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IMPROVING THE SET-UP OF THE PINEAPPLE DRYING FACTORY

SI/CKI/85/801

COOK ISLANDS

Technical report: Rehabilitation of the Pineapple Drying Plant *

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

Based on the work of Erik Kissmeyer-Nielsen, Fruit processing expert

United Nations Industrial Development Organization
Vienna

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I SUMMARY

A Background

Grieco Foods (Cook Islands) Ltd., Mangaia Island was established in December, 1980 as a fully owned overseas Company. The primary processing activities planned were dehydration of subtropical fruits such as pineapples, papaya, mango, passionfruit,guava and star fruit. Secondary processing activities were to be glace'ing of green pineapple, mixed dried fruit and nut pacakaging, fruit leather manufacturing, banana chip manufacturing and fruit and nut coating. It was hoped that other processing activities could be added but the major attraction for the Cook Island Government was actually mainly the possibility of processing the Mangaia pineapple crop, since it was becoming difficult to market. To date the following capital inputs have been made:

	NZ$ 000's
1. Cook Island Government (CIDB)	
Processing Building	348
Cool Room Insulation	12
Water Purifier	15
Extensions	29
Reimbursement, Materials	13.4
Electric Power Supply	141
Water Supply & Access Roads	5
Gas Supply	20
Port Facility Upgrading	7.5
Total Cook Island Government	590.9
2. Grieco Foods (Cook Islands) Ltd.	
Capital Equipment	525
3. Boral Australia Ltd.	
LPG Facility and Pipings	405
Total Project Cost.	NZ$1,520,900

The factory was ready to operate for the 1983/84 pineapple crop season and an initial run started. A break-down of the dehydrator did, however, cause a delay in the dehydration of the fruit which was prepared for the run. By the time the dehydrator was repaired the pineapple had fermented in the sugar solution. Thus the project has so far not produced the intended dehydrated pineapple product (or other products) to be presented to potential buyers.

Following this abortive test-run the project appears devoid of working capital and Grieco Foods (Cook Island) Ltd. requests provision of an additional NZ$500,000 and NZ$750,000 for the pineapple and papaya growers to enable them to grow the amount of fruit needed by the factory to allow it to operate. This request met a cool reception by the Cook Islands Government since it would empthy out all available funding to C.I.D.B. (Cook Islands Development Bank). It is furthermore felt by the Cook Islands Government that the level of Grieco's input is very small. The NZ$525,000 value given the equipment landed by Grieco Foods (Cook Islands) Ltd. by the Griecos is furthermore felt to be very optimistic. The Cook Islands Government and C.I.D.B. feels it may include salaries and travel expenses incurred by Company officials. Various more expensive and essential equipment was supplied by the Cook Islands Government from the Kia Orana Foods Corporation.

Frank Grieco has in the meantime declared himself unable to resume operation of the Grieco Foods (Cook Islands) Ltd. unless his request for the required capital injection is honored and has retired to the parent company in California. He has just accepted an offer for NZ$20,000 by the Cook Islands Government to buy out his share of the Grieco Foods (Cook Islands) Ltd.. The company is thus now totally in the hands of the Cook Islands Government, which has entered it under the management of the Kia Crana Foods Corporation in Rarotonga. An effort is at present being made to assess the plant and arrive at modification to make the plant operational for the 1985/86 pineapple season. Allthough the initial test run was abortive, it did bring out some serious shortcomings in the plants technical performance of which very high and irregular power consumption was very prominent. Also the design of the fruit dehydrator is ineffective in aspects such as lacking insulation, large airspaces between the drying tunnel walls, cealing and floor and the loaded drying trays. The cooler appears designed way too large for actual needs

B Purpose and Scope

The purpose of the project is to assist the Cook Islands Government to appraise the technical aspects of the Mangaia Fruit Dehydration and Processing Factory in order to arrive at needed modifications to ready the plant for start up this coming November - April, 1985/86 season for pineapple production. Mangaia Island pineapple growers have been increasing their pineapple acreage in anticipation of finding a market for them at the factory. The failure of the factory to start up has left them with surplus pineapples hard to market due to the high freight cost of sending the pineapples to outside markets. The Kia Orana Factory in Rarotonga had to purchase some of these during the 1984/85 season but the cost of the freight was NZ$100 per ton or equal to the price paid the growers. Also some of the pineapples arrived overripe at the KOF in Rarotonga. KOF has produced pineapple juice concentrate which they packed in plastic pouches and stored under refrigeration. They experienced difficulties when sending some of this concentrate to New Zealand, since it fermented on the way and became unfit for consumption. They now are left with the problem what to do with the rest of this refrigerated pineapple concentrate. Hot filling in tin cans would be better idea technically but tin cans are unfortunately very expensive by the time they arrive in the Cook Islands. This is the reason, dehydrated pineapple presents a more tempting solution, since it can be packed in cheaper containers such as cardboard boxes with plastic pouches inside. It also is easier to store for extended periods so they adapt themselves better to the less reliable shipping schedule for Mangaia Island.

C. Conclusions and Recommendations

The Mangaia Fruit Dehydration and Processing Plant only operated a few days during the 1983/84 pineapple production season at the time of its initial trial run. The trial run became abortive due to mechanical failure of the tunnel dryer recirculation fan. By the time this problem was overcome the prepared pineapple fruit had fermented in the sugar solution in which it was stored in the cooling room by which it was rendered unfit for human consumption. This trial run was, however, useful since it brought out other technical problems. Among the more serious problems is, that the two diesel powered el-generators could not carry the peak el-consumption. A major source of the high peak el-consumption is the 1400 liter el-heated galvanized water blancher. The two el-heating elements do not deliver enough heat quickly to bring the water temperature back up to 190°F on emerging the stainless steel blanching basket with the prepared fruit. There is a need to replace this with a more direct heat source. The Ginaca pineapple peeling and coring machine failed to cut tops and bottoms of the pineapple cylinders which consequently had to be done manually. This is attributed to insufficient air pressure for the pneumatically operated cutting knives. A close examination of the electric motors and their installation revealed that most are of U.S. origin made for 60 and not 50 cycle. Furthermore they do not have appropriate starters to level off the peak starting load. The Cook Islands electric and power supply division (hence EPS) has declared themselves unable to deliver electricity to the factory until these defects are corrected. Also the direct butane gas fired heater for the tunnel drier consumes a great deal of gas. There is a need for

a cheaper alternative heat source for this. Numerable other but less dramatic changes and modifications are needed prior to restarting the factory. The principal owners of the factory Mr. and Mrs. Frank Grieco have in the meantime sold their share in the factory to the Cook Islands Government for NZ$20,000. The factory is now managed by the director of the Kia Orana Factory on Rarotonga and is wholly owned by the Cook Islands Government. The KOF director Mr. Michael Benns arranged for the May 23-30/85 appraisal mission to the Mangaia Fruit Dehydration and Processing Factory by a multidiciplinary team of experts including Mr. Paul D. Williams, Managing Director and chief mechanical engineer, Waterwide Developments (NZ) Ltd. and the UNIDO expert. This led to a detailed aggreement on actions to be taken including a timetable by which Waterwide Developments (NZ) Ltd. is undertaking the recommissioning of the Mangaia Fruit Dehydration and Processing Factory. The factory is to be ready for operation at the beginning of the 1985/86 pineapple production season on a turn-key basis by which Waterwide guarantees the factory will produce a normal untainted dehydrated pineapple of a marketable quality. The New Zealand Government has given a NZ$200,000 grant for this which appears sufficient for this. Details of the recommissioning and its timetable is given in appendix 1.

The initial processing is expected to comprise of a total 1985/86 season intake of 500 tons of fresh pineapples. With a normal ratio of finished dried product to fresh product of 1 to 10 this will give a production of 50 tons finished dried pineapple provided that the Ginaca functions normally and the fruit is reasonably sound and well graded of a suitable size.

The factory was originally scheduled to process 2000 tons of fresh pineapple per season, but the continued failure to get the factory operative have led to a decrease in pineapple planting by the Mangaia growers who virtually only have an economically feasible market for their pineapples at the factory. Various mostly New Zealand sources fof prices for the finished dehydrated pineapple product varies between NZ$3.60 and 5.55 which gives a medium price of NZ$4.57 per kg cif New Zealand. As shown below this will give a slight net margin for the factory when not considering depreciation of equipment and buildings the cost of which has been paid by grants.

	NZ$
Gross Sales 50,000 kg. @ NZ$4.575	228,752
Sales Losses (0.5%)	1,438
Freight NZ$120/ton	6,000
Net Sales	210,168
Plant Operation Costs	
500 tons pineapple @ NZ$150	75,000
5000 Cartons with Plastic Pouches	20,000
Utilities	
100 tons wood @NZ$25	2,500
Butane gas back-up	2,500
Electricity NZ$200/day	20,000
Water	2,000
Labor	
7 workers 100 days, 2 shifts, 7 x 100 x 2 x NZ$2 x 8	22,800
2 Workers 260 days, 1 shift	8,320
1 plant operator	10,400
Maintenance	30,000
Plant Operation Costs	193,520
Gross Margin	16,648

Allthough the margin is small it is sufficient to pay the growers for the fruit. The margin would become more favorable with an increased processing volume. Also papaya is scheduled to be processed in this plant which would furthermore make the factory more economically viable provided the finished products can be profitably marketed. At present it is mainly the New Zealand market the factory is aiming after because the Cook Islands have a preferred trade status with New Zealand and numerable importers of dried fruits in New Zealand have allready declared their interest in purchasing pineapple and papaya dried fruits from the Mangaia factory provided the products are sound. In the mean time the International Trade Centre (UNCTAD/GATT), Geneva, Switzerland have been contacted for more detailed information about the World Market for dehydrated pineapple and papaya and it is hoped they will come up with this in the very near future.

II. PRESENT SITUATION

A Fruit Processing

Grieco Foods (Cook Islands) Ltd., Mangaia Island was established in December, 1980 as a fully owned overseas company. Principal owners were Mr. and Mrs. Grieco, Grieco Foods, a division of Grieco Enterprises Inc., Sultana, California 93666, U.S.A.. The primary product to be produced was dehydrated pineapple and the secondary product dehydrated papaya. The planning called for sugared and non-sugared dehydrated fruits. There were tentative plans for numerable other products, mainly snack and health foods.

Initially the plan was for processing of 2000 tons of raw pineapple. The factory was ready for operation for the 1983/84 pineapple season at a scaled down version It has two tunnel dehydrators approximately 40' long, 7' high and 6' 9" wide, but only one tunnel was completed by the 1983/84 pineapple season. The completed tunnel is made to hold 10 steel trolleys each made to carry 33 wooden drying trays each 6' x 3' or a total of 330 wooden trays per tunnel load (with an estimated load of 12 kg prepared pineapple fruit per tray a full tunnel load is 330 x 12 = 3960 kg). The total drying time is about 18 hours. This corresponds to 8 to 10 ton raw fruit or about 800 kg finished dried fruit.

