is used as a home-mixed water-based paint, mainly in the villages. Since there is a demand for this type of paint, it should be produced by the factory, but it cannot be expected to yield a high profit, since it is cheap. It is proposed that initial production be limited to 150,000 kg as recommended in the 1974 study, until the market has been established. The range of colours proposed is listed in table 4. The cost of production of each colour of distemper paint has been calculated from the retailers' sales (annex III). There is a considerable advantage in starting with this production because the equipment for producing the coloured distemper-powder mix (dry-grinding mill) would also be usable for up-grading local rock material that has been ground in various sites of the country for other purposes. This would facilitate attempts at the gradual incorporation of local rock material into paints, thus permitting the substitution of local materials for imported ones.

Failure to begin this production because of its low profitability would make the step-by-step substitution of the local minerals for use in paint manufacture, as well as their standardization, almost impossible. The result would be unnecessary prolongation of the process of changing over to use of local raw materials. It must be stated, however, that local raw materials other than mineral powders will still be unobtainable on the Lesotho market in the first development phase of the factory.

Table 3. Raw material costs compared with current paint prices

(R/kg)

Quality of the paint materials	Raw material cost	Government price	Retailer's price	Price ex factory	Average market price	Comparison of the raw material cost/average market price	
						Ratio	Per cent
PVA paint for general purposes: white and light colours	0.27	0.62	1.53	1.30	0.76	0.27/0.76	35.5
Interior acrylic (high quality) emulsion paint	0.40	0.63	1.90	1.61	0.82	0.40/0.82	48.8
Exterior acrlylic (high quality) emulsion paint	0.65	0.63	1.90	1.61	0.82	0.65/0.82	73.3
High glossy synthetic enamel for wood and metal: light colours	0.78	0.35	2.40	2.04	1.17	0.78/1.17	66.6
High glossy synthetic enamel for wood and metal: bright colours	0.92	Mainly in retail sale	2.78	2.36	2.36	0.92/2.36	39.0
Roof primer for galvanized steel surfaces	0.63	0.95	1.90	1.62[a]/1.55	1.02	0.63/1.02	61.7
Roof paint (for overcoat)	0.53	0.95	1.90	1.62[a]/1.55	1.02	0.53/1.02	52.0
Stoep paint (light oak/dark oak)	0.56	1.19	1.66	1.41	1.23	0.56/1.23	45.5
Silver paint	0.68	1.01	2.43	2.07	1.23	0.68/1.23	55.3
Varnish	0.69	0.98	2.59	2.20	1.22	0.69/1.22	56.6
Thinner	0.18	0.46	Mainly sold at Government prices	0.46	0.46	0.18/0.46	39.1

a/ Calculated ex prices for 5 litre/20 litre containers, which are used in almost the same volume.

Table 4. Distemper powder mix production programme for the initial period of the development phase: 1978-1980

Colours	Share (per cent)	Yearly (1 000 kg)	Monthly (1 000 kg)
White	28	42	3.5
Cream	32	48	4
Beige	16	24	2
Yellow	8	12	1
Green	8	12	1
Blue	8	12	1
Total	100	150	12.5

The possibility of obtaining the needed equipment

The possibility of purchasing this equipment and starting production was examined in view of the availability of funds from a voluntary contribution of $50,000. Many inquiries have already been made to manufacturers and suppliers in Belgium, Denmark, Federal Republic of Germany, France, Poland, Switzerland and the United Kingdom, as well as on the African market, mainly for auxiliary equipment. The list of equipment for the pilot plant (annex IV) which was prepared on the basis of the quotations received during the mission, shows that the financial aid for the equipment needed in the initial phase of development in the period 1978-1980 substantially exceeds the sum approved. On the basis of these quotations, the purchase of the basic equipment for the plant has been calculated to be $132,950. The breakdown of items is as follows:

Items	Costs ($)
1 c	10,200
2 b	13,600
3 c	5,100
4 d	12,000
6 d	8,150
7 a	9,140
8	1,600
9	1,100
10	9,200
12	16,840

Items	Costs ($)
13	23,320
15	7,000
16	8,000
19	7,700
Total	132,950

Summary

The most important findings of this market study may be summarized as follows: There is a market for paints in Lesotho that corresponds to the size of the planned pilot paint plant. Its establishment would support the development of small industry in the country. Development of the production related to the paint products should bring:

(a) A range of paint qualities wider than the 11 items assumed initially;

(b) An increase in the quanitiy of paints that could satisfy rising demand up to the figures as shown in table 1.

Regions of the Republic of South Africa within about ten kilometres from the Lesotho border, with their approximate population of 600,000, can be expected to enter the market, which would require further increases in production. This would seem feasible in the follow-up of the factory's development to 1980, depending on the standardization of local paints. The market penetration of South Africa may be undertaken when production experience has been gained and the factory is operating efficiently. In the first instance, however, production should be confined to water-based products such as polyvinyl acetates (PVA) since they are relatively simple to produce and may be priced very competitively.

The possibility of supplying the market in South Africa with distemper-powder mix is limited by an apparent lack of usable rock material. Consequently, this line of development of the factory should not be attempted until an exploration for usable qualities of local mineral raw materials for paints has been completed.

If raw materials account for 51% of the average price of marketed paints, this would be very encouraging to the establishment of the plant. Final conclusions, however, must take into consideration other costs such as packing, raw material transportation, labour and maintenance costs etc. A rough estimation of some of these costs was carried out and is presented in annex IV.

The preliminary assessment leads to the conclusion that the paints can be produced profitably and competitively and sold at discounted prices.

The possibility of starting operations in 1978 as scheduled, depends on the equipment of the factory with up-to-date basic machinery and auxiliary devices. In the preliminary study, some indispensible apparatus such as a filling machine, a kneading machine (for the production of the adhesives) and several auxiliary devices including a compressor, pumps, a lifting and tilting unit, a truck and the basic laboratory equipment, were omitted. An escalation of the costs of machines must also be allowed for, since equipment prices have increased from 10 to 23%.

If operations are not begun with at least the basic equipment being installed in the factory, the project may encounter further difficulties, since costs may rise to a level that may make it no longer feasible. On the other hand, paint prices have also increased, so the proposed project is still viable, although additional funds would be required at the outset to set up the plant.

This study has shown that the plant would be profitable from the outset, becoming economically self-sufficient. Further technical development of the factory would entail the production of resin products (PVA emulsions and/or alkyd resins), and the increased turnover would improve the profitability of the enterprise.

With reference to the design of the plant

Basic design data for the pilot plant

The pilot plant should be designed for a capacity appropriate for the market demand; that is, up to the estimated figures of 582,000 litres of paint products (table 1) and 150,000 kg of distemper-powder mix (table 4) by the year 1980. The building must be large enough to accommodate stores for raw materials, packaging and final products; the workshop; the testing laboratory; and the office.

Despite the assumed peak production by 1980, the building could be made slightly larger to allow for further expansion of the factory in the next decade by providing, additionally, an area for reactors for manufacturing the PVA emulsions and/or alkyd resins at the start of the second development phase, and an area for semi-products, packaging and final stored products.

It is difficult at present to estimate the starting date for production of semi-products, since it will be influenced by many factors, including self-sufficiency of the factory, procurability of the local raw materials (for example, edible oils[2], which are the main raw material used for modifying the medium and long oils alkyd resins etc.) and the skills of the labour to be trained before starting operation.

The design of the factory should assume 600,000 litres/year as peak production (582,000 litres/year by the end of 1980), which would provide leeway for any slight increase in manufacture of such items as adhesives, putties and other special products. This would be the target of development and would provide a check on the possibility of meeting total market demand. The entire area needed for the plant depends on these figures.

Storage area

The figures for the storage area are shown in table 2 and table 4. The right (month) production columns give figures which are to be treated basically as a standard period for storing raw materials. From the auxiliary tables (annex V and table 5) the monthly raw material demand is calculated with respect to the packaging used in transportation and storage at the start of the operation (25,000 litres of paints and 12,500 kg of distemper-powder mix). These amounts may be easily adjusted for the top production programme anticipated (100% demand in 1980) by doubling the figures for paint only, while retaining the figure for distemper.

Thus, the amount of raw materials to be stored for use at the end of the initial phase (1980) will be 62.5 tons. Raw materials should be separated in the store into solid materials, water-based emulsions, solvents and solutions as well as packaging materials and final products. This is shown in annex VI.

Stocks of materials for packaging, as as for the final products, are calculated to be stored for 15 days. The required store area in the building itself is estimated to be 270m^2 excluding an area of 50m^2 adjacent to the main building.

2/ An assessment of a study by the Canadian Industrial Development Agency (CIDA) of the viability of sunflower-seed production in Lesotho is still envisaged.

Table 5. Monthly raw material demand (tons) calculated for the distemper powder mix production programme in the initial period of development 1978-1980

Components	Formulations						
	1	2	3	4	5	6	Total
Whiting W	3 339	3 068	1 524	694	943	867	10 435
Ultramarine blue	10					90	100
Umber, raw or burnt		760					760
Ochre			390	260			650
Iron oxide, black					4		4
Pigment yellow				3			3
Pigment green					10		10
Spindle oil	18	20	10	5	5	5	63
Distemper size	133	152	76	38	38	38	475
	3 500	4 000	2 000	1 000	1 000	1 000	12 500

Workshop, laboratory and office area

This area was calculated by summarizing the area needed for the workshop, testing laboratory and the office passage for internal operation of the hand truck. Related figures are shown in annex VI. Although the data are calculated from the production programme as for the year 1980, they take into account future increases in produotive oapaoity in order to oover inoreased market demand in the follow-up development period, which is to begin in 1981. There is a potential for increased production because the machines will initially be running in eight half hour shifts only, and not at full load during the initial phase. Thus, the workshop area is calculated to be only 100 m^2 in this period, with an allowance for future expansion of the factory.

