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TRANSFER OF TECHNOLOGY THROUGH THE ESTABLISHMENT OF A MULTI-PURPOSE PILOT PLANT

DP/IRA/83/014

IRAN

Technical report: transfer of technology*.

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

Based on the work of M.B. Bhate, pharmaceutical industry adviser

United Nations Industrial Development Organization
Vienna

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EXPLANATORY NOTES

General:

Value of currency: 1 US$ - Rials 86.5 (April, 1984)

Organizations:

Alhavi	A Government owned Pharmaceutical Formulation Unit under The Ministry of Industries, Iran
Darupakhsh	A Government owned Pharmaceutical Formulation Unit under The Ministry of Health, Iran
N.I.O.	National Industries Organization under the Ministry of Industries, Iran
Toobi	A Government owned manufacturing unit for Inorganic Chemicals under the Ministry of Industries, Iran
U.N.D.P.	United Nations Development Programme
U.N.I.D.O.	United Nations Industrial Development Organization
W.H.O.	World Health Organization

Acknowledgements:

The writer wishes to express his deep appreciation for the assistance and information received from the concerned organizations, especially from Darupakhsh, N.I.O., Toobi, U.N.D.P., and U.N.I.D.O., which is hereby gratefully acknowledged.

Summary:

In accordance with the decision of the Government of the Islamic Republic of Iran, to achieve self-sufficiency with respect to pharmaceutical chemicals and since there are no facilities for the manufacture of pharmaceutical chemicals in the country, the only choice to achieve the Government objectives is to establish a pharmaceutical chemical pilot plant for the following reasons.

1. Technologies for the production of pharmaceutical chemicals are not available in the country,
2. No facilities are available within the country to adopt technologies even if they are acquired.
3. Skilled manpower to undertake manufacture of pharmaceutical chemicals is not available.
4. The present policy of the Government does not permit the setting up of subsidiaries by foreign companies.
5. The production of the pharmaceutical chemicals has to be undertaken by the State.

The only way to achieve the objective is, therefore, to acquire the missing links with UNDP assistance.

For this purpose a scheme for establishing a multipurpose pilot plant is being proposed. Such a scheme will provide:

a) The necessary equipment to produce pharmaceutical chemicals needed for the formulations.

b) Acquisition of suitable manufacturing technologies from the leading contractors in the world.

c) A full fledged training programme off the job outside the country and on the job in the pilot plant.

d) Experience, skill and confidence required for such manufacturing activities.

Introduction:

The Government of the Islamic Republic of Iran in their efforts to become self-sufficient in the pharmaceutical industries sector approached UNDP for assistance in the establishment of a pilot plant for the production of pharmaceutical chemicals. However, it was found necessary to investigate the pilot nature of the above project to introduce new technologies in terms of products, techno-economic feasibility with reference to qualified staff, raw materials and market. For this purpose, Mr. M. Bhate, UNIDO consultant, had been delegated to Iran.

Simplification and rationalization of production of pharmaceutical products is an absolute necessity for a public health programme. This calls for the production of generic drugs. In response to this the Government has already adopted a totally generic base approach. It is now the intention of the Government to produce, in the long run, as many pharmaceutical chemicals, listed, within the country as would be possible. With this intention the Government hopes to achieve:

1. Self-sufficiency with respect to the pharmaceutical chemicals required for their pharmaceutical industries.
2. To give a philip to their intended manufacturing activities in the country.

Pharmaceutical formulation is the only prevailing activity in the field of drugs. All raw materials in terms of bulk drugs are imported at present.

The lack of manufacturing activity for the production of pharmaceutical chemicals is, therefore, the principal bottleneck to self-sufficiency. There is also a critical shortage of trained manpower in managerial, administration, production engineering, etc.

According to the Government policy it is not possible to start these activities by:

1. Setting up turn-key ventures by foreign companies, and
2. Establishing joint ventures with such companies.

It is also not possible to start a manufacturing programme because of lack of technologies, experience and expertise needed by such a programme. The only way, therefore, is to acquire the above-mentioned requirements with UNDP assistance.

Justifications and Recommendations

As mentioned in the body of the report, Iran, like any other developing country, depends heavily on the imports of pharmaceutical chemicals required by the formulating industries. In order to be self-sufficient in this respect, the country has to set up manufacturing activities for the pharmaceutical chemicals, but this cannot be done because of lack of technology.

There are manufacturing activities on a large-scale for the production of some heavy chemicals and petroleum products. However, there is absolutely no manufacturing programme for pharmaceutical chemicals. It cannot be argued that because manufacturing experience and ability to produce these heavy chemicals is available, the same experience and skill is sufficient to start manufacturing activities for pharmaceutical chemicals. There is a basic difference in the manufacturing activities of heavy chemicals and pharmaceutical chemicals. This lies in the fact that whereas the pharmaceutical chemical industries have to deal with the manufacture of basic drugs, which are ultimately used by pharmaceutical formulation industries, where strict norms and standards have got to be followed, the other chemical industries do not have to deal with these conditions and thus do not have the required experience.

It cannot also be argued that because there are pharmaceutical formulation industries in the country, the necessary skill and experience exists for starting manufacturing activities for pharmaceutical chemicals. This is because the personnel involved in the pharmaceutical formulations only deal with the raw materials that have been produced according to strict manufacturing standards and norms. They do not have to follow these norms, whereas during the production of pharmaceutical chemicals such norms have to be adhered to with full determination and devotion. This sort of training is totally absent in any other manufacturing set-up and so it definitely does not exist in this country. Such experience and skill will, therefore, have to be developed in the country. In order to achieve this goal the country must acquire the following basic requirements, which are not available locally.

i) The know-how for the manufacturing of pharmaceutical chemicals,
ii) The experience, the skill and the rigid standards and devotion to follow the same,
iii) A massive training programme off the job outside the country and on the job in the plant itself.

The only way to achieve this is to establish a multipurpose pilit plant and acquire the process know-how.

In view of the above-mentioned facts, a multipurpose plant to introduce manufacturing technologies and provide facilities for a massive training programme is highly recommended.

Analysis of the present status

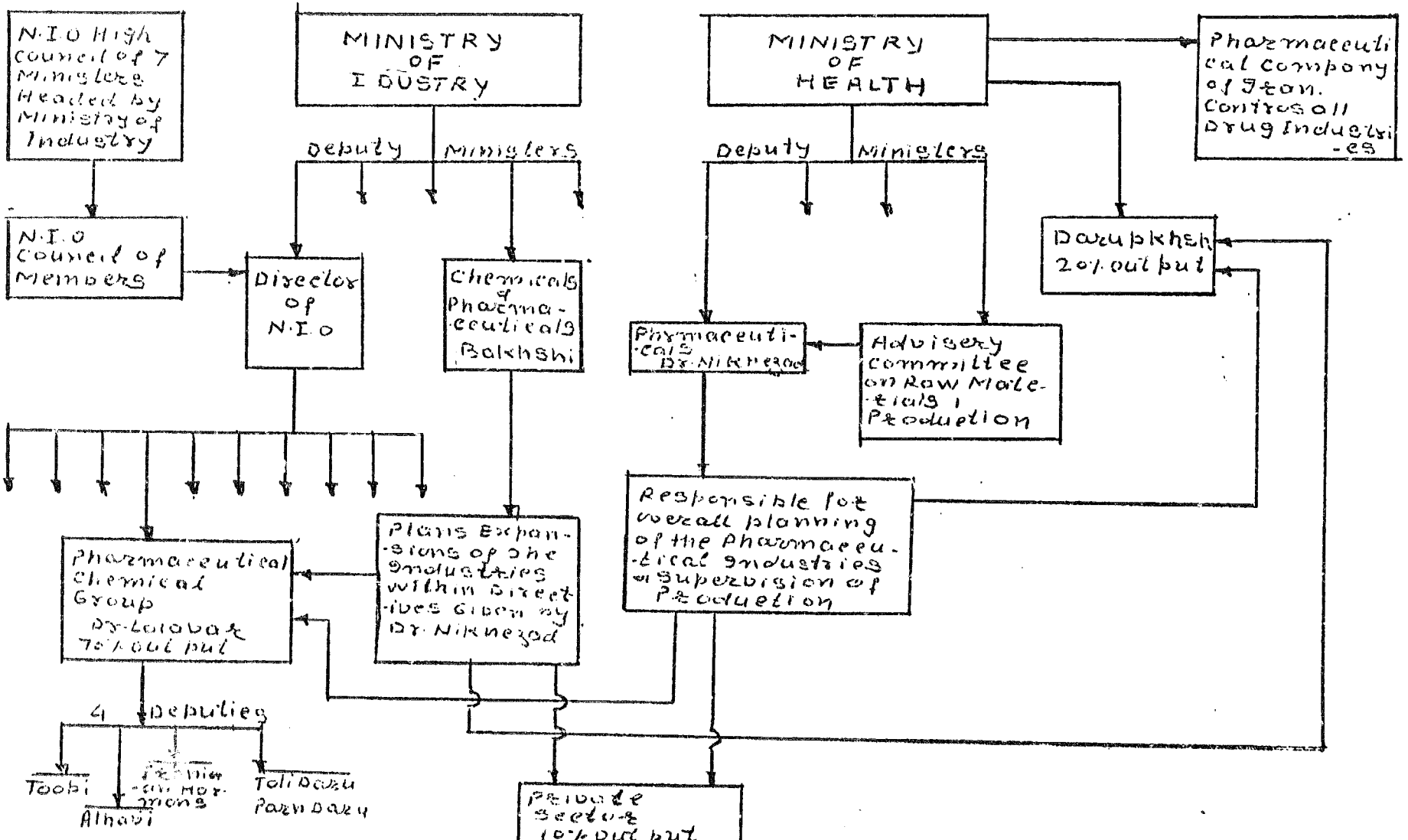
As mentioned above, to simplify and rationalize pharmaceutical chemicals the Government has already adopted afull fledged generic system for the production of pharmaceutical formulations. Such a generic list appears in Annex 1. Prior to the Revolution, there were about 4,000 different drug products on the Iranian market and they were mostly imported. These different drugs were sold under their proprietary names.

After the Revolution, the Government undertook preparation and promulgation of a generic name pharmacopea, comprising over 500 items. As a result of this and other measures, the number of different drug items have been reduced from over 4,000 to about 1,000, of which almost 600 are produced locally. The remaining ones have to be imported. These drugs are now sold in their generic names only.

National requirement of some specific pharmaceutical products have been tabulated in Annex 2.

After the Revolution, the Government has nationalized most of the major industries, including of course the pharmaceutical industries. Accordingly, all the nationalized industries are directed by different ministries. An overall picture of the pharmaceutical industries in Iran is attached herewith.

STRUCTURE OF THE PHARMACEUTICAL INDUSTRIES IN IRAN



Dr. Lolavar is the Chairman of the Board of Directors for all firms in the country, in addition to appointing other Board Members.

The contribution of the private and Government undertakings towards the manufacture of pharmaceutical products is as follows:

National consumption (100%)

	Immediate past	Present	Forecast
Imported	60-65%	35-40%	20-25%
Formulations	35-40%	60-65%	75-80%

The contributions by N.I.O., Darupkhsh and the private sector towards production of pharmaceutical products is thus:

N.I.O.	70%
Darupakhsh	20%
Private	10%

Present Manufacturing Activities

The only manufacturing activities in the field of chemicals are:

1. Heavy chemicals such as sulfuric acid, caustic soda, ammonia, urea.
2. Petroleum products such as benzene, toluene, xylene, phenol.
3. Pharmaceutical formulations.

Not a single pharmaceutical chemical is being manufactured in the country.

Future Programme

Some of the organizations are preparing schemes in the field of pharmaceutical products production.

Mention may be made about the following activities under consideration.

Darupakhsh

Darupakhsh is a Government undertaking under the Ministry of Health and their activities are: a) Formulations and, b) Manufacture of bulk raw materials. The formulation activities are carried out by Darupakhsh while the bulk raw materials are manufactured by their subsidiary concern called Temad. Temad have recently started a pilot plant for the production of morphine and cocaine.

Alhavi Pharmaceutical Co.

This is also another Government undertaking. They have formulation units. They are now planning to cultivate herbs that normally grow in Iran and start the production of herbal medicines and plant extracts.

Toobi

This is yet another Government undertaking. Their main activities are production of inorganic raw materials. At present they are putting up a plant for the production of precipitated magnesia. The equipment is under erection and they expect to start the plant in a few months. They also have a research laboratory and are at present engaged in the recovery of caffeine from tea waste since Iran is producing sufficient quantities of tea.

Need for a Pilot Plant

As discussed earlier, the country has no technologies and manufacturing skills for producing pharmaceutical chemicals and must, therefore, acquire the same via transfer of technologies. Demonstration and training are parts of technologies. A laboratory demonstration on a work bench is not the way of imparting training because laboratory scale models just cannot simulate the operation conditions that are present on a large-scale plant. The operating personnel will have to be taught how to handle different equipment and different chemicals having different chemical and physical properties. To establish such a training programme, certain minimum production levels will have to be followed, which is just not possible on a work bench only. Again, a laboratory scale demonstration will not expose the personnel, undergoing training, to the sequence of operations and the sequence in which different equipments are used. This is possible only on a pilot plant or an actual large scale manufacturing plant.

The Pilot Plant

Selection of Product Mix

A study on the requirement of pharmaceutical chemicals and the possibilities of availability of technologies indicate a product mix that is presented in Annex 3. As mentioned earlier, certain minimum production levels have to be adopted for proper training programmes. Since the purpose of this plant is not to start a full manufacturing programme, the production level is so chosen that it will be within the minimum production level. The product mix spells out such production levels for different pharmaceutical chemicals. Another alternate product mix is also suggested in Annex 4. It will be noticed that the annual combined production of the product mix will be just 112.5 tons and that the percentage of each item produced varies from about 8 per cent of the national requirement, in the case of Paracetamol, to as much as 70 % of the national requirement for Chlordiazepoxide.

Selection of Equipment

Having selected the required product mix the next job is to provide suitable equipment to produce them. Lists of equipment and estimated cost, cost of civil construction and working capital requirements are given in Annex 5.

A multipurpose pilot plant can do many other functions. Also manufacturing processes of pharmaceutical chemicals are purely batch type operations, so once one product mix is tried out, the same plant can be used over again for trying another product mix. So the function of a pilot plant does not end when certain objectives for which it is set up are fulfilled. That is why it is called a multipurpose pilot plant. Thus a multipurpose pilot plant becomes a very handy tool at the hands of a receiving body to acquire various manufacturing programmes for not only pharmaceutical chemicals but for that purpose a host of other organic chemicals. The main objective of a pilot plant is the transfer of technologies the easy way. Working on a pilot plant by its very nature offers the body enough data that are required for a feasibility study. Such data are just not possible on a bench scale model.

The foregoing discussions lead to only one conclusion, that is that for a smooth transfer of technologies and for an on the job training programme, a multipurpose pilot plant is a must.

A look at the list of equipment will show that it includes glass lined and stainless steel equipment, some of which could be used in semi-commercial plants.

The following argument will justify the inclusion of the recommended equipment.

a) Material of construction

Glass lined and stainless steel reactors have been included in the project. An examination of the different processes of manufacture indicate that there are certain reactions, that are to be carried out under acidic conditions using acids such as sulfuric acid at critical concentrations and hydrochloric acid at any concentration, and with the use of various solvents such as benzene, toluene, acetone, methanol. No normal material of construction except glass lining can be used for carrying out such reaction.

Production of pharmaceutical products is a special job where strict adherence to manufacturing standards has to be followed. One of these conditions is to avoid iron contamination so stainless steel and rubber lined carbon steel reactors have been included to minimize iron contamination.

Size of the reactors

The size of any reaction vessel is a function of the batch volume. When there are a number of batch operations that have to be carried out in one type of equipment then the capacity of that equipment must be consistent with the maximum volume that has to be handled. Again, as mentioned earlier, for successful personnel training programmes, on the job and for smooth transfer of manufacturing technology, certain minimum production levels have to be followed. The capacities of all the reactors and the down stream equipment have been fixed after giving full consideration to the above-mentioned facts.

Number of Equipment

During the production programme one batch has to be transferred from one reaction vessel to the other having the same capacity and material of construction. Such transfers are necessary from the operation point of view. The reason for inclusion of two glass lined reactors of 1,000 lt is in accordance with the above discussion. The same argument holds good for stainless equipment also. Even though all equipment

may not be in use at any particular moment. The sequence of operations and facilities for intermediate storage of semi processed batches require the inclusion of that number of equipment. As far as dryers are concerned, some products can be dried under moderately high temperatures of up to 80-90°C, however some of the products are temperature-sensitive and are required to be dried at lower temperatures, which means under vacuum. This justifies the inclusion of vacuum dryer and forced draught dryers. Again, as far as possible no two products must be dried at the same time in a single dryer. Many times two or more products get ready for drying at the same time. Naturally, more than two forced draught dryers have to be included in the list. Chilled water plant and chilled brine plants have been included since the same reactions have to be carried out at temperatures beyond the reach of cooling water systems.

Two small boilers are two small (in half the required capacity) chilled water plants have been included instead of one big unit for both. The reason for this is that if there is only one big boiler and one big chilled water unit, then in the case of failure of any one of the units, the total production programme will come to a halt, whereas with two half capacity equipment, the production programme can still be carried out at a reduced level in cases of failure of any one of the smaller units.

Capacities of Bulk Storage Tanks

A close scrutiny of the raw materials requirement indicates large volumes of some of the solvents that have to be used. So is the case with acids. As such the inclusion of high capacity storage tanks is a necessity.

Raw Materials

Annexes 6, 7, 8 and 9 give the present-wise requirement of raw materials. These lists will facilitate the maintenance of inventory of raw materials at the required levels. Likewise the total requirements of raw materials has been divided in two groups, a) imported, and b) locally available raw materials. The requirement of these two groups has been listed separately in Annexes 10 and 11 respectively with the market price whereever possible prevailing in Teheran during March 1984.

