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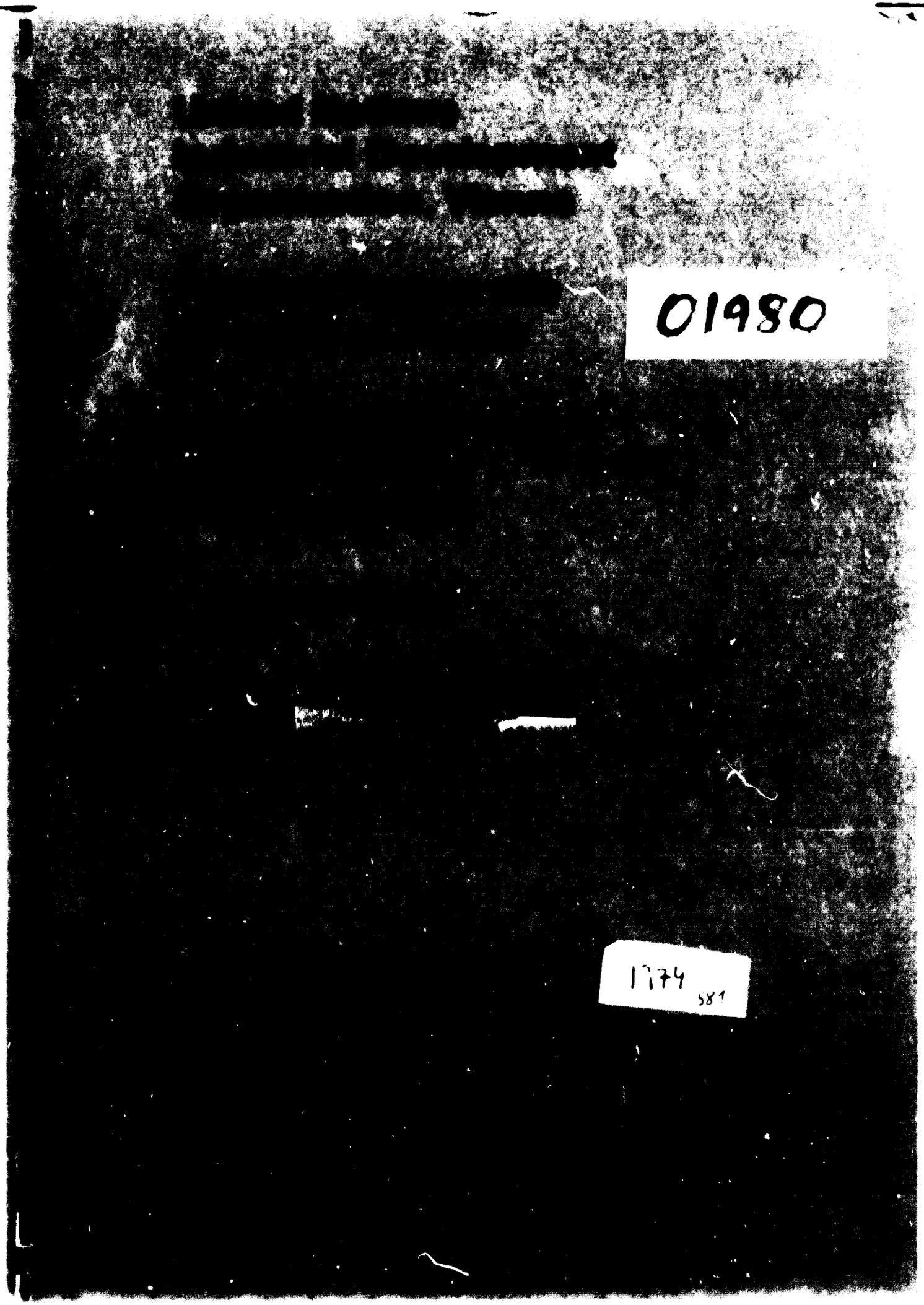
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UNIDO, VIENNA

PEOPLE'S DEMOCRATIC
REPUBLIC OF YEMEN

INTEGRATION OF BOTTLING OF
AERATED WATER
(YE/PDY/72/006)

PRINCIPAL REPORT

November 1974

UNIDO, VIENNA

PEOPLE'S DEMOCRATIC
REPUBLIC OF YEMEN

INTEGRATION OF BOTTLING OF
AERATED WATER
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PRINCIPAL REPORT

SYNOPSIS OF REPORT

Contents:- This report presents the findings and recommendations resulting from the first study phase of the project to reorganise the National Organisation for Bottling Aerated Water in the People's Democratic Republic of Yemen.

The report is divided into four principal sections, of which the subjects are as follows:-

Section 2 - The Current Situation - the existing markets for soft drinks, the economic and technical environment, the product range and quality, the condition of each plant and of each major piece of equipment in it.

Section 3 - The Future Markets - the expected development in each market sector and the resultant total market forecast over a five-year period.

Section 4 - Proposals to Meet the Market Requirements - the overall strategy for reorganisation and renovation, product changes and raw material economies, overhaul programmes for process and bottling plant, management and system changes and the estimated financial implications of the proposals.

Section 5 - Specific Recommendations for the Second Phase of the Project - details of the work content and the timetable proposed for the experts' contribution in:- supervising the plant development programme and the establishment of quality control laboratories; advising and training engineering and quality control counterparts.

Findings and Proposals:- The most salient findings and proposals from the report are considered to be the following:-

- The National Bottling Organisation is working close to the limit of its present production capacity. There is a high risk of plant breakdown and of poor and unsafe product quality due to the poor condition of the plant and the lack of quality control.

- The Organisation's market for soft drinks could increase by between 20% and 60% over the next five years, depending upon the country's economic growth and upon Government policies towards the industry. Exports will remain a small proportion of total turnover.

- Integration of production on to two sites has already been accomplished and the experts consider that the costs of further consolidation on to one site would outweigh the benefits resulting from such a move.

- A detailed development programme for the renovation of two bottling plants is put forward which should enable them to meet the forecast demands. There is the possibility of bringing a third plant into service as a reserve and for possible transfer to Mukallah in due course.

- Full lists of necessary replacement parts for the overhaul of each major item of plant are included, with guidance as to whether the parts can be obtained locally or must be imported.

- A common method of water treatment is proposed and the plant defined, using the relatively recent reverse osmosis techniques which are particularly suitable for Yemen conditions.

- Economies in imported raw materials for soft drinks are suggested, particularly the substitution of saccharin for the sugar which makes up nearly 50% of the Organisation's raw material imports.

- Changes in management organisation and systems are put forward, particularly in the fields of production control, quality control and maintenance engineering. These changes should facilitate the achievement of high production and product quality from the existing plants.

- Detailed proposals for quality control procedures, testing methods, document design and equipment needs are presented.

- The conditions necessary for the commencement of the second implementation phase of the project are defined.

UNIDO, VIENNA

PEOPLE'S DEMOCRATIC REPUBLIC OF YEMEN

INTEGRATION OF BOTTLING OF AERATED WATER (IS/PDY/72/006)

PRINCIPAL REPORT

CONTENTS PAGE

CONTENTS PAGE

APPENDICES (Continued)

APPENDICES

CONTENTS PAGE

APPENDICES

November 1974

UNIDO, VIENNA

PEOPLE'S DEMOCRATIC
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INTEGRATION OF BOTTLING OF
AERATED WATER
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PRINCIPAL REPORT

1. Introduction and Definition of Terms of Reference for Study Phase of Project

During 1973 the P-E Consulting Group Limited received several communications from UNIDO concerning their ability to provide expert staff to assist the National Organisation for Bottling Aerated Water in the People's Democratic Republic of Yemen. In December 1973 a formal invitation to tender was received and, in reply to this, the experts' proposal for a project to integrate the bottling of aerated water was put forward in January 1974.

After some revision of this proposal in the ensuing months, particularly concerning the nominated team members, the experts were notified that they had been awarded a contract to perform the project in July 1974.

The team leader visited Vienna for briefing on 16th - 17th July 1974 and then proceeded directly to Aden to perform the following preliminary tasks:-

- Collection of water samples to allow a rapid preliminary analysis of water quality in London

- Examination of the bottling plant to establish the equipment makes, model numbers and condition, so that the suppliers could be quickly contacted

- Introduction to Government and National Bottling Organisation staff, particularly the nominated counterpart engineer and chemist.

A report on this preliminary visit to Aden was submitted to UNIDO on 26th July 1974. This report recorded the achievement of all the objectives of the preliminary visit, except the introduction to the counterparts, who were not available. The report recommended that the main study should be slightly rescheduled to separate the study activities of the terms of reference from those concerned with implementation of changes. This rescheduling was accepted by UNIDO and is considered in the discussion of the terms of reference which follows.

Terms of Reference

1. To study the existing and potential market for soft drinks.

2. To assess the economic and technical situation of the Yemeni soft drink industry.

3. To examine all machinery in the existing plants and to report on the state of each major piece of machinery.

4. To prepare a list of spare parts required but not locally available.

5. To supervise the overhaul of all repairable machinery which is in need of such treatment, provided spare parts are readily available in the country. Alternatively to render detailed technical advice on overhauling requirements.

6. To examine the water feed to the existing plants and to draw up plans for a water feed based on the town water supply.

7. To supervise or advise in the establishment of a quality control laboratory, provided that laboratory equipment is available in the country. Alternatively to give detailed advice on establishment of a quality control laboratory.

8. To advise on the establishment of procedures for quality testing.

9. To train a counterpart chemist to assure control of the laboratory.

10. To draw up plans, taking the afore-mentioned market study into consideration, for the integration of available equipment and premises into one (or more) production line(s).

11. To advise in writing the future counterpart engineer on how to execute the planned integration.

12. Recommend the measures to be taken so that the National Organisation of Aerated Water runs more efficiently and economically, and meets the local demand.

Of the twelve items listed in the terms of reference, it was proposed that items 5 and 7 which were concerned entirely with implementation, should be deferred until the second phase of the study. By this means the delays and administrative problems often associated with implementation would not affect the timetable of the study activities. It was then discovered, early in the fieldwork, that a counterpart engineer and counterpart chemist could not be made available from within the Organisation, so that it was not possible to perform the training functions defined in items 9 and 11.

The experts therefore concentrated during the first study phase of the project, on items 1 to 4 and items 6, 8, 10 and 12. It is understood that items 5, 7 and 9 and the training implications of item 11 would be accomplished during a second implementation phase of the project.

This report is devoted solely to the first study phase activities and, as such, defines and justifies the experts' recommendations for a project to integrate and improve the National Bottling Organisation. It should therefore form the basis for any decisions about the nature and duration of the second implementation phase.

At the request of the Ministry of Industry of the PDRY, the experts also produced a brief, "preliminary action" report which they submitted to the Government before leaving the field. Copies of this report have also been provided to UNDP in Aden and to UNIDO in Vienna. The objective of this short-term action report was to recommend measures which could be taken immediately by the Ministry and the National Bottling Organisation without awaiting the experts' principal report. All the recommendations made in the preliminary action report are elaborated and, in some cases, slightly modified in the present principal report.

The study which has formed the basis of the experts' proposals was performed by the nominated UNIDO team, consisting of:-

N.C. Robson - team leader, engineer and packaging machinery expert

E.C. Windsor - economics and marketing specialist

R.M. Voelcker - chemist and food analysis expert.

The study field work was carried out between August 6th and September 22nd 1974 in and around Aden, with liaison meetings with equipment and raw materiel suppliers in Beirut on the outward and return journeys. Debriefing took place on Vienna on September 23rd 1974.

For the guidance of readers unfamilier with towns and regions in the People's Democratic Republic of Yemen (hereafter abbreviated to the PDRY) a map of the country is provided as Appendix 1.1.

The currency of the PDRY is the South Yemen Dinar, abbrevieted to SYD in Tables and Appendices to this Report. A South Yemen Dinar is made up of 1,000 fils and is approximately equivalent in value to three US dollars at present.

2. The Current Situation

2.1 Economic Background

2.1.1 Economic Development Objectives of the People's Democratic Republic of Yemen

The economic objectives of the Republic are set out in the Quinquinniel Plan for Economic and Social Development, 1974/75 to 1978/79, published in March 1974. The main objective is to move away from a service-orientated economy towards one more dependent on agricultural and industrial production. During the five year plan, priority is to be given to projects (a) that make use of local raw materials and (b) that produce commodities which help to reduce the import of similar raw materials. The plan envisages that production will increase as follows:-

Table 2.1 - Planned Growth in Production, 1972/73 to 1978/79
(000 SYD* at fixed 1969 prices)

	1972/73	1978/79	Increase
Industrial Production	9,317	24,579	165%
Agricultural Production (incl.Fisheries)	31,217	48,241	54%

Source: Quinquinnial Plan, 1974

The capital investment required to fund this increase is estimated at 75,358,000 dinars. Of this total 40,872,000 dinars are expected to be provided from foreign sources. The remainder will be funded from internal sources as follows:-

* SYD - South Yemen Dinar

Table 2.2 - Planned Funding of Capital Investment from Internal Sources

Internal Source	'000 SYD
Development share from profits of corporations and public organisations.	8,600
Deductions from salaries and wages	2,600
Depreciation and uninvested profits of corporations and public organisations	2,000
Self-resources for financing of corporations and public organisations' projects	6,872
Bank credits	8,593
External credits and grants for local financing	5,494
Contribution of the private sector	326
Total	34,485

Source: Quinquinnial Plan, 1974

The estimated growth in industrial production during the period of the plan is set out in Appendices 2.1 and 2.2. Appendix 2.1 illustrates the comparative importance of the production of aerated water in 1972: it then represented nearly 9% of the value of public sector production and 4% of total industrial production. In the Quinquinnial Plan however, aerated water production receives a low priority for growth. Appendices 2.1 and 2.2 illustrate that production of aerated water is planned to increase only as follows:-

Table 2.3 - Planned Industrial Growth

	1972	1978/79	Increase
Aerated water production ('000 SYD 1969 prices)	369	456	24%
Total industrial production ('000 SYD 1969 prices)	9,317	24,570	164%
Aerated water production (million bottles p.a.)	14.4	17.0	18%

As presently planned, production of aerated water in 1978/79 would represent only 3% of public sector production and less than 2% of total industrial production. There is no provision in the plan for capital investment in production of aerated water before 1978/79. Provision is made, however, in the reserve project lists of the Ministry of Economy and Industry for a techno-economic study into the feasibility of a local brewery. If such a project appeared feasible it could be considered for incorporation into the plan by 1978/79.

The Quinquinial Plan also identifies the major priorities in terms of foreign trade. These are:-

- to decrease the deficit in trade and balance of payments

- to activate other sources of foreign exchange earnings

- to reduce expenditure on imports of non-basic materials.

The Plan envisages that 1972 exports and re-exports of approximately 4 million dinars can be increased by 1978/79 to 13.95 million dinars. It is however accepted that, despite the planned investment in new projects, the potential for increasing exports is limited. It is planned to restrict imports of some commodities, replacing these where possible with local products and to re-orientate trade towards socialist and friendly countries. The forecast is that imports could be limited to an increase of 20% in the period 1974 to 1979. Among other items, imports of machinery, where possible on a basis of commercial credits, could be limited to 5 million dinars annually.

For purposes of our study, therefore, we have assumed that the Yemeni soft drink industry can best make its contribution to the national economy in two main areas:

1. By decreasing (or limiting increases in) any foreign trade deficit attributable to its operation. This would involve reducing, or limiting increases, in the value of raw materials imported for the manufacture of soft drinks. Similarly foreign exchange earnings could be increased by increasing the revenue obtained from the export of soft drinks or from increased sales to non-Yemenis for foreign currency.

2. By increasing (or preventing reductions in) the value added within the national economy from the manufacture of soft drinks. This added value is then available for funding planned economic and social development programmes, as well as for funding the improvements required for the industry's own development and the welfare of its employees and customers.

2.1.2 The Contribution of the National Organisation for Bottling Aerated Water to the National Economy

We have attempted to show the economic contribution of the Republic's soft drink industry in Appendix 2.3. The model emphasises the two aspects of foreign trade deficit and internally added value as discussed earlier. The values used in the model are based on actual costs in 1973/74 (see section 2.1.3 which follows) and on a typical production level of 600,000 24 bottle cases annually. We have made our own estimate of the value of "export" sales (see section 2.2).

In terms of foreign trade, the Yemeni soft drinks industry imported raw materials valued, before custom duty, at 125,000 dinars. Based on the relative proportions estimated in the 1974/75 budget for imported materials, and excluding any new machinery or glass bottles, this total breaks down as follows:-

Table 2.4 - Breakdown of Import Costs

Imported Material	% of Total Imports 1974/75 Budget	Equivalent (SYD)
Production Materials		
Sugar	43.8	54,750
Concentrates	27.5	34,375
Crown Corks	9.5	11,875
Sub Total	80.8	101,000
Indirect Overheads		
Fuel	10.6	13,250
Spare Parts (Machines & Trucks)	8.6	10,750
Sub Total	19.2	24,000
TOTAL	100.0	125,000

We have estimated (section 2.2) that "export" sales produce a maximum of 15,000 dinars in foreign currency. The deficit on foreign trade resulting from the present operations of the soft drinks industry is therefore 110,000 dinars annually. It is probable that, as a result of the rapid increase in price of imported materials, this deficit will tend to worsen in the next few years.

In terms of value added within the national economy, the imported raw materials, valued at 125,000 dinars, are taxed, processed and re-sold within the economy to a value at point of sale of 415,000 dinars. The difference - a total of 290,000 dinars - may be accounted for as follows:-

Table 2.5 - Added Value

	SYD	
	Added Value	Total Value
Value of Imported Raw Materials		125,000
Add:- Import Tax	20,000	
Goods and services from other Yemeni industries	35,000	
Wages and other employment benefits	117,000	
Estimated tax on bottles of soft drinks	28,000	
	200,000	200,000
Value of Goods After Production		325,000
(i.e. 600,000 cases @ average 542 fils/case)		
Add:- Margin to co-operatives and retailers	90,000	90,000
Value of Goods at Point of Sale		415,000
(i.e. 14 million bottles @ average 29.5 fils per bottle)		
Total Value Added	290,000	

2.1.3 Financial Situation of the National Organisation for Bottling Aerated Water

At the end of 1973, when the 1974/75 budget was prepared for all operations of the National Organisation (desalinated water, ice and CO_2 as well as soft drinks) it was hoped to break even at a level of 600,000 cases of soft drinks and a case price of 525 fils. The outline of the 1974/75 budget is set out in Appendix 2.4. In view of the prospect of increased production material and electricity costs, it was decided to increase the usual soft drink case price from 525 to 550 fils. The retail selling price was not changed and remained at 30 fils per bottle. The effect of this was to reduce the resellers' mark-up from $\frac{195 \text{ fils}}{525 \text{ fils}}$ (i.e. 37%) to $\frac{170 \text{ fils}}{550 \text{ fils}}$ (i.e. 31%) and increase the manufacturers revenue by 4.8%.

Based on costs in the April/May/June 1974 quarter for soft drinks manufacture, we calculate that "break-even point" (without allowing for depreciation) is 575,000 cases yearly at the higher price. Even at the 1973/74 rate of production (660,000 cases annually), the soft drinks operations are only achieving a surplus of 15,500 dinars above costs incurred. This surplus is calculated after deduction of excise tax but before making any provision for depreciation of the plant or transfer to development funds. The break-even chart is set out in Appendix 2.5. The cost and revenue calculation on which this is based is set out in Appendix 2.5 but can be summarised as follows:-

Table 2.6 - Current Costs and Revenue at Various Levels of Sale (Cost and Revenue in '000 SYD) - Soft Drinks Only

Annual Rate of Sale ('000 Cases)	575	660	750	1,000
Sales Revenue @ Av. 542 fils/cass	312	357.5	406.5	542
'Fixed'Overhead Costs	122	122	126	132
Variable Overhead Costs	24	28	32	42
Production Costs (including excise)	167	192	218	291
Total Costs	313	342	376	465
Surplus	-1	+15.5	+30.5	+77

Source: National Organisation Cost and Revenue Data (April/May/June quarter, 1974)

The above analysis compares quite closely with the National Organisations assessment of its financial situation in the 1974/75 budget statement (Appendix 2.4). In their budget forecast the National Organisation expected to break even (after providing 10,532 dinars for depreciation) at a throughput of 600,000 cases annually and an achieved case price of 520 fils. This was based on December 1973 costs but cannot be directly compared with the analysis above since the budget also includes cost and revenue for the ice, water and CO_2 operations of the National Organisation. Our analysis

above shows that because of higher June quarter 1974 costs, the soft drinks revenue at 542 fils/case and at a throughput of 660,000 cases was only sufficient to produce a surplus of 15,500 dinars for depreciation etc. It must be expected that higher costs both of imported materials and of domestic services will continue to erode the present operating surplus. As an example of this the increase in electricity charges from July 1974 will increase costs by 3,660 dinars p.a. (from 1,716 to 5,377). The full effect of the past years price increases has not yet fully worked through the current cost statements. Some examples of the level of price increases between December 1973 and June 1974 are shown in the following table:-

Table 2.7 - Cost Increases, December 1973 to June 1974

Commodity and Unit	December 1973 (Fils)	June 1974 (Fils)	Effect in Full Year (SYD)
Sugar (kilo)	109	162	23,000
Crown Corks (per 1,000)	114	190	10,000
Diesel Fuel (gall)	113	171	500
Marine Diesel (gall)	70	165	7,500
Petrol (gall)	220	337	1,800

Source: Department of Home Trade Retail Prices (as provided by National Organisation).

It is difficult and perhaps unrealistic to try to assess the total value of the Organisation's assets. Current account liquid assets are understood to be about 50,000 dinars. The only capital accounts available to us dated before nationalisation. As all the original companys' assets were acquired at that time, it must be considered that all plant and buildings are now fully depreciated. Most of the plant and buildings date from the early sixties, so that this is a reasonable assumption. Depreciation and interest payments on plant and buildings are non-existent, judging from the Organisation accounts. It is understood that all property is owned by the state, and the Organisation therefore pays rent for the lease of the buildings, amounting to about

5,000 dinars per year. In addition the Organisation is paying bank interest at 8% on short term loans, notably on 120,000 dinars advanced for the intended purchase of a new line. The National Bank has also revived recently its claim for outstanding debts incurred before nationalisation; including interest, these now amount to about 200,000 dinars, thus cancelling out the Organisation's 50,000 dinars credit balance.

The alternative method of valuing the assets is to assess their current sale or replacement value. The sale value of the plant is small, perhaps 20,000 dinars in all, and the buildings are state owned.

The only other significant realisable asset is the Organisation's empty bottle stocks. As most of the bottles are of internationally branded design, they should be readily saleable. The Organisation has no complete record of its bottle stocks but it has been possible, by considering the sales levels, stock rotation and the volume of unused bottle stocks at the Pepsi Cola and Green Spot plants, to produce the following estimate of current total stocks:-

Table 2.8 - Estimate of Current Bottle Stocks

	Approx. Qty. of Bottles
Bottles in current use	
- Canada Dry types	2,000,000
- Other types	1,000,000
Bottles not in current use	
- Pepsi Cola types (at Pepsi Cola plant)	100,000
- Mirande types (at Pepsi Cola plant)	200,000
- Schweppes types (at Green Spot plant)	2,400,000
- Green Spot, etc. types (at Green Spot plant)	1,200,000
Total	6,900,000

Source: P-E estimates from physical stocktaking

The resale value of this stock, at the current price of about 15 fils each, is thus about 100,000 dinars.

The replacement value of the plant can be broadly represented by the cost of the organisation's proposed new line, together with all necessary ancillary equipment. The cost of such a line, at current prices, is estimated as 140,000 dinars, and other necessary items would add about 30,000 dinars, giving a total replacement cost of about 170,000 dinars. The cost of replacement of buildings would be borne by the state and any new property would be leased to the Organisation as at present.

On the basis of the above estimates, we consider that a minimum valuation of the Organisation's assets is about 200,000 dinars, while a more optimistic valuation based on replacement costs would be about 350,000 dinars. Against these must be set the National Bank's assessment of current liabilities at about 20,000 dinars. It is understood that no expenditure has been incurred on the proposed new line.

2.2 The Market and the Products

2.2.1 The Past and Present Demand for Soft Drinks in the Peoples Democratic Republic of Yemen

(a) Total Sales

Over the last eleven years, annual sales of aerated soft drinks have varied between 2,642,000 24 bottle cases (63,408,000 bottles) and 540,000 cases (12,960,000 bottles). Prior to nationalisation of the soft drinks industry on March 1st 1973, the market was mainly supplied by three privately owned bottling groups. Each of these bottlers has the franchise in South Yemen for one of three international brands of soft drinks, namely Coca-Cola, Pepsi Cola and Canada Dry. The first plant started operations in Crater in 1953 with the Coca-Cola franchise. Coca-Cola retained the leading share of the market

until 1966/67. The operations of two smaller bottling operations with less widely known brand names (i.e. "Stim" and "Green Spot") have been aggregated with Coca-Cola's own sales in the following table. Stim products, originally bottled in a separate plant, were later produced and distributed jointly by Coca-Cola from their Crater plant. Green Spot products, including for a short time Schweppes mixer drinks, were produced separately at a fourth small plant in Mansoura which was first run privately but later merged with Coca-Cola. The "Green Spot" plant is not presently in operation. The second main plant to open was that of the Pepsi-Cola bottler at Ma'alla in 1956. This plant is not now operational. The third plant (Canada Dry) commenced operation's at Mansoura in 1961. Since nationalisation, soft drinks are produced at two locations - the former Canada Dry plant at Mansoura and the former Coca Cola plant at Crater. Canada Dry products - made from concentrates supplied by the franchisor and sold in Canada Dry bottles - represented 80% of total sales in 1973/74. The balance is represented by soft drinks produced from unbranded concentrates imported from essence manufacturers and sold in Coca Cola (including Stim and Green Spot) and Pepsi Cola bottles. The historical pattern of past and present sales since 1963 is set out in the following table and illustrated graphically in Appendix 2.6.

Table 2.9 - Sales of Soft Drinks in the PDRY by Brand 1963-1973/74

Figures in '000 cases (1 Case = 24 Bottles)

Year	Coca Cola (incl. Stim and Green Spot)	Pepsi Cola	Canada Dry	Total
1963	1,021	521	450	1,992
1964	801	604	670	2,075
1965	829	655	728	2,212
1966	1,061	750	831	2,642
1967	598	451	856	1,905
1968	290	333	619	1,242
1969	231	250	582	1,063
1970	189	187	536	912
1971	148	129	380	657
1972	85(est)	80(est)	375	540
1973	92(est)	90(est)	420	602
(1973/74)	90(est)	93(est)	483	666

Source: National Organisation's Sales Analysis
Sales Data from former Coca-Cola and Pepsi-Cola ledgers (incomplete)
P-E estimates.

(b) Market Segmentation

The nature of the market has changed significantly over the period reviewed above. In 1965, for example, the demand for soft drinks included, as well as the local Yemeni market:-

- sales to passengers and crews of vessels stopping at Aden

- sales to non-Yemeni nationals, i.e. British forces and other administrative personnel and their families

- exports to North Yemen, Somali and Djibouti.

In 1970, the main demand for soft drinks was derived from sales to domestic consumers. While some additional demand was still generated from shipping, non-Yemeni nationals and exports, the effect of these factors was limited because:-

- the Suez Canal was closed in 1967 and the number of large ships using Aden Port fell from about 6,000 ships in 1965/66 to 1,350 ships in 1972/73

- the number of transit passengers from ships virtually ceased in 1967

- British forces and dependents left in 1967

- bottling plants have now been set up in North Yemen.

In the following tables, we have estimated the relative importance in 1965 and 1973 of the market segments identified above.

Table 2.10 - Estimate of the Main Constituent Sectors of Soft Drinks Market in 1965

Sector	'000 Cases	'000 Bottles
Shipping Crews. All vessels. 6,000 vessels @ 20 cases	120	2,880
& Transit Passengers (on ship). 500 vessels @150 cases	75	1,800
Transit passengers (Aden)150,000 @ 2 bottles	12	300
Non-Yemeni Residents 150,000 @ 120 bottles p.a.	750	18,000
Local Market 1,500,000 @ 15 bottles p.a.	938	22,500
Exports North Yemen (est)	200	4,800
Somali/Djibouti (Est)	100	2,400
Total	2,195	52,680

By comparison with the 1965 market, we estimate that the market in 1973 for soft drinks was made up as follows:-

Table 2.11 - Estimate of Constituent Sectors of Soft Drinks Market in 1973/74

Sector		'000 Cases	'000 Bottles
Shipping & Transit	Crews. 1,300 @ 10 cases	13	312
	Passengers Negligible	-	-
	Airport (Est) 40 cases/week	2	48
Non Yemeni Residents	2,000 @ 150 bottles p.a.	12	300
Local Market	1,500,000 @ 10 bottles p.a.	625	15,000
Exports	North Yemen Negligible	-	-
	Somali/Djibouti (Est)	10	240
	Total	662	15,900

Source: P-E Estimates

(c) Products Range

We have already shown (in Table 2.9 of Section 2.2.1 a) how, as the market has declined, the range of products has been reduced. This process has been accelerated since nationalisation. In Appendix 2.7 we identify some of the brands and flavours available from Coca Cola in 1965 and 1970 and from Pepsi Cola in 1970. The Coca Cola and Pepsi Cola brands now represent only 27% of the total market. They cannot be regarded as genuine Coca Cola or Pepsi Cola products since they are manufactured from essences not supplied by the franchisors. Since they are supplied in the original Coca Cola and Pepsi Cola bottles, they may still be identified by consumers as the original brand.

Canada Dry products represent 73% of the 1973/74 market and Canada Dry sales in 1972/73 and 1973/74 consisted of the following flavours and quantities:-

Table 2.12 - "Canada Dry" Sales 1972/73 and 1973/74 ('000 Cases)

Brand		1972/73 Sales	1974	
			Sales	% of Total
Canada Dry	Cola	301.3	341.1	71
	Orange	9.8	74.6	15
	Fruit Punch	38.6	52.2	11
	Pineapple	2.9	13.0	2½
	Tonic	2.1	1.6	½
	Ginger Ale	.4	.1	-
	Soda Water	.9	-	-
Canada Dry	Total	356.0	482.6	100

Source: National Organisation and Canada Dry.

The total sales of the National Organisation in the latest (April/May/June) quarter of 1974 were as follows:-

Table 2.13 - National Organisation Total Sales April/May/June Quarter 1974

Brand	3 Months '000 Cases	%
Canada Cola	111.5	55 } 72
Akrass Cola* (Pepsi and Coke)	32.6	17 }
Canada Orange	29.2	14
Lemon/Lime*	6.3	3
Apple*	4.3	2
Canada Kola Champagne (Fruit Punch)	13.4	6½
Canada Pineapple	2.6	1
Tonic*	0.9	½
Soda Water*	2.6	1
National Total	203.3	100

Source: National Organisation

In the above table the products marked with an asterisk are those being manufactured from imported essences not supplied by a soft drinks franchisor. The proportions of different flavours consumed in the Republic can be compared with those consumed in another Arab country as follows:-

Flavours	% of Total in PDR Yemen	% of Total in Kuwait
Cola	72%	60%
Lemon/Lime	3%	25%
Orange	14%	10%
Mixers	1½%	4%
Others	9½%	1%
	100%	100%

We believe that these figures suggest that there is scope in the Republic to introduce a "premium quality" drink in the very large Cola market. There may also be an opportunity to develop the lemon/lime flavour, perhaps as a 'premium' product.

(d) Seasonality of Consumption of Soft Drinks

The market for soft drinks is highly seasonal in the People's Democratic Republic of Yemen. About 60% of the annual market is consumed in the two summer quarters. We have compared the seasonality of monthly sales for two periods. In Appendix 2.8 we first show the seasonal pattern as an average of the three years 1963, 1964 and 1965 and then compare this with the pattern for the three years 1971, 1972 and 1973. The comparison is illustrated graphically in Appendix 2.9.

These figures show that as the market has changed over the last twelve years the summer peaks have become even more acute. In the graphical presentation of recent seasonality we have attempted to determine, from the shape of the sales curve, the volume of sales which has been lost because of capacity limitations at the seasonal peak of demand. This volume can be indicated theoretically as the difference between the actual sales curve with its flattened peak induced by production limitations, and a sine curve following the seasonal trend patterns. By this method the average unsatisfied demand in the three years considered is calculated as 14,000 cases p.a.; such a result must be regarded as an underestimate of lost demand because it reflects only the existing distribution pattern.

It is evident that the loss of such peak season sales can be avoided in future either by increasing the effective plant capacity, by plant improvements or by more shift working, or by building up stocks in advance of the peak demand. The latter policy would necessitate a longer product shelf life 4 - 6 months - and therefore much closer control of product purity and sterility. These possibilities are considered in Section 3.

In Appendix 2.10 we have shown the recent variation in seasonality of sales for the Organisation's principal products. It is evident from this graph that seasonal effects are distorted, firstly, by sales growth over the year - particularly for Canada Dry Cola - and by sharp fluctuations in sales which are due mainly to product availability. This effect is especially marked for the slow moving lines, where sales appear more dependent upon production schedules than on any seasonal consumption trend. In broad terms, however, it can be deduced from the graph that peak seasonal sales generally exceed average sales by about 50%.

(e) Geographical Distribution of Soft Drink Sales

We have analysed the geographical distribution of soft drink sales for two periods - for the period 1970/71 and for five months of 1974. The distribution of sales has moved as follows:-

	% of Total Sales						
	1970/71	Jan 74	Feb 74	Mar 74	Jun 74	Jul 74	5 Month Average
Sales in Aden and First Governorates	69	70	65	60	63	69	66
Sales in other Governorates	31	30	35	40	37	31	34

Based on the 1970/71 sales figures we can compare the sales made on each of the Aden sales routes with the latest distribution of population in Aden:-

Table 2.14 - Aden Sales, Delivery Lorries and Population

Sales Route	% of Aden Total Sales	No. of Delivery Lorries	% of Aden Population	
Crater	28	2		18.4
Ma'alla	14	1		16.0
Tawahi	18	1		5.7
Kharmaksar	16	2		5.1
Mansoura			10.4	
Shaikh Othman	12	2	9.6	28.8
Dar Sa'ad			8.8	
Little Aden	10	1		8.7
Other	2	-		17.2
Total	100%	9		100.0%

Source: National Organisation and Population Census

Sales outside Aden, based on the sales during five months in 1974 were as follows:-

Table 2.15 - Sales Outside the First Governorate, 1973

Sales Area/Branch	% of "Outside Aden" Sales	No. of Lorries	Governorate
Dhala	28	1	2nd Governorate
Lahej	13	1	2nd Governorate
Sheikh Othman	22	Collected	2nd, 3rd, 4th Governorates
Zinzibar	35	Collected	3rd Governorate
Stores (Mansours)	2	Collected	Mainly 5th Governorate
	100%		

Source: National Organisation

Based on the above tables, we have related sales to the different governorates and to the Aden districts to the population in that area. In this way we can estimate soft drinks consumption per head in different areas of the Republic. The calculation is set out in Appendix 2.11 in detail, and illustrates how the average annual soft drinks consumption per head ranges from 114 bottles per inhabitant in Tawahi to 0.2 bottles per head in the Fifth Governorate.

We conclude that there is already a tendency for consumption outside Aden to increase and - as we demonstrate in section 3.1 - we expect this tendency to increase. We believe that the National Organisation can take advantage of this movement by adjusting its present system of distribution to increase sales to the changing population and consumption pattern.

(f) Pricing

The National Organisation operates a very simple system of pricing. All drinks (except pineapple and mixers which represent only some 3% of sales) are sold at a Crate price of 550 fils to the retailer and resold at 30 fils/bottle. This policy is followed regardless of the bottle size and regardless of whether the product is manufactured from more expensive franchisers concentrate or from cheaper unbranded essence.

The effect of the uniform selling price policy is to reduce the organisation's margin on those products requiring more expenditure on raw materials. The build up of costs for each of the principal products is presented in Appendix 2.12 and the following table, derived from that Appendix, shows the resulting variation in the difference between material costs and wholesale price.

Table 2.16 - Variation in Margin Between Material Costs and Wholesale Price, - July 1974

Product	Canada Dry	Akrass Cola	Canada Orange	Lima Lime	Akrass Apple	Canada Cheap Cola	Canada Pineapple
Material Costs as percentage of Wholesale Price	57.5	42.7	60.2	44.7	48.9	54.2	49.7

Source: National Bottling Organisation (from Appendix 2.12).

From the above table it is clear that there is wide variation in the margin between material costs and wholesale price. The manufacturing costs and overheads are considered to be reasonably constant whatever the product, except for minor differences related to bottle size, and are equivalent to about 40% of the wholesale price. Thus the margin between manufacturing cost and wholesale price appears to vary between zero, for Canada Orange and 17% for Akrass Cola. It is evident

therefore, that with the present uniform pricing policy, the products using cheaper raw materials are effectively subsidising those which use costly franchisor's syrups.

We consider that selling prices should reflect the Organisation's actual manufacturing costs, otherwise it is probable that a distortion of demand, already evident towards those products which are better value for the consumer, and correspondingly less economic for the Organisation, will be accentuated. It is not surprising, in the present situation, if the consumers are found to prefer the franchisor's brands because they undoubtedly represent better value for him.

We have already discussed the question of the retailer's margin (see Section 2.1.3). We believe that the reduction of this margin should be regarded as a "once and for all" move, because we believe that if it is repeated it will result in the closure of many more existing outlets and could precipitate a decline in sales. It is significant that one large co-operative has already sought exemption from the reduction in margin. We understand that Zinzibar co-operative, distributing soft drinks in the Third Governorate has sought an increased margin to cover its costs of collecting and distributing soft drinks. The special pricing arrangement there, we understand, is that supplies are purchased from the National Organisation at the old Crate price (525 fils/case) with a 15% discount. If this information is correct, the mark-up (assuming that no special delivery charge is made to consumers) would be $\frac{274 \text{ fils}}{446}$ = 62%, compared with the normal retailers mark-up of $\frac{170}{550}$ fils = 31%. If other co-operatives sought similar discounts and if the proportion of business passing through the private sector diminished, the National Organisation could suffer a very significant drop in revenue.

We have concluded that there is scope to introduce a more selective form of pricing, and to attempt to obtain a higher resale price for more expensive flavours to those sections of the market that can afford a higher price, see section 3.1.6 which follows. We think that the National Organisation should resist attempts to raduce its wholesale (Crate) price in its own lorries, and should ancourage its more distant distributors to recover their delivary costs by a levy on the sale price rather than by a reduction of the Crate price.

2.2.2 The Quality of National Bottling Organisation Products

Most of the National Bottling Organisation products were sampled and examined during the course of the study at the Mansoura (ex Canada Dry) plant. A few checks were made at the Crater (ex Coca Cola) plant, but the following comments refer to products made at the Mansoure plant only:-

- the tests tended to very from one batch to another
- the level of fill of the bottles varied too widely to be satisfactory
- the degree of carbonation was almost always too low, affecting the taste and keeping quality of the product.

The poor state of the plant may be blamed for some of the defects, but steps can be taken to make improvements immediately, and these are discussed later.

The production of good quality products, which do not vary significantly from the Canada Dry or agreed standards, should be the aim of the Organisation, especially if it is to anter export markets. These products should have a better shelf life than the maximum of two months achieved at the moment. To improve shelf life, moulds, yeasts and bacterie must not be allowed to cause spoilage. These organisms are kept in check by the acidity, lack of oxygen and proper carbonation of the product. Nearly all the rejects seen were the result of mould growth. Moulds must have

oxygen to grow, but are very sensitive to carbon dioxide which inhibite growth. Similarly low acid and low carbon dioxide allow the growth of yeasts, whilst correct levels of citric acid inhibit the growth of bacteria. Hence tha right balance between flavour, acidity, sugar, carbonation (and the exclusion of air) will not only help to produce an acceptable product but assist in prolonging shelf-life.

At the Mansoura plant, bottles were being insufficiently rinsed on leaving the washer and alkali was being carried over into the product. The acid of the soft drink was therefore being partially neutralized. The degree of carry over varied from bottle to bottle and depended on the condition of the washer rinsing nozzles. A check made on the final day of the study showed that bottle rinsing had improved, but some bottles containing alkali were still to be found.

Tha carbonation of the products was almost invariably too low dua to ineufficient cooling of the water prior to carbonation. Carbon dioxide is more soluable in cold water than in warm, and tha system at the Mansoura plant should be improved as a matter of urgency. The results of tests carried out during the course of the etudy are shown in Appendix 2.13 and the insufficient carbonation can be clearly seen. There was no improvement in carbonation during the course of the study.

Soft drinks produced at the Crater plant were more uniform in bottla fill. Spot checks for alkali carry over on washed bottles failad to find any insufficiently rinsed bottles. The carbonation of Canada Cola measured on 24th August 1974 was found to be too low. The significance of the test was explained to the production supervisor, and a spot chack on the last day of the study showed a distinct improvement.

2.3 Present Operations - Plant and Equipment

2.3.1 Carbon dioxide Generating Plant

The National Bottling Organisation possesses a Wittemann Haeselberg carbon dioxide generator at its Mansoura plant. It was installed in the mid sixties to supplement the capacity of existing equipment at the Sira ice works which was old and unable to meet peak demand.

The Wittemann generator has worked spasmodically, but has now been out of commission for some years. In the meantime the Sira equipment has been kept going and is now the only source of CO_2 in the PDRY. The Wittemann generator makes carbon dioxide by burning a mixture of hydrocarbon fuel and air to produce water, carbon dioxide and nitrogen. After cooling, the gases are passed through a solution of monoethanolamine (MEA) in which the carbon dioxide dissolves. The saturated MEA is heated to drive off the carbon dioxide gas and the MEA is recycled. The carbon dioxide is scrubbed, washed, deodorised, compressed, dried, liquified and stored ready for use. The carbon dioxide produced is 99.9 per cent pure, and free from air, oil and moisture. The sophisticated and potentially hazardous nature of the generator makes it imperative for the operators to be adequately trained in the operation and maintenance.

2.3.2 Water Treatment Plant

The town water supply is treated at the Crater and Mansoura plants by similar processes, although the equipment and layout differ considerably. Product water is filtered, and treated by Ionics demineralisers before being stored in tanks ready for use. The Ionics demineralisers were installed in the early 1960's and work on the principle of electrodialysis. The incoming water is divided into two main streams and is subjected to an electric field by means of two electrodes with a continuous direct current potential difference between them. Under the influence

of the current, cations migrate to the cathode and anions to the anode. By placing positive and negative membranes arranged alternatively between the electrodes, permeable to anions and cations respectively, the mineral content of one water stream is increased while the other water stream is demineralised. This system, when properly operated, is capable of producing water with total dissolved solids below 500 parts per million, and therefore suitable for soft drink manufacture. It is, however, expensive to run, consuming large amounts of electricity when compared with chemical dosing water treatment methods, requiring frequent membrane replacement and rejecting 50 per cent of the incoming water in the high mineral content waste stream.