Size of the building

Summarizing the storage area (270 m^2) and workshop (100 m^2), it should be stated that a building as spacious as 500 m^2 would be adequate to meet the factory's needs for starting up and its further development. The remaining 130 m^2 inoludes a 10 m^2 room for a testing laboratory, 28 m^2 for offioes and 92 m^2 for the truok operation passage (2 m in width).

Staff

The pilot paint plant of the size considered here would require, in the initial phase of development, 11 full-time employees on the posts as shown in table 6, in which the duties of all staff members are set out.

Table 6. Staffing of the plant

Post	Duties	Number
Manager	Supervision and management of production	1
Bookkeeping	Bookkeeping and current economical analysis	1
Purchasing agent	Provision of raw materials Sale Sale of final products Final product shipping Operation of the card index	1
Tinter	Matching colours Controlling the charging of materials to be mixed and ground as well as final products Controlling the quality of raw materials and products	1
Workers	Weighing, mixing and grinding, including internal transportation of raw materials and semi-products Servicing the filling machine	2
	Packaging Internal transportation of paokings	2
Technician	Maintenance of the machines Running the spare parts store Performing running repairs	1
Storekeeper	Acceptance and storage of raw materials Acceptance of the final products Despatching of the raw materials and final products	1
Driver	General pick-up and delivery	1

At least two general workers and the tinter should be brought to a desired level of experience before starting their duties; training periods of three to six months for everyone should be required. In the initial phase the staff need supervision for at least four months by a paint-manufacturing exper

Two local volunteers will be needed to begin at the same time as the expert: one with technical expertise in paint manufacturing, for twelve months, and an economist for the first four months only. In addition a fellowship for twelve months of training for a manager should be scheduled so that he will be able to assume the management of the factory with the departure of the volunteer technician. Should the manager be trained at the Technical School for Paint Chemists in Krefeld, Federal Republic of Germany, to complete a two-year course, as recommended in the previous report, a request for UNIDO aid in the form of a project manager and a prolongation of the volunteer's time by six months would be necessary. A flow chart showing the training periods and the distribution of personnel during the setting up period (1978-1979) is attached (annex VIII).

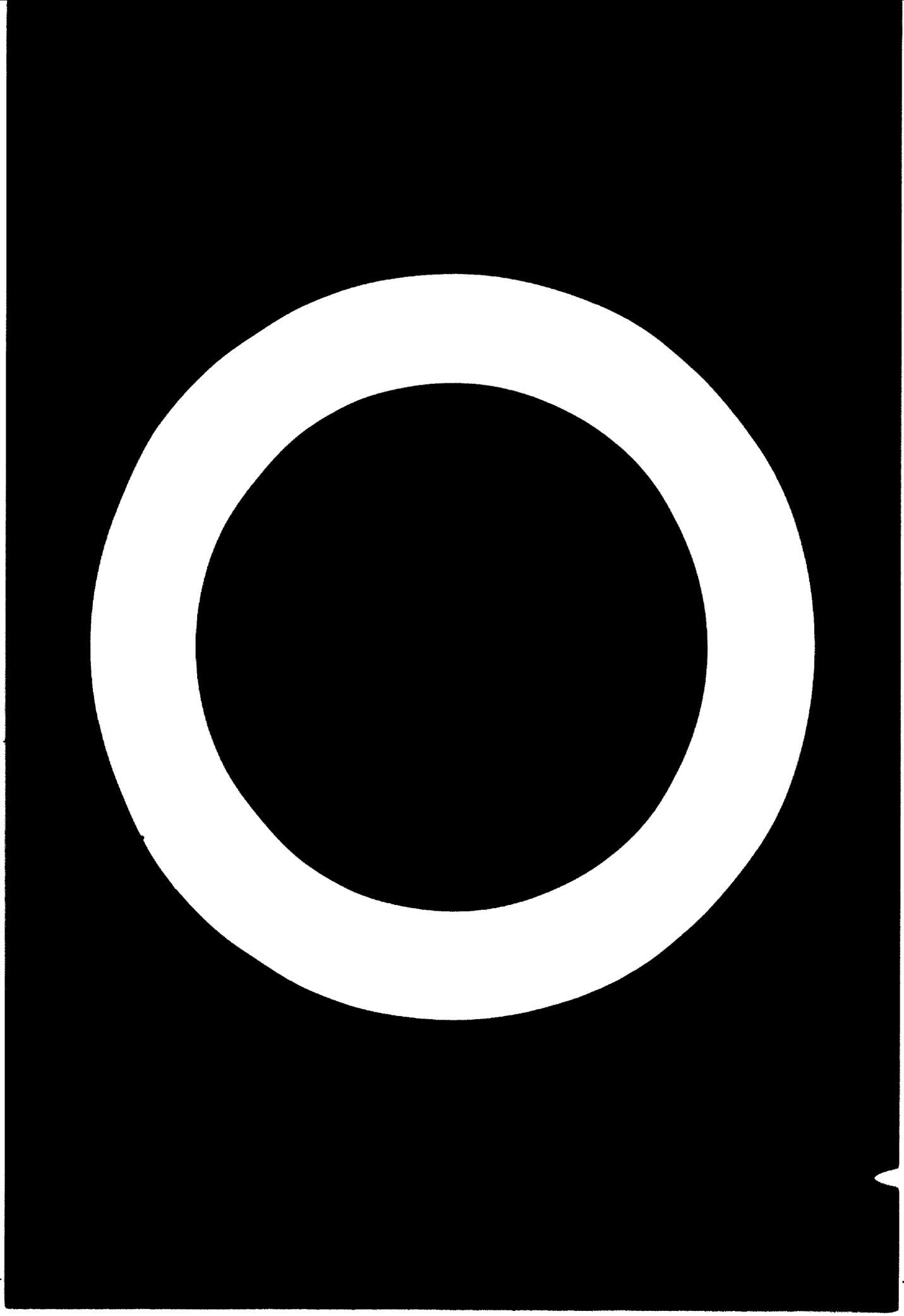
Selection of equipment and raw materials

Equipment. A list of the equipment required during the initial phase of development and its technical data are shown in annex IX. It has been prepared on the basis of quotations reviewed as shown in annex IV in which an appropriate selection in view of the factory's output, financial constraints and as few sources as possible was made. The list has been complemented by essential technical specifications of equipment such as dimensions, weight, power demand and other remarks for convenience of the future contractor. The suppliers and prices are shown in annex IV.

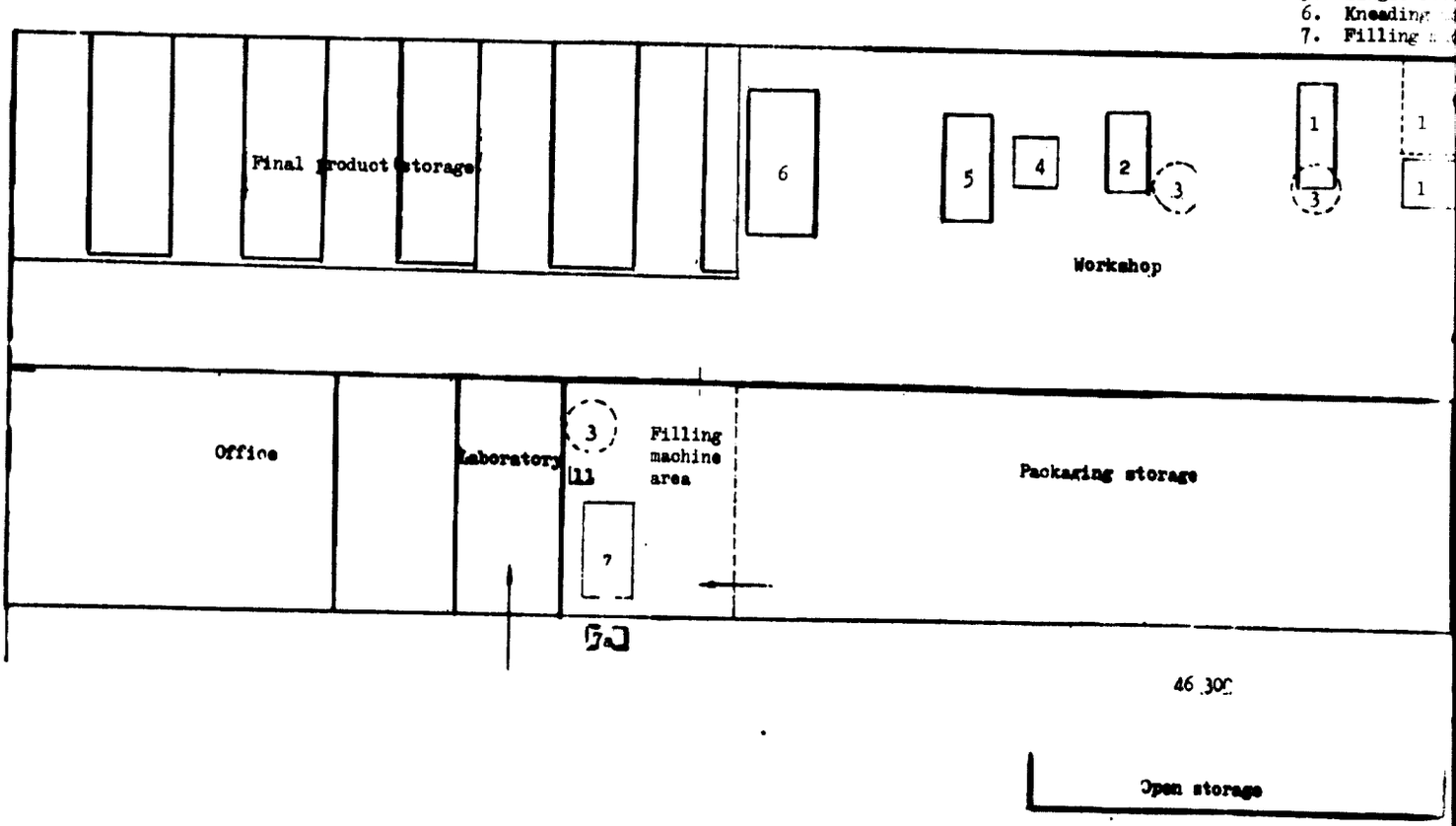
Raw materials. Specification of the raw materials covering one month's demand are to be found in the market study (annex V and table 5). Suppliers and manufacturers of the raw materials are shown in annex X.