Laboratory Equipment

Besides normal laboratory ware are included some sophisticated instruments such as:

1. High pressure liquid chromatograph,

2. Polarimeter,

3. Infrared spectrometer.

These instruments are required for precise analysis of pharmaceutical chemicals.

Since the purpose of the pilot plant is rigorous planning in every field, this addition will provide better experience to the quality control personnel.

Similarly, are also included in this list of laboratory instruments, one piece of equipment, i.e the Erwek a unit for formulation. This equipment will be useful in product development exercises.

Infrastructure

Necessary information regarding services, availabilities of construction materials, and all other additional information required appears in the following Annexes:

Annex 12 - Availability of construction materials, facilities for storage and transport

Annex 13 - Availability of Utilities

Annex 14 - Additional information

Training Programme

Intensive on the plant training has to be given to personnel at all levels. In the first place a team of higher level personnel will have to be sent outside the country and the contractors offering manufacturing technologies will give very intensive training programmes to the selected team. A training programme for a period of 10 months has been envisaged. Annex 15 presents a list of such a team that will have to be sent for training. Similarly, Annex 16 presents the total requirement of the operating and administrative personnel.

Work Schedule

A tentative study of all the operations indicate that the total project will be completed in about 36 months after the approval of the project. A probable bar chart showing the timings for various activities is attached herewith.

Feasibility Study

A feasibility study has been made even though such a study is generally not required for pilot plant study. Market value of proposed mixes of pharmaceutical chemicals is given in Annexes 17 and 18. Cost of labour overheads is given in Annex 19.

As can be seen from Annexes 20 - 30, the cost of production for every single item works out higher than the respective prevailing market price. Results of only a few pharmaceutical chemicals such as Procaine Hydrochloride, Lignocaine Hydrochloride Oxyphenbutazone and Clotrimazole are somewhat interesting.

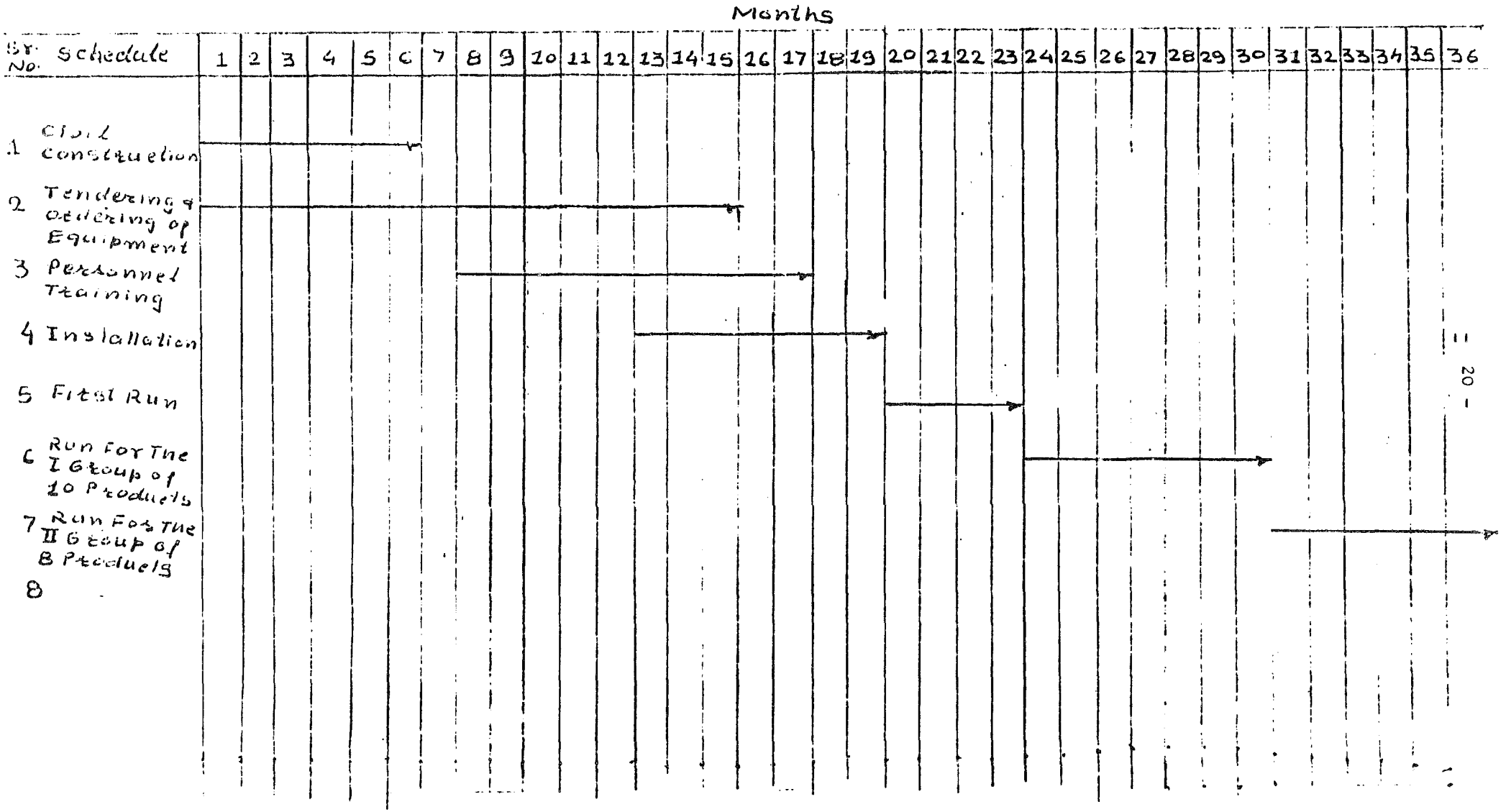
It therefore becomes very clear that the proposed multi purpose pilot plant will only fulfil the main objective of the project which is to make available the technologies and skills for the production of pharmaceutical chemicals and prepare

background for the manufacturing activities for such products. It also becomes very clear from the cost analysis that this plant is not meant for commercial production. Even the products produced will not be on sale, since in the first attempt they may not conf rm to the quality control standards. However, in case they do conform to the quality standards then they will be made available to the formulation industries.

Layout of Proposed Pilot Plant

Site plan for proposed pilot plant os shown in Annex 31. The layout of existing plant of Daru Paksh is indicated in Annex 32. The plant building of Daru Paksh is shown in Annex 33. The equipment layout for proposed pilot plant is indicated in Annex 34.

WORK SCHEDULE
FOR
MULTI PURPOSE PILOT PLANT



Annex 1

GENERIC NAMES OF PHARMACEUTICAL CHEMICALS

A

acenocoumarol
acetaminophen
acetazolamide
acetic acid
acteohexamide
acetylcholine Cl
ACTH
* AGENTS FOR ACTIVE IMMUNICATION (pg. 72)
* AGENTS FOR PASSIVE IMMUNICATION (pg. 72)
albumin normal serum
ALCOHOL 38B (pg. 74)
allantoin
allopurinol
alprenolol
ALLERGIC EXTRACTS (pg. 73)
aluminium acetate
aluminium hydroxide
aluminium subacetate
amantadine HCl
\+ ambenonium chloride
\+ amikacin sulfate
aminacrine HCl
aminophylline
amiodarone
amitrptyline HCl
ammonium cbloride
ammonium hydroxide inhalant
amobarbital Na
amoxicillin
\+ amphotericin B
ampicillin
ampicillin Na
\+ amyl nitrite
antihemophilic factor
ANTIVENINES (pg. 73)
apomorphine HCl
aprotinin
\+ asparaginase
aspirin
atropine sulfate
azathioprine
azathioprine Na

B

bacitracin
barium sulfate
beclomethasone dipropionate
belladonna alkaloids (total)
benzalkonium chloride
benzethonium chloride
benzocaine
benzoin
benzoyl peroxide
\+ benztropine mesylate
benzyl benzoate
bephenium hydroxynaphthoate
berberine HCl
beta caroten
betamethasone
betamethasone acetate
betamethasone disodium phosphate
betamethasone valerate
\+ bethanechol chloride
bile extract
biotin
biperiden HCl
biperiden lactate
biacodyl
bismuth subgallate
\+ bleomycin sulfate
borax
boric acid
bromhexine Hcl
bromocriptine mesylate
buclosamide
buclosamide
\+ bupivacaine HCl
busuflan
butalbital Na

C

caffeine
calamine
calcium gluconate
calcium pantothanate
candicidin
capreomycin sulfate
\+ carbachol
carbamazepine
carbamide peroxide
carbenicillin disoidum
carbenicullin indanyl sodium
carbidopa
carbimazole
carbogen
carbon dioxide

Annex 1 (cont.)

	C
+	carmustine (BCNU)
	cascara sagrada
	castor oil
	CDP-choline
	cefazolin Na
	cephalexin monohydrate
	cephalothin soidum
	cephradine
	cetrimide
	cetylpyridinium chloride
	charcoal
+	chloral hydrate
	chlorambucil
	chloramphenicol
	chormaphenicol palmitate
	chloramphenicol sodium succinate
	chlordiazepoxide
	chlorguanide HCl
	chlorhexidine gluconate
+	chloroprocaine HCl
	chlorpheniramine maleate
	chloroquine phosphate
	chlorpromazine
	chlorpromazine HCl
	chlorpropamide
	chlorthalidone HCl
+	cholestyramine
	chorionic gonadotropin (human)
	chymotrypsin
	cimetidine
	cimetidine HCl
++	clemastine fumarate
	clidinium Br
	clindamycin HCl
+	clindamycin palmitate HCl
+	clindamycin phosphate
	clobetasol propionate
	clobutinol HCl
	clofibrate
	clomiphene citrate
+	clonazepam
	clinidine HCl
	clotrimazone
	cloxacillin Na monohydrate
	coal tar
	codeine phosphate
	colchicine
	colistin sulfate
	conjugated estrogens
	cromolyn Na
	crotamiton
	cyclizine HCl
+	cyclopentolate HCl
	cyclophosphamide
	cyproheptadine HCl
++	cyproterone acetate
	cytarabine

	D
+	dacabazine
+	dactinomycin
	dantrolene Na
+	dapsone (DDS)
	daunorubicin HCl
	deferoxamine mesylate
	demeclocycline HCl
+	desmopressin
	desoxycorticosterone acetate
	dexamethasone
	dexamethasone acetate
	dexamethasone sodium phosphate
	dexchlorpheniramine maleate
	dexpanthenol
	dextran
++	dextranomer
	dextromethorphan HBr
	diatrizoate meglumine
	diazepam
	diazoxide
	dicloxacillin Na monohydrate
	dicyclomine HCl
	dienestrol
	diethylstilbestrol
	digitoxin
	digoxin
	dihydroergotamine mesylate
	dihydrogenated ergot alkaloids
+	dihydrotachysterol
	dimenhydrinate
+	dimercaprol
+	dioctyl sodium sulfosuccinate
	diphenhydramine HCl
	diphenoxylate HCl
	dipyridamole
	dipyrone (injectable only)
+	disopyramide phosphate
+	disulfiram
+	dobutamine HCl
	dopamine HCl
	doxapram HCl
	doxorubicin
	doxycycline hyclate
	doxycycline momohydrate
++	droperidol
	drarogesterone

Annex 1 (cont.)

E

\+ edrophonium chloride
* ELECTROLYTES (pg. 74)
emetine HCl
enflurane
ephedrine sulfate
epinephrine (HCl, bitartrate)
ergotamine tartrate
erythromycin ethylsuccinate
erythromycin lactobionate
* ESSENTIAL AMINO ACIDS (Pg. 69)
\+ estradiol dipropionate
estradiol valerate
ethacrynic acid
ethambutol
ether
ethinyl estradiol
ethiodized oil
ethosuximide
\+ ethoxazene HCl
ethylstibamine
ethylestrenol
eucalyptus Tr.

F

* FATS (Pg. 74)
felypressin
fenfluramine HCl
++ fentanyl citrate
ferrous sulfate
fibrinogen
\+ flucytosine
\+ fludrocortisone acetate
\+ fluocinolone acetonide
fluorescein Na
fluorouracil
fluphenazine (HCl)[2]
flurandrenolide
\+ flurazepam HCl
\+ fluroxene
folic acid
\+ folinic acid
fosfestrol disodium
furazolidone
furosemide

G

gallamine triethiodide
\+ gamma benzene hexachloride (lindane)
gelatin
gentamicin sulfate
gentian violet
glibenclamide
\+ glucagon

G

glycerin
glycopyrrolate
\+ gold sodium thiomalate
gramicidin
griseofulvin (microcrystals)
guaifenesin
guanethidine sulfate

H

haloperidol
halothane
hamaelis
hemicellulase
heparin Na
hexachlorophene
\+ histoplasmin
homotropine HBr
human plasma protein fraction
\+ hydralazine HCl
hydrastine HCl
hydrochlorothiazide
hydrocortisone acetate
hydrocortisone Na succinate
hydrogen peroxide
\+ hydroquinone
hydroxychloroquine sulfate
hydroxypropylmethylcellulose (HPMC)
\+ hydroxyurea
hydroxyzine HCl
hyoscine HBr
hyoscyamine sulfate

I

ibuprofen
idoxuridine
imipramine HCl
indocyanine green
indomethacin
\+ INFANT MILKS (pg. 74)
insulin isophane (NPH)
insulin regular ultralente
insulin Zn suspension - lente
intrinsic factor semilente
iodine
iodipamide meglumine
iodochlorhydroxyquin
iopanoic acid
iophendylate
\+ ipecac syrup
iron-dextran complex
isocarboxazid
\+ isoetharine mesylate
\+ isoflurophate
isoniazid
isoproterenol HCl
isosorbide dinitrate
isoxsuprine HCl

Annex 1 (cont.)

K

kanamcyin sulfate
kaolin
ketamine HCl

L

\+ lactulose
levamisole HCl
levodopa
levothyroxine Na
lidocaine HCl
lincomycin HCl
liothyronine Na
lithium carbonate
lomustine

M

mafenide acetate
megnesium hydroxide
magnesium sulfate
magnesium trisilicate
mannitol
mebendazole
meclizine HCl
medroxyprogesterone acetate
mefenamic acid
meglumine antimonate
meglumine iothalamate
melphalan
menadione Na bisulfate
menadione
menotropins
metnhol
meperidine HCl
mephenlermine sulfate
mepivacaine HCl
meprobamate
merbromin
mercaptopurine
mestranol
metaproterenol sulfate
methadone HCl
\+ methenamine mandelate
methimazole
methocarbamol
methotrexate
\+ methoxamine HCl
methyldopa
methyldopate HCl
methylene blue
methylergonovine maleate
\+ methylphenidate HCl
methylprednisolone acetate
\+ methyltestosterone
methyl salicylate
metoclopramide HCl
metrizamide
metronidazole
\+ metyrapone
\+ miconazole nitrate
mineral oil
minocycline HCl
\+ mithramycin
mitomycin
morphine sulfate
\+ mumps skin test antigen
myrtillus anthocyanosides

N

nalidixic acid
nalorphine HCl
naloxone HCl
nandrolone decanoate
nandrolone phenpropionate
naphazoline HCl
naphazoline nitrate
neomycin sulfate
neostigmine Br
neostigmine methylsulfate
niacin
niacinamide
niclosamide
nifedipine
niridazole
nitrofurantoin
nitrofurazone
\+ nitrogen mustard
nitroglycerin
\+ nitroprusside Na
nitrous oxide
nitrous oxide
* NONESSENTIAL AMINO ACIDS
nonoxynol g
norepinephrine bitartate
norethindrone
norethindrone acetate
norgestrel (or levonorgestrel)
nystatin

O

\+ old tuberculin (mantoux)
opium
oxazepam
oxethazaine
\+ oxybutynin chloride
oxygen
oxymetholone
oxyphenbutazone
oxytetracycline HCl
oxytocin

Annex 1 (cont.)