The Ionics demineralisers require sulphuric acid in the water treatment process. Difficulty has been experienced from time to time in obtaining supplies, and at the end of the expert's field work both Ionics demineralisers were shut down as sulphuric acid was unobtainable. Soft drinks were being produced with town water, which had been softened but not demineralised, and which was therefore not suitable for the purpose.

Tests were carried out at the beginning of the study, when sulphuric acid was available, to see if the Ionics demineralisers were functioning properly. The following figures show that neither demineraliser was reducing the total dissolved solids to a satisfactory degree.

Table 2.17 - Solids in Organisation Water

Total Solids	Mansoura		Crater	
	Before Treatment	After Treatment	Before Treatment	After Treatment
Parts Per Million	1,704	846	1,446	1,198
Percentage Reduction		50.4		17.3

Both demineralisers need replacement membranes, and the Organisation must at once pay its outstanding debts to Ionics Incorporated so that these replacements may be obtained and the plant kept in operation.

In both the Crater and Manscura plants, water for bottle washing is softened by base-exchange. Town water is passed through base-exchange resins where the calcium and magnesium ions are replaced by sodium ions, rendering the water soft. The resins require frequent regeneration with common salt, obtained locally, which removes the calcium and magnesium ions to waste, replacing them with sodium ions. The condition of the bottle washers at both plants suggests that neither softener is working satisfactorily, and that they need re-packing. No one interviewed at either plant could remember the sand and carbon filters being re-packed within the last five years. Whilst there was no evidence to show that any were not functioning properly, it is normal practice to repack them at regular yearly intervals. The sand filter removes suspended matter, and the carbon filter absorbs chlorine and other gases dissolved in the water, colour and taints. A breakdown of either can cause serious problems. If suspended matter enters the product, carbon dioxide foaming and gushing will result. A small amount of free chlorine will cause a distinct taste in the water making it unsuitable for soft drink manufacture.

At the ex-Green Spot plant, which is not now operating water for the product used to be treated by two Permutit Deminrolit MI units, where cations and anions are removed by ion exchange resins, producing a very pure water. In this system the ion exchange resins need frequent regeneration with hydrochloric acid and sodium hydroxide.

The water treatment at the ex-Pepsi-Cola plant, also out of commission, used very effective but costly distillation equipment, producing a water of exceptionally high quality for this application. The plant is now beyond repair or has been removed, however.

Water flows through the Crater and Manscura plants are shown diagrammatically in Appendices 2.14 and 2.15.

2.3.3 Other Process Plant

The significant items of process plant, in addition to the CO_2 generating plant and water treatment plant already described, are as follows:-

- boilers
- syrup mixing, filtering and storage
- water cooling plant and compressors
- carbonators.

The availability and condition of each of these types of plant at each of the Organisation's sites is detailed in the subsequent paragraphs.

- Boilers:- the primary purpose of boilers in soft drink bottling plants is to provide steam for water heating, particularly for the bottle washing machines. Each of the four original plants therefore had its own boiler for this purpose; the present situation is:-

  Manscura - one boiler of about 1,000 lbs/hr capacity in operation, the original boiler is out of commission and probably beyond repair, the second, transferred from Green Spot, is working satisfactorily.

  Crater - one boiler of about 1,500 lbs/hr capacity, transferred from Pepsi Cola, is in operation; the original Coca Cola boiler is out of use.

  Green Spot and Pepsi Cola - there are now no boilers at either of these plants.

- Syrup mixing, filtering, pasteurising and storage:- the schedule of syrup preparation and storage equipment at each plant is as follows:-

Mansoura - syrup preparation comprisae two 2,000 litre mixing tanks, with an inganious locally-designed sack hoist for loading sugar into them. The syrups are then pumped through a simple paper-element filter and, in the cese of some of the more sensitive, fruit basad syrups, through a small steam heated pasteuriser. Prapared syrups are then held for up to 24 hours in a cold room in one of three 2,000 litre storage vessels.

The Organisation had just received, in connection with its proposed new high-speed line, a Seitz Orion syrup filter with a capacity of 1,500 litras per hour. At present output rates this capacity is at leaet threa times greater than raquired from Mansoura production.

Creter - syrup is mixed in one of two 2,000 litre mixing vessels and is filtered; there are no fecilities for syrup pasteurising. Prepared syrups are held in one of three 2,000 litre storage vessals.

Green Spot - all syrup preparation and storaga aquipment has been removad, to supplement or replace that at the Mansoura plant

Pepsi Cola - only two small mixing tanks remain of the original syrup treatment plant; the remainder has baen transferred to Crater.

- Water cooling plent end compressors:- for effective carbonation of soft drinks it is essential that the feed weter is cooled, preferebly to betwean 36°F and 40°F. It is evident, therefore, that the capacity and performance of the cooling plant is particularly important in the Aden environment, where ambient temperaturas within the fectory vary betwean 100° and 115°F in the summer and where the incoming water temperature is oftan 90°F. The existing weter cooling systems in each plant are as follows:-

Mansoura - the original CEM 750 water cooler, with a capacity of about 400 imp gallons per hour, matched to the carbonator and filler, is still in good working order but the Freon refrigerating system is suspect. To achieve the required water temperature drop of about 50°F, the Freon compressor has to work almost continuously and, as a result, frequently overheats and shuts down.

Trials at different cooler settings instituted by the experts, were successful in reducing water temperature but gave rise to excessive product foaming and resultant variable fill, because of the improved carbonation. This problem, coupled with continuing compressor overheating difficulties, discouraged the experts from further efforts during the course of the study and it is considered that a full overhaul of the cooling and carbonation plant, and the replacement of the compressor, should be a priority task of the second project phase.

Crater - an old Hall Thermotank cooling plant is in use, consisting of two Sterne ammonia compressors, two immersed coil type water cooling tanks and one forced draught ammonia condenser. The capacity of each cooler is considered to be about 600 imp. gallons per hour. One of the compressors is on standby and one of the cooling tanks is currently out of action. Nevertheless the system is producing a satisfactory water temperature drop and has a substantial reserve of capacity, having been designed to provide cooled water for two lines instead of the present one.

Green Spot - a relatively new (1965) Mojonnier Model 660 A1 carbo cooler and syrup cooler, is installed but has been out of use since the plant closure. The capacity of this plant is understood to be 360 imp. gallons per hour, consistent with the output of the slow speed Green Spot line. The plant appears to be in excellent condition and in working order, except for the pump and compressor which have been transferred to the Mansoura site for other applications. It is considered that the capacity reserves of this plant should enable it to meet the Mansoura water cooling needs and the unit could

therefore be available as a substitute for the existing equipment at Mansoura or, with slight modification, for the larger plant at Crater.

Pepsi Cola - a Mojonnier Model 8.20 carbo cooler and syrup cooler is installed and is complete and in working order. The capacity of this much older plant, dating from 1956, is also estimated to be 360 imp. gallons per hour and this unit can also be considered, therefore, as a possible replacement for the equipment at Mansoura and Crater.

- Carbonator:- the carbonators are closely linked with the water cooling plant and, in the case of the Green Spot and Pepsi Cola Mojonnier equipment, are incorporated with water cooling on the same base; for these two plants, therefore, the comments above concerning water treatment also apply to the carbonators. The carbonators contain few moving parts and are subject to little wear, therefore they do not present a significant maintenance problem nor should they need replacement. The carbonators installed in the operating plants are as follows:-

Mansoura - a CEM Model 75 saturator is installed and is working satisfactorily in view of the high temperature of the water with which it is supplied. Most seals and other wearing parts on the pump for this saturator were replaced in 1973 but there is an outstanding requirement for replacement CO_2 pressure and water temperature gauges, as neither are functioning.

Crater - the operating line is equipped with a RIVI carbonator matched to the RIVI 40 head filler; a smaller and substantially different RIVI carbonator is still installed on the second line but is no longer serviceable.

2.3.4 Bottling Plant

The main items of bottling equipment in a typical franchisor's bottling line for returnable bottles are indicated schematically in the flow chart shown in Appendix 2.16. This chart also shows the normal material flows and the function of much of the process plant. The individual pieces of equipment in the National Bottling Organisation plants are discussed under the following headings:-

- bottle cleaner/washer
- filler and crowner
- in-bottle mixer
- inspection stations
- conveyors and handling equipment.

The availability and condition of each of these types of plant at each of the Organisation's sites are as follows:

Bottle Cleaners/Washers:- the bottle cleaner, in a plant using returnable bottles, is the bottler's main defence against the risk of infection, even epidemics, being spread by his product, quite apart from the more limited risk of poisoning. It is therefore essential that the bottle cleaners are cleaning and sterilising the bottles and, after cleaning, are rinsing off all traces of the cleaning agents which can otherwise mar the product taste. In addition the cleaner should handle the bottles smoothly, without damage and without jamming.

Mansoura:- The operating bottle cleaner at Mansoura is an Archie Ladewig 12 bottle wide unit rated at about 120 bpm. The machine is in poor physical condition, much of the casing being heavily corroded and the working parts encrusted with scale. Although the machine dates from 1961, there is evidence that the deterioration is recent, resulting perhaps from the Organisation's decision to purchase a replacement line late in 1973. Drive motors and pumps are in need of overhaul and many of the spray jets should be replaced. Nevertheless the fundamental mechanical parts such as the main drive gears are in good condition and well greased.

In addition the Organisation has a second, identical Ladewig washer at Mansoura which was damaged in shipment and has never been used. Although this spare machine has been neglected and allowed to deteriorate in the open air, it is still available as a source of major spares such as the bottle conveyor chains.

Replacement parts to a value of 500 dinars were purchased and installed on the operating washer during 1973; it is considered that a major overhaul of the washer is now due and that further significant expenditure on spares will be needed in the near future.

Crater:- A Meyer BL42 bottle cleaner dating from 1960 is installed on the Crater line. This is a 20 bottle wide machine and has a capacity of up to 200 bpm. In practice the line is not at present run at more than 120 bpm because of supposed filler limitations and the Organisation adopts the extravagant policy of only using 16 of the available 20 feed pockets. The cleaner is in good condition and appears to be well maintained. There are minor running problems, mainly arising from the range of bottle sizes handled, but these can be readily overcome with the help of replacement parts. An order for replacement parts was prepared at the end of 1973 but was not proceeded with because of the advent of the proposed new line.

Green Spot:- The washer, a Miller Hydro 80 bpm unit dating from 1958, is in a corroded condition and has not operated since the line closure. Nevertheless it is considered that the machine could be brought back into operation after extensive overhaul. The necessary spare parts are obtainable and the supplier has confirmed that such a policy would be significantly less expensive than purchase of a new machine.

Pepsi Cola:- The washer is an Archie Ladewig unit similar to those at Mansoura and is therefore available as a further source of spares for the machine which is operating. This unit dates from 1960, is very well worn and is therefore not considered to merit renovation, nevertheless it should provide a useful source of replacement parts for items which do not wear significantly during normal use.

Fillers and Crowners:- The filler is the focal point of a bottling line at which syrup, water, CO_2, bottles and closures are brought together. Its performance therefore dictates the speed and efficiency of the production operation. The nature and condition of filling equipment at each of the sites is as follows:-

Mansoura:- Production depends upon a Crown CEM 4-20 filler installed in 1961. This unit, with 4 syruping heads, 20 carbonated water heads and 4 crowning stations, has a nominal output of up to 120 bpm on 7 oz. bottle. In practice the machine was normally run at between 95 bpm, on 10 oz. bottles and 110 bpm. on 7 oz. bottles. Above these speeds bottle handling deteriorated resulting in frequent jams and mislocated bottles. Relatively minor adjustments and modifications to the bottle guides and holders should enable speeds to approach the nominal levels.

The filler is in relatively good condition, a complete replacement set of the main wearing parts having been fitted in 1973. The minor running problems of sticking valves and variable fill levels which are encounted are dependant on the quality of maintenance and setting, not on the age of the machine. In particular, fill level variation is mainly due to excessive fobbing which in turn results from the relatively high temperature of both the carbonated water and the bottles. Improvements to the water cooling plant and to the washer final rinsing should help to alleviate this problem. It is considered that the filler itself has many years of useful life ahead, given adequate maintenance and provision of spare parts.

Crater:- The operating filler is a Rigamonti and Villa (RIVI) Monobloc 8-40/8 unit installed in 1960. The nominal output of the 40 head unit is at least 180 bpm, but it is at present confined to speeds of about 120 bpm. The management argue that the useful life of the filler will be extended by this de-rating.

Mixers:- For filling machines having separate syrup and water filling, it is desireble to incorporate a bottle agitetor or inverter to ensure adequate mixing of the syrup and carbonated water before the product leaves the factory. The need for such plant is debatable, especially in the developing country situation, and only two of the four original franchisors appear to have used them. The present location and condition of mixers in the Organisation's plants is as follows:-

Mansoura:- A Potter and Rayfield Model 160 bottle inverter is installed in the line and is both necessary and effective for the colas, in which insufficient mixing is clearly visible. The unit is in good condition and necessary replacement wearing parts were fitted in 1973.

Crater:- No mixer is included in the Crater line and instead a hand operated crate inverter is used. The complete crate of filled bottles is rotated by hand about its horizontal axis, with the aid of a section of conveyor which can be rotated and has a top panel which clamps over the crate. This device produces some superficial mixing but is considered to be inadequate; for this reason the crate loaders on the Crater line are in the habit of inverting each bottle once or twice in the course of their crate loading operation.

Green Spot:- No mixer was installed in the Green Spot line, presumably because the tonics and other mixer drinks bottled there were not considered to need mixing.

Pepsi Cola:- A CEM Model A Mixer was incorporated in the Pepsi Cola line and appears to be in working order. It has not operated since the line closure in 1972 and its throughput is limited to about 120 bpm maximum. Nevertheless it is a serviceable piece of equipment and could easily be transferred to any other production line, for example the Mansoura line, for which its output is sufficient.

Inspection Stations: On most slow speed bottling lines, visual inspection stations are installed after the bottle cleaner and after the filling, closing and mixing operations. The units usually consist of a simple back-illuminated ground glass screen mounted alongside the conveyor. The bottles pass in front of the screen, and the back lighting should assist in the detection of foreign matter in either a cleaned or a filled bottle. Similar inspection stations were installed on all lines and are in use on the operation lines at Mansoura and Crater.

The effectiveness of these inspection stations depends more on the calibre and supervision of the inspectors than on the condition of the equipment. Nevertheless, the Organisation's policy of removing some of the light sources, to reduce operator eye strain, is counter to the purpose of such inspection stations. The alternatives of abandoning supposed 100% inspection, or of increasing its effectiveness are discussed under the appropriate heading in section 4.

Conveyors and Handling Equipment:- All the Organisation's four plants were originally equipped with powered slat chain bottle conveyors running from the bottle cleaners, via the fillers and other equipment, to the crate loading plant. In addition, unpowered roller conveyors are normally used to convey empty crates from the bottle cleaner infeed to the crate loading point, and filled crates from the loading point to the palletising area.

The two operating lines at Mansoura and Crater are both satisfactorily equipped with bottle and crate conveyors at present, but this has been achieved at the expense of the conveyors at the other plants and of the second Crater line. Most of the slat chains and drive gear have now been removed from the latter.

2.3.5 Vehicles and Mobile Equipment

Delivery Vehicles:- The Organisation currently poeessee 16 serviceeble delivery vehicles, compared with a total fleet of 32 vehicles at the time of nationalisation. This subetantial reduction reflects the economies in delivery routee which were possible as a result of the integration of distribution from the four factories.

Of the present fleet, 12 vehicles are used for deliveries within the First Governorate, and the remaining 4 for trenshipment between the Mansoura end Crater sites. Distribution to customers and collection of empties is centred at the Mansoura site, and the trenshipment operations consists of a shuttle eervice of 4 - 6 return journeys per day, taking pallets of sorted empty bottles from Mansoure to Creter and bringing beck pellete of filled bottles.

It is understood that many of the Organisation's delivery vehicles are reaching the end of their useful life, and the potential of replecement parts from the non-serviceable vehicles has been largely used up. Thus it is considered that the Orgenisation will shortly be faced with the need to replace at leeat a quarter of its delivery vehicle fleet.

Fork Lift Trucks:- Fork lift trucks are used at both the Mansoura and Creter sites for the movement of pallet loede of creted empty and filled bottles. All the trucks ere diesel or petrol engined, with e consequent problem of exhaust fumes in enclosed storage and handling ereas. The present truck fleets consist of three units at Mansoure end two et Creter, at least two of theee are normally out of service undergoing repeirs et eny one time, and there are no other unserviceeble trucks eveileble as sources of replecment parts. The Organisation has therefore budgeted for the purchese of two replecement fork lift trucks in the year 1974-75.

2.4 Property

2.4.1 Locations

The National Bottling Organisation has a total of seven sites in the Aden area, of which six house production plant, the seventh is a sales outlet in Sheikh Othman. Of the six production sites, only those at Mansoure and Crater, the old Canada Dry and Coca Cola sites respectively, are currently producing soft drinks. The old Green Spot and Pepsi Cola sites, in Mansoure and Maala, are closed and employ only caretakers and watchman.

The two remaining production sites, at Sira and Burieka, house small ice and CO_2 making plants; they have no connection with the bottling factories, except for the provision of CO_2 from Sira, and offer no scope for bottling operations. These two sites are not considered further in this report, as they are entirely disconnected from the problems of bottling plant integration.

The locations of the two operating and two closed bottling plants are indicated on the map of Aden shown as Appendix 2.17. This map shows that all four sites are well positioned for distribution both on the Aden peninsular and to the mainland, with the location of the Maneoura and Maala sites at either end of the causeway being especially advantageous. The Organisation's present headquarters, at the Mansoura Canada Dry plant, are only about 400m from the Green Spot site, giving a possibility of joint working and shared supervision in the future. The Crater site is particularly convenient as a distribution point for Crater town; in practice it is not used for this purpose at present.

2.4.2 Sites

The Organisation's four sites which house bottling plants are shown in Appendices 2.18 - 2.22, they are considered here in the light of their scope for future development and expansion:-

Mansoura (Canada Dry):- The site plan, and a more detailed layout of the main factory building, are shown in Appendices 2.18 and 19. It is evident from these plants that the site has considerable potential for further development; there is scope for at least doubling the present building area. The site is flat and it is understood that the provision of services is adequate to meet any probable future demands. Vehicle access to the site and marshalling area on the site are good thus facilitating its use as the Organisation's distribution centre.

Crater (ex Coca Cola):- The site is 1½ miles from the centre of Crater town in a largely residential area. The surrounding space is entirely built up, with blocks of flats, on either side of the factory, and backs against a cliff side. The site layout is shown in Appendix 2.20 and demonstrates that the existing buildings occupy almost all the available area, giving no scope for expansion. Vehicle access is restricted to a narrow roadway running along the side of the factory, and one small gateway; the site is therefore ill equipped for a distribution role despite its convenient location.

Green Spot:- The site and factory building plan are shown in Appendix 2.21. The site is divided into two clearly demarcated areas, the factory itself being on a relatively restricted space with limited vehicle access and marshalling but there is a large separate open area at the rear available for storage and perhaps for further building. This latter area is separated from the factory site by stores and outbuildings, and has its own separate access from a road at the rear which leads directly to the Canada Dry site. It is thus evident that the Green Spot site has considerable potential for development.

Pepsi Cola:- The site and the factory building which occupies most of it are shown schematically in Appendix 2.22. The factory is one of a row of small units built on a narrow strip of flat land between the main road and the mountainside. For this reason the yard space and vehicle access are severely restricted, and there is no scope for further building.

2.4.3 Buildings

As all property in the PDRY is nationalised, the factory buildings and the sites are the property of the state and are leased to the National Bottling Organisation. The current cost of these leases for all the Organisation sites is understood to total about 5,000 dinars per year and is therefore a small element of total overheads. The buildings at each of the four bottling plants are shown in Appendices 2.19 and 2.22 and their construction and state of repair is discussed in the following paragraph. It should be mentioned that in all the buildings there are small office areas, not shown in the plans, at first floor or mezzanine level. At the Mansoura plant there are some offices and service flats, and provision for building more, at a second floor level.

All of the factories are of steel frame construction with concrete and brick cladding; the roofs are mostly of corrugated asbestos. The buildings were all erected in the late fifties and all, while structurally sound, are in a poor state of repair.

The abandoned Green Spot and Pepsi Cola factories are naturally in a poor state with much superficial deterioration - windows shattered, walls and floors damaged, pipework hanging loose and disconnected.

The operating factories at Mansoura and Crater are also in poor condition and, being food factories, are in urgent need of repair and redecoration. Floors are broken up and irregular and are in a dirty and dangerous condition. Walls are cracked and dirty and the tiled areas in the bottling halls are in need of re-tiling. Many windows are broken, allowing free ingress of sand and dirt. All of these defects are relatively easily and inexpensively cured, once the staff are persuaded of the importance of a high standard of building repair and decoration as an aid to achieving the levels of hygiene so essential in a food factory.

2.4.4 Production Areas

The state of repair and decoration of the fabric of the building is especially important in the production areas - the syrup preparation and storage rooms and the bottling halls - because the dilute syrup solutions which can accumulate in these areas are in excellent medium for bacteria growth, with resultant risks of infection and contamination. Both of the present production areas are in urgent need of repair and redecoration to facilitate keeping them clean.

The production areas at all four plants have been laid out in broadly the same way, as evidenced by the layouts shown in Appendices 2.19 - 2.22. These layouts follow traditional practice and cannot be faulted from the standpoint of production flow. They have a limitation, however, at the high ambient temperatures normal in Aden. The absence of air conditioning in the production area, coupled with the heat source represented by the washer, make the achievement of the low bottling temperatures, necessary for good carbonation, almost impossible. Layout and structural changes which facilitate the achievement of lower ambient temperatures in the production area could assist in the achievement of improved product quality.

2.4.5 Storage and Load Marshalling Areas

It is evident from the building plans, shown in Appendices 2.19 - 2.22, that large areas have been allocated in all the factories for storage and marshalling of empty and filled bottles. In addition to the warehouses in current use at Mansoura and Crater, there are large reserves of space on the Mansoura site and at Green Spot and Pepsi Cola which are used for storage of empty bottles and damaged crates.

The operating warehouses at Mansoura and Crater are in a dirty, dilapidated condition but represent a smaller risk than that already observed in the production areas. The adequacy of the storage and marshalling space within the warehouses is in contrast to the limited vehicle manoeuvring space, particularly at Crater.

Increase in throughput at a particular factory need not necessitate expanded production area because it can often be achieved by high speed plant which occupies little more space. By contrast, any increase in throughput will necessitate increases in storage space. It is therefore essential that any site chosen for an expansion of production should have space available for warehouse extension; such extension would only be possible at the two Mansoura sites.

2.4.6 Office Accommodation

All of the four original bottling plants had adequate office space to meet their own requirements; in most cases these were on a first floor or mezzanine level over the production areas. The combining of almost all administrative functions at the Mansoura (Canada Dry) site has led to pressure on office space there, with corresponding availability of space at the other three sites. There is, however, potential for providing extra office space at the Mansoura site because the building has been designed to allow the construction of a second floor of offices over the present ones.

2.5 Other Resources

2.5.1 Workforce

The Organisation has a large and, in some areas, under utilised labour force, totalling about 170 people. The total number of employees, including management and sales staff amounted to 256 people in September 1974. Of these, 226 were employed in the bottling factories and the remaining 30 at the ice works. The detailed breakdown of labour allocation is shown in Appendix 2.23.

The allocation of work at the bottling plants is indicative of the poor utilisation of labour in the present operations. This effect is more noticeable at the Mansoura plant, as evident from the following summary table:

Table 2.18 - Allocation of Bottling Labour Force

	Mansoura	Crater	Total
Management	31	3	34
Sales	49	-	49
Direct Labour:-			
Skilled Operatives	9	10	19
Unskilled	30	17	47
Indirect Labour:-			
Skilled	23	5	28
Unskilled	21	4	25
TOTALS	163	39	202

Source: National Bottling Organisation

Some of the discrepancies between Mansoura and Crater manning levels are explicable in terms of differences in method of operation, as follows:-

- All management and selling activities are now centred at Mansoura, with only residual production supervision at Crater.

- The warehouse and distribution activities at Mansoura serve both operating factories and work two shifts for this purpose. Thus, additional direct and indirect unskilled labour is needed at Mansoura

- Both vehicle maintenance and crate repeirs, employing mechanics and carpenters respectively, are based at Mansoura and largely account for the extra indirect skilled personnel there.

Nevertheless it is considered, both by the experts and by the Organisation's management, that staff levels at Mansoura are disproportionately high. This conclusion is reinforced if we take account of a further 15 employees at Mansoura, who are currently on semi-permanent leave, increasing the Mansoura totel to 178.

The main reason for this overstaffing is the previously higher levels of employment - nearly 400 when the Organisation was four separate companies - and management's reluctence to ley off steff. The reduction in staffing levels has been achieved almost entirely by natural wastage and retirements. It can be confidently predicted that there is scope for a further reduction of up to 20% in the labour force at Mansoura, without any changes in method or equipment. Thus any labour saving advantages obtainable from new, higher speed plant, are achieveable at once, if the Organisation wishes, by a policy of employing only the numbers necessary to perform the work.

2.5.2 Management

The Organisation is fortunate to have retained some, at least, of the original management from the previous companies. These staff have conserved, firstly a technical knowledge of bottling plants and, secondly, a knowledge of the financial control systems necessary and how to operate them. Thus in the field of accounting and, to a lesser extent, of engineering and maintenance, the management has been able to keep the Organisation in production and marginally viable.

In almost all other fields of Management, the Organisation is noticeably weak and unsure of its objectives. This uncertainty arises particularly in those areas, such as production supervision, where the supervisory role can be considered as conflicting with democratisation of industry. The role of the worker's committee is understood to be crucial in this regard, and until some reasonable formula can be agreed by them for the nature and powers of a supervisory management position, the Organisation will remain difficult to run. At present production and personnel management are unsure of their authority and responsibility and, as a result, avoid decisions or actions which might be unpopular. Whereas financial control of the Organisation is excellent, control of personnel seems unacceptable and therefore virtually non-existent.

The quality control function has declined, it is understood, largely because of labour objections. Attempts to recruit a new quality controller at Mansoura were recently thwarted by the refusal of the workers' representatives to allow payment of more than the minimum labourers' wage rate for the task. This hostility of the labour force towards the quality control function must be overcome before any real progress can be made in the improvement of product quality.

The sales management role seems to be effective and to achieve rapid and widespread distribution of the products that are available. The product demand, as evidenced by the Organisation's ability to sell everything it can produce, changes the sales manager's role from that of salesman to, in effect, that of distribution manager.

It is evident that, in the Organisation's rapidly changing situation, it would be desirable to have general management and a management board with long standing experience of the industry. Such experienced management is not available in sufficient numbers, however, and a perhaps excessive load is therefore placed on the new young managers who are running the Organisation. In these circumstances it is very necessary that the management team be strengthened, both in terms of numbers of trained senior staff, and by training both in management skills and in the specific problems of the bottling industry.

2.5.3 Water - Quality

Water is the major ingredient of soft drinks, comprising about 85 per cent of ready-to-drink beverages. Water used in soft drink manufacture must be able to meet certain quality standards, and be available in sufficient quantity.

The in-coming town water supply must be potable from the chemical and bacteriological points of view. For soft drink manufacture town water is rarely good enough for direct use, and in-plant water treatment is almost always necessary to improve the quality. After treatment the water used must be clear, colourless, odourless, tasteless, free from organic matter and suspended matter, virtually free from manganese and iron (not more than 0.1 part per million of each element), and low in alkalinity. Total dissolved solids should not exceed 500 parts per million. Higher figures than these are likely to affect the taste, may cause an odour and can discolour the final product. The presence of organic matter will cause unnecessary foaming at the filler and may make the water a suitable medium for the growth of micro-organisms. Suspended matter particles will provide nuclei for the release of carbon dioxide, impairing the efficiency of carbonation, and causing gushing when opening the bottle. Alkaline water will neutralise some of the acid contents of the product, impairing its flavour and affecting its keeping quality.

Both the Crater and Mansoura plants obtain their water supply from the Public Water Corporation, as did the Green Spot and Pepsi-Cola plants which are not longer operating. The in-coming water is hard and very high in total dissolved solids, high in chlorides and sulphates. Samples for chemical analysis were taken at Crater on 26th July and at Crater and Mansoura on 18th September 1974. The results are set out in Appendix 2.24. Samples for bacteriological analysis were taken in sterile sample bottles on 26th July 1974 at Mansoura and at both plants on 24th August 1974. Results of the bacteriological

examination are also shown in Appendix 2.24. All analyses were carried out in London, and the high bacterial counts found were almost certainly due to the unavoidable delay of 4 days between sampling and carrying out the bacteriological examinations. Bacteria of the Coliform group were absent in all samples, and the water was therefore fit for drinking.

The Aden town water is not suitable for use for soft drink manufacture or for bottle washing without prior treatment. The product water must be treated to reduce total dissolved solids to below 500 parts per million with corresponding reductions in sulphate and chloride contents. Water for bottle washing must be softened before use to prevent deposition of lime inside pipes and in the bottle washers. If replacement membranes and sulphuric acid are obtained for the Ionics demineralisers product water of suitable quality could quickly be available once more.

2.5.4 Water - Availability

Most of the water supplied by the Public Water Corporation to the Crater and Mansoura plants comes from boreholes at Bir Nasir about 60 kilometres north of Aden. It is conducted to Aden in asbestos pipes, where it is held in storage reservoirs.

It was impossible to obtain accurate water usage figures for either plant due to gallonage records which were obviously taken from faulty water meters. For example the Mansoura plant was charged for 3,195,900 gallons for the period December 1973 to May 1974. The Crater plant, with a slightly higher output of soft drinks, was charged for 225,100 gallons for the period January to June 1974. Water consumption for the April to June 1974 quarter for both plants was 1,105,800 gallons, according to the Public Water Corporation's meter readings. This figure was obtained after complaints had been made about previous readings, resulting in at least one meter being replaced. The current consumption figures are thought to represent a reasonable figure.

An adequate supply of water is available to serve both the Crater and Mansoura plant needs for the foreseeable future; sufficient water is available at Mansoura to meet a doubling of production there. However, it is understood that the drainage system at Mansoura is already overloaded, and is likely to be so for some time to come until major new drainage works are commissioned. The experts' proposals for water treatment, given later in this report, would reduce the level of effluent from the water treatment plant by about 50 per cent.

2.5.5 Other Services

The primary service requirement, in addition to water supply and drainage, is electrical power supply. The Organisation's current monthly consumption is about 24,000 KwH, split evenly between the Mansoura and Crater plants. It is understood that there is no significant restriction on the power supply available to the sites, either at 440 volts or at 240 volts, as both were equipped to handle much greater throughputs than are achieved at present.

The main restraint on electricity consumption is its rapidly escalating cost in Aden. All of the electricity cost rates were substantially increased in July 1974; the net effect on the Organisation's electricity bill is an increase of 200%, from about 200 dinars to about 600 dinars per month. Fortunately this electricity cost remains a relatively small proportion of the total overheads, but it is nevertheless an incentive to power conservation and to preferring machinery with low power consumption in any re-equipment programme.

The other services used by the Organisation - telephone and cable services, laundry services for employees' working clothes, public transport services - are all considered to be adequate.

2.6 Aspirations

2.6.1 General Objectives

The Management of the National Bottling Organisation, like that of any other undertaking, are keen to expand and modernise their facilities and to increase their sales. It is for these reasons that they have supported the Ministry of Industry in its requests for the present studies, and when the commencement of the study was delayed, began their own programme of plant replacement. In this latter policy they found themselves at variance with the Ministry both in terms of the specific capital expenditure programmes which they proposed and in terms of the objectives of the Organisation in the National context.

The following paragraphs detail our understanding of the Organisation's current objectives and plans in advance of the present report.

2.6.2 Plant Integration

Both the Organisation and the Ministry have been anxious to achieve an increasing integration of the original four bottling operations, in terms of their administration and of the physical achievement of production.

The integration of the managements and systems is already achieved, though there is scope for refinement of the management structure. Physical integration has been achieved to the extent that there are now only two plants operating, in place of the original four; this reduction is consistent with the drop in total production which has occurred over the past ten years and has not, therefore, required any change in the productive capacity of the plants.

The Organisation had intended that a total physical integration would be achieved by the provision of a new high speed line at the Mansoura site which would replace all the existing lines. As discussed in the next section, this option is no longer open and instead it had been hoped that existing equipment could be renovated and then be concentrated at Mansoura. Specifically, Management and Ministry representatives have advocated that the operating line at Crater should be overhauled and then be reinstalled on the Mansoura site either in a new building or, if practicable, within the existing production areas. This scheme would allow the closure of the Crater site, with some resulting labour and administration economies, and would eliminate the present transhipment between Mansoura and Crater. The merits of this possibility are considered further in Section 4.1.2.

2.6.3 Replacement Bottling Line

In January 1974 the National Organisation confirmed an order for a 300 bpm soft drink line, with most of the necessary ancillary equipment. This plant would have had more than sufficient capacity to replace both of the present operating lines. Because of price escalation and other difficulties, this contract was terminated in September 1974; the experts were involved, with the Organisation and with the Ministry of Industry, in the discussions leading to this decision. It can now be assumed that the existing equipment will be kept in service, by maintenance and overhaul, for as long as possible, and that replacement plant will not be purchased where this can be avoided.

2.6.4 Existing Plant at the Green Spot Site

For some years the Management have been reviewing the possibility of renovating the ex-Green Spot equipment installed at the Green Spot Mansoura site and installing it in a new bottling factory in Mukallah. This plant is for the most part capable of being overhauled and brought back into service, as indicated in Section 2.3, unlike most of the equipment at the ex-Pepsi Cola factory.

It therefore remains an objective of Manegement that, when the selee potential in the Mukalleh and Hadrammut areas is considered sufficient, the ex-Green Spot line would be reestablished there and thus would eliminate the heavy transport cost penalties at preeent incurred in distributing soft drinks from Aden.

2.6.5 CO_2 Plant

It is evidently desirable that the CO_2 manufacturing plant et Mansoura be brought back into operation. The Management have been trying for some years to achieve this, using both the Organisation's technical staff and those of the BP refinery; they have tried, but failed, to negotiate terms on which the manufacturer's technical staff would visit Aden to advise them.

It is now hoped that, with the aid of the initiative given to this matter by the experts' involvement both with the manufacturer and with BP, it will be possible to achieve the plant overhaul within the next year and therefore to ensure relieble, long-term supplies of CO_2 to the PDRY economy.

2.6.6 Crown Plant

The Organisation has received a complete crown-making plant as a gift from the Hungerian people. This plent is still in its shipping ceees aweiting the errivel of Hungarian engineers to erect it, and the letter are, in their turn, awaiting confirmation that the Organisation has obteined the necessary raw materials - tinplate and cork wads.

The Management have been endeavouring, with little succees, to obtain supplies of tinplate and wade but have now located a possible eource in Spain. They therefore hope to have the raw materials in the near future and to then have the plant commissioned. By this means the Organisation should soon be able to eliminate its 15,000 dinars per year bill for imported crowns, though no costs are yet known for the crowns which they will be manufacturing.

The plant does not include equipment for producing the alternative compound lined crowns, nor can the Hungarians provide this; this a considerable drawback in view of the scarcity of cork wadding materials.

2.6.7 Diversifications

The Organisation and the Ministry of Industry have toyed for some years with the concept of establishing a brewery and beer bottling operation in the PDRY. For this reason, the original specification of the high speed line required that it be capable of being easily switched to beer bottling; this requirement was withdrawn after suppliers had explained the difficulties. The Organisation already possesses a 100 bpm pasteuriser suitable for bottled beer. This pasteuriser was delivered in 1965 but was never unpacked and is still in its original cases on the Green Spot site.

It is understood that the Government has now requested a UN study of the feasibility of establishing a brewery in the Yemen. This study would take many months to accomplish and so a decision on the brewery issue may not be available for some years. Nevertheless, it is considered that any development plans for the Mansoura sites should take into account the possibility of such a development in due course.

The Organisation has also considered diversification into soft drink concentrates which are uncarbonated and diluted with water by the user. Such products could be filled on the existing plant once the requisite bottle change parts were obtained. Projects for making soft drinks from local fruits such as dates (see section 4.2) have also been discussed with the experts, as have the prospects of establishing a distillery based on alcohol from date sugar.

3. The Future Market for Soft Drinks

We have analysed the past and present market for soft drinks in the PDRY in section 2.2. From that basis we can identify the factors which are likely to influence demand and forecast future sales under a number of various assumed circumstances.

3.1 Factors Affecting Demand

Past demand for soft drinks can be catagorised into two sectors:-

- domestic consumption, which includes Yemeni nationals and non-Yemens living in the Republic

- exports, which include sales to shipping passing through Aden and to local Arabian and African territories.

We propose to discuss a number of factors which are likely to influence the home and export demand for soft drinks. These are:-

Domestic Consumption

1. Changes in the amount of money available to consumers for spending on soft drinks. We have used gross national product per capital as an indicator.

2. Growth in population.

3. Drinking habits, taking account of local customs and the availability of alternative beverages.

4. Geographical area over which soft drinks are distributed.

5. The extent to which "dynamic" elements, such as brand competition, advertising and promotion, are present in the market.

6. Pricing policy.

7. The size and nature of the non-Yemeni communities in the Republic. Because sales to non-Yemenis can be regarded as a means of obtaining foreign currency, this factor is dealt with under export sales.

Export Sales

8. Sales to shipping and to the passengers in transit by way of the Republic, particularly to the changing Suez Canal traffic.

9. Sales to nearby Arabian and African territories, particularly to North Yemen, Somalia and Djibouti.

3.1.1 The Relationship of GNP per Capita and Domestic Consumption

It has been found in a number of other countries that consumption of soft drinks bears a fairly consistent relationship to movement of gross national product per capita. The relationship between consumption and GNP per capita is shown graphically in Appendix 3.1. This graph shows that consumption of soft drinks tends to rise steeply with an increase in GNP per head before reaching a saturation level when income per capita is high. We have plotted the soft drink consumption figures for 6 OECD countries (Portugal, Spain, Italy, Britain, France and America) against GNP per capita over the period 1958 - 1968. In order to verify whether or not a similar relationship existed in Arab countries, with climates, customs and beverage preferences which might differ widely from those of the OECD countries, we have also plotted the 1972/73 consumption of soft drinks in five relevant Arab countries. We compare estimated consumption and GNP per capita figures for the Peoples Democratic Republic of Yemen with those for the Arab Republic of Yemen, Saudi Arabia, Lebanon and Kuwait as in the following table:-

Table 3.1 - Estimated 1972/73 Consumption of Soft Drinks and 1968/69 GNP per Capita for 5 Selected Arab Countries

Country	Population ('000)	Total Soft Drink Sales (1972)	Consumption (litres per head)	GNP per Capita £1968/69
Yemen Arab Republic	5,750	0.9 million cases	0.9	30
PDR Yemen	1,400	0.6 million cases	2.6	50(est)
Saudi Arabia	6,500	7 million cases	6.5	150
Lebanon	3,000	8 million cases	16.0	230
Kuwait	775	14 million cases	108.4	1,590

Source: Middle East Association London (Population and GNP per Capita)
P-E Estimate (Soft Drink Sales and PDR GNP per Capita)

We believe that consumption of soft drinks is likely to follow a similar pattern in Arab countries to its development in the other countries we have studied. It may well be that, because of the hotter climate and fewer alternative beverages (e.g. milk or wine etc) in the Middle East, the potential rate of growth in Arab countries may be even more rapid than in OECD countries.

The circumstances of the PDRY economy differ from those ruling in the other OECD and Arab countries in that the economy is centrally planned and that priority is devoted to industrial development rather than to consumer spending. For these reasons, it was emphasised to us during our study that change in GNP per capita was a less reliable indicator in the Republic than in other countries cited. We were unable, in discussions with the Central Planning Commission and with other government officials, to obtain an assessment of past, present or future movements in Gross National Product. We have therefore made an approximate estimate of the GNP per capita based on past data (see Table 3.1 above). This estimate can be verified and corrected if necessary when data becomes available. We have assumed in our forecast in section 3.2 that, within the period of the Quinquinnial Plan, increases in GNP per capita will be directed towards the internal funding of industrial development projects. We have thus assumed that there will be no significant increase in the amount of consumer purchasing power available for soft drinks before 1978/79. If this assumption is not correct, the effect on domestic consumption can be recalculated

by projecting future demand against future GNP from historic relationships of GNP and soft drinks consumption. We should be pleased to make this recalculation if required.

3.1.2 Growth of Population

The effect of population growth is allowed for, in the indicator discussed above. Provided that national GNP (or that part of it which is available for private consumption) increases as fast as population, there will be no decline in GNP capita with increasing population. We have assumed that this will be the case, and that GNP per capita will remain at least constant over the period of the Quinquinnial Plan. This means, for purposes of our forecast, that demand for soft drinks will increase proportionately to population growth. The population census of 1973 and the projections of future growth are given below:-

Table 3.2 - Total Population 1973 and Foracast Growth to 1979

Year	Total	Estimated Population, '000	% Growth Per Annum
1973		1,590	-
1974		1,632	2.6
1975		1,677	2.8
1976		1,723	2.7
1977		1,767	2.7
1978		1,817	2.7
1979		1,856	2.7

Source: Quinquinnial Plan and May 1973 Census

3.1.3 Drinking Habits Including Local Customs and Availability of Alternative Beverages

If our estimate of GNP per capita in Table 3.1 ie approximately correct, it would seem from Appendix 3.1 that consumption of soft drinks in the PDRY is comparatively higher (related to GNP per capita) than in most other countries illustrated. We have also shown (Section 2.2.1 c) that the proportion of Cola flavour soft drinks is comparatively higher. We have estimated that 95% of soft drinks are consumed in Aden and the First, Second and Third governorates. These figures can be partly attributed to the Yemeni custom of eating qat and of preferring Cola type drinks with this. We do not envisage any significant change in this custom and the preferences associated with it.

Demand for soft drinks can be significantly affected by the availability of other beverages. For example, in Appendix 3.1 the comparatively low consumption of soft drinks in France is associated with the very high consumption of wines in that country. The main alternative beverages we have considered are beer and squashes (i.e. fruit flavoured concentrates for dilution with water). The import figures for these products are illustrated in Appendix 3.2. While we cannot tell what proportion of these alternative beverages reached domestic consumers, it seems probable:

(a) that beer consumption has remained steady and may be increasing slightly (assuming that 1972 was exceptional)

(b) that consumption of squashes has been severely curtailed by restricting imports.

For purposes of our forecast we have assumed that the imports of alternative beverages will continue to be limited with the object of containing the total growth of imports within the limits indicated in the Quinquinnial plan. We have assumed that the potential project to produce and/or bottle beer locally will not

have any significant effect on domestic beer consumption before 1978/79. The effect of squash consumption is more immediately relevant to demand for aerated soft drinks. In Britain, for example, consumption of soft drinks has been restrained by the very high consumption of diluted squashes. In 1973 British consumption (comparing squashes in their ready to drink form, i.e. with the addition of 4 parts of water to one of concentrate) was:-

Aerated Soft Drinks	348 million gallons	- 44%
Squashes	450 million gallons	- 56%
Total	798 million gallons	100%

The British habit of drinking squashes in exceptional and is reproduced in few other countries. Nevertheless the National Organisation believes that discontinuing the import of concentrates resulted in an increased demand for aerated soft drinks in 1973/74. We would agree that - if concentrates are not available in Aden, where they can be mixed with potable water - some part of that demand (probably less than 30%) will be transferred to aerated soft drinks. Assuming that imports of concentrates are allowed to take place with reasonable limits - possibly up to a level of 40,000 litres of concentrates annually - we do not believe that this would affect demand for aerated soft drinks by more than 10,000 cases (-1½%) annually. It is possible that, since the National Organisation already import concentrates and sweetening they could themselves undertake the production, bottling and sale of such a limited quantity of "squash" concentrates for the domestic market.

3.1.4 Geographical Area over which Soft Drinks are Distributed

We analysed the geographical distribution of past and present soft drink sales against the existing population in section 2.2.1. Two thirds of all sales are made in Aden to 18% of the population. By purchasing new delivery lorries for Dhala and Lahaj to take advantage of the improved roads to these areas, the National Organisation has improved its sales to the Second Governorate.

We believe that further scope exists to expand sales in the Third, Fourth and Fifth Governorates where present consumption, we calculate, is respectively only 6.7, 1.2 and 0.2 bottles per head, per annum. By comparison, sales in the First and Second Governorates are equivalent to 35.9 and 11.0 bottles per head, per annum. We consider that priority should be given to improving distribution in the Third Governorate and, when the Mukalla and Seiyun roads are completed, in the Mukalla and Hadhramaut areas of the Fifth Governorate. Despite increased discounts to the co-operative in Zinzibar, national sales in the Third Governorate are said to be running at a level of less than one third the level achieved previously by Canada Dry alone. Similarly, trials have been carried out to increase sales in Mukalla, but since the selling price was set at double the Aden price in order to offset the increased costs of hired transport, the result proved uneconomic. We recommend that further studies should be carried out to assess the viability of direct delivery from Aden to major outlets in the Third and Fifth Governorates. In our forecast we have assumed that, by 1978/79, present sales to the Second, Third, Fourth and Fifth Governorates can be increased by 50%.

3.1.5 "Dynamic" Elements in the Soft Drinks Market

Prior to nationalisation of the soft drinks industry, three private bottlers were competing with each other to increase their shares of the market in the Republic. This competition, while wasteful in some respects, is generally thought to have some effect in creating preferences for soft drinks in place of other consumer products and thus increasing the size of the total market for soft drinks. This effect is created by such factors as:-

- offering a range of choice of different brands and flavours

- promoting soft drinks and specific brands by advertising or consumer sampling

- encouraging retailers to sell soft drinks by providing refrigerators and displays, high retail margins and dealer incentives

- encouraging the bottlers own sales staff to sell more cases by salary increases or commission payment

- seeking new sales outlets.

The current policy of the National Organisation is to phase out these competitive factors. The range of brands and flavours has been reduced. Any residual consumer preferences for brands other than Canada Dry and the existing flavours will have been greatly diminished by the use of non-branded essences in production. No new promotions, as far as we know, have been undertaken. Canada Dry has allotted money for a limited advertising campaign this year: the National Organisation treated this in their 1974/75 budget as an additional revenue contribution of £3,000, not for appropriation to advertising. Retail mark-ups have been reduced (see section 2.1.3) from 37% to 31% on the new crate price. The practice of paying commission to van salesmen has been discontinued. So far as new retail outlets are concerned the number of private outlets (shops, bars etc.) is diminishing. The private sector is to some extent being replaced by trading co-operatives but it is uncertain how far these wholesalers are motivated towards increasing sales of soft drinks.

We have assumed that the economic policy within which the National Organisation operates will not encourage it to reinstate the former "competitive selling" factors. In our forecast we assume that improvements in its selling techniques will be limited to tasks such as replanning sales routes to take advantage of the new distribution of consumers and outlets, informing the public of any new brand or pricing policy introduced and re-introducing sales analysis systems to provide better forecasts of short term demand changes.

3.1.6 Pricing Policy

The last increase in sales revenue (at the beginning of 1974) was achieved by increasing the case price while retaining the same retail selling price per bottle to the consumers. This method of raising revenue cannot be used more than once or twice in our view without reducing the reseller's margins to a point where he (whether privately or co-operatively owned) loses interest in selling soft drinks. We understand that this method was chosen primarily because of a reluctance to increase the consumer price. The second main feature of current price policy (see sections 2.2.1 and 2.1.3) is that resale prices are set at a simple level of 30 fils/bottle for most drinks. Apart from mixer drinks and pineapple (3% of the total sales) there is no distinction between brands or bottle prices.

In section 2.1.3 we showed that the National Organisation was "breaking even" at a production level of 575,000 cases annually and an average achieved case price of 542 fils/case. At 660,000 cases p.a. the surplus was 15,500 dinars and even at 750,000 cases would only amount to 30,500 dinars. We also showed that extra costs of electricity, further sugar and fuel increases might add as much as 30,000 dinars to costs over the next year.

We propose that some savings can be achieved in raw material costs, notably by substitution of sugar by saccharin. We also believe that the National Organisation should aim to generate some surplus of sales revenue over costs; this surplus should be treated as the Organisation's own fund for minor plant renewal and repairs. This fund should aim to accumulate at least 10,000 dinars per year, and this would largely offset the proposed raw material savings.

We do not consider it likely that market demand will increase significantly above the present level of 660,000 cases p.a. over the next year, nor is there any significant scope for increasing plant capacity above that figure without working more overtime.

In these circumstances we believe that the National Organisation should consider increasing its revenue by means of price increases. We understand the reluctance to increase consumer prices, but consider that - if the soft drinks industry is to continue to make its financial contribution towards the development of the industrial economy - some increases in price are necessary within the next 6 months. Customer resistance to increased "bottle" charges may be over estimated. Even in 1972, when consumer spending was affected by salary reductions, sales were only 10% below the level of 1973. We consider that price increases, whether by way of an overall increase or selective increases, could increase the Organisation's trading surplus without unduly reducing sales volumes. The price increases should be designed, over a period of time, so as to:-

- reflect more accurately the present production costs

- take advantage of those market segments best able to pay more

- encourage the development of an internationally branded product

- ensure that the retailer obtains some benefit from increases in the consumer price.

We recommend that the Organisation makes an overall price increase to its consumer prices for soft drinks. At present the retail price is normally 30 fils/bottle, we suggest this be increased to 35 fils/bottle (an increase of 16.6%).

This objective could be achieved for example:-

- either by restricting the premium price to products made from the franchisor's concentrate in his bottles, e.g. Canada Dry Cola at 40 fils/bottle and 750 fils/case. All other Colas would be made from Akrass essence and would sell at the present price. This choice would be available to home and export markets alike. Some domestic consumers, as well as export/non-Yemeni consumers, would be willing to pay the premium price.

- or by labelling the selected premium product as "export quality" for example. This would primarily be directed to the premium markets and need not be available in the domestic market.

We regard this alternative as suitable for future, longer term development of the pricing policy. It would involve some changes in production and distribution systems, requiring more accurate and controlled differentiation between products and bottle types, and more complicated sales recording.

A selective price increase of this kind would not, however, produce sufficient revenue, nor produce revenue quickly enough, to justify the production and other changes involved. We calculate its effect as follows:-

Sales of Premium Products to 75% of 1973 Export and non-Yemeni markets	28,000 cases
and to 2% of 1973 Home market	12,000 cases
Total Sales	40,000 cases
From the above, the increased Revenue @ 200 fils/case would be:-	8,000 dinars

For these reasons we recommend that in addition an overall price increase must be made in time for the spring and summer peaks of 1975. Further selective price increases could be made later to take account of the cost anomalies by product.

We suggest an increase of 5 fils because we do not believe it is sensible to make a smaller increase involving the use of smaller coins at point of purchase. We suggest that the case price be increased to 650 fils/case (an increase of 18.2%). The result of this increase assuming that sales fall by about 5% as a result, would be:-

	Present Prices	Increased Prices
Sales	660,000 cases	625,000 cases
Case Price	550 fils	650 fils
Selling Price	720 fils	840 fils
Retail mark-up	170 fils/case	190 fils/case
Retail mark-up(%)	+30%	+29%
Bottlers Revenue	363,000 BYD	406,250 BYD

Increased Revenue 43,250 BYD

The result of these increases is therefore to produce an increase of revenue of 43,250 dinars (+12%) assuming a 5% decrease in sales volume. If there were a greater decrease in sales (say by 10%) the revenue increase would be 27,000 dinars (+7½%). We consider that a 5% decrease in sales volume would not incur increases in the costs of production per unit of more than one or two per cent.

In the long run we believe that there is scope to introduce one or more premium products, selling at a slightly higher than average price to special market sectors. These would be a few internationally branded products selling to customers best able to pay higher prices. For example, in the lists overleaf:-

Premium Brand	Premium Markets
Canada Dry Cola Green Spot (or other) lemon/lime Mixer Drinks	Ships, hotels, embassies and possibly exports

3.1.7 Sales to Non-Yemenis Resident in the PDRY

The tables in section 2.2.1 a, in which we estimated the proportion of total sales attributable to different market sectors, illustrate the past importance of non-Yemeni residents in 1965. We have estimated that the number of non-Yemeni residents fell from 120,000 people in 1965 to 2,000 in 1973. We were unable to obtain detailed figures of past numbers or an estimate of future changes. We have assumed for purposes of our forecast that the continued development of the economy during the Quinquinnial Plan will involve some increase in the number of non-Yemenis temporarily resident in the Republic. These would either be attached to UN, other international or national missions or on secondment as experts to organisations or projects within the Republic. Revenue from such sources can be regarded as "export" revenue to the extent that it is derived from foreign currency sources.

3.1.8 Sales to Shipping and Other Passengers in Transit Through the PDRY

The first table in Appendix 3.3 shows the change in shipping traffic through the port of Aden between 1967 and 1973. The second table shows a forecast of future shipping through Aden and includes figures for Suez Canal traffic on the assumption that the canal is open from the second quarter (April/May/June) of 1975.

In broad terms, the Yemen Port Corporation (port of Aden) forecast that by 1978/79 the tonnage of shipping using Aden en route to and from the Suez Canal will return to its former level. The Suez Canal traffic will however consist of fewer but larger vessels and the passenger traffic formerly transiting at Aden is unlikely to be restored.

In making our forecast, we have used the Yemen Port Corporation's estimate for the number of vessels stopping at Aden, and have made our own estimate of the number of transit passengers arriving by sea. We have also estimated the possible increase in transit passengers travelling by air on the assumption that international flights stop off at Aden airport between Europe and India or Africa. We have not felt able to assume that - even if ship or air traffic does increase as forecast - large quantities of soft drinks will be purchased in the PDRY Generally speaking, ships and aircraft prefer to purchase soft drinks (a) where they can buy them in tins, rather than bottles (b) where a choice of international brands is available and (c) where the chandlers/distributors are anxious to provide competitive service and prices.

3.1.9 Export Sales to Nearby Arabian and African Territories

In the past, significant quantities of soft drinks were exported from Aden to North Yemen and to Somalia and Djibouti. Canada Dry, Pepsi-Cola, Coca-Cola and Stim bottling plants are now operating in North Yemen in Hodeidah, Taiz and Sana'a. It is likely that further plants will commence operations in Somalia and Djibouti before 1978/79. For these reasons we do not regard the potential for exporting soft drinks to the PDRY's traditional partners as promising. Trade routes and trading relationships with the PDRY's other neighbours on the Arabian peninsula e.g. Saudi Arabia and Muscat/Oman do not at present give any prospect for exports of soft drinks to those territories. Export prospects must be regarded as very limited in view of increasing competition from such countries as Egypt and Kuwait and because of export purchasing preferences similar to those listed in section 3.1.8. It should also be emphasised that Coca-Cola, Pepsi Cola and Canada Dry (as any manufacturer with an international brand raputation) would be particularly concerned that any products sold internationally under their name or in their bottles should conform in all respects to their quality and marketing standards. It is for this reason that we have recommended that the National Organisation establish and market a premium quality product which could satisfy international standards and compete for export business.

3.2 Forecast of Future Sales

In the previous section we identified the main factors which in our view are likely to influence future demand for soft drinks in the PDRY. We also stated the assumptions we proposed to make in our forecast and explained the reasons for these assumptions. If, on studying this report, the National Organisation or the government wish to vary any of our assumptions, the relevant market sector can be readily adjusted to suit the new assumption, and the total forecast adjusted accordingly.

We forecast that the demand for aerated soft drinks in the Republic in 1978/79 will not exceed our high estimate of:-

Table 3.3 - Forecast of Potential Market for Soft Drinks 1978/79

Sector		'000 Cases	'000 Bottles
Shipping & Transit	Crews. 4,000 vessels @ 12 cases	48	1,152
	Passengers ships and airport est. 100 cases/wk	5	120
Non-Yemeni Residents	5,000 @ 150 bottles p.a.	31	750
Local Market	Aden, 330,000 @ 40 bottles p.a.	550	13,200
	Other Governorates 1,535,000 @ 6 p.a.	384	9,210
Export Sales	Negligible	-	
	Total	1,018	24,432

Source: P-E Estimate

The principal element in this forecast is our estimate of domestic consumption in Aden and the other governorates. It combines both the forecast growth of population (Quinquinnial Plan) and a small increase in annual consumption. If the population were only 1,500,000 in 1973 (instead of 1,590,000), if the population growth were only 1.7% p.a. (instead of 2.7% p.a.) and if there were no increase in annual consumption of soft drinks, the local market in 1978/79 would represent:-

Aden	303,000 @ 36 bottles	=	455,000 cases
Others	1,357,000 @ 4 bottles	=	226,000 cases
			681,000 cases

On this conservative basis the total market, including the same figures for shipping and transit and for non-Yemeni residents as in Table 2.21 would amount to 765,000 cases.

In our judgement, therefore, the forecast made in the Quinquinnial Plan for the 1978/79 sales of the soft drinks industry (17,000,000 bottles or 708,000 cases) is lower than our conservative estimate (765,000 cases) above. It therefore assumes that steps will be taken to reduce consumer demand for soft drinks below the levels we consider likely. We believe that the potential market for soft drinks in the Republic in 1978/79 will lie between 765,000 cases (lower limit) and 1,018,000 cases (upper limit).

Consideration has also been given to the trend of future sales by product and bottle type; for example it is possible that as sales expand into other Governorates the dominance of Cola sales will be eroded because in these new markets the practice of drinking cola with qat has not been established. After studying this aspect of the sales trend in detail, we have come to the following conclusions:-

- there should not be any market requirement for the introduction of new products or bottle sizes

- the mix of products and bottle sizes will change, largely as a result of Organisation production and distribution policy, but will not significantly affect production methods or costs

- the total sales forecasts should remain broadly correct despite the expected changes in product and bottle mix.

In view of these findings, and particularly of the conclusion that the Organisation itself can and will determine the product and bottle mix to suit its own requirements, we do not consider that any more detailed analysis of product or bottle size trends is justified.

4. Proposals

4.1 Overall Plan of Development

4.1.1 Total Production Capacity

From Section 3.2 it has been concluded that the total bottling output required in 1978/79 would be between 765,000 cases per annum and 1,018,000 cases per annum, compared with the present output of about 600,000 cases per annum. This forecast increase in demand suggests that an increase in capacity of between 25% and 65% will be needed over the next four to five years. Such a capacity increase can be achieved in a number of ways, either separately or in combination, as follows:-

- by purchasing additional or replacement equipment giving greater nominal outputs
- by overhauling and improving the efficiency of existing equipment
- by increasing working hours by overtime or by the extension of shiftworking
- by reducing the seasonality of production, by improving product shelf life and thus enabling stocks to be built up before the peak season.

The first of these alternatives is effectively ruled out by the Government decision not to purchase a new high speed line. There is no doubt that the other three methods are more economical in terms of capital investment, provided that they can, between them, provide all the capacity increase needed. The potential of each of these latter three methods is examined, as follows:-

- Overhaul of existing equipment:- The current peak output of the Mansoura line is about 32,000 cases for a typical month of 25 - 7 hour days. This output is about 60% of the nominal maximum attainable, whereas after overhaul and with improved management, outputs of 70% of nominal should be obtainable in these circumstances. The resultant monthly output would be 37,000 cases.

The peak output of the Crater line in recent months has been 45,000 cases, about 50% of the nominal maximum. Assuming that 70% of nominal output can be obtained after overhaul, the resultant monthly output could be 63,000 cases.

Thus a peak monthly output of 100,000 cases should be possible from the two existing lines after their overhaul. This is equivalent, with the present pattern of seasonality, to an annual output of about 900,000 cases. By line overhaul alone, therefore, it is considered that 75% of the forecast maximum extra demand could be achieved.

The above calculation neglects the further potential obtainable by restoring the ex-Green Spot line. A conservative estimate of the monthly output of this line is about 30,000 cases. The resultant annual potential, if all three lines were in operation, would be 1,200,000 cases, well in excess of the forecast maximum demand. By this means it is evident that the forecast demand could be met entirely by improvements to the existing plant.

It is considered that major overhaul of the existing lines will give them a further useful life of at least five years, beyond this period further overhaul or replacement may be necessary.

- Increased working hours:- The prospects for increasing working hours are restricted by the Government's opposition to overtime working and by an apparent resistance to shift working among the labour force. The latter objection might be overcome, however, and the resultant increase in capacity would be as follows.

The present peak production from the Crater and Mansoura plants is achieved with about 175 hours of daywork and 45 hours of overtime per month, making 220 hours in all. Assuming that overtime was eliminated by the introduction of two shift working, and that each shift consisted of six productive hours, the total available time per month would be 300 hours. This would be equivalent to a capacity increase of about 35%.

The potential capacity increase achievable by increased working hours is therefore limited, but it would provide a useful reserve and would also enable overtime to be eliminated.

- Increased stockholding:- If product quality can be improved sufficiently to give a shelf life of not less than four months, it should be possible to build up stocks for a period of up to three months before the seasonal demand peaks. Such a policy could only be safely operated with supplies to the local areas of Aden and the first governorate, where rapid distribution and consumption can be relied upon. It is considered that the peak monthly demand could be reduced by 12 - 15% in this way, with a corresponding affect on the total capacity required.

In conclusion, it is proposed that the following combination of methods be used to provide the 1978/79 capacity requirements:-

- Overhaul both operating plants over the next two years to give a capacity of 900,000 cases in 1977; renovation of the Green Spot plant should not be necessary for this purpose.

- Over the same period improve product quality to allow accumulation of stocks, thus increasing the effective capacity in 1977 by a minimum of 12%, to about 1,000,000 cases.

- If it is found necessary, introduce shift working from 1977 onwards on one or both lines, perhaps during peak months only. The maximum potential with full shift working, would be about 1,350,000 cases, well in excess of forecast demand.

4.1.2 Location of Production

The increases in production proposed in the previous section could be achieved either at the present two operating locations, Mansoura and Crater, or at one, integrated plant. The operating Mansoura site is the only possible choice for such an integration; the Crater site is evidently inadequate for expansion whereas Mansoura has reserves of space and already houses most of the administration and half of the production.

The merits and drawbacks, in that order, of plant integration on the Mansoura site are as follows:-

Merits:- The transhipment of empty and filled bottles between Crater and Mansoura would be eliminated. The costs of this operation have been difficult to identify and separate from the other transport and warehousing costs; they are estimated as not exceeding 3,000 dinars per year at present.

- Theoretically, labour savings of 2 supervisory staff and of up to 10 unskilled employees should be possible, in addition to the labour saved on transhipment. The value of the saving is estimated as up to 4,000 dinars per year but this is unlikely to be realised because of the Organisation's 'no redundancy' policy and because such labour reductions are possible, if desired, with the existing two site operation.

- There will be non-quantifiable savings in various functions, such as warehousing and maintenance, from their amalgamation on one site.

Drawbacks:- To establish the existing Cratar bottling plant on the Mansoura site will entail considerable buildings and services costs. It is assumed that the equipment would be overhauled as part of the move but the costs of overhaul would not be included, being incurred whether the plant is moved or not. The costs of building modifications and of reinstalling services are estimated as totalling about 15,000 dinars.

- The Cratar equipment would be installed at Mansoura adjacent to the existing production plant, so that the same services and goods handling facilities could be used. It is inevitable in this situation that production will be lost from both lines during the installation. This loss, which is additional to that incurred by overhaul on separate sites, is estimated as amounting to two weeks production. Assuming the transfer can be accomplished at a slack production period, this loss would cost about 10,000 dinars.

- The Crater plant is well constructed and equipped, and it can be argued that to vacate this plant and create a new facility is contrary to the Government's declared policy of making the best use of existing assets.

- The morale at the Crater plant is high and both its total production and its efficiency are greater than at Mansoura. It is undesirable to risk the sacrifice of this good operation, for the sake of an unpredictable gain in total performance.

- The fostering of a healthy competitive spirit between two separated operations can be conducive to improvements in efficiency and output at both; this possibility will be lost if the plants are combined.

It is possible to analyse the quantifiable implications of plant integration to achieve a financial justification, but in this case the non-quantifiable advantages and drawbacks must also be given serious consideration. The cost balance is as follows:-

Cost of Crater plant transfer to Mansoura, including transport and lost production - 25,000 dinars.

Annual cost saving resulting from elimination of transhipment (no allowance made for other labour savings) - 3,000 dinars per annum.

On the basis of the above cost comparison, it will take 7 or 8 years to recover the costs of relocating the Crater plant. The experts consider that this recovery period is unacceptably long, bearing in mind that other plant changes and renovations may be necessary within that period. The experts further consider that the unquantifiable disadvantages of the transfer of the Crater plant outweigh the benefits obtainable. They therefore propose that both the Mansoura and Crater plants be overhauled and reinstalled in their present locations and the transhipment between the two sites should continue.

The process of integrating the Organisation's management, its distribution and all service functions should be accelerated, but it is recommended that production from two locations should be maintained as at present.

4.1.3 Programme of Development

To minimise disruption and loss of production, it is essential that any programme for the overhaul of the Organisation's facilities must be carefully planned and scheduled. To this end there is an optimum sequence of plant overhaul, as follows:-

a) Idle plant - overhaul of reuseable plant, salvaging of useful replacement parts from plant which is not reuseable. This work can be achieved without affecting current production and should create a capacity reserve available during the subsequent overhauls of productive plant

b) Low output plant:- overhaul and restoration to original performance standards. The loss of production resulting from this work is less than that arising with higher output plant and the plant, once restored, will have reserve capacity during subsequent overhaul of the latter

c) Higher output plant:- overhaul and restoration to original performance standards. This work entails heavy loss of production and therefore must be scheduled for slack demand periods and be performed as rapidly as possible.

Applying the above sequencing to the Organisation's plant, the following programme of work is proposed.

- Obtain and instal essential replacement parts for the operating production plant, to ensure that it is working at its maximum present potential - during 1975.

- Bring useable idle plant into working order and, where necessary, into operation. Such plant includes the Carbo Coolers at the Green Spot and Pepsi Cola factories, the unused Meyer pasteuriser, the Wittemann CO_2 equipment and the complete Green Spot bottling line - during 1975/76.

- Strip useable replacement parts from all idle plant which cannot be restored or for which there is no further need. Included in this category are the spare Archie Ladewig washers at Mansoura and in the Pepsi Cola factory, the CEM filler at Pepsi Cola and and RIVI 6/24 filler at Crater - during 1975.

- Overhaul the complete bottling line and ancillary plant at Mansoura, replacing the water treatment and water cooling equipment. This work should be accomplished over a maximum interval of two months during the winter slack demand period. To allow this, all spare parts and technical skills necessary must be assembled in advance - during Jan/Feb 1976.

- Overhaul the complete bottling line and ancillary plant at Crater, replacing the water treatment equipment. This work must be accomplished within two months during the winter slack demand period and all spare parts and technical skills must be assembled in advance - during Jan/Feb 1977.

The detail of the above tasks and the schedules of replacement parts necessary are referred to under the appropriate heading in the remainder of this section. The short-term tasks have also been listed and described in the action report already submitted to the Ministry of Industry in the PDRY.

4.2 Raw Materials

4.2.1 Existing Product Ingredients

During the financial year 1973 to 1974 imported sugar accounted for 46.3 per cent of the Organisation's total raw materials bill (excluding water and bottles), with extracts and essences at 31.5 percent, and crown corks accounting for 10.9 percent by value. Since then the price of sugar has increased and accounts for an even higher proportion of raw material costs.

The costs of other product ingredients, such as the preservative sodium benzoate, are a very small part of the raw material bill, and, therefore, give little scope for significant economy.

The Organisation's water consumption is considered to be reasonable now that a closer watch is being kept on water metering. There should still be scope for water economies at the Mansoura plant, however, as its consumption apparently exceeds that of the more productive Crater plant.

The experts believe that it is possible to reduce significantly the Organisation's cost for sugar, extracts and essences. Firstly, cheaper extracts and essences should be sought and used for the cheaper product lines. Secondly, the use of saccharin should be considered, to replace a proportion of the sugar used in all the products.

Saccharin Trials - Saccharin is a white crystalline powder, which has no odour, but which has a remarkably sweet taste. On a wieght for weight basis it is about 500 times as sweet as sugar, and can be detected by taste at a concentration as low as one part in 70,000 parts of water. It has been used for many years as an artificial sweetener in foods and drinks, although it has no food value. Tests carried out over long periods have shown that saccharin, even at high levels of concentration, has no apparent toxic effects, and it is therefore considered a safe food additive.

Discussions were held in Beirut with representatives of Canada Dry concerning the use of saccharin in their products. They confirmed that formulations containing saccharin were available for their products, which they would gladly supply if requested to do so by the National Bottling Organisation.

During the experts' study a series of tasting trials were carried out on orangeade samples prepared with varying amounts of sugar and saccharin. It must be borne in mind that the refreshing tasts of an acceptable soft drink is brought about by the satisfactory balance between sweetness, acidity, flavour, carbonation, temperature at which the drink is consumed, and to some extent colour. The orangeade samples were prepared from orangeade essence brought from London and not normally used by the Organisation, to avoid bias in the trials. In the first trial the percentage (weight/weight) of sugar, known as the °Brix, varied from 5 per cent to 8 per cent with varying amounts of saccharin, whilst all other ingrediants remained the same. The amount of saccharin present is shown as 'apparent Brix' based on its sweetening power.

Table 4.1 - First Testing Trial Results

Sample			Taster					
Number	°Brix Sugar	Apparent Brix Saccharin	A	B	C	D	E	F
			1st and 2nd Choice					
1	8	5	2	2				1
2	5	10						
3	5	15		1	2	2	2	
4	7	8	1		1	1	1	2

In the second series a sample made with sugar only was introduced.

Table 4.2 - Second Testing Trial Results

Sample			Taster				
Number	°Brix Sugar	Apparent Brix Saccharin	G	H	I	J	K
			1st and 2nd Choice				
1	15	-				1	1
2	10	5	1	2	2	2	2
3	6.5	7.5	2				
4	6.5	12.5		1	1		

In the final trial the sample sweetened with sugar only, fared rather better.

Table 4.3 - Third Testing Trial Results

Sample			Taster											
Number	°Brix Sugar	Apparent Brix Saccharin	L	M	N	O	P	Q	R	S	T	U	V	W
			1st and 2nd Choices											
1	13	-	1	1		1	1	1	1	2	1			
2	8	5			1		2					1	1	1
3	5	10							2					
4	6.5	12.5	2		2	2							2	
5	8	7.5		2				2		1	2	2		2

Although the trials were of a limited nature using one product only, sufficient evidence exists to show that a limited reduction in the sugar content may be made without affecting the flavour to any great extent, judging by the preference recorded. It must be borne in mind that soft drinks are a source of nourishment and the experts consider that it would be unwise to replace more than 20 per cent of the sugar with saccharin since saccharin has no food value. As a first step Canada Dry in Beirut should be contacted to obtain formulations containing saccharin, and a search should be made for a supplier of food grade sodium saccharin. Difficulties may be experienced as demand for saccharin exceeds supply at the present time, because of sugar scarcity and high prices.

4.2.2 Ingredients for Possible New Products

The Director of Industry asked the experts if it was possible to make a soft drink from indigenous fruits which might have international appeal. Bananas, dates and paw paws were suggested as worthy of consideration.

Following up this suggestion, the experts have been able to establish the feasibility of using the natural sugar of dates to make a sugar syrup for sweetening soft drinks. Dates contain about 60 per cent sucrose (the ordinary sugar obtained from beet or cane) with a small amount of invert sugar Sugar syrup can be made by boiling the flesh of dates with water to extract the sugar, and then decolorizing the aqueous extract with activated charcoal. The resulting syrup should be entirely suitable for soft drink manufacture.

The Ministry of Agriculture confirmed that there was a surplus of dates in the PDRY and the experts consider that their use as a partial substitute for imported sugar should be actively pursued by conducting small scale trials. This possibility is discussed in more detail in Section 5 of this report. Water soluble gums and proteins extracted at the same time as the sugar would probably need to be removed and the extraction of mineral matter prevented in order to make a satisfactory syrup.

4.2.3 Packaging Materials

Most of the Organisation's packaging materials (glassware and tinplate for crowns) are, and will continue to be imported. It is therefore essential that packaging materials are used efficiently to minimise this hard currency commitment. Specific proposals for each of the principal packaging materials used are as follows:-

- Glassware:- Bottles will continue to be imported into the PDRY because the quantities required are well below the levels needed to justify a glass making plant.

  The high technology and the wastefulness of non-returnable bottles rule them out in the PDRY environment where distribution and bottle recovery costs are low.

  To minimise the import bill for bottles the following steps are suggested:-

  - Purchase, as far as possible, a standard bottle size and shape which is obtainable from several sources. The Organisation's concentration on the 250 cc Canada Dry bottle probably achieves this end, because a cheaper, non-proprietary bottle shape would be more difficult to obtain.

  - Use the huge reserves of empty bottles, stored at the Green Spot and Pepsi Cola sites, which are described in Section 2.1. To avoid confusion arising from the different bottle shapes and colours, it is suggested that they could be paint marked with a colour code identifying the product. It is understood that the Organisation will be acquiring change-parts to enable them to fill the bottles which compose the bulk of this reserve stock.

- Improve the bottle recovery procedure, perhaps by charging, and refunding, a higher deposit.

- Improve the condition and setting of bottle handling on the filling lines, to minimise breakage there.

- Tinplate Crowns:- Crowns are currently being obtained from Kenya at a cost of about one dinar per 1,000. The Organisation hopes to bring into use the crown making plant donated from Hungary and a production area to house this plant has already been constructed at Mansoura. Unfortunately the plant has not been unpacked from its crates and no details were available concerning its specification or output. It is understood that the plant as supplied is only able to produce wadded crowns and does not include compound lining equipment; in view of the scarcity and relatively high cost of cork wads by comparison with compound lining materials, this is a significant drawback.

The experts recommend that this plant by brought into production as soon as possible, because otherwise it is a wasting asset. The necessary raw materials, tinplate and cork wads, should be obtained at once in quantities sufficient, at least, for the Hungarians to carry out plant installation and trials.

Once the plant is producing crowns and an Organisation engineer has been trained in its working and maintenance, the possibilities of introducing the necessary lining machine and curing oven to produce the cheaper compound lined crowns can be investigated.

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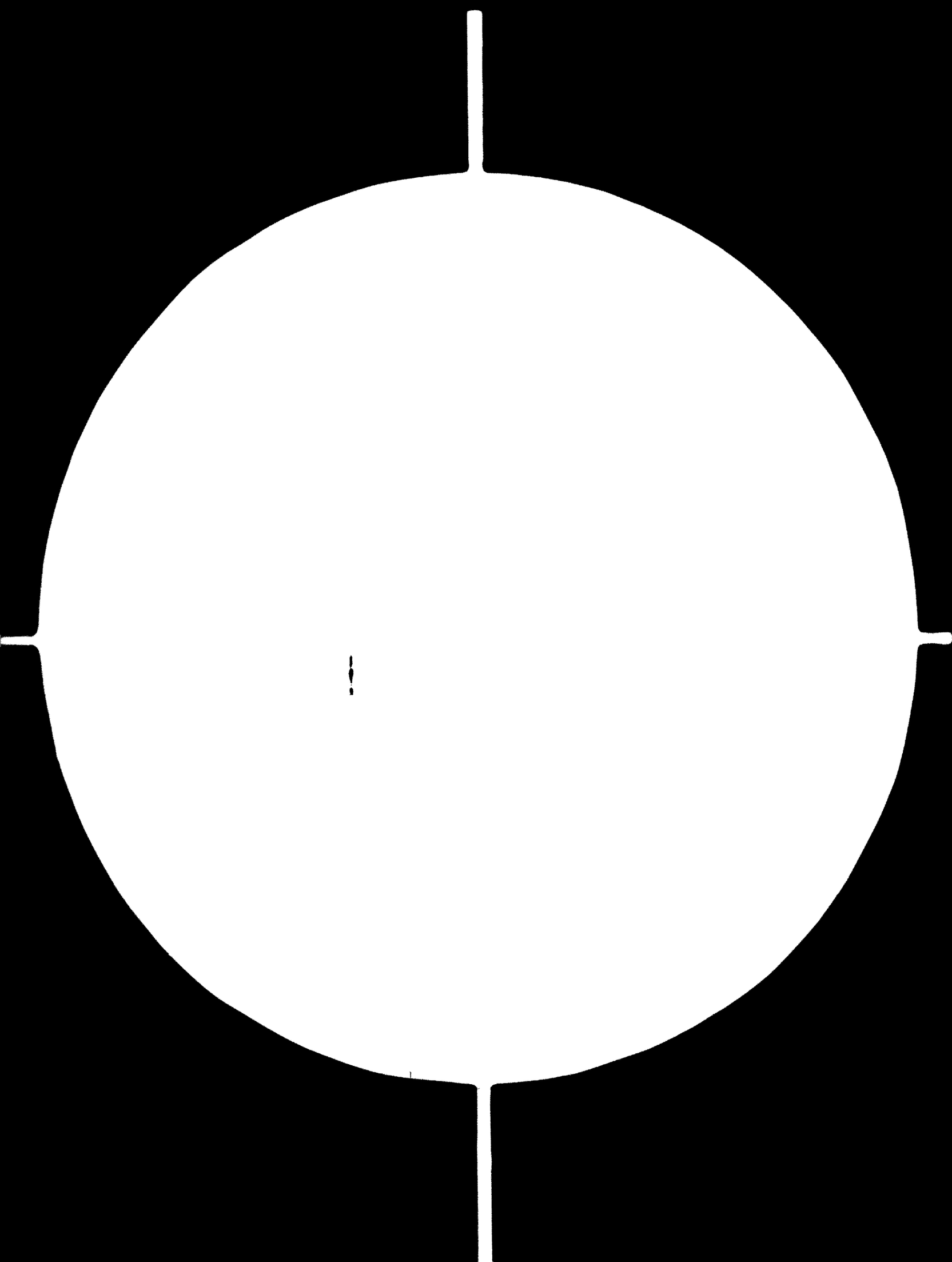

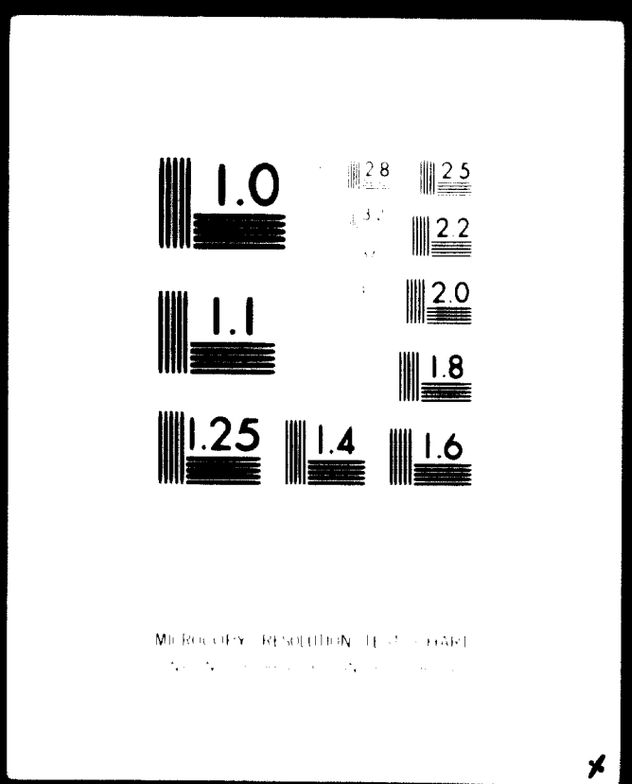

- Crates and Pallets:- The Organisation has standardised on a 24 bottle crate and a 40" x 48" pallet; this standardisation undoubtedly facilitates stockholding and distribution. Nevertheless the Organisation is faced with a continual shortage of crates because of non-return and damage by users; pallets do not present a comparable problem because they are not used for customer distribution. At Mansoura there are stocks of at least 10,000 damaged crates awaiting repair, sufficient for 240,000 bottles.

The experts recommend that an urgent programme of crate rehabilitation should be undertaken to reduce the crate shortage and to clear the stock of useless, damaged crates. The Organisation's three carpenters could be assisted in this work by providing unskilled labour, such as the students who are frequently attached to the factory, to sort and prepare the damaged crates ready for repair.

To reduce the quantity of damaged, unusable crates in the future, it is recommended that the policy concerning returns of damaged crates should be tightened. Both the salesman and, in turn, the factory, should refuse to accept and refund deposit on crates which are not in a suitable condition for reuse. By this means customers may be persuaded to treat crates more carefully and, perhaps, to repair any damage which they have caused

4.3 Water Treatment

4.3.1 Recommended Principles of Operation

Ideelly, a water treatment plant should produce water which meets the physicel, chsmicel and bacteriological requirements for soft drink manufecture, and which is unaffected by fluctuetions in ths chemicel end physicel propsrties of the in-coming water supply. In the pest electrodialysis has been used at the Crater and Mansoura plents as the beet means of correcting the brackish characteristics of Aden town water. Whilst satisfactory results can be obtained by this method, it is depsndent on the supply of replacement membranes et reguler intsrvals end on the availebility of sulphuric acid. The experts proposed that both Ionics demineraliser plants should be scrapped, beceuse of their current unsatisfactory condition and because of their dependsnce, for successful operation, on scarce sulphuric ecid end on replacsment filter membranes.

It is proposed thet the electrodialysis plant should be replaced by reverse osmosis units. These units are of fairly recent origin end were not available in the sarly 1960's when the electrodialysis units were inetelled. Reverss osmosis is an ideal way of treating breckish or highly mineraliced weters. The process is simple, having no moving parts other than the pump, and does not require regeneration, hence there ie no need to buy regenerating chemicals. Running coets, in terms of power consumption, are elightly lees than thoee of electrodielyeie.

In normal oemosis, when two equeous solutione of different concentratione are separated by a semi-permeable membrane, water passes through from the lese concentreted to the more concentreted side. In the cese of reverse osmosis, pressure ie applied to the brackish water to force it through a special membrane. In this wey water is separeted from ite impuritiss, removing et leaet 90 per cent of the totel dissolved solide. At the same time organic matter, colour, off-flavours end bacteria are left behind by the water as it passes through the membranee. Variations in the quality of in-coming water do not affect the quality of ths treated water, hence water of nearly constant compoeition is attainable.

The semi-permeable membranes last about 5 years if properly treated. Whilst no chemical phase change is involved in the process, and hence no chemical regeneration is required, back-flushing at regular intervals with water is essential to the successful operation of the process and to prolong the life of the membranes.

It is advisable to soften the in-coming water by base-exchange when using reverse osmosis units with hard water and it would therefore be desirable to soften the water at the Crater and Mansoura plants before reverse osmosis treatment. With correctly softened water, the reverse osmosis unit produces approximately 75 per cent treated water and 25 per cent waste water. This compares favourably with the electrodialysis demineralisers which reject 50 per cent of the in-coming water to waste. As no chemicals are used in the reverse osmosis process, the waste water can be used for other industrial purposes; although it will be high in total dissolved solids it is soft and can be used for flushing toilets or for fire-fighting applications.

If these proposals are accepted, the water treatment plants at the Crater and Sheikh Othman would require modification but most of the existing tanks and pipework would remain in use.

4.3.2 <u>Application at Crater Plant</u>

The existing carbon filter (Paterson Engineering Co. Ltd.) through which the in-coming water passes, could be repacked as a base-exchange resin filter to soften the water. The size of this filter is sufficient to handle 5000 gallons per day, and by using it costs would be kept to a minimum. It would, however, be necessary to acquire a brine regeneration tank and link it with this filter. The Ionics demineraliser would be replaced by a reverse osmosis plant such as an Intercept 3 unit. (The Elga Group, Lane End, Buckinghamshire HP14 3JH, UK.)

Assuming that local skills can be be made availabls to carry out the modifications described, the following approximate costs would be involved:-

Re-bed cerbon filter as a resin filter	250 SYD
Regenaretion tank	150 SYD
Elga Intercept 3	5000 SYD

(Transport costs are not includad)

The Intsrcept 3 has a maximum output of 7000 gallons per 24 hour day and would have ampla capacity to raplace ths Ionic demineraliser which has a theoretical capacity of 5000 gallons per day. It may be possible to make a raganeration tank locally, or to use one of the Permutit Deminrolit regenaration tanks from the Green Spot factory to save foreign currency.

4.3.3 Application at Mansoura Plant

The Permutit carbon filter placed directly before the Ionics demineraliser is not suitable for rapacking as a basa-exchange resin filtar. The second carbon filter aftar the Ionics traatment, located between the inside water storage tank and the Kwik Klaan polishing filter, would be suitabla, however. This filter should raplace the first, and be re-bedded with base-axchange resin. A brina regeneration tank would also be needad to link up with this filtar. Assuming that local skills can be made available to carry out the modifications, the following approximate costs would be involved:-

Re-bed second carbon filter as a resin filter	500 SYD
Regeneration tank	150 SYD
Elga Intercept 3	5000 SYD

(Transport costs are not included)

If additional bottling capacity was envisaged in the future it would be perferable to install an Intercept 5 at a cost of 7200 dinars. This unit produces 12,000 gallons maximum per 24 hour day as compared with 7000 gallons maximum per 24 hour day from the Intercept 3.

The experts favour the Elga Intercept units, as they have experience of their successful use in the UK, and have had recent opportunities to observe them working successfully at one of the Coca Cola UK bottling plants which had a severe problem with variable quality of water supply.

The large water storage tank in the open air at the Mansoura site is exposed to full solar radiation, and the water, already at 70°-80°F on receipt, can reach 90°-100°F by the end of a summer day. A light roof screen to shade the tank would minimise the temperature gain and could be provided quickly at minimal cost.

4.4 Process Plant

4.4.1 Carbon Dioxide Generator

The carbon dioxide generator should be brought back into commission as soon as possible for the following reasons:

- the operating CO_2 plant at Sira is old and uneconomic and a major breakdown there would cut off the supply of CO_2 in PDRY until arrangements could be made to import cylinders.

- the plant at Sira is unable to meet present peak demands, and probable future requirements.

- a large capital asset is lying idle when it could be contributing to the successful operation of the Organisation and to the economy of the PDRY.

In the past the suppliers (Wittemann Maeselberg) have suggested that a member of their engineering staff make two visits to Aden. The purpose of the first visit would be to check over the entire system, to carry out a complete inspection of all items of equipment, and to draw up a list of parts needing replacement. The second visit would enable the engineer to carry out replacement work, to instruct local personnel in operation and maintenance, and to start up the plant. The experts consider that this proposal from Wittemann Masselberg should be implemented at once and that it represents the quickest way of bringing the plant back into working order, and instructing local personnel in its use and maintenance.

In the meantime the experts have also attempted to short-cut the overhaul process by requesting the engineering manager of the BP refinery at Little Aden to inspect the CO_2 plant and to indicate, on the basis of this inspection, whether the BP plant engineers are willing and able to assist, on a short term, paid basis.

4.4.2 Sugar Treatment and Storage

Bottlers' sugar for making soft drinks should be of a higher quality than that sold for domestic use. Since sugar is one of the main ingradients in soft drinks it is important that non-sugar impurities present should be kept to a minimum. Excessive amounts of non-sugar impurities can cause foaming at the filler, sediment in the beverage, taints, and bacterial spoilage. In many countries, therefore, standards have been set for the quality and cleanliness of bottlers' sugar. In the experts' view, the sugar being used for soft drink manufacture in the National Bottling Organisation is sub-standard, due to its high ash content, colour, and sediment. The total viable bacterial count was high - 12,000 per 10 grammes, but the yeast and mould counts were not excessive. In addition to its very poor, yellowish colour, extraneous particles of dirt could easily be seen in the sugar. The experts were therefore pleased to find that the Seitz syrup filters, ordered originally in connection with the proposed new line, had been received from Germany; these filters should help considerably in improving the quality of the syrup, and therefore of the finished product.

As already observed, the bulk sugar storage conditions are poor and the risk of contamination and infestation is high. It would be unrealistic to demand entirely clean and hygienic storage conditions for the sugar in view of its already contaminated condition when received and the fact that the syrup is filtered before use. Nevertheless, it would seem desirable to reduce the extent of contamination in storage by stacking the sugar sacks off the floor, on pallets in a totally enclosed space inaccessible to vermin. This enclosure could then be kept relatively clean and could be fumigated regularly to keep down the level of insects and other pests.

The Organisation's syrup mixing and storage tanks are in good condition and there are sufficient to meet the maximum levels of increased throughput which have been forecast. In addition there are still a number of tanks in reserve at the Pepsi Cola plant. These latter, like all other potentially useful equipment, should be properly cleaned and put into protected storage pending their future use.

4.4.3 Water Cooling Plant and Carbonators

The water cooling plant is a crucial element in attempting to bottle carbonated soft drinks in tropical conditions. While the Crater cooling equipment is working satisfactorily, that at Mansoura is not achieving sufficient cooling and as a result, carbonation is inadequate. Replacement or total overhaul of this latter plant is therefore regarded as an urgent priority which should be performed as soon as the necessary replacements can be obtained.

The carbonators at both Mansoura and Crater plants are considered to be working satisfactorily and have very few moving parts to wear out; stripping, cleaning and replacement of the few wearing or perishable parts should therefore be sufficient to restore this equipment to the original specification.

The idle carbonator-cooler equipment at the Green Spot and Papsi Cola sites is in good condition and should be brought back into use. Unfortunately the peak capacity of both these plants is about 400 gallons per hour, and would therefore be just sufficient to supply the Mansoura line but inadequate for Crater. It is therefore proposed that the relatively new (1965) Green Spot Carbo-Cooler should be overhauled as a matter of urgency and should then replace the existing water cooler and carbonator at Mansoura. Overhaul of the complete Mansoura line is scheduled for early 1976 and this Carbo-Cooler should therefore be brought back into working order during 1975 so that it can be installed at Mansoura as part of the line overhaul.

The Pepsi Cola Carbo-Cooler, dating from 1956, should be overhaulad during 1975 and 1976, to replace the Green Spot unit aftar the latter is transferred to Manaoura. When the Pepsi Cola plant is reinatalled with the Graen Spot lina, the latter can be brought back into aervica as a reaerve.

The specific proposals for each of these pieces of equipment are as follows:-

- CEM Saturator and Water Cooler, Model 75-C-AA-FK, at Mansoura

  Replacement parts for the saturetor and for the cooling system compressor were installed in 1973; little else can be done for the plant until its proposed replacement by the Green Spot Carbo-Cooler system as part of the Mansoura line overhaul. It is suggested that the CEM saturetor should be retained as a reserve and for this reason a list of necessary spare parts for its overhaul are included in Appendix 4.1. If, however, the Management accept that the present Manaoura equipment is to be replaced, no urgency is attached to this overhaul.

- RIVI 'Carborivi No.1' Saturator No. 034 and MTI Engineering Water Cooling System at Crater

  This equipment appears to be in good condition; major replacement parts for the cooling system, including a new Sterne cooling coil and Hall forced draught condensar were instelled in 1973. It is therefore considerad that the plant should continue in satisfactory operation until overhaul of the complete Cratar line, which is programmed for early 1977.

- Mojonnier Carbo-Cooler/Syrup Cooler, Model 6.60, No. 4080 at Green Spot, Mansoura

  It is proposed that this plant, installed in 1965 but not operated since 1972, should be overhauled as a matter of urgency ready for installetion on the Mansoura 'Canada Dry' line early in 1976. A list of the necessary replacement parts for overhaul is included in Appendix 4.1. In addition the Organisation will have to restore to the plant its refrigerant pump and motor which have already been transferred to Mansoura.

- Mojonnier Carbo-Cooler/Syrup Cooler, Model 8.20, No. 3078 at Pepsi Cola, Maala
  Thia equipment dates from 1956 and has not operated since 1972; because of its age, it is considered to have less potential than the similar Green Spot plant although its nominal capacity is about the same. It is therefore suggested that this plant should replace the Green Spot unit in the relatively slow speed Green Spot line. Restoration of the latter is programmed during the years 1975/76, so that line should be available as a reserve early in 1977; the overhauled Pepsi Cola unit should therefore be available for reinstallation at that time. The spare parts' requirements will be similar to those detailed for the Green Spot Carbo-Cooler.

4.4.4 Ancillary Process Plant

The ancillary process plant consists of boilers, to provide steam and hot water for bottle washing etc. and compressors, both for air and for cooling system refrigerants; for the latter application the compressors can be considered as part of the cooling system and are therefore covered by the appropriate proposals made in the previous section.

In broad terms, it is considered that the following overhaul and replacement programme will be necessary for these categories of equipment over the next five years.

- Mansoura plant:- The operating boiler, transferred from the Green Spot plant, is considered to be in satisfactory condition and should only require routine maintenance and cleaning. The old Frick refrigerant compressor should be withdrawn from service when the Mansoura line is overhaulsd and the water cooling plant replaced. This compressor can then be thoroughly overhauled and kept as a reserve, perhaps for use with the Green Spot line.

- Crater plant:- It is understood that the operating boiler and compressors are in satisfactory condition and should only require normal routine maintenance and cleaning over the next few years.

- Green Spot plant:- If the Green Spot line is brought back into service, either at the Green Spot or Canada Dry sites in Mansoura, a new boiler and compressor will be needed because the units originally installed at Green Spot have been removed. It is calculated that a boiler of 1,000 lbs/hr capacity and a four-cylinder, 20 cfm compressor will be needed; detailed specifications can be drawn up when the exact requirements are determined during the overhaul.

4.5 Bottling Plant

4.5.1 Bottle Washers

The Organisation's bottle washers should be progressively overhauled in accordance with the total development programme, set out in Section 4.1, for all of the usable production lines. Thus the productive Archis Ladewig washer at Mansoure should be overhauled early in 1976 and the Meyer washer at Creter early in 1977. It is also advocated that the Miller Hydro washer at the Green Spot plant should be restored to working order during 1975/76, along with the rest of that line, as a reserve available for reinstallation in Mukallah in due course. The remaining washers in the Organisation should be stripped of useable spare parts and then scrapped. The detailed proposals for each washer are as follows:-

- Archis Ladewig Bottle Washer, No. 22661768, at Mansoure - Necessary replacement parts were obtained and installed on this machine during 1973 and it is expected that it should now be able to continue in production without major work until the full overhaul proposed for it in January/February 1976. It should, however, receive its normal annual cleaning, stripping and repainting early in 1975 as well as continuing routine maintenance.

  Necessary replacement parts for the full overhaul are listed in Appendix 4.1 and should be ordered at least nine months ahead of the requirement date. For this reason it is essential that the salvaging of useable replacement parts for this washer from the two other Archis Ladewig units should be accomplished in the next 3 months, so that the spares orders on the supplier can be reduced accordingly.

- Meyer Dumore Bottle Cleanar, No. BL42, Modal 320 P.T. Mk III, at Crater -
An order for essential raplacement parts was placed at the end of 1973 but was not proceeded with. The axperts have already proposed, in their action raport to the Govarnment, that this order be resuscitated at once, and the recommendation is reaffirmed. Full overhaul of the machine is proposad in January/February 1977 and in the meantime the normal annual cleaning, stripping and repainting, as well as routine maintenance must continua.

Necessary raplacement parts for the full overhaul are listed in Appendix 4.1 and should be orderad at least nine months before the requirad date. No similar plant is available in Yemen as a source of spares.

- Miller Hydro Washer No. E109/BH 802B at, Green Spot Plant, Mansoura -
No maintenance has been performed on this machine since it ceased operation in 1972. The experts proposa that this machine be restored to working order, together with the rast of the Green Spot line, at minimum cost. It is suggestad that this work be accomplished gradually during 1975/76 as a sacond priority task, so that the plant is then available as part of an occasional reserve lina or for transfer to Mukallah.

A list of necessary spare parts for full overhaul is included in Appendix 4.1 but it is advocated that axpenditure on spares should be kept to the minimum necessary to bring the machine back into use. Most of the work will consist of repair or replacement of corroded sheet metal panels, followed by surface treatment and painting.

- Idle Archie Ladewig Bottle Washers at Mansoura and at Pepsi Cole Plant -

Neither of these washers can be economically restored to working order, and it is therefore proposed to strip all useable spares from them and scrap them. This work should be completed early in 1975 so that the parts recovered are not duplicated in the spares order for the overhaul of the operating Archie Ladewig washer early in 1976.

The Mansoura machine has never been used but many mechanical parts have already been stripped from it. The main chain and some of the sprockets and bearings are useable but must be salvaged quickly as the machine is at present deteriorating in the open air. The removing, cleaning, lubricating and safe storage of these parts is therefore a top priority task which should be accomplished as soon as possible.

The Pepsi Cole machine is well worn but has not been used as a source of spares as yet. Although corroded, many of its mechanical parts, and the spray pipework are in sound condition and can be salvaged. The removing, cleaning, lubricating and safe storage of these parts is less urgent than for the Mansoura unit as the machine is under cover.

4.5.2 Fillers and Crowners

The Organisation's fillers and crowners should be progressively overhauled in accordance with the total development programme, set out in Section 4.1, for all useable production lines. Thus the CEM filler at Mansoura should be overhauled early in 1976 and the RIVI 8/40 filler at Crater early in 1977. The Meyer filler and crowner at the Green Spot plant should be restored to working order during 1975/76, along with the rest of that line. The remaining fillers and crowners should be stripped of useable spares and scrapped. The detailed proposals for each filler and crowner are as follows:-

- CEM Filler, Model 4-20-AB-FK, No. CD-4-20-1156, at Mansoura - Necessary replecement parte were received end installed for this unit during 1973 and a further ordsr was placed, but not proceeded with, et the end of 1973. The experts have already proposed in their action report, that this order be resuscitated at once and thase parts obtained and installed as eoon as possible. Full overhaul of this machins is proposed in January/Febrvery 1976 end, in the meantime normal annual stripping end cleaning should take plecs, as well ae routine maintenance.

  Necessery replacement parts for the full overhaul are listed in Appendix 4.1 and should be ordered early in 1975, at least nine months before the required date. The selvaging of useable speres for this machine from the CEM filler at Pepsi Cola should thersfore be accomplished in the next three months, so that the speres order on the supplier can be reduced accordingly.

- RIVI Monobloc Filler, Model 8/40/8, No. 8723, at Crater - Necessary replacement parts for this filler were ordered and invoiced in July 1974 but had not been rsceived in Aden at the time of the experts' departure. These parts should be installed immediately on receipt and the filler should then be eble to continue in production until its proposed major overhaul in January/February 1977. It should, however, receive its normal annual etripping and cleaning es well es continuing routine maintenance, until that time.

  Necessary replacement parts for overhaul ere listed in Appendix 4.1 and should be ordered at least six months shead of the requirement date. For this reason, it is essentisl that salvaging of useable parts for this filler from the other RIVI filler at Crater should be accomplished within the next eighteen months, so that the spares order on the supplier can be reduced accordingly.

- Meyer Dumore Filler and Crowner, Model 24/8, No. HP 714 - No maintenance has been performed on this machine since it ceased operation in 1972. The experts propose that it be restored to working order, together with the rest of the Green Spot line, at minimum cost. It is suggested that the work be accomplished gradually during 1975/76 as a second priority task, so that the plant will then be available as a reserve line or for transfer to Mukallah. The suppliers have advised that this machine is obsolete and that they no longer hold spares for it; it will therefore not be possible to order replacement parts. Instead the experts advocate that overhaul and replacements should be kept to the minimum necessary to bring the machine back into use and, where it is unavoidable, replacement parts should be produced in Aden. In practice it is probable that essential replacement parts will be confined to easily-fabricated wearing strips and plates, and perishable non-metallic parts,

- Idle CEM 4-20 Filler at Pepsi Cola plant and RIVI 6-24 Filler, at Crater -
Neither of these filler can be economically restored to working order and it is therefore proposed to strip them of all usable spares and then scrap them. For the CEM filler, this should be completed early in 1975 so that the parts recovered are not duplicated in the spares order for the overhaul of the operating CEM filler early in 1976; work on the RIVI filler is less urgent.

On the CEM filler, the complete waterbowl and all filling assemblies have already been used as replacements at Mansoure, but the syruping and crowning heads and most drive parts are available as speres, though worn. The removing, cleaning, lubricating and safe storage of these parts should proceed as a matter of urgency.

As the RIVI filler is smaller than the one operating at Crater, there is limited interchangeability of spares. Nevertheless, many of the wearing components in the filling heads and lifting platforms are common to both machines and should therefore be salvaged. The removing, cleaning, lubricating and safe storage of all parts can be carried out at leisure over the next eighteen months.

4.5.3 Beverage Mixers

The Organisation's two beverage mixers should be overhauled and made full use of as part of the total development programme set out in Section 4.1 for all useable production lines. It is suggested that the CEM beverage mixer from the Pepsi Cola plant should be overhauled during 1975, and the Potter and Rayfield mixer at Mansoura early in 1976, as part of the overhaul of that line. The experts then recommend that, when the Crater line is overhauled early in 1976, the Potter and Reyfield mixer should be transferred to the Crater line and be replaced at Mansoura by the CEM mixer. The detailed proposals for each mixer are as follows:-

- Potter and Rayfield Mixer, Model 160, No. 63062343, at Mansoura - Necessary replacement parts for this mixer were obtained and installed in mid 1973, and the experts consider that the unit should be able to continue in production until its proposed overhaul in January/February 1976. It should, however, receive its normal annual stripping and cleaning, as well as continuing routine maintenance until that time.

Necessary replacement parts for the full overhaul are listed in Appendix 4.1 and should be ordered early in 1975, at least nine months ahead of the requirement date.

- CEM Beverage Mixer, Model (A), No. 825 -
No maintenance has been performed on this unit since it ceased operation in 1972. The experts propose that it be restored to working order for eventual installation in the Mansoura line early in 1977.

A list of the necessary spare parts for full overhaul of this mixer is included in Appendix 4.1 and should be ordered in 1975, at least nine months ahead of the late 1976 deadline for the overhaul.

4.5.4 Inspection Stations

There are two inspection stations on each of the operating lines and it is proposed that these should be renovated as part of the total overhaul programme. Thus the inspection stations at Mansoura should be renovated in January/February 1976 and those at Crater in January/February 1977.

There are no moving parts in the inspection stations and the only normal replacements required are the fluorescent light sources. It is advocated, however, that the inspection stations should be made more effective. The alternative of disbanding 100% visual inspection has been discounted, because it provides a degree of insurance against contaminated product reaching the customer, and because low-cost inspection labour will continue to be available.

The method proposed for increasing the effectiveness of inspection is to increase the intensity of back illumination without increasing the eye strain for the inspector. To do this it is suggested that the number of light sources at each station be increased to four tubes, for which the units are designed.
At the same time the area visible to the inspector would be reduced by screens to a rectangular window, equal in height to the bottle fill level and spanning the width of perhaps six bottles. By this means the total light reaching the inspector would be reduced, but the light passing through the bottle which he is inspecting would be doubled.

Eye strain will remain a potential problem at inspection stations and it is best avoided by operating the inspectors in relays, with each inspector spending only about thirty minutes on continuous inspection before being relieved to perform some less arduous task.

4.5.5 Conveyors and Other Ancillary Equipment

The bottle and crate conveyors and other ancillary equipment on the Organisation's productive lines should be overhauled in accordance with the total development programmes, set out in Section 4.1, for each line. Thus the equipment at Mansoura would be overhauled in January/February 1976 and that at Crater in January/February 1977. In addition the Graan Spot line conveyors should be restored to working order during 1975/76, with the rest of this equipment, so that the complete line is available as a reserve or for installation in Mukallah. The conveyors which are not in use, on the idle Crater and Pepsi Cola lines, should be used as sources of spare chain links, drive gears etc, for the operating lines.

4.6 Quality Control

4.6.1 Objectives and Standards

The objective of quality control is to maintain standards agreed for the range of soft drinks produced. Non-existent or ineffactual quality control leads to variable product quality, poor shelf-life and inefficisnt plant operation. The experts therefore consider it essential to recruit and train quality control personnel as soon as possible for both plants to help overcome the current problems of poor product quality. Specific recommendations for recruitment and training are presented in Section 5.

As a first step to improve product quality, standards must be set for water quality and for the composition and characteristics of the finished product. Canada Dry and the other extract suppliers provide product formulations and standards, and these should be adhered to. The limits of acceptable variation from standards must be decided; it should be possible to produce a soft drink to within $\pm$ 0.5° Brix, $\pm$ 0.3 gas volumes of carbon dioxide and $\pm$ 5 per cent of the nominal bottle fill, relative to the agreed standards. The standards and limits of variation must be made known to all staff concerned so that no one is in doubt of what is required. In a similar way staff in charge of the water treatment plant must know what standards of water quality are expected.

4.6.2 Methods and Procedures

Quality control personnel should carry out the routines set out in Appendix 4.2, recording results where applicable on appropriate forms as shown in Appendix 4.3, and reporting deviations outside the defined limits of variation as they occur. The methods to be used are also presented in detail in Appendix 4.4. Quality controllers must have aptitude for this exact, careful work, a broad knowledge of the bottling process and an ability to stand firm against production pressures when they consider that standards are not being achieved. They must not be directly involved in production or in any other activity except quality control and

the senior quality controller should be directly responsible to the plant manager. Any disagreements over acceptable quality between the production manager, who is primarily interested in keeping that plant running and maintaining output, and the quality controller, whose job is to see that standards are maintained, should be referred to the plant manager. Effective quality control enables the production manager to concentrate on production in the knowledge that product quality is up to standard unless he is informed to the contrary. It does not, however, relieve him of his responsibility to try to produce soft drinks conforming to the agreed quality standards.

Quality controllers are concerned with the quality of incoming raw materials as well as with the quality of the finished product. If they were not concerned with raw materials, sub-standard and thus wasted production could still occur because the sub-standard products would be prevented from leaving the plant. Therefore the quality controllers must monitor water quality, syrup strength, adequacy of bottle washing, plant hygiene and concentration of soaking solutions in bottle washers. They should also assist salesmen in investigating customer complaints, act as 'trouble shooters' on particular quality problems and keep adequate records of tests made and bottles rejected.

Many of the proposed quality checks would be carried out on an hourly patrol basis. If however there was a change in the product being made, additional checks would be made after the changeover. The hourly checks are shown in Appendix 4.2 at a frequency of six per six-hour day. When overtime is worked the checks would be made on a continuing hourly basis. Tests which are shown in Appendix 4.2 as performed twice per day, should be made once in the morning and once in the afternoon.

Quality controllers should be able to tell by taste whether a product tastes 'right', and hence an organoleptic test is included in the test procedures.

Inspectors on the bottling lines looking for chipped, cracked, dirty bottles and foreign bodies etc, should be changed over at half hourly intervals. It is unreasonable to expect such 'one hundred per cent' inspection to be carried out satisfactorily for longer continuous periods because eye fatigue, etc. reduces the operators' powers.

It is suggested that the bacteriological tests should be carried out twice monthly by the Public Water Corporation Laboratory in Aden to check the bacteriological fitness of the product water and the product itself. If an unsatisfactory bacteria count is obtained the source of infection must be identified and eliminated at once by sampling and testing at each stage of the production process. It is understood that the Public Water Corporation is prepared to undertake this work for a small fee. The danger points for microbial contamination are shown in Appendix 4.5.

4.6.3 Training

The quality control procedures proposed in this section should not require any elaborate or extensive training of personnel. It is therefore considered that, provided recruits with suitable intelligence and education can be found, the necessary training can be undertaken within the factory environment over a period of two to four weeks. In Section 5.2.1 detailed proposals for the performance of this training by the experts are put forward as part of the proposed second phase of the project.

4.6.4 Cleanliness, Hygiene and Safety

The state of both plants was not satisfactory from the cleanliness and hygiene point of view. The design of the Crater plant, with the bottling equipment in a well, made it easier to clean than the Mansoura plant, and it looked the cleaner of the two. The importance of cleanliness and good hygiene cannot be stressed too strongly if contamination and infestation is to be avoided and products with adequate shelf-life produced.

The following points should be noted and acted upon:-

- there should be a total ban on the entry of unauthorised persons and livestock to the water treatment, syrup preparation and storage areas and to the bottling hall

- there should be no eating, smoking, spitting, chewing of qat or washing of clothes in the production area

- the wearing of uniform, regularly laundered, protective clothing by all production personnel should be made mandatory

- all chipped, cracked and missing wall tiles should be replaced and the floors repaired and tiled walls washed down regularly with a bactericidal detergent solution

- all floors in the production area should be regularly washed down with dilute hypochlorite solution and the floors generally kept in a cleaner condition than at present

- adequate washing and toilet facilities for production staff should be provided and kept in clean condition.

The experts were told that soap and other cleaning materials were often unobtainable. It is essential that these materials are made available for use in food plants of this type if public health is not to be endangered.

Every item of equipment used to make the product must be kept free from contamination by moulds, yeasts and bacteria. At the end of each day's production chlorinated water containing 100 to 200 parts per million of chlorine, depending on the contact time, should be run through the line to combat any micro-biological build up. Fresh water should be run through the line before the start of the next day's production run to remove traces of chlorine.

All the equipment which comes into contact with the products or ingredients, for example filler heads, should be cleaned down with steam jets at the end of each day. Syrup storage tanks should not be overlooked in this sterilization process.

When the time comes to replace the existing petrol engined fork lift trucks, electrically powered models, which do not pollute the product storage area with exhaust fumes, should be considered.

On the last day of the field work both plants were producing Canada Cola. A sample bottle was taken from each plant and brought to London for bacteriological examination. Both bottles were found to be free from pathegenic organisms, i.e. organisms capable of causing food poisoning in man. Thus, on the basis of our very small scale tests, the production was bacteriologically safe at the time the sample was taken.

We are not confident that the present production operation is safe for the work force, either from the standpoint of risk of disease, nor from that of physical danger. The suggested improvements in cleaning and hygiene should reduce the disease hazard.

To avoid physical hazards, the Organisation must become aware of the concepts of industrial safety. The lack of guards on moving machinery and drive belts, the uneven, slippery condition of floors, the general untidiness of all the production areas, combine to provide a most dangerous working environment. A particular, potentially fatal danger arises from bottle explosions on the filler; to avoid the risks arising from flying glass it is essential that filler guards are improved and always in place when the fillers are running.

4.6 Management Organisation and Methods

4.7.1 Management Structure

Because the National Bottling Organisation has been so recently established, it is inevitable that the management structure is as yet ill defined and uncertain. We consider that a formal and well understood management structure should be established as soon as possible but accept that it must be tailored to the local situation and to the skills and personalities available to fill the various roles. As a starting point, however, a typical organisation tree suitable for a bottling operation is presented in Appendix 4.6. This chart demonstrates appropriate chains of authority and responsibility in the organisation and the relative position of the various managers. The financial and sales managements already match the organisation chart shown but the production and personnel management need development both in terms of numbers and of structure. It is recommended that the production and personnel management teams be established on the lines indicated in the organisation chart.

4.7.2 Management Team

It is proposed that the management team be strengthened, both by recruitment and by training, in the areas of production supervision, quality control, maintenance engineering and personnel. To this end the following new appointments, and preliminary job descriptions, are suggested:-

- Production Manager, Crater plant - The present management void at Crater, which is creating extra work and strain for the supervisory staff there, must be filled as quickly as possible. This role, although subordinate to the Organisation's Production Manager based at Mansoura, should have full responsibility for production at Crater and for all day-to-day problems there.

- Production Controller:- The production controller would be responsible to the Production Managers for the preparation of a monthly, weekly and daily forward load schedule, based on the production control methods discussed in the next section.

- Quality controller:- The quality controller, although answerable to the Production Managers in day-to-day matters, should have recourse to the General Manager in the event of a dispute about quality. The quality controller would be responsible for verifying and reporting on the quality both of the product and of incoming raw materials. The quality controller would be based at Mansoura and should have at least one assistant, to cover the Crater operation.

- Production Foreman, Mansoura plant:- To reduce the workload of the production manager, so that he can concentrate on the problems of product and plant improvement, it is proposed that a production foreman be nominated for the Mansoura bottling line. This foreman would be responsible for the day-to-day working of the line and for discipline on it.

- Maintenance Foreman:- A maintenance foreman should be appointed from among the existing team of maintenance fitters to be responsible for the planning and accomplishing of maintenance work at both the Mansoura and Crater plants. He would be charged with implementing the changes in maintenance methods discussed in the next section.

- Project Engineer:- For the duration, at least, of the proposed plant improvement project, between 1975 and 1977, it is considered that a qualified engineer is needed. This project engineer, although responsible to the production manager, would also be counterpart to the experts during their initiation of the development in the second phase of their project, and would be trained and advised by them. He would then superintend the completion of the plant improvement project, co-ordinating production staff, contractors and suppliers. The role and training of the project engineer is discussed further in Section 5.

- **Personnel Manager:-** It is understood that the present personnel manager has tendered his resignation. If this is the case, it is essential that he be replaced immediately by someone who has the confidence of all members of the workforce. In the evolving industrial democracy within the National Bottling Organisation it is essential that there is a strong, sensible Personnel Manager to work with the General Manager in pursuing the best interests of the Organisation as a whole.

4.7.3 Management Methods

Changes or innovations in management method are suggested in the fields of production, quality control, maintenance and finance. The major proposals for the introduction of quality control systems have been discussed in Section 4.6. The remainder of this section deals with the more limited proposals made in the other three areas, as follows:-

- **Production Control:-** A formal production control system should be introduced by the proposed production controller, perhaps with the initial guidance of the experts. The objective of the system will be to plan production so as to maximise output from the available plant capacity and working hours. To this end, size changeovers, and other controllable interruptions would be minimised and production programmed to match the product demand and the availability of raw materials, particularly bottles.

  As bottles are at present a major restraint on continuous production, it is suggested that a bottle stock control system be introduced. For each bottle size and type, a record of the rate of return of empties should be kept. A typical pattern of bottle return and production is shown in Appendix 4.7, demonstrating the 'saw tooth' effect of slow bottle accumulation followed by rapid use.

Once the normal rate of return is known, it will be possible to predict the approximate date at which there will be a sufficient stock of a particular bottle to justify a production run. With this information it should be possible to build up a production programme which is not interrupted by bottle shortages.

- Maintenence:- As with production control, a formal maintenance programme is proposed. At present it appears that, apart from cleaning and washing down, maintenance is performed on the basis of necessity - normally when the performance of an item has fallen intolerably, or a failure has occurred. This 'exception' maintenance will continue to be necessary but in addition planned maintenance should be introduced, with greasing, lubrication inspection, adjustment and replacement being carried out at predetermined intarvels. The Production Manager has already devised a basic planned maintenance programme and we recommend that the maintenance fitters should begin to operate this programme at once.

To minimise the disruptive effect of maintenance work on production, the bulk of the maintenance work should be performed outside production hours. For this reason the maintenance fitters' hours should be staggered relative to those of the production workers. We suggest that the fitters should normally start work one or two hours before the end of the production shift and continue until all planned maintenance and necessary repair work have been completed each day. It would be necessary, however, that at least one fitter should be present throughout the production shift in case emergency repairs or adjustments are needed. This work could be performed on a weekly rota basis.

The two skilled and experienced fitters who were in charge of maintenance at the Green Spot and Pepsi Cola plants should be given the task of recovering useable parts or complete pieces of equipment at those plants in accordance with the recommendations in the previous sections.

- Financial Controls:- We recommend that the accounts department should produce weekly and monthly 'exception' reports for management. These reports would present, from the excellent financial records already produced, all significant or exceptional information of which management should know. If there are reasonable explanations for the exceptional position, these should be given, if not, management must act to correct the situation whenever possible.

The use of financial yardsticks of business performance should be encouraged. Thus when management are considering new investments, the accountant should provide for them the comparitive values of return on the investment, payback period, etc. so that the true financial alternatives can be assessed before a decision is reached. Similarly the concepts of added value and marginal cost should be applied to each product, so that the relative value of each to the Organisation can be continuously reviewed. With this information, the pricing policy and the production mix can be altered to reflect the real financial position. Above all, the management must be trained to understand and appreciate the importance of the financial data which is available to them from the Organisation's excellent accounting systems.

4.8 Financial Consequences of the Proposals

4.8.1 Bases of Cost Data

It is important to establish, as far as possible, the financial consequences, in terms of expenditure and of cost benefits, which arise from the foregoing proposals. In practice, however, the uncertainty of costs at the present time in the PDRY will probably invalidate any attempts to determine absolute values. Nevertheless, indicative costs have been established by the experts because of their usefulness in allowing financial comparisons between different aspects of the project - it is probable that relative values will remain the same even when absolute values are substantially changed.

Costs in the PDRY have been established wherever possible from Ministry or Organisation sources. Thus labour rates and costs of services such as electricity and water are based on current rates in Yemen. Costs of spare parts and new equipment have been obtained from recent quotations and invoices to the Organisation, or direct from suppliers. All costs in this report have therefore been established at mid 1974 prices with no allowance made for escalation or inflation.

4.8.2 Potential Cost Benefits

The main cost benefits which should arise from the experts' proposals are, firstly, hard currency savings resulting from cheaper raw materials, secondly, reduced production costs per unit as a result of higher production from the same overheads. In the following paragraphs the cost benefits are established in percentage terms to facilitate comparisons:-

- Raw materials cost savings:- Sugar currently represents about 45% of the raw materials bill and essences, about 33%. It is envisaged that savings of about 20% of sugar costs and 10% of essence costs should be readily achievable by the methods proposed in Section 4.2. The reduction possible on the total raw materials bill should therefore be about 12%, worth perhaps 25,000 dinars per year on current volumes of production.

- Spreading of overheads:- It has been predicted that the forecast peak demand in 1978 of one million cases can be produced by the Organisation's existing plant and labour force. This would represent an output increase of about 50% by comparison with current production. As a result the overhead costs per unit, assuming that all overheads can be kept broadly as at present, would be reduced by a third. The effect of this reduction, at the Organisation's current level and cost of overheads, would be to increase total margins by up to 75,000 dinars per year.

There are many other, relatively smaller, sources of savings as a result of the operational changes proposed but no attempt has been made to quantify these. The total saving, identified above, from raw materials and from spreading of overheads is in itself very significant, representing about 20% of sales turnover.

4.8.3 Costs of Development Programme

Having cancelled the purchase of a new line and thus saved perhaps 150,000 dinars, most of it in foreign exchange, the Organisation can justify some investment in the renovation of its existing plant.

The development programme discussed in the previous sections has been divided into four phases for the purposes of financial evaluations as follows:-

- First priority:- work which should be accomplished as soon as possible during 1975, mostly being work which influences ordering for the overhaul of the Mansoura line.

- Overhaul of the Mansoura line:- all aspects of this line overhaul scheduled for accomplishment early in 1976.

- Overhaul of the Crater line:- all aspects of this line overhaul scheduled for accomplishment early in 1977.

- Second priority:- work other than the principal line overhauls which should be accomplished during 1975 and 1976,

The costs of the principal elements of the work involved in each of these work phases are estimated to be as follows:-

	Estimated Costs $YD
- First priority work:-	
Strip and salvage useable replacement parts from CEM filler at Pepsi Cola plant	100
Strip and salvage useable replacement parts from Archie Ladewig washers at Mansoura and Pepsi Cola plants	300
Obtain and instal replacement membranes for lonics demineralisers at Mansoura and Crater plants	1,600
Receive and instal RIVI filler parts as ordered for Crater plant (already invoiced and paid for - therefore no cost included)	-

	Estimated Cost SYD
Obtain and instal Meyar bottle cleaner parts as ordered for Crater plant	3,000
Overhaul Mojonnier Carbo-Cooler and Syrup Cooler at Graan Spot Plant, including pumps and compressor and specialist assistance	6,000
Overhaul Wittamann CO_2 generator including necessary replacement parts and specialist assistance	5,000
Total Estimated Cost	16,000

- Mansoura line overhaul:-

Replace Ionics demineraliser with Elga reverse osmosis plant, including cost of new plant and specialist assistance	8,000
Replace boiler by 1,000 lbs/hr unit including cost of new boiler	3,000
Replace CEM water cooler and saturator with overhauled Mojonnier Carbo-Cooler and Syrup Cooler ex Green Spot plant	500
Overhaul Archie Ladewig washer, including purchase of necessary replacement parts	8,000
Overhaul CEM filler, including purchase of necessary replacement parts	5,000
Overhaul Potter and Rayfield mixer including purchase of necessary replacement parts	1,000
Overhaul conveyors, sight screens, etc.	500
Total Estimated Cost	26,000

	Estimated Cost SYD
- Crater Line Overhaul:-	
Replace Ionics demineraliser with Elga reverse osmosis plant, including cost of plant	8,500
Overhaul Meyer washers, including purchase of necessary replacement parts	10,000
Overhaul RIVI filler, including purchase of necessary replacement parts	4,000
Install overhauled Potter and Rayfield mixer ex Mansoura	100
Overhaul conveyors, sight screens, etc.	400
Total Estimated Cost	23,000
- Second Priority Work:-	
Overhaul CEM mixer ex Pepsi Cola plant and reinstall at Mansoura on principal line, including replacement parts	2,000
Overhaul Mojonnier Carbo-Cooler and Syrup Cooler ex Pepsi Cola plant and reinstall at Mansoura on slow speed line, ex Green Spot plant, including replacement parts and specialist assistance	5,000
Overhaul Permutit water treatment plant ex Green Spot plant for reinstallation at Mansoura with slow speed line including replacement parts and specialist assistance	2,500
Overhaul Miller Hydro washer and reinstall at Mansoura with slow speed line, including replacement parts	6,000

Overhaul Meyer filler and reinstall at Mansoura with slow speed line, including manufacture of replacement parts	4,000
Strip and salvage useable replacement parts from RIVI 6/24 filler at Cratar	100
Unpack, examine, clean and store Meyer pasteurisar at Green Spot plant. No allowance for replacement parts, as these cannot be estimated until the plant is unpacked and inspected thoroughly	400
Total Estimated Cost	20,000

No budget costs have been included for the establishing of the Hungarian crown making plant as the plant specifications have not been available to the experts, and as installation and commissioning will be performed by Hungarian engineers on an, as yet, undefined cost basis.

The total estimated costs of all four phases of the experts' proposed development programme amount to 85,000 dinars, substantially less than the cost of a new high speed line. Of this total it is estimated that about 70,000 dinars would be hard-currency expenditure, covering costs of replacement parts and foreign specialist assistence.

5. Recommendations for Second Phase of Project

5.1. Composition of Second Phase

The activities remaining from the experts' terms of reference for accomplishment during the second phase of the project as listed in Section 1 are primarily concerned with training and supervision. Such activities, unlike those of the first phase, require continuous contact and communication between the experts and Organisation staff for their achievement. It is therefore essential that English-speaking counterparts are available within the Organisation, to receive training and to act as intermediaries for the experts' supervisory role. This point is reiterated in the conclusions of the report because it is so vital to the success of the second phase.

The total development programme put forward in Section 4 will take at least two years to accomplish. Financial restraints and shortage of experienced labour could necessitate further delays in this already generous timetable. To make the best use of the experts' time during this programme, it is proposed that they should be present for two to three months at the start and should then make three or four visits of about two weeks duration, spaced at intervals of perhaps six months. In particular it is proposed that the experts should visit the Organisation during the major overhauls of the two operating lines, which are scheduled for early 1976 and early 1977. Excellent communications would have to be maintained between the experts and the Organisation to ensure that these visits were profitably used.

The bulk of the experts' work in the project second phase would be accomplished during the initial two to three month attachment, and would comprise the following activities:-

- Supervising the first priority engineering work scheduled in Section 4, which includes the installation of urgently needed parts on the operating lines, the stripping of useful parts from surplus machines, and the reinstatement of one Carbo-Cooler and the CO_2 plant.

- Training the counterpart engineer and, through him, the Organisation's maintenance staff, in maintenance and overhaul methods and in the operation of particular items of equipment. This training would be performed as part of, and would often be indistinguishable from, the supervisory role.

- Advising the counterpart engineer and, through him, the Organisation's management, on the technical details and scheduling of the three further stages of the plant development programme - the Mansoura and Crater line overhauls and the second priority work.

- Supervising the establishment of quality control laboratories at the Mansoura and Crater plants. This would include the decision of their layouts and locations, and the supervision of their construction and the installation of the test equipment, and of the first weeks of operation.

- Training the counterpart quality controller to assume charge of the laboratories, including training in communication and report presentation for management as well as in the test methods and procedures defined in this report.

Provided that the counterparts, equipment and replacement parts are available at the start of the second phase, it should be possible to accomplish most of these tasks in a period of one or two months. The main exception is supervising the establishment of the quality control laboratories, which will almost certainly entail an extension or a second visit, in addition to the planned progressing visits.

5.2 Recruitment and Training

5.2.1 Engineering

The chief task of the propoeed counterpert engineer would be to co-ordinate and suparvise the plent development programme, in e project angineering role. At the completion of the project, efter two or three yeers, he would revert to the role of chief engineer in the Orgenisetion or could move on to manage other projects.

It ie unlikely that a suitably quelified cendidate for this position will be found within the Orgenisetion, nevertheless the post should be advertised internally, before an external recruit is considered. The epplicants for the post should be interviewed and asseseed for:-

- an adequate standard of technical education, prefarably in mechanical engineering
- eome experience of maintenence and overhaul of mechanicel and, desirably, process plant
- ability to work well with and direct other people, necessery for the project co-ordinating and supervisory role
- ability to understand both written and spoken English.

Once applicents have been interviewed, a short list should be prepared, the remaining applicants interviewed again and a decision on the appointment them made.

The appointed project engineer would be trained and advised by the experts during the second phase of the project. In addition it would be desireble for the engineer to visit enother bottling plant, probably in the Middle East, end the factory of one of the equipment suppliers, perhaps in Italy or the UK.

The nature of the in-plant training given by the experts would be broadly as follows:-

- training by discussion - using the existing English language operating and maintenance manuals, the experts would explain the working, and the maintenance and overhaul procedures recommended for each major item of equipment. The principles of a soft drink bottling operation and of planned maintenance would also be outlined

- training by supervision - the expert engineer would work with the counterpart on one or two of the more complex items, to guide him both on the detail of the equipment and on dismantling and reassembly procedures. Once satisfied that the engineer was conversant with both the equipment and the methods, the expert would assume a supervisory role.

5.2.2 Quality Control

The posts of senior quality controller at Mansoura and of assistant quality controller, operating at Crater, should be advertised within the Organisation. The jobs offered would command a wage substantially higher than that of line operators, in recognition of the responsibility involved, and the importance that management places on their role. It is better to recruit from within if possible to increase internal promotion prospects, and to obtain people who in all probability already have a working knowledge of soft drink manufacture. Only if it proves impossible to recruit from within, should the Organisation revert to external recruitment. Applicants for the two posts should be interviewed and assessed for:

- an adequate standard of education in a technical subject
- an aptitude for arithmetic
- ability to work well with other people
- conscientiousness, and a belief in the worthwhile nature of the quality control tests
- mental toughness in pursuit of the job objectives
- ability to understand both written and spoken English.

Once applicants have been interviewed, a short list could be drawn up, the remaining applicants interviewed again, and the appointments made. The quality controllers selected must then be trained to carry out the test routines and to understand why they are necessary. It is part of the experts' brief, during the second phase of the project to, train quality control personnel, and thorough training would be given, as described in the following paragraphs. Assistance in interviewing and selecting people could also be provided if required.

The quality controllers appointed should spend up to a month in the laboratory of the Public Water Corporation, to study the routine chemical and bacteriological tests carried out on water samples. Water forms a very important part of the process, and a thorough knowledge of water and water testing would provide an ideal introduction and background to the in-plant training.

The in-plant training would consist, in broad terms, of the following stages:

- training by lecture - two or three half days of lectures to all recruits on the purpose of quality control and the methods for particular tests

- training by example - for the first few days of the training the expert would operate as a quality controller, showing the recruits by example just how each method and procedure should operate

- training 'on the job' - over the succeeding weeks, the quality controllers would be entrusted with performing the quality control tasks. Their performance, and the quality of their results, would be monitored by the expert until he was confident of their ability to continue operating independently.

5.3 Setting up of Quality Control Laboratories

Quality control laboratories should be set up at the Mansoura and Crater plants with the minimum delay, to aid in the production of quality soft drinks. The quality control routines outlined in Section 4 should be instituted, and form the basis of all testing work. Before quality control can start to function properly, staff must be recruited and trained, space provided for laboratories at each plant, and additional testing equipment and materials purchased.

The quality control laboratory at each factory should be located as near to the bottling line as possible, to cut down time spent walking to and from the line and to be seen as part of the production process. Suitable locations are available in both factories. The laboratory itself should have glassed-in windows so that the quality controllers can see what is happening on the bottling line from inside the laboratory and so that production personnel can be aware of the quality controller at work. It should be equipped with a sink and running water, cupboards for keeping the test equipment, working surfaces for conducting the tests, and a desk for writing up the results. It should be as small as possible so that it is not used as a meeting place or rest room for other personnel.

The work of the experts in connection with setting up the quality control laboratories would consist of:

- detailed planning of the layout of the laboratory on each site, taking account of ease of access to the line, availability of necessary services, and provision of a relatively quiet, air conditioned working environment

- supervision of the construction of the laboratories, on an intermittent basis, to ensure that the experts' plans are realised

- supervision of installation of test equipment, previously ordered, under the direction of the experts

- supervision of the first weeks of operation of the new laboratories, to ensure that the methods, documentation and equipment are used correctly.

A nucleus of test equipment exists at each plant, and an inventory is given in Appendix 4.3. It would be necessary, however, to add to this equipment so that the tests shown in Appendix 4.4 can be carried out. A purchasing list of additional equipment is given is Appendix 4.9. None of this proposed new equipment is available within the country. The experts would therefore propose that the National Organisation ordered this equipment in the near future, with guidance from the experts concerning sources of supply. The experts would then defer any visit to the factories to instruct quality controllers, until all the equipment ordered had been safely received.

5.4 Supervising the Plant Reorganisation Programme

The plant reorganisation programme proposed has been set out, with its timetable, in Section 4. The experts have a role to perform in supervising the initial stages of plant overhaul and in advising on the execution of the subsequent stages. As previously indicated, the performance of this supervisory role will be very dependent on the availability of a counterpart engineer and on his ability and experience.

As the experts are not members of the Organisation's management, any supervisory role is necessarily advisory rather than administrative. Thus the experts can ask management that a certain operation be performed and can then observe and advise during its accomplishment, but they cannot order that the operation be carried out, nor dictate the way of doing it. This limitation applies particularly to, for example, overhaul and maintenance work which will delay production - management can insist that output must not be sacrificed and that the experts' work be deferred to a more opportune time.

The specific tasks for the experts to supervise in Aden will depend to some extent on the operating conditions in the plants when they return, but should broadly consist of:-

- Stripping down and salvaging of useable spare parts from the two spare Ladewig washers and the spare CEM filler.

- Installation of essential replacement parts on the operating Ionics water treatment plants, the Meyer washer and the RIVI filler.

- Overhaul and renovation of the Carbo Cooler at the Green Spot plant.

- Overhaul and renovation of the CO_2 generating plant at Mansoura (this operation will also require specialist advice from the suppliers of the equipment or other experts on this potentially hazardous process plant).

- Preparing and issuing orders on suppliers, either local or overseas, for replacement parts necessary for the full overhaul of the Mansoura line and, at a later stage, the Crater line.

- Drawing up detailed plans and timetables, within the Organisation, for the accomplishment of the remaining three stages of the development programme.

All the above work should be able to be accomplished during the experts' first, one or two month return visit to Aden. It is then proposed that the experts would make three or four subsequent visits of about two weeks duration at six monthly intervals. These would be timed to coincide, in particular, with the proposed major overhauls of the Mansoura and Crater plants. During these progressing visits the supervisory work would involve:-

- Observing the stage of the development which has been reached, and the availability of necessary skills and replacement parts.

- Supervising directly the work being carried out during the period of the experts' visit.

- Updating the development programme, with management, in the light of the progress achieved and of new developments in the market or in the Organisation.

- Advising management on subsequent stages of the programme, in particular concerning any shortcomings or deficiencies which should be corrected.

6. Conclusion

The foregoing report on the National Bottling Organisation in the PDRY contains detailed and comprehensive proposals for the renovation and improvement of the industry. To carry any of these proposals forward to implementation, however, will require the active co-operation of the Organisation's management and labour force. The experts hope, therefore, that the authorities will be able to encourage the introduction of these proposals and, perhaps, to appoint a Ministry of Industry representative with responsibility for monitoring their progress.

In particular, the experts are concerned that, if they are invited by UNIDO and the Government to assist in the implementation of their proposals, certain steps should be taken in advance of their return to the field. Firstly, it will be essential that English speaking counterparts are available to benefit from the experts' training and supervisory contribution and to carry on the management of implementation work after the experts' departure. Secondly, the necessary replacement parts for the first phase, at least of the implementation programme, should be obtained ready for the experts' return, so that they can supervise their installation and the start of the programme.

Ideally there should be both an engineer counterpart and a quality control counterpart to make the best use of the training possibility. It will be vital, however, to have at least one English speaking technician available in the Organisation if the experts are to perform the four main outstanding tasks in their original terms of reference, i.e.:-

- To supervise the overhaul of all repairable machinery which is in need of such treatment, provided spare parts are readily available in the country; alternatively, to render detailed technical advice on overhauling requirements.

- To supervise or advise in establishment of a quality control laboratory, provided that laboratory equipment is available in the country; alternatively, to give detailed advice on the establishment of a quality control laboratory.

- To train a counterpart chemist to assure control of the laboratory.

- To advise the counterpart engineer on how to execute the planned integration.

In view of their dependence on the counterparts and spares for the next stage of the project, the experts will require confirmation that these are available before they will feel justified in returning to the field to complete their task.

At the conclusion of this first study phase of the project, the experts wish to express their gratitude for the co-operation and hospitality which they received in the Yemen. The help of Ministry of Industry staff, in particular their counterpart engineer, Abdullah Ibrahim Saeed, has been invaluable in the rapid accomplishment of the study.

All the staff with whom the experts have worked in the National Bottling Organisation have been unfailingly helpful. They have done their best, often in difficult circumstances and by dint of considerable extra work, to provide the experts with the equipment, information and trials required.

The experts now look forward to returning to Aden in the near future to assist the National Bottling Organisation in its difficult task of reorganising and renovation.

N.C. Rebeen
R.N. Voelcker
E.C. Windsor
October 1974.

UNIDO Project IS/PDY/72/006 Principal Re

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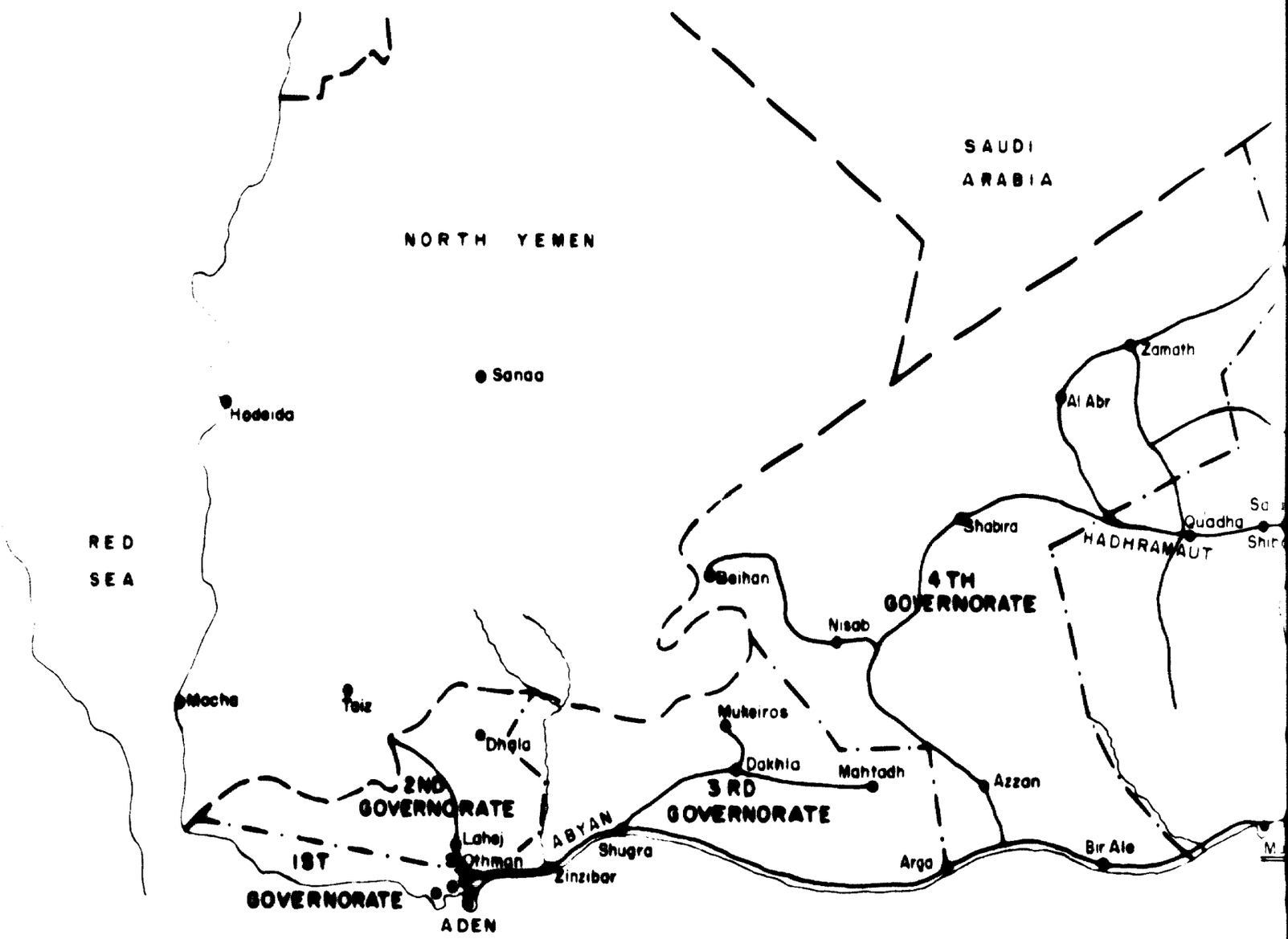

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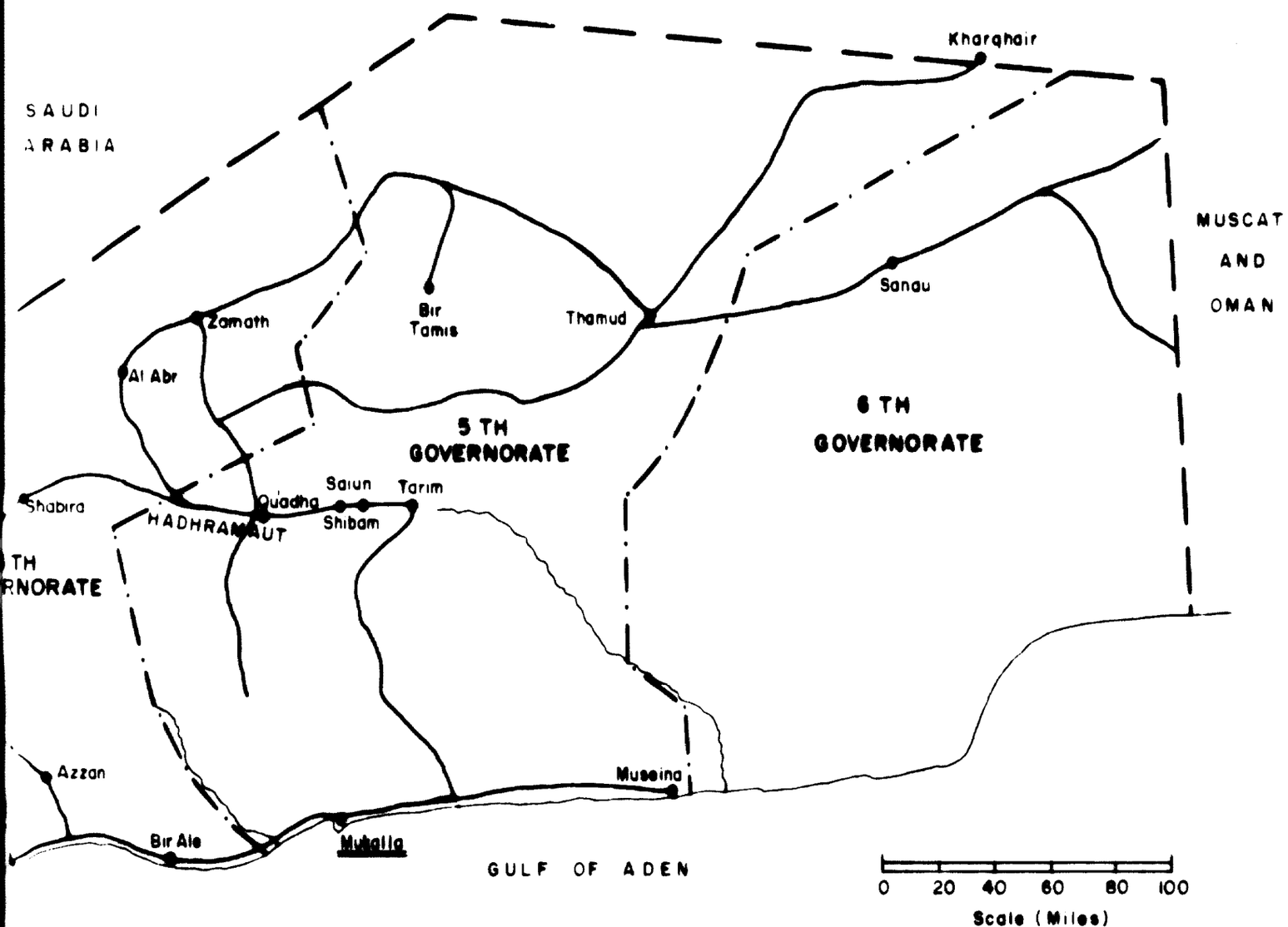


SECTION 2

UNIDO PROJECT IS/PDY/72/006 - PRINCIPAL REPORT

VALUE OF INDUSTRIAL PRODUCTION BY SECTORS

SECTOR		Prod. 1972	Estd. 1978/79
Public Sector	1 Salt Extraction Development	138.0	279.0
	2 Food Salt	30.0	30.0
	3 Flour Mill	-	1,785.0
	4 Spinning & Weaving	-	1,250.0
	5 Shoe Manufacture	-	325.0
	6 Oxygen & Acetylene	-	41.5
	7 Plastic Wares	6.6	160.0
	8 Vegetable Oils	-	452.0
	9 Annimal Fodder	-	302.0
	10 Mechanical Slaughterhouse	-	2,154.0
	11 Dates	-	48.0
	12 Public Coroporation Aerated Water	369.0	456.0
	13 Tannery	-	100.0
	14 'Martyrs' Furniture Factory	40.1	50.0
	15 'Martyrs' Garment Factory	71.0	190.0
	16 Fisheries Industry	-	3,213.0
	17 Cotton Seed Oil (Maalla)	216.7	-
	18 Other Industries	61.2	-
	19 Electric Power	1,372.0	2,136.0
	20 Water	1,227.0	1,625.0
	21 Construction & Repair of Vessels	452.0	580.0
		3,983.6	15,176.0
	22 Paints	105.7	110.0
	23 Cans	9.4	10.0
	24 Matches	123.1	172.4
	25 Cigarettes	-	2,630.0
	26 Aluminium	-	167.0
		238.2	3,089.4
Private	27 Rubber Sandals	-	156.0
	28 Other Furniture, Haberdashery Sesame Pressing	3,374.0	2,612.0
Coop	29 Two Cotton Ginneries	1,721.2	3,536.0
Total Industry		9,317.0	24,570.0

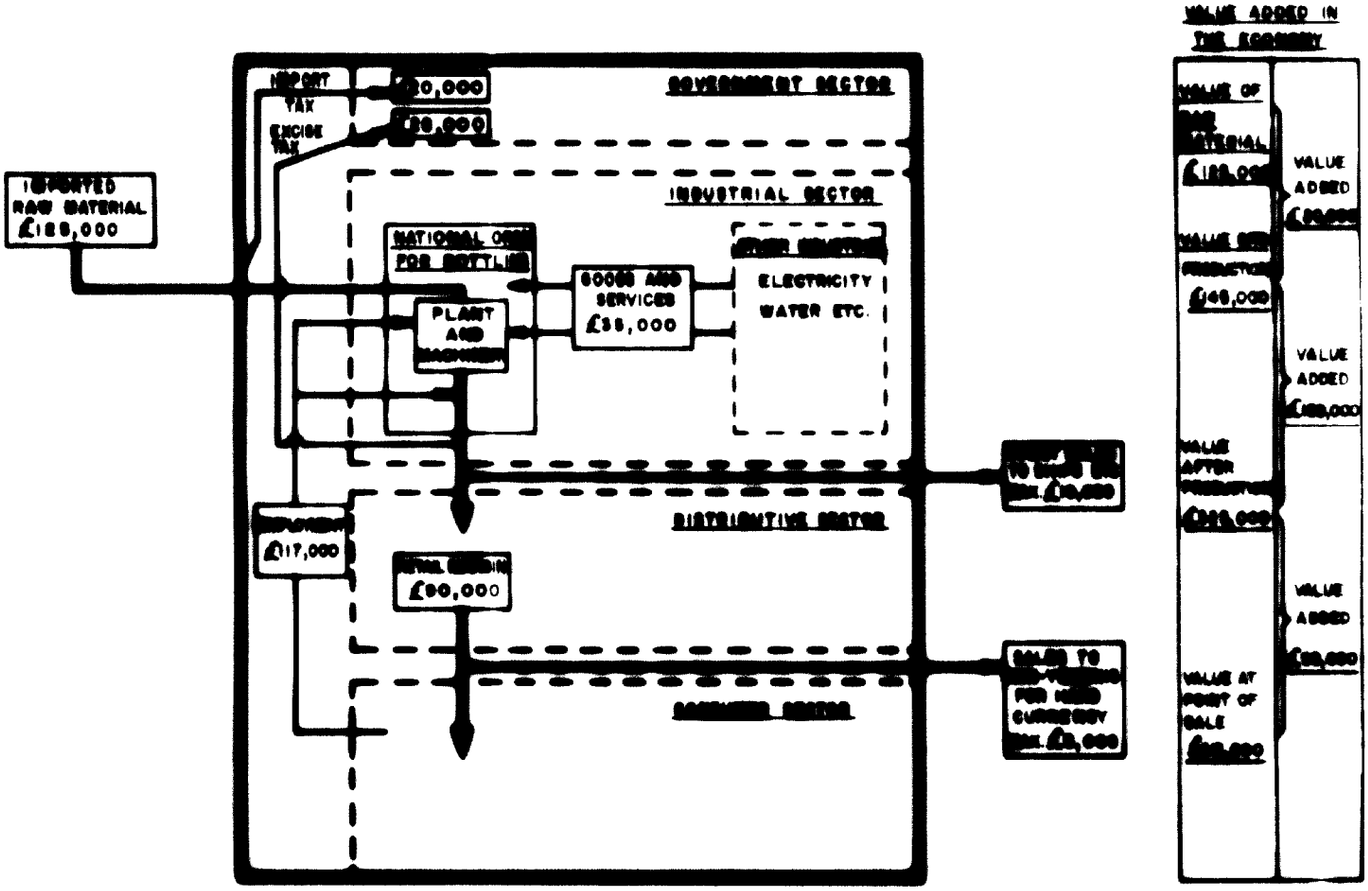
INDUSTRIAL PRODUCTION

		Base Year 1972	74/5	75/6	76/7	77/8	78/9
Gen. Electricity	mn KWH	148.8	161.2	217.6	234.5	252	268
Aluminimum Wares	T	119.2	140	160	180	240	300
Plastic House Wares	T	15.0	60	70	80	90	100
Plastic Shoes	000 Pr	400	450	700	1300	1500	1600
Leather Shoes	000 Pr	-	46	90	142	185	217
Tanned Hides	000	-	120	250	200	150	150
Matches	mn Boxes	30	40	40	41	42	43
Cotton	000 T	4.4	5.4	5.8	6.3	7.5	8.5
Cotton Textiles	mn Metres	-	-	2.4	5	6.5	7.2
Ready Made Clothes	000 Doz	34	34	35	35	36.0	37
Cigarettes	mn	-	360	400	440	480	520
Food Salt	000 T	74	74	120	150	150	150
Flour	000 T	-	-	-	14	34	56
Vegetable Oils	000 T	848	1000	1100	1200	2600	3000
Fish Oil	T	-	700	1000	1600	4000	4070
Fish Meal	T	-	2660	3800	6080	15200	15400
Canned Fish	MN Cans	-	-	-	-	5.1	15.0
Aerated Drinks	MN Bottles	14.4	$15.0^{+4.2}$	$15.5^{+3.3}$	$16.0^{+3.2}$	$16.5^{+3.1}$	$17.0^{+3.0}$

A DIAGRAM TO ILLUSTRATE EFFECTS OF BOTTLING INDUSTRY ON THE NATIONAL ECONOMY (1973/74)

EFFECT ON THE NATIONAL BALANCE OF TRADE

IMPORTS: - £128,000 NET DEFICIT - £110,000 EXPORTS: + £18,000



UNIDO PROJECT IS/PRY/72/026 - PRINCIPAL REPORT

NATIONAL ORGANISATION FOR BOTTLING AERATED WATER

ORIGINAL BUDGET 1974/75, PREPARED DECEMBER 1973

Sales Revenue		SYD
Soft Drinks (600,000 cases @ av. 520 fils/case)		311,920
Water		5,000
Ice		25,000
CO_2		7,200
	Sub Total	349,920
Other Revenue		4,000
	Total Revenue	353,720

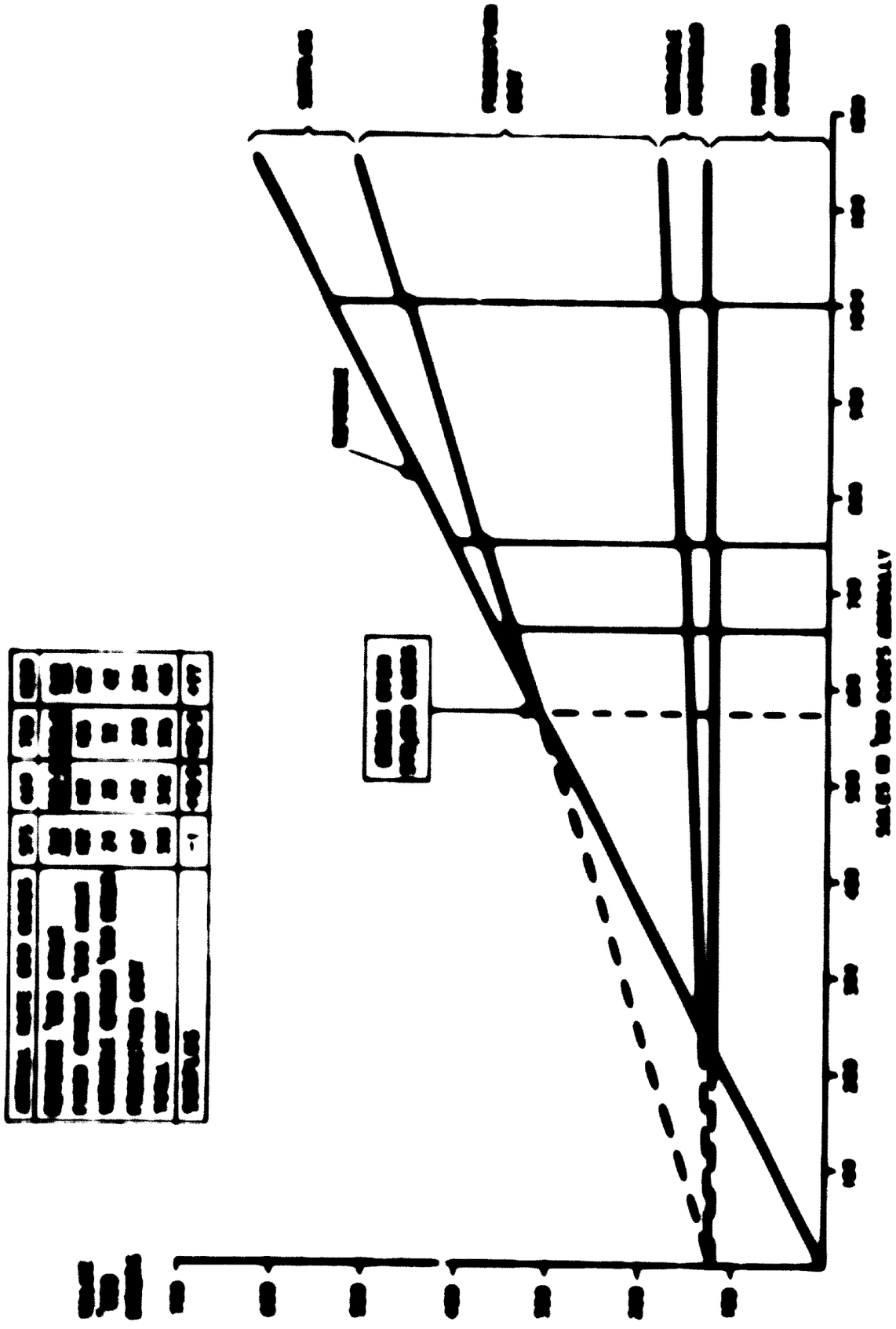
Costs		
Raw Materials (Beverages only)		135,164 *1
General Expenses (Salaries & Wages etc)		107,700
Other Factory Expenses		47,932 *2 *3
	Sub-Total Production Cost	290,796
Duty (2 fils per Bottle)		28,243
Expenses for Sales and Management		35,430 *3
	Total Costs	354,089
Plus Excess of Over Cost		631
		353,720

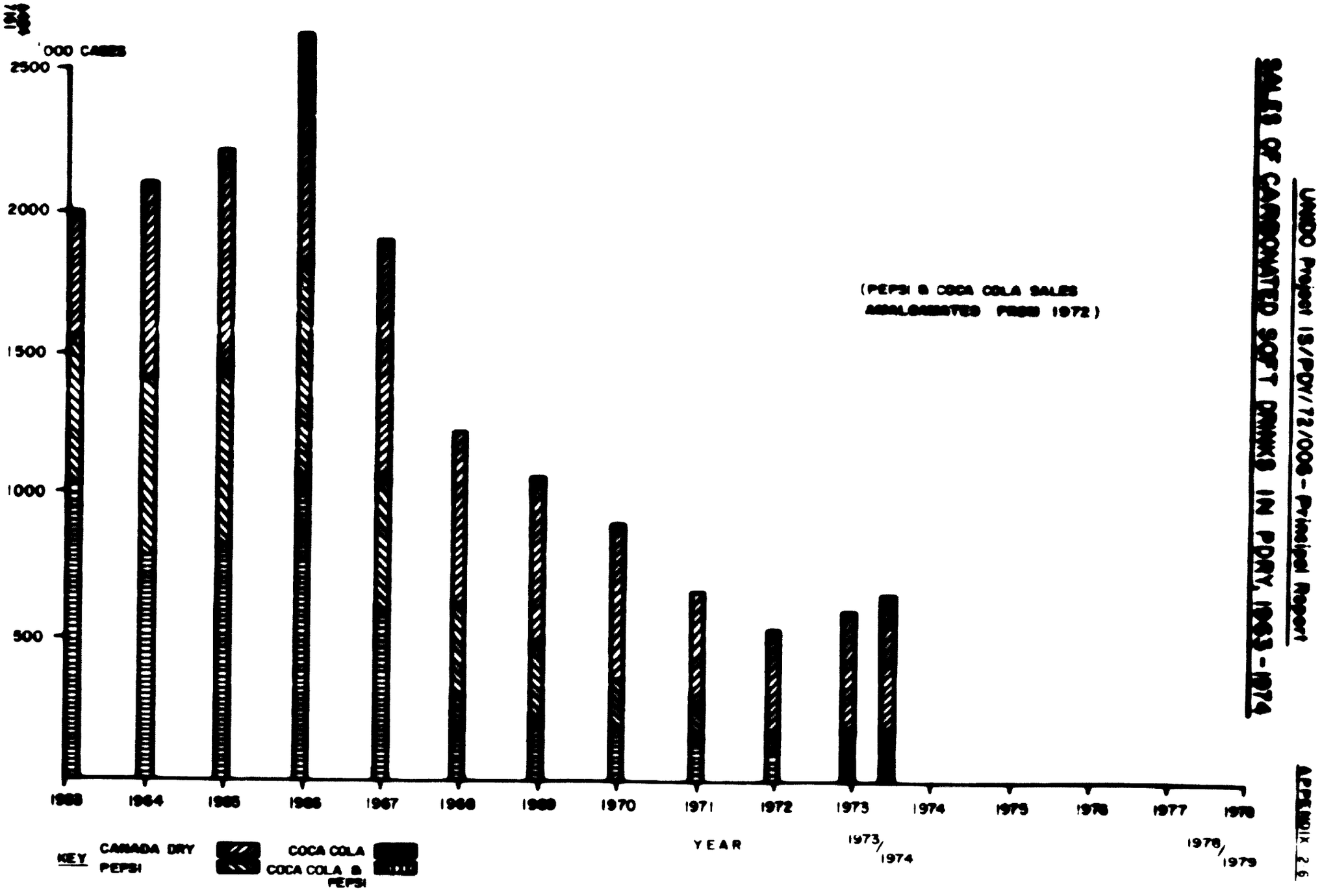
*1 Includes Sugar @ 57,400 SYD

*2 Includes Spare Parts for Machinery @ 6,000 SYD
and Depreciation @ 10,532 SYD

*3 Costs include Items Attributable to Operations other than Soft Drinks.

[redacted] BREAK-EVEN CHART





UNIDO Project IS/PDY/72/003 - Principal Report

SALES OF CARBONATED SOFT DRINKS IN PDRY 1963 - 1974

ANNEX 2.6

UNIDO PROJECT IS/PDY/72/006 - PRINCIPAL REPORT

PAST SALES BY PRODUCT TYPE AND FLAVOUR

Table 1 - Sales by Bottlers of Coca-Cola, Green Spot and Stim Brands

Brand	1965 Sales 000 Cases	1970 Sales 000 Cases
"Coke" Cola	388	67
Stim Orange	24	88
Stim Lemon	30	4
Stim Apple	11	8
Green Spot Orange	31	-
Green Spot Lemon/Lime	29	4
Schweppes Tonic	12	6
Schweppes Soda	10	6
Schweppes Ginger Ale	7	-
Schweppes Bitter Lemon	4	-
"National" Lemon	64	3
	829	189

Table 2 - Sales by Pepsi-Cola Bottlers

Brand	1970 Sales 000 Cases
"Pepsi" Cola	108.3
Mirinda Orange	13.9
Mirinda Lemon/Lime	2.6
Club Soda	4.1
	128.9

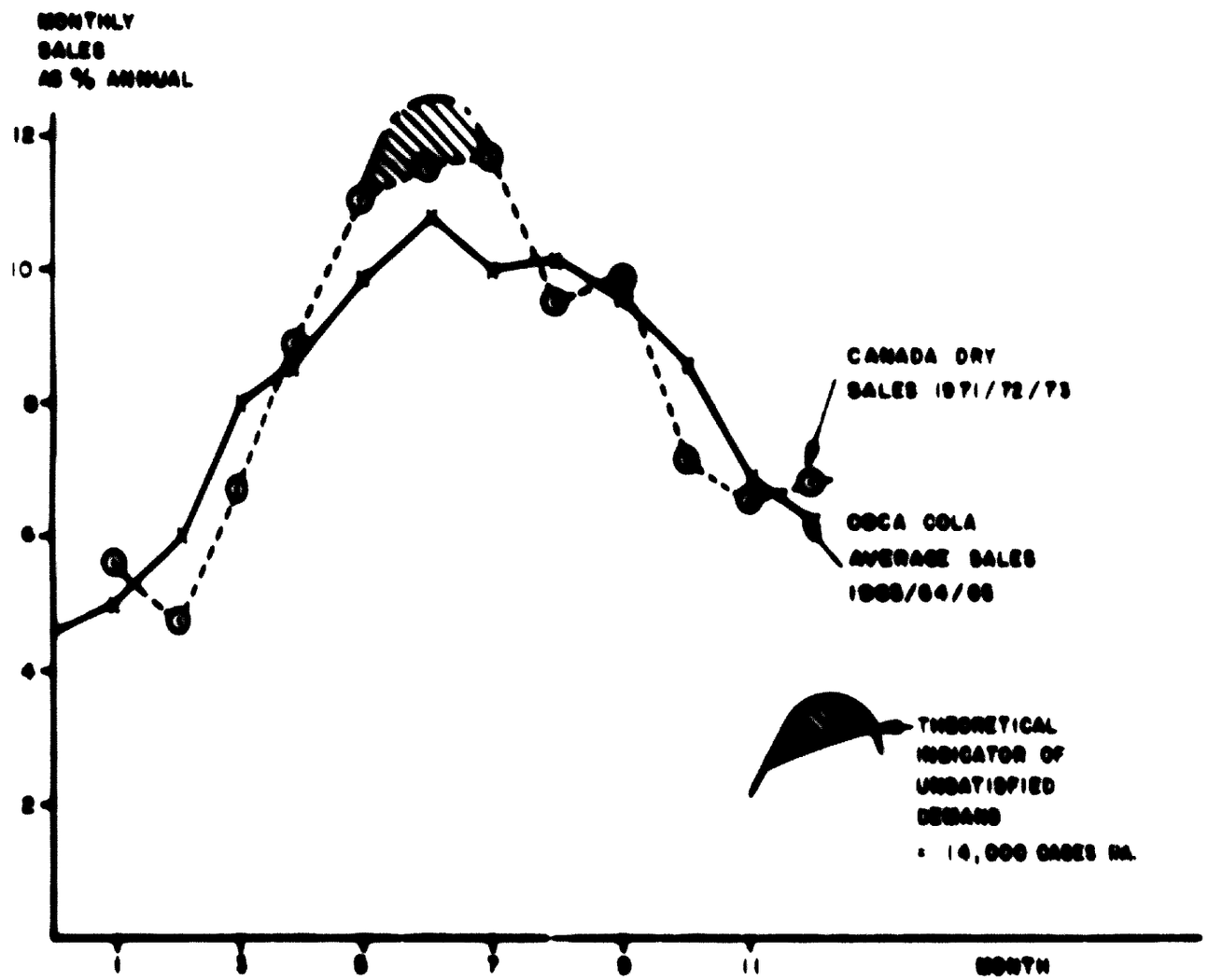
UNIDO PROJECT IS/PDY/72/006 - PRINCIPAL REPORT

SEASONALITY OF SOFT DRINKS SALES
1963/64/65 COMPARED WITH 1971/72/73

Month & Quarter	Previous Seasonality % Coca-Cola Sales 1963/64/65	Present Seasonality % 'National' Sales 1971/72/73
January	5.05	5.63
February	5.95	4.73
March	7.96	6.73
J/F/M Quarter	18.96	17.09
April	8.60	8.89
May	9.80	11.07
June	10.92	11.58
A/M/J Quarter	29.32	31.54
July	10.05	11.64
August	10.31	9.45
September	9.58	9.82
J/A/S Quarter	29.94	30.91
October	8.57	7.05
November	6.91	6.62
December	6.30	6.78
O/N/D Quarter	21.78	20.45
Total for Year	100%	100%

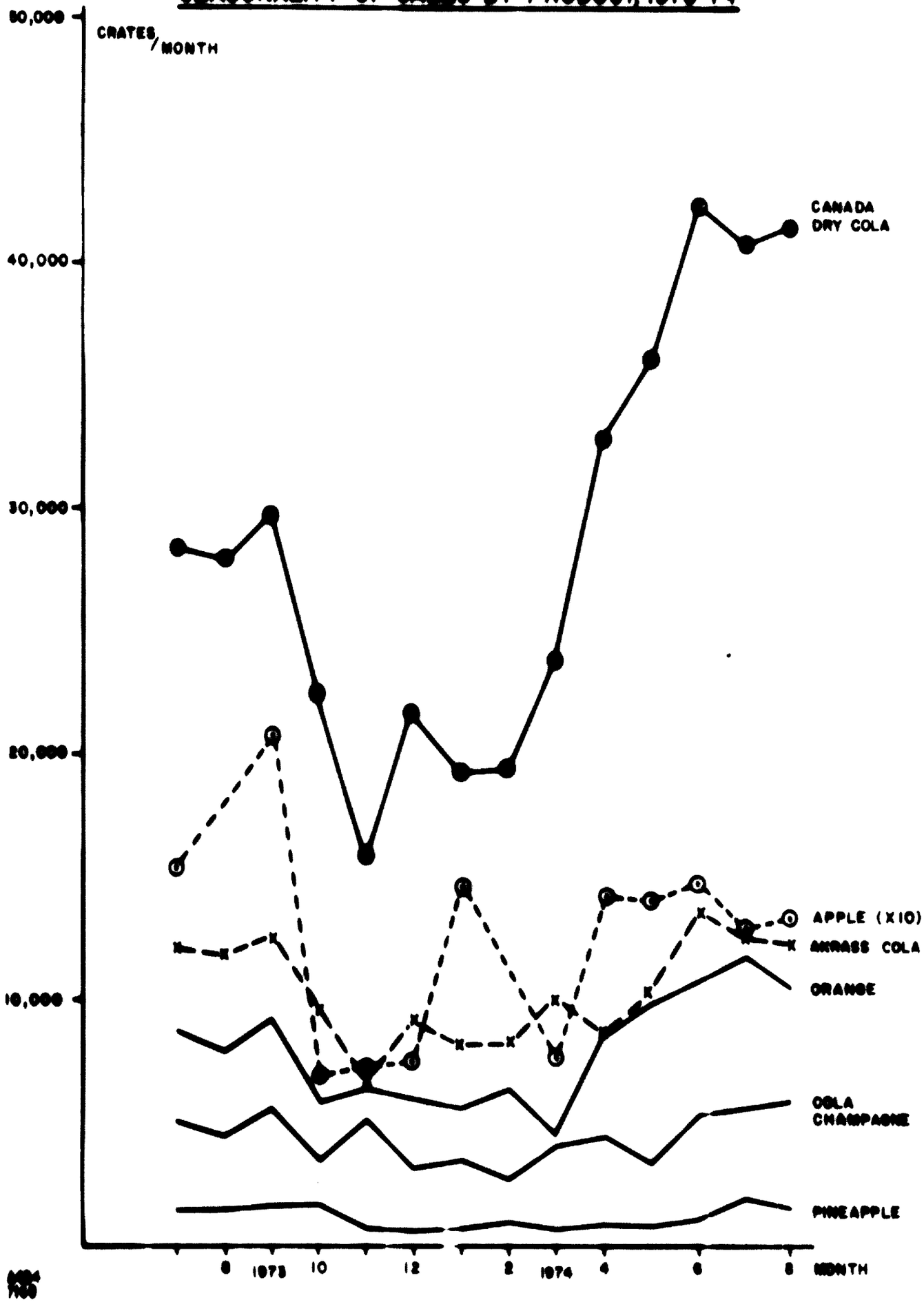
UNIDO Project 18/PDY/72/006 - Principal Report

SEASONAL SALES TRENDS



UNIDO Project IS/PDY/72/006-Principal Report

SEASONALITY OF SALES BY PRODUCT, 1973-74



UNIDO PROJECT IS/PDY/72/006 - PRINCIPAL REPORT

DISTRIBUTION OF SALES RELATED TO POPULATION IN DIFFERENT DISTRICTS

Sales Area/Governorate	Crate Sales 000	Bottle Sales 000	Population 000	Bottles Per Head
1st Governorate				
Aden - Crater	122.0	2,928	54.3	54.0
Ma'alla	61.0	1,464	47.0	31.1
Tawahi	78.4	1,882	16.5	114.4
Khormaksar	19.7	1,673	14.8	113.3
Mansoura				
Sheikh Othman	52.3	1,255	84.3	14.9
Dar Sa'ad				
Little Aden	43.6	1,046	25.5	41.0
Other Areas	8.6	206	50.6	4.1
Sub-Total 1st Governorate	435.6	10.454	291	35.9
2nd Governorate	125.0 estd	3,000	273	11.0
3rd Governorate	86.7 estd	2,081	311	6.7
4th Governorate	8.2 estd	197	162	1.2
5th Governorate	4.5 estd	108	451	0.2
6th Governorate	-	-	61	-
& Thamud	-	-	41	-
Sub-Total Other Governorates	224.4	5,386	1,299	4.1
Total Sales in Republic	660.0	15,840	1,590	10.0

UNIDO PROJECT IS/PDY/72/006 - PRINCIPAL REPORT

PRODUCTION COMPOSITION, COST AND PRICES (JULY 1974 VALUES)

(Quantities and costs are derived for 100 - 250 cc bottles, to facilitate comparison, whatever bottle size is used).

Product:-	Canada Cola	Akrass Cola	Canada Orange	Lemon Lime	Akrass Apple	Canada Cherry Cola	Canada Pineapple
Normal Bottle Size	10 oz	10 oz	250 cc	250 cc	250 cc	7 oz	7 oz
Constituents							
Essence (units)	0.025	0.003	0.017	0.006	0.011	0.012	0.010
Sugar (kg)	3.12	2.75	4.09	2.88	2.88	3.25	2.55
CO_2 (lbs)	0.69	0.41	0.58	0.61	0.60	0.96	1.17
Krassal (litres)	0.076	-	-	-	-	-	-
Bi - Flow (kg)	0.001	-	-	-	-	-	-
Sodium Benzoate (kg)	-	0.001	0.014	0.007	0.011	0.12	-
Citric Acid (kg)	-	0.006	0.052	-	0.120	0.017	0.13
Crowns (units)	96.5	89.5	103	109	103	125	125
Bottles (units)	0.33	0.63	0.85	0.66	2.05	0.24	0
Constituent Costs	Fils	Fils	Fils	Fils	Fils	Fils	Fils
Essence	304	199	365	152	202	227	99
Sugar	504	445	665	467	462	536	414
CO_2	55	41	45	74	47	77	93
Krassal	16	-	-	-	-	-	-
Bi - Flow	0	-	-	-	-	-	-
Sodium Benzoate	-	1	7	4	8	6	-
Citric Acid	-	-	-		48	7	14
Crowns	107	99	112	120	112	139	139
Bottles	7	13	12	12	41	5	-
Total costs of ingredients	993	800	1204	792	920	998	759
Total costs including all raw materials	1200	960	1444	950	940	1200	858
Total Costs [illegible]	[illegible]	960	1450	1055	1120	1245	1100
Wholesale Selling price per 100 bottles	2200	2200	2200	2200	2200	2400	2210
Wholesale price per crate	550	550	550	550	550	550	530
Retail price per bottle	30	30	30	30	30	30	30

UNIDO PROJECT IS/PDY/72/006 - PRINCIPAL REPORT

Representative Quality Measurement Results - Some Typical Figures

Plant: Mansoura

Product: Canada Cola

Bottle Size: 198 ml

Brix Standard = 11.5 Gas Volume Standard = 4.0

Filler Head	Date 1974	Time	Temp °F	°Brix	CO_2 P.S.I.	Gas Volumes	Remarks
3	21st Aug.	12.00	77	11.0	32.0	2.4	
18	21st Aug.	12.00	78	11.5	30.5	2.3	
3	24th Aug.	10.00	75	11.3	38.5	2.8	
18	24th Aug.	10.00	75	11.2	37.5	2.8	
3	26th Aug.	10.00	79.5	11.2	35.0	2.4	
18	26th Aug.	10.00	80.5	11.0	33.0	2.4	
3	28th Aug.	10.30	77	15.0	33.0	2.5	
18	28th Aug.	10.30	78	11.0	38.0	2.3	
3	31st Aug.	10.00	75	11.3	37.0	2.7	No improvement
18	31st Aug.	10.00	75	11.3	36.0	2.7	in carbonation
3	1st Sept.	11.00	79	11.5	37.5	2.6	during course
18	1st Sept.	11.00	81	11.5	33.0	2.3	of the study
3	3rd Sept.	12.00	79	11.5	38.0	2.6	
18	3rd Sept.	12.00	79	11.5	35.0	2.4	
3	7th Sept.	11.30	77	11.0	35.0	2.5	
18	7th Sept.	11.30	78	11.0	33.0	2.4	
3	9th Sept.	1.15	77	11.5	30.0	2.3	
18	9th Sept.	1.15	77	12.0	28.0	2.2	
-	11th Sept.	9.00	76	11.8	39.0	2.8	
-	11th Sept.	11.00	73	11.3	43.0	3.2	
3	15th Sept.	11.15	78	11.2	37.0	2.6	
18	15th Sept.	11.15	77	9.8	30.0	2.3	

Plant: Crater

Canada Cola Bottle Size 284 ml

Brix Standard = 11.5 Gas Volume Standard = 4.0

-	24th Aug.	12.15	75	11.5	41.0	3.0	
-	24th Aug.	12.15	77	11.8	40.0	2.8	Improvement in
-	24th Aug.	12.15	74.5	11.5	37.0	2.7	carbonation
-	18th Sept.	9.30				3.6	during study
-	18th Sept.	9.30				3.8	

UNIDO PROJECT IS/PDY/72/006 - PRINCIPAL REPORT

Representative Quality Measurement Results

Plant: Mansoura

Product: Champagne Cola

Bottle Size: 7oz (198 ml)

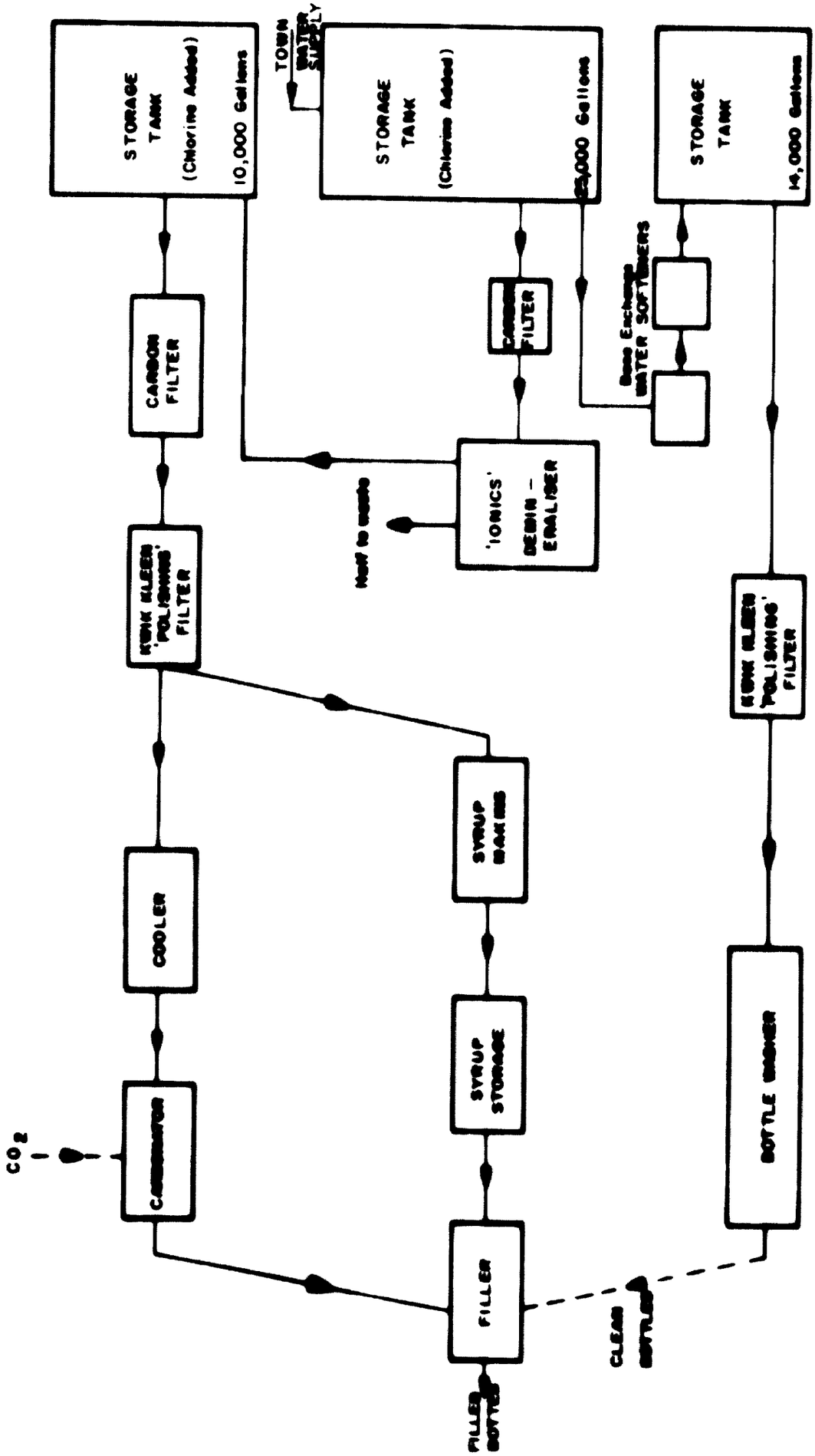
Brix Standard = 12 Gas Volume Standard = 2.5

Filler Head	Date	Time	Temp °F	Brix	CO_2 P.S.I.	Gas Volumes	Fill Ml
1	21st Aug '74	10.30	77	11.5	48.0	3.2	212
2			77	12.0	39.5	2.8	203
3			77	11.5	47.0	3.2	210
4			77	11.8	30.0	2.5	197
5			76	11.5	46.0	3.2	215
6			76	11.5	43.0	3.0	212
7			76	13.3	44.0	3.1	217
8			76	12.0	46.0	3.2	218
9			76	12.5	39.0	2.8	197
10			76	11.5	47.0	3.2	213
11			76	18.2	6.0	0.2	135
12			77	13.0	42.0	2.9	207
13			76	11.5	41.0	2.9	198
14			76	12.0	43.0	3.0	208
15			77	11.9	49.0	3.2	214
16			76.5	12.0	38.0	2.7	197
17			76.5	12.0	36.5	2.6	185
18			76.5	12.0	45.0	3.1	208
19			76.5	10.5	46.5	3.2	222
20			77	11.0	49.0	3.3	225

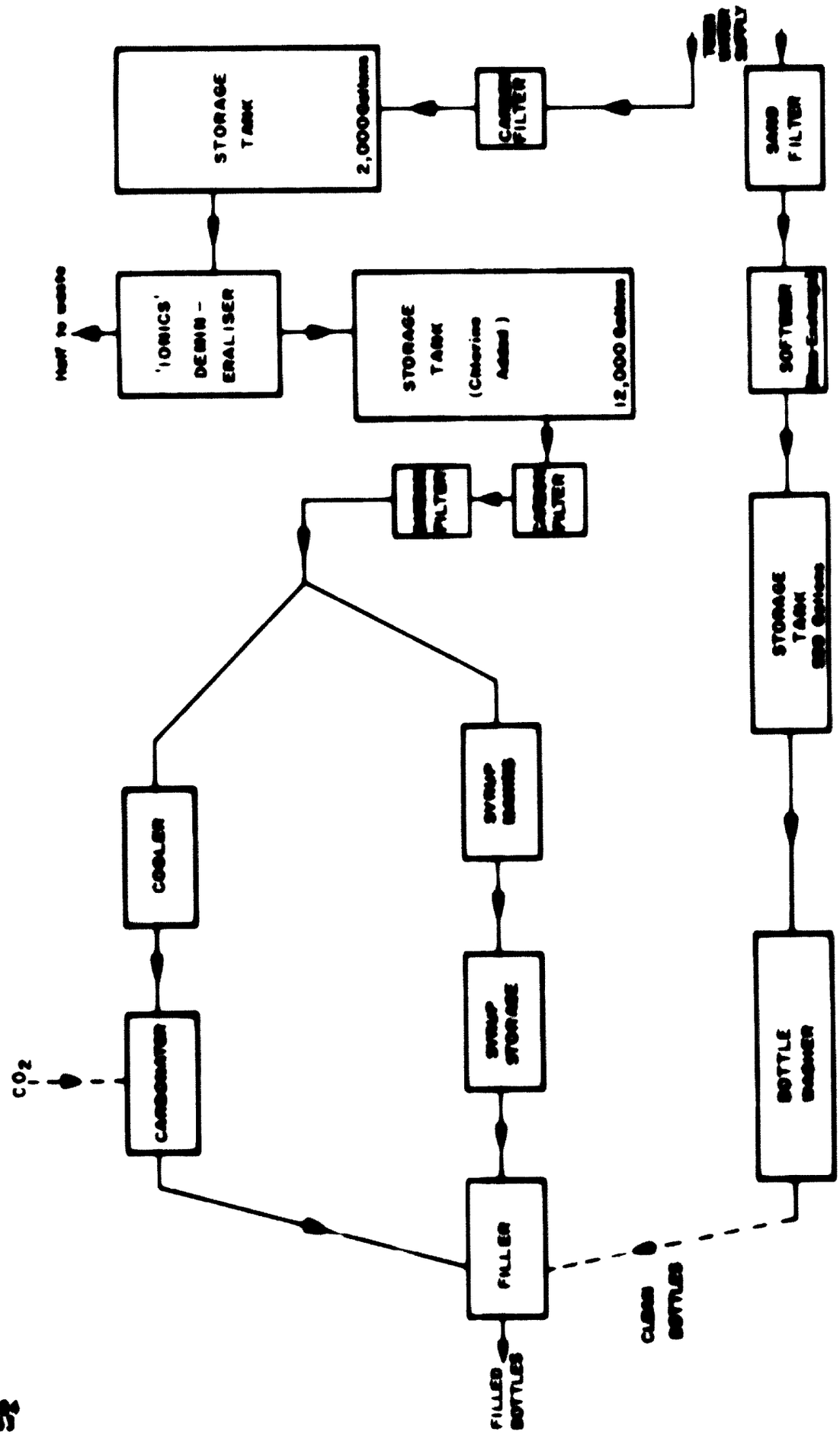
Summary of Results (Ignoring Head 11):-

Maximum	13.3		3.3	225
Minimum	10.5		2.5	185
Average	11.8		3.0	208
Range	2.8		0.8	40

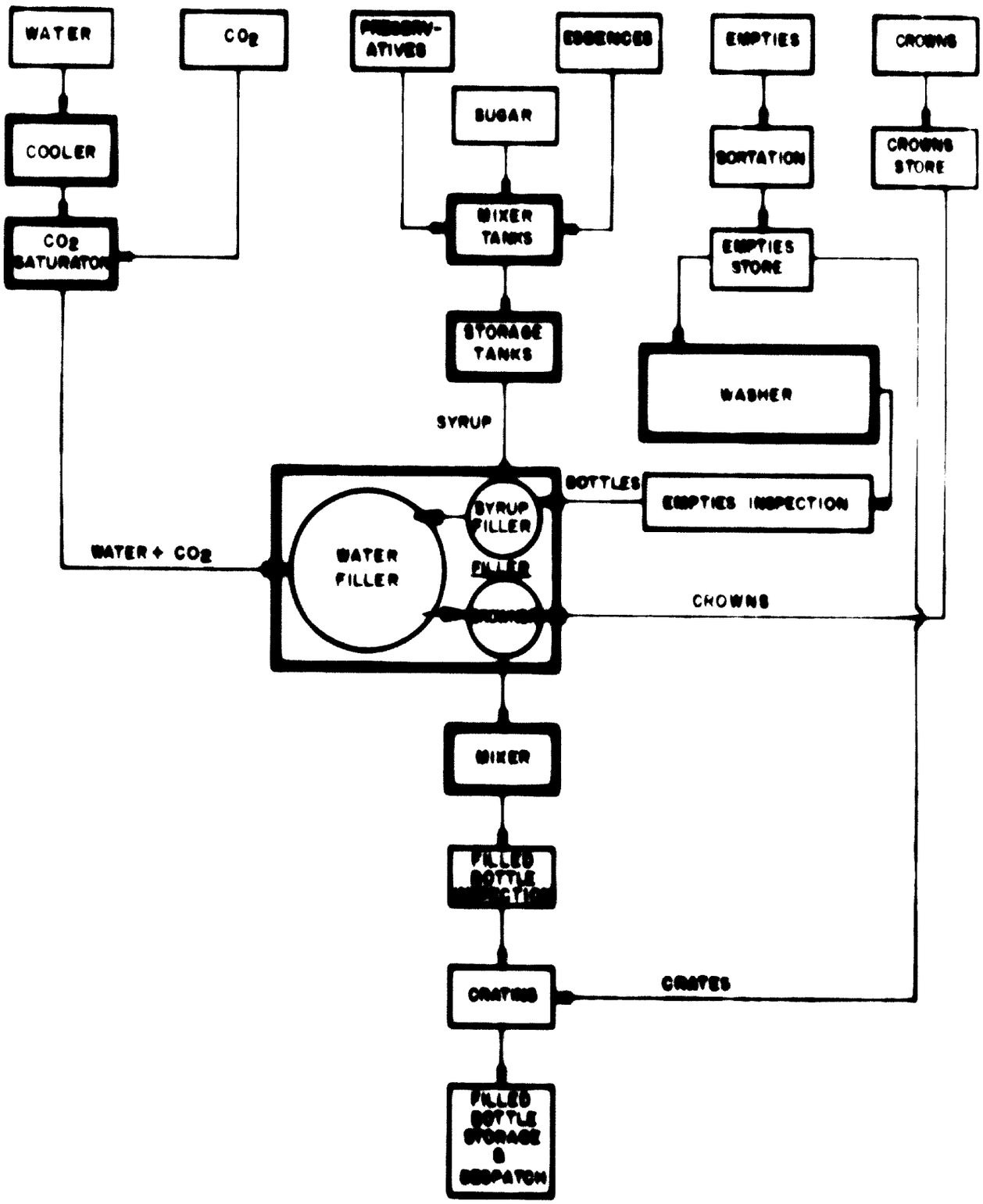
WATER FLOWS - MANSOURA PLANT



WATER FLOWS - CRATER PLANT



SCHEMATIC LAYOUT OF TYPICAL BOTTLING PLANT
(SEPARATE SYRUP & WATER SYSTEMS)



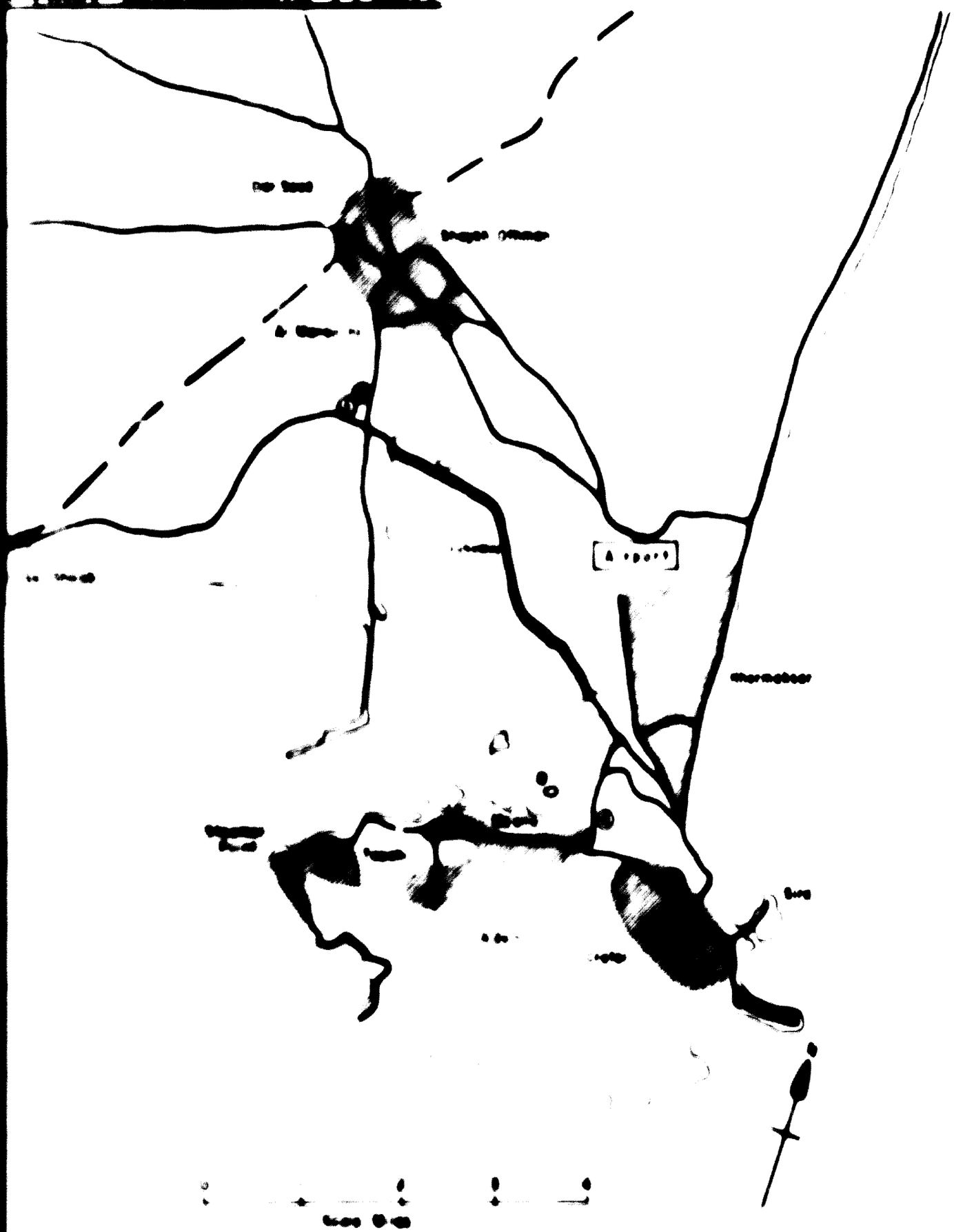
AREA & LIMITS OF FIRST GOVERNORATE

Population			
FH	ADEN	TAWAHI	18,664
		[illegible]	14,788
		CRATER	34,2[illegible]
		BA ALLA	47,[illegible]44
			[illegible]
	SHAAB	DAR SAAD	25,852
		[illegible]	28,[illegible]
		[illegible]	30,900
		[illegible]TTLE ADEN	23,522
			107,[illegible]93

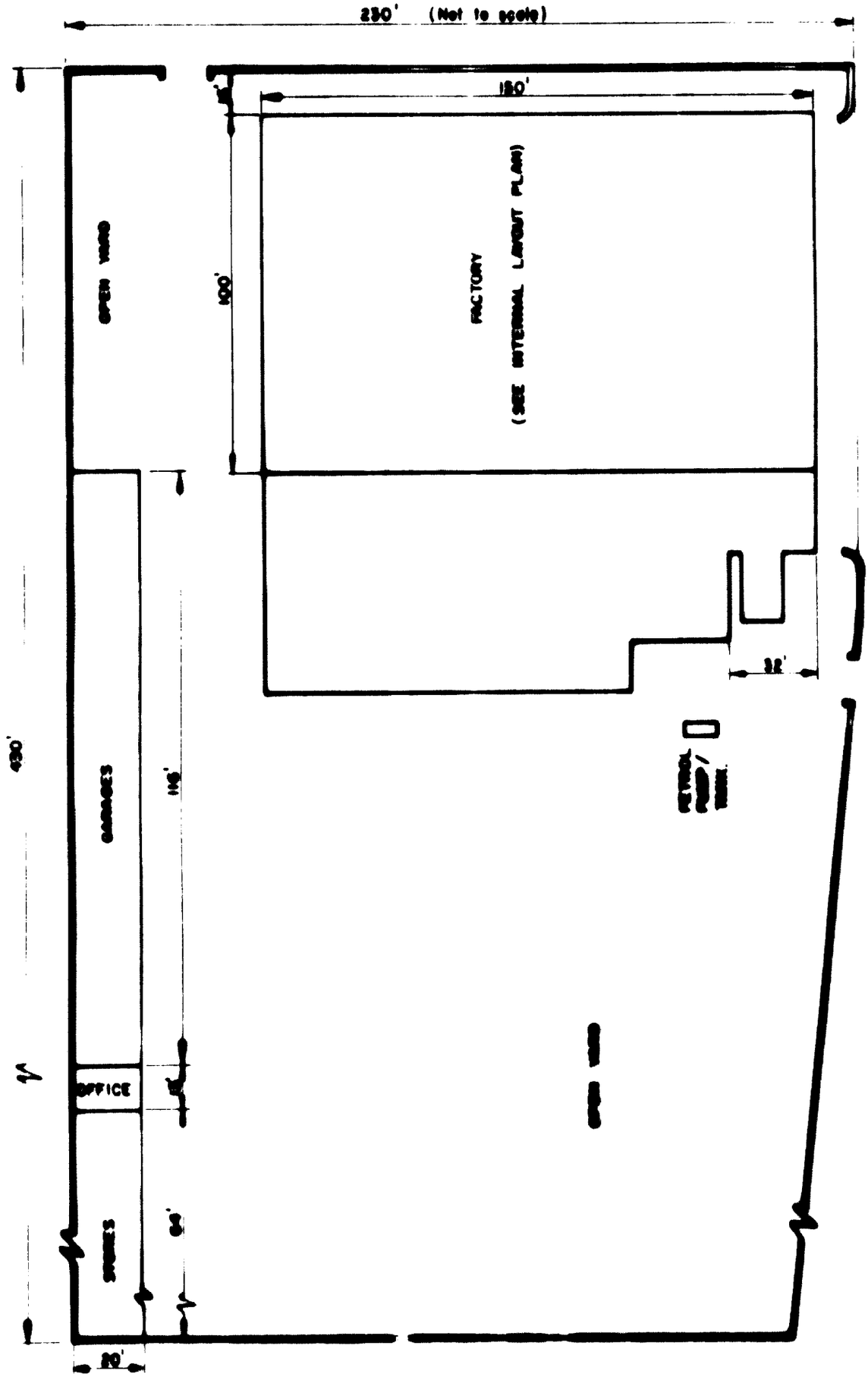
LEGEND

- Roads
- [illegible] of 2nd Governorate
- Sea [illegible]oof
- [illegible] Name of towns/districts
- Main Centres of population
- [illegible] Dry Factory
- Green Salt Factory
- Cocoa Cola Factory
- Hippo Cola Factory

SECTION 1



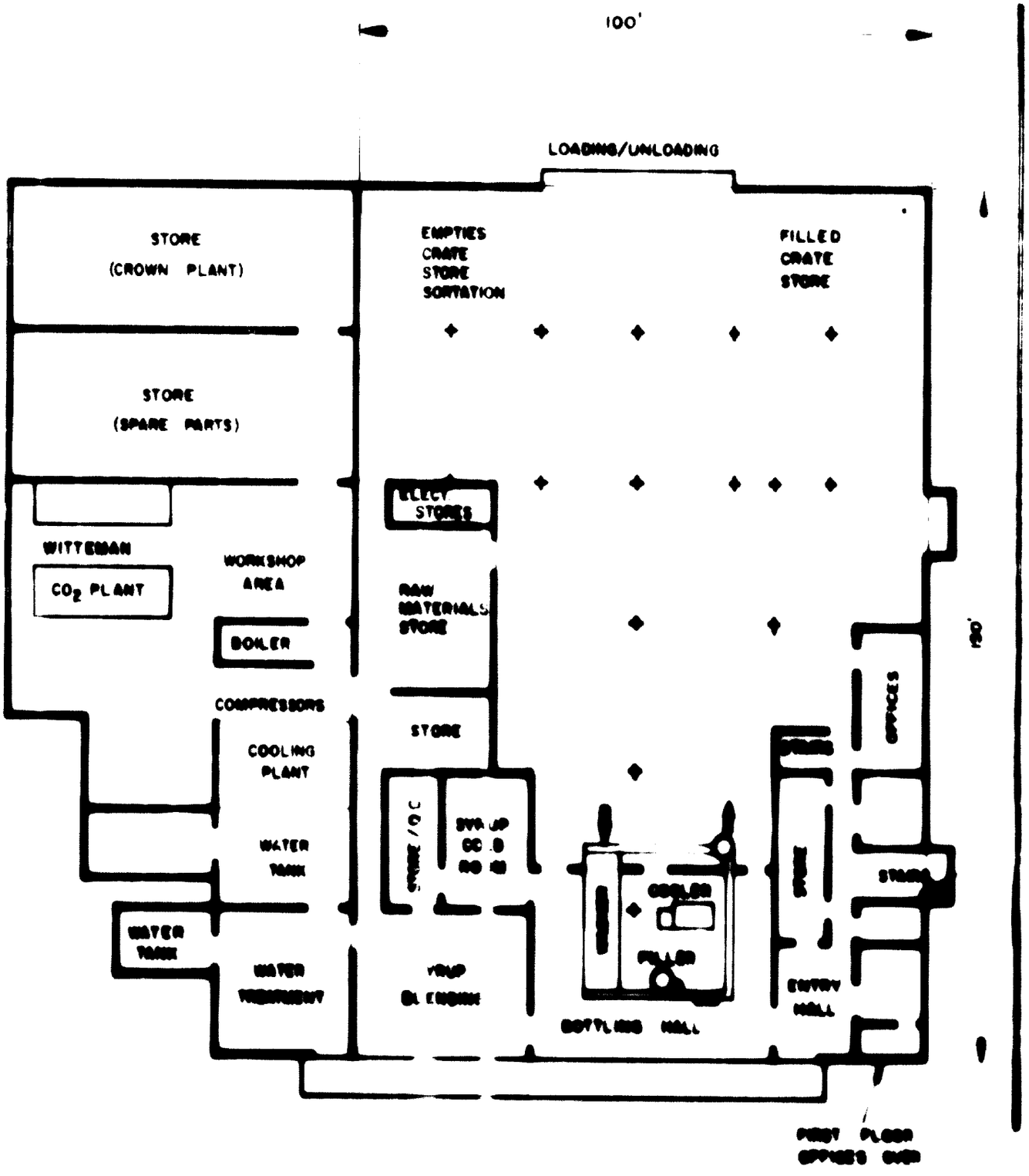
CANADA DRY, MANSOURA - SITE



CANADA DRY, MANSOURA - INTERNAL LAYOUT

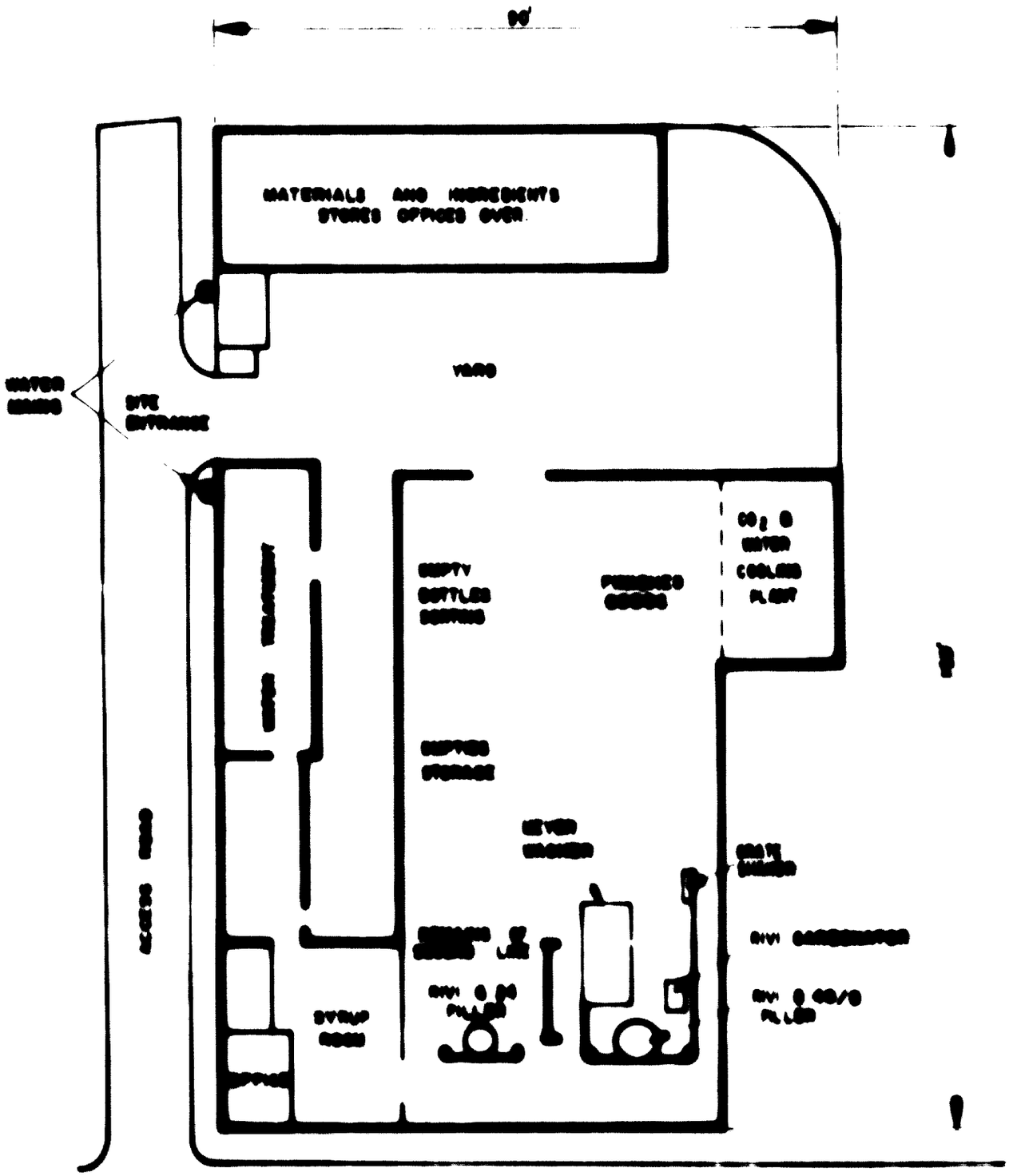
SCALE 24' - 1"

FLOOR AREA 18,000 □' APPROX



COCA COLA, CRATER - SITE LAYOUT

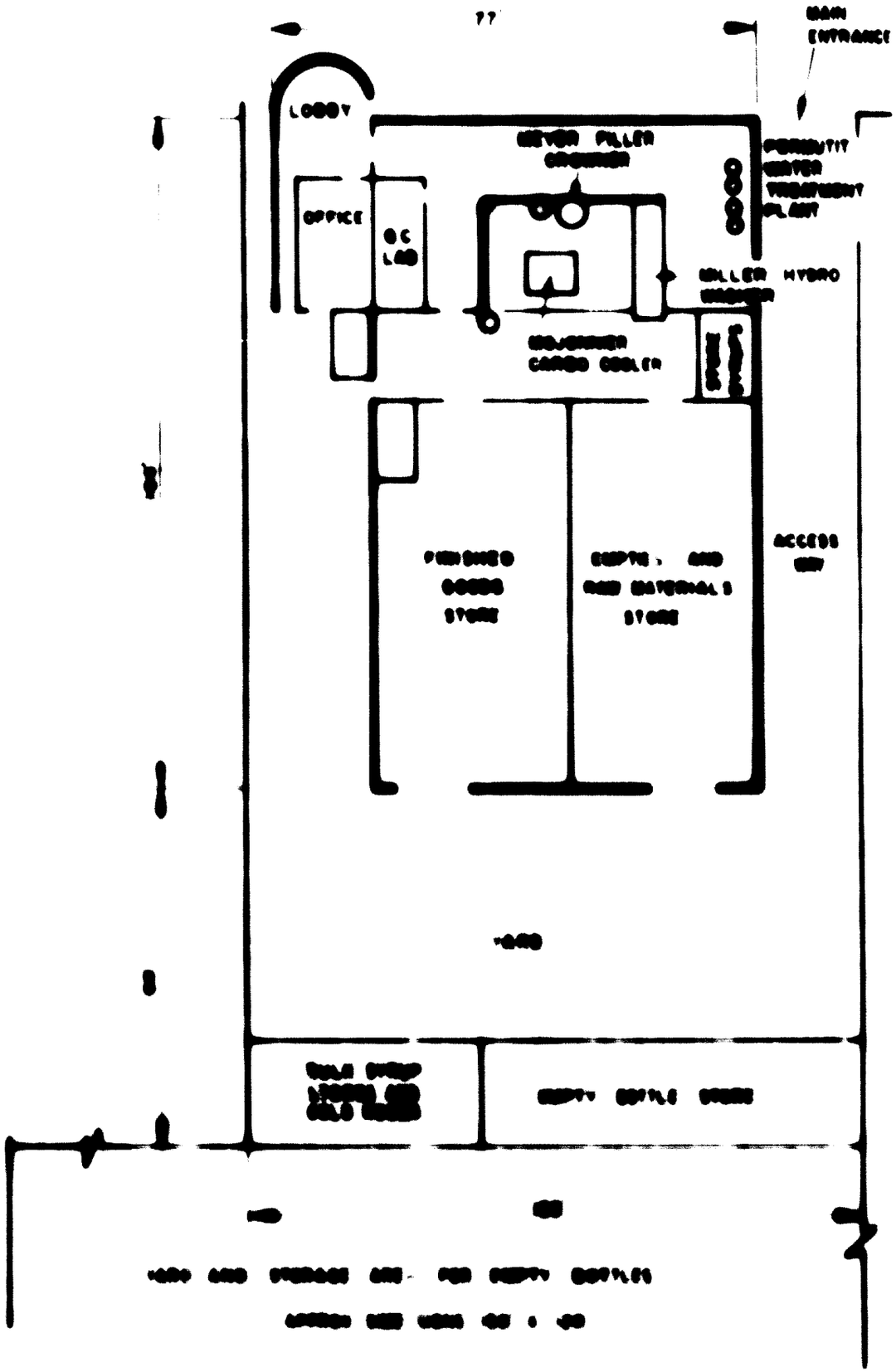
(approximate only)



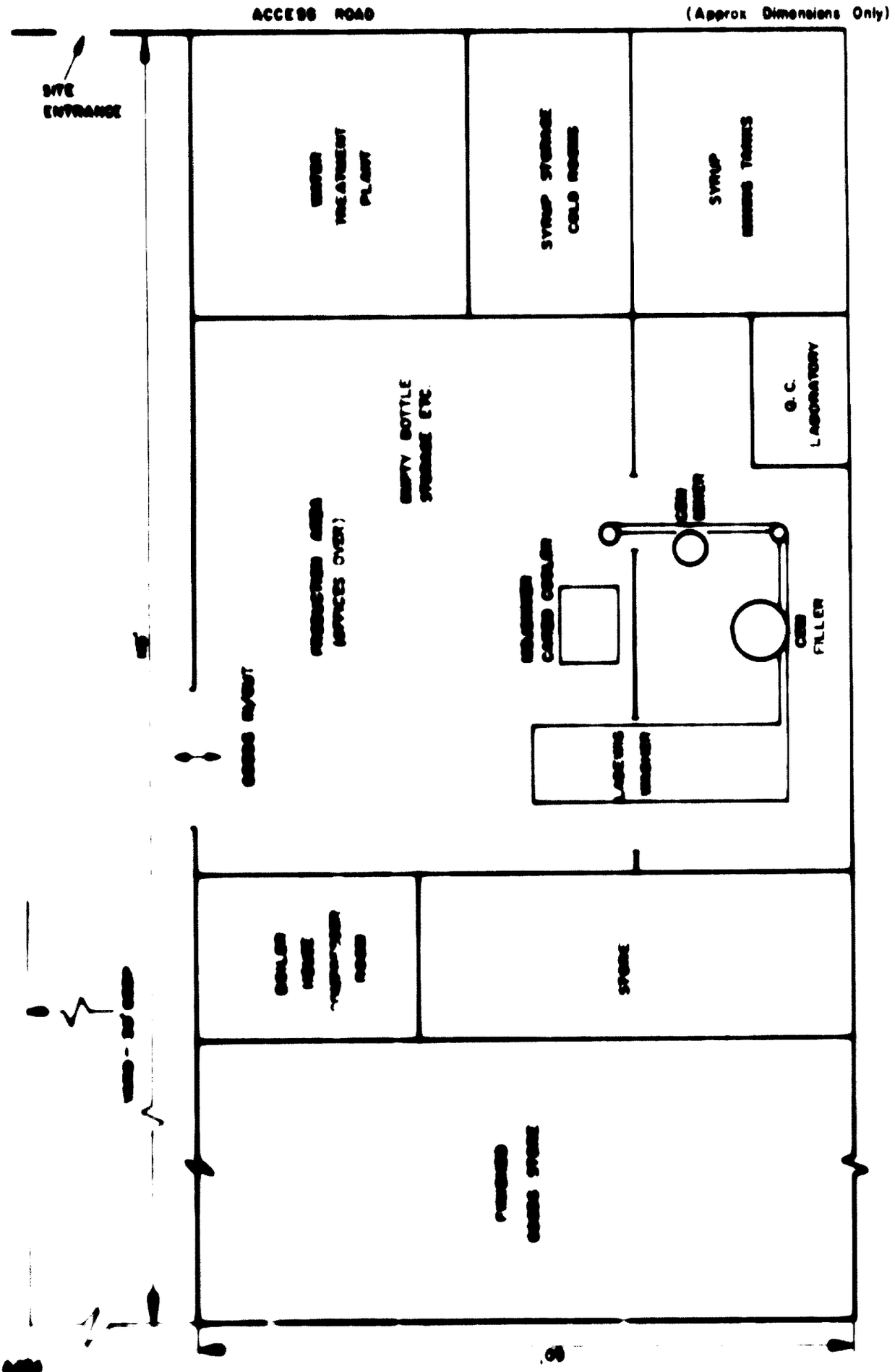
[illegible]

GREEN SPOT, MANSOURA - SITE LAYOUT

(approximate only)



PEPSI-COLA - MAALA



UNIDO PROJECT IS/PDY/72/006 - PRINCIPAL REPORT

NATIONAL BOTTLING ORGANISATION STAFF LEVELS AT SEPTEMBER 1974

Job Category	Mansoura	Crater	Sira & Burieka	Totals
General Manager & Staff	6	-	-	6
Sales Manager & Staff	6	-	-	6
Accounts Dept & Cashiers	14	2	-	16
Purchasing & Imports	1	-	-	1
Personnel Dept	2	-	-	2
Production Supervision	2	1	2	5
Mechanics	4	2	4	10
Operators	9	10	-	19
Labourers	30 (2 shifts)	17	24	71
Lift Truck Drivers	12	1	-	13
Watchmen	10	4	-	14
Garage Mechanics	4	-	-	4
Garage Assistants	7	-	-	7
Carpenters (Crate Repair)	3	-	-	3
Storekeepers	4	2	-	6
Sales Staff Drivers & Assistants	44	-	-	44
Sales Staff Sheikh Othman Branch	5	-	-	5
Green Spot & "Pepsi" Cola Watchmen	9*	-	-	9
Labourers & Watchmen on Leave	15*	-	-	15
Totals	187	39	30	256

* Staff not currently employed on Organisation's productive activities.

UNDP PROJECT 10/PNY/72/004 - PRINCIPAL REPORT

Water Analyses

Bacteriological Analysis

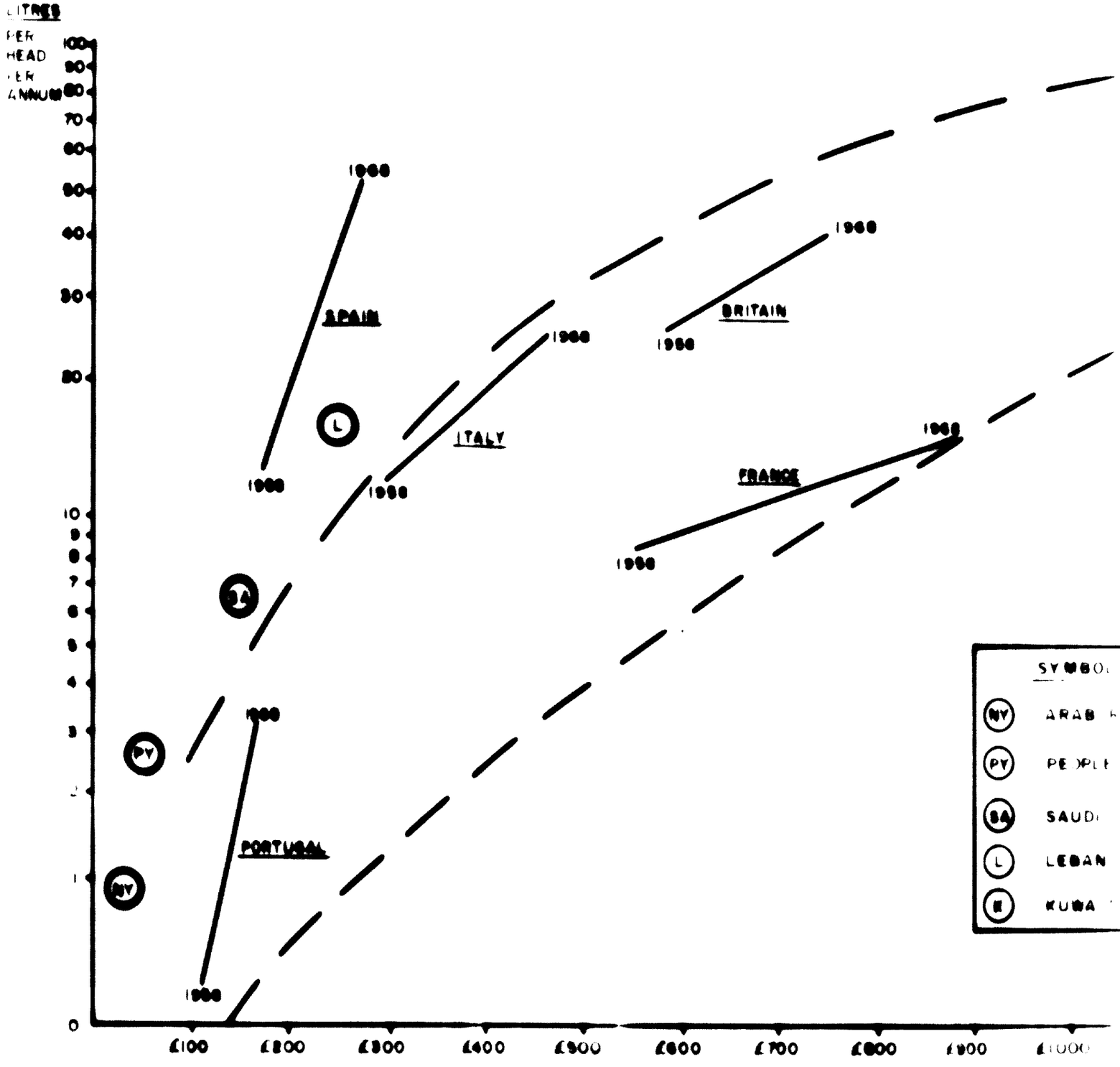
Plant:- / Date Sampled:-	Vanoeura 20/7/74	Vanoeura 24/8/74		Crater 24/8/74	
	Raw Water	Raw Water	After Treatment	Raw Water	After Treatmen
Total count per ml.					
1 Day at 37°C	[illegible]	6,600	4,000	200	4,800
2 Days at 37°C	8,000	10,600	25,000	24,000	64,000
3 Days at 22°C	10,000	14,600	11,200	32,000	2,000
Coliforms in 100 ml	Nil	Nil	Nil	Nil	Nil

Chemical Analysis (Parts per million - mg. per litre)

Plant:- / Date Sampled:-	Vanoeura 20/7/74	Vanoeura 18/9/74	Crater 18/9/74
	Raw Water	Raw Water	Raw Water
Total Dissolved Solids	1120	1 [illegible]	1470
Chloride (Cl)	[illegible]	[illegible]	[illegible]
Sodium (Na)	[illegible]	[illegible]	[illegible]
Zinc (Zn)	0.12	0.11	0.10
Lead (Pb)	0.01	0.01	0.01
Copper (Cu)	0.024	0.025	0.020
Iron (Fe)	0.10	0.08	0.08
Manganese (Mn)	0.000	0.000	0.005
Calcium (Ca)	65.0	51.0	57.0
Magnesium (Mg)	[illegible]	[illegible]	68.0
Sulphate (SO_4)	[illegible]	[illegible]	[illegible]
Total Alkalinity (as $CaCO_3$)	[illegible]	[illegible]	[illegible]
Total Hardness	[illegible]	[illegible]	[illegible]
pH	[illegible]	[illegible]	8.10

UNIDO Project IS/PDY/72/006 - Principal H

SOFT DRINKS CONSUMPTION RELATED TO PER C
INCOME



SECTION 1

RELATED TO PER CAPITA NATIONAL
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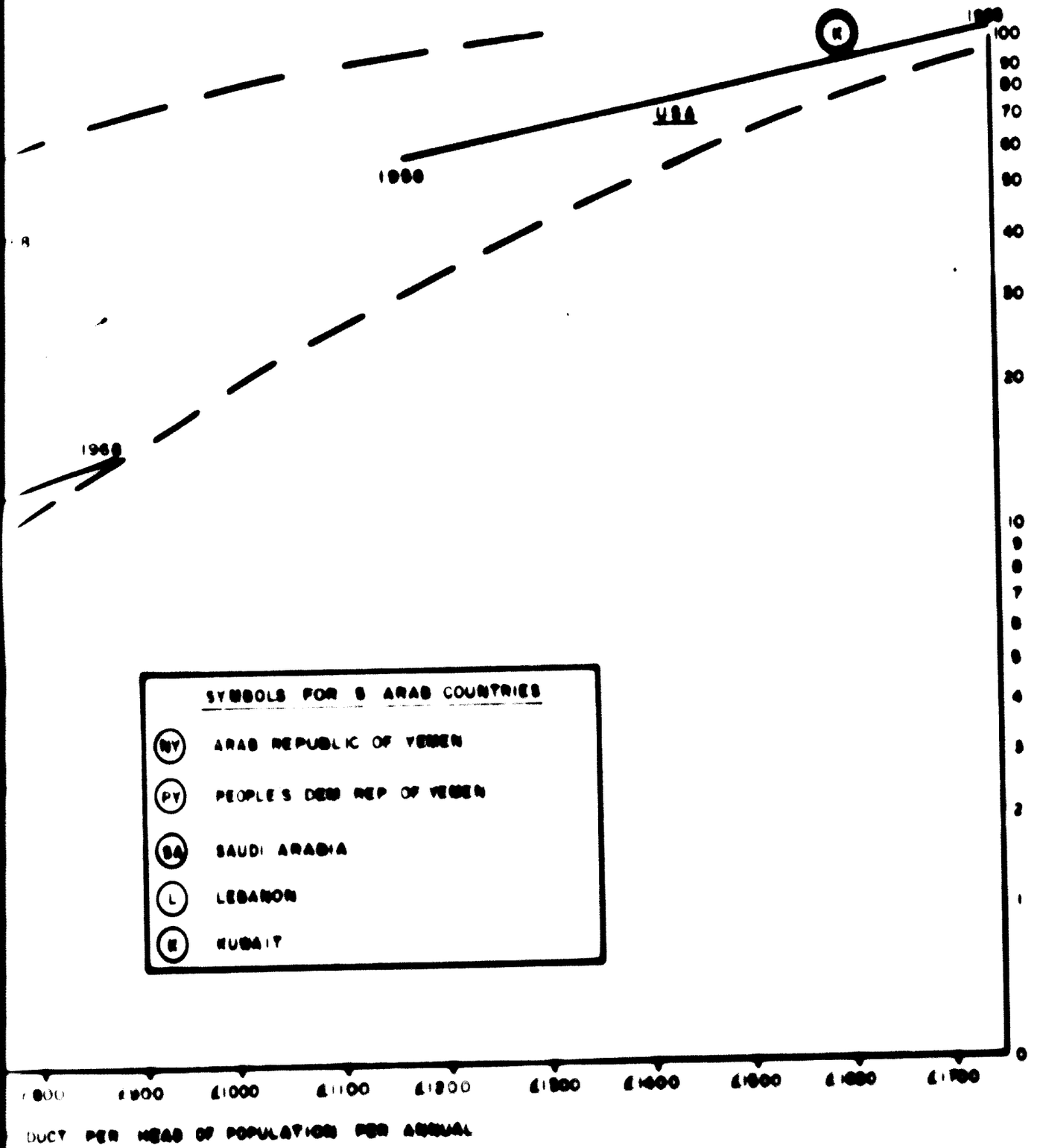

UNIDO PROJECT IS/PDY/72/006 - PRINCIPAL REPORT

BEVERAGES OTHER THAN SOFT DRINKS

IMPORTS OF BEER & "CONCENTRATES" (SQUASHES)

Beer Imports

Year	Quantity (Litres)	Value (C & F Aden) Yemen SYD
1967	1,730,423	190,123
1968	931,296	114,935
1969	1,343,224	109,145
1970	658,257	108,254
1971	801,655	120,715
1972	1,911,479	*888,160
1973	1,034,172	196,930

* Special Imports for 1972

1st Half 1972	876,531	131,232
2nd Half 1972	1,034,948	756,928

Concentrates (Squashes) Imports

Year	Quantity (Concentrated)	Value SYD	Quantity Equivalent (Ready to Drink) Colm. 1 x 5
1964	1,635,930	37,039	8,180,000
1965	1,019,977	20,995	5,100,000
1966	1,502,284	31,091	7,510,000
1967	882,285	18,916	4,410,000
1968	290,030	5,730	1,450,000
1969	313,153	6,081	1,570,000
1970	70,792	2,000	355,000
1971	35,000	1,103	175,000
1972	6,036	236	30,000
1973 (1st Half)	270	14	1,350

License to import withdrawn in 19 1 but imports now reintroduced in August/September 1974.

UNIDO PROJECT IS/PDY/72/006 - PRINCIPAL REPORT

SHIPPING - PORT OF ADEN

Table 1 - Shipping Activity (Port of Aden) 1962 to 1973

Year	No. of Ships	Net Registered Tonnage (000T)	Transit Passengers
1962	5929	28,946	203,975
1963	6206	30,340	186,787
1964	6416	31,738	198,165
1965	5727	28,462	146,300
1966	6246	31,426	128,420
1967	Figures incomplete and not available		
1968	1382	6,101	880
1969	1568	8,089	2,519
1970	1613	8,174	2,532
1971	1466	6,512	1,955
1972	1371	5,595	Figures not available
1973	1320	5,542	

Source: Yemen Ports Corporation (Port of Aden)

Table 2 - Forecast of Future Shipping Traffic (Port of Aden)

Year	No. of Ships Total	Net Registered Tonnage (Millions of Tons)	Suez Canal Traffic No. of Ships incl. in Colm. 2
1973/74 Actual	1,320	5.5	NIL
1974/75 Estd.	1,280	5.5	NIL
1975/76 Estd.	3,600	22	2,900
1976/77 Estd.	4,570	28	3,700
1977/78 Estd.	4,990	29	3,900
1978/79 Estd.	4,940	30	3,600

Schedules of Principal Spare Parts Required for Overhaul of Bottling Machinery

As required by their terms of reference, the experts have prepared lists of principal spare parts for each major item of equipment. These lists were prepared after detailed study of the condition of the machines and with reference to the Maintenance Manuals and Spare Parts Catalogues where these were available.

For each item the spare parts are divided into those which are not locally available and those which can be made locally as and when required.

Canada Dry Plant, Mansoura

1. Washer

Archie Ledgwin Bottle Washing Machine 12 Wide Model No. 2200A700
Spare Parts to be Ordered from Supplier

Part No.	Quantity	Description
2	1	Drive Gear
3	2	Bearing
5	1	Set-up Cam
6	1	Drive Sprocket
7	1	Lifter Cam
8	1	Ejector Cam
10	1	Speed Reducer Gear
12	3	Drive Belt
14	1	Variable Speed Pulley
20	1	Safety Sheave Assembly
34	1	Main Drive Chain
37	2	Bearing
41	2	Cam Roller
44	2	Sprocket
46	2	Bearing
47	1	Drive Gear
48	1	Drive Gear
51	2	Bearing
52	1	Pinion
53	1	Sprocket Pinion Assembly
55	4	Gasket
56	4	Bearing

61	1	Sprocket
62	4	Gasket
63	4	Bearing
64	4	Gasket
70	1	Sprocket
71	2	Gasket
73	1	Load Drive Sprocket
74	2	Bearing
81	2	Bearing
86	2	Bearing
88	1	Load Safety Assembly
89	0	Load Chain Sprocket
91	2	Bearing
93	1	Drive Sprocket
94	1	Oscillator Drive Sprocket
95	1	Oscillator Drive Chain
98	2	Bearing
99	0	Idler Pulley
101	2	Bearing
102	1	Oscillator Drive Sprocket
121	2	Pin
125	1	Spring
130	1	Precision Screw
134	1	Precision Valve Lever Stud
135	1	Pin
141	1	Air Cylinder
142	1	Air Cylinder Piston
143	4	Piston Rubber O'Ring
144	1	Air Cylinder Stud
148	1	Pin
150	1	Stud for Air Cylinder Lever
151	1	Pin
154	1	Pin
159	1	Pin
161	2	Manhole Cover Gasket
166	0	Clean-out Cover Gasket
172		Set Collar
174	2	Bearing
182	1	Bearing Plate
183	1	Bearing Plate
184	1	Damper Lever
185	1	Drive Lever
188	1	Ejector Cam Lever Stud
189	2	Ejector Cam Roller
192	1	Pin
198	2	Bearing
201	1	Safety Stop Wheel
202	1	Safety Stop Switch
205	1	Lever
206	1	Limit Plate

[illegible] PLANT

211	1	Cam Roller
212	1	Safety Stop Assembly
213	1	Pin
214	1	Manifold
215	1	Pin
216	1	Pin
217	1	Counter Balance Spring
218	6	Rubber Gasket
219	24	Fresh Water Nozzles
220	18	Semi-Fresh Water Nozzles
221	1	Centering Frame Catch
222	12	Alkali Removal Rinse Nozzles
223	1	Clevis Pin
224	48	Wash Chamber Nozzles
225	1	Double Sprocket
226	1	Load Drive Chain
227	1	Load Drive Chain
228	1	Safety Stop Switch
229	1	Load Conveyor Drive Chain
230	24	Prerinse Nozzles
231	1	Main Washer Chain
232	30	Bottle Carrier
233	12	Load Infeed Conveyor Chain
234	12	Load Guide
235	1	Pump Drive Motor
236	1	Pump
237	1	Motor Pulley
238	1	Pump Pulley
239	1	Pump Drive Belt
240	1	Overload Shield
241	1	Recharge Strainer Assembly
242	1	Washer
243	1	Spring
244	1	Screen
245	1	Gauge Cock
246	1	Pressure Gauge
247	1	Adjusting Cock
248	1	Adjusting Cock
249	1	Adjusting Cock
250	1	Adjusting Cock
251	1	Adjusting Cock
252	1	Valve
253	1	Valve
254	1	Valve
255	1	Adjusting Cock
256	1	Prerinse Whistle Valve
257	1	Screen for Semi-Fresh Water Tank
258	1	Drain Valve
259	1	Valve
260	1	Steam Strainer

336	1	Regulator
337	1	Thermometer
338	1	Regulator Bulb
340	1	Steam Trap
341	1	Steam Trap
342	1	Solution Level Gauge Valve
344	1	Pump Drive Motor
345	1	Pump
346	1	Motor Pulley
347	1	Pump Pulley
348	1	Pump Drive Belt
351	1	Pump Suction Gland
355	1	Adjusting Cock
356	1	Screen
357	1	Drain Valve
358	1	Bath Tank Regulator
362	1	Regulator for Alkali Tank
361	1	Thermometer for Bath Tank
364	1	Swing Check Valve
365	1	Silent Heater
366	1	Regulator Bulb
368	1	Bath Solution Circulating
371	1	Clevis Pin
376	1	Clevis Pin
377	1	Safety Stop Assembly
378	1	Safety Stop Spring
380	12	Rubber Stop for Ejector
384	1	Clevis Pin
388	1	Safety Stop Spring
394	3	Hose Clamp
395	1	Hose Nipple

[redacted]

[redacted]	[redacted]	[redacted]
[redacted]	1	Load Stop Pin
[redacted]	12	Discharge Guide
[redacted]	1	Knockout Angle
[redacted]	12	Elevator Flapper
[redacted]	1	Safety Stop Lever
[redacted]	1	Stage Plate for Automatic Stop
[redacted]	1	Discharge Receiving Guide
[redacted]	1	Previous Pipe
[redacted]	12	Previous Guide
[redacted]	12	Separating Pieces for Load Plate
[redacted]	1	Load Plate
[redacted]	4	Outside Alkali Spray Pipes
[redacted]	1	Outside Alkali Removal Steam Pipe
[redacted]	1	Outside Alkali Removal Spray Pipe
[redacted]	4	Outside Salt-Fresh Water Spray Pipe
[redacted]	1	Outside Fresh Water Spray Pipes
[redacted]	1	Discharge Conveyor Support
[redacted]	1	Discharge Conveyor Support
[redacted]	1	Header Pipe for Fresh Water
[redacted]	1	Header Pipe for Salt-Fresh Water
[redacted]	1	Header Pipe for Alkali Removal Steam Header
[redacted]	1	Rods for Stop Header
[redacted]	1	Rods for Stop Header
[redacted]	1	Previous Pipe

) Fillers

[redacted] Serial No. [redacted]

Spare Parts to be Ordered from Supplier

Item No.	Part No.	Quantity	Description
[redacted]	[redacted]	1	Grouper [redacted] Thrust Bearing Top Plate
[redacted]	[redacted]	1	Grouper [redacted] Thrust Bearing Bottom Plate
[redacted]		1	Worm Gear Reducer
	[redacted]	1	Pipe Bend
	[redacted]	1	Piping
[redacted]	[redacted]	1	Oil Inlet Nipple
	[redacted]	1	Pipe Bend
	[redacted]	1	Drop Out
[redacted]	[redacted]	1	Perforator Drive Joint Flange
[redacted]	[redacted]	1	Perforator Drive Joint Flange Sleeve
[redacted]	[redacted]	1	Perforator Drive Joint
	[redacted]	1	
	[redacted]	1	Perforator Drive Reducer
[redacted]	[redacted]	2	Drive Belt (Fast Feed Speed Pulley)
[redacted]	[redacted]	1	Bottle Lift Cylinder Cover Assembly
[redacted]	[redacted]	[redacted]	Bottle Lift Cylinder Bushing
[redacted]		[redacted]	Bottle Lift Cylinder Assembly
[redacted]		[redacted]	Bottle Plunger Spring
[redacted]	[redacted]	1	Filling Valve Carrier Sub Assembly
[redacted]	[redacted]	[redacted]	Filling Valve Adapter and Nozzle Assembly
[redacted]	[redacted]	[redacted]	Filling Valve Sealing Washer
[redacted]	[redacted]	[redacted]	Filling Valve Sealing Disc
[redacted]	[redacted]	[redacted]	Filling Valve Centering Ball Washer
[redacted]	[redacted]	[redacted]	Filling Valve Adapter Washer (Middle)
[redacted]	[redacted]	[redacted]	Filling Valve Adapter Washer (Lower)
[redacted]	[redacted]	[redacted]	Filling Valve Body Washer
[redacted]	[redacted]	1	Water Gauge Valve (Upper)
[redacted]	[redacted]	1	Water Gauge Valve (Lower)
[redacted]	[redacted]	1	Water Gauge Packing Washer (Brass)
[redacted]	[redacted]	1	Water Gauge Glass Packing (Rubber)
[redacted]	[redacted]	2	Water Gauge Glass
[redacted]	[redacted]	2	Water Gauge Nut Cone
[redacted]	[redacted]	1	Fresh Plunger Washer
[redacted]	[redacted]	2	Grouper and Counter Transfer Bearing Plate (2 pieces - Front)
[redacted]	[redacted]	2	Grouper and Counter Transfer Bearing Plate (2 pieces - Rear)
[redacted]	[redacted]	2	Grouper and Counter Star Wheel
[redacted]	[redacted]	1	Grouper Chain Bearing
[redacted]	[redacted]	1	Grouper to Filler Transfer Spider Shaft Bearing
	[redacted]	[redacted]	8 rpm

[illegible] Parts List

CP-10-11	12761	20	Sprayer and Fertilizer Dial Digger Screw
CP-10-12	66520	20	Sprayer and Fertilizer Dial Digger Screw Washer
	CP115	20	Screw
	CP20	10	Screw
	CP121	10	Screw
	CP [illegible]	1	Stud
	CP [illegible]	1	Sleeve
	CP [illegible]	1	Nut
CP-10-14	11819	1	Table Lower Drain Tubing
CP-10-8	19814	2	Infeed and Outfeed Spider Shaft Bushing
CP-10-5	12764	2	Sprayer and Fertilizer Drive Column Bushing (Upper and Lower)
CP-10	12780	1	Filler y- Fertilizer Spider Shaft Upper and Bushing
CP-10-6	12761	8	Spider Shaft Bushing
CP-10-9	11920	1	Conveyor Chain Level Rear Bearing Bushing
CP-11-17	12	1	Sprayer Revolving Table Bearing Plate (3 pieces)
CP-11-16	12811	1	Sprayer revolving Table Assembly
CP-11-4	12824	1	Sprayer Shaft Bushing
CP-11-36	1	2	Sprayer to Filler Transfer Spider Shaft
CP-11-37	12	1	Intermediate Rear Bushing
CP-11-38	12	1	Intermediate Rear Shaft Sleeve
CP-11-4	12	3	Fertilizer Revolving Table Bearing Plate (3 pieces)
CP-11-5	12	1	Fertilizer Shaft Bushing
CP-11-40	1	3	Spider Shaft Nut
CP-12-10	11	1	Water Hose Lubrication Tubing (Front)
CP-12-19	11	1	Water Hose Lubrication Tubing (Rear)
CP-12-20	11	1	Water Hose Screw Bearing Lubrication
	CP [illegible]	1	Tube Connector
	CP [illegible]	1	Tube Nozzle
CP-13-6	11	1	Sprayer Spreading Arm Bracket
	CP [illegible]	6	Bolt
	CP171	6	Pin
CP-13	12	1	Sprayer Spreading Arm Assembly
CP-13-21	12	1	Sprayer Arm
CP-13-18	11	6	Sprayer Arm Assembly
CP-13-1	1	6	8 Tube Sprayer Assembly
CP-13-10	14	24	Sprayer Cylinder Flange Arm Location
CP-13-24	1	12	Sprayer Retaining Bolt Spring
CP-13-17	1	8	Sprayer Tube
CP-13-21	1	12	Sprayer Tube Pin
CP-13-27	12	12	Sprayer Suspension Link
CP-17-1	121	1	Fertilizer Flanger Assembly Complete
CP-17-13	1316	12	Thread Assembly
CP-17-14	12	8	Crank Platform
CP-17-3	1186	1	Fertilizer Arm Roller Hub
CP-17-2	12	1	Fertilizer Arm Roller Assembly
CP-17-8	12	1	Fertilizer Arm Roller Bushing
CP-17-9	11	1	Fertilizer Arm Roller Bushing

CB-18A-16	107294	1	Hopper Drive Bevel Gear Assembly
CB-18A-17	107036	1	Hopper Drive Bevel Pinion
	CP266	2	Pin
CB-18A-18	106809	1	Hopper Drive Pinion
CB-19-12	127060	1	Cream Chute
CB-20-20	117605	1	Counter Pressure Striker and Water Cam Bracket
CB-20-6	169021	2	Counter Pressure Liver Bearing Assembly
CB-21-10	170202	1	Counter Pressure Trip Plunger and Support
CB-21-14	170201	6	Counter Pressure Trip Plunger Spring
CB-11-11	170205	1	Counter Pressure Trip Plunger Comp. Shaft
CB-21-12	170207	6	Counter Pressure Trip Plunger Comp. Spring
CB-21-16	170207	2	Counter Pressure Trip Plunger Lock Nut
	CP206	2	Lock Washer
CB-21-11	170208	1	Counter Lock Washer Plunger Plug
CB-23-1	117050	1	Filler Guard Hinge Assembly (Left Front)
CB-23-5	117002	1	Filler Guard Hinge Assembly (Right Front)
CB-23-9	61 7004	1	Filler Guard Hinge Assembly (Right Rear)
CB-23-6	61 7030	1	Filler Guard Hinge Assembly (Left Rear)
CB-23-10	11 7036	1	Safety Guard and Holder Assembly
CB-268-1	61 7003	1	Right Instrument Mounting Plate Assembly Includes Oil Pressure Gauge
CB-268-12	100000	1	Left Instrument Mounting Plate Assembly Includes Gas Pressure Gauge
CB-23-12	117000	2	Conveyor Drive Chain
	CP000	2	Chain Split Link
CB-23-13	117030	1	Conveyor Chain Bevel Gear Bushing
CB-30-11	110200	6	Infeed Gate Upper Guide
CB-30-12	110207	6	Infeed Gate Lower Guide
CB-30-10	30017	2	Infeed Gate Spring
CB-30-7	130716	2	Outfeed Gate Spring
CB-30	110000	1	Infeed Spider Assembly for 2½" Ø Bottle
CB-30-10	117024	1	Crowner Bottle Guide
CB-30-11	110000	1	Infeed and Outfeed Bottle Guide
CB-30-12	169071	1	Transfer Bottle Guide
CB-30-9	100016	1	Turnover Bottle Guide
CB-30-3	117010	1	Turnover and Crowner Spider
CB-30-4	117010	1	Turnover to Filler Transfer Spider
CB-30-7	11010	1	Outfeed Spider
CB-30-8	117000	1	Filler and Crowner Transfer
CB-30-1	110011	1	Infeed Spider Assembly for 2½" Ø Bottle
CB-30-3	117010	1	Turnover and Crowner Spider
CB-30-4	117011	1	Turnover to Filler Transfer
CB-30-6	117011	1	Outfeed Spider
CB-30-8	117012	1	Filler and Crowner Transfer Spider
CB-30-9	100007	1	Turnover Bottle Guide
CB-30-10	117000	1	Crowner Bottle Guide
CB-30-11	110000	1	Infeed and Outfeed Bottle Guide
CB-30-12	169071	1	Transfer Bottle Guide

Items Parts to be Made Locally as Required

Most of the sheet metal work and steel guides and wear strips can be fabricated locally as required.

Mansoura Plant

3. CO_2 Saturator

CEM Saturator Model 75-C-AA-FK Serial No. EN-75-C-5062

Spare Parts to be Ordered from Supplier

Key No.	Part No.	Quantity	Description
1-4	168433	1	Tank Outlet Flange Gasket
1-7	82876	1	Tank Inlet Tube Gasket
1-22	102570	1	Air Chamber to Pump Pipe Flange Gasket
1-24	102190	1	Pump Outlet Flange Gasket
1-28	507256	1	Check Valve
1-30	102292	1	Tank Inlet Line Flange Gasket
1-34	127073	1	Safety Valve Pull Rod Handle
2-3	102288	1	Water Chamber Head Gasket
	102583	2	Water Inlet Valve Assembly, CEM Saturators ♯ ♯ 500, ♯ ♯ 750 and ♯ ♯ 1000
	102584	2	Water Outlet Valve Assembly, CEM Saturator ♯♯ 750 and ♯♯ 1000
2-17	102585	1	By-pass Valve Body Assembly
2-28	102286	1	Pump Body Inlet Valve Plate Gasket
2-29	102284	1	Inlet Valve Plate - Outlet Valve Chamber Gasket
2-30	102285	1	Outlet Valve Chamber - Valve Chest Cap Gasket
2-31	102287	1	Pump Body End Plate Gasket
3-4	102745	2	Oil Shield
	102208	4	Pump Piston Cup Leather, CEM Saturators ♯♯ 750 and ♯♯ 1000
	102209	2	Pump Piston Cup Leather Center Washer Saturator ♯♯ 750 and ♯♯ 1000
3-9	102283	2	Crankshaft Bearing Cap Gasket
3-16	102556	2	Connecting Rod Assembly (sold as Assembly only)
3-21	102201	2	Wrist Pin
3-26	102657	2	Pump Piston Rod Packing Gland Nut
3-27	102658	2	Pump Piston Rod Packing Gland
3-28	102681	4	Pump Piston Rod Packing
	102210	4	Pump Piston Cup Leather Spacer, CEM Saturators ♯♯ 750 and 1000
3-32	500313	2	Crankshaft Oil Seal
	500312	2	Bearing
4-1	116220	1	Tank End Gasket
4-9	168501	1	Lower Sight Glass Plate Assembly
4-14	168356	2	Sight Glass Gasket
5-7	500276	1	Pressure Gauge (Pounds Per Square Inch)
5-16	168202	1	Gas Inlet Check Valve Assembly Complete with Cap Gasket
5-24	168201	1	Gas Inlet Check Valve Cap Gasket
7-11	507255	1	Electrode Holder, Cover and two Electrodes
7-15		1	Contactor (Includes Contactor Coil)
7-17		1	Time Delay Relay

7-18 7-19	1 1	Liquid level control Relay Solenoid Valve

Spare Parts to be made locally as required

Most of the sheet metal work, plumbing and pipe fittings can be fabricated or obtained locally as required.

[redacted]

4. [redacted]

[redacted] and Shorthold Model [redacted]

[redacted] Parts to be Ordered from Supplier

Part No.	Quantity	Description
[redacted]	[redacted]	[redacted]
11	1	Pinion
14	1	Helical Gear
16	1	Worm Chain
17	1	Worm
18	2	Worm Bearing
25	2	Inner Door Cam
26	2	Outer Door Cam
28	2	Miter Gear
31	10	Pinion
33	1	Adjustable Sprocket [illegible]
34	1	Safety Switch
36	12	Bearing
39	1	Inner Door Guide
41	4	Assembly
42	1	Outer Door Guide
43	1	Safety Switch
45	1	Spacer & Spring
46	10ft	Elevator Chain Link
49	1	Portable Pitch Puller
100	1	Drive Belt
101	1	Gearbox Pulley
102	1	Drive Chain
103	1	Drive Clutch & Sprocket [illegible]
104	1	Safety Switch
105	1	Gearbox

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]	[redacted]
[redacted]	[redacted]

[illegible]
(Continued)

[illegible]

1 [illegible]

[illegible]

[illegible]

Part No.	Quantity	Description
[illegible]	[illegible]	Carrier Assembly
[illegible]	[illegible]	Sp. Carrier Bolt Lock
[illegible]	[illegible]	Bolt and Nut, Carrier
[illegible]	[illegible]	Link Carrier Chain Assembly
[illegible]	[illegible]	Bearing, [illegible]
[illegible]	[illegible]	Bushing [illegible]
[illegible]	[illegible]	Gasket [illegible] Cover
[illegible]	[illegible]	Gasket [illegible] Cover
	[illegible]	[illegible] Assembly
[illegible]	[illegible]	Roller, Nylon
[illegible]	[illegible]	[illegible] Roller
[illegible]	[illegible]	Bushings [illegible] for [illegible] Lever
[illegible]	[illegible]	Bushings, [illegible] for [illegible] Lever
[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]
	[illegible]	[illegible]
[illegible]	[illegible]	Bearing, [illegible]
[illegible]	[illegible]	Gasket
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	Bearing, [illegible]
[illegible]	[illegible]	Gasket
[illegible]	[illegible]	Bearing, [illegible]
[illegible]	[illegible]	Gasket
[illegible]	[illegible]	Bearing Flange
[illegible]	[illegible]	Chain [illegible], Baldwin [illegible]
[illegible]	[illegible]	Link [illegible], Baldwin Offset
[illegible]	[illegible]	Bushings, [illegible]
[illegible]	[illegible]	Bushings, [illegible]
[illegible]	[illegible]	Gasket
[illegible]	[illegible]	Bushing
[illegible]	[illegible]	Bushing, [illegible]
[illegible]	[illegible]	Gasket [illegible]
[illegible]	[illegible]	Pin [illegible]
[illegible]	[illegible]	Pin [illegible]
[illegible]	[illegible]	Links, Chain [illegible] Baldwin [illegible]
[illegible]	[illegible]	Shoe Assembly [illegible] Clutch
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	Bearing, [illegible]
[illegible]	[illegible]	O-Ring, [illegible]

[illegible]	1	Bearing, Clutch Tube Center
[illegible]	1	Slip Yoke, Clutch PTO Assembly
[illegible]	6	V Belt B Section 4L12
[illegible]	2	Bushing, Oilite A1[illegible]
[illegible]	2	Bushing Oilite A1[illegible]
[illegible]	2	Bushing Oilite A2[illegible]-1
[illegible]	2	Bushing Oilite A2[illegible]-2
[illegible]	2	Bushing Oilite A2[illegible]-1
		(For 2-1" [illegible] Gear Shaft Tube)
[illegible]	2	Bushing, Brenetti
[illegible]	2	Bushing, Super Oilite
[illegible]	6	Bolt Inside Breech Gear Box
[illegible]	2	Bushings, Oilite [illegible]-1
[illegible]	1	Pin
[illegible]	4	Pin Ball Head
[illegible]	1	Latch Right Hand [illegible]
[illegible]	1	Pin
[illegible]	1	Bushing Oilite A2[illegible]-1
[illegible]	1	Pin Ball Head
[illegible]	1	Pin Cam Pullcups
[illegible]	1	Washer Cod
[illegible]	1	Bushing Oilite A1[illegible]-1
[illegible]		Pin
[illegible]	2	Bushings, Oilite A[illegible]-16
[illegible]	1	Box, Right Hand Position Assembly
[illegible]	1	Box, Left Hand Position Assembly
[illegible]	2	Shaft, Lifter Bracket
[illegible]	1	Rod Left Hand Lifter Bar Cam
[illegible]	1	Bar Left Hand Lifter Shaft Assembly
[illegible]	1	Pin
[illegible]	1	[illegible] Left Hand Connecting Rod
[illegible]	1	Box, Right Hand Lifter Shaft Assembly
[illegible]	1	[illegible], Right Hand Connecting Rod
[illegible]	1	Pin
[illegible]	1	Pulcrum, Lifter Shaft Bar
[illegible]	1	Rod, Right Hand Lifter Bar Cam
[illegible]	2	Washer
[illegible]	1	Bushing
[illegible]	2	Body shaft stop Assembly, Bar Lifter
		(Item 1 & Item 2)
[illegible]	2	Bushings Oilite A1[illegible]
[illegible]	2	Pin
[illegible]	2	Pin
[illegible]	2	Bushing
[illegible]	2	Springs (For Machines [illegible] & [illegible] only)
[illegible]	6	Springs (For Machines 10 & [illegible] only)
	1	Washer, Sleeve Bracket Assembly
		(Includes Washer)
	2	Box, Under Spout Sleeve Pump
		(For [illegible] Section)
	1	Tube, Recessed Rod Support
[illegible]	60	Bracket
[illegible]	120	Washer
[illegible]	1	Valve, Relief
[illegible]	1	Strainer - 3"
[illegible]	1	Cover, Pump Tank Assembly
[illegible]	1	Bushing

G - 562

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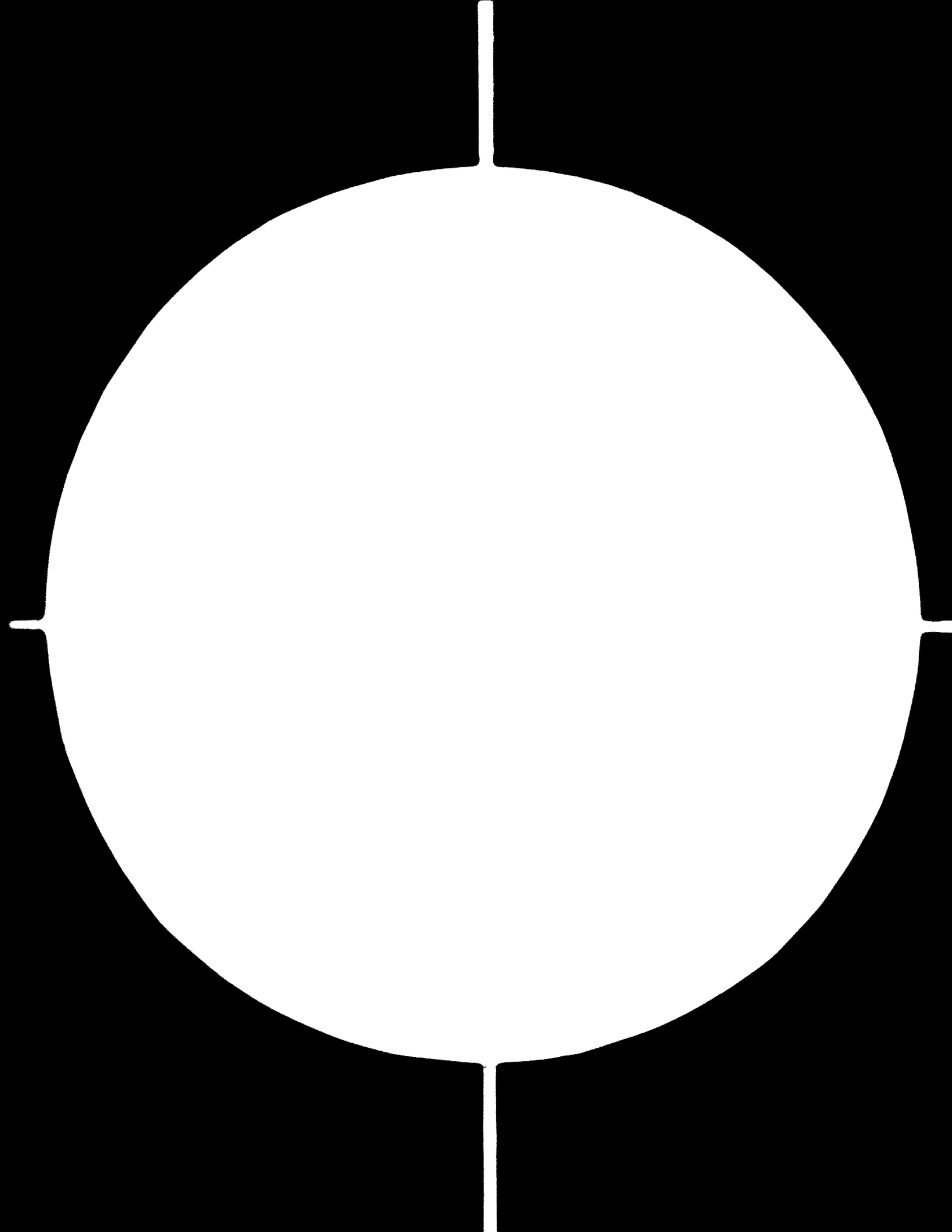


	2	Header, Spray Nozzle Double Assembly (for 20 Bottles wide)
SW326	1	Spring, Trigger
26726	1	Belting, Balata 1½" x 2"
SW5165	1	Spring
SW7583	1	Spring, Torsion
259RS	1	Spring
525RS	1	Spring
SW6648	4	Retainer, Spring
SW6647	1	Spring, Compression
27635	4	Gasket, O'Ring # 11-112
SW6787	1	Spring
SW980	1	Spring
BC940	1	Head, Valve Connecting Rod
23857	2	Trap Steam-Sarco ¾"
27769	2	Glass Water Gauge
B3476	1	Bracket Water Gauge
22320	1	Cock, Water-Essex-Brass
41CC	2	Thermometer Tank
	1	Truss Knockout Finger
WD417	40	Finger Knockout
SW316	1	Rod Slip Connection
746RS	1	Spring Slip Conn
340RS	2	Roller
SW2597	1	Pin
B3838	1	Head, Connecting Rod
SW4014	1	Spring Coil
SW3415	1	Spring Coil
26893	2	Lining Brake
26251	1	Bushing Oilite A1207-1
26235	3	Bushing Oilite 1049-18
SW9774	1	Pin
31RS	2	Pin, Ball Head
SW3344	1	Spring, Conical Knockout
BC2102	2	Lever, Discharge Push Off
B4102	8	Screw, Spring Loop End
SW624	2	Spring
SW980	2	Spring
SW2619	1	Spring
BC1518	2	Lever, Safety Roller
SW2617	1	Roller
26230	2	Bushings Oilite A1003-1
DFC702	1	Sprocket, Conveyor-Rex 15T-½" P. 1½"P
DFC708	1	Sprocket, Conveyor-Whitney 13T-¾" P.
118744	1	Pin Sprocket
211531	1	Station Stop and Start - A - B Bul 800T - Style 6TX-PB/3938 - Complete
T836	1	Bracket Channel End
B2377	1	Shoe Left Hand Dish. Carrier Adj.
SW2012	1	Screw Take-up Adj.
SW9862	1	Strip Corrugated Safety
SW8836	3	Sheet Tilter-4 Bottle Section
26279	2	Bushings Oilite A2004-1
SW319	1	Spring
B4102	2	Screw Spring Loop End

Crater Plant

2. Filler

Rigamonti & Villa RIVI Monobloco 8.40.8 IMP 037
Spare Parts to be Ordered from Supplier

Tavola 'A' - Riempitrice

Numeri	Pos	Dis	Denominazione
20	800	0416 B/5	Sede per valvolina
40	802	0416 B/5	Guamizione per rubinetto
40	803	0416 B/5	Guamizione per valvolina
40	804	0416 B/5	Valvolina
40	805	0416 B/5	Anello distanziale
20	807	0416 B/5	Nazelli per stelo
40	808	0416 B/5	Guarnizione tipo OR 119
20	813	0443	Guarnizione per mazzetta
30	815	0443	Mazzette
40	816	0443	Guarn. per cannucia
30	817	0443	Tubetti interri
30	818	0443	Tubetti esterni
30	819	0443	Puntali
40	820	0416 B/5	Guide per valvolina
40	821	0416 B/5	Molla per valvolina
40	822	0416 B/5	Guarn. per disco
40	823	0416 B/5	Molle
40	826	0416 B/5	Platorello per disco
40	827	0416 B/5	Dischi
40	828	0416 B/5	Guarn. per girello
40	833	0440	Guarn. DUBO
40	835	0440	Paracolpo
40	840	0416 B/5	Sfera
40	845	0421	Guarn. per campanella
80	847	0421	Gomma per campanella

Crater Plant

Tavola 'B' - RIVI Cilindro Tappante

Numeri	Pos	Denominazione
40	3	Grano con cava es. int.
2	4	Cilindro tappante
2	5	Sopportino
40	6	Grano con cava es. int.
40	7	Vite Brugola
8	10	Dado per perno
40	11	Ingrassatorn Ø ¼" Gas
8	12	Rullino
8	13	Bronzina
4	16	Molla di tappatuna
8	17	Rondella per molla
8	21	Tirante
8	22	Ghiera di registro
12	23	Rondella per platorello
12	24	Platorello
8	28	Ghiera di chiusura
8	29	Pistone
12	30	Calottino di tappatina
4	31	Nolla di rimando
40	33	Vite T. Sv. Ø ¼" x 13

Tavola 'C' - Cilindro Alza Bottiglie

Numeri	Pos	Denominazione
40	3	Disco appoggia bottiglie
80	4	Vite T. Cil Ø ¼" x 14
80	5	Rondelle elastiche tipo RDE.
80	7	Anello fine corsa superiore
80	9	Guarn. anello OR 139
80	11	Guarn.
80	14	Anello fine corsa superiore
40	18	Rullo
40	19	Cuscinetti SKF tipo 6004
40	20	Anello Seeger Ø 42 interno
40	22	Rondella
40	33	Anello di tenuta GACO 200
40	38	Guida per asta
40	45	Guarn. anello OR 119
40	46	Guarnizione