Requirements of the plant buildings. These requirements are given in detail in annex XI. They comprise the dimensions of the building, the materials to be used for floors and roofs, insulations, ventilation, light, sink holes, water and power demand, sewerage and fire hazard prevention aids.

Factory layout. The location of a 500 m^2 building as required has been considered. Since the local small industry in Maseru is located at the Sebaboleng Commercial Centre, now developing, as a BEDCO industrial estate, it would be advisable to attach the pilot paint plant to it. An advantage of this siting is that BEDCO would be the potential contractor of this project. One of the buildings (building L) of the size mentioned is to be built during 1978. The layout of this building is shown in the following figure. The cost of the building of the size required was estimated at R 42,000. Adjusting the building to the requirements of the plant may cause an additional cost of about R 8,000.



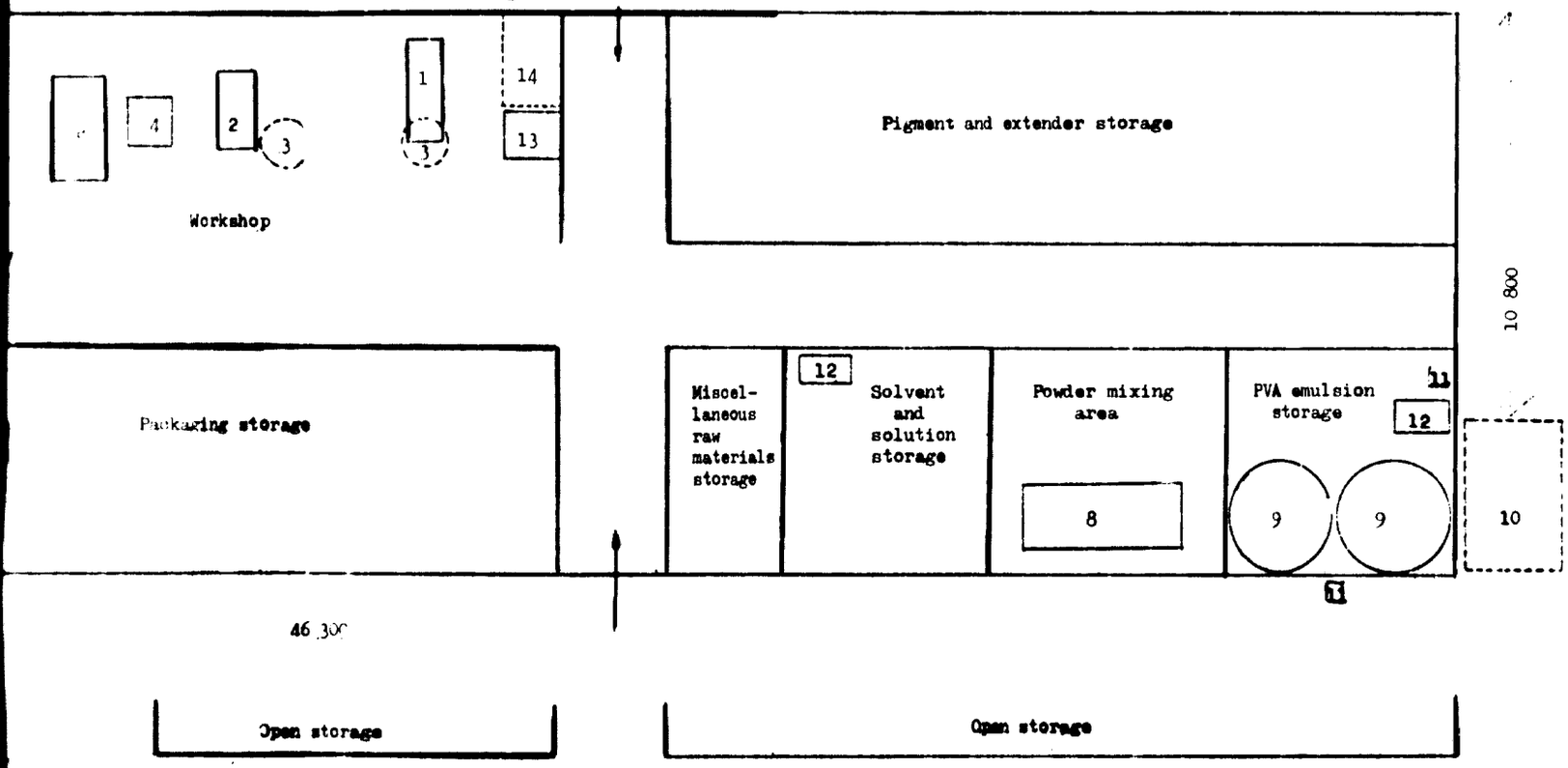
Layout of the pilot paint plant at Maseru



[redacted]

Key:

1. High-speed disperser
2. Pearl mill
3. Movable containers
4. Lifting and tilting device
5. Single-roller mill
6. Kneading machine
7. Filling machine
7a Compressor
8. Dry-grinding mill
9. Tanks
10. Tank (outdoors)
11. Pump
12. Indicating scales
13. Platform scale
14. Drum jockey



With reference to the establishment and operation of the plant

Machines

The already approved $50,000 and the additional $83,000 were estimated on the basis of quotations obtained (see annex IV). They do not include transportation; this cost element must be taken into consideration.

Before installation, the machines should be stored under suitable conditions and not subjected to the elements for long periods.

Installation should be completed speedily to ensure the maximum expert assistance in the initial phase of production. Installation costs must also be taken into consideration.

Raw materials

Storage space for raw materials should be provided, with access for mechanical handling.

Development of the project

Members of the Diamond Exploration Project have agreed to do preliminary work into the possibility of obtaining local raw materials, with particular reference to the following minerals:

Zeolite, montmorillonite, kaoline, barytes and talc;

All possible coloured mineral rock materials (such as ferrous oxides and kimberlite).

Four samples of rock materials collected during the expert's reconnaissance trip to sites near Maseru, crushed and ground in the usual laboratory manner, should be sent to the producer of the PVA emulsions for testing. This was agreed with the potential supplier of the PVA emulsion (Movilith MD60). The address of this supplier is:

Hoechst S.A., Ltd
3 Carlton Street, Industria
P.O. Box 8692, Johannesburg 2000

Attention: Mr. Stark, Dyestuff Division.

Two local volunteers should be assigned to the expert during the second phase of the mission: an economist for the first four months and a person with technical expertise in paint production for the full twelve months.

Miscellaneous. Final calculations for paints to be produced should take into consideration other costs such as packing, raw material transportation, labour and maintenance costs.

Inquiries were made to the potential suppliers of packing; the costs shown in table 7 appear to be realistic.

Table 7. Costs (R) of paint-packaging materials

Tins		Plastic buckets		Pails	
Size (litre)	Cost (R)	Size (litre)	Cost (R)	Size (litre)	Cost (R)
0.25	0.143	1	0.1775 + 0.02 b/	20	1.56
0.50	0.184	2	0.24 + 0.02	25	1.67
		2.5	0.25 + 0.02		
1	0.248	5	0.39 + 0.02		
5	0.476	10	0.80 + 0.04		
		20	1.30 + 0.04		

a/ For PVA paints

b/ For printing (per colour).

When calculating transportation costs, the cost per kilometre should assume a quantity of raw materials not less than 10,000 kg transported by road over a distance of no more than 500 km.

III. RECOMMENDATIONS

For the initial phase

The Government should request a total of $132,950 from UNIDO to provide the initial equipment for the factory. This would involve an extra allocation of $82,950 above the $50,000 already approved. However, the whole sum is required before operations can begin. Once this amount has been made available, the factory should be able to operate without further external financial assistance. Future expansion (including reactors for resin production) should be financed internally.