P

pancreatin
pancuronium Br
pantothenic acid
para aminobenzoic acid
para aminosalicylic acid (PAS)
paramycin sulfate
paregoric
pectin
penicillamine
penicillin G, benzathine
penicillin G, potassium
penicillin G, procaine
penicillin G, sodium
penicillin V, potassium
+ pentagastrin
pentazocine HCl
pentazocine lactate
peppermint oil
perphenazine
phenazopyridine HCl
phenobarbital
phenobarbital Na
+ phenolsulfonphtalein
+ phentermine HCl
phentolamine mesylate
phenylephrine HCl
phenylpropanolamine HCl
phenytoin
phenytoin Na
physostigmine sulfate
phytanodione (K1)
pilocarpine nitrate, HCl
piperazine citrate
pipotiazine palmnitate
+ platinum diamino dichloride (cisplatin)
polymyxin B sulfate
polysorbate 80
polyvinyl alcohol
potassium chloride
potassium iodide
povidone (polyvinylpyriolidone)
povidone iodine
+ pralidoxine chloride (PAM)
+ prazosin Hcl
prednisolone
prilocaine HCl
+ primaquine phosphate
primidone
probenecid
procainamide HCl
procaine HCl
procarbazine HCl
progesterone
promethazine HCl
propanidid
propantheline BR
+ proparacaine HCl
propranolol HCl
propyliodone
+ propylthiouracil
protamine sulfate
prothionamide
+ protirelin
++ pseudoephedrine HCl
psyllium
pyrazinamide
+ pyrethrins
+ pyridostigmine Br
pyrilamine maleate
+ pyrimethamine
pyrvinium pamoate

Q

+ quinacrine HCl
quinidine sulfate

R

reserpine
resorcinol
rifampin

S

salbutamol
salbutamol sulfate
salicyclic acid
scopalamine N butyl bromide
secobarbital Na
+ secretin
selenium sulfide
silver nitrate
+ silver sulfadiazine
simethicane
simfibrate
sodium diatrizoate
sodium EDTA
sodium fluoride
sodium ipodate
sodium nitrite
sodium polystyrene sulfonate
sodium salicyclate
sodium tetradecyl sulfate
sodium thiosulfate
somatropin
sorbitol
+ spectinomycin HCl
spironolactone
+ streptodornase
streptokinase

Annex 1 (cont.)

streptomycin sulfate
succinylcholine chloride
sulfacetamide sodium
sulfamethoxazole
sulfamethoxypyridazine
+ sulfapyridine
sulfasalazine
sulfisoxazole
+ sulfisoxazole acetyl
sulfoxone Na
sulfur

T

tamoxifen citrate
terbutaline sulfate
+ testolactone
testosterone
testosterone propionate
testosterone enanthate
tetracaine HCl
theophylline
thiabendazole
thiethylperazine maleate
thimerosal
++ thioguannie
thiopental Na
thioridazine HCl
thiothixene
thrombin
thyroid
+ thyrotropin
timolol maleate
tobramycin sulfate
tolazoline HCl
tolnaftate
+ tranexamic acid
tranylcypromine sulfate
triacetin (glyceryl triacetate)
triamcinolone acetoniae
triamterene
triclofos sodium
triethylene thiophosphoramide (thio-TEPA)
trifluoperazine HCl
triflupromazine HCl
trihexyphenidyl HCl
trimeprimine maleate
trimeprazine tartrate
trimethoprim
+ trimethaphan camsylate
+ trioxsalen
+ tripelennazine citrate
+ tripelennamine HCl
tromethamine
+ tuberculin PPD

tubocurarine chloride

U

undecylenic acid
urea

V

valproate sodium
vancomycin HCl
vasopressin
verapamil HCl
vinblastine sulfate (VLB)
vinoristine sulfate (VCR)
vitamin A
vitamin B1 (thiamine HCl)
vitamin B2 (riboflavin)
vitamin B6 (pyridoxine HCl)
vitamin B12 (cyanocobalamin)
vitamin C (ascorbic acid)
vitamin D (D2,D3)
vitamin E

W

warfarin Na

Z

zinc sulfate
zinc oxide
zinc undecylinate

ANNEX 2

National Requirement of Pharmaceutical Chemicals*
From 1980 to 1987

Figures in tons

	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
Diphenyl Hydantoin and its Na. Salt	4.3	4.6	5	6	6.5	8	9
Nicotin-amide	26.3	28	30	33	37	40	45
Niacin	21.5	23	25	27	30	34	40
Metronidazole	8.6	9.2	10	11	13	14	15
Imidazole from Acetaldyde	4	4.5	5	5.5	6	6.5	8
Mebendazole	2.6	2.6	3	3.4	3.8	4	4.5
Methyl Imidazole	0.8	0.9	1	1.1	1.5	2	3
Clotrimazole	2	2.5	3	3.4	3.7	4.2	4.5
Procaine Hydrochloride	8.5	9.5	10	11.5	12.6	14	15
Lignocaine Hydrochloride	4.4	4.4	5	5.8	6	6.8	7.5
Oxyphen Butazone	12	13.8	15	17	19	20	24
Nikethamide	3	0.92	1	1.2	1.4	2	2.3
Clofibrate	5	6.4	7	8.5	9	10	11.5
Ethambutol	12.9	13.8	15	17	19	20	22
Isoniazid	4	4.5	10	13.0	15.0	18	18.0
Propranolol	1.5	1.8	2	2.5	3	3.5	4.5
Trimethoprim	17.5	18.5	20	24	27	29	32
Nalidixic Acid	6	6.5	7	7.4	8	9	11
Indometacine	8.5	9	10	11.5	12	13	14.5
Diazepam	1.5	1.5	2.0	2.3	2.8	3.0	3.5
Chlorodiazepoxide	1.0	1.2	1.5	1.7	1.9	2.0	2.2
Paracetamol	-	-	250.0	261.0	273.0	286.0	300.0
Totals	155.9	167.12	437.5	474.8	511.2	569.3	597

* Source of information: Darupakhsh as of March 1984

Annex 3

NATIONAL REQUIREMENT AND PROPOSED PRODUCTION LEVEL FOR DIFFERENT PHARMACEUTICAL CHEMICALS

PROPOSED PRODUCT MIX:A

No.	Name of Pharmaceutical Chemical	Proposed Annual Production Tons	Per cent National Requirement	National Requirement Tons/Year
1.	Nicotinamide	15	33.3	45
2.	Procaine Hydrochloride	8	50.0	16
3.	Clofibrate	3	25	12
4.	Diphenyl Hydantoin	4	44	9
5.	Lignocaine Hydrochloride	2	25	8
6.	Indometacine	2	13	15
7.	Nalidixic Acid	7	63	11
8.	Oxyphen Butazone	10	41	24
9.	Paracetamol	20	6.0	300
10.	Chlorodiazepoxide	1.5	70.0	2
11.	Niacin	15	37.5	40
12.	Mebendazole	3	60.0	5
13.	Ethambutol	10	45	22
14.	Isoniazid	5	27	18
15.	Chlortriamazole	2	40.0	5
16.	Diazepam	2	56.6	3.5
17.	Nikethamide	1	40.0	2.5
18.	Propranolol	2	44	4.5
	Total annual production	112.5		

Annex 4

PROPOSED PRODUCT MIX:B

No.	Name of Pharmaceutical Chemical	Proposed Annual Production Tons	Per cent National Requirement	National Requirement Tons/Year
1.	Metronidazole	6	42.8	14
2.	Phenylbutazone	5	-	-
3.	Ferrous Fumarate	4	-	-
4.	Ibuprofen	6	-	-
5.	Aspirin	30	30.0	100
6.	Methyl Salicilate	3	-	-
7.	Sulfamethaxazole	4	-	-
8.	Trimethoprim	10	40.0	25
9.	Pyrazinamide	2		
10.	Haloperidol	10	-	-
11.	Chloroquine Phosphate	12	-	-
12.	Sulfinpyrazone	5	-	-
13.	Tinidazole	4	-	-
	Total annual production	101		

ANNEX 5

List of equipment and estimated cost

Serial No.	Item - Process Equipment	Capacity	No.	Estimated cost Unit cost US$	Estimated cost Total cost US$
1	Jacketed glass-lined reactor with agitator	1,000 l	2	40,000	80,000
2	G.L. condenser	4 sq.m.	2	8,000	16,000
3	G.L. Receiver	600 l	1	12,000	12.000
4	Jacketed S.S. reactor with agitator	1,000 l	4	9,000	36,000
5	S.S. Condenser	4 sq.m.	4	3,000	12,000
6	S.S. Receiver	600 l	2	3,000	6,000
7	Jacketed s.s. reactor with agitator	600 l	4	7,000	28,000
8	S.S. condenser	3 sq.m.	4	2,000	8,000
9	S.S. Receiver	500 l	2	3,000	6,000
10	Jacketed S.S. flat top reactor with agitator	600 l	1	6,000	6,000
11	M.S.R.L. flat top reactor with agitator	600 l	2	3,000	6,000
12	Jacketed S.S. concentration pan with agitator	400 l	1	4,000	4,000
13	Jacketed S.S. vacuum still pot with agitator	200 l	1	4,000	4,000
14	S.S. Condenser	1.5 sq.m.	1	1,000	1,000
15	Jacketed S.S. Receiver	200 l	1	2,000	2,000
16	12,000 S.S. basket centrifuge		2	8,000	16,000
17	10,000 S.S. basket centrifuge		1	6,000	6,000
18	M.S.R.L. filter box	600 l	2	4,000	8,000
19	S.S. filter box	600 l	1	8,000	8,000
20	S.S. sparkler filter		1	3,000	3,000
21	S.S. pressure leaf filter		1	1,000	1,000
			Sub-total:		269,000

ANNEX 5

List of equipment and estimated cost

(Continued)

Serial No.	Item - Process Equipment	Capacity	No.	Estimated Cost Unit cost US$	Estimated Cost Total cost US$
					bgt. frd. 269,000
22	Forced draft dryer	94 trays	3	4,000	12,000
23	Forced draft dryer	40 trays	1	3,000	3,000
24	Forced draft dryer	30 trays	1	2,000	2,000
25	Forced draft dryer	10 trays	1	1,000	1,000
26	Vacuum shelf dryer with condenser		1	9,000	9,000
27	Water ring vacuum pumps	7 h.p.	4	2,000	8,000
28	High vacuum pump	2 h.p.	1	1,000	1,000
29	S.S. centrifugal pump	50 lbm at 25 m	4	2,000	8,000
30	M.S.R.L. pump	50 lbm at 25 m	2	1,000	2,000
31	All glass reactor	100 l	2	2,000	4,000
32	S.S. pulveriser		1	2,000	2,000
33	S.S. mechanical sieve		1	2,000	4,000
34	S.S. resin column	0.6 mo 1.5 m high	2	2,000	4,000
35	S.S. blender		1	3,000	3,000
36	S.S. vent. condenser	1.5 sq.m.	5	1,000	5,000
37	Dial type balance	to weigh 50 kg.	2	1,500	3,000
38	Miscellaneous Equipment - lump sum				6,000
				Total	344,000

ANNEX 5

List of equipment and estimated cost

(Contined)

Serial No.	Item	Capacity	No.	Estimated cost Unit cost US$	Total cost US$
	Tank Farm Equipment				
1	Tank for storing hydrochloric acid, high density polythene	10,000 l	1	2,000	2,000
2	M.S. storage tank for sulfuric acid	10,000 l	1	5,000	5,000
3	M.S. storage tank for caustic soda	10,000 l	1	4,000	4,000
4	M.S. storage tank for benzene	10,000 l	1	4,000	4,000
5	M.S. storage tank for toluene	10,000 l	1	4,000	4,000
6	M.S. storage tank for acetone	10,000 l	1	4,000	4,000
7	M.S. storage tank for ethanol	10,000 l	1	4,000	4,000
8	M.S. storage tank for methanol	10,000 l	1	4,000	4,000
9	M.S. storage tank for diesel	10,000 l	2	4,000	8,000
10	C.I. submersible pump for solvent		5	2,000	10,000
11	C.I. pump for sulfuric acid		1	1,000	1,000
12	C.I. pump for caustic soda		1	1,000	1,000
13	Polypropeline pump for hydrochloric acid		1	1,500	1,500
	M.S. vent condensers	1 sq.m.	5	1,000	5,000
15	C.I. pump for diesel oil		1	1,000	1,000
	Service equipment		Sub-total		58,000
1	Steam generator to generate steam at 10 atm	500 kg/hr	2	30,000	60,000
2	Demineralized water unit	3 m^3/hr	1	15,000	15,000
3	Soft water unit,dealkalizer	3 m^3/hr	1	10,000	10,000
4	H.D.P. storage tank for D.M. water ,	10,000 l	2	2,000	4,000
5	H.D.P. storage tank for soft water	10,000 l	2	2,000	4,000
6	S.S. pump for D.M. water	25 lpm at 25 m	1	1,500	1,500
7	C.I. pump for soft water	25 lpm at 25 m	1	500	500
8	Refrigeration unit for chilled water at SC	30 tr	2	30,000	60,000
9	Refrigeration unit for chilled brine	10 tr	1	10,000	10,000
			Sub-total		

ANNEX 5

List of equipment and estimated cost

(Continued)

Serial No.	Item - Service Equipment	Capacity	No.	Estimated cost Unit cost US$	Estimated cost Total cost US$
10	Cooling tower	150 tr	1	15,000	15,000
11	C.I. cooling water pump	1,500 lpm at 25 m	2	3,000	6,000
12	C.I. chilled water pump	500 lpm at 25 m	2	2,000	4,000
13	C.I. chilled brine pump	100 lpm at 25 m	2	1,500	3,000
14	Hot oil circulation unit	70,000 K.cal/hr	1	15,000	15,000
15	AIr compressor		2	3,000	3,000
16	Electric substation 50 KVA		1	25,000	25,000
17	Diesel generator 50 KVA		1	20,000	20,000
18	Incinerator		1	2,500	2,500
19	Battery operated fork lift truck		1	15,000	15,000
				Total	273,500

ANNEX 5

Cost of Installed Equipment

			US$	US$
I.	A.	Cost of Process Equipment	344,000	
	B.	Cost of Tank Farm Equipment	58,000	
	C.	Cost of Service Equuupment	273,500	
		Total of A, B and C*		675,000
	D.	Cost of Spare Parts for 3 years trouble-free service	67,500	67,500
	Total Ex-works Cost of Equipment			743,000
	E.	Handling charges to convert to Ex-works cost to F.O.B. cost	74,000	
	F.	C.I.F. charges 25% F.O.B. charges	204,000	
	G.	Handling charges in Iran 10% of C.I.F.	100,000	
		Total landed cost of equipment		1,121,000
	H.	Cost of Installation		
		i) Cost of installation labour	190,000	
		ii) Cost of installation material	380,000	
		iii) 10% extra for explosion proofing	57,000	
		Total installation cost		627,000
		Total installed cost of equipment		1,748,000

* These cost figures are as per writer's experience and information on prevailing cost of fabrication in India

ANNEX 5

(Continued)

II. A. Equipment for Analytical Laboratory	Quantity
1. a) Metler semimicro balance	1
b) Single pan balance	1
c) Rough balance (Avery type)	1
2. Melting point apparatus	1
3. Laboratory drying oven (0 to 250°C)	2 (one vac. oven)
4. Muffle furnace	1
5. Karl Fischer apparatus	1
6. Refractometer	1
7. Spectro Calorimeter	1
8. T.L.C. equipment	1
9. Vacuum pump	1
10. Heating mantles	3
11. Hot plates	3
12. PH meter	1
13. U.V. - viewing cabinet	1
B. Glass Ware and Other Laboratory Items	
1. Burette (10,25 and 50 cc capacity)	1 doz. each
2. Pipettes (1, 2, 5, 10, 25 and 50 cc)	20 each
Lamda pipettes (5, 10 and 25)	3 each
Graduated pipettes (1, 5 and 10)	10 each
3. Beakers (25, 50, 100, 250 and 500)	2 doz. each
1,00 cc	1 doz. each
4. Conical flasks (25, 50, 100, 250, 500 and 1,000 cc) Erlenmeyer	1 doz.
Iodometric flask (250 ml)	1 doz.
5. Kjaldhal distillation units (Kjaldhal flasks)	2
Kjaldhal distillation units 500 ml	6
Kjaldhal distillation units 300 ml	6

ANNEX 5

(Continued)

		Quantity
6.	Platinum crucibles and tongs with pt. tip	2
7.	Nickel crucibles	2
8.	Silica (Vitreosol) crucible	1 doz.
9.	Miscellaneous items (such as stand, clamps, etc.)	
10.	Round bottom flask with standard joints (D-24) (100, 250 and 500 ml)	1 doz. each
11.	a) Thermometer (ordinary 0 to 250° C)	6
	b) Thermometer (Q.F.C. 250° C)	3
12.	Standard glass joints, adapters, glassenheeds, etc.	
13.	Separating funnel (50, 100, 250 and 500 cc)	6 each
	Ordinary funnels	1 doz
14.	Weighing bottles	1 doz
15.	Sintared glass crucibles	1 doz.
16.	Filteration flask (50, 100, 250, 500, 1 ltr.)	6 each
17.	Glass condenser for various types	1 doz.
	Coiled type	1 doz.
18.	Glass cylinders (10, 25 and 100)	1 doz. each
19.	Nesler tubes (25, 50 and 100)	1 doz.
20.	Volumetric flasks (10, 25, 50 and 100)	1 doz. each
	25, 500 and 1 ltr.	6
21.	Test tubes - all sizes	2 doz.
22.	Desiccators ordinary	4
	Vacuum	2
23.	Specific gravity bottle and pyknometers	10) 25) 3 each 50)
	Pyknometers	4
24.	100 l all-glass assembly	1

Total estimated cost of Laboratory Ware A and B US$50,000

ANNEX .5

(Continued)

		US$
C.		
1.	Perkin-Elmer Series 4 high pressure liquid chromatograph complete with all spares and accessories c.i.f.	58,800
2.	Perkin-Elmer Model 241 polarimeter complete with all spares and accessories c.i.f.	20,000
3.	Beckman Acculab infrared spectrophotometer complete with all spares and accessories c.i.f.	33,600
4.	Erweka unit for formulation complete with all spares and accessories c.i.f.	40,000
5.	Atomic absorption spectrometer)	48.600
6.	Gas chromatograph)	
	Total	251.000

III. Cost of Civil Construction

A.	Cost of process building - Basement/Ground Floor each 630 sq. m.	550,000
	Mezzanine floor 300 sq. m building available	
B.	Additional cost for modifications, alterations and reinforcing existing columns and foundations	55,000
C.	Cost of office accommodation, 50 sq. m. available	45,000
D.	Cost of warehouse for raw materials, 250 sq. m. new construction	130,000
E.	Cost of warehouse for finished products, 75 sq. m. new construction	40,000
F.	Cost of building for service equipment, 220 sq. m. new construction	130,000
G.	Work shop, cafeteria, time office, etc. to be pooled, hence no cost has been considered	
	Total cost of Civil Construction	950,000

ANNEX 5

Summary

			US$
I.	Installed cost of equipment		1,748,000
II.	Cost of laboratory equipment		202,400
III.	Cost of civil construction		950,000
IV.	Requirement of Working Capital	US$	US$
A.	Margin money for imported raw materials (4 months inventory)	330,000	
B.	Margin money for indigenous raw materials (1 month inventory)	5,000	
C.	Stock in process 15 days stock	88,000	
D.	Cost of finished product for 1 month (margin money)	65,000	
E.	Provision for 1 month labour cost	60,000	
F.	Provision for interest	322,000	
	Total working capital		873,000

Annex 6

Annual Cost of Raw Materials and Inventory required for Pharmaceutical Chemicals *