The initial trial run failed since the dehydrator fan broke down. The ready cut pineapple fermented while waiting for the repair of the drier fan. Various technical difficulties did however come to light. Among these was the failure of the Ginaca to cut tops and bottoms of the pineapple cylinders claimed to be caused by insufficient air pressure on the pneumatic system positioning the cylinders. The blancher consumed enormous amounts of power, during the blanching dips overstraining the diesel powered el-generators and posing and posing unreasonable high operating costs. This calls for an alternate heat source for the blancher. It was also found difficult to drive the trolleys onto the steel tracks in the dryer. The steel trolleys also do not support the full length of the wooden drying trayes and thus exert undue pressure on these with resulting bending and breakage. Also the curruga-ted roof of the dryer should be replaced by a flat roof and the 4 to 6" clearance beween the walls of the dryer and the drying trays should be cut to about 2". The fresh air intake to the dehydrator should be improved.A less costly fuel source than butane gas is needed, etc.. (Referral is made to "Section C, Energy Audit of the Greco Pineapple Processing Plant Mangaia, Cook Islands by Dr. John Todd, Energy Studies Unit, University of the South Pasific"(U.N. Contract, 1984)).

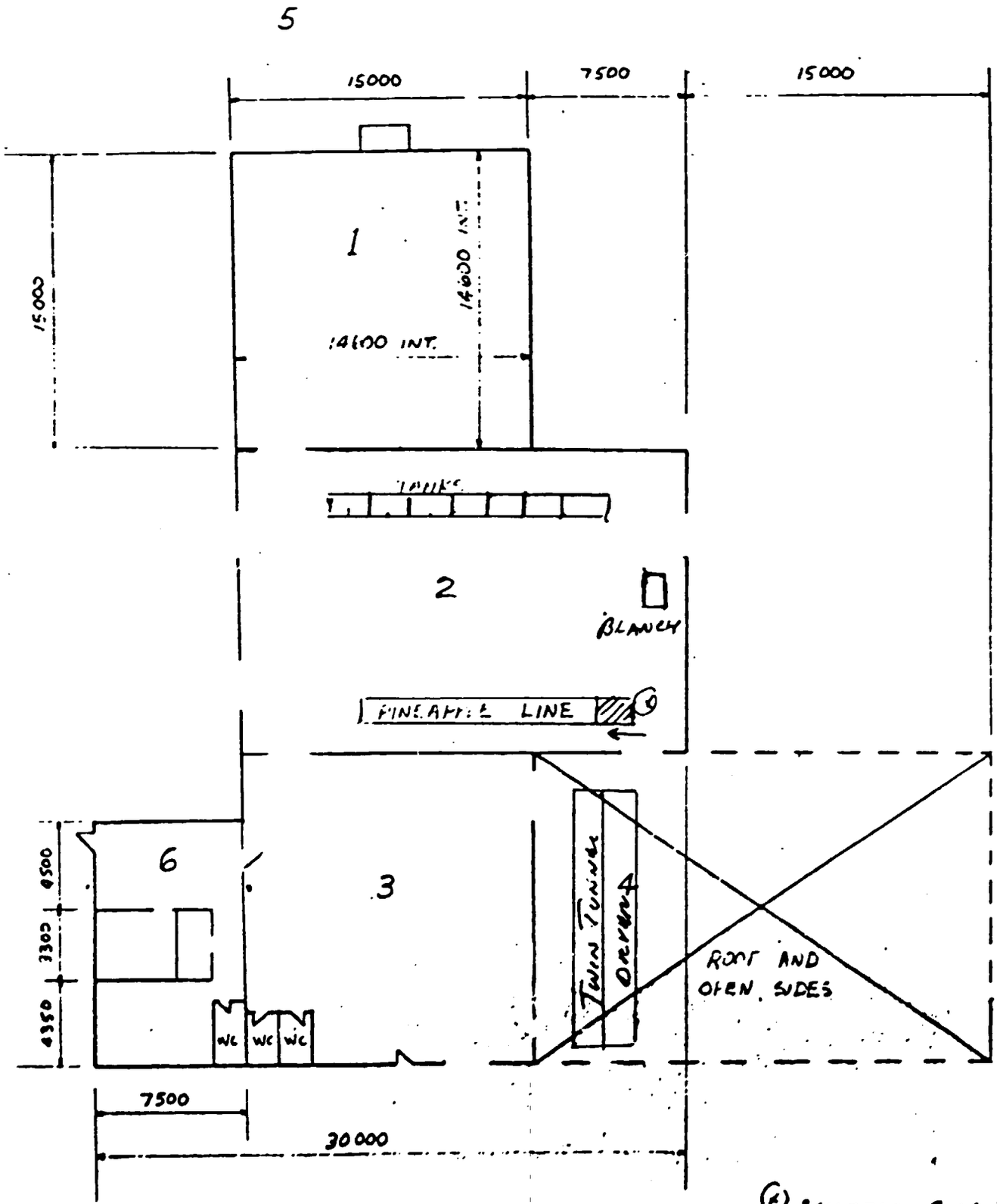
A.1. Present Processing Set-up

The processing plant is housed in a one story cement block building as shown in figure 1. The size is more indicative of a highly optimistic future production expansion than actual needs. While there are very adequate office, storage, processing, cooling room and sanitary facilities there are no provisions for laboratory or product development facilities. The basic flow sheet for non-sugar and sugared dried fruit production is shown in figure 2. When producing non-sugared dried fruits the sugar solution soaks are deleted. Present health food trends seem to prefer low sugar content products.
The fruit processing is done in room 2 (figure 1).
The Genaca pineapple peeling and coring machine, grading and trimming belt is where the pineapple line is shown with the slicing mashine and grading belt extending across the sliding door opening leading to the twin tunnel dehydrator on the dehydration and receiving platform marked area no. 4 on figure 1. This door opening can be made accesssible by shortening the grading belt by two meters, which with the low volume product flow will not be a problem. The present 1400 liter galvanized electrically heated blancher is situated between the end of the pineapple line and the outside door.
There are seven (3 m x 2.3 m x 1.5 m) heawy duty plastic vats with depressor covers for sugar syrup fruit dips (this line is marked "tanks" on figure 1).
A gantry winch system provides overhead transport for the stainless steel blanchings baskets from the end of the pineapple processing line to the blancher and syrup tanks. Its overhead monorail appears only poorly supported by the present floor mounted profile iron supports. Also the gantry winch is of a very light construction.
The cement floors are not treated with acid resistant paint to protect them against the highly corrosive fruit juices, but should be.