Credit facilities must be obtained to finance the construction of the buildings. R 50,000 will be required for this purpose. It is essential that the building be completed by the end of June 1978.

The working capital required for six months operations will be as follows:

Installation cost	R 17 000	(including shipment)
Raw materials	R 99 000	(including shipment)
Labour	R 13 000	
Operating cost	R 18 900	
Total	R 147 900	

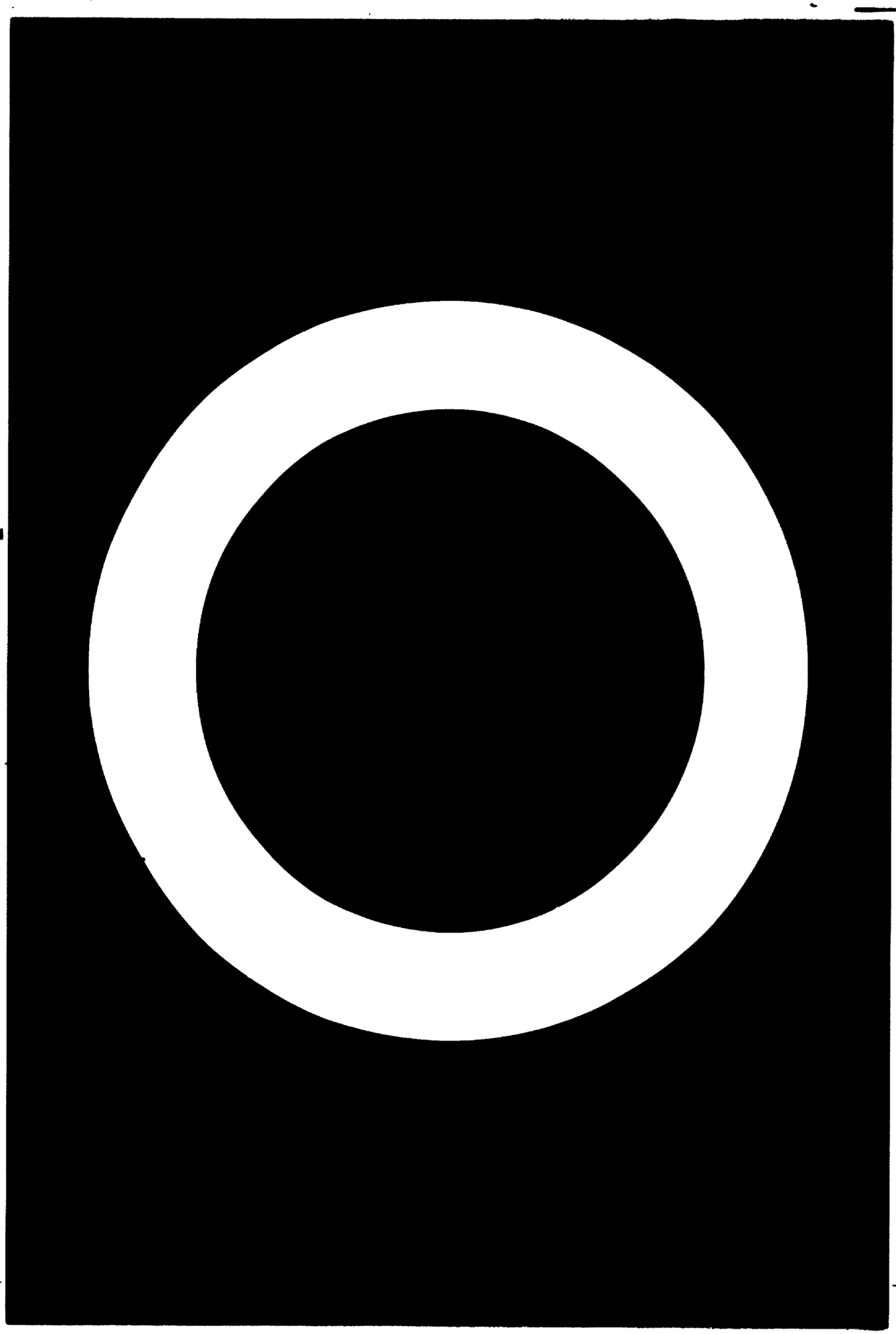
A pool of labour must be trained before and during the initial phase by means of the proposed scheme (annex VIII).

Local raw materials must be gradually introduced to replace imported ones. Co-operation will be required from the UNDP Geology Project and the Department of Mines and Geology to discover and exploit local reserves of mineral rock material with possible future assistance from a UNIDO expert.

For future development

The products should be standardized and upgraded so as to make possible the penetration of the local South African market so as to expand and utilize the full capacity of all equipment.

Further stages in the production process should be introduced (production of trade materials under licence), and attempts should be made to use less semi-manufactured raw materials (semi-products).



Annex I

OFFICIALS APPOINTED AND INDIVIDUALS INTERVIEWED DURING THE MISSION

A.T. Kabbah	UNDP Resident Representative
D. Youcer	UNDP Programme Officer
M. Sejanamane	Deputy Director, Central Planning and Development Office
S.J. Brushett	Assistant Secretary, Central Planning and Development Office
D. Mokhesi	Permanent Secretary, Ministry of Commerce and Industry
S.K. Molapo	Assistant Secretary, Ministry of Commerce and Industry
R. Selebalo	Permanent Secretary, Ministry of Finance
Mr. Woolfe	Sewerage Engineer, Ministry of Works
N.M. Fagan	Managing Director, Basotho Enterprises Development Corporation (BEDCO)
B. Gunn	Business Extension Manager, BEDCO
J.J. Reed	Project Manager, Exploration for Diamonds, United Nations Office of Technical Co-operation (UNOTC)
T.C. Harper	Physical Development Manager, BEDCO
M.M. Mofelehetsi	Deputy Business Extension Manager, BEDCO
M. Mofolo	Commissioner of Mines (UNDP-supported post)
P.M. Lerotholi	Geologist
M. Brunell	Geologist, Department of Mines
N. Vassiliou	Agricultural Planning Economist/Adviser, FAO Central Planning and Development Office
Mr. Hutcheon	Professor, National University of Lesotho, Faculty of Chemistry
M. Laurence	Sales Manager, Plascon Parthenon Paint, Maseru
R.T. Chiddy	Director, Renou Plastics, Isando, Transvaal
R. Kalil	Heavy Equipment Agent/Supplier, Bloemfontein Orange Free State
B. Goosen	Mitchell Cotts Air Freight (S.A.) (Pty) Ltd, Bloemfontein, Orange Free State

Annex II

COST CALCULATIONS FOR 11 PAINT FORMULATIONS

PVA general-purpose white (basic formulation for white and light colours)[a/]

Component	Charge (kg)	Price (R/kg)	Cost (R)
Titanium dioxide (type Tioxide RXL)	56.8	1.003	56.97
Whiting W	284.0	0.066	18.74
Microflex LX15	241.4	0.062	14.97
Mica	49.7	0.380	18.89
Kaolin G	35.5	0.052	1.85
Icekap K	35.5	0.380	13.49
Tylose MHB 30000	7.1	3.200	22.72
Nopco NDW	4.3	0.800	3.44
Acticide MPM	1.4	4.200	5.88
Calgon (10%)	7.1	0.714	5.07
Sodium hydroxide solution	2.8	0.300	0.84
Solvesso 150	17.0	0.600	10.20
Nopilith DMO	142.0	0.675	95.85
Water	563.7	-	-
	1 192.7		268.90
Waste	- 28.3		

Yield (kg)	1 164.4
Specific gravity	1.42
Output (Litres)	1 000
Average raw materials cost	R 270/1 000 litres

a/ Tinting the basic white paint with bright organic pigments to achieve paints shaded yellowish (e.g., Colanyl Yellow G30), greenish (e.g., for Colanyl Green GG), bluish (e.g., Colanyl Blue AR) and so on may increase the unit raw material cost of the paint up to 115% of the cost of the basic paint.

Interior acrylic (high-quality) emulsion paint (white)

Component	Charge (kg)	Price (R/kg)	Cost (R)
Titanium dioxide (type Tioxide RCR2)	174.0	1.080	187.92
Whiting W	531.0	0.066	35.05
Matrosol 250 HR	5.0	3.200	16.00
Triton x 100	2.0	1.521	3.04
Nopco NDW	1.0	0.800	0.80
Nopco NX2	3.0	0.900	2.70
Acticide MPM	0.5	4.200	2.10
Orotan 731 (25%)	14.0	0.714	10.00
Ammonia	1.0	0.300	0.30
Texanol	17.0	1.090	18.53
Ethylene glycol	10.0	0.600	6.00
Water	577.0	-	-
Primal AC 388 (50%)	134.5	0.909	122.26
	1 470.0		404.70
Waste	- 30.0		

Yield (kg)	1 440.0
Specific gravity	1.44
Output (litres)	1 000
Average raw material cost	R 404.70/1 000 litres

Exterior acrylic (high quality) emulsion paint

Component	Charge (kg)	Price (R/kg)	Cost (R)
Titanium dioxide (type Tioxide RCR2)	264.0	1.080	285.12
Whiting W	267.3	0.066	17.64
Natrosol 250 HR	4.7	3.200	15.04
Triton x 100	1.0	1.521	1.52
Orotan 731 (25%)	17.0	0.714	12.14
Acticide MPM	1.0	4.200	4.20
Nopco NXZ	1.0	0.900	0.90
Napco NDW	1.0	0.800	0.80
Ammonia	0.5	0.300	0.15
Texanol	18.0	1.090	19.62
Ethylene glycol	20.0	0.600	12.00
Primal AC 388 (50%)	305.1	0.909	277.34
Water	485.4	-	-
	1 386.0		646.47
Waste	- 36.0		

Yield	1 350.0
Specific gravity	1.35
Output (litres)	1 000
Average raw material cost	R 676.17/1 000 litres

High-gloss synthetic enamel for wood and metal (cream)

Component	Charge (kg)	Price (R/kg)	Cost (R)
Titanium dioxide (type Tioxide RCR2)	91.0	1.080	98.28
Zinc oxide	169.0	0.493	83.32
Whiting W	169.0	0.066	11.15
Iron oxide yellow	2.6	0.147	0.38
Alkyd resin 30-2026	685.1	0.748	512.45
White spirit	106.6	0.196	20.89
Shellsol A	19.5	0.376	7.33
Lead naphthenate (10% Pb)	18.2	0.800	14.56
Manganese naphthenate (2% Mn)	18.2	0.800	14.56
Cyclohexanone oxime (20%)	13.0	0.800	10.40
Aluminium stearate (15%)	7.8	0.770	6.01
	1 300.0		779.33
Waste	- 30.0		

Yield (kg)	1 300.0
Specific gravity	1.27
Output (litres)	1 000
Average raw material cost	R 780/1 000 litres

High gloss synthetic enamel for wood and metal (bright red)

Component	Charge (kg)	Price (R/kg)	Cost (R)
Pigment scarlet a/	55.0	7.120	391.06
Whiting W	248.0	0.066	16.04
Bartyes	50.0	0.112	5.06
Microflex LX15	50.0	0.062	3.01
Alkyd resin 30-2026	570.0	0.748	426.04
White spirit	100.0	0.196	19.06
Shellsol A	20.0	0.376	7.05
Lead naphthenate (10% Pb)	20.0	0.800	16.00
Manganese naphthenate (2% Pb)	20.0	0.800	16.00
Cyclohexanone oxime (20%)	14.0	0.800	11.02
Aluminium stearate (15%)	3.0	0.770	2.03
	1 150.0		912.37
Waste	20.0		

Yield (kg)	1 130.0
Specific gravity	1.13
Output (litres)	1 000
Average raw material cost	R 15.07/1 000 litres

a/ Hansa Yellow, Phthalocyanine Blue or Phthalocyanine Green should be taken instead Scarlet Red for bright colours: yellow, blue and green accordingly.

Roof primer for galvinized steel surfaces

Component	Charge (kg)	Price (R/kg)	Cost (R)
Iron oxide red	127.0	0.147	18.22
Zinc yellow (zinc chromate)	127.0	0.592	85.81
Whiting W	127.0	0.066	8.18
Microflex LX15	127.0	0.062	7.69
Supertalc SF	95.0	0.057	5.42
Alkyd resin P470 (70%)	220.0	0.880	193.60
Alkyd resin 30-2026 (50%)	312.0	0.748	233.40
White spirit	134.0	0.196	26.26
Shellsol A	28.0	0.376	10.53
Lead naphthenate (10% Pb)	15.0	0.800	12.00
Manganese Naphthenate (2% Mn)	15.0	0.800	12.00
Cyclohexanone oxime (20%)	12.0	0.800	9.60
Aluminium stearate (15%)	3.0	0.770	2.31
	1 342.0		625.02
Waste	30.0		

Yield (kg)	1 312.0
Specific gravity	1.3
Output (litres)	1 000
Average raw material cost	R 625.02/1 000 litres

Roof paint (overcoat)

Component	Charge (kg)	Price (R/kg)	Cost (R)
Iron oxide red	180.0	0.147	26.46
Iron oxide yellow	90.0	0.147	13.23
Zinc oxide	86.0	0.493	42.40
Supertalc SF	80.0	0.057	4.56
Whiting W	180.0	0.066	11.88
Alkyd resin P470 (70%)	325.0	0.880	286.00
Alkyd resin 30-2026	86.0	0.748	64.33
White spirit	200.0	0.196	39.20
Shellsol A	28.0	0.376	10.53
Lead Naphthenate (10% Pb)	15.0	0.800	12.00
Manganese naphthenate (2% Mn)	15.0	0.800	12.00
Cyclohexanone oxime (20%)	12.0	0.800	9.60
Aluminium stearate (15%)	3.0	0.770	2.31
	1 300.0		534.50
Waste	30.0		

Yield (kg)	1 270.0
Specific gravity	1.27
Output (litres)	1 000
Average raw material cost:	**R 534.50/1 000 litres**

Stoep paint (light oak/dark oak) for interior timber

Components	Charge (kg)	Price (R/kg)	Cost (R)
Iron oxide yellow	132.2	0.147	19.43
Iron oxide red	54.5	0.147	8.01
Calcium carbonate or Whiting W	194.7	0.066	12.85
Kaolin G	36.6	0.052	1.90
Alkyd resin 30-2026	590.0	0.748	441.32
Shellsol A	18.8	0.375	7.07
Mineral spirit	127.9	0.196	25.07
Lead naphthenate (10% Pb)	20.0	0.800	16.00
Manganese naphthenate (2% Mn)	20.0	0.800	16.00
Cyclohexanone oxime (20%)	11.8	0.770	9.09
Aluminium stearate (15%)	3.5	0.800	2.80
	1 210.0		559.54
Waste	30.0		

Yield (kg)	1 180.0
Specific gravity	1.18
Output (litres)	1 000
Average raw material cost:	**R 560/1 000 litres**

Varnish

Components	Charge (kg)	Price (R/kg)	Cost (R)
Alkyd resin 30-2026 (50%)	280.0	0.748	209.44
Alkyd resin P470 (70%)	460.0	0.880	404.80
White spirit	128.0	0.196	25.09
Shellsol A	24.0	0.376	9.02
Lead naphthenate (10% Ph)	20.0	0.800	16.00
Manganese naphthenate (2% Mn)	20.0	0.800	16.00
Cyclohexanone oxime (20%)	10.0	0.800	8.00
	942.0		688.35
Waste	12.0		

Yield (kg)	930.0
Specific gravity	0.930
Output (litres)	1 000
Average raw material cost:	R 688-35/1 000 litres

Silver paint

Components	Charge (kg)	Price (R/kg)	Cost (R)
Varnish	727.0	0.688	500.18
Aluminium powder/paste standard	170.0	0.900	153.00
White spirit	96.0	0.196	18.82
Shellsol A	17.0	0.376	6.39
	1 010.0		678.39
Waste	10.0		

Yield (kg)	1 000.0
Specific gravity	1.00
Output (litres)	1 000
Average raw material cost:	R 678.39/1 000 litres

Thinner

Components	Charge (kg)	Price (R/kg)	Cost (R)
White spirit	680	0.136	133.03
Shellsol A	130	0.376	48.07
	810		181.10
Waste	10		

Yield	800
Specific gravity	0.8
Output (litres)	1 000
Average raw material cost:	R 182.00/1 000 litres

Annex III

COST CALCULATIONS FOR SIX DISTEMPER POWDER MIXES

White

Component	Charge (kg)	Price (R/kg)	Cost (R)
Whiting W	954.0	0.066	62.96
Ultramarine blue	3.0	0.352	1.06
Spindle oil	5.0	0.344	1.72
Distemper size	38.0	0.012	0.46
Total	1 000.0		66.20

Average raw material cost: R 66.20/1,000 kg

Average market price (current): R 150.00/1,000 kg

Cream

Component	Charge (kg)	Price (R/kg)	Cost (R)
Whiting W	767.0	0.066	50.62
Umber, raw or burnt	190.0	0.147	27.93
Spindle oil	5.0	0.344	1.72
Distemper size	38.0	0.012	0.46
Total	1 000.0		80.73

Average raw material cost: R 80.73/1 000 kg

Average market price (current): R 150.00/1 000 kg

Beige

Component	Charge (kg)	Price (R/kg)	Cost (R)
Whiting W	762.0	0.066	50.29
Ochre	195.0	0.147	28.67
Spindle oil	5.0	0.344	1.72
Distemper size	38.0	0.012	0.46
Total	1 000.0		81.14

Average raw material cost: R 81.14/1 000 kg

Average market price (current): R 150.00/1 000 kg

Yellow

Component	Charge (kg)	Price (R)	Cost (R)
Whiting W	694.0	0.066	45.80
Pigment yellow G	3.0	5.65	16.95
Ochre (light)	260.0	0.147	38.22
Spindle oil	5.0	0.344	1.72
Distemper size	38.0	0.012	0.46
Total	1 000.0		103.15

Average raw material cost: R 103.15/1 000 kg

Average market price (current): R 220.00/1 000 kg

Green

Component	Charge (kg)	Price (R/kg)	Cost (R)
Whiting W	937.0	0.066	61.84
Pigment green B	10.0	8.380	83.80
Iron oxide black	9.0	0.150	0.60
Spindle oil	5.0	0.344	1.72
Distemper size	38.0	0.012	0.46
Total	999.0		148.50

Average raw material cost: R 148.42/1 000 kg

Blue

Component	Charge (kg)	Price (R/kg)	Cost (R)
Whiting W	867.0	0.066	57.22
Ultramarine blue	90.0	0.352	31.68
Spindle oil	5.0	0.344	1.72
Distemper size	38.0	0.012	0.46
Total	1 000.0		91.08

Average raw material cost: R 91.08/1 000 kg

Annex IV

EQUIPMENT REQUIRED FOR THE PAINT PILOT PLANT AT MASERU

Machinery	Quantity	Suppliers	Type	Price ($)	
				Convertible	Unconvertible
1. High-speed disperser	1	(a) Drais-Werke GmbH 6800 Mannheim 31 (Waldhof) P.O. Box 39, Speckweg 43-45 Federal Republic of Germany	RDV-2 17.5 kW "Star"	15 750	10 200
		Other possible suppliers			
		(b) Netzsch-Maschinenfabrik 8672 Selb, Werkstr. 19 P.O. Box 105 Federal Republic of Germany	NDV-24 24 PS Ex 15 PS Ex	 16 000 15 000	
		(c) Polimex-Cekop Ltd Warszawa, Czackiego 7-9 P.O. Box 815, Poland	M 250 S MD 500	7 900 10 200	
		(d) Torrance and Sons Ltd Bitton, Bristol BS15 6HW, England	25 h.p.	10 750	
2. Pearl-mill equipped with glass beads (pearls)	1	(a) Drais-Werke GmbH address as above	PM 25	17 430	
		(b) Netzsch-Maschinenfabrik address as above	KE-20V	13 600	
		(c) Polimex-Cekop Ltd address as above	MK 60-S	12 600	
		(d) Torrance and Sons Ltd address as above	C-5 or 30 SM attritor	13 950	
		(e) Rouselle, 59000 Lille 170 rue Pierre-Legrand France	Contimill- 30		

Machinery	Quantity	Suppliers	Type	Cost ($) Convertible	Cost ($) Unconvertible
3. Mobile container and container cover	6	(a) Drais-Werke GmbH address as above	4x250 litres	4 500	
			2x500 litres	2 700	
		Other possible suppliers			
		(b) Netzsch-Maschinenfabrik address as above	4x250 litres	Alltogether	
			2x500 litres	6 300	
		(c) Polimex-Cekop address as above	2x250 litres	2 300	5 100
			2x500 litres	2 800	
		(d) Torrance and Sons Ltd address as above	4x75 gallons [a]	2 850	
			2x120 gallons	2 250	
4. Single-roller mill (Uniroll Mill) equipped with lifting device for container	1	(a) Drais-Werke GmbH address as above	ME-2	14 520	
			or ME-3	17 770	
		(b) Torrance and Sons Ltd address as above			
		Other possible suppliers			
		(c) Netzsch-Maschinenfabrik address as above			
		(d) Polimex-Cekop Ltd address as above	HW 400 fl	12 000	12 000
5. Equalization mixer [b] (homogenizer)	1	Drais-Werke GmbH address as above	VLM-1000		
6. Filling line, completely equipped with pump plant	1	(a) Diaf A/S DK-2700 Copenhagen NV P.O. Box 923, 25-29 Vibevej Denmark	Diaf weight-filling machine, type Maxwell (Maxwell-conveyor-line)	11 600	

Machinery	Quantity	Suppliers	Type	Price ($) Convertible	Price ($) Unconvertible
Other possible devices					
Filling device for paints and lacquers	1	(b) Netzsch-Mohnopumpen GmbH D-8267, Waldkraiburg Liebiegstr. 28 Federal Republic of Germany	Netzsch-Mohnopumpen Abfüllanlage		
Mobile filling machine for paints and lacquers with automatic tin supply	1	(c) T. De Vree and Co. n.v 82060 Merksem Toekomstlaan 10 Belgium	Model 167	15 822	
Filling machine with semi-automatic tin supply (pneumatic control method)	1	(d) Chemtra Ltd P.O. Box 4333 26 Roper Street New Centre, Johannesburg South Africa	Model NEUMO Type SAF 80/1	6 400	
Compressor	1		Bencor	1 750	
Filling device as above	1	(e) W.H. Rosenmeyer, Johannesburg South Africa	Bexuda C + E	10 168	
Compressor	1	Kalil Motors, Bloemfontein South Africa	Delfos-Atlas		
7. Lifting and tilting unit	1	(a) Drais-Werket GmbH address as above	Hydraulic	9 140	
Lifting device, 2 tons	1	(b) Chemtra Ltd address as above	Chain tackle	160	
8. Pump, mobile	3	Chemtra Ltd address as above	Model SB-1A	1 600	
9. Drum Jockey	1	Chemtra Ltd address as above	Load 300 kg	1 104	

	Machinery	Quantity	Suppliers	Type	Price ($)	
					Convertible	Unconvertible
10.	Storage tanks for PVA emulsions for solvent (mineral spirit)	 2 1	 South African market South African market	 V = $8m^3$ V = $8m^3$	 7 000 2 200	
11.	Wet-grinding ball mill eqqipped with hard	1	Drais-Werke GmbH address as above	KP 500	9 600	
12.	Dry-grinding ball mill equipped with chronium-nickel steel balls	1	Drais-Werke GmbH address as above	KE 1000	16 840	
13.	Kneading machine	1	Drais-Werke GmbH address as above	CSK 14	23 320	
14.	Hopper - Mill equipped with discs made of hard porcelain/ porphyry b/	1	Drais-Werke GmbH address as above	TM 4g		
15.	Van	1		Volkswagen	7 000	
16.	Truck	1	Hand trucks and hand cars Lehr Werkstatt GmbH 5990 Altena, Postfach 335 Federal Republic of Germany	Low-leading truck "Fix"	8 000	
17.	Scales, load 500 kg	1	From the South African market	Platform scale		
	Scales, load 100 kg	2	From the South African market	Indicating scale		
18.	Hand carriage	1	From the South African market			
19.	Laboratory equipment devices	1	Drais-Werke GmbH address as above	Listed separately below	7 700	

Machinery	Quantity	Suppliers	Type	Price ($) Convertible	Price ($) Unconvertible
High-speed lab mixer	1	(a) Drais-Werke GmbH address as above	1/6 PS Motor 10-6,000 V/min		
Item as above, model IKA 38		B. Oven Jones Ltd Johannesburg, P.O. Box 68 South Africa	40-6,000 r.p.m.		610
Laboratory hopper-mill with the discs made of hard porcelain or porphyry	1	(b) Drais-Werke GmbH address as above	TM 1[illegible]		
Item as above		B. Oven Jones Ltd address as above	Pulverizer, Type UA	2 615	
Kneading machine (laboratory kneader)	1	(c) Drais-Werke GmbH address as above	Table model AK-3		
Item as above, model 0.75 litres		B. Oven Jones Ltd address as above	HKD 75	3 980	
Porcelain morter mill		(d) Fritsch OHG, Laborgeräte 658 Idar-Oberstein 1 Hauptstr. 542 Federal Republic of Germany	Pulverisette 2		740
Vibrating screen	1	(e) Fritsch OHG, Laborgeräte address as above	Pulverisette 3		1 350
Laboratory centrifuge ball mill for wet grinding	1	(f) Fritsch OHG, Laborgeräte address as above	Pulverisette 6		1 715
Item as above for dry-grinding		B. Oven Jones Ltd address as above	Model Norton Jar Mill		605
Agate hand mortar with pestle	1	(g) Fritsch OHG, Laborgeräte	Achatmörser		315

Machinery	Quantity	Suppliers	Type	Price ($)	
				Convertible	Unconvertible
Pan scale with weight set	1	(h) From the South African market address as above		60	
Technical lab scale	1	(i) As above, item (a)		100	
Specific gravity balance b/	1	(j) As above, item (e)		145	
Viscometer + stopwatch	1	(k) F. Kurt Retsch, Fabrikchemischer Apparate 5657 Haan (Rheind) Federal Republic of Germany	Ford-4		
Item as above, Flow-cup + stopwatch	1	B. Oven Jones address as above	Ford No.4	67 43	
Device for testing the coarse particles in paints	1	(l) F. Kurt Retsch address as above, item (k)	0-100 mi		
Fineness-of-grind-gauge		B. Oven Jones address as above	Model 502	137	
Laboratory stove	1	(m) F. Kurt Retsch address as above, item (k)	Range up 180°C		
Laboratory oven			Model TV 10V/1	290	
Device for measuring of coat-scratch resistance	1	(n) F. Kurt Retsch address as above	Adjusted for ASTM D 2197-63T		
Scratch testers		B. Oven Jones, address as address as above		375	
Device for measuring of wet film thickness of paints b/	1	(o) address as above, item (k)	ASTM D 1212-51		
Wet film thickness gauge		B. Oven Jones address as above, item (a)	Size 0-100 microns	140	

a/ 1 gallon = 4.456 litres

b/ May be purchased in second stage of factory development.

phase 1 7 692
phase 2 5 595
13 287

Annex V

MONTHLY RAW MATERIAL DEMAND (TONS) CALCULATED FOR THE PAINT PRODUCTION PROGRAMME DURING THE INITIAL PERIOD OF THE DEVELOPMENT PHASE: 1978-1980