Product Mix - A

No.	Name of Pharmaceutical Chemical	Annual Cost of Raw Materials		Annual Cost of Inventory US$
		Imported US$	Local US$	
1	Nicotinamide	133,120 (44,000)	2,200	44,000
2	Procaine Hydrochloride	313,800 (104,000)	14,000 (1,000)	105,000
3	Clofibrate	54,900 (18,000)	48,300 (16,000)	34,000
4	Diphenyl Hydantoin	41,000 (14,000)	4,600 (1,000)	15,000
5	Lignocaine Hydrochloride	45,500 (15,000)	5,600 (2,000)	17,000
6	Indomethacin	117,300 (39,000)	40,600 (13,000)	52,000
7	Nalidixic Acid	2,290,900 763,000)	4,400 (1,000)	764,000
8	Oxyphen Butazone	287,700 (95,900)	209,200 (69,700)	165,600
9	Paracetamol	300,400 (100,000)	- -	100,000
10	Chlorodiazepoxide	92,100 (31,000)	45,500 (15,000)	46,000
11	Niacin	76,500 (25,500)	76,600 (25,500)	51,000
12	Mebendazole	84,900 (28,399)	7,500 (2,500)	31,000
13	Isoniazid	30,000 (10,000)	88,700 (29,600)	40,000
14	Clotrimazole	165,000 (55,000)	-	40,000
15	Diazepam	40,000 (13,000)	81,000 (27,000)	55,000
16	Ethambutol	215,200 (72,000)	6,800 (2,300)	74,000
17	Nikethamide	26,000 (9,000)	3,000 (10,000)	10,000
18	Propranolol	37,400 (12,000)	27,600 (9,000)	21,000

* Inventory figure included within brackets

Annex 7

Annual Cost of Raw Material and Inventory Required for Pharmaceutical Chemicals

Product Mix - B

No.	Name of Pharmaceutical Chemical	Annual Cost of Raw Materials		Annual Cost of Inventory US$
		Imported US$	Local US$	
1.	Metronidazole	372.700 (124.300)	49.500 (4.000)	128.300
2.	Phenylbutazone	69.000 (23.000)	1.000	23.000
3.	Ferrous Fumarate	9.000 (3.000)	21.000 (2.000)	5.000
4.	Ibuprofen	204.350 (68.100)	49.300 (4.000)	72.100
5.	Aspirin	147.000 (49.000)	900	49.000
6.	Methyl Salicilate	160.000 (53.300)	6.230	53.300
7.	Sulfamethaxazole	229.200 (76.400)	37.900 (3.000)	79.400
8.	Trimethoprim	442.000 (147.300)	4.500	147.300
9.	Pyrazinamide	103.200 (34.400)	18.300 (1.500)	36.000
10.	Haloperidol	999.300 (333.100)	84.000 (7.000)	340.100
11.	Chloroquine Phosphate	473.100 (124.400)	33.000 (3.000)	127.400
12.	Sulfinpyrazone	387.500 (129.000)	61.900 (5.200)	134.200
13.	Trinidazole	164.000 (55.000)	34.500 (3.000)	88.000

RAW MATERIAL REQUIREMENT FOR THE PRODUCTION OF PHARMACEUTICAL CHEMICALS - PRODUCT MIX - A

No.	Name of Pharmaceutical Chemical		Raw materials required	Requirement per 100 kg product kg	Unit cost of raw materials US$/kg	Raw material cost per 100 kg product US$	Annual requirement of raw materials tons	Annual cost of raw materials	
								Imported US$	Local US$
1	Nicotinamide Annual proposed production 15 tons	1	3-cyanopyridine	138	6.15	848.70	20.7	127.300	-
		2	Sodium Hydroxide 50% solution	26	0.50	13.00	3.9	-	1.950
		3	Active carbon	4	2.2	8.80	0.6	1.320	-
		4	Liquor ammonia	4	0.25	1.00	0.6	-	150
		5	Resin IRA-402	2	15.00	30.00	0.3	4.500	-
						901.50		133.120	2.100
2	Procaine Hydrochloride Annual proposed production 8 tons	1	Benzocaine	117	20.00	2.340.00	9.36	187.200	-
		2	Diethylamino ethanol	108	11.55	1.247.40	8.64	99.800	-
		3	Sodium metal	0.7	16.00	11.20	56 kg	900	-
		4	Acetic acid	1.8	1.00	1.80	144 kg	144	-
		5	Toluene	36	0.60	21.60	3.0	-	1.800
		6	Sodium chloride	21	0.70	14.70	1.7	-	1.200
		7	Liquor ammonia	6	0.25	1.50	0.5	-	0.200
		8	Hydrochloric acid	72	0.80	57.60	6.0	-	4.800
		9	Sodium hydrosulfite	0.6	1.20	0.70	48 kg	60	-
		10	Active carbon	3	2.20	6.60	240 kg	530	-
		11	Hyflowsupercel	9	2.20	19.80	720 kg	1.600	-
		12	Ammonium chloride	63	0.64	40.30	5	3.200	-
		13	Ethanol	30	2.50	75.00	2.4	-	6.000
		14	Isopropranol	68	3.00	204.00	5.5	16.500	-
		15	Acetone	27	1.80	48.60	2.2	3.900	-
						4.090.80		313.834	14.000
3	Clofibrate Annual proposed production 3 tons	1	P. Chlorophenol	100	6.00	600.00	3	18.000	-
		2	Acetone	480	1.80	864.00	15	27.000	-
		3	Sodium Hydroxide 50% soln.	182	0.50	91.00	6	-	3.000
		4	Chloroform	160	1.20	192.00	4.8	5.800	-
		5	Hydrochloric acid	280	0.80	224.00	8.5	-	6.800
		6	Sodium Bicarbonate	65	0.60	39.00	2.0	1.200	-
		7	Ethanol	480	2.50	1200.00	15	-	37.500
		8	Toluene	40	0.60	24.00	1.5	-	900
		9	Sulfuric acid	26	0.12	3.10	800 kg	-	90
		10	Sodium sulfate anhydrous	10	0.15	1.50	300 kg	-	45
		11	Active carbon	24	2.20	52.80	720 kg	1.600	-
		12	Hyflow supercel	20	2.20	44.00	600 kg	1.300	-
						3335.40		54.900	48.300

Annex 8 (Continued)

RAW MATERIAL REQUIREMENT FOR THE PRODUCTION OF PHARMACEUTICAL CHEMICALS

No.	Name of Pharmaceutical Chemical		Raw materials required	Requirement per 100 kg product kg	Unit cost of raw materials US$/kg	Raw material cost per 100 kg product US$	Annual requirement of raw materials tons	Annual cost of raw materials	
								Imported US$	Local US$
4	Diphenyel Hydantoin	1	Benzil	117	6.40	748.80	4.48	30.000	-
	Annual proposed	2	Urea	53	1.60	84.80	2.11	3.400	-
	production 4 tons	3	Potassium hydroxide	93	2.00	186.00	3.72	7.500	-
		4	Active carbon	1	2.20	2.20	40 kg	90	-
		5	Hydrochloric acid (33%)	144	0.80	115.20	5.75	-	4.600
						1,137.00		40.990	4.600
5	Lignocaine	1	M.Xylidene	64	2.40	153.60	1.28	3.000	-
	Hydrochloride	2	Chloracetyl chloride	60	12.18	730.10	1.20	14.600	-
	Annual proposed	3	Sodium carbonate	40	0.50	20.00	800 kg	-	400
	production 2 tons	4	Benzene	420	0.50	210.00	8.5	-	4,250
		5	Diethylamine	80	8.30	664.00	1.6	13.300	-
		6	Sulfuric acid	35	0.12	4.20	700 kg	-	90
		7	Active carbon	4.5	2.20	9.90	90 kg	200	-
		8	Sodium hydroxide 50% soln.	28	0.50	14.00	560 kg	-	280
		9	Acetone	400	1.80	720.00	8	14.400	-
		10	Hydrochloric acid	40	0.7	28.00	800 kg	-	-
						2.554.50		49,500	5.600
6	Indometacine	1	Para-anisidine	120	4.00	480.00	2.4	9.600	-
	Annual proposed	2	Sodium nitrite	72	0.35	25.20	1.5	500	-
	production 2 tons	3	Sodium hydroxide	20	0.5	10.00	400 kg	-	200
		4	Sod. sulfate anhydrous	216	0.15	34.40	4.32	-	600
		5	Zinc dust	120	6.00	720.00	2.4	14.400	-
		6	Sodium chloride	450	0.90	315.00	9.0	-	6.300
		7	Hydrochloric acid	330	0.80	264.00	6.6	-	5.300
		8	Acetic acid	168	1.00	168.00	3.36	3.400	-
		9	Sodium bicarbonate	240	0.60	144.00	4.8	2.800	-
		10	P. Chlorabenzoyl chloride	162	7.60	1.321.20	3.25	24.700	-
		11	Ethanol	480	2.50	1.200.00	9.6	-	-
		12	Active carbon	21	2.20	46.20	420 kg	900	-
		13	Hyflowsupercel	16.5	2.20	36.30	330 kg	700	-
		14	Levulinic acid	110	25.20	2.772.00	2.2	55.000	-
		15	O.phosphoric acid	161	1.00	161.00	3.22	3.200	-
		16	Toluene	356	0.60	213.6	7.0	-	4.200
		17	Ethyl acetate	60	1.50	90.0	1.2	1.800	-
		18	Petroleum ether	15	1.00	15.0	300 kg	300	-
						7.925.30		117.300	40.600

RAW MATERIAL REQUIREMENT FOR THE PRODUCTION OF PHARMACEUTICAL CHEMICALS

Annex 8 (continued)

No.	Name of Pharmaceutical Chemical	Raw materials required	Requirement per 100 kg product kg	Unit cost of raw materials US$/kg	Raw material cost per 100 kg product US$	Annual requirement of raw materials tons	Annual cost of raw materials	
							Imported US$	Local US$
7	Nalidixic acid Annual proposed production 7 tons	1 2-Amino-6-Methyl pyridine	160	12.00	1.920.00	11.1	134.500	-
		2 Diethyl ethoxl methylene malonate	320	11.30	3.616.00	22.4	253.100	-
		3 Petroleum ether	330	1.00	330.00	23.0	23.000	-
		4 Sodium bicarbonate	20	0.60	12.00	1.4	800	-
		5 Diphenyl ether	230	1.5	345.00	16.1	24.500	-
		6 Dimethyl formamide	1.000	1.2	1.200.00	70	84.000	-
		7 Dimethyl sulfate	154	4.2	646.00	10.78	49.300	-
		8 Sodium carbonate	106	0.5	50.30	7.4	-	3.700
		9 Sodium hydroxide flakes	60	0.8	48.00	4.2	3.400	-
		10 Hydrochloric acid	12	0.8	9.60	800	-	700
		11 Acetic acid	170	1.0	170.00	12	12.000	-
		12 Active carbon	2.0	2.2	4.40	140	300	-
					8.351.30		584.900	4.400
8	Oxyphen Butazone Annual proposed production 10 tons	1 Benzyl chloride	133.5	1.70	226.95	13.35	22.695	-
		2 Parahydroxy azobenzene	200	3.0	600.00	20.00	60.000	-
		3 Zinc dust	87.2	6.00	523.00	8.7	53.200	-
		4 Sodium methoxide	47	4.00	188.00	4.7	18.800	-
		5 Butylmalonic acid diethylester	179.5	7.00	1.256.50	18.0	126.000	-
		6 Raney-Nickel	45.5	4.0	182.00	4.6	18.400	-
		7 Hydrogen gas	0.9	1.0	0.90	90 kg	90	-
		8 Carbondioxide gas	85.0	1.0	85.00	8.5	8.500	-
		9 Sulfurdioxide gas	96.0	1.0	96.00	9.6	9.600	-
		10 Hydrochloric acid	72.7	0.8	58.00	7.3	-	5.800
		11 Sodium hydroxide	120.5	0.8	96.00	12.0	9.600	-
		12 Active carbon	1.3	2.2	2.80	130 kg	300	-
		13 Xylene	286	0.5	143.00	28.6	-	14.300
		14 Benzene	171	0.5	85.50	17.1	-	8.500
		15 Acetone	287	1.8	516.00	28.7	51.600	-
		16 Ethanol	683	2.5	1.707.00	68.3	-	170.000
		17 Sodium sulfate anhydrous	41	0.15	6.00	4.1	-	600
					5.772.65		378.785	199 .200

Annex 8 (Continued)

RAW MATERIAL REQUIREMENT FOR THE PRODUCTION OF PHARMACEUTICAL CHEMICALS

No.	Name of Pharmaceutical Chemical	Raw materials required	Requirement per 100 kg product kg	Unit cost of raw materials US$/kg	Raw material cost per 100 kg product US$	Annual requirement of raw materials tons	Annual cost of raw materials	
							Imported US$	Local US$
9	Paracetamol Annual proposed production 20 tons	1 P.Aminophenol	96	15	960.00	19.2	192 .000	-
		2 Acetic anhydride	90	1.2	108.00	18.0	21.600	-
		3 Sodium hydrosulfite	1.8	1.2	2.16	200 kg	400	-
		4 Active carbon	3	2.2	6.60	300 kg	600	-
					1.076.76		214 .600	
10	Chlordiazepoxide Annual proposed production 1.5 tons	1 Chloramino benzophenone	205	12.00	2.460.00	3	36.000	-
		2 Ethanol	905	2.50	2.262.50	13.57	-	33.900
		3 Hydroxymethyl sulfate	82.5	13.00	1.072.50	1.23	16.000	-
		4 Chloracetaldehyde	170	7.00	1.190.00	2.55	17.800	-
		5 Sodium bicarbonate	102.5	0.6	61.50	1.5	900	-
		6 Chloroform	400	1.2	480.00	6.0	7.200	-
		7 Acetic acid	255	1.0	255.00	3.8	3.800	-
		8 Chromic acid	57.5	2.5	143.75	860 kg	2.200	-
		9 Sodium chloride	155	0.7	108.50	2.32	-	1.600
		10 Sodium bisulfite	10	1.5	15.00	200 kg	300	-
		11 Acetone	87.5	1.8	157.50	1.3	2.300	-
		12 Monomethylamine	58	4.4	255.20	870 kg	3.800	-
		13 Methanol	48	1.8	86.40	720 kg	1.300	-
		14 Active carbon	8	2.2	17.60	120 kg	300	-
		15 Hyflowsupercel	8	2.2	17.60	120 kg	300	-
					8.583.05		92.200	35.500
11	Niacin Annual proposed production 15 tons	1 3-Cyanopyridine	90	6.2	558.00	13.5	83.700	6.000
		2 Sodium Hydroxide Sol.	80	0.5	40.00	12.0		
		3 Active carbon	2	2.2	4.40	300 kg	600	-
		4 Sulfuric Acid	150	0.12	18.00	22.5	-	2.700
					620.40		84.300	8.700

Annex 8 (continued)

RAW MATERIAL REQUIREMENT FOR THE PRODUCTION OF PHARMACEUTICAL CHEMICALS

No.	Name of Pharmaceutical Chemical	Raw materials required	Requirement per 100 kg product kg	Unit cost of raw materials US$/kg	Raw material cost per 100 kg product US$	Annual requirement of raw materials tons	Annual cost of raw materials	
							Imported US$	Local US$
12	Nebendazole Annual proposed production 3 tons	1 Thiourea	50	1.4	70.00	1.5	2.000	-
		2 Methylchlorformate	95	11.20	1.064.00	2.85	31.900	-
		3 Dimethylsulfate	50	4.20	210.00	1.5	6.300	-
		4 3-4-Diaminobenzophenone	110	3.11	343.10	3.3	10.300	-
		5 Acetic acid	20	1.00	20.00	600 kg	600	-
		6 Active carbon	20	2.2	44.00	600 kg	1.300	-
		7 Ethanol	100	2.5	250.00	3.0	-	7.500
		8 Methanol	500	1.8	900.00	15.0	27.000	-
		9 Sodium hydroxide	100	0.8	80.00	3	2.400	-
							81.800	7.500
13	Ethambutol Annual proposed production 10 tons	1 D-2 Aminobutanol	128	3.20	409.60	12.8	41.000	-
		2 1-2 Dichloroethane	60	2.40	144.00	6	14.400	-
		3 Isopropanol	450	3.00	1.350.00	45	135.000	-
		4 Benzene	10	0.50	5.00	1	-	500
		5 Hydrochloric acid	60	0.8	48.00	6	-	4.800
		6 Sulfuric acid	120	0.12	14.40	12	-	1.500
		7 Sodium hydroxide	60	0.8	48.00	6	4.800	-
					2.019.00		195.200	6.800
14	Isoniazid Annual proposed production 5 tons	1 4-Cyanopyridine	110	6.20	682.00	8.5	34.100	-
		2 Sodium Hydroxide	90	0.50	45.00	4.5	-	2.300
		3 Sulfuric Acid	350	0.12	42.00	17.5	-	2.100
		4 Ethanol	500	2.5	1.250.00	25.0	-	62.500
		5 Ammonia	80	1.0	80.00	4.0	-	4.000
		6 Hydrazine Hydrate	100	2.0	200.00	5.0	10.000	-
		7 Active Carbon	5	2.2	11.00	250 kg	600	-
					2.310.00		44.700	70.900
15	Chlortriamazole Annual proposed production 2 tons	1 O-Chlorobenzoic Acid	190	5.4	1.026.00	3.8	20.500	-
		2 Imidazole	45	8.0	360.00	0.9	7.200	-
		3 Acetonitrile	200	7.5	1.500.00	4.0	30.000	-
		4 Triethylamine	67	3.6	241.20	1.4	-	5.500
		5 Benzene	420	0.5	210.00	8.4	4.200	-
		6 Thionylchloride	192	0.7	134.40	3.8	2.700	-
		7 Aluminium Chloride	270	1.3	351.00	5.4	7.200	-
		8 Acetone	200	1.8	360.00	4.0	7.200	-
		9 Phosphorous Penta Chloride	215	1.4	301.00	4.3	6.000	-
		10 Caustic Soda	50	0.5	25.00	1.0	-	500
					4.508.00		84.800	6.000

Annex 8 (continued)

RAW MATERIAL REQUIREMENT FOR THE PRODUCTION OF PHARMACEUTICAL CHEMICALS

No.	Name of Pharmaceutical Chemical		Raw materials required	Requirement per 100 kg product kg	Unit cost of raw materials US$/kg	Raw material cost per 100 kg product US$	Annual requirement of raw materials tons	Annual cost of raw materials	
								Imported US$	Local US$
16	Diazepam Annual proposed production 2 tons	1	Methyl chloramino benzophenone	180	5.60	1.008.00	3.6	20.200	-
		2	Chloracetyl chloride	81	12.18	986.58	1.62	19.700	-
		3	Benzene	216	0.50	108.00	4.32	-	2.200
		4	Acetone	43	1.80	77.40	860 kg	1.600	-
		5	Hexamine	133	4.50	598.50	2.66	-	-
		6	Ethanol	1.575	2.5	3.937.50	31.50	-	78.800
		7	Sodium bicarbonate	43	0.6	25.8	860 kg	500	-
		8	Active carbon	27	2.2	59.40	540 kg	1.200	-
		9	Hyflow supercel	4.5	2.2	9.90	90 kg	200	-
						6.811.08		43.400	81.000
17	Nikethamide Annual proposed production 1 ton	1	Nicotinic acid	90	6.70	630.00	0.9	6.300	-
		2	Thionylchloride	179	0.8	14.3	1.8	1.200	-
		3	Benzene	115	0.50	57.50	1.15	-	600
		4	Diethylamine hydrochloride	97	10.00	970.00	0.97	9.700	-
		5	Sodium hydroxide	54	0.80	43.20	0.54	400	-
		6	Toluene	290	0.60	174.00	2.90	-	1.800
		7	Hyflow supercel	18	2.20	39.60	180 kg	400	-
		8	Active carbon	7	2.20	15.40	70 kg	200	-
		9	Sodium sulfate	14	0.15	2.10	140 kg	-	200
		10	Sodium chloride	14	0.70	1.00	140 kg	-	200
		11	Pot. Permanganate	1	5.46	5.46	10 kg	-	60
						1.952.60		18.200	2.860
18	Propranolol Annual proposed production 2 tons	1	α-Naphthol	121	8.96	1.075.20	2.42	21.700	-
		2	Epichlorhydrine	142	2.34	332.30	2.84	6.650	-
		3	Sodium hydroxide	40	0.80	32.00	0.80	700	-
		4	Isopropylamine	135.5	2.10	284.60	2.70	5.600	-
		5	Ethanol	520.0	2.50	1.300.00	10.40	-	26.000
		6	Benzene	140	0.50	70.00	2.80	-	1.400
		7	Active carbon	4	2.2	8.80	80 kg	200	-
		8	Hydrochloric acid	14	0.7	1.00	280 kg	-	200
		9	Isopropanol	60	3.0	180.00	1.2	3.600	-
		10	Acetone	80	1.8	144.00	1.6	1.600	-
		11	Hyflowsupercel	4	2.2	8.8	80 kg	200	-
		12	Nitorogen gas	4 cm	-	-	8 cm	-	
						3.436.70		40.250	27.600

RAW MATERIAL REQUIREMENT FOR THE PRODUCTION OF PHARMACEUTICAL CHEMICALS - PRODUCT MIX - B

No.	Name of Pharmaceutical Chemical	Raw materials required	Requirement per 100 kg product kg	Unit cost of raw materials us$/kg	Raw material cost per 100 kg product US$	Annual requirement of raw materials tons	Annual cost of raw materials	
							Imported US$	Local US$
1	Metronidazole proposed annual production 6 tons	1 2-Methyl-5-Nitro Imidazole	190	10.0	1.900.00	11.4	114.000	
		2 Formic Acid	448	1.40	627.20	27.0	37.800	
		3 Ehtylene oxide	334	11.00	3.674.00	20.0	220.000	
		4 Liq. Ammonia	534	0.25	133.80	32.0	-	8.000
		5 Sodium chloride	500	0.70	350.00	30.0	-	21.000
		6 Ethanol	156	2.50	390.00	10.0	-	20.500
		7 Active carbon	7	2.2	15.4	420 kg	900	
					7.090.40		372.700	49.500
2	Phenylbutazone proposed annual production 5 tons	1 Monochlorobenzene	188	1.20	225.60	9.9	11.400	
		2 Hydrazobenzene	87	3.00	261.00	4.4	13.200	
		3 Sodium Methoxide	28	4.00	112.00	1.4	5.600	
		4 Diethyl-N-Butyl Malonate	102	7.00	714.00	5.0	35.000	
		5 Active carbon	10	2.20	22.00	.5	1.100	
		6 Hydrosulfite, sodium	1.3	1.20	1.56	65 kg	78	
		7 Acetic acid	50	1.00	50.00	2.5	2.500	
		8 Sulfuric Acid	50	0.12	6.00	2.5		300
		9 Sodium carbonate	30	0.50	15.00	1.5		700
					1.407.16		68.878	1.000
3	Ferrous Fumurate proposed annual production 4 tons	1 Ferrous sulfate	200	0.20	40.00	8	1.600	
		2 Fumaric acid	83	1.70	141.10	3.2	5.400	
		3 Active carbon	3	2.2	6.60	120 kg	300	
		4 Formalin	10.8 lt	0.4	4.30	4	1.600	
		5 Sodium hydroxide	52	0.5	28.50	2		1.000
		6 Ethanol	200	2.5	500.00	8		20.000
					720.00		8.900	21.000

Annex 9 (continued)

RAW MATERIAL REQUIREMENT FOR THE PRODUCTION OF PHARMACEUTICAL CHEMICALS - PRODUCT MIX - B

No.	Name of Pharmaceutical Chemical	Raw materials required	Requirement per 100 kg product kg	Unit cost of raw materials us$/kg	Raw material cost per 100 kg product US$	Annual requirement of raw materials tons	Annual cost of raw materials	
							Imported US$	Local US$
4	Ibuprofen proposed annual production 6 tons	1 Acetyl chloride	91	1.5	136.00	5.5	8.250	
		2 Aluminium chloride	185	1.3	236.60	11.0	14.300	
		3 Dichloromethane	387	2.5	967.50	23.0	57.500	
		4 Dimethyl sulfoxide	110.3	2.5	275.75	6.6	16.500	
		5 Chloroform	50	1.2	60.00	3.0	3.600	
		6 Ethylene glyocol	448	0.8	358.40	30.0	24.000	
		7 Hexane	132	0.9	118.80	8.0	7.200	
		8 Hydrochloric acid	565	0.8	452.00	34.0	-	27.000
		9 Isobutyl benzene	151	5.0	755.00	9.0	45.000	
		10 Methanol	120	1.8	216.00	7.2		13.000
		11 Potassium hydroxide	133	2.0	266.00	8.0	16.000	
		12 Raney nickel	18	4.0	72.00	1.0	4.000	
		13 Sodium bicarbonate	67	0.6	40.20	4.0		2.400
		14 Sodium cynide	68	1.9	129.20	4.2	8.000	
		15 Sodium chloride	125	0.7	87.50	7.5		5.300
		16 Sodium sulfate	100	0.15	15.00	6.0		900
		17 Toluene	15	0.5	7.50	1.0		500
					4.193.45		204.350	49.300
5	Aspirin proposed annual production 30 tons	1 Salicilic acid	96	3.7	355.20	30	111.000	
		2 Acetic anhydride	95	1.2	114.00	30	36.000	
		3 Sulfuric acid	4.5	0.12	8.40	1.4		200
		4 Sodium hydroxide	3.5	0.5	1.75	1.4		700
					497.35		147.000	900
6	Methyl salicilate proposed annual production 3 tons	1 Salicilic acid	112	3.7	414.40	3.4	12.600	
		2 Methanol	110	1.8	198.00	3.3		6.000
		3 Sulfuric acid	17	0.12	2.04	0.5		10
		4 Sodium carbonate	12	0.5	6.00	0.4		200
		5 Sodium sulfate	3	0.15	.45	0.1		10
		6 Potassium permanganate	01	5.46	.95	3 kg		10
					621.84		12.600	6.230

RAW MATERIAL REQUIREMENT FOR THE PRODUCTION OF PHARMACEUTICAL CHEMICALS - PRODUCT MIX - B

No	Name of Pharmaceutical Chemical	Raw materials required	Requirement per 100 kg product kg	Unit cost of raw materials us$/kg	Raw material cost per 100 kg product US$	Annual requirement of raw materials tons	Annual cost of raw materials	
							Imported US$	Local US$
7	.Sulfamethoxazole proposed annual production 4 tons	1 Acetone	82	1.8	147.60	3.3	5.900	
		2 Active carbon	0.8	2.2	1.76	32 kg	100	
		3 Bacetylamino benzene sulfonyl chloride	195	4.5	877.50	8.0	36.000	
		4 Liq ammonia	737	0.25	184.25	30.0		7.500
		5 Benzene	33	0.5	16.50	1.3		700
		6 Diethyl oxalate	205	6.0	1.230.00	8	48.000	
		7 Hydroxylamine sulfate						
		8 Methanol	326	1.8	586.80	13.0		23.400
		9 M.I.B.K	152	1.4	212.80	61.0	85.400	
		10 Pyridine	97	5.5	533.50	4.0	22.000	
		11 Sodium Hydrosulfite	6	1.2	7.20	0.3	400	
		12 Sodium hydroxide	133	0.5	66.50	5.3		2.600
		13 Sodium hypo chlorite 12%	64	0.20	12.80	2.6		500
		14 Sodium metal	34	16.0	544.00	1.4	22.400	
		15 Sulfuric acid	252	0.12	30.24	10.0		1.200
		16 Toluene	94	0.5	47.00	4.0		2.000
					4.498.45		220.200	37.900
8	Trimethoprim proposed annual production 10 tons	1 Acetic acid	224	1.0	224.00	22.4	22.400	
		2 Acrylonitrile	44	1.2	52.80	4.4	5.300	
		3 Active carbon	12	2.2	26.40	1.2	2.600	
		4 Liq ammonia	104	0.25	26.00	10.4		2.500
		5 Aniline	56	1.02	57.12	5.6	5.600	
		6 Dimethyl Sulfoxide	123	2.5	307.50	12.3	30.800	
		7 Guanidine hydrochloride	95	6.7	363.50	10.0	67.000	
		8 Isopropanol	16	3.0	48.00	1.6	4.800	
		9 Morpholine	66	3.47	229.00	6.6	22.900	
		10 Sodium Hydroxide	41	0.5	20.50	4.0		2.000
		11 Sodium methoxide	10	4.0	40.00	10.0	40.000	
		12 3.4.5 - trimethoxy benozaldehyde	119	20.0	2.380.00	12.0	240.000	
					3.774.82		441.400	4.500

Annex 9 (Continued)

Annex 9 (continued)

RAW MATERIAL REQUIREMENT FOR THE PRODUCTION OF PHARMACEUTICAL CHEMICALS - PRODUCT MIX - B

No	Name of Pharmaceutical Chemical	Raw materials required	Requirement per 100 kg product kg	Unit cost of raw materials us$/kg	Raw material cost per 100 kg product US$	Annual requirement of raw materials tons	Annual cost of raw materials	
							Imported US$	Local US$
9	Pyrazinamide proposed annual production 2 tons	1 Pyrazine 2-3-dicarboxilic acid	180	25.0	4.500.00	03.6	90.000	
		2 Acetic anhydride	550	1.2	660.00	11.0	13.200	
		3 Methanol	472	1.8	849.60	9.5		17.100
		4 Toluene	90	0.5	45.00	1.8		900
		5 Liq ammonia	60	0.25	15.00	1.2		300
					6.069.60		103.200	18.300
10	Haloperidol proposed annual production 10 tons	1 Aluminium chloride	100	1.3	130.00	10	13.000	
		2 Fluoro benzene	60	8.00	480.00	6	48.000	
		3 Toluene	80	6.50	40.00	8		4.000
		4 Thionyl chloride	100	0.80	80.00	10	8.000	
		5 V-Chloro butyric acid	80	20.00	1.600.00	8	160.000	
		6 Benzene	300	0.5	150.00	30		15.000
		7 Petroleum Ether	300	1.00	300.00	30		30.000
		8 Potassium carbonate	40	0.33	13.20	4	1.300	
		9 M.E.K	300	1.4	420.00	30	42.000	
		10 Potassium Iodide	50	20.4	1.000.00	5	100.000	
		11 P. Chloroaceto Phenone	250	5.00	1.250.00	25	125.000	
		12 Methyl Iodide	240	8.00	1.920.00	24	192.000	
		13 Magnesium ribbon	4	12.00	4.80	40 kg	10	
		14 Tetrahydrofuran	5	4.00	20.00	500 kg	2.000	
		15 Ammonium chloride	500	0.96	480.00	50	50.000	
		16 Acetic acid	400	1.0	400.00	40	40.000	
		17 P. Formaldehyde	50	0.86	43.00	5	4.000	
		18 Acetic anhydride	400	1.2	48.00	40	48.300	
		19 Hydrogen Bromide	100	15.4	1.540.00	10	154.000	
		20 Caustic soda	100	0.5	50.000	10		5.000
		21 Methanol	600	0.6	360.00	60		30.000
		22 Carbon-tetra-chloride	200	.62	124.00	20	12.000	
					10.453.00		999.310	84.000

Annex 9 (continued)

RAW MATERIAL REQUIREMENT FOR THE PRODUCTION OF PHARMACEUTICAL CHEMICALS - PRODUCT MIX - B

No	Name of Pharmaceutical chemical		Raw materials required	Requirement per 100 kg product kg	Unit cost of raw materials us$/kg	Raw material cost per 100 kg product US$	Annual requirement of raw materials tons	Annual cost of raw materials	
								Imported US$	Local US$
11	Chloriquine Phosphate proposed annual production 12 tons	1	4 Hydroxy-7chloro quinoline	47	55	2.585.00	5.65	310.750	
		2	Phosphorous oxychloride	94	1.5	141.00	11.3	16.950	
		3	Dichloroethane	187	2.4	448.80	22.5	54.000	
		4	Novoldiamine	43.5	16.3	709.00	5.25	85.600	
		5	Ammonia	75	1	75.00	9.0		9.000
		6	Phosphoric acid	64.7	0.35	22.50	7.8	2.700	
		7	Ethanol	58.8	2.5	147.00	7.0		17.500
		8	Carbon	5	2.2	11.00	0.6	1.300	
		9	Phenol	23.5	0.8	14.10	3.0	1.800	
		10	Benzene	29	0.5	14.50	4.0		2.000
		11	Caustic lye	73	0.5	36.50	9.0		4.500
						4.203.60		473.100	33.000
12	Sulfin pyrazone proposed annual production 5 tons	1	Thiophenol	250	9.0	2.250.00	12.5	112.500	
		2	Dichloro ethane	340	2.4	816.00	17.0	40.800	
		3	Caustic soda	108	0.5	54.000	5.0		2.500
		4	Diethyl malonate	283	5.0	1.415.00	14.0	70.000	
		5	Sodium methoxide	137	2.4	139.40	6.9	16.600	
		6	Acetic acid	934	1.0	934.00	50.0	50.000	
		7	Chloro benzene	295	1.2	354.00	14.75	17.700	
		8	Hydrazino bensene	258	6.0	1.548.00	12.9	77.400	
		9	Methanol	660	1.8	1.188.00	33		59.400
		10	Hydrogen perioxide	64	0.7	44.80	3.5	2.500	
						8.743.20		387.500	61.900
13	Trinidazole proposed annual production 4 tons	1	2-Methyl-5-Nitro imidazole	190	10.0	1.900.00	7.6	76.000	
		2	Triethylethanol	106	6.0	636.00	4.0	24.000	
		3	Sulfuric acid	57	0.12	6.84	2.5		3.000
		4	Zinc chloride	204	1.17	238.68	8.0	9.400	
		5	Caustic soda	120	0.5	60.00	4.8		24.000
		6	Carbon	17	2.2	37.40	0.7	1.500	
		7	Acetic acid	172	1.6	172.00	28.0	28.000	
		8	Liq ammomia	750	0.25	187.50	30.0		7.500
		9	Hydrogen paroxide	320	0.8	256.00	13.0	10.400	
		10	Hyflosupercel	16	2.2	35.20	0.7	1.500	
		11	M.I.B.K	300	1.1	330.00	12	13.200	
						3.859:62		164.000	34.500

Annex 10

List of required imported raw materials

No.	Name of Raw Material	Landed Price US$	No.	Name of Raw Material	Landed Price US$
1.	3-Cyanopryridine	6.19	51.	Thionylchloride	0.80
2.	Resin IRA-402	15.00	52.	Diethylamine hydrochloride	10.00
3.	Benzocaine	20.00	53.	Potassium permanganate	5.46
4.	Diethylamino Ethanol	11.55	54.	Alfa Naphthol	8.96
5.	Sodium Metal	16.00	55.	Epichlorhydrine	2.37
6.	Acetic Acid	1.00	56.	Isopropylamine	2.10
7.	Sodium Hydrosulfite	1.20	57.	Thiourea	1.40
8.	Active Carbon	2.20	58.	Methylchlorformate	11.20
9.	Hyflosupercel	2.20	59.	Dimethylsulfate	4.20
10.	Isopropanol	3.00	60.	3-4-Diaminobenzo phenone	3.11
11.	Acetone	1.80	61.	D-2 Aminobutanol	3.20
12.	P.Chlorophenol	6.00	62.	4-Cyanopyridine	6.20
13.	Chloroform	1.20	63.	Hydrazine hydrate	2.00
14.	Benzil	6.40	64.	O-Chlorobenzoic acid	5.40
15.	Potassium Hydroxide	2.00	65.	Imidazole	8.00
16.	M-Xylidine	2.40	66.	Acetonitrile	7.50
17.	Chloracetyl chloride	12.18	67.	Triethylamine	3.60
18.	Diethylamine	8.30	68.	Aluminium chloride	0.70
19.	P-Anisidine	4.00	69.	Phosphorous pentachloride	1.40
20.	Sodium Nitrite	0.35	70.	2-Menthyl-5-Nitro imidazole	10.00
21.	Zinc Dust	6.00	71.	Formic acid	1.50
22.	P-Chlorobenzoyl Chloride	7.60	72.	Ethylene oxide	11.00
23.	Levulinic Acid	25.20	73.	Monochlorobenzene	1.20
24.	O-Phosphoric Acid	1.00	74.	Hydrazina	3.00
25.	Ethyl Acetate	1.50	75.	Sodium Methoxide	4.00
26.	2-Amino-6-Methyl Pyridine	12.00	76.	Diethyl-N-Butyl Malonate	7.00
27.	Petroleum Ether	1.00	77.	Ferrous sulfate	0.20
28.	Diethyl ethoxy methylene malonate	11.30	78.	Fumaric acid	1.20
29.	Diphenyl ether	1.50	79.	Formaldehyde	0.40
30.	Dimethyl formamide	1.20	80.	Acetyl chloride	1.50
31	Dimethyl sulfate	4.20	81.	Dichloroethane	2.50
32.	Caustic Soda flakes	0.80	82.	Dimethyl sulfoxide	2.50
33.	P-Hydroxy Azo benzene	3.00	83.	Ethylene glycol	0.80
34.	Sodium methoxide	2.40	85.	Isobutylbenzene	5.00

Annex 10 (continued)

No.	Name of Raw material	Landed Price US$
99.	4-Hydroxy-7-chloro quinoline	55.00
100.	Phosphorous Oxychloride	1.50
101.	Novoldiamine	16.30
102.	Phosphoric Acid	0.35
103.	Thiophenol	9.00
104.	Diethyl Malonate	5.00
105.	Hydrogene Peroxide	0.70
106.	Zinc Chloride	1.17
107.	Fluorobenzene	8.00
108.	V-Chlorobutyric acid	20.00
109.	Potassium carbonate	0.30
110.	Methyl Ethyl Ketone	1.40
111.	Potassium Iodide	
112.	P.Chloroaceto phenone	5.00
113.	Methyl Iodide	8.00
114.	Magnesium Ribbon	12.00
115.	Tetra Hydrofuran	4.00
116.	Ammonium chloride	0.96
117.	P.Formaldehyde	0.86
118.	Hydrobromic acid	15.4
119.	Carbon Tetrachloride	0.62

Source of Information:
1. Darupaksh
2. Chemical Market Reporter
3. Chemical Weekly (Bombay)
4. Sarabhai Research Centre

Annex 11

List of Indigenously Available Raw Materials

No.	Name of Raw Material	Market* price US$/kg	No.	Name of Raw Material	Market* price US$/kg
1	Sulfuric Acid (98%)	0.12			
2	Hydrochloric Acid	0.80			
3	Nitric Acid (60%)	0.84			
4	Caustic Lye (50%)	0.50			
5	Sodium Bicarbonate	0.60			
6	Sodium Carbonate	0.50			
7	Sodium Chloride	0.70			
8	Sodium Sulfate	0.15			
9	Ammonium Chloride	0.64			
10	Liquor Ammonia (24%)	0.25			
11	Ammonia Gas	1.00			
12	Ethanol	2.50			
13	Methanol	1.80			
14	Benzene	0.5			
15	Toluene	0.5			
16	Xylene	0.5			
17	Urea	1.6			

* Source of information: Darupakhsh as of March 1984

Annex 12

Availability of Construction Materials, Facilities for Storage and Transport

All building construction materials are available. The price structure of the major construction materials is:

1. Cement US$ 4.50/50 kg. bag

2. Bricks US$60.00/1,000 bricks

3. Structural steel: US$ 0.70/kg

Prevailing cost of building constructions:

For factory buildings - US$ 814/m^2

For godowns - US$ 520/m^2

Storage and transport facilities: There is a highway running across both the pilotplant building, which is existing and recommended for the multi-purpose pilot plant, and an available open piece of land. Transport facilities are available.

The existing storage facilities in the pilot plant building, considered for this project, will not be available because the basement is recommended for multi-purpose pilot plant. Storage facilities will have to be created by constructing a warehouse.

Annex 13

Availability of Utilities

Major utilities, such as steam, electricity, good quality and plentyful supply of water, are available during construction and erection periods.

Additional utilities for the multi-purpose pilot plant will have to be made available for which provision has been made in the project.

Required information:

Steam: Fuel charges for steam generation US$ 0.07/kg steam generated

Electricity: Supply, 440 V, 3 phase 50≈

Power failures do occur many times. To take care of this situation a 75 KVA diesel generator has been provided

Water: Good quality water is available either by sinking bore wells or can be drawn from canal running along the highway

Quality: 250 p.p.m. Total hardness
550 p.p.m. Total dissolved solids

Cost of water: US$ 0.21/1,000 lt

Cost of softing: US$ 0.25/1,000 lt

Cost of dimineralization US$ 0.46/1,000 lt

ANNEX 14

Additional Information

1. Customs duty in Iran on imported equipment - 35%
2. Handling charges in freight and other charges required to be paid to bring equipment from the port to Teheran - US$ 29 per ton
3. Rates of interest on borrowing:
   a) From financial institutions - 12%
   b) From the Bank - 12%
4. Rates for insurance permia - R 19 per 1,000
5. Income tax rates, for pilot working only - 20%
6. Sales tax if any - nil
7. Testing charges for getting finished drugs - nil
8. Rates for building constructions:
   a) For factory purposes - Rl 70,000/sq.m
   b) For godowns - Rl 45,000/sq.m.
9. Depreciation allowed on:
   a) Equipment - 10% st. line
   b) Buildings 5%
10. Maintenance cost in per cent of:
    a) Cost of equipment - 5%
    b) Cost of building constructions - 2.5%

(1 US$ = 86.5 Rials (Rl).

Source of information: Darupakhsh as of March 1984

ANNEX 15

Training Requirement Outside the Country

	Number	Month
Production Director	1	6
Factory Chief	1	3
Financing Supervisor	1	1
Personnel (Quality Control) (Chemist, Toxilogist)	3	6
Production Manager, Chemist and Operator	5	10
Chemical Engineer (Designer)	1	3
Mechanical Engineer and Technicians	2	4
Total:	14	33

ANNEX 16

Personnel Requirement for the Plant

	Production	Laboratory	Maintenance	Administration	Finance	Purchase	Services
Plant Manager, Chemist and high-level personnel	7	3	2	1	1	1	-
perators, Technicians, Clerk	4	3	3	3	3	2	1
Skilled workers	6	1	6	1	1	1	1
Unskilled workers	14	-	3	-	-	-	6
Total:	31	7	14	5	5	4	8

Total need: 74

Annex 17

Market Value of Pharmaceutical Chemicals

Product Mix

No.	Name of Pharmaceutical Chemical	Market Price* US$/kg
1	Nicotanimide	8.00
2	Procaine Hydrochloride	46.30
3	Clofibrate	31.72
4	Diphenyl Hydantoin	12.58
5	Lignocaine Hydrochloride	46.30
6	Indomethacüb	37.03
7	Nalidixic Acid	69.45
8	Oxyphen Butazone	38.77
9	Paracetamol	14.77
10	Chlordiazepoxide	56.71
11	Niacin	9.26
12	Mebendazole	254.63
13	Ethambutol	393.52
14	Isoniazid	8.68
15	Clotriamazole	103.16
16	Diazepam	32.40
17	Nikethamide	13.88
18	Propranolol	23.15

* These are the prevailing local purchase prices in Teheran as of March 1984. Information supplied by Darupakhsh

Annex 18

Market Value of Pharmaceutical Chemicals

Product Mix B

No.	Name of Pharmaceutical Chemical	Market Value US$/KG
1.	Metronidazole	23.00
2.	Phenylbutazone	13.94
3.	Ferrous Fumarate	2.80
4.	Ibuprofen	31.00
5.	Aspirin	2.80
6.	Methyl Salicilate	2.50
7.	Sulfamethaxozole	25.00
8.	Trimethoprim	45.00
9.	Pyrazinamide	64.40
10.	Haloperidol	340.00
11.	Chloroquine Phosphate	26.00
12.	Sulfinpyrazone	200.00
13.	Tinidazole	28.00

Source of Information:
1. Chemical Weekly (Bombay)
2. Sarabhai Research Centre
3. Ambalal Sarabhai Enterprise

ANNEX 19

Cost of Labour and Overheads

		Rls
Production		26,040,000
Laboratory		7,800,000
Maintenance		10,680,000
Administration		4,680,000
Finance		4,680,000
Purchase		3,360,000
Services		4,320,000
Total		61,560,000
	=	711,600 US$
		(1 US$ = 86.5 Rls)

Source of information: Darupakhsh as of March 1984

COST OF PRODUCTION - PRODUCT MIX A

Name of Pharmaceutical Chemical — Figures in US$

No.	Item	Nicotinamide	Procaine HCl	Clofibrate	Diphenyl Hydantoin	Lignocaine HCl	Indomethacine	Nalidixic Acid[x]	Oxyphenbutazone	Paracetamol
1.	Coat of raw materials	9.02	40.90	33.35	11.37	25.57	79.32	206.71	57.72	10.76
2.	Cost of utilities	1.20	0.85	0.62	0.35	0.50	0.62	1.14	0.65	0.20
3.	Cost of labour & overheads	6.16	6.25	6.00	6.25	5.30	5.30	6.15	6.40	6.24
4.	Cost of depreciation and maintenance	2.85	2.87	2.75	2.87	2.50	2.50	2.81	2.95	2.87
5.	Cost of interest	3.53	5.40	4.66	3.65	4.10	7.10	22.57	6.10	3.90
6.	Cost of insurance	0.26	0.38	0.37	0.28	0.30	0.55	1.70	0.46	0.29
	Cost of Production	23.02	56.65	47.75	24.61	38.24	95.09	241.08	74.28	24.36
	Market Prices per kg	8.00	46.30	31.72	12.58	46.30	47.03	69.45	38.77	14.77

No.	Item	Chlordiazepoxide	Niacin	Mebendazole	Ethambutol	Isoniazid	Clotrimazole	Diazepam	Niketha-mide	Propranolol
1.	Cost of raw material	85.83	6.20	29.81	21.20	23.10	45.00	68.71	20.80	34.36
2.	Cost of utilities	0.43	0.25	0.56	0.43	0.32	0.45	0.90	0.50	0.35
3.	Cost of labour and overheads	9.47	6.65	5.93	7.12	6.40	5.25	5.25	7.00	5.25
4.	Cost of depreciation and maintenance	4.40	3.06	2.73	3.30	2.95	2.50	2.50	3.30	2.50
5.	Cost of interest	10.2	3.85	4.66	4.78	2.88	7.50	6.20	5.20	4.45
6.	Cost of insurance	0.73	0.28	0.33	0.36	0.34	0.55	0.45	0.40	0.35
	Cost of Production	111.06	20.29	44.02	37.29	35.99	61.25	84.01	37.20	47.26
	Market prices per kg	56.71	9.26	54.36	36.00	8.68	103.16	32.40	13.88	23.15

COST OF PRODUCTION - PRODUCT MIX - B

No.	Item	Metroni-dozole	Phenylbu-tazone	Ferrous Fumarate	Ibuprofen	Aspirin	Methyl Sali-cilate	Sulfame-thoxazole
1.	Cost of raw materials	70.90	14.7	7.20	41.92	4.76	6.11	47.20
2.	Cost of utilities	0.70	0.65	0.20	0.82	0.25	0.20	0.53
3.	Cost of labour and overheads	5.93	7.12	8.89	5.93	7.11	7.11	8.89
4.	Cost of depreciation and maintenance	2.66	3.67	4.11	2.66	3.29	3.29	4.11
5.	Cost of interest	6.66	4.30	4.55	5.03	3.73	6.20	7.92
6.	Cost of insurance	0.42	0.30	0.32	0.33	0.28	0.43	0.50
	Cost of Production per kg	87.27	30.74	25.27	56.69	19.42	23.34	69.15
	Market Price per kg	23.00	13.94	2.80	31.00	2.80	2.50	25.00

Annex 21

No.	Item	Trimetho-prim	Pyrazina-mide	Haloperi-dol	Chloroquine Phosphate	Sulfin pyrazone	Tinidazole
1.	Cost of raw materials	40.48	60.69	109.03	42.04	87.53	38.59
2.	Cost of utilities	1.50	0.65	1.50	0.45	1.60	0.35
3.	Cost of labour and overheads	7.12	7.12	7.12	7.12	7.12	7.12
4.	Cost of depreciation and maintenance	3.29	3.29	3.29	2.75	3.67	4.11
5.	Cost of interest	6.10	6.55	9.60	4.80	8.80	6.00
6.	Cost of insurance	0.40	0.42	0.56	0.31	0.52	0.45
	Cost of production per kg	58.89	78.72	131.10	57.47	109.24	56.62
	Market Price per kg	45.00	64.40	340.00	26.00	200.00	28.00

Annex: 22

Allocation of costs of depreciation, maintenance, labour and overheads

Product Mix A

No.	Name of Pharmaceutical Chemical	Annual productions tons	Percentage Weightage	Allocation of costs of Depreciation and Maintenance	Allocation of costs of Labour and Overheads
				US$	US$
1	Nicotinamide	15	13	42,700 (2.85)	92,500 (6.16)
2	Procaine Hydrochloride	8	7	23,000 (2.87)	50,000 (6.25)
3	Clofibrate	3	2.5	8,200 (2.73)	18,000 (6.00)
4	Diphenyl Hydentoin	4	3.5	11,500 (2.87)	25,000 (6.25)
5	Lignocaine Hydrochloride	2	1.5	5,000 (2.50)	10,600 (5.3)
6	Indomethacine	2	1.5	5,000 (2.50)	10.600 (5.3)
7	Nalidixic Acid	7	6	19,700 (2.81)	43,000 (6.15)
8	Oxyphen Butazone	10	9	29,500 (2.95)	64,000 (6.4)
9	Paracetamol	20	17.5	57,500 (2.87)	124,500 (6.24)
10	Chlorodiazepoxide	1.5	2.0	6,600 (4.4)	14,200 (9.47)
11	Niacin	15	14	46,000 (3.06)	99,700 (6.65)
12	Mebendazole	3	2.5	8,200 (2.73)	17,800 (5.93)
13	Ethambutol	10	10	33,000 (3.30)	11,200 (7.12)
14	Isoniazid	5	4.5	14,800 (2.95)	32,000 (6.40)
15	Chlortramazole	2	1.5	5,000 (2.50)	10,500 (5.25)
16	Diazepam	2	1.5	5,000 (2.50)	10,500 (5.25)
17	Nikethamide	1	1.0	3,300 (3.30)	7,000 (7.00)
18	Propranolol	2	1.5	5,000 (2.50)	10,500 (5.25)
	Figures in brackets are respective costs in US$ per kg of pharmaceutical chemical			329,000	711,600

Annex 23

Allocation of cost of depreciation, maintenance, labour and overheads

Product Mix B

No.	Name of Pharmaceutical Chemical	Annual Production Tons	Percentage Weightage	Allocation of cost of Depreciation & Maintenance	Allocation of cost of Labour and Overheads
1.	Metrobidazole	6	5	16.450 (2.66)	35.580 (5.93)
2.	Phenylbutazone	5	5	16.450 (3.67)	35.580 (7.12)
3.	Ferrous Fumarate	4	5	16.450 (4.11)	35.580 (8.89)
4.	Ibuprofen	6	5	16.450 (2.66)	35.580 (5.93)
5.	Aspirin	30	30	98.700 (3.29)	213.480 (7.11)
6.	Methyl Salicilate	3	3	9.870 (3.29)	21.348 (7.11)
7.	Sulfamethoxazole	4	5	16.450 (4.11)	35.580 (8.89)
8.	Trimethoprim	10	10	32.900 (3.29)	71.160 (7.12)
9.	Pyrazinamide	2	2	6.580 (3.29)	14.232 (7.12)
10.	Haloperidol	10	10	32.900 (3.29)	71.160 (7.12)
11.	Chloroquine Phosphate	12	10	32.900 (2.75)	71.160 (7.12)
12.	Sulfinpyrazone	5	5	16.450 (4.11)	35.580 (7.12)
13.	Tinidazole	4	5	16.450 (4.11)	35.580 (7.12)
				329.000	711.600

Annex 24

Cost of Depreciation and Maintenance

Annual Depreciation and Maintenance

A.	Cost of Equipment	US$ 1,940,000	
	Annual cost of depreciation at 15% since it is a chemical plant		US$ 291,000
	Annual cost of maintenance		29,000
B.	Cost of civil construction	1,000,000*	
	Annual depreciation of building at 5%		5,000
	Annual maintenance		4,000
	Total cost of depreciation and maintenance		329,000

* Refer to Annex 2

Cost of Labour

From Annex 15

Total cost of direct labour and overheads 711,600

Basis for allocation of cost of maintenance, depreciation and labour

Because more than one product will be produced in this plant the cost of depreciation, maintenance and direct labour have been allotted according to calculated weightage for every pharmaceutical chemical based on the usage of the equipment by that particular chemical.

Cost of Raw Materials

This cost has been taken vide Annex 6.