Crater Plant

Tavola 'D' - Dosatore 8D Costante

Numeri	Pos	Denominazione
40	287	Calotta tipo S.T.E.F.A.
20	290	Guarnizione
40	291	Guarnizioni per valvola centr.
20	297	Guarnizione per gomito
8	300	Tubo
20	304	Guarnizione
40	308	Guarnizione per valvolina
16	309	Molla per valvolina
8	311	Valvolina centrale
16	313	Molla
40	314	Vite per bloccaggio girello
40	315	Vite di fiss. piattina

Tavola 'F' - Dispositivo Puenmatico per Apertura Rubinetti

Numeri	Pos	Dis	Denominazione
4	10	683/1	Calotta per pistone GACO/C 175
4	11	683/1	Pistone
4	12	683/1	Molla per ritorno
4	26	683/1	Tubo flessibile Aeroguip L-295

Crater Plant

3. Mixer

CEM Beverage Mixer Model (A) No. 825

Spare Parts to be Ordered from Supplier

Key No.	Part No.	Quantity	Description
BM-1-6	125902	1	Reeves # 28 Vari-speed Pulley Assembly (50 & 60 Cycle Power)
BM-1-20	125993	1	Worm Gear Shaft Top Bearing
BM-1-21	125994	1	Worm Gear Shaft Bottom Bearing
BM-1-24	126002	2	Worm Shaft Bearing
BM-1-27	102443	1	Worm Gear Top Cover Oil Seal
BM-1-31	12595	1	Worm Shaft Oil Seal
BM-1-36	125603	1	Main Drive Pinion
BM-1-38	121373	2	Drive Belt
BM-2-2	125609	3	Flanged Bushing
BM-2-3	125608	2	Straight Bushing
BM-3-7	125617	2	Spider Drive Gear (Infeed and Outfeed)
BM-3-16	125921	1	Conveyor Bearing and Slip Clutch A.
BM-3-28	163181	1	Outfeed Conveyor Chain Driven Sprocket
BM-3-33	125671	1	Conveyor Drive Chain
BM-4-2	125057	1	Trip Lever Bracket
BM-4-4	76260	1	Trip Lever
BM-4-5	125827	1	Trip Lever Pin
BM-4-6	76263	1	Trip Cam Plunger
BM-5-5	125622	1	Sun Gear
BM-5-9	125600	1	Turret
BM-5-11	125621	1	Bottle Clamp Lift Cam
BM-6-7	125768	7	Vertical Shaft and Bevel Gear Assembly
BM-6-9	125764	7	Horizontal Shaft and Bevel Gear Assembly
BM-6-10	125973	7	Bottle Platform Horizontal Shaft Nut
BM-6-16	125741	7	Shaft and Clevis Assembly
BM-6-20	125703	7	Clamp Shaft Roller
BM-6-21	125701	7	Clamp Shaft Roller Pin
BM-6-22	125691	8	Bottle Clamp Spring
BM-6-23	125579	7	Bottle Platform Vertical Roller
BM-6-24	125678	7	Vertical Roller Pin
BM-6-26	125616	7	Planetary Gear
BM-7-1	125649	1	Infeed Timing Gate and Support Assembly
BM-7-21	163052	1	Infeed Safety Gate Assembly
BM-8-1	163064	1	Outfeed Safety Gate Assembly
BM-8-7	163070	1	Outfeed Bottle Guide
BM-8-10	163233	6	Bottle Clamp
BM-8-11	125776	12	Bottle Clamp Rubber
BM-10-4		1	Infeed Spider
BM-10-5		2	Upper Wearing Strip
BM-10-6		2	Upper Wearing Strip
BM-10-7		2	Lower Wearing Strip
BM-10-8		2	Lower Wearing Strip
BM-10-10		1	Outfeed Spider (2 Pockets)
BM 11-1		1	Drive Motor (1 Horsepower)
BM-11-3		1	Magnetic Contactor
CP-422A	500302	1	Fafnir ## 1519 Thrust Bearing or Equal

Crater Plant

CP-423A	500396	14	Fafnir ## 205-K Ball Bearing or Equal
CP-424A	500397	7	Fafnir ## 5-C Ball Bearing or Equal
CP-425A	500398	7	R.B.C. ## EJ7214 Roller Bearing or Equal

Spare Parts to be made Locally as Required

Key No.	Part No.	Quantity	Description
BM-2-6	125645	1	Chain Track Filler Strip
BM-2-7	125643	2	Chain Wearing Strip (Left Hand)
BM-2-8	125644	2	Chain Wearing Strip (Right Hand)
BM-2-9	125752	1	Rear Transfer Plate (Infeed)
BM-2-10	125753	1	Rear Transfer Plate (Outfeed)
BM-4-3	125687	1	Trip Lever Shaft
BM-5-3	125634	1	Column to Shaft Gasket
BM-6-14	125522	7	Bottle Support Plate

Green Spot Plant, Mansoura

1. Carbonator Cooler

Mojonnier Type 5 Carbo-Cooler. Model 6.60 No. 4080

Spare Parts to be Ordered from Supplier

Quantity	Description
1	Ammonia Charging Line
4	Neroprene Bevelled Gasket for 1" I.A.M.D. Fitting
4	Neroprene Bevelled Gasket for 1½" I.A.M.D. Fitting
4	Neroprene Bevelled Gasket for 2" I.A.M.D. Fitting
-	Neroprene Bevelled Gasket for 2½" I.A.M.D. Fitting
4	Fibre Gasket for ½" Ammonia Flanges
4	Fibre Gasket for 1¼" Ammonia Flanges
4	Fibre Gasket for 1½" Ammonia Flanges
1 (piece)	5' Length of ¼" dia White Sanitary 18" dia Tank Cover Seal
1	"O" Ring - 6¼" o/d x i/d x ¼" dia Black Sanitary Rubber - Tank Inlet Head
3	"O" Ring - 1¼" x 1¼" i/d x ¼" dia Black Sanitary Rubber - Sany. Divn. Valve
4	"O" Ring - 1¼" o/d x 1¼" i/d x ¼" dia Neoprene Sany. Rubber - 1¼" Cool Secn Coup
-	"O" Ring - 1¼" o/d x 1¼" i/d x ¼" dia Neoprene Sany. Rubber - 1½" Cool Secn Coup
-	"O" Ring - 2¼" o/d x 2¼" i/d x ¼" dia Neoprene Sany. Rubber - 2½" Cool Secn Coup
1	White Sanitary Rubber Diaphragm for 1" Saunders Valve
-	White Sanitary Rubber Diaphragm for 1½" Saunders Valve
1	White Sanitary Rubber Diaphragm for 2" Saunders Valve
1	¼" "D" Section Black Sanitary Rubber x 48" Long - Manhole Gasket
4	Rubber Washer - 1.1/16 o/d x 11/16 i/d x ¼" Thick Tasteless Gum Rubber - NH_3 Leak Detector
4	Rubber Washer - 1.9/16 o/d x 1¼" Thick Black Sany. Rubber - Liquid Level Contrrol
4	Rubber Washer - 2½" o/d x 2" i/d x 1/16 Thick Neoprene Rubber - Surge Drum Peep Hole
4	Rubber Washer - 3" o/d x 2½" i/d x ¼" Thick Sany. Rubber - Water Head Glass
1	Pyrex Glass Cylinder - 1½" o/d x 18" Long - Liquid Level
1	Pyrex Glass Cylinder - 3" o/d x 12" Long - Water Head
1	Pyrex Glass Cylinder - 1" o/d x 2½" Long - NH_3 Leak Detector
1	Bottle of Blue Ink for Taylor Recorder
1	Bottle of Red Ink for Taylor Recorder
2	Boxes of Taylor Recorder Charts OP 3402
1	Taylor Clock Key
1	Danfoss Strainer at Liquid Line for EUSA-10-¼
1 (set)	Danfoss Spares Kit for Back Pressure Reg Valve No. MSA-351-¼
6	Fibre Gaskets for Danfoss Valves - ½"
-	Fibre Gaskets for Danfoss Valves - ¾"

Green Spot Plant

6	Fibre Gaskets for Danfoss Valves - 1"
6	Fibre Gaskets for Danfoss Valves - 2"
4	Feet Pads for Carbo-Cooler
2	Cartridge Fuses 6 Amps
3	Cartridge Fuses 4 Amps
1	350 Watt CO_2 Heater Element for Bratby Heater

Green Spot Plant

2. Bottle Washer

Miller Hydro Bottle Washing Machine No. 109/BH802B

Spare Parts to be Ordered from Supplier

Drawing No.	Quantity	Description
5753		Mist Sprays
		Spray Supply Pipe
14/1		Jets
RLS10	2	Ball Bearing
	1	Oil Seal
	1	Operating Collar
	2	Operating Clutch
	2	Clutch Pins
	1	Clutch Body
1606E	1	Ball Bearing
A/9103		Unloader Box (Short)
A/2308		Fork (Short)
3981		Guide Plate (Short)
3711	2	Roller
SK/965		Grease Seal
4222	5	Joint
4200	1	Stop for Finger Pusher Bar
6203	4	Ball Bearing
4197	2	Pocket Shaft Bearing
5407	2	Timing Plate
5404	2	Sprocket
6205	6	Ball Bearing
6205	1	Spur Gear
5401	4	Bevel Gear
4191/2	1	Ball Bearing
A/9206	1	Finger Pusher Arm
11	1	Cam
7766/1	1	Slat Sprocket
3725	2	Spring
3727	1	Spring
4322	1	Slip Joint Rod
6207	2	Ball Bearing
6207	1	Spur Gear
3377	2	Worm Wheel
T12	1	Thrust Race
RL12	1	Ball Race
250116	4	Oil Seal
B/9112/1	1	Bottom Half Fountain Wheel
B/9113	3	Top Half Fountain Wheel
5452	78	Jets
3371	2	Oil Gauge
5524	1	Washer
RL8	1	Ball Bearing
B/9112	1	Bottom Half Fountain Wheel

3371	4	Scraper Blades
SK324	1	Compression Spring
3394	1	Adjuster Screw
3385	1	Spring
B/9112/2	1	Bottom Half Fountain Wheel
9781/1	1	Rinse Wheel
4870	32	Jet
3443	1	Spring
T20	1	Thrust Race
RMS12	4	Ball Bearing
9779	2	Top Half Fountain Rinse Wheel
1205	1	Joint
10785	1	Idler Sprocket (10 Tooth)
3998/2	1	Rotary Dise
5878	1	Bush
1658/A	1	Bevel Gear
LS8AC	1	Ball Bearing
1658/B	1	Bevel Gear
1751	1	Oil Seal
RLS9	2	Ball Bearing
18318	2	Oil Seal
3485	1	Worm Wheel
17530	2	Oil Seals
7766/2	1	Chain Sprocket
4"F.M	1	Pressure Gauge
4"F.M	1	Thermometer
-	1	Top Valve
-	1	Bottom Valve (with tap)
-	1	Channel Joint
-	1	Strainer Basket

Spare Parts to be Made Locally

Drawing No.	Quantity	Description
-	1	1" Bore Hose

Most of the sheet metal coverings and steel guides and wearing strips can be fabricated locally as required.

Item	Test	Method	Keep Records	Frequency per 6 Hour Day	Reason
Product Water - after treatment	Absence of Chlorine	Colorimetric - Chlorotex	✓	2	These tests are intended to ensure that no filter or demineraliser has ceased to function properly.
	pH (acidity/alkalinity)	Colorimetric, or by meter	✓	2	
	Total Dissolved Solids	On-Line Electrical Conductivity reading	✓	2	
	Appearance	Visual for Colour, Haze, Sediment	✓	2	
	Temperature of cooled water before carbonation	Dial Reading	✓	6	To make sure that the cooling system is working properly.
Washer Water	Hardness	Clark's Soap Method	✓	2	To check that base-exchanges do not need regenerating.
Carbon Dioxide	Pressure of Gas entering carbonator	Dial Reading	✓	6	Adequate supply of carbon dioxide.
Bottle Washing	Concentration of soaker solutions	ABCB Tablet Test	✓	1	To make sure that soaker solution is strong enough for washing & sterilising.
	Bottle Alkalinity	Phenolphthalein Test	✓	2	To check if alkali is being carried over due to insufficient bottle rinsing.
	Chipped, cracked, dirty bottles-foreign bodies	On-Line Test	✗	Continuous	
Syrup	Syrup Strength	Baume Hydrometer	✓	Each Batch	

Item	Test	Method	Keep Records	Frequency per 6 Hour Day	Reason
Product	Sugar content (w/w)	Brix Refractometer		6	
	Carbonation (Gas Volumes)	Gas Volume tester, Thermometer		6	
	Acidity	Titration with Standard Alkali		2	To check that the product bottled is up to standard
	Organoleptic	Comparative tasting		6	
	Bottle Fill	Measuring Cylinder		6	
Pack	Chipped, dirty bottles, foreign bodies Incorrect bottle or crown.	On-Line Visual Inspection		Continuous	
	Bottle Fill	Visual, Go No-Go Gauge		Continuous	
	Crown Crimp Test	Go No-Go Gauge		6	To minimise the risk of leakage
Occasional Tests	Sugar content, Carbonation, crown crimp and fill of 20* consecutive bottles	As above		Once a week	To check the accuracy of each filling head
	Bacteriological tests on the product water after treatment	To be carried out by the Public Water Corp. Lab.		Once per Week	
	Bacteriological tests on product				

* The number of bottles taken should equal the number of filling heads

APPENDIX 4.3

UNIDO PROJECT IS/PDY/72/006 - PRINCIPAL REPORT

RAW MATERIAL - QUALITY CONTROL FORM

Syrup	°Baume	
Bottle Washing	Adequate Rinsing	
Washer Water	Hardness	
Product Water	Appearance	
	Electrical Conductivity	
	pH Reading	
	Free Chlorine	
Time		
Date		
Syrup	°Baume	
Bottle Washing	Adequate Rinsing	
Washer Water	Hardness	
Product Water	Appearance	
	Electrical Conductivity	
	pH Reading	
	Free Chlorine	
Time		
Date		

PRODUCT QUALITY CONTROL FORM

DATE	PRODUCT AND SIZE	TIME	CO_2 P.S.I	TEMP ^oF	GAS VOLS.	^oBRIX	FILL ml.	TASTE AND APPEARANCE

UNIDO PROJECT IS/PDY/72/006 - PRINCIPAL REPORT

METHODS FOR CARRYING OUT PROPOSED TESTS

Chlorotex Method for Free Chlorine (British Drug Houses Method)

Transfer 5 ml of chlorotex reagent to one of the graduated tubes and add exactly 50 ml of water under test. Mix, allow to stand for one minute, and compare the colort produced with the colours on the chart. Chlorine should be absent in the product water.

pH (Acidity/Alkalinity)

There are a number of test kits available for measuring pH to one place of decimals where an indicator is added to a sample of the water, and the colour produced compared with standard sealed buffer tubes or glass discs. An example is the British Drug Houses Lovibond Comparator.

Whilst a pH meter can produce more accurate results, colormetric methods are convenient to use and of sufficient accuracy for routine work.

Total Solids

The electrical conductivity increases as the solids dissolved in the water increase. Hence electrical conductivity measurements can be related to totsl dissolved solids. The reverse osmosis plant would be fitted with an electrical conductivity meter which can be used to check the quality of the product water. It may be necessary to check or calibrate it after installation by obtsining a true figure for a water sample from the Public Water Corporation Laboratory.

Appearance

Any colour or turbulence of the water can be measured by comparing with standards. However, for routine purposes a visual assessment is recommended.

Total Hardness

Clark's soap method may be used to obtain an indication of total hardness of the water.

Place 50 ml of water under test in an 8 oz bottle and titrate the water with Clarks' standard soap solution, adding a little at a time. Shake vigorously after each addition, and the end point is reached when a permanent lather is obtained. A permanent lather is defined as one that remains for 5 minutes when the bottle is laid on its side. If acid water is being tested, the acidity must first be neutralized with $N/_{50}$ soda to methyl orange.

Concentration of Bottle Washing Solutions

A quick and convenient way of determining the total alkali content and the caustic content of soaker solutions is to use the 'American Bottlers of Carbonated Beverages' tablet tests. By adding the appropriate tablets to 10 ml of soaker solution, and counting the number of tablets (or quarters or halves) necessary to cause a colour change, the total alkali and caustic contents can be quickly determined.

For more accurate results titration methods should be used. To determine caustic alkali place 10 ml of soaker solution in a 50 ml conical flask, and add 5 ml of 20 per cent barium chloride solution and 2 drops of phenolphthalein indicator. Titrate with standard 2.5 normal sulphuric acid until th colour changes from pink to colourless. The number of millilitres of 2.5 normal acid uaed represents the percentage of caustic alkali present.

To determine the total alkali content of the soaker solution repeat the titration omitting barium chloride solution and using methyl orange as indicator.
(If aluminates are uaed in the washer solution a modified method must be used.)

Bottle Alkalinity

Alkali carry over can be detected by placing a few drops of phenolphthein indicator solution inside a bottle and on the outside. The prssence of alkali is revealed by the indicator changing from colourless to pink.

Sugar Content (Degrees Brix)

The sugar content can conveniently be determined by placing a drop of the product on the prism of a Brix refactometer and taking the reading direct, applying any temperature correction.

Carbonation (Gas Volumes

The unit of measurement taken as standard is the volume. This is defined as the amount of gas in millilitres that a given volume of water will absorb at atmospheric pressure and at $60^{o}F$ ($15.5^{o}C$). At $60^{o}F$ beverage water will absorb one volume of carbon dixide. When the pressure is increased to 15 lb., i.e. one extra atmosphere, the water will absorb 2 volumes of carbon dioxide. Reduction of the temperature will also permit the water to dissolve greater amounts of the gas.

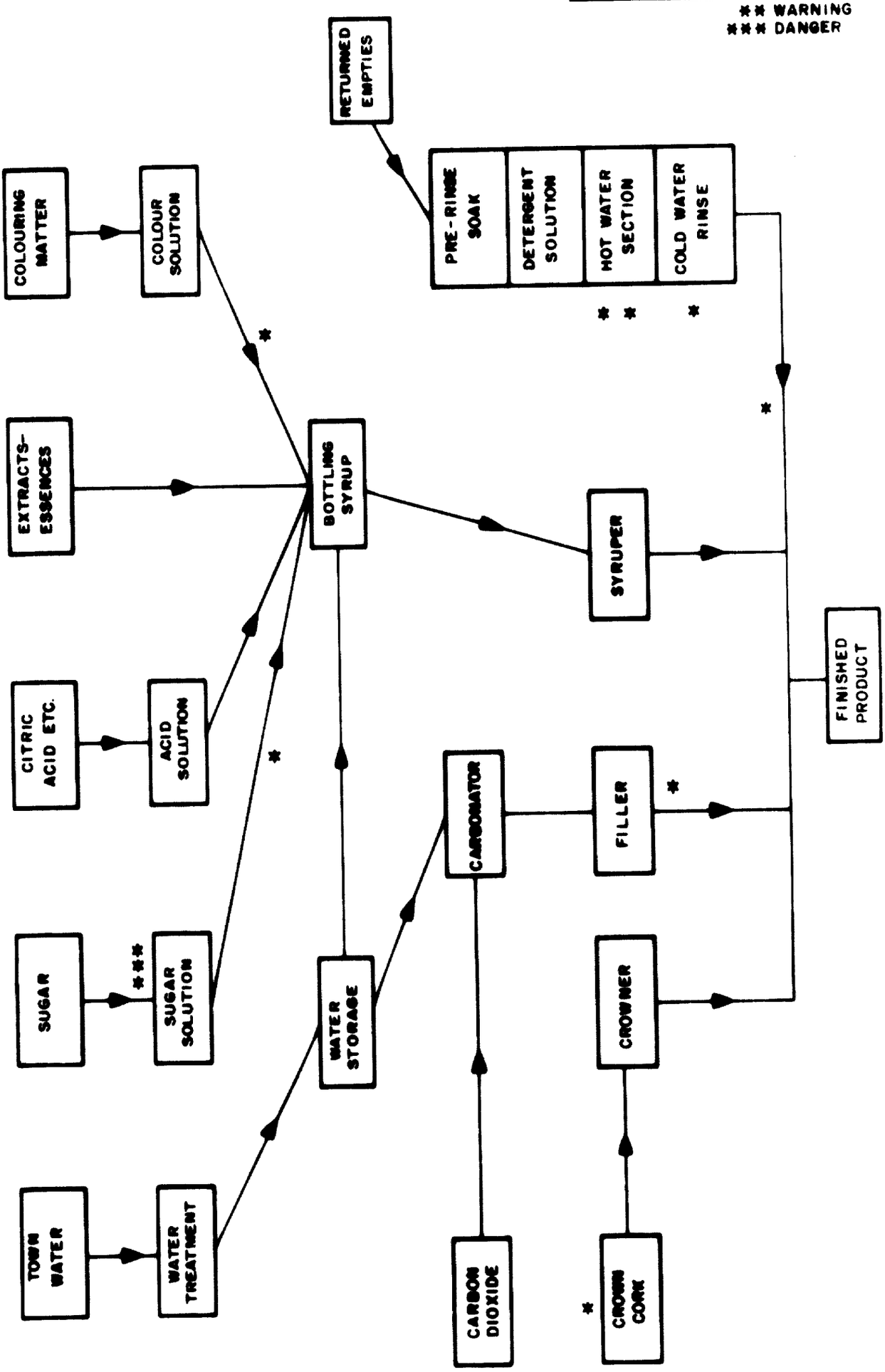
To determine the gas volumes clamp a bottle in a special tester fitted with a pressure gauge, a hollow spike for piercing the crown and a sniff valve. Piece the crown, and open the sniff valve, allowing the initial pressure to escape. After closing the sniff valve, shake the bottle vigorously until a maximum reading is obtained on the gauge. Record this reading, open the sniff valve and record the temperature of the contents of the bottle. The gas volume is then read off from a temperature/pressure table.

Acidity

Before determining acidity the carbon dioxide should be removed from the beverage by pouring it back and forth between two beakers until foaming stops. Pipette 10 ml into a conical flask, add phenolphthalein indicator solution and titrate with $N/_{50}$ sodium hydroxide solution until a pink colour appears. Note the number of millilitres of sodium hydroxide used (the titre).

$$\text{Percentage citric acid} = \frac{\text{Titre} \times 0.02 \times 70 \times 100}{1000 \times 10}$$

ORIGIN OF MICROBIAL CONTAMINANTS



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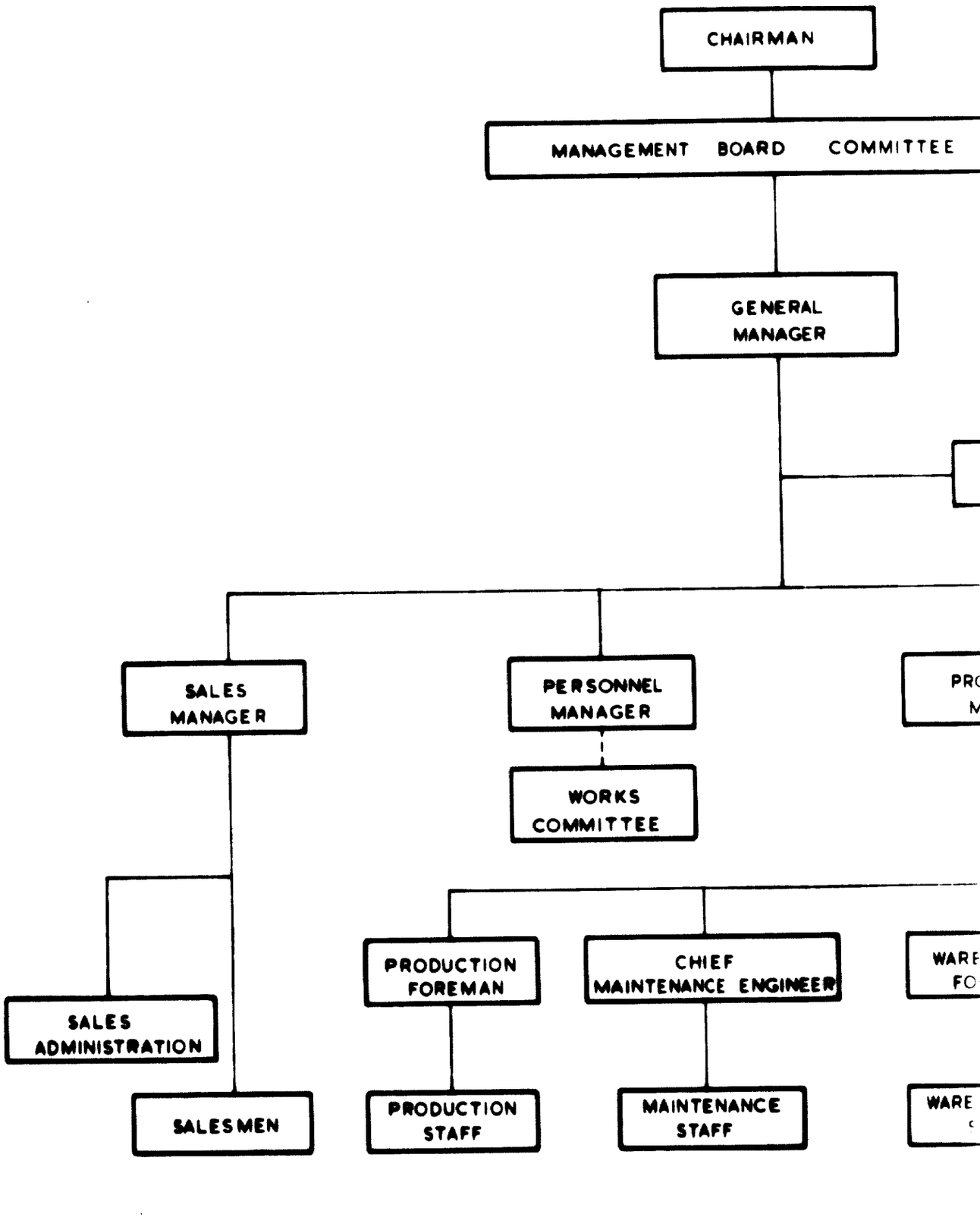
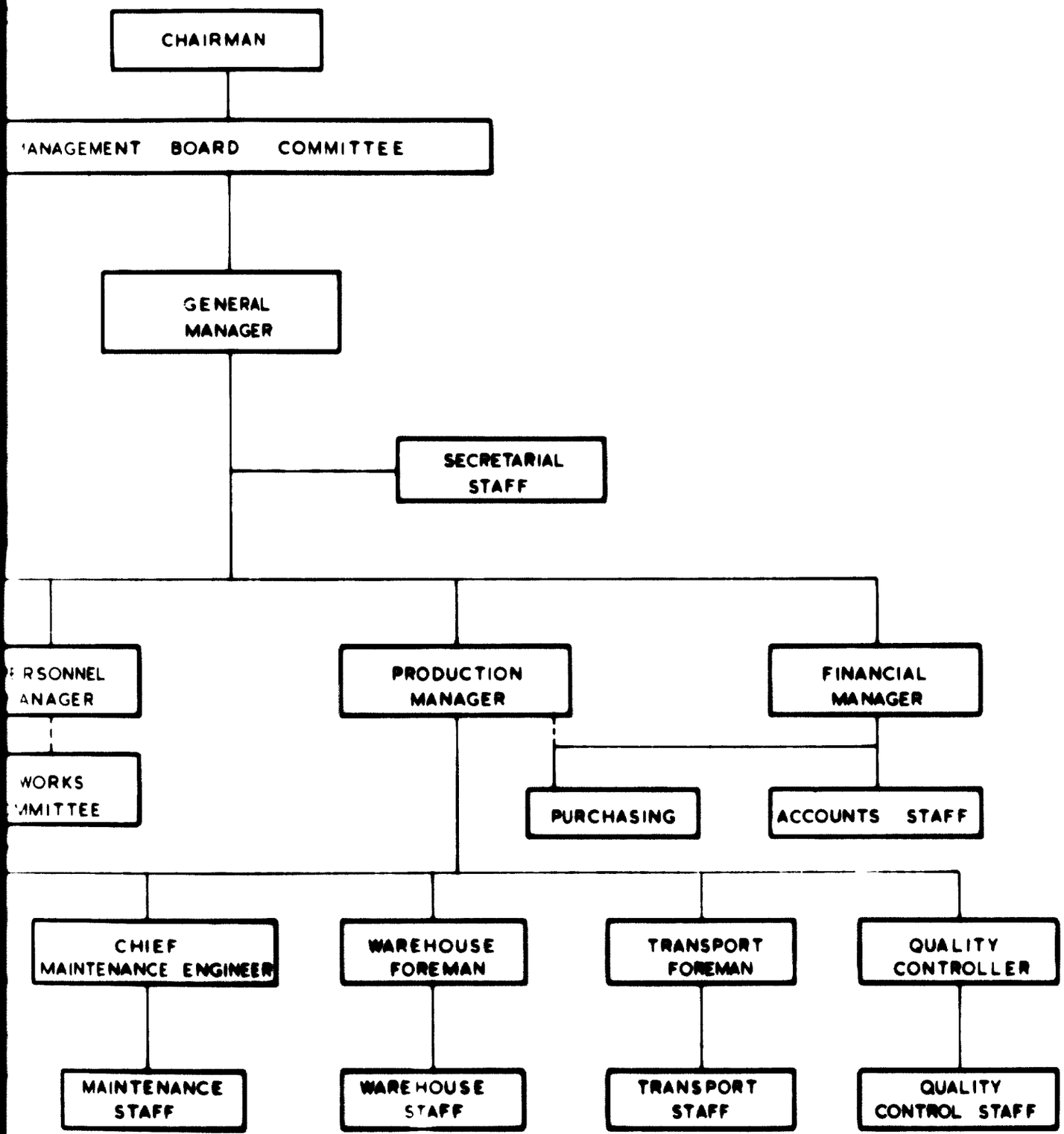
TYPICAL BOTTLING ORGANISATION

MANAGEMENT STRUCTURE



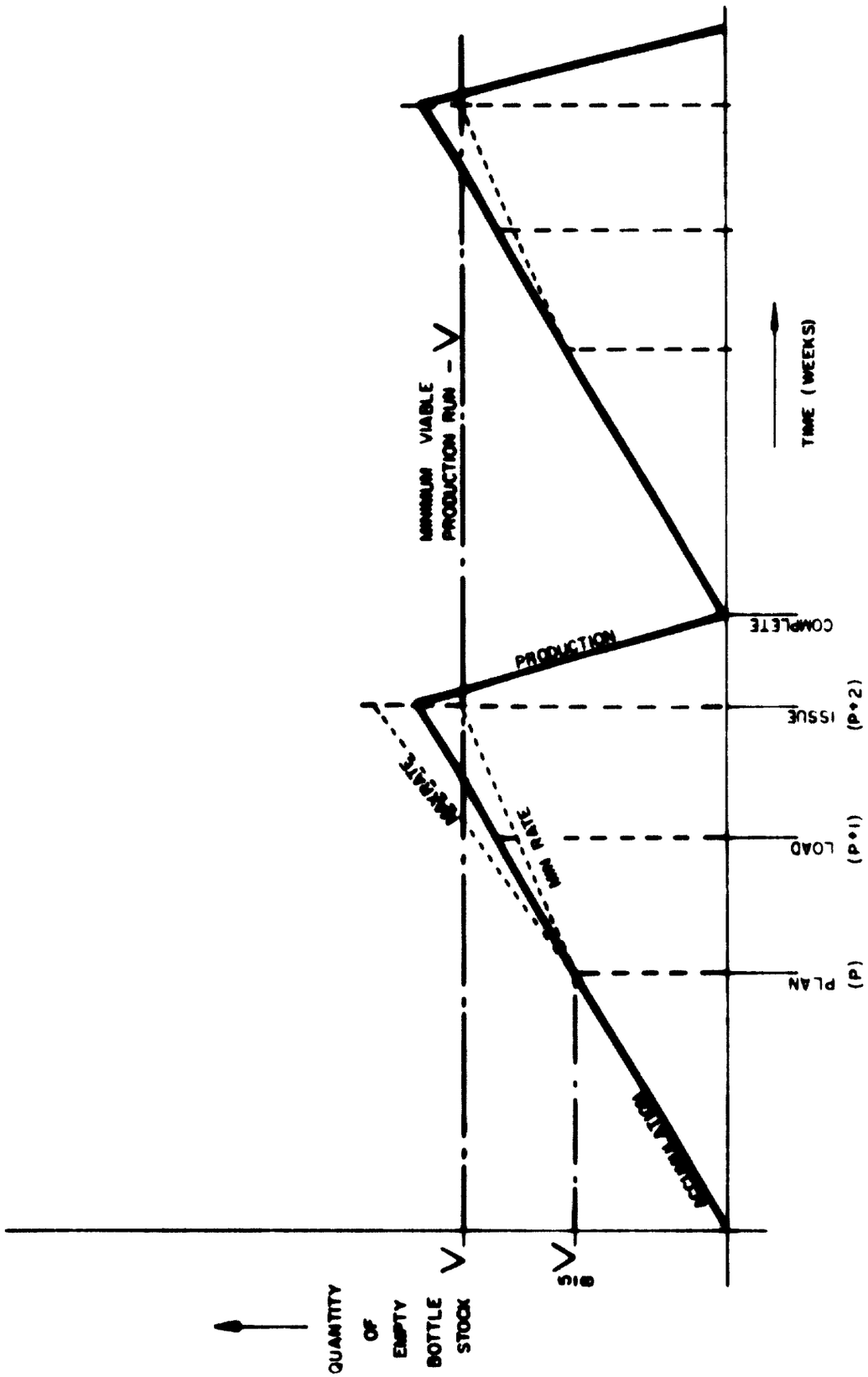
KL BOTTLING ORGANISATION

NAGEMENT STRUCTURE



PROPOSED EMPTY BOTTLE STOCK CONTROL SYSTEM

(REVERSED SAW-TOOTH CURVE)



UNIDO PROJECT IS/PDY/72/006 - PRINCIPAL REPORT

INVENTORY OF QUALITY CONTROL EQUIPMENT

Crater Plant

2	100 ml Plastic Measuring Cylinders
2	50 ml Plastic Measuring Cylinders
2	250 ml Glass Graduated Measuring Cylinders
7	500 ml Glass Graduated Measuring Cylinders
1	Quart Glass Graduated Measuring Cylinders
1	Quart Glass Measuring Jug
1	Pint Glass Measuring Jug
1	½ Pint Glass Measuring Jug
3	20-40° Baume Hydrometers
1	20-30° Baume Hydrometers
1	28-33° Baume Hydrometers
2	0-70 Baume Hydrometers
4	53-60° Brix Hydrometers
3	25 ml Pipettes
1	20 ml Pipettes
2	10 ml Pipettes
3	5 ml Pipettes
3	250 ml Glass Conical Flasks
1	100 ml
1	Plastic Funnel
3	10 ml Graduated Pipettes
2	1 Litre Standard Volumetric Flasks
2	0-10 ml Self-Filling Burettes

Carbonation gas volumes tester 0-100 p.s.i.-

ABCB soda strength test tablets 1 and 2.

INVENTORY OF QUALITY CONTROL EQUIPMENT

Mansoura Plant

1 500 ml Graduated Glass Measuring Cylinder

1 500 ml Ungraduated Glass Measuring Cylinder

2 500 ml Plastic Measuring Cylinders

9-12° Brix Hyrdrometer

9-14.5° Brix Hydrometer

20-30° Baume Hydrometer

0-50° Brix Refractometer

1-13° Brix Refractometer

Carbonation gas volumes tester 0-100 p.s.i., and one spare gauge. (Terriss)

1 Metal Dial Thermometer 25° - 125°F (Terriss)

1 Go No-Go Crown Crimp Gauge (Terriss)

1 Taylor Colormetric Chlorine Test Kit (Broken but Usable)

1 Taylor pH Test Kit - No Benzo Yellow Reagent

1 Pocket Thermometer

ABCB soda strength test tablets 1 and 2

1 pH in working order (2 others not working)

UNIDO PROJECT IS/PDY/72/006 - PRINCIPAL REPORT

Additional Quality Testing and Laboratory Equipment Required by The National Bottling Organisation

Chlorotex

Two Chlorotex test kits available from: British Drug Houses Limited, Poole, Dorset BH12 4NN United Kingdom, and additional bottles of Chlorotex reagent. One 500 ml bottle will be sufficient for about 2 months for each plant.

Lovibond

Two Lovibond 1000 comparators with discs to cover pH range 5.2 to 8.4, i.e. BROMOCRESOL PURPLE and PHENOL RED, and supplies of these reagents. One 500 ml bottle of each will be sufficient for about 2 months per plant, based on two tests per day. The Lovibond comparator is obtainable from: British Drug Houses Limited.

One Still to produce distilled water, electrically heated and preferably wall-mounted. The 'BARA' Still produces 3 litres of distilled water per hour, and is obtainable from: Baird and Tatlock (London) Limited P.O. Box 1, Freshwater Road, Chadwell Heath, Essex RM1 1HA, United Kingdom. (Note: One Still would be able to produce sufficient distilled water for the laboratories at both plants.)

One Brix pocket refactometer 0 to 50 per cent range, obtainable from Baird and Tatlock (London) Limited.

2 space thermometers, preferably dial reading stainless steel, 20 to 140° Fahrenheit.

Glassware - obtainable from: Baird and Tatlock (London) Limited.

- 2 50 ml graduated measuring cylinders
- 2 10 ml Class B volumetric pipettes
- 2 1000 ml Class B standard volumetric flasks
- 12 250 ml conical flasks
- 2 0-50 ml Class B automatic burettes
- 2 0-25 ml Class B automatic burettes.

Chemical Reagents - obtainable from: British Drug Houses Limited, or from: Hopkin and Williams Limited P.O. Box 1, Freshwater Road, Chadwell Heath, Essex RM1 1HA, United Kingdom.

- Clark's Standard Soap Solution
- Phenolphthalein indicator solution
- Methyl Orange indicator solution
- $N/_{50}$ standard sodium hydroxide solution (ampoules of concentrated solution sufficient to make 1 litre)
- $N/_{50}$ standard sulphuric acid solution (also in ampoule form)

Supplies of ABCB tablets numbers 1 and 2 should be obtained as at present.

NOTE:

Baird and Tatlock (London) Limited and Hopkin and Williams Limited have the following agents and distribution centres.

Lebanon — Compton Pharmaceutique du Levant,
P.O. Box 860,
97 Rue Monseigneur Hoyek, Beirut.

Kuwait — Hopkin and Williams.

Mohamed N. Alhajcry,
P.O. Box 152, Kuwait,
Arabian Gulf.

Baird and Tatlock

Rezayat Trading Company,
P.O. Box 106 Kuwait,
Arabian Gulf.

Bahrain — Yousuf Malmood Husian,
P.O. Box 23, Tijjar Road,
Bahrain, Arabian Gulf.

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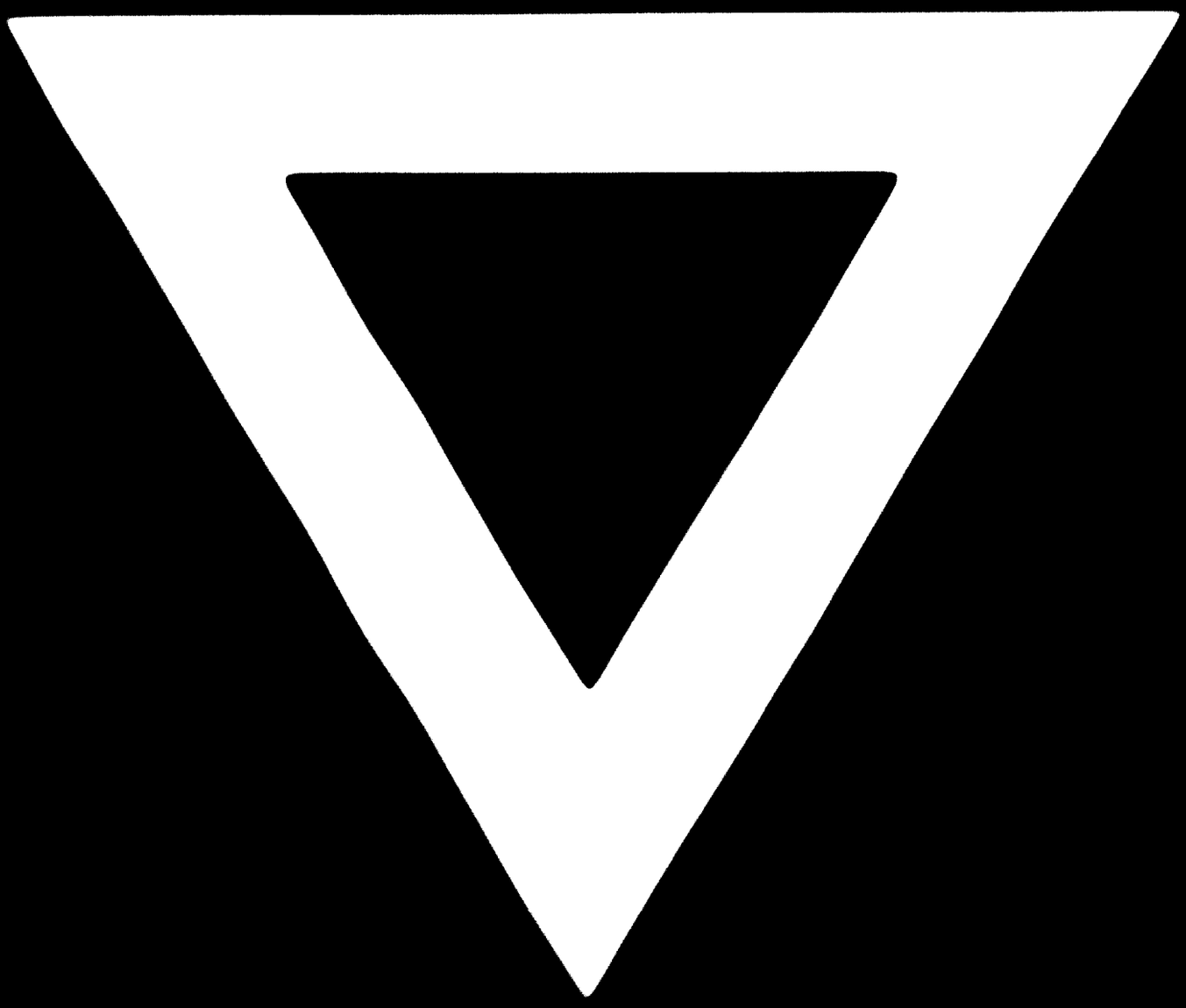

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