III. FIGURES

FIGURE I

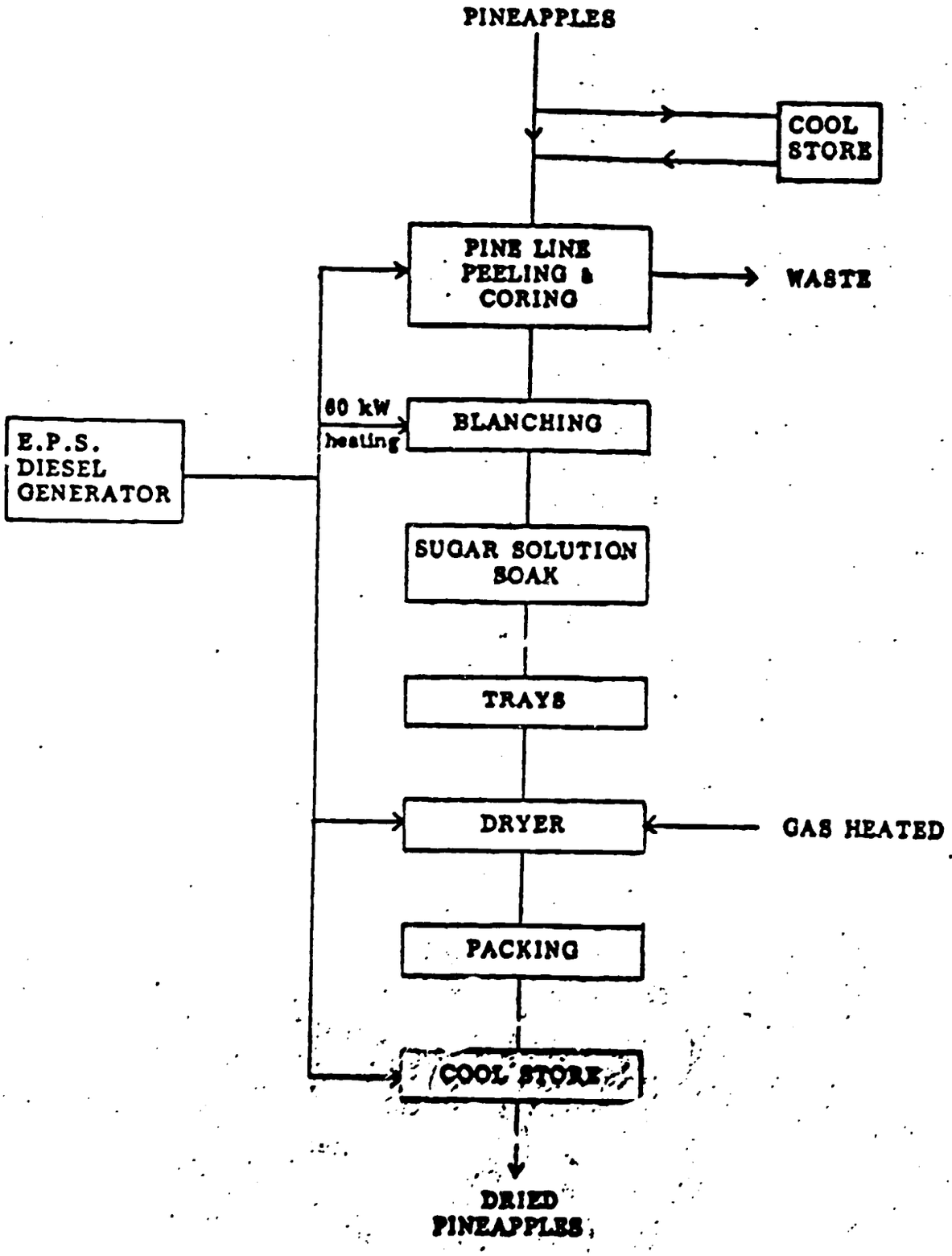
FLOOR PLAN-MANGAIA FRUIT PROCESSING FACTORY



(x) SHORTAN 2M TO OPEN PASSAGE TO DRYER.

NOTE : ALL DIMENSIONS IN MILLIMETRES

FIGURE 2 FLOW SHEET FOR PINEAPPLE DEHYDRATION



The processing flow plan is to load the wooden drying trays in room 2, loading them onto the steel trolleys up to 33 trays high and then drive the loaded trolley onto the steel tracks in the dehydration tunnel. The dehydration tunnel can take ten trolleys. The drying time is about 18 hours after which the trolley is removed from the tunnel, the dried fruit unloaded into a large vat for equilibration of moisture and the product is finally filled into plastic bags inserted in cardboard boxes (about 10 kg. net.). It would be simpler to drive the loaded trolleys directly into the drying tunnel through the sliding door in room 2 rather than through the sliding door in room 3 because the pineapple processing belt blocks this. This can be achieved by shortening the pineapple processing belt by 2 meter, which at the low rate of processing would not pose a problem. Each drying tray has an approximate load capacity of 12 kg. wett prepared fruit. With 33 drying trays per trolley and 10 trolleys per tunnel load one full tunnel load is 33 x 12 x 10 = 3960 kg or about 800 kg dried fruit. One apparent problem with the drying tunnels is that there is too much space between the sides and the cealing and the drying trays allowing too much air to seek throughthese spaces rather than between the slatted wooden trays around the fruit. The present use of butane gas is also prohibitively expensive posing a need for a cheaper alternative fuel such as solid fuel (wood). The first abortive trial run also indicated, that the el-motor of the hot air circulation fan in the tunnel dryer could not take the exposure to the hot air and consequently broke down. Commonly it should be mounted outside the tunnel with a driveshaft connecting it to the inside circulation fan.