Cost of Services

Because of scanty process information, cost of utilities are given on ad hoc basis taking into consideration amount of solvents used and recovered by any particular pharmaceutical during the production

Annex 25

Allocation of the cost of Interest

Product Mix A

No.	Name of Pharmaceutical	Annual Production tons	Percentage Weightage	Allocation of cost of interest on fixed cost US$	Cost of interest on inventories US$	Total annual cost of interest US$	Cost of interest per kg of product US$
1	Nicotinamide	15	13	45,000	8,000	53,000	3.53
2	Procaine Hydrochloride	8	7	24,200	19,000	43,200	5.40
3	Clofibrate	3	2.5	8,500	6,000	14,000	4.66
4	Diphenyl Hydantoin	4	3.5	12,000	2,600	14,600	3.65
5	Lignocaine Hydrochloride	2	1.5	5,200	3,000	8,200	4.10
6	Indomethaeine	2	1.5	5,200	9,400	14.600	7.1
7	Nalidixic Acid	7	6	20,500	137,500	158,000	22.57
8	Oxyphen Butazone	10	9	31,200	29,700	61,000	6.10
9	Paracetamol	20	17.5	60,000	18,000	78,000	3.90
10	Chlordiazepoxide	1.5	2.0	7,000	8,300	15,300	10.20
11	Niacin	15	14	48,500	9,300	57,800	3.85
12	Mebendazole	3	2.5	8,500	5,500	14,000	4.66
13	Ethambutol	10	10	34,500	13,300	47,800	4.78
14	Isoniazid	5	4.5	17,200	7,200	14,400	2.88
15	Chlortriamazole	2	1.5	5,200	9,800	15,000	7.50
16	Diazepam	2	1.5	5,200	7,200	12,400	6.20
17	Nikethamide	1	1	3,400	1,800	5,200	5.20
18	Propranolol	2	1.5	5,200	3,200	8,900	4.45
				347,000*			

* Total fixed cost, vide Annex 2, US$ 2.89 m.
Annual interest at 12% = US$ 347,000

Annex 26

Allocation of the cost of Interest

Product Mix B

No.	Name of Pharmaceutical Chemical	Annual Production Tons	Percentage Weightage	Allocation of cost of interest on fixed cost US$	Allocation of cost of interest on inventories US$	Total annual Cost of interest US$	Cost of interest per kg of Product US$
1.	Metronidazole	6	5	17.350	23.000	40.350	6.66
2.	Phenylbutazone	5	5	17.350	4.200	21.500	4.30
3.	Ferrous Fumarate	4	5	17.350	900	18.250	4.55
4.	Ibuprofen	6	5	17.350	13.000	30.350	5.06
5.	Aspirin	30	30	103.100	8.800	112.000	3.73
6.	Methyl Salicilate	3	3	103.310	8.300	18.600	6.20
7.	Sulfamethoxazole	4	5	17.350	14.300	31.650	7.90
8.	Trimethoprim	10	10	34.700	26.500	61.200	6.10
9.	Pyrazinamide	2	2	6.940	6.170	13.100	6.55
10.	Haloperidol	10	10	34.700	61.200	96.000	9.60
11.	Chloroquine Phosphate	12	10	34.700	23.000	57.700	4.80
12.	Sulfinpyrazone	5	5	17.350	24.440	41.500	8.30
13.	Tinidazole	4	5	17.350	6.960	24.000	6.00
				345.900			

Annex 27

Annual Interest on the Investment on Inventories of Raw Materials

Product Mix A

No.	Name of Pharmaceutical Chemical	Inventories		Total Inventory	Annual Interest at 12%
		Raw Materials	Others		
		US$	US$	US$	US$
1	Nicotinamide	44,000	22,000	66,000	8,000
2	Procaine Hydrochloride	105,000	52,000	157,000	19,000
3	Clofibrate	34,000	17,000	51,000	6,000
4	Diphenyl Hydantoin	15,000	7,000	22,000	2,600
5	Lignocaine Hydrochloride	17,000	8,000	25,000	3,000
6	Indomethacine	52,000	26,000	78,000	9,400
7	Nalidixic Acid	764,000	382,000	1,146,000	137,000
8	Oxyphen Butazone	165,000	83,000	248,000	29,700
9	Paracetamol	100,000	50,000	150,000	18,000
10	Chlordiazepoxide	46,000	23,000	69,000	8,300
11	Niacin	51,000	26,000	77,000	9,300
12	Mebendazole	31,000	15,000	46,000	5,500
13	Ethambutol	74,000	37,000	111,000	13,300
14	Isoniazid	40,000	20,000	60,000	7,200
15	Chlortiamazole	55,000	27,000	82,000	9,800
16	Diazepam	40,000	20,000	60,000	7,200
17	Nikethamide	10,000	5,000	15,000	1,800
18	Propranolol	21,000	10,000	31,000	3,700

Annex 28

Annual Interest on Investment on Inventories of Raw Materials

Product Mix B

No.	Name of Pharmaceutical	Inventories		Total Inventory US$	Annual Interest @ 12% US$
		Raw Materials US$	Others US$		
1.	Metronidazole	128.000	64.000	192.000	23.000
2.	Phenylbutazone	23.000	12.000	35.000	4.200
3.	Ferrous Fumarate	5.000	2.500	7.500	900
4.	Ibuprofen	72.000	36.000	108.000	13.000
5.	Aspirin	49.000	24.500	73.500	8.800
6.	Methyl Salicilate	53.000	26.500	69.500	8.300
7.	Sulfamethoxazole	79.500	39.500	119.000	14.300
8.	Trimethoprim	147.300	73.600	221.000	26.500
9.	Pyrazinamide	34.400	17.000	51.400	6.168
10.	Haloperidol	340.100	170.000	510.000	61.200
11.	Chloroquine Phosphate	127.400	63.600	191.000	23.000
12.	Sulfinpyrazone	134.200	67.000	201.200	24.140
13.	Tinidazole	55.000	3.000	58.000	6.960

Allocation of Cost of Insurance

Product Mix A

Amount to be insured

No.	Name of Pharmaceutical Chemical	Annual Production Tons	Percentage Weightage	Allocation of Fixed Cost US$	Cost of Inventories US$	Total Amount Insured US$	Annual Premium at 9/1000	Cost of Insurance per kg US$
1	Nicotinamide	15	13	375,000	66,000	441,700	4,000	0.26
2	Procaine Hydrochloride	8	7	202,300	157,000	359.300	3,000	0.38
3	Clofibrate	3	2.5	72,200	51,000	123,200	1,100	0.37
4	Diphenyl Hydantoin	4	3.5	101,200	22,000	123,200	1,100	0.28
5	Lignocaine Hydrochloride	2	1.5	43,300	25,000	68,300	600	0.30
6	Indomethacine	2	1.5	43,300	78,000	121,300	1,100	0.55
7	Nalidixic Acid	7	6	173,400	1,146,000	1,319,400	11,900	1.70
8	Oxyphen Butazone	10	9	260,100	248,000	508,100	4,600	0.46
9	Paracetamol	20	17.5	505,750	150,000	655,750	5,900	0.29
10	Chlordiazepoxide	1.5	2	57,800	69,000	126,800	1,100	0.73
11	Niacin	15	14	404,600	77,000	481,600	4,300	0.28
12	Mebendazole	3	2.5	72,200	46,000	118,200	1,000	0.33
13	Ethambutol	10	10	289,000	111,000	400,000	3,600	0.36
14	Isoniazid	5	4.5	130,000	60,000	190,000	1,700	0.34
15	Clotriamazole	2	1.5	43,300	82,000	125,000	1,100	0.55
16	Diazepam	2	1.5	43,300	60,000	103,300	900	0.45
17	Nikethamide	1	1	28,900	15,000	43,000	400	0.40
18	Propranolol	2	1.5	43,300	31,000	74,300	700	0.35
				2,890,000				

Annex 30

Allocation of Cost of Insurance

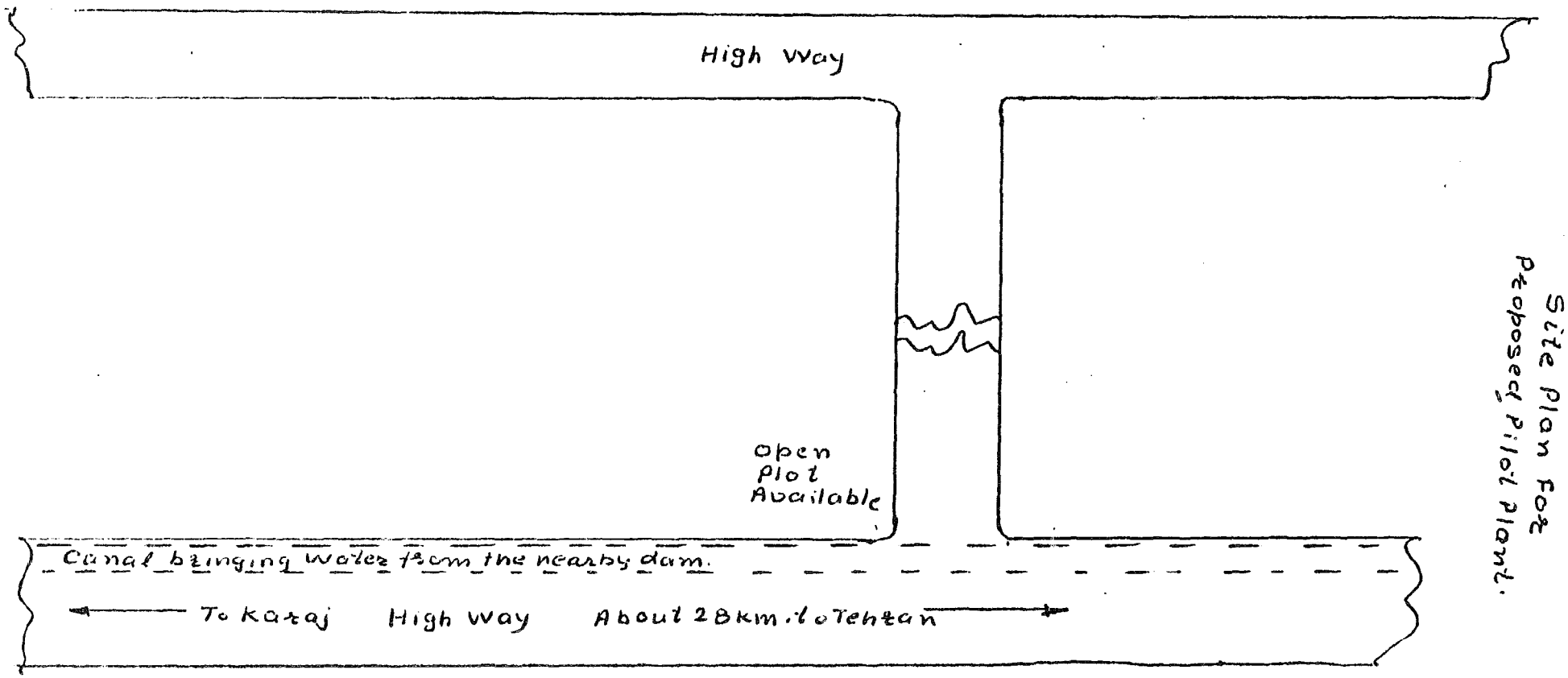
Amount to be Insured

Product Mix B

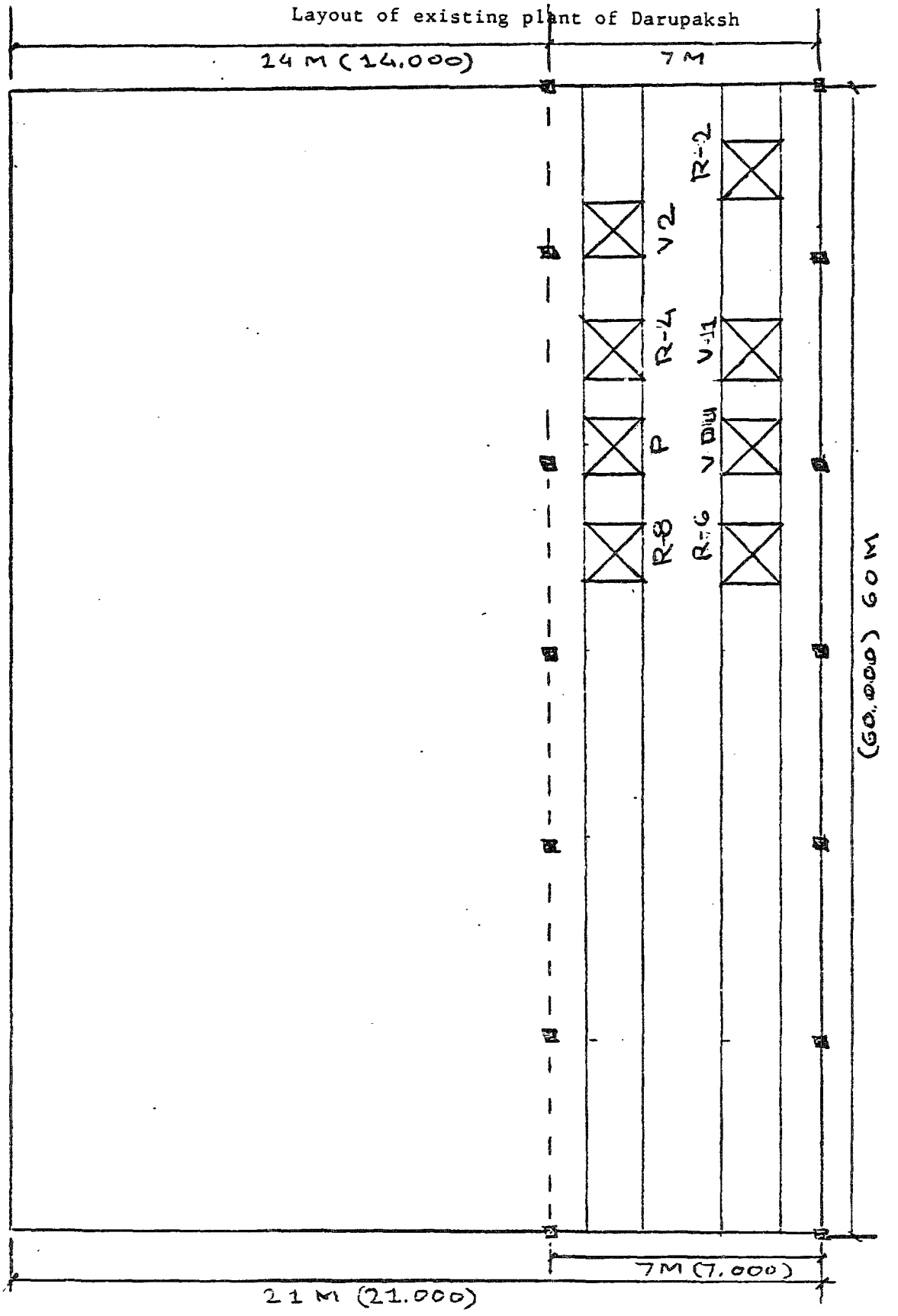
No.	Name of Pharmaceutical Chemical	Annual Production Tons	Percentage Weightage	Allocation of Fixed Cost US$	Cost of Inventories US$	Total Amount Insured US$	Annual Premium @ 9/1000	Cost of Insurance per kg US$
1.	Metronidazole	6	5	144.500	128.300	273.000	2.500	0.42
2.	Pnenylbutazone	5	5	144.500	23.000	167.500	1.500	0.30
3.	Ferrous Fumarate	4	5	144.500	5.000	150.000	1.300	0.32
4.	Ibuprofen	6	5	144.000	72.000	216.500	2.000	0.33
5.	Aspirin	30	30	867.000	49.000	916.000	8.300	0.28
6.	Methyl Salicilate	3	3	86.700	53.300	140.000	1.300	0.43
7.	Sulfamethoxazole	4	5	144.500	79.400	224.000	2.000	0.50
8.	Trimethoprim	10	10	289.000	147.300	436.000	4.000	0.40
9.	Pyrazinamide	2	2	57.800	34.000	92.200	830	0.42
10.	Haloperidol	10	10	289.000	340.000	629.000	5.660	0.58
11.	Chloroquine Phosphate	12	10	289.000	127.400	416.500	3.800	0.31
12.	Sufinpyrazone	5	5	144.500	134.200	278.700	2.510	0.52
13.	Tinidazole	4	5	144.500	55.000	199.500	1.800	0.45
				2.890.000				

ANNEX - 31

Site Plan For Proposed Pilot Plant.



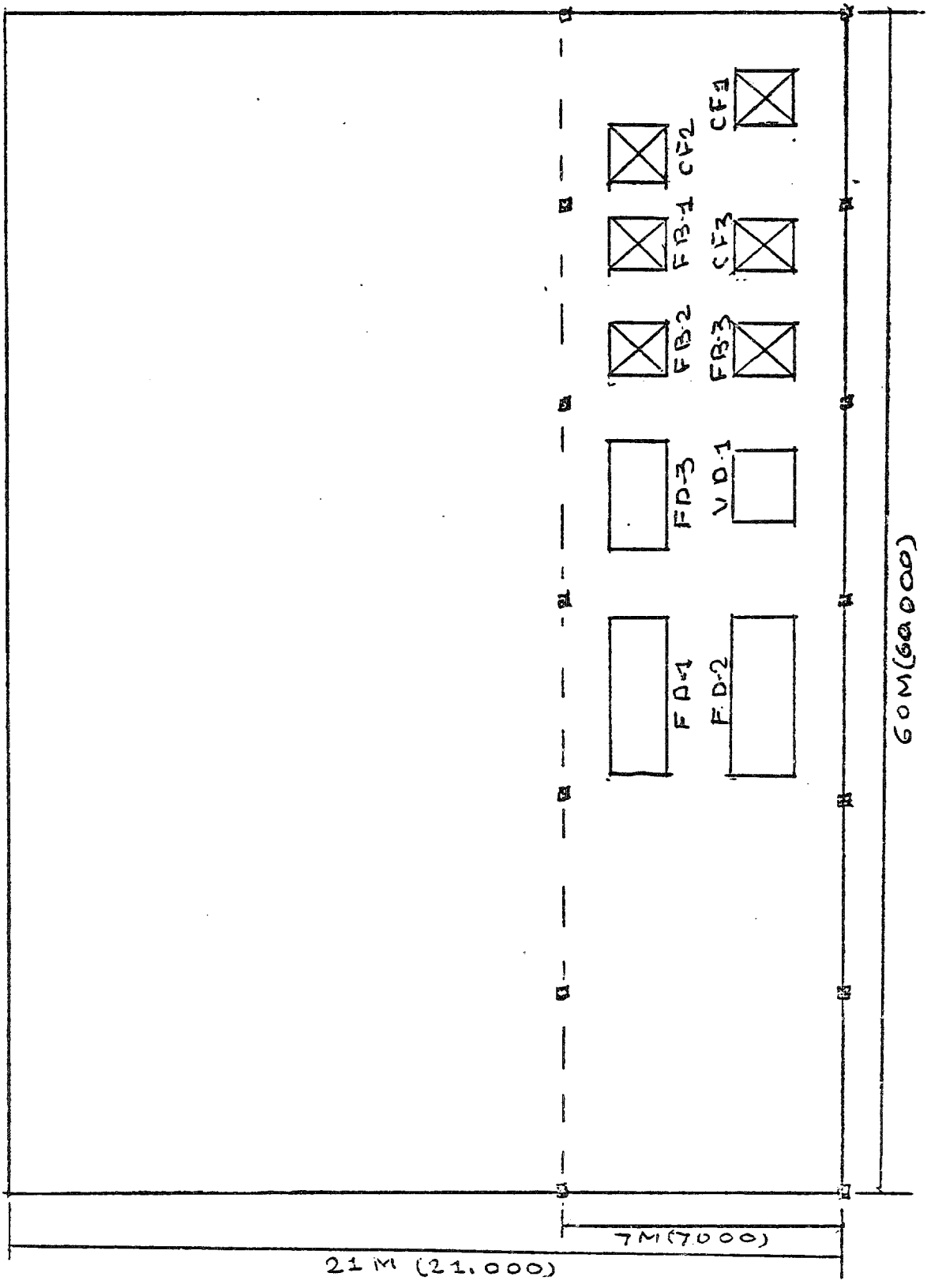
ANNEX: 32



Existing Ground Floor
of Pilot Plant Building of Darupakhsh

ANNEX : 33

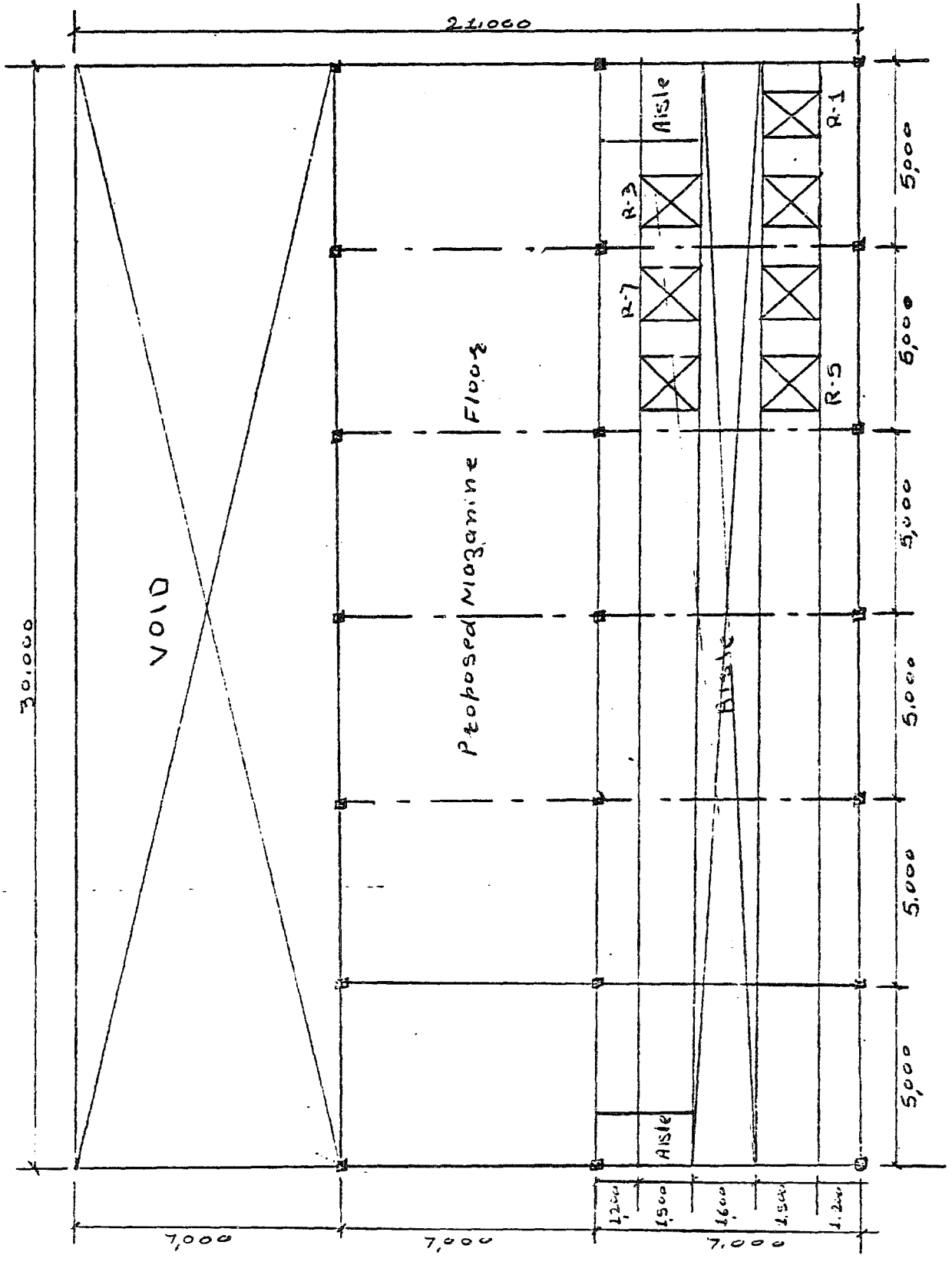
Plant Building of Darupaksh



Basement of
Pilot Plant Building of
Darupaksh

ANNEX- 34

Equipment Layout for Proposed Pilot Plant



Proposed Mezzanine Floor
over Existing Ground Floor
of Pilot Plant Building of Darupakhsh

Annex 35

List of the Visited Institutions

1. Daruparksh: A Government undertaking for the manufacture of pharmaceutical formulations

   Dr. M. E. Zolfaghari
   Manager, Basic Pharmaceutical Production of Temad
   (a Division of Darupakhsh),Teheran

2. National Industries Organization:

   Dr. P. Lolavar
   Group Manager of National Industries Organization,
   Teheran

3. Alhavi Pharmaceutical Co:

   Dr. Gh. Akhavan Fazid
   Managing Director and Member of the Board of Alhavi
   Pharmaceutical Company, Teheran

   Mr. M. Baloutehian
   Planning and Materials Manager of Alhavi Pharmaceutical Co.

4. Toobi:

   Dr. Razaeyan, General Manager

   Mr. Khazaet, Financial Manager

   Mr. Esmailnezad, Chemical Engineer in Charge of Production and Development

   Mr. Houssaini, Chemical Engineer

   Dr. Morteza, Head of Research Laboratories

ANNEX: Cost of Production

Name of Pharmaceutical Chemical — Figures in US$

No.	Item	Niacin-amide	Procaine HCl	Clofi-brate	Diphenyl Hydantoin	Lignocaine HCl	Indome-thacine	Nalid Aci
1	Cost of raw materials	9.02	40.90	33.35	11.37	25.57	79.32	327.
2	Cost of utilities	1.20	0.85	0.62	0.35	0.50	0.62	1.
3	Cost of labour and overheads	6.16	6.25	6.00	6.25	5.30	5.30	6.
4	Cost of depreciation and maintenance	2.85	2.87	2.75	2.87	2.50	2.50	2.
5	Cost of interest	3.53	5.40	4.66	3.65	4.10	7.10	22.
6	Cost of insurance	0.26	0.38	0.37	0.28	0.30	0.55	1.
	Cost of production	23.02	56.65	47.75	24.61	38.24	95.09	362.
	Market prices per kg	8.00	46.30	31.72	12.58	46.30	37.03	69.

No.	Item	Chlordia-zepoxide	Niacin	Mebend-* azole	Etham-* butol	Isoniazid	Clotria-mazole	Diaze
1	Cost of raw materials	85.83	7.40	30.79	21.20	6.94	82.52	25.
2	Cost of utilities	0.43	0.25	0.56	0.43	0.32	0.45	0.
3	Cost of labour and overheads	9.47	6.65	5.93	7.12	6.40	5.25	5.
4	Cost of depreciation and maintenance	4.40	3.06	2.73	3.30	2.95	2.50	2.
5	Cost of interest	10.2	3.85	4.66	4.78	2.88	7.50	6.
6	Cost of insurance	0.73	0.28	0.33	0.36	0.34	0.55	0.
	Cost of production	111.06	21.49	40.00	37.29	19.83	98.75	41.
	Market prices per kg	56.71	9.26	254.63	393.52	8.68	109.16	32.

* Market prices of these products seem to be exhorbitant

x Information available on raw material requirement appears doubtful

Annex:

Allocation of costs of depreciation, maintenance, labour and overheads

No.	Name of Pharmaceutical Chemical	Annual productions tons	Percentage Weightage	Allocation of costs of	
				Depreciation and Maintenance	Labour and Overheads
				US$	US$
1	Nicotinamide	15	13	42,700 (2.85)	92,500 (6.16)
2	Procaine Hydrochloride	8	7	23,000 (2.87)	50,000 (6.25)
3	Clofibrate	3	2.5	8,200 (2.73)	18,000 (6.00)
4	Diphenyl Hydentoin	4	3.5	11,500 (2.87)	25,000 (6.25)
5	Lignocaine Hydrochloride	2	1.5	5,000 (2.50)	10,600 (5.3)
6	Indomethacine	2	1.5	5,000 (2.50)	10.600 (5.3)
7	Nalidixic Acid	7	6	19,700 (2.81)	43,000 (6.15)
8	Oxyphen Butazone	10	9	29,500 (2.95)	64,000 (6.4)
9	Paracetamol	20	17.5	57,500 (2.87)	124,500 (6.24)
10	Chlorodiazepoxide	1.5	2.0	6,600 (4.4)	14,200 (9.47)
11	Niacin	15	14	46,000 (3.06)	99,700 (6.65)
12	Mebendazole	3	2.5	8,200 (2.73)	17,800 (5.93)
13	Ethambutol	10	10	33,000 (3.30)	11,200 (7.12)
14	Isoniazid	5	4.5	14,800 (2.95)	32,000 (6.40)
15	Chlortramazole	2	1.5	5,000 (2.50)	10,500 (5.25)
16	Diazepam	2	1.5	5,000 (2.50)	10,500 (5.25)
17	Nikethamide	1	1.0	3,300 (3.30)	7,000 (7.00)
18	Propranolol	2	1.5	5,000 (2.50)	10,500 (5.25)
	Figures in brackets are respective costs in US$ per kg of pharmaceutical chemical			329,000	711,600

Annex

Cost of Depreciation and Maintenance

Annual Depreciation and Maintenance

A.	Cost of Equipment	US$ 1,940,000		
	Annual cost of depreciation at 15% since it is a chemical plant		US$	291,000
	Annual cost of maintenance			29,000
B.	Cost of civil construction	1,000,000*		
	Annual depreciation of building at 5%			5,000
	Annual maintenance			4,000
	Total cost of depreciation and maintenance			329,000

* Refer to Annex 2

Cost of Labour

From Annex 15

Total cost of direct labour and overheads	711,600

Basis for allocation of cost of maintenance, depreciation and labour

Because more than one product will be produced in this plant the cost of depreciation, maintenance and direct labour have been allotted according to calculated weightage for every pharmaceutical chemical based on the usage of the equipment by that particular chemical.

Cost of Raw Materials

This cost has been taken vide Annex 6.

Cost of Services

Because of scanty process information, cost of utilities are given on ad hoc basis taking into consideration amount of solvents used and recovered by any particular pharmaceutical during the production

Annex

Allocation of the cost of Interest

No.	Name of Pharmaceutical	Annual Production tons	Percentage Weightage	Allocation of cost of interest on fixed cost US$	Cost of interest on inventories US$
1	Nicotinamide	15	13	45,000	8,000
2	Procaine Hydrochloride	8	7	24,200	19,000
3	Clofibrate	3	2.5	8,500	6,000
4	Diphenyl Hydantoin	4	3.5	12,000	2,600
5	Lignocaine Hydrochloride	2	1.5	5,200	3,000
6	Indomethaeine	2	1.5	5,200	9,400
7	Nalidixic Acid	7	6	20,500	137,500
8	Oxyphen Butazone	10	9	31,200	29,700
9	Paracetamol	20	17.5	60,000	18,000
10	Chlordiazepoxide	1.5	2.0	7,000	8,300
11	Niacin	15	14	48,500	9,300
12	Mebendazole	3	2.5	8,500	5,500
13	Ethambutol	10	10	34,500	13,300
14	Isoniazid	5	4.5	17,200	7,200
15	Chlortriamazole	2	1.5	5,200	9,800
16	Diazepam	2	1.5	5,200	7,200
17	Nikethamide	1	1	3,400	1,800
18	Propranolol	2	1.5	5,200	3,200
				347,000*	

* Total fixed cost, vide Annex 2, US$ 2.89 m.
Annual interest at 12% = US$ 347,000

Annex

Annual Interest on the Investment on Inventories of Raw Materials

No.	Name of Pharmaceutical Chemical	Inventories		Total Inventory	Annual Interest at 12%
		Raw Materials	Others		
		US$	US$	US$	US$
1	Nicotinamide	44,000	22,000	66,000	8,000
2	Procaine Hydrochloride	105,000	52,000	157,000	19,000
3	Clofibrate	34,000	17,000	51,000	6,000
4	Diphenyl Hydantoin	15,000	7,000	22,000	2,600
5	Lignocaine Hydrochloride	17,000	8,000	25,000	3,000
6	Indomethacine	52,000	26,000	78,000	9,400
7	Nalidixic Acid	764,000	382,000	1,146,000	137,000
8	Oxyphen Butazone	165,000	83,000	248,000	29,700
9	Paracetamol	100,000	50,000	150,000	18,000
10	Chlordiazepoxide	46,000	23,000	69,000	8,300
11	Niacin	51,000	26,000	77,000	9,300
12	Mebendazole	31,000	15,000	46,000	5,500
13	Ethambutol	74,000	37,000	111,000	13,300
14	Isoniazid	40,000	20,000	60,000	7,200
15	Chlortiamazole	55,000	27,000	82,000	9,800
16	Diazepam	40,000	20,000	60,000	7,200
17	Nikethamide	10,000	5,000	15,000	1,800
18	Propranolol	21,000	10,000	31,000	3,700

Annex

Allocation of Cost of Insurance

No.	Name of Pharmaceutical Chemical	Annual Production Tons	Percentage Weightage	Amount to be insured: Allocation of Fixed Cost US$	Amount to be insured: Cost of Inventories US$	Amount to be insured: Total Amount Insured US$	Annual Premium at 9/1000	Cost of Insurance per kg US$
1	Nicotinamide	15	13	375,000	66,000	441,700	4,000	0.26
2	Procaine Hydrochloride	8	7	202,300	157,000	359.300	3,000	0.38
3	Clofibrate	3	2.5	72,200	51,000	123,200	1,100	0.37
4	Diphenyl Hydantoin	4	3.5	101,200	22,000	123,200	1,100	0.28
5	Lignocaine Hydrochloride	2	1.5	43,300	25,000	68,300	600	0.30
6	Indomethacine	2	1.5	43,300	78,000	121,300	1,100	0.55
7	Nalidixic Acid	7	6	173,400	1,146,000	1,319,400	11,900	1.70
8	Oxyphen Butazone	10	9	260,100	248,000	508,100	4,600	0.46
9	Paracetamol	20	17.5	505,750	150,000	655,750	5,900	0.29
10	Chlordiazepoxide	1.5	2	57,800	69,000	126,800	1,100	0.73
11	Niacin	15	14	404,600	77,000	481,600	4,300	0.28
12	Mebendazole	3	2.5	72,200	46,000	118,200	1,000	0.33
13	Ethambutol	10	10	289,000	111,000	400,000	3,600	0.36
14	Isoniazid	5	4.5	130,000	60,000	190,000	1,700	0.34
15	Clotriamazole	2	1.5	43,300	82,000	125,000	1,100	0.55
16	Diazepam	2	1.5	43,300	60,000	103,300	900	0.45
17	Nikethamide	1	1	28,900	15,000	43,000	400	0.40
18	Propranolol	2	1.5	43,300	31,000	74,300	700	0.35
				2,890,000				

Annex

List of the Visited Institutions

1. Daruparksh: A Government undertaking for the manufacture of pharmaceutical formulations

   Dr. M. E. Zolfaghari
   Manager, Basic Pharmaceutical Production of Temad
   (a Division of Darupakhsh), Teheran

2. National Industries Organization:

   Dr. P. Lolavar
   Group Manager of National Industries Organization,
   Teheran

3. Alhavi Pharmaceutical Co:

   Dr. Gh. Akhavan Fazid
   Managing Director and Member of the Board of Alhavi
   Pharmaceutical Company, Teheran

   Mr. M. Baloutehian
   Planning and Materials Manager of Alhavi Pharmaceutical Co.

4. Toobi:

   Dr. Razaeyan, General Manager

   Mr. Khazaet, Financial Manager

   Mr. Esmailnezad, Chemical Engineer in Charge of Production and Development

   Mr. Houssaini, Chemical Engineer

   Dr. Morteza, Head of Research Laboratories