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Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

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TECHNICAL ASSISTANCE IN THE PETROLEUM PRODUCTS SECTOR

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GUINEA-BISSAU

Technical Report*

THE REVIEW OF AND RECOMMENDATIONS ON THE IMPORTATION, THE STORAGE, THE HANDLING, THE TRANSPORTATION AND DISTRIBUTION OF PETROLEUM PRODUCTS IN GUINEA-BISSAU

Prepared for the Government of the Republic of Guinea-Bissau
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of H. Baba-Ahmed
Petroleum Engineer

Backstopping officer: M. Derrough, Industrial Operations Technology Division

United Nations Industrial Development Organization
Vienna

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ABSTRACT

The consumption of energy in Guinea-Bissau relies heavely on fuel imports for power generation, industry, fishing, farming and cooking while charcoal and wood are extensively used, especially in rural areas, for commercial and artisanal activities and for household cooking. Lack of foreign earnings, and therefore restrained fuel imports, vital spare parts and equipment, hampers the economic development of the country. Strenghtening of the petroleum sector, by means of soft loans or grants, should concentrate first on safeguarding present assets (i.e. storage and distribution facilities) before building additional hydrocarbon infrastructure to spur the economic development of the country. As the reliance on fuels will increase over the years, petroleum research and exploration activities should be increased and serious considerations should be given to the hydroelectric potential of the country while generation of electricity by burning farming residues ought to be introduced.

I GUINEA BISSAU

To appreciate the current financial, managerial and engineering problems of Guinea Bissau's Hydrocarbon companies it is necessary to follow the country's development since independence.

A. Background

Guinea Bissau is a small country on the West African coast with about 915,000 inhabitants (1988). The country consists of a mainland with large areas of river delta and a number of islands in the Atlantic Ocean . It covers an area of some 36,000 square kilometres. The coast line is crossed by rivers forming deep estuaries making surface transportation difficult and costly to operate. With creation of suitable infrastructure, water transportation in general looks to be more appropriate and cheaper for this area .

The annual temperature is about 25 C with minimal variation during the year. The monsoon season is from May through October and the average rainfall is about 150 cms in the north and 300 cms in the south. In July and August the rainfall is heavy and the southern part of the country is not accessible by road due to flooding of low lying areas. In the absence of railway facilities, people and cargoes are transported by road and barges to the extent possible with the available infrastructure. Transport and communication facilities, in general, are inadequate in the country. The expansion of these facilities is essential for the economic recovery of the country.

The consumption of petroleum products, some 31,700 tones in 1988, is mainly for transportation, diesel power generation, fishing, agriculture and illumination . All fuel is imported. Motor gasoline is used for cars and for outboard engines of small fishing boats. Larger fishing boats, pusher tugs, barges, etc. use diesel oil. Kerosene for illumination is used in the towns and villages in the absence of satisfactory electricity distribution. Liquefied petroleum gas (LPG) is consumed for cooking, but due to lack of cylinders and badly managed distribution system, the consumption is limited to customers in the capital area. Very small quantities move into other areas.

With an estimated per capita income of about US$170 (1987), the country is among the 10 poorest in the world. This GDP per capita has been decreasing steadily over the last 10 years being now just over half its former level. The economy is characterised by a large rural sector, producing primarily for self consumption. Agriculture, fisheries and forestry account for about 90 percent of employment and an estimated 50 percent of GDP. Marketed output is largely confined to export crops, primarily cashews, groundnuts, and palm kernels. In 1987 cashews accounted for almost 70 percent of total exports. Rice is the main food crop. In the 1950's Guinea Bissau was a net exporter of rice (around 40,000 tons annually); however, since 1962 the country has relied on imports to supplement domestic production. Since the reintroduction of price incentives in 1983, production has been steadily increasing, to about 140,000 tons in 1987, and it is expected that the country will re-achieve self-sufficiency by the early 1990's.

After independence in 1974, Guinea Bissau faced the task of rebuilding its economy. The protracted liberation war had dislocated one fifth of the population, destroyed an important part of the economic infrastructur and reduced output of the main crops by over one third. An ambitious public investment program financed mainly by external borrowing was implemented, focusing on the manufacturing sector but neglecting agriculture. Inappropriate pricing policies, an increasingly overvalued exchange rate, and an inefficient marketing system prevented recovery of agricultural production, depressed official exports, and stimulated the parallel market. Severe fiscal imbalