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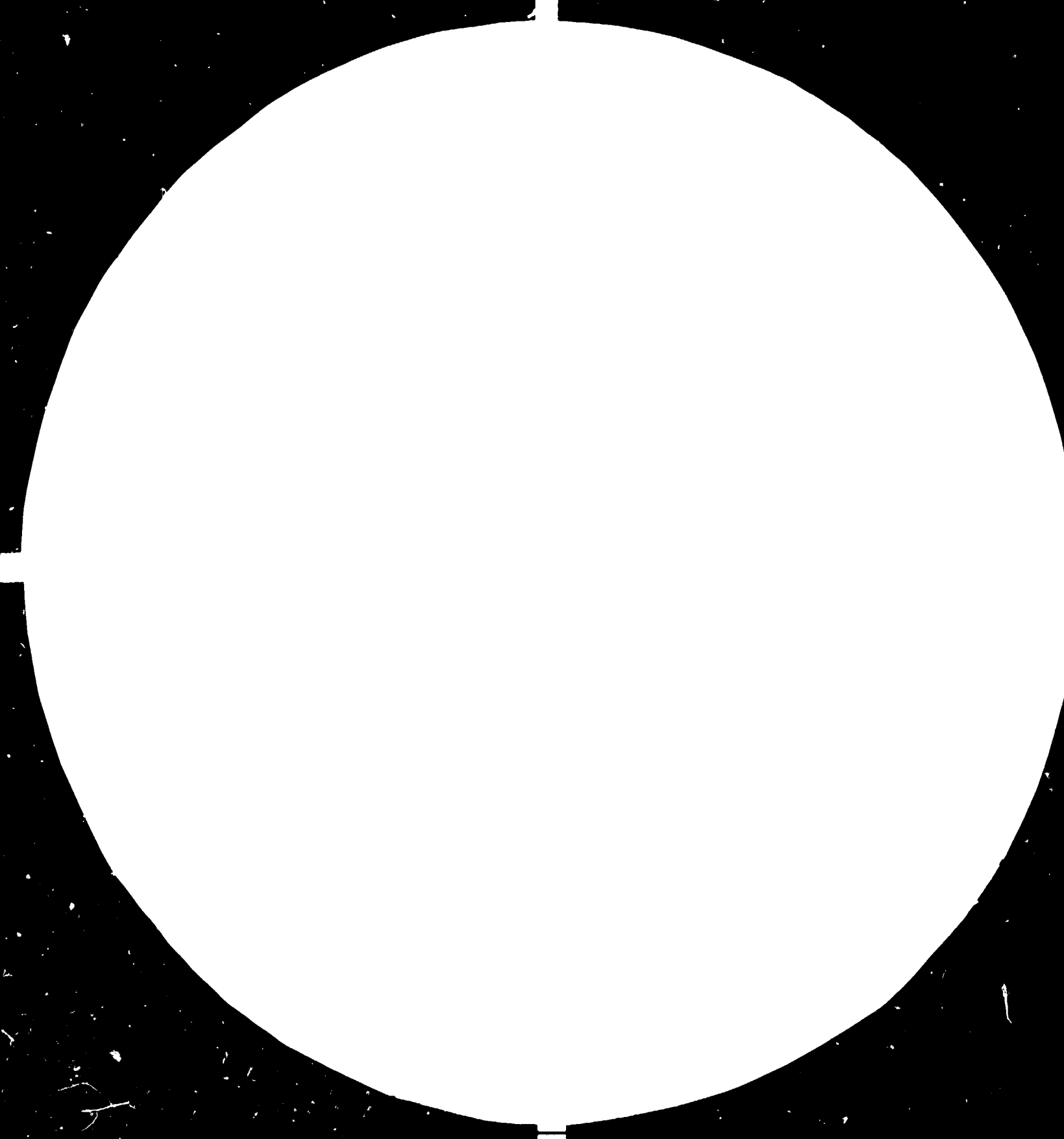
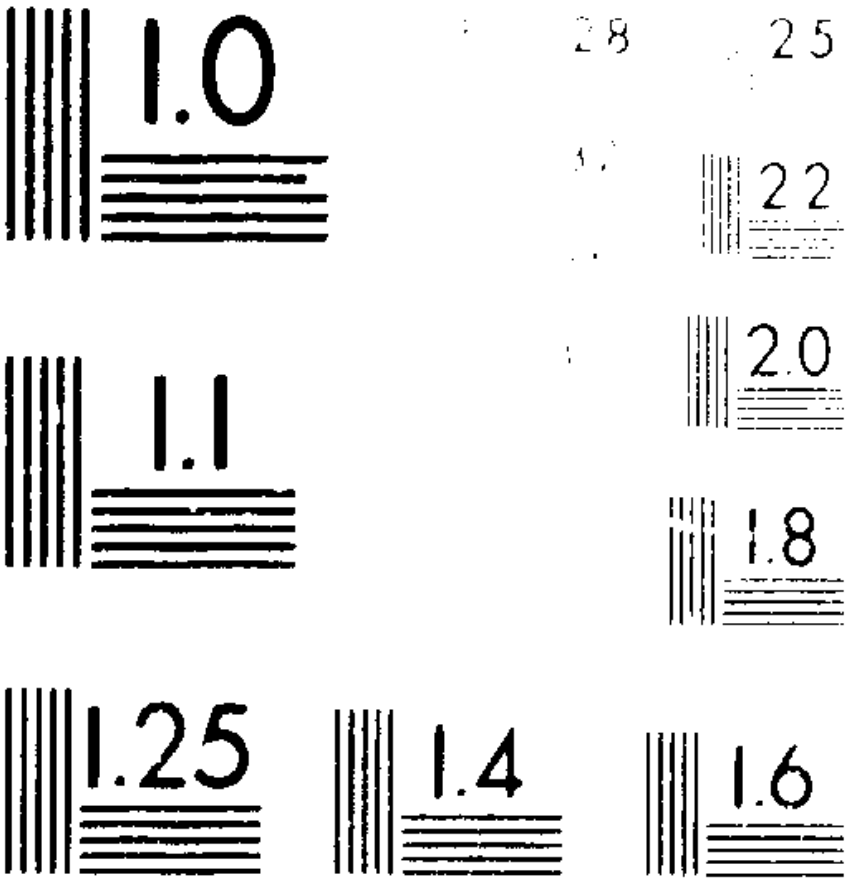




December 1984

English

14324

Somalia.

DEVELOPMENT OF A NATIONAL CHARCOAL INDUSTRY

SI/SOM/83/802

Technical Report

First phase from 3 May to 10 July 1984
Second phase from 17 September to 29 November 1984

Prepared for the Government of Somalia
by the United Nations Industrial Development Organization

Based on the work of Walter Emrich, expert
in charcoal and pyrolysis technology

United Nations Industrial Development Organization
Vienna

Table of Contents

First Phase

Second Phase

Abbreviations used

NRA National Range Agency

Currency conversion: 1 US Dollar ≙ 26 Somalian Shillings

1. INTRODUCTION AND SUMMARY

This is a report of a mission from 3 May to 10 July 1984. A return mission is scheduled for September 1984 to complete the work for which the terms of reference are given in Appendix I.

During a meeting in Vienna conducted by Mr. M. Maung, and Mrs. D. Runca, backstopping officers, the consultant was adviced also to draw-up a master plan for the implementation of a National Charcoal Industry Development Programme in Somalia.

Immediately after arrival in Mogadishu on 8 May 1984, the specific points and tasks of the mission were discussed with the General Manager of the National Range Agency (NRA), Dr. A. Karani. The summary of this discussion is attached in Appendix II.

Several conversations and interviews with the charcoal cooperatives in Mogadishu, representatives of the planning department and charcoal dealers revealed, that all previous assessments can be considered as still valid. No improvements have been observed.

Therefore the present status of the charcoal production and the charcoal markets in Somalia may be best characterized as follows:

- the cooking fuel for households consists mainly of charcoal. Apart from that illegal firewood markets exist and provide part of the cooking fuels used in households. Kerosine is not likely to become a substitute fuel for cooking.
- the charcoal is exclusively made from forest wood. The utilisation of forestal and agricultural residues is not known to the charcoal makers.
- charcoal briquettes with their energy saving effects are not available on the markets.
- the use of charcoal manufacture by-products and their commercial value are not known to the charcoal makers.

The National Range Agency as reponsible institution of all public forests in Somalia is well aware of the heavily wood cutting by the charcoal cooperatives and the associated resources depleting effects. An obvious sign of the speed with which the charcoal makers are progressing further into the woodlands is the fact, that the distances between the charcoal camps in the Bhaidows area and the city of Mogadishu have increased about 150 Km during the past two years only.

It has been recognised generally that only a well organised demonstration and training programme will have the efficiency necessary to change the habits of the traditional charcoal makers and to create the awareness for application of less wasteful methods.

The improvement of the charcoal production in Somalia has to be propelled on two levels:

- modifying the present earthmound kilns with "forced draft" attachment for the achievement of better charcoal and for collection of liquid by-products. Training of the charcoal makers in the construction and operation of kilns with fixed shells, preferably kilns of the "Half Orange" type made from clay bricks.

- replacement of forest wood by forestal and agricultural waste. Setting-up a charcoal briqetting plant for the processing of the char obtained from waste conversion and of the charcoal fines falling out of the present earth-mound kilns.

A National Charcoal Industry Development Programme of such size will require a period of time which is estimated to be four years at least.

The part of the charcoal development programme dealing with the conversion of waste - Somalia abounds in particular in agricultural residues - will demand extensive research and test work.

Due to the present economic status the National Range Agency was not able to care for the usual financial arrangements concerning transportation costs, purchases of tools and smaller equipment.

Therefore a request for USD 2,550.- had to be submitted to UNIDO in Vienna and was approved by the end of May.

For the design of the masterplan more data had to be collected. The necessary interviews and discussions took place mainly in Mogadishu. Contacts have been made with NRA, the marketing and production charcoal cooperatives, the ministry of planning and local banks as well as stores and maintenance shops.

However, longer trips scheduled for Kisimajo and Bhaidowa had to be cancelled due to a severe gasoline shortage lasting for more than five weeks.

During the first visit to the new forestry school in Afgoie it became clear that no laboratory space to accomodate the charcoal research and training centre can be provided for the time being.

The two alternatives will be discussed in the respective chapter of this report and a recommendation has been included.

The laboratory equipment already purchased by UNIDO is stored within the premises of the UNDP/Mogadishu. The inventory has been checked and compared with the original purchase documents and no parts have been found missing.

During the following weeks equipment has been procured and the retorts for waste conversion have been constructed and are now stored at UNDP also.

The concluding phase of the mission, is scheduled for September/October of this year.

2. MASTERPLAN FOR THE NATIONAL CHARCOAL INDUSTRY DEVELOPMENT PROGRAMME

The concept:

The National Charcoal Industry Development Programme will coordinate all charcoal activities, including source research and test programmes for alternative raw materials.
For this purpose a project manager will be appointed who will pursue the task along the lines set-forth by the masterplan and in close cooperation with the NRA.

The design of the concept is made in such a way that a high dissemination effect for improved charcoal making at various levels will be achieved.

Since charcoal making in Somalia involves about 12,000 persons, including the transportation and marketing of charcoal, any changes may have undesirable socioeconomic effects [illegible], if not carefully planned and integrated into the existing system.
On the other side Somalia offers ideal conditions for the promotion of better and more effective charcoal technology because of a well established organisation represented by two charcoal cooperatives. Therefore, any alterations and promotion of better kilns has to be done through joined activities with these co-operatives.

Therefore the demonstration and training under the National Charcoal Industry Development Programme becomes very improtant. The future project should train a minimum of 50 charcoal students per annum.

The charcoal project also must engage in direct support of the charcoal cooperatives by assisting and advising the members of the charcoal camps, whenever they have adopted the proposed techniques.

The other objective of the National Charcoal Industry Programme will be the evaluation of forestal and agricultural wast resources presently untapped.

The conversion of these raw materials will require the application of more advanced technology and can be considered as a separate section of the Programme not necessarily be covered by

the charcoal production cooperatives.

However, the obtained products from these new production centers have to be promoted and marketed by the charcoal marketing cooperative, whether they are charcoal briquettes or the familiar lump charccoal.

The National Charcoal Industry Programme will include all regions of the country. It is proposed that it be carried out over a period of four years.

At the moment it is not sure whether the four years will be sufficient to alter the present working habits and the structure of the charcoal industry in Somalia. However, according to experience with similar charcoal programmes in various countries it is very likely to achieve its goal within this time frame. On the other side the National Charcoal Industry Programme will progress, if it is able to prove and demonstrate the commercial values of the envisaged technologies. The charcoal cooperatives will embark on it, because it will contribute to their own benefits.

Description of the programme:

The submitted masterplan distinguishes between three major working sections, which are supposed to start at the same time and overlap with each other:

Section 1.	Research and testing work
Section 2.	Training programme
Section 3.	Technology transfer

The latter section represents the main goal and is designed to implant a high number of improved kilns per year and also to establish sufficient waste converters in selected areas.

The input to section 3 will come from the two other sections. We assume that the proposed research capacity will be able to evaluate the commercial utilisation of two different waste or residue sources per year. This will eventually allow the establishing of more than three prototype plants for the manufacturing of charcoal briquettes combined with a sizable gas production

for electricity or steam generation.

The project should have a training capacity which enables it to turn out approximately 200 charcoal trainees within four years, which equals appr. 5 % of all charcoal makers presently operating earthmound kilns. Since these trained students ve become acquainted with the construction and operation as well of the modified earthmound kilns and gained sufficient experience with fixed shell kilns they will be capable to transfer their skills to others.

Under the great number of available and commercially proved technologies for improved charcoal making we have selected the following types:

Earthmound kiln with forced draft: This kiln type has gained large popularity especially in the Eastern countries of Europe like Russia. The technique offers the advantage of the controlled air-intake, which minimizes the damage of over - and underburning of charcoal, yielding uniform charcoal quality. It is also possible with the addition of simple devices to collect part of the tar oil, which represents a substitute for heating fuels in particular natural oil.
Investment costs of "forced draft" kilns are very low and their operation is similar to the traditional method.

Argentine or Brazilian fire brick kiln: These kilns can be build from clay and without foreign materials. They vary in sizes between 8 m^3 and 80 m^3 of capacity. The advantage has to be seen in their fixed shells with calculated airinlet ports and smoke outlets. The operation requires less attantion as for any other kiln types. The charcoal obtained from these kilns is of high quality and suitable for all industrial processes.
Both kilns are the most popular types and their number may be in the range of several hundred thousands in South America alone. They also can be constructed with external heating chambers. Henceforth having the cycle characteristics of charcoal retorts. Construction cost do normally not exceed USD 200.- per kiln, if suitable clay can be found in the vicinity of the kiln sites.

Oildrum retort: These retorts are assembled from spent oildrums. They can be fitted with gas pipes for gas collection.
They are usually employed for the conversion of agricultural waste. Since most of these waste materials are obtained in small particles the yielded char has to be agglomerated if used as

household fuel.

Typical raw materials in Somalia are: cotton stalks and cotton gin waste, sisal residues, papaya plantation waste, sugar cane bagasse (excess bagasse from sugar factories), banana plantation waste, forestal residues like bark, brush, leaves, etc., waste from lumber operations, shells and husks of coconut plantations.

The time frame and further details of the entire workload to be performed by the project have been given in the submitted draft of the masterplan.

Appendix 4 displays the structure of the proposed kilns and a simple briquetting machine, which can be assembled from scrap material.

Costs of the National Charcoal Industry Programme: The prices for the equipment - research and training facilities - have been determined according to the quotations obtained from stores and manufacturers in Mogadishu. They are listed in the submitted draft of the masterplan.

The estimated investment will be appr. USD 60,000.- and the annual expenditures for the personnel, trainees, maintenance and office/ research work USD 160,000.- .

3. Installation OF THE CHARCOAL RESEARCH AND TRAINING CENTRE

Site selection: During the previous mission this question had been discussed with all institutions involved and it was aggreed that the new forestry school in Afgoje should provide the space for the project office, laboratory and training ground.

Afgoje is located about 45 km west of Mogadishu on the cross-roads to Bhaidowa and to the south.

The main reason for choosing Afgoje is the fact that the university of Mogadishu with its research facilities is near enough to provide support whenever it may be needed.

Another consideration may be seen in the circumstance that the farmlands surrounding Afgoje are the largest in Somalia and abound in agricultural waste. Therefore it is very likely that some conversion plants for agricultural waste may be located just here in the future.

Necessary electricity and water supply are secured, which is one of the basic requirements for any research work.

With this choice, however, we had to accept the drawback of far distances to the actual charcoal camps, which are located in Bhaidowa (250 km) and in the Juba Valley area (450 km). This will cause additional expenditures for the transportation and accomodation of the future charcoal students.

Since all these questions have been discussed with the representatives of the NRA who assured that no objections to the UNIDO plans will arise and who confirmed their full support.

Costs for buildings and construction work: During the first visit to the new forestry school in Afgoje we were advised that for the time being and also for an unknown period thereafter the management of the school will not be able to provide adequate space for the project office and the laboratory within their existing premisses.

It was further learned that the originally planned size of the school could not be realized due to the lack of funds, although sufficient ground is available for expansion.

Several alternative solutions are now available:

- construction of an adequate building of 150 m^2. In appendix 5 a quotation from a local construction company is attached. The estimated costs will be USD 60,000.- if prefabricated building panels are applied.
  Construction work done in the traditional way and with firebricks will be cheaper but requires longer time for completion. The exact costs have not been determined because of lack of time.
- placing the office into a fourty foot container and the laboratory into a 12 m trailer van.
  Although this way would offer the advantage of a mobile charcoal laboratory, we do not favour this idea, because there is no need for this type of fieldwork
- modifying the lecture room with its kitchen annex in the nursery, which is located appr. 1,000 m apart from the school. Estimated costs USD 3,500.- including the basic furniture.

We suggest to pursue the latter proposal, which could be realised during the second phase of this mission, if the necessary funds will be provided in time.
The building has been checked by the consultant. The walls, condition of the roofs, ceiling and floor are sound but will need some repair. Also the doors and the window shades require some reinforcing

to warrant more security against wilfully damaging.
As far the general security is concerned the charcoal laboratory would be situated in a guarded compound near the offices and accomodations of the nursery personnel.
The training kilns and and other facilities can be placed nearby and smoke leaving the kilns, when in operation, would not affect residential areas or personnel quarters since the distances between the kiln sites can be kept sufficiently spaced.

However, one disadvantage is that during the rainy season the access from the main road to the nursery (500m) may be in bad condition and difficult to travel with four-wheel-drive cars.

This proposal was discussed and reviewed with the Director of Forestry, Dr. Jumale, and found as a most suitable solution.

4. COST ESTIMATE FOR THE SECOND PHASE OF THE MISSION

The consultant has been advised by the NRA that the government will not be able to contribute by funding the necessary purchases, labour, etc. during the second phase of this mission.
Therefore certain provisions by UNIDO have to be made before the begin.

Kiln construction: It is intended to build a Half Orange kiln with a capacity of 14 - 15 m^3.
Approximately 1,500 firebricks are necessary. Presently the brick-factory in Afgoje does not produce bricks and will resume operation later in this year.
It is very doubtful whether the factory will be back in operation in time. We therefore have decided to use part of the bricks of the uncompleted beehive model kiln, which was erected two years ago.
In the meantime we have discarded the idea to finish it because no suitable iron belt for the dome can be located in Mogadishu.
The oildrum retorts for the agricultural waste conversion have been assembled already and are now stored at the UNDP premisses in Mogadishu.
The earthmound demonstration kiln with "forced draft" and pyrolysis oil collector will not erected before the actual project will start.
The estimated expenditures for the kiln programme will therefore consist of transportation and labour cost only. They are contained in the summary list.

Purchases of equipment and tools: Most of the equipment has been acquired already and is stored in the UNDP premises in Mogadishu also (refer to appendix 6).
Since NRA will not be able to provide maintenance and gasoline for transportation we have also included the essential items in the following list.
Our compilation also containes expenditures at the construction site for tools, cooking set for the preparation of tea, etc.

Nr.	Item description	SoSH	USD	
1	Radius rod with leader	-	350.-	X)
1	Mason hammer,heavy weight	750.-	45.-	
2	Broadleaf hacks	600.-	35.-	
1	Ark saw for wood cutting	500.-	30.-	
2	Torch lights,spare batteries	350.-	20.-	
4	Oildrums,200 ltr each for water storage	2,800.-	165.-	
10	Jerry cans for water and gasoline transportation	4,200.-	250.-	
1	Construction material for shed	2,000.-	120.-	
1	Kerosine stove	1,800.-	105.-	
1	Set cooking utensils	1,200.-	70.-	
1	Set table and chairs	2,000.-	120.-	
2	Pad locks	260.-	15.-	
1	Foot locker	450.-	27.-	
1	Towing cable for car	800.-	50.-	
1	Socket wrench set	6,500.-	385.-	
1	First aid kit	800.-	50.-	
	Sundries	-	250.-	
	Total equipment expenses		2,087.-	

All prices are based on quotations obtained from local stores and maitenance shops in Mogadishu and Afgoje.
Conversion rate: 1 USD = 17 SoSH.
It has also to be pointed out that the inflation rate in Somalia according to the statistical figures,collected by UNDP for the first quarter of 1984 was appr. 40 %.Therefore an allowance may become necessary for all purchases later in this year if the inflation rate continues to progress.

X) has to be made outside of Somalia,because no workshop with the necessary machinery could be located in Mogadishu

Summary of the necessary funds:

- Modification and restoring of building for Office/laboratory	USD	3,500.-
- Construction material for kilns	USD	- .-
- Equipment and tools	USD	2,087.-
- Labour expenses, one mason, two helpers 30 working days	USD	1,450.-
- Transportation expenses		
Car rental, one 4 WD for 14 days x)	USD	600.-
- Gasoline, oil, maintenace for one 4WD	USD	950.-
Total expenses	USD	8,587.-

x) it is assumed that the government will provide adequate transportation after the first two weeks.

5. STATEMENT OF EQUIPMENT PURCHASES

Upon request UNIDO has approved funds of USD 2,550.-(Pichler's telex No. PYS 37666 of 30.05.84) for the acquisition of equipment.
This amount includes USD 650.- for transportation expenses.The balance of USD 1,900.- equals appr. SoSH 32,300.-.
The following purchases were made:

Nr.	Item description	SoSH
1)	Tools,auxiliary material for retort Sepcom Comp. inv. 745	6,050.-
2)	Assembling of two charcoal retrots,providing of cover lids and gas pipes Doolco Comp. inv. 2034	9,600.-
3)	One footlocker Local market Mogadishu	400.-
4)	Tools,auxiliary material Sepcom Comp. inv. 806	8,640.-
5)	Three oildrums Local market Mogadishu	2,250.-
6)	One footlocker Local market Mogadishu	450.-
7)	Fotocopies Otika da Sare ee Banadir Comp.	130.-
8)	Transportation of two charcoal retorts Mr. Abdulahi Hassan	500.-
9)	Fotocopies Shabeele Fotocopy Comp.	145.-
10)	Wrench for Landrover Mercedes Benz Mogadishu	102.-
11)	Landrover repair	300.-
12)	Out of pocket expenses for helpers, watchmen,tips	470.-
	Total expenses	29,037.-
	Received from UNDP: check # 84117	15,000.-
	check # 841135	15,000.-
	Total received	30,000.-

The balance due to UNDP of SoSH 963.- was handed back to the accounting department together with the submission of all original receipts.

For the purchase of gasoline,oil,etc. coupons were obtained from UNDP and endorsed at the designated gas station in Mogadishu. (storage list attached in appendix 6.)

UNITED NATIONS

Appendix 1.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNIDO

2 December 1983

Request from the Government of the Somali Democratic Republic

For Special Industrial Services

INTERNAL

JOB DESCRIPTION

SI|SOM|83|802|11-01|32.1.C

Post title	Expert in Charcoal Production
Duration	Four months (split mission possible)
Date required	As soon as possible
Duty station	Mogadiscio, with travel within the country
Purpose of project	To assist the Government in the improvement of charcoal production from biomass resources and in the propagation of more advanced technologies including techniques involving the recovery of by-products.
Duties	In close co-operation with the National Range Agency (NRA) and other appropriate Government authorities, the expert will specifically expected to :

1. Assist in the establishment of a laboratory at the Forestry Training Centre in Afgooye;
2. Construct and operate a Brazilian type beehive brick kiln;
3. Train national personnel in the construction and operation of such kilns;
4. Conduct a course on charcoal manufacture which includes :
   a. demonstration of improved brick kilns;
   b. small-scale and industrial charcoal production;
   c. raw materials requirements including biomass waste materials;
   d. charcoal quality control;

..../..

e. advanced charcoal production techniques and recovery of by-products;
f. charcoal marketing.

5. At the beginning of the assignment, the expert will submit a work plan on the activities to be carried out during the four months' period.

The expert will also be expected to prepare a final report, setting out the findings of the mission and recommendations to the Government on further action which might be taken.

Qualifications — Chemical engineer or industrial chemist with extensive experience in charcoal production.

Language — English

Background Information — Charcoal is the main domestic fuel in the country and the rate of consumption has been increasing steadily. Mogadiscio, the capital, with an estimated population of 450,000, uses 150 tons daily or about 54,000 tons p.a. In terms of wooded areas required to satisfy this need, this represents 72,000 ha which are cut annually. In fact, larger areas are needed because of the exclusive use of one species of acacia, Acacia Dussei, and the lack of expertise on the part of charcoal makers. Today, large areas of Acacia scrub forests have been completely depleted and the distance between charcoal production areas and the capital has increased to nearly 300 km. This has resulted in a periodic shortage of charcoal supply and an increase in charcoal price.

The Government is greatly concerned about the steady increase of charcoal consumption and the resulting alarming rate of the deterioration of resources. Under the project SI|SOM|78|803, Development of Charcoal Industry and Establishment of a Pilot Plant, Unido provided assistance to the National Range Agency which resulted in :

i. an assessment of the present charcoal industry;

ii. the establishment of a National Charcoal Industry Development Plan;

iii. investigation of charcoal production from agricultura wastes;

iv. a proposal for setting up a charcoal briquetting plant;

v. the design and construction of a national fire brick charcoal kiln;

vi. supply of equipment for a charcoal laboratory.

The Government has requested further UNIDO assistance for the training of personnel in construction and operation of charcoal kilns and for the installation of a charcoal laboratory, for which the Government has already provided the required space.

Appendix 2.

10 May 1974

SUMMARY

Ref: SOM/21/70
CHARCOAL PROJECT SOMALIA

On Thursday 10, 04, the initial meeting with national representative Agency, Mogadiscio took place, with the target to set the priorities for the first phase of the mission of Walter Emrich within the period of May, 05 til July, 04, 74.

PARTICIPANTS

Dr. A.Karani
Director of NRA

Mr. G.Scala
UNDP - Programme Coordinator

Dr. Jumale
Director of Forestry

Mr. W.EMRICH
UNIDO Expert

RESULTS

It is agreeable to NRA to conduct the Programme as proposed by Mr. W.Meurer, back-stopping Officer- UNIDO.
First priority is given to the drawing-up of a Master Plan (4 years period).
However it is desirable for the NRA to have established besides of a "Half-orange kiln" (made from fire bricks) a retort for the convertion of agricultural waste also.
The latter can be constructed of six oil drums also some piping and other maintenance work will be necessary.
The introduction of retort technology becomes for Somalia very important because of the utilisation of the charcoal gas, e.g. for drying operations or producing of electricity.
Dr. Karani stated expressive by that the costs for the kiln and retort construction are not available from the budget of the Agency and should be provided by UNIDO.
The charcoal expert estimated the following costs:

A) HALF ORANGE KILN

- 1500 fire bricks	USD	300.-
- Water supply	"	100.-
- Construction Tools (Shovels, split level, hammers etc)	"	175.-
- Auxiliary material (Rope, nails, wire, boards)	"	75.-
- Radius rod with leader (Necessary for training of unskilled people)	"	300.-
- Contingencies	"	50.-
Total	USD	1.200.-

B) Oil Drum retort (ONE UNIT)

- 6 spent drums (200 LTR)	USD	120.-
- 2,30 m gas pipe	"	30.-
- [illegible]		

....2.....

- 15m^2 metal sheet	USD	300.-
- 2 cover lids	"	150.-
- Tools (Shovels, hammer, wire cutter etc)	"	125.-
- 300 fire bricks	"	150.-
- Maintenance work (welding, bending appr. 40 hours)	"	125.-
- Contingencies	"	40.-
Total	USD	1.150.-

NEA will provide labour for construction and operation of the kiln and retort. It will also provide transportation for the charcoal export.
Since the approval for the Project is a very time consuming task within the Agency it was agreed upon:
That UNDP should provide a 4 wheel driven car for the expert for the first two weeks (maximum).

UNDP will apply for providing of the necessary funds at UNIDO/VIENNA - - MR. M.WAUNG.

Appendix 3.

WDA/8/0/1649/84

24 OCT 1984

To: General Manager of the N.R.A. =MOGADISHU=
CC: Director of the Forestry Department N.R.A =MOGADISHU=
CC: Dr. Walter Emrich, Charcoal Expert =MOGADISHU=

Sub: Pre-feasibility studies of the Future charcoal Development Project in Somalia.

I would inform you what we were doing, since the arrival of the charcoal expert who has been surveying for the charcoal development project which are to be established in Afgoi nursery, in the near future and here as follows:-

- Tools of different types have been collected for the construction of half orange kiln in Afgoi district.
- 2 retorts have been prepared for the construction of such kiln.
- Trips to Afgoi have been carried out to look for a room for the laboratary equipments in Afgoi nursery which are now stored in U.N compound in Mogadishu.
- The disavailabity of fire bricks in Afgoi brick focotry that is colosed for the time being have been realised.
- A place for the construction of the half orange kiln has been marked in Afgoi nursery.
- The retorts and tools have been transported to the U.N.D.P centre in Mogadisho.
- An old fire brick plant near Afgoi has been visited.
- A trainning programme has been planed for the charcoal burners to improve their local methoods and to apply the new one.

...../ ...../.....

The charcoal expert wh
time told me that the construct back home in tow weeks
in Afgoi would be postponed for f h e half orange kiln
lack of five bricks and added that the arrival for the
the laboratory equipments in Afgoi nursery d be no room for
construct new buildings such as laboratory ro UNIDO should
and concluded that he would discuss the U.N.I.D.O offices
the construction of the new buildings as soon as he r es
there.

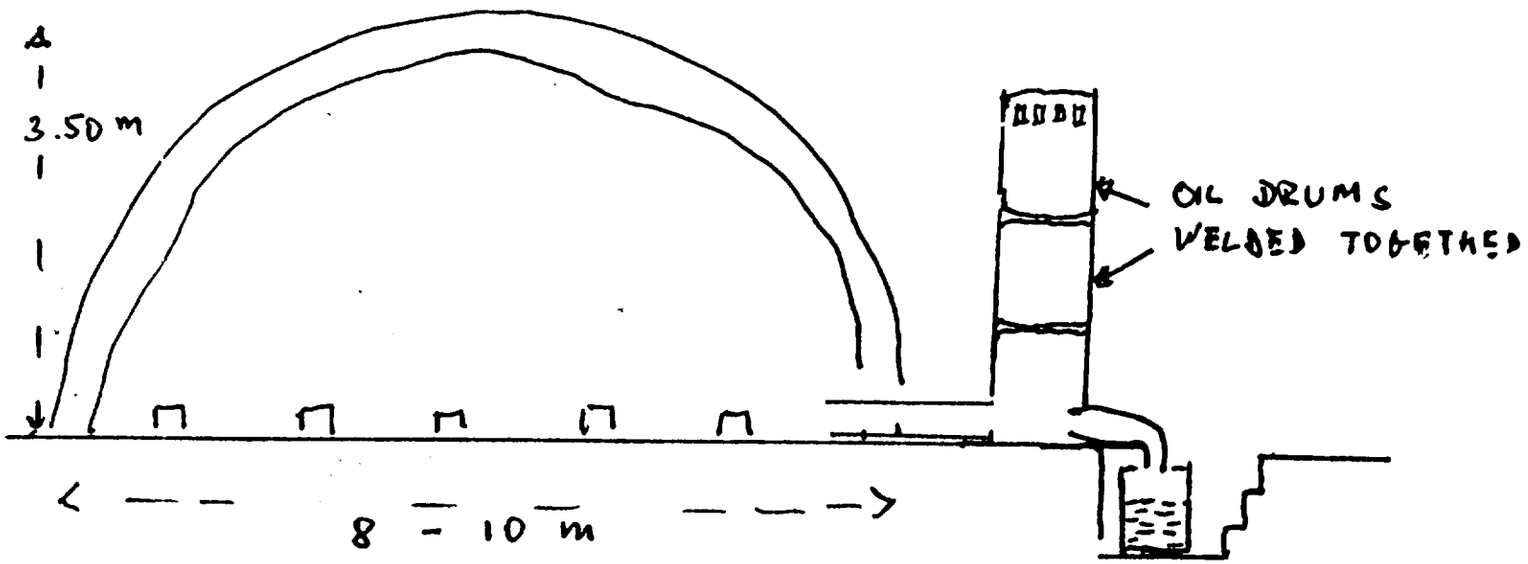
Yours Sincerely,

Abdillahi [illegible] Mohamed
Counter-part of the Charcoal Develop.Project.

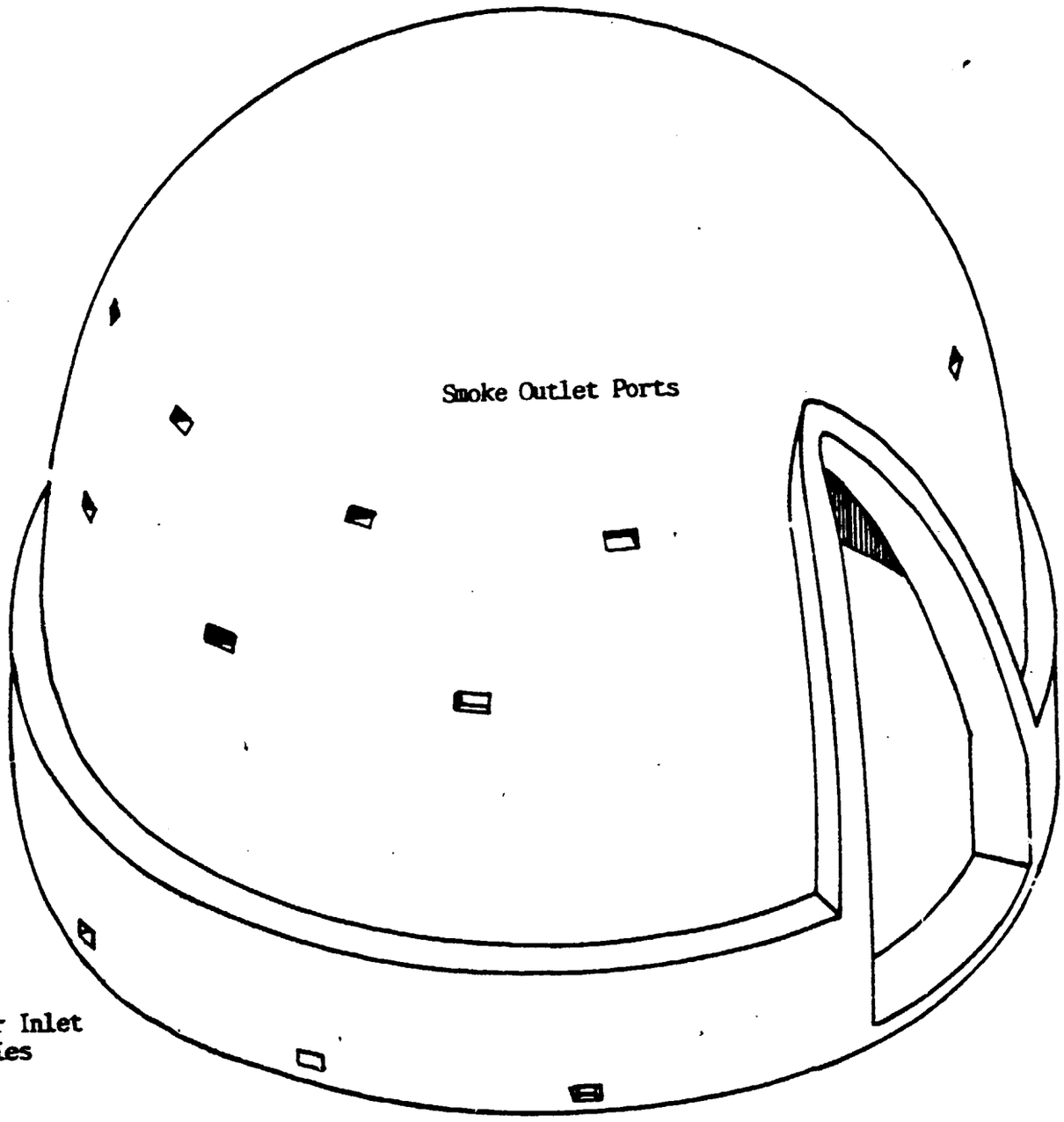
Appendix 4.

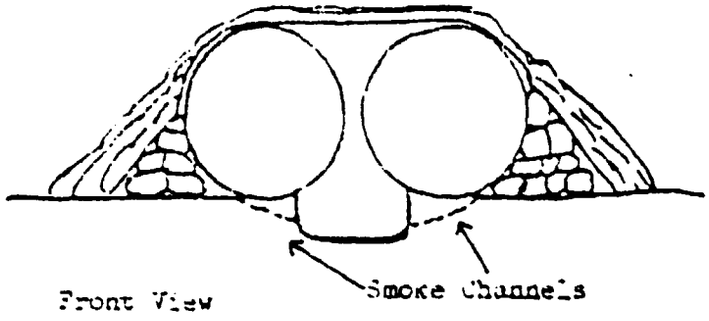
- Earthmound kiln with by-product recovery
- Half Orange kiln
- Oildrum retort
- Simple briquetting machine

EARTHMOUND KILN WITH BY-PRODUCT RECOVERY

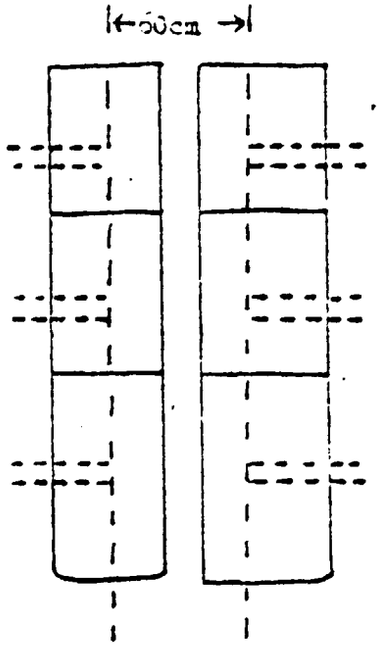


Half Orange Kiln



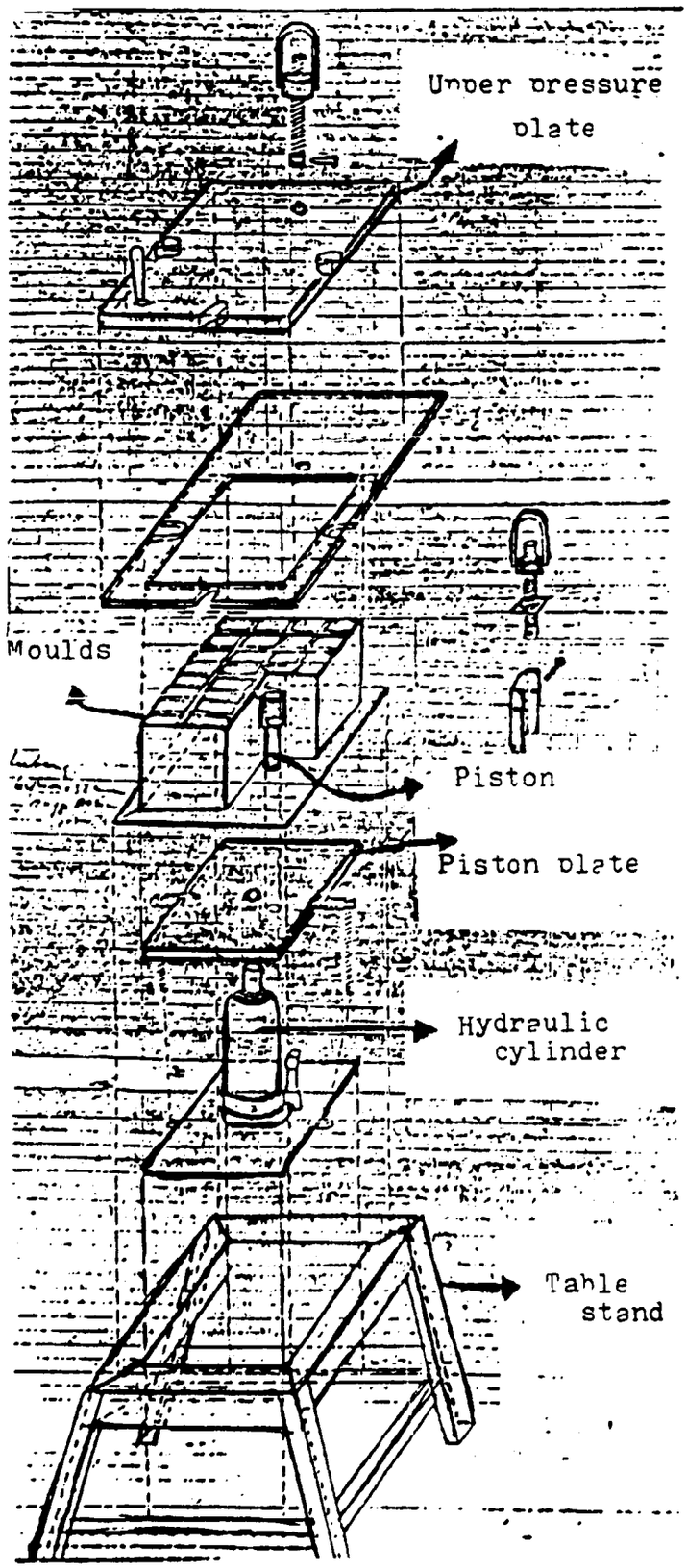


Oil Drum Retorts installed



Three 200 ltr. oil drums form one retort

Simple Charcoal Briquetting Press



Somali Prefab Building Materials

P.O. Box 591 Mogadishu Somali Democratic Republic
Cable: somcom Phone: 3877

Your ref. Our ref. Mogadishu 20 th June 1984

U N I D O

Purchasing Department

International Cent re

A - 11000 Vienna

AUSTRIA.

Dear Sirs,

Subject:- Prefab Building- Charcoal Project.

With refsence to your request for an offer for thconstruction in prefab of covered area of 178.8M^2 we wish to submit for your consideration the following estimates-

	UNIDO CHARCOAL PROJECT.		
1 . Foundations	155.3 M^2	@ 51.4 US$ M^2	US$ 7.982.42
2 . Roof Panel	178.8 "	" 41.- " "	" 7.330.80
3 . Wall Panel	144 "	" 41.50 " "	" 5.976.--
4 . Partion Wall	118.8 "	" 37.50 " "	" 4.455.--
5 . Beams	23.2 "	" 51.50 " "	" 1.194.80
6.. Colums	5.5 "	" 42.- " "	" 231.--
7 . Painting			" 883.20
8 . Jointing Sealant			" 1.478.40
9 . Elecrical Insulation			" 5.500.--
10 . Doors	8	" 230.- " "	" 1.840.--
11 . Windows	90.95 X 1.2 & 1.8 X 1.3		" 3.740.--

Somali Prefab Building Materials

P.O. Box 591 Mogadishu Somali Democratic Republic
Cable: somcom Phone: 3877

/ 2 /

Your ref.	Our ref.		Mogadishu		
12 . Floor Coatings	139 M^2	a US$	17.50	US$	2.275.--
13 . Plumbing				"	2.500.--
14 . Erection Cost				"	4.000.--
			Total	"	49.390.--

We wish to state that if we are awarded the Contract we shall complete the project and hand it over in 5 months time starting from the signature of the Contract to your satisfaction.

Since all Chemicals and other imported materials for the work are to be imported immediately we would ask for an advance payment of US Dollars 20.000.-- to our suppliers in Denmark,against a Bank guarantee for the advance by the Somali Commercial Bank.

The rest of the Contract sum will be paid when the project is handed over.

Thanking You,

Yours Faithfully,

Mr. Ali Sheikh Mohamed

Somali Prefab Building Materials.

Somali Prefab Building Materials

Bank: Somali Commercial & Savings Bank

Appendix 6.

List of tools purchased during the course of this mission. These tools are placed in two footlockers, secured with one pad lock each and stored in the main storage room of UNDP/ Mogadishu.

Tool Set Nr. I - contents

I mason chisel
I mason bob with string
2 trowels
I split level, 30 cm long
2 carpenter pencils
I handsaw
I metal saw with four spare blades
I pangs
I ax
I hammer, light
I nail puller
I wire cutter
I screw driver set
I plier
I metal sheet puncher
I yardstick, 2 m

Other materials

2 rolls of thin rope
2 kg wire
2 kg nails

Tool Set Nr. 2 - contents

I soldering lamp
I chain, appr. I.5 m
I metal sheet scissors
2 Spring scales, max. 25 kg each
I jumper cabel
2 padlocks
2 pangas

200 m rope, medium

I envelope with keys for tool set I and the padlock which with the shovels are chained together.

Seperately kept are:

4 shovels, chained together and secured by a padlock

SECOND PHASE

1. Results and Conclusions

The UNIDO Charcoal Centre

The centre consists of a kiln site for the training in kiln and retort technology and the evaluation of raw materials,attached to the charcoal laboratory.
It is therefore adequately equipped to serve as a basis for the National Charcoal Industry Development Programme in Somalia.
The values and capabilities of the centre should be exploited within a long-term systematic plan under the responsibility of a competent project manager.
The desired masterplan has been submitted to UNIDO during the first phase of this mission.
Special attention had to be given to the fact,that the future work of the UNIDO charcoal centre will yield an optimal dissemination effect for the use of advanced technology and also for the substitution of firewood by agricultural residues.
After the departure of the UNIDO Charcoal Expert any activity in the charcoal centre may cease.Therefore the decision to provide new funds should be made soon to avoid an undesirable longer time elapse.

Charcoal laboratory

Instruments and apparatus have been checked and are functioning.The normal analytical work of a medium sized charcoal plant can be conducted.For further completion minor tools may be purchased.The estimated costs are USD 800.-.
The electricity supply is unreliable which will impede the research work.
Therefore it is suggested to employ a charcoal gas generator (appr. 4 kw), which would make the charcoal centre virtually independent from outside energy supply.

Half Orange charcoal fire brick kiln

The construction costs for a Half Orange charcoal fire brick kiln of 14 m^3 firewood capacity will be about
USD 200.- if the fire bricks are made at the kiln site by the operators and water supply is in reach.

CARBO GAS retort

No problems were encountered to find the necessary metal scrap for the construction of the retort.Two retorts consisting of three oil drums each are located over one fire chamber with a chimney added.The unit can produce several hundred kg of char per day which is sufficient to carry out the research work for various raw materials.

The produced charcoal gas is led by two gas pipes into the fire chamber of the retort, thus saving fuelwood.
For the purpose of analytical evaluation it may be taken from the gas pipes directly.

Personnel training.

Lectures to the senior class of the forestry school were held. A number of interested students participated also in the construction training of the Half Orange charcoal fire brick kiln.
The costs for fire bricks are extremely high in Somalia. The ex-factory price is presently USD I.50/fire brick.
It is therefore envisaged to reuse the once purchased construction material in future training courses, unless the charcoal students provide the firebricks by themselfes by producing them on site.
For this purpose the kiln cupola must not be burnt out to harden the mortar which consists of mud only.
To prevent a collapse of the cupola due to rain falls, which would damage the bricks considerably, we have dismantled the kiln up to the straight jacket.

2. Final Installation of the Charcoal Research Laboratory

The original plans of UNIDO to locate the research laboratory within the compound of the new forestry school in Afgoje had to be given up because there is presently and for an unknown period thereafter no space available. NRA therefor decided to provide laboratory space in form of the old lecture room withir the nearby nursery.
This building contains only one single room and had to be subdivided by a partition.
Since it was not more in use after the forestry school was moved to the new premisses some repair work was necessary.
The lecture room has an annex which was previously used as the kitchen for the students.

Concerning the power supply the laboratory had to be hooked up to the main line of the nursery and addtional power outlets for the laboratory equipment were installed.
A reliable electricity supply remains a problem,which we could not yet solve.The Afgoje area is served by a small power plant which will deliver electricity for a few hours per day only.
This situation has emerged during the energy crisis in Somalia and may prevail for a long time in the future also.
Since it is,however,essential for research work to have a permanent power source the most suitable solution would be to employ a producer gas generator fueled with charcoal.
The advantage for this method can be seen in the fact that the future project will be independant from the shortages of the diesel or gasoline deliveries and would produce its own fuel supply.
The buildings within the nursery do not have direct water supply but there are sufficient outside taps.The supply comes from an own pumping station and the water itself is clean enough to serve for laboratory work.
The furniture consisting of tables and chairs has been purchased on the local markets.
The laboratory equipment was purchased by UNIDO in October I98I and had been stored in the premises of UNDP-Mogadishu since then.
After the containers and packages in which it was shipped to Mogadsihu had been carried over to Afgoje a check of the inventory was made in the presence of Mr. Hassan Ali Nur as the assigned representative of NRA.
All parts have been listed in the attached inventory list which served also for the purpose of the official transfer to the NRA.
The lists contain also equipment and tools for kiln construction as well as the transferred inventory of the nearby kiln site.
The comparison with the UNIDO invoices revealed that only

minor parts have been found missing.

These are:

1	porcelain pestle for the porcelain mortar
1	package of crucible high form 30 mm (36 ea/cs)
1	guide bar for the Echo chainsaw

It was decided to store all project equipment in the laboratory building because it can be easier checked until the project makes permanent use of it. The inventories are listed on pages 36 to 39.

The nursey is secured by a fence and besides of the UNIDO charcoal laboratory several other buildings including two offices are there. Some of the buildings accomodate the permanent staff of the nursery and a watchman is patrolling the area during the night.

The access to the nursery is guarded by a Gate which will be closed and locked after the working hours.

The kiln site is only 80 m away from the laboratory within the nursery fence.

SI/SOM/83/802 UNIDO - Charcoal Project Nr. I

Inventory List General Equipment

Nr.	Qty.	Item
I	I	Typewriter Olivetti Lettera Nr. 24 77 452
2	I	Desk Calculator Canon P 2I - D
3	2	Pony Transceiver, Model CB - 36, Serial Nrs. 77 0 675 and 77 0 987
4	2	Recharger for Pony transceiver
5	I	First Aid kit
6	4	Tables
7	4	Chairs
8	I	Half Orange kiln with straigth jacket, cupola taken apart; consisting of appr. I,200 fire bricks
9	I	Carbo Gas retort unit, consisting of 2 retorts made from 3 oil drums each, with two lids and two gas pipes established and ready for use
I0	I	shelter for kiln and retort operator
II		Fences of kiln site
I2	2	Signs indicating kiln area and laboratory building

Received for NRA:

.....

Hassan Ali Nur, NRA counterpart

Date: 19. 11. 84

Turned over by:

.....

Walter Emrich -UNIDO Expert

SI/SOM/83/802 UNIDO - Charcoal Projedt Nr. 2

Inventory List General Laboratory Equipment

Nr.	Qty	Item
I	I	Dec - o - gram balance,with single hanging pan, Serial Nr. ---
2	I	Mettler H 54 AR balance,Serial Nr. S/N 798187
3	I	Grinding mill hand power with one spare screw
4	4	Grinding plates coarse
5	4	Grinding plates W/4B
6	2	Pyrometer ,Fischer Model 32 - JC
7	2	Thermocouples
8	I	Mortar with pestel,iron
9	I	Mortar,porcelain
I0	3	Flame spreader
II	3	Tripod, 6 inches, two rings
I2	3	Tripod, IC inches,four rings
I3	2	Desiccator,plain, 250 mm ø
I4	5	Sieve,brass, top cover
I5	5	Sieve,brass,receiver
I6	2	Sieve ,brass, Nr. 7
I7	2	Sieve ,brass, Nr. 3 ½
I8	2	Sieve ,brass, Nr. 25
I9	2	Sieve,brass, Nr. 35
20	2	Sieve,brass, Nr. I8
2I	I	Sieve,brass, Nr. I6
22	I	Sieve,brass, Nr. 70
23	I	Sieve ,brass, Nr. 40
24	I	Sieve,brass,NrI00
25	I	Sieve,brass, Nr. 230
26	I2	Cylinder, grad., I00 ml
27	72	Crucible,flat capsule, 40 mm
28	72	Crucible cover ,45 mm
29	72	Crucible cover, 65 mm
30	36	Jar,glass,round, I05 mm ø
3I	36	Jar,glass,rectangular, 20 x I0 x I0 cm
32	I	Spring balance, I2 kg

Received for NRA:

.....

Hassan Ali Nur,NRA Counterpart

Date: 11/11/87

Turned over by:

.....

Walter Emrich, UNIDO Expert

SI/SOM/83/802 UNIDO - Charcoal Project Nr. 3

Inventory List Electric Laboratory Equipment

Nr.	Qty.	Item
I	2	Fischer Junior oven, 230 VAC Serial Nr. 33 II I5 and 33 II 7
2	2	Muffle Furnace ,240 Volt ,Model Nr. I82 Serial Nr. I7I and I89
3	I	Hot Plate, I2 x I2,240 Volt ,Serial Nr. 23 70 40 92
4	2	Autemp Heater,230 V, Serial Nr. 220 and Nr. II8
5	I	Ball Mill, 2 - tier, 220 V,Serial Nr. CE - 8II46 with 2 porcelain jars

Received for NRA:

.....

Hassan Ali Nur,NRA Counterpart

Turned over by:

.....

Walter Emrich,UNIDO Expert

19.11.84

SI/SOM/83/802 UNIDO - Charcoal Project Nr. 4

Inventory List Equipment for Kiln Construction

Nr.	Qty.	Item
I	I	Radius Rod with leader and centre pole
2	4	Shuffle
3	I	Distance rod
4	I	Split level
5	2	Broom
6	2	Mason toller
7	2	Panga
8	I	Hand saw
9	2	Metal saw with spare blades
I0	2	Spring scales, 25 kg
II	2	Carpenter clamp
I2	I	Soldering torch
I3	I	Mason punch
I4	I	Pad lock
I5	I	Nail puller
I6	I	Hammer
I7	I	Ax
I8	I	Mason chissel
I9	I	Wire cutter
20	I	Plier
2I	I	Metal cutter
22	I	Mason bob
23	I	Screw driver set
24	I	Towing chain
25	I	Echo chain saw (guide bar missing)
26	-	various plastic containers and buckets and plastic sheet

materials: rope,wire,nails,etc.

Received for NRA:

.....

Hassan Ali Nur - NRA counterpart

Date: 19.11.84

Turned over by:

.....

Walter Emrich, UNIDO Expert

3. Manual for the Construction of an Argentine Half Orange Charcoal Kiln with straight jacket

3.1. General

Charcoal kilns made from fire bricks represent the most popular technology to produce high quality charcoal. Among these the "Half Orange" firebrick kiln outnumbers by far all other types.

It was first introduced in South America several decades ago and it is employed by small charcoalmakers as well as by large industrial companies. It is estimated that the total number of fire brick charcoal kilns presently in operation is well above 300,000 in Brazil and Argentina alone.

Sizes, shape and capacity of the fire brick charcoal kilns can vary greatly. They can be designed for the sole purpose of charcoal making or with installations for the recovery of charcoal by-products (producer gas and pyrolysis oil) also.

Foto I. shows the kiln which was built within the course of the UNIDO Charcoal Programme (SI/SOM/83/802) on the nursery site in Afgoje and used for demonstration.

Foto Nr. 1

The vertical part of the kiln (straight jacket) contains the air inlet holes. The cupola contains two rows of smoke outlet ports.

The kiln has one gate only for charging and discharging. The firewood capacity is appr. 14 m^3.

The commercially proved success of fire brick charcoal kilns is based on several criteria, which may be summed up as follows:

- low investment costs.Construction material consists of clay ,sand and water (mud) only.The fire bricks can be produced by the charcoal maker.
- the lifespan of the kiln exceeds ten years
- maintenance costs are almost negligible if compared to metal kilns,
- simple operation.A battery of more than ten kilns can be supervised by one operator,
- yield and charcoal quality are significantly higher as compared to those of charcoal pits and earthmound kilns.

3.2. Selection and preparation of the kiln site.

The size of the kiln site has to be chosen in view of the number of kilns which may be constructed eventually.Space must be provided not only for the kilns itself but also for storage of fuelwood,the curing of the discharged charcoal,a shelter for the operator and night watchman,etc.
Therefore an area of 80 m^2 is usually considered as being necessary per kiln.
Furthermore the kiln site must

- be levelled even
- be with drainage of water from rain falls
- provide water at the site or nearby
- be sufficiently accessable by trucks or other means of transportation vehicles

Before starting the construction work the site should be cleared from all vegetation and a ditch be drawn for the cary-off of rain water.
At the beginning some dry firewood must be stored on the selected site which will be burned as required to speedup the drying of the mortar(mud) especially during the raigy seasons.
Frequently jute bags and plastic sheet is kept handy and used for protection of the kiln structure against a sudden rainfall.

3.3.Marking of the kiln site.

After the site preparation has been completed the place for each kiln will be marked with a centre pole.Then the marking of the kiln base (foundation) starts as shown in figure 1.
It is better to indicate the interior and exterior circles of the foundation lines by wooden pegs which should be placed in a distance of 40 - 50 cm to each other.
Special care has to be taken that the centre pole is not incidentally removed

or broken-off,because it will serve as a guide for the construction of the straight jacket and the cupola.

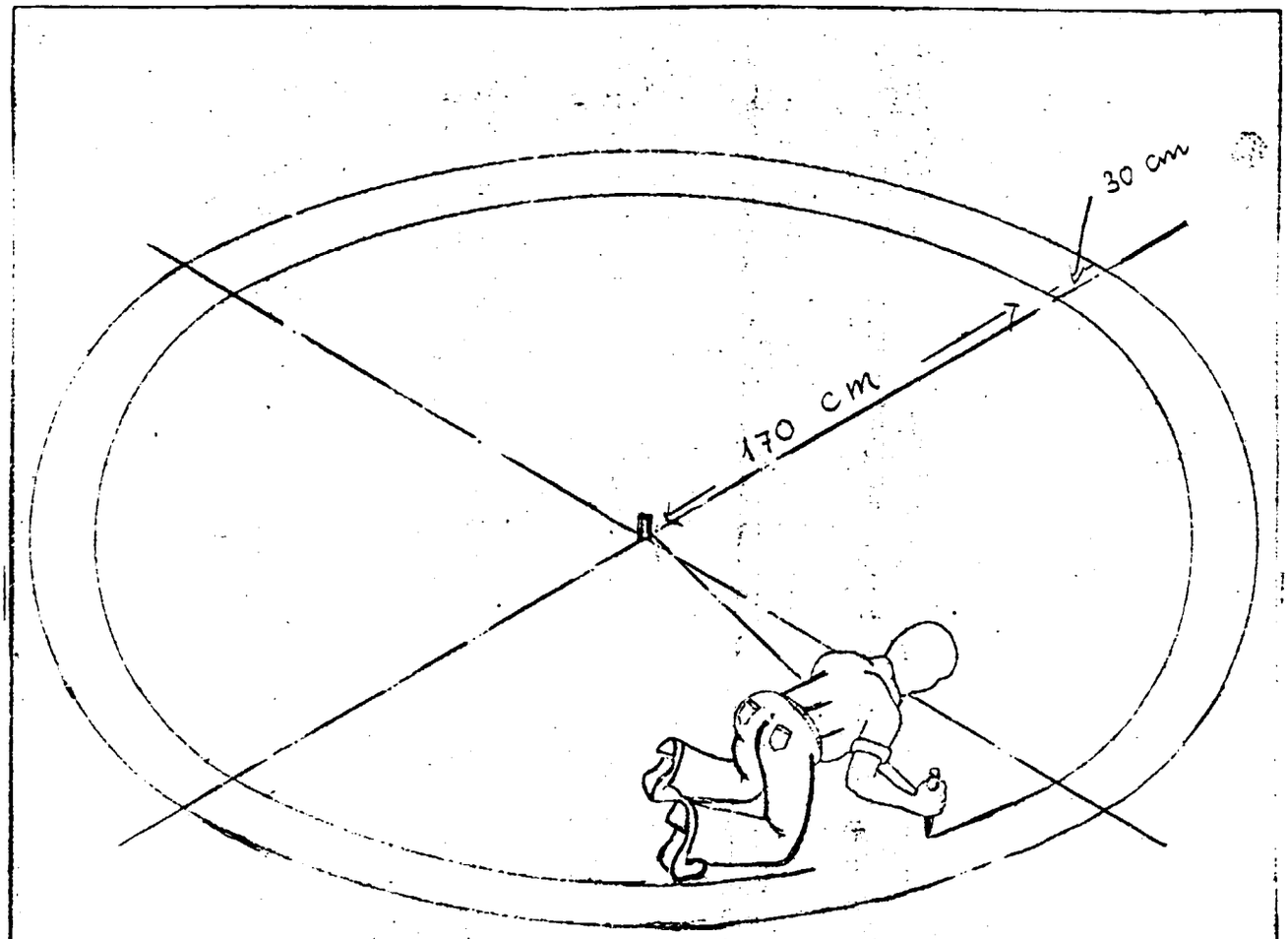


Figure I. Marking of the kiln base

For the diameter of Half Orange kilns no standard measures are in existence. However,it has become common practice to apply the maesures 340,450,700 and 800 cm for the extent of the kiln bases.
Smaller kilns are also in widespread use mainly by single families.

3.4. Laying the kiln foundation.

The foundation ditch has to be dug out always closely following the marked inner and outer circles (see figure 2).
The depth of the foundation will depend on the consistence of the local soil but normally does not extend a depth of 60 cm.
Approximately 30 cm are filled in with a mixture of sand and gravel.On top of it fire bricks are laid in rows crosswise (see figure 3).
Between each brick layer mud is applied generously.

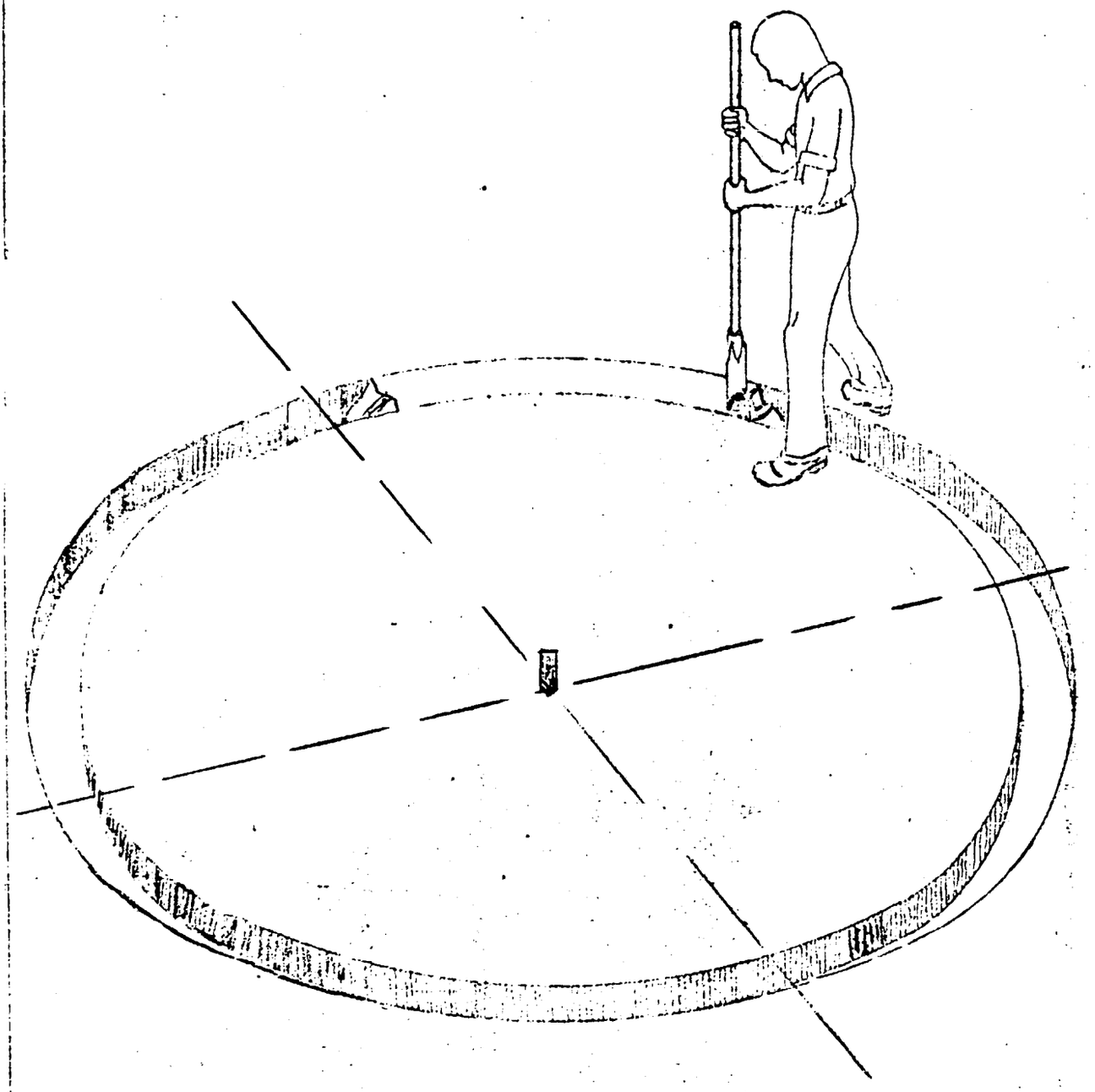


Figure 2. Excavating of foundation ditch

The fire bricks of the last foundation layer should point with their length towards the centre pole of the kiln and must be positioned exactly in level (use of a splitlevel).

The last brick layer of the completed foundation must raise appr. 10 cm above ground.

Then the kiln bottom will be filled with soil and densified as shown in Fig.3. The kiln bottom must be even with the last brick layer of the foundation to prevent the influx of rain water.

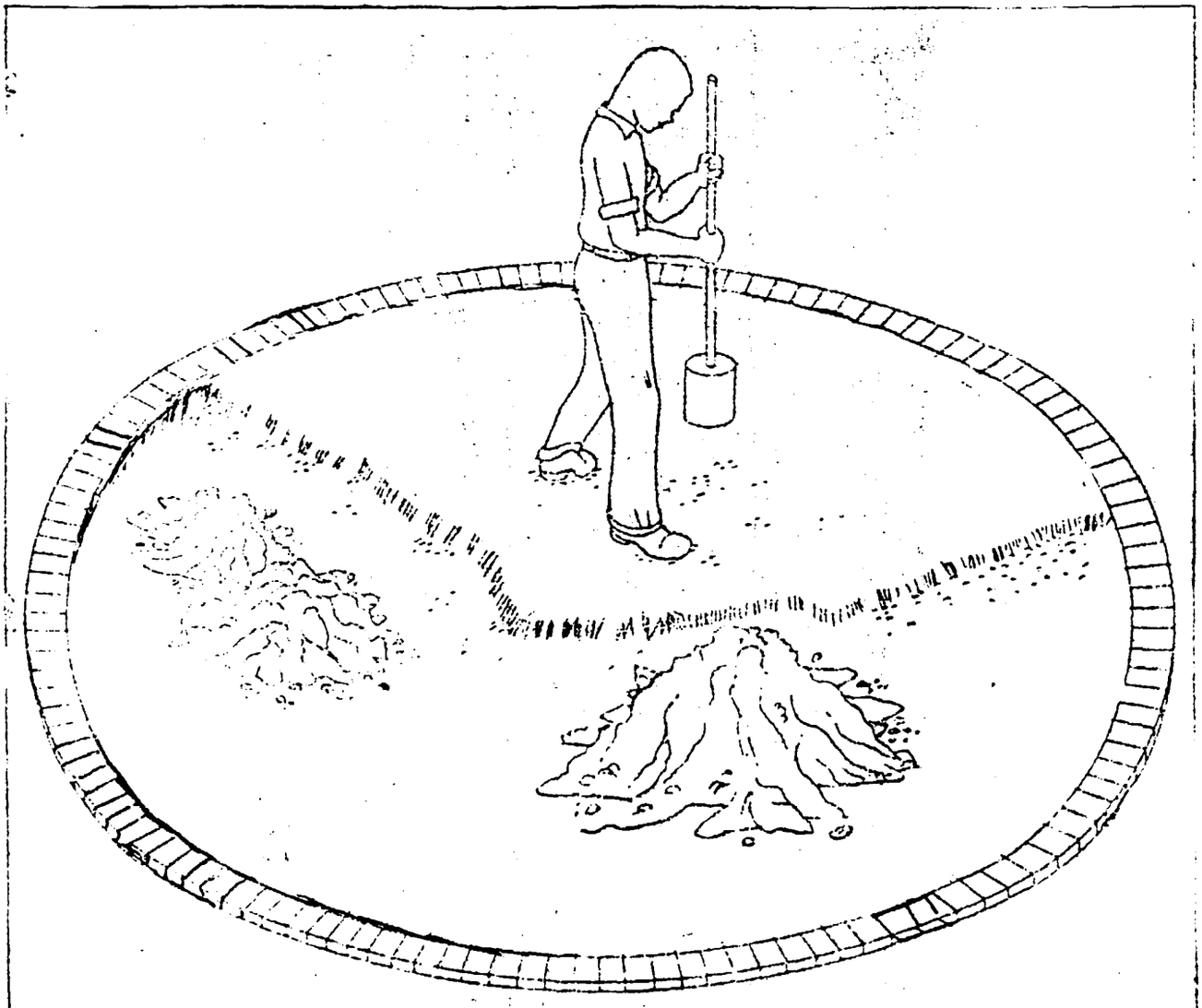


Figure 3. Laying the foundation and filling in the kiln bottom

3.5. Construction of the straight jacket

The straight jacket is the vertical part of the kiln and it carries the load of the kiln cupola.

The straight jacket is built by the same construction way as for the foundation. That means the brick layers are crosswise positioned.

The first brick row contains nine air inlet holes which are spaced in a distance of 95 cm of each other.

The measures on the inner side of the wall are 8 cm in width and 11 cm high.

The width of the kiln gate is 60 cm on the inner side of the kiln and remains unchanged up to the top layer of the straight jacket.

The heigth of the straight jacket must not exceed 60 cm,thus enabling an operator conveniently to step on the outer rim when checking the top of the kiln during operation.
To achieve an uniform distance between the straigth jacket and the centre pole a distance rod should be used always.

3.6. Construction of the kiln cupola

Whereas foundation and straight jacket are designed as double walls the cupola itself will be constructed with a single row of fire bricks,except both sides of the kiln entrance which are reinforced (refer to foto 1.).
To achieve the desired capacity of the kiln the cupola has to be enlarged vertically to a height of 240 cm.It thereforedoes not form a strict spherical space but is rather oval shaped.
The unskilled builder needs for this purpose a radius rod with"leader".Its use is shown in foto 2.

Foto Nr. 2

With the"leader"of the radius rod the distance between each fire brick row and the kiln centre can be altered individually.Normally the brick layers of the cupola are reset (moved to the exterior side)in a sequence which depends on the heigth and length of the fire bricks. This sequence can be calculated before.