It was found hard to place the wheels of the drying tray loaded trolleys onto the steel tracks in the tunnel because they swivel independently. There is thus a need to secure the rear wheels in a forward pointing position and syncronise the movements of the front wheels so they follow the direction of the trolley. The trolleys also only supported 4' of the 6' long drying trays with a resulting bending and damaging of the wooden drying trays. There is a need to weld on 4 one foot profile iron to support the wooden trays all the way to the ends.

An economic draw back to the present pineapple processing set-up is that it does not allow optimum utilization of by products. The eradicator flesh (flesh scraped from the pineapple peel) and the cores from the pineapples cannot be used for production of more valuable products such as pineapple juice and crushed pineapple, but must be used for cattlefeed or discarded. The high freight rates and the lack of a local market for this renders it economically non viable.

The present processing set-up can also be used for processing of papaya into dehydrated papaya flesh, but the process will call for almost complete manual processing.

The cooling room. room no. 1 on figure 1 is far too large for the anticipated processing volume. It would help to divide it up into at least two independently cooled cooler rooms to be able to save on electricity.

The abortive trial also showed a prohibitively high peak el-consumption. The el-generators could not carry this peak. The main cause of this appears to be the el-heated blancher, which when emerging a new load of fruit for blanching cools rapidly and consequently pulls as much electricity for its two heating elements as it can. The Cook Island electricity and power supply division

has declared, that it is emperative that these plant problems must be corrected before restarting the plant. This has brought about the urgent need for a total re-appraisal of the plant by a group of experts of which the UNIDO fruit processing expert is one. The findings, conclusions and recommendations of this study are presented in this report.

The fact, that the plant has actually not functioned normally yet brings out the unfortunate lack of operational data, such as performance of management and labor, economic performance, quality of product(s), their marketability and price range, etc.. It is thus necessary to turn to world market information through various sources. Through this some idea of prices and quantities have arisen and especially from New Zealand with which Cook Islands enjoy a trade preference and and actually have had a trade relationship in processed and not procesed produce over many years.

The report presenting the conclusions and recommendations arrived at by the appraisal mission to the Mangaia Fruit Dehydration and Processing Factory May 23 - 30, 1985 is presented in appendix I. That the principal owners of of the factory, Mr. and Mrs. Frank Grieco have turned over their share of the factory for the modest payment of NZ$20,000 to the Cook Islands Government have cleared the way for defenite decisions on what to do with the factory. Mr. Frank Grieco initially demanded a far greater compensation closer to the more than NZ$500,000 value he had attached to his share of the factory equipment and materials. This makes it possible to use a New Zealand Government Grant on approximately NZ$200,000 for the re-habilitation of the plant on a turnkey basis rather than a piece-meal approach, thus making the machine company responsible for a satisfactory rehabilitation guaranteing a sound final product without taint.

IV. Appendix 1

Appraisal Mission to
Mangaia Fruit Dehydration
and Processing Factory
(formerly Grieco Foods (Cook Islands) Ltd.)
Mangaia, Cook Islands, May 23 - 30, 1985
by
Erik Kissmeyer-Nielsen
UNIDO Fruit and Vegetable
Processing Expert

Section I

The expert went to the Mangaia Fruit Dehydration and Processing Factory on Thursday, May 23, 1985 ahead of the main appraisal mission headed by the factory Director Michael E. Benns scheduled to arrive in Mangaia on Monday, May 27, 1985. He met with the Cook Islands Government Representative, Mr. Stui John, who gave him some background information on the processing venture. His arrival ahead of the main appraisal mission was done so that he could familiarize himself with the factory so he would be ready to contribute to the overall appraisal and assess the needed technical modifications required to make the factory operative and able to produce a marketable product. It should at this point be pointed out, that the factory has actually never operated in a normal way, since the first trial dehydration of pineapple during the 1983/84 pineapple production season was abortive. The dehydrator broke down in the very beginning of the trial. Still some major technical problems did emerge during this trial. Among these were that the el-heated water blancher's peak electricity consumption exceeds the capacity of the two diesel powered el-generators, the Genaca peeling and coring machine failed to cut the tops and bottoms of the pineapple cylinderes due to an apparaent malfunction of the pneumatically operated positioning mechanism (servicing a Genaca machine is a highly specialized service which is mostly performed by the Genaca Manufacturer or mechanics especially trained by them) the butane gas consumption of the drier burner is exceedingly high and the burner lacks a flame baffler plate to prevent the flame from shooting uncontrollably ahead torward the aircirculation fan which consequently gets overheated. An other problem is to place the steel trolley wheels onto the steel rails in the dryer tunnel.

Further findings and conclusions by the UNIDO expert are:

1 He inspected the twin tunnel dryer of which only one tunnel is finished. He found;
   a. The steel trulleys do not support the full length of the 6' x 3' wooden drying trayes. They are only 4' wide which causes the wooden trayes to sag resulting in some breakage. They should be widened by welding on four one foot sections of profile iron.
   b. The steel rail accesses in the tunnel dryer should be eased by welding on short sloping steel accesses. The rear swivel wheels of the trolleyes should be fixed pointing in the direction of the trolley movement in the tunnel.

c. The el-motor driving the aircirculation fan in the drying tunnel should be mounted outside the drying tunnel so it is not exposed to the heat in the tunnel. The el-motor is normally connected with the fan with a drive shaft.
d. The 4-5" clearing between the tunnel sides and trayes should be reduced to about 2" by mounting heat resistant cement-fiber plates on tunnel sides. The same should be done for the roof of the dryer.
e. The present use of butane gas as fuel should be substituted by use of a cheaper solid fuel such as wood of which the Cook Islands Government claims there are adequate supply in Mangaia. Solid fuel burners with controlled air recirculation are increasingly used in dehydration of food products.