Materials	Months											
	1	2	3	4	5	6	7	8	9	10	11	Total
Titanium oxide RXL	568											568
Tioxide RCR2		544	825	227								1 596
Zinc oxide				422			150					572
Zinc chromate						217						217
Iron oxide, yellow				7			158	66				231
Iron oxide, red						217	315	27				559
Organic pigments [a]					28							28
Whiting W	2 870	1 659	834	422	124	217	315	27				6 508
Microflex LX15	2 414				25	217						2 656
Mico	497											497
Kaolin G	355							18				373
Barytes					25							25
Supertalc SF						166	136					302
Aluminium powder and paste										43		43
Icekap K	355											355

Materials	Months											
	1	2	3	4	5	6	7	8	9	10	11	Total
Tylose MHB 30 000	71											71
Nopco NOW	43	3	3									49
Nopco NXZ		9	3									12
Acticide MPM	14	2	3									19
Calgon (10%)	71											71
Sodium hydroxide sodium	28											28
Solvesso 150	170											170
Natrosol 250HR		16	15									31
Triton x 100		6	3									9
Orotan 731 (25%)		44	53									97
Ammonia		3	2									5
Hexanol		53	56									109
Ethylene glycol		31	62									93
Lead naphthenate (10%)				46	10	26	26	10	15	4		137
Manganese naphthenate (2%)				46	10	26	26	10	15	4		137
Cobalt naphthenate (15%)												
Cyclohexanane oxime (20%)				33	10	21	21	6	8	2		101
Aluminium stearate (15%)				20	2	5	5	2				34

Materials	Months											
	1	2	3	4	5	6	7	8	9	10	11	
Movilith DM60 (50%)	1 420											1 420
Primal AC 388 (50%)		420	953									1 373
Alkyd resin 30 - 2026				1 712	285	546	151	295	210	54		3 253
Alkyd resin P470						385	569		345	90		1 389
White Spirit				267	50	235	350	64	96	49	510	1 621
Shellsol A				49	10	49	49	10	18	9	98	292
Total	8 846	2 790	2 812	3 251	579	2 327	2 271	605	707	255	608	25 051
Water	5 637	1 803	1 516									8 956
Total	14 483	4 593	4 328									34 007

Annex VI

CALCULATION OF THE STORAGE AREA

A. Raw materials (one month's storage)

	Area needed (m^2)
Pigment and extenders (in sacks) 31,000 kg	70
PVA emulsions (in tanks 2 x 8 m^3)	20
Alkyd resins (45 drums (220 litres each) stored outside of the building under roof, 25 x 2 m)	50 a/
White spirit (in 8 m^3 tank underground outside of the building)	-
Solvents or solutions 15 drums (200 litres each) in separate store division	18
Miscellaneous raw materials (10 items): stored in small quantities in seperate stores division	12
	120 + 50

B. Packing (15 days' storage)

			Rows	Shelves
20-litre containers	diameter 300 mm x 800	= 240 m	3	80
5-litre tins	diameter 180 mm x 1,200	= 216 m	4	54
2-litre tins	diameter 150 mm x 800	= 120 m	4	30
1-litre tins	diameter 120 mm x 800	= 96 m	6	16
500-ml tins	diameter 95 mm x 800	= 76 m	8	10
250-ml tins	diameter 75 mm x 800	= 60 m	10	6
				196 (200 m)

	(m^2)
Assuming four levels x 50 m x 75 cm (width of the shelves)	37.5
Plus free room calculated 1.5: 1	25.0
	62.5

C. Final product (15 days' storage)

Paints, as above item B	62.5
Distemper-powder mix in small packings	25.0
	87.5
Total areas A + B + C	50 + 270.0 a/

a/ Including area outside of the building.

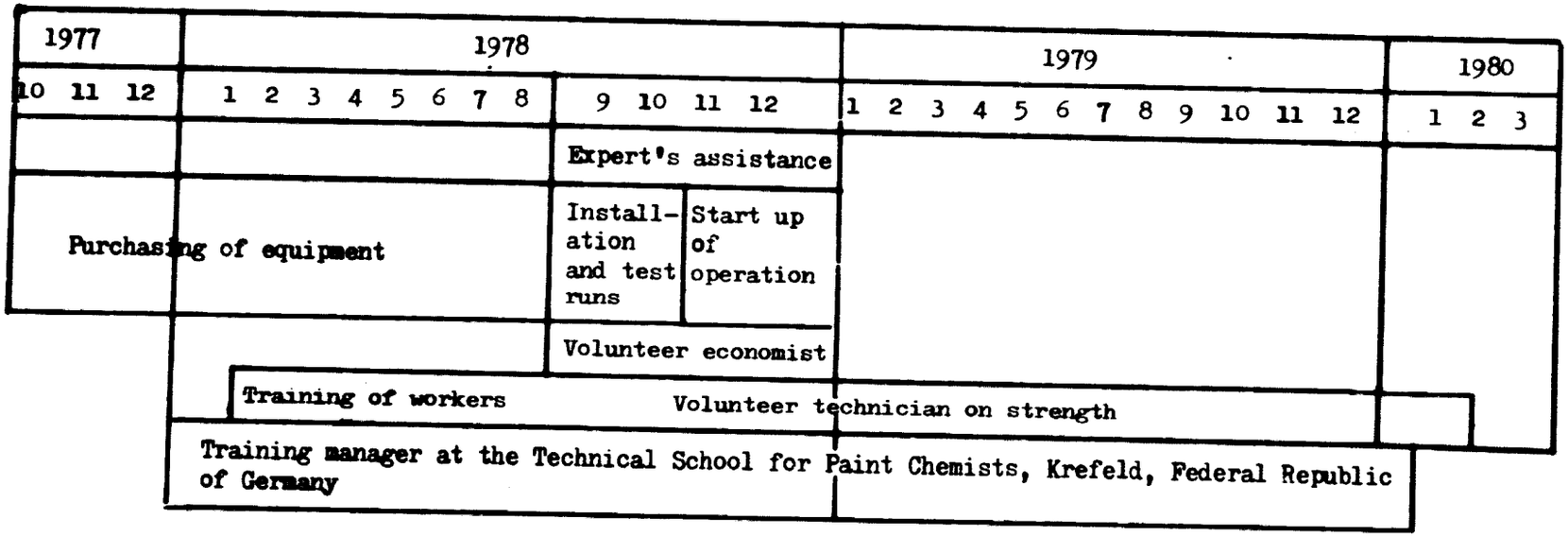
Annex VII

CALCULATION OF THE WORKSHOP AND ACCOMMODATION AREA

		Area needed (m^2)	
A.	**Workshop**		
	High-speed disperser, 1.97 m x 0.95 m	ca 2	
	Pearl mill, (0.98 + 2 x 0.95 m) x 0.69 m	= 2	
	Mobile containers, 4 x 0.80 m + 4 x 0.35 m	= 8	
	Single-roller mill 2.0 m x 0.83 m	= 2	
	Mobile containers 0.8 m x 0.80 m + 0.8 m x 0.8 m	= 2	
	Lifting and tilting unit, 0.95 m x 0.35 m	= 1	
	Filling machine, 4.0 m x 1.8 m	= 8	
	Compressor, 1.8 m x 0.9 m	= 2	
	Dry-grinding ball mill, 2.8 m x 1.23 m	= 4	
	Kneading machine, 2.7 m x 1.35 m	= 4	
	Mobile container, 0.8 m x 0.8 m	= 1	
	3 pumps, 3 x 1 m^2	= 3	
	Drum jockey + drum	= 3	
	3 Scales, 3 x 2 m^2	= 6	
	Hand truck	= 2	
		ca 50	
	Plus free room calculated 1:1	ca 50	
	Total area required for the workshop		100
B.	**Laboratory**		10
C.	**Office**		
	Manager		10
	Purchasing agent, bookkeeper		10
	Toilets		8
D.	**Passage for internal operation of the truck**	46 m x 2 m =	92
	Total area, A + B C + D		230

Annex VIII

TRAINING PERIOD FLOW CHART AND DISTRIBUTION OF PERSONNEL DURING THE INITIAL STAGE (1978-1980)



Annex IX

TECHNICAL SPECIFICATIONS OF THE EQUIPMENT REQUIRED IN THE INITIAL DEVELOPMENT PHASE OF PAINT PRODUCTION

Apparatus	Items corresponding to annex IV	Quantity	Principal dimensions (mm)	Weight (kg)	Power demand (kW)	Remarks
High-speed disperser type MD 500 (two-impeller agitator	1 (c)	1	Length 1 940 Width 950 Weight 2 115 (minimum to 2 915 maximum)	1 400 + 350 (motors)	Main motor, 18 Motor of the hydraulic, 1.5	Width is given of the container when working
Pearl mill, type KE-20V equipped with glass beads	2 (b)	1	Length 1 450 Width 690 Height 2 050	600	Driving motor, 17.5	Special glass or steatite beads: 37 kg + 10 kg (reserve)
Mobile containers and container cover	3 (c)	4 x 250 litres 2 x 500 litres	Diameter 800 Diameter 950	4 x 120 2 x 200	Nil	
Simple-roller mill	4 (d)	1	Length 2 000 Width 830 Height 1 500	1 980	Main drive motor, 7. Pump-driving motor, 0.9	
Filling machine (fully equipped)	6 (d)	1	Length 4 000 Width 1 800 Height 1 900	1 150	Driving motor for compressor, 18	Pneumatic control method With compressor, air receiver, starter etc.
Lifting and tilting unit	7 (a)	1	Length 950 Width 950	1 100	Motor of the hydraulic lift Drum jockey lift, 30	Length and width are given of the container when working