The following resetting table applies to fire bricks with the dimensions heigth 11 cm, length 25 cm :

Nr. of fire brick row	Resetting
I - 3	I cm each
4 - 6	2 cm each
7	3 cm
8 - I0	4 cm each
11	5 cm
I2 - I4	3.5cm each
I5 - I7	2 cm each
I7 -	I cm each

The cupola of such a kiln would consist of 20 fire brick rows.
The entrance of the charcoal kiln forms a steep arch due to the inclination of the cupola and its heights should not exceed I65 cm.
The lower row of smoke ports will be positioned intermittend to the air inlet holes(lower part of the straight jacket) within the fifth fire brick layer. They are spaced accordingly to the air inlet holes. They measure 6cm x 11 cm on the interior side of the cupola.
The upper row of smoke ports is located in the elenveth fire brick layer and they are arranged vertically above the air inlet holes.The dimensions are the same as for the lower smoke ports.
For the construction of the cupola as little as possible mortar(mud) is applied and it is very important that each firebrick is laid in place according to the angle indicated by the radius rod.
Starting with row Nrs. I2 - I4 more and more half fire bricks (I2 cm length) have to be employed,and later on fire bricks not exceeding 5 cm in length should be used to form the top of the cupola.
It is also very important that the kiln builder places the fire bricks firmly and "corner to corner" with the adjacent brick.
Frequent checking with the split level is necessary.
If the construction material is provided at the plant site two skilled charcoal operators can construct the argentine "Half Orange" kiln within six working days.

3.7. Maintenance of the kiln

Before operation, the kiln must be sealed on the outside with a cover of mud.
The so called "green kiln" will then be cured by maintaining a fire (made from dry firewood) inside for at least one week.

3.9 Details of the construction

4. Oil drum charcoal retort

4.1. The installation of the CARBO gas retort

The CARBO GAS retort is suitable for the carbonisation of biomass particles, e.g. nutshells,leafs,small branches,twiglets,shredded waste.

The economy of this technology stems mainly from the following facts:

- low investment costs.The retort can be built by local maintenance shops from spent oil drums and other scrap metal.
- recovery of two products.The retort generates charcoal and producer gas.
- expansion of the plant capacity is possible.The owner of a retort plant may add more capacity at any time if the market demands it and his funds will allow it.
- low maintenance cost.
- simple operation.One operator can supervise up to twenty retorts.
- utilisation of producer gas.The produced gas can be utilised for the generation of electricity,drying of copra or as fuel in a steam boiler.

The CARBO GAS retort enjoys its main popularity in rural areas,which abound of agricultural waste but are lacking of any kind of energy.

It is the intention to operate one retort unit in the forestry school in Afgoje by NRA for demonstration purpose and to carry put research work on common waste material in Somalia.

As already outlined in the previous report(first phase)the retort was to be installed near the charcoal laboratory.

The retort has been assembled during the first phase of this mission.It consists of three oil drums welded together and two of these units form the retort.

For the installation the site was selected near the Half Orange kiln on the ground of the nursery in Afgoje.

As shown in figure 1 the retort is placed over the fire chamber on rocks and covered with soil.

For better firing a chimney has been built in also.

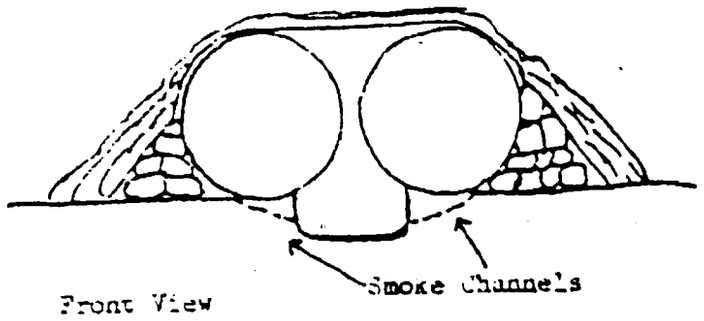
For the charging of the retort a movable cover is placed on each forward end and fastened with four screws and bolts to the retort body.

At the rear end a gas pipe leads the gas produced during the carbonisation phase to the outside.

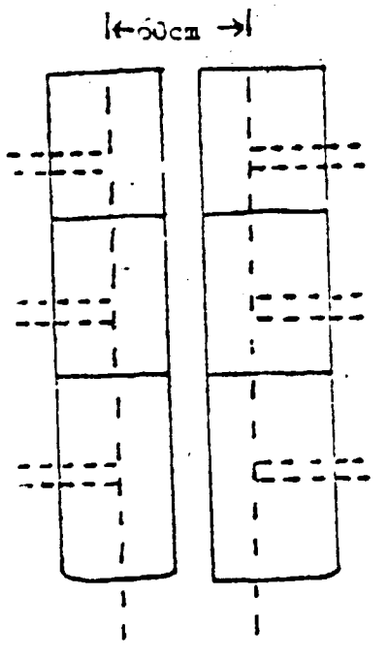
If there is no other usage for the producer gas it will be burnt underneath of the retorts in the fire chamber.

The installation of the CARBO GAS retort in Afgoje was delayed due to the fact that the NRA required its display in a national exhibition in honor of the fifteenth anniversary of the Somalian revolution.

Figure 4



Oil Drum Retorts installed



Smoke Channels
15cm wide

Three 200 ltr. oil drums form one retort

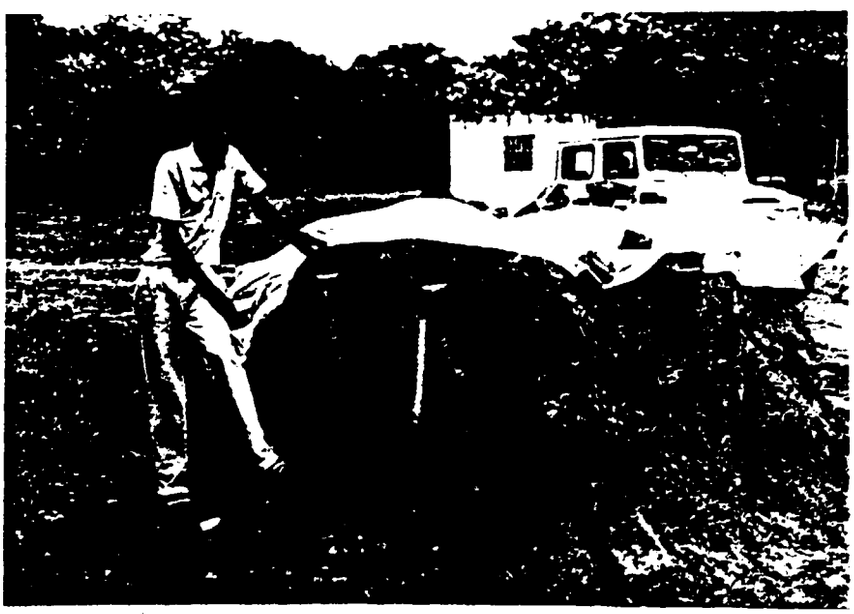
4.2. The operation of the CARBO GAS retort

The biomass is charged at full capacity of the retort and packed as dense as possible. The charging can be facilitated by using metal sheets as trays, which helps minimise the work load of the discharging of the produced charcoal.
After closing the lids, a fire is made in the fire chamber from dry wood or dry rubbish.
The first gas will develop after reaching 280 °C in the interior of the retort which should be accomplished after 30 to 40 minutes.
As soon as the gas exits through the gas pipes it will ignite itself by the burning firewood.
Starting from this point the firing with other materials may be gradually reduced because the carbonisation process maintains itself by the burning of producer gas.
The carbonisation will be finished when no gas is more produced.
Depending on the moisture content of the charged biomass the carbonisation phase will be terminated after three hours in general.
After the carbonisation the cooling phase begins and lasts usually 12 hours.
The normal operational cycle is as follows;

07:00	to	10:00 am	= discharging of the charcoal
10:00	to	01:00 pm	= charging the retorts
01:00	to	05:00 pm	= firing the retorts
05:00	to	08:00 pm	= reduced firing of the retorts
08:00	to	07:00 am	= cooling of the retorts

In a charcoal operation where the producer gas is provided for power or steam generation the operational cycle has to be altered in a way that alway part of the retorts are within the carbonisation phase, thus the gas supply will be continuously or available during the periods it is needed.
We were not able to operate the CARBO GAS retort during this mission mainly because of lack of firewood.


KILNSITE



5. Work Schedule

Date	Duties performed
I8.09.84	Arrival of the expert in Mogadishu
I9.09. - 25.09.	Meetings in Mogadishu,preparations for fieldwork, NRA assigns Mr. Hassan Ali Nur as counterpart
26./27.09.	Car provided (Toyota 4-wheel drive)by UNDP/NRA, car serviced,insurance policy validated
28.09. - I8.I0.	Selection and preparation of kilnsite in Afgoje-nursery, improvements of laboratory building, construction of Half Orange kiln, training of personnel, lecturing to senior forest students of the forestry school in Afgoje curing of Half Orange kiln begins 24 trips to Afgoje
I8.I0. - 22.I0.	Preparatory for the National Industry Show in Mogadishu upon request of NRA, Setting up of the Carbo Gas retort for display and design of information signs to indicate details of UNIDO Charcoal project in Somalia termination of kiln curing in Afgoje because of lack of suitable firewood, 4 trips to Afgoje
23.I0. - 08.II.	Transportation of laboratory equipment,tools and construction material to Afgoje, Carbo Gas retort released by the exhibiton agency on 06.II. only, transportation of retort to kiln site in Afgoje, extreme heavy rain falls do not permit continuous fieldwork and cause the collapse of part of the cupola of the Half Orange kiln I4 trips to Afgoje
09.II. - I3.II.	Repair of Half Orange kiln and progressing with training, inventory check of laboratory equipment, resuming work with Carbo Gas retort, frequent rain falls cause interruption of fieldwork, 4 trips to Afgoje
I4.II. - 20.II.	Installation of elctricity in laboratory completed, work on Carbo Gas retort completed, inventory check of laboratory equipment the goods and materials of the kiln site completed, curing of repaired Half Orange kiln not possible because lack of sufficient firewood, to prevent damage of kiln stones by another collapse due to rain falls the cupola is been partly taken apart and the remaining kiln shell protected with plastic sheet, heavy rain falls also during this period make fieldwork very difficult, 9 trips to Afgoje
20.II. - departure	Turn over of all inventory to NRA, preparing of final report, concluding meetings with NRA,UNDP,charcoal cooperatives,etc. in Mogadishu, 5 trips to Afgoje
29.II.84	departure of the expert from Mogadishu