2. <u>The electrically heated blancher</u>
a. The present el-heated galvanized steel blancher should be replaced by a more diect heated stainless steel blancher with about double the present water capacity (from 1400 liter to 2400 liter of liquid). Galvanized steel corrodes in the sulphor dioxide solution used in the blancing process. This causes browning of the fruit. The solid fuse burner suggested by the Waterwide company (the DF75 Solid Fuel burner) could also heat the blancher. The larger volume blanching liquid will lessen the temperature drops on emerging a new batch of pineapples.
b. There is a need to build two additional stainless steel baskets for the blancher for allways having a spare basket for filling (the blanch is only a two minute dip at about 190°F.).

3. The present overhead rail lift for the blanching baskets should be reinforced by:
a. Brace the steel rail by attaching supports to the heavy profile iron roof rafters, which at present is only poorly supporters by profile iron mounted in the floor.
b. The present light weight el-winch should be replaced by a heavy weight winch

4. The Cooling Room should be devided in order to save energy for the compressors. The actual amount of fruit processed does not warrent the use of the very large cooling room.

5. A list of inventory is attached. Aside from that listed the following was found:
a. Sugar, 143 bags each 35 kg. = 5,005 kg

b. Natriumbisulfite, 13 bags each 50 kg. = 650 kg
Anhydroussodiummetabisulfite, 6 drums each approx. 25kg= 150 kg.

c. Cardboard cartons, approx. 10,000

6. Assessment of the monetary value of the existing equipment Most of it has been moved from the Kio Orano Factory in Rarotonga, which has stopped processing pineapples some time ago. This dates back from the early 70's. Food machinery is commonly depreciated over a 10 year period after which it only has a small residual value. The tunnel driers have not been finished and the rest of the equipment is second hand. The principal owners of the factory, Mr. and Mrs. Frank Grieco have accepted a Cook Island offer of NZ$20,000 for the equipment delivered by them.

7. An item which has given rize to consern is the water supply. It does, however, appear that Mangaia can supply sufficient water from three, possibly four, bore holes with their own individual diesel powered pumps. The factory does have rain water collection systems from the roofs entering into cement silos. The factory does have a water purification system, an ultraviolet light exposure system. Part of the factory roof does not have rain water recovery system but could get this. The EPS (electric and power systems) Department is cooperating on securing an adequate supply. Some prudence in water use must be exersized.

Section II

The appraisal mission arrived in Mangaia on Monday May 27, 1985 headed by Michael B. Benns, the factory director. Other members of this mission were Paul D. Williams, Managing Director and chief mechanical engineer, Waterwide Developments (NZ) Ltd., Haumoana, New Zealand, Ed. Winnen, Agricultural Officer, Rarotonga (Dutch Bilatteral AID), Ken Richards, Department of Energy, Rarotonga (US Volunteer), the food technologist from the Kia Orano Factory in Rarotonga.
The mission members had allready been exposed to the Mangaia Fruit Dehydration and Processing Factory situation. Paul D. Williams specializes in designing and delivering food dehydration equipment and is an expert in solid fuel (mostly wood) burners for use in dehydrators. Ed Winnen has since the beginning of the year been in the process of preparing a feasibility study on this venture. Also Ken Richards has for some time been involved in this project. The whole mission made an in depth app aisal of the factory. After lengthy discussions a plan(as attached) was arrived at on the modefication of the plant to enable its normal operation and production of a marketable product. Waterwide Development (NZ) Ltd. was commissioned to undertake this on a turn-key basis. The New Zealand Government has given a NZ$200,000 grant for this which appears sufficient appart from some smaller very special modifications. It is planned to start the factory in November, 1985, which is the beginning of the next major pineapple production season Nov. - March.

INVENTORY OF PINEAPPLE PROCESSING FACTORY EQUIPMENT

1 COOL ROOM

1 2 x Evaporator Units
2 1 x Compressor Unit
3 144 x Plastic Buckets
4 25 x Plastic Storage Bins
5 U.C.* Cardboard Boxes
6 U.C. Sugar
7 U.C. Chemical Additive

* UN-Counted

2 PROCESSING ROOM

1 7 x Gondolas (Syrup Vats, 3m x 2.3m x 1.5m)
2 6 x Depressors (Cover for Gondolas used to drain product)
3 2 x Stainless Steel Peel Tables
4 1 x Ginaca (Pineapple peeling and coring machine) ex K.O.F.
5 1 x conveyor belt processing table ex KOF
6 1 x slicer ex KOF
7 1 x Ginaca (for larger fruits, not installed) ex KOF
8 1 x blanching tank
9 1 x gantry winch and gantry system
10 1 x work bench including: 1 bench vice
1 grinding machine
11 3 x syrup circualtor pumps
12 1 x pineapple grader ex KOF

3 PACKAGING ROOM

1 10 x steel trolleys
2 295 x wooden drying racks
3 1 x mobile steam cleaner
4 2 x 100lb gas cylinders
5 1 x dicing machine
6 1 x pallet lift
7 1 x palstic bag sealing machine
8 1 x air compressor
9 1 x arc welder
10 1 x clark forklift
11 1 x toledo scale
12 300 harvest tote boxes
13 1 x scullery sink
14 4 x plastic rubbish bins
15 1 x 20lb gas cylinder
16 1 x gas cylinder troller
17 1 x oxygen cylinder
18 2 x octelene cylinder