Apparatus	Items corresponding to annex IV	Quantity	Principal dimensions (mm)	Weight (kg)	Power demand (kW)	Remarks
Pump	8	3	Length 286 Width 260 Height 381	3 x 75	3 x 1.7 = 5.1	Model S8 1A
Drum Jockey, load 300 kg	9	1	Length 1 800 Width 1 200 Height 2 800 (max)	400		
Storage tanks for PVA emulsions V = 6 m^3 for PVA emulsions V = 8 m^3 for solvents V = 8 m^3	10	1 1	Diameter 1 900 Height 2 850		Nil	Stainless steel 304
Dry-grinding ball mill, type KE 1 000 equipped with 750 kg chronium nickel steel grinding balls	12	1	Length 2 800 Width 1 230 Height 1 780	4 300	Driving motor, 10	With support for the drum
Kneading machine, type c, class SK 14, size 200	13	1	Length 2 700 Width 1 350 Height 2 100	1 700	Main motor, 11 Motor of the hydraulic for tilting, 0.4	
Scales Platform scale Indicating scale	17	1 2			Nil	Range up to 2 000 kg Range up to 500 kg

Apparatus	Items corres-ponding to annex IV	Quantity	Principal dimensions (mm)	Weight (kg)	Power demand (kW)	Remarks
Hand truck, turnable	18	1	Length 1 828 Width 914		Nil	Capacity up to 1 500 kg
Van	15	1				
Truck	16	1				
Labaratory equipment	19		Dimensions of the separate room of 12 m^3		10	Listed separately in annex IV

Annex X

SUGGESTED SUPPLIERS OF RAW MATERIALS

Titanium dioxide RXL/RCR2	ICI (Imperial Chemical Industries) Leyds St. 1, Braamfontein Johannesburg Telex: 8-7661
Zinc oxide/zinc chromate	Zinc Chemicals (Pty) Ltd Springs Volgelstrulsbult Rd Telex: 8-6733
Organic pigments Tylose Mowilith DM 60	Hoechst South Africa 3 Caxton Street Industria P.O. Box 8692 Johannesburg 2000 Telex: 8-7134
Iron oxide yellow Iron oxide red Whiting W Microflex LX 15 Mica Kaolin G Barytes Supertalc SF Icekap K	G & W Base and Industrial Materials (Pty) Ltd 155 Immelman Rd. P.O. Box 14052 Wadeville, Transvaal Phone: 34-9100
Nopco NDW Nopco NXZ	Diamond Shamrock (Africa) 135 Old Main Rd. P.O. Box 703 Pinetown 3600, Natal Phone: Durban 727681
Acticide MPM	Thor Chemicals 16 Henwood Rd. P.O. Box 369 Pinetown 3600, Natal Phone: Durban 728388 Telex: 6-5075
Salvesso 150	Esso Chemicals (Pty) Ltd P.O. Box 78010 Transvaal, Sandton-City Telex: 8-6499
Natrosol 250 HR	T. & C. P.O. Box 1521 Durban 4000
Triton X100 Orotan 731 (25%) Primal AC 388 (50%)	Rohm and Haas Pinetown
Texanol	Jacobson van der Berg P.O. Box 3577 Johannesburg 2000 Phone: 7881940 Telex: 8-7443

Ethylene glycol	Union Carbide SA (Pty) Ltd Smith St. Bedford Centre Bedfordview Telex: 8-3851
Alkyd resin 30-2026	British Plastics Gillits Rd. Pinetown 20 Telex: 6-5080 SA Phone: 72-6226
Alkyd resin P-470	Polyresin Products 132 Sea Coal Lake Rd. Durban Telex: 6-2403 SA Phone: 83-3831
Mineral spirit Shellsol A	Shell Chemical Office 601 Shellhouse St. Braamfontein Rd. P.O. Box 496 Johannesburg Phone: 72-96700

Annex XI

SPECIFICATIONS OF THE PLANT BUILDINGS

Area: 500 m^2

Store, workshop, offices, laboratory areas as shown on the layout figure.

Height: at least 3 m at the walls.

Floors:

(a) Workshop, store, passage - cement-based floor;

(b) Laboratory - terazzo floor;

(c) Offices - standardized execution.

Roof: asbestos-cement roofing material.

Ventilation:

(a) Workshop: ventilators (6 changes of air per hour);

(b) Other rooms, natural ventilation.

Light: incandescent or fluorescent lamps.

Water demand:

(a) For cooling of equipment 0.4 m^3/hour;

(b) For periodic washing of equipment, 0.5 m^3/shift.

For cooling, the naturally cold public supply would be utilized and discharged as waste. The effluent would have a temperature in the range 50° to 65°C, but would not be polluted chemically.

When washing after PVA production runs or changing colours, the diluted paint constituents may be re-used as water in the manufacturing process, but sometimes would be discharged via a separating tank.

Hardness of water:

The town supply, with a hardness of 30-40 parts per million Ca CO_3 considered to be suitable without requiring further softening.

Power demand:

The electrical power required for the plant has been estimated by about 100 kW, and a 25% surplus should be planned for the further development of the plant.

Sewerage:

The effluents would contain diluted paint constituents. They may include:

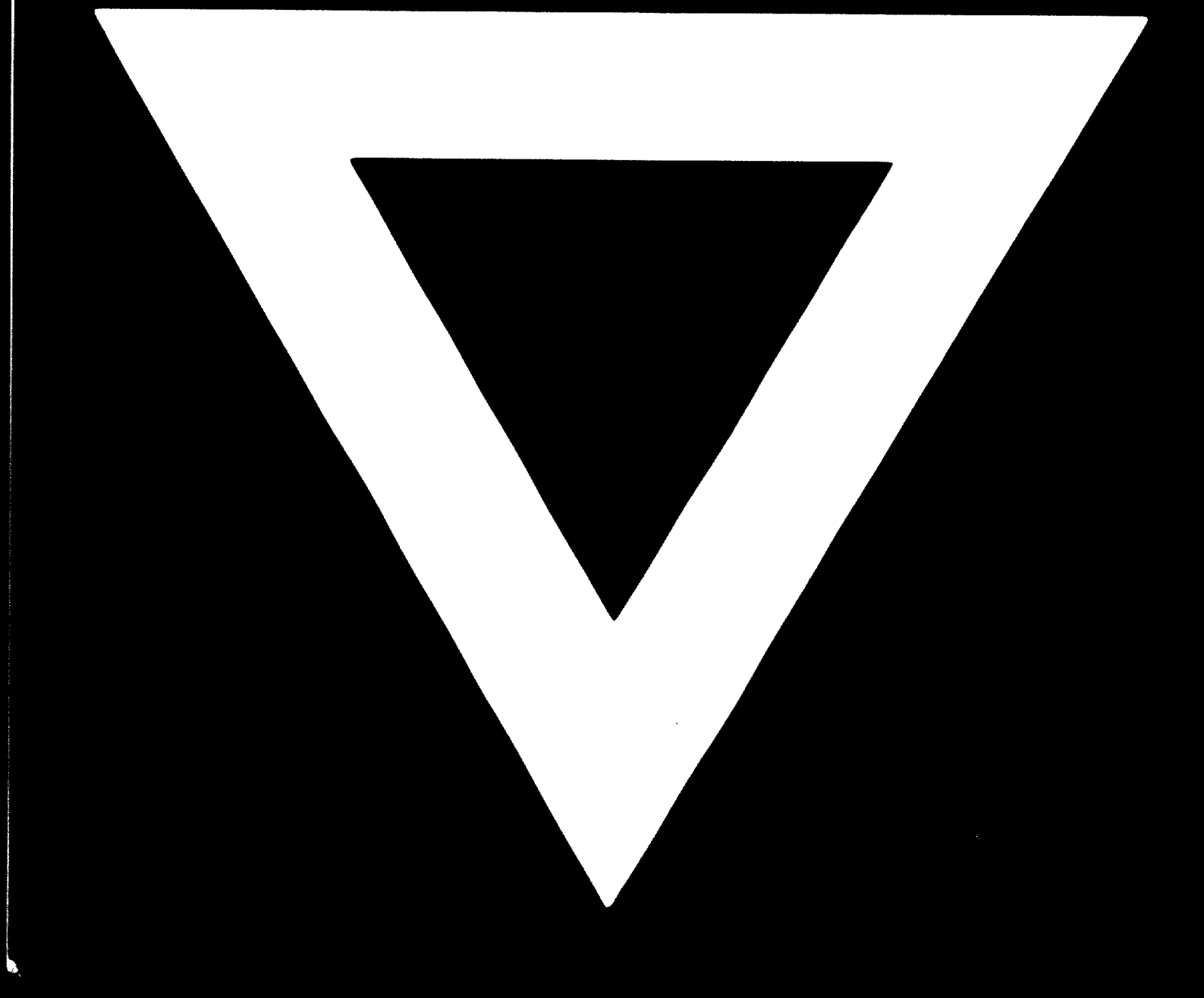
(a) Pigments and extenders (specific gravity 2.7 to 5.1) mainly oxides of titanium and zinc, carbonates and silicates of calcium, aluminium and iron;

(b) Salts of lead and chronium in slight quantities (specific gravity 3.5 to 4.5);

(c) Resins such as PVA and alkyd resins. The last are immiscible with water;

(d) Solvents (mineral spirits mainly).

C-688



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