4 DEHYDRATOR AREA

1 2 x steel frame, fiberlite walled drying rooms
2 1 x hot air blower
3 1 x LPG burner

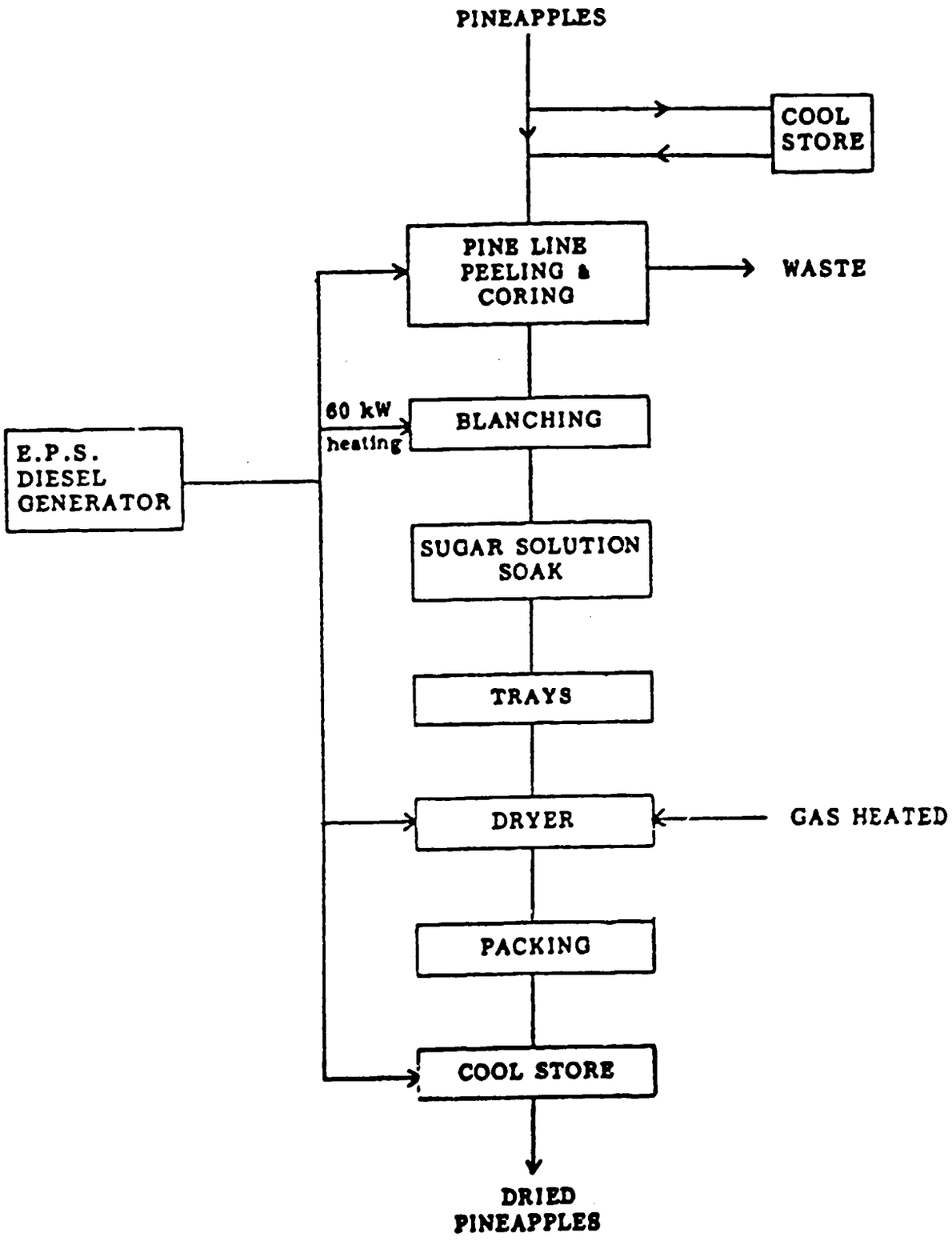
5 WATER EQUIPMENT AREA

1 1 x Ultraviolet steriliser
2 1 x Pressure pump
3 1 x Solar water heating unit

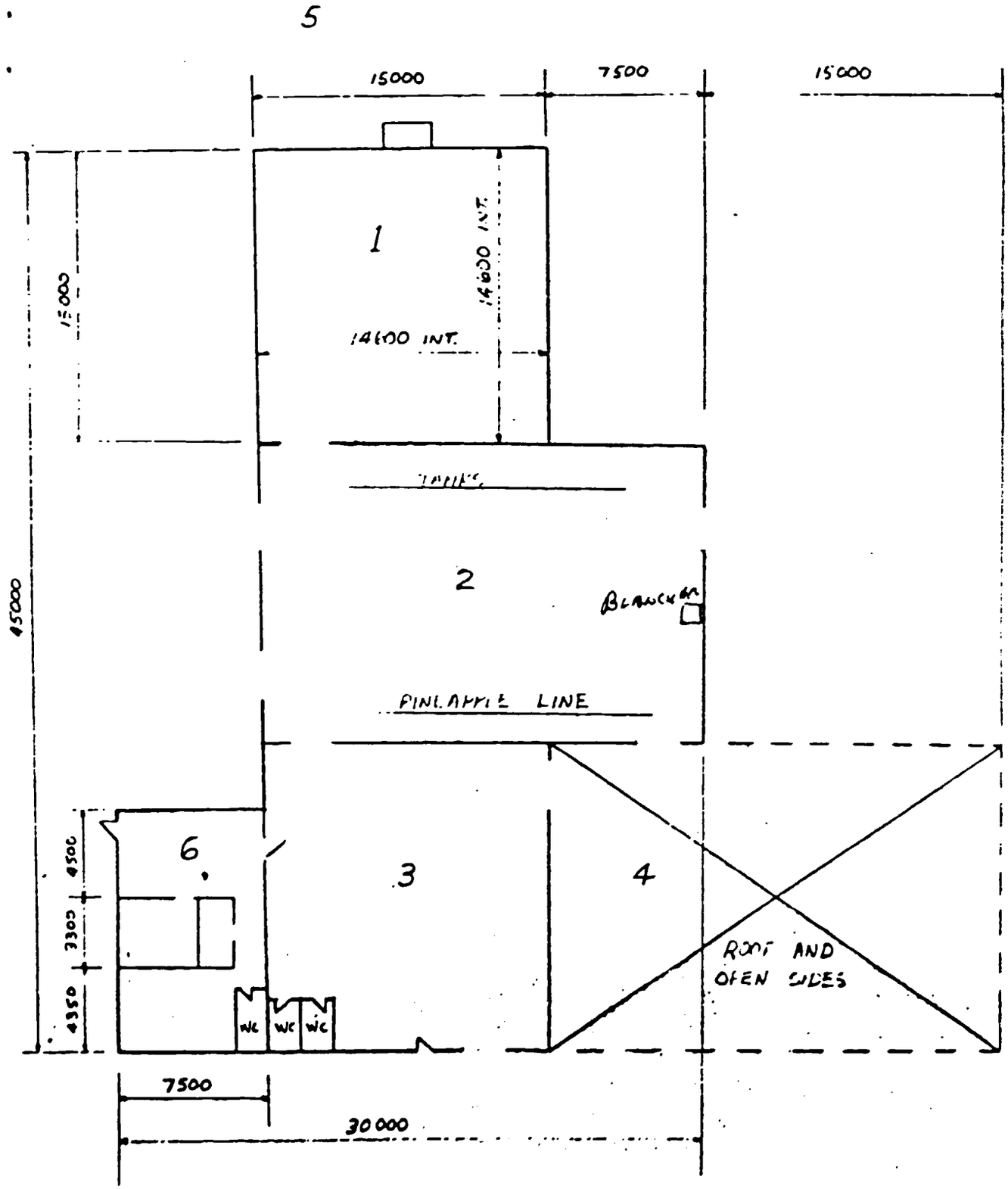
6 OFFICE

1 1 x typewriter
2 3 x office desks including chairs
3 1 x Conference table including chairs
4 1 x stencil cutting machine

FIGURE 2 FLOW SHEET FOR PINEAPPLE DEHYDRATION



FLOOR PLAN-MANGAIA FRUIT PROCESSING FACTORY



NOTE : ALL DIMENSIONS IN MILLIMETRES

Task	June	July	Aug	Sept	Oct	Respon
Ginaca						
eliminate 2nd conveyor		xxxxxxxxxxx				Hunter
floggle toggle		xxxxxxxxxxx				Hunter
rewiring			xxxxxx			Mckay
reconditioning-cleaning		xxxxxxxxxxx				KOF
refitting dies	xxxxxx					KOF
shift machine					xxxxxx	KOF
painting					xxxxxx	KOF
Baskets						
ship existing to Raro		xxxxxx				KOF
modify exixting				xxxxxxxxxxx		Hunter
duplicate				xxxxxxxxxxx		WW
Blanching tank						
discard old unit			xxxxxx			KOF
design-build new	xxxxxxxxxxx					WW
Syrup tanks						
design-construct tressels					xxxxxx	KOF
construct duckboards					xxxxxx	KOF
move tanks				xxxxxx		KOF
clean tanks					xxxxxx	KOF
purchase pump		xxxxxx				WW
design drip table	xxxxxx					WW
construct drip table				xxxxxxxxxxx		WW
modify buckets					xxxxxx	KOF
Gantry						
design		xxxxxx				WW
prefabricate		xxxxxx				WW
installation					xxxxxx	Hunter
purchase block		xxxxxx				WW
Trollies						
modify existing trollies (corners and extension)					xxxxxx	Hunter
construct 5 new trollies					xxxxxx	Hunter
modify rails					xxxxxx	WW
supply and install winch					xxxxxx	WW
clean and repair trays				xxxxxxxxxxx		KOF
build 50 new trays				xxxxxxxxxxx		KOF
search for new wheels	xxxxxx					WW
supply trolley drawing	xxxxxx					KOF
Burner and drier						
design and fabricate	xxxxxxxxxxx					WW
installation				xxxxxxxxxxx		WW

	June	July	Aug	Sept	Oct	Respon
Burner house						
design		xxxxxx				WW
construction				xxxxxxxxxxx		KOF
Shipping						
arrange shipping	xxxxxxxxxxx					KOF
packaging			xxxxxx			WW
ship			xxxxxx			WW
Floor covering						
purchase		xxxxxx				WW
application				xxxxxx		KOF/WW
Water reticulation						
obtain diagram	xxxxxx					KOF
wire pump and purifier			xxxxxx			Mckay
test water		xxxxxx				KOF
alterations to system				xxxxxx		KOF
Refrigeration						
measure room size	xxxxxx					KOF
order new panels	xxxxxx					KOF
install partition				xxxxxx		KOF
Rehab of forklift			xxxxxx			KOF
Rewire factory			xxxxxxxxxxxxxxxxx			Mckay
Woodfuel						
prepare woodlot	xxxxxx					KOF
purchase wood		xxxxxx				KOF
Clean factory						
yard			xxxxxx			KOF
refrigerator				xxxxxx		KOF
process room					xxxxxx	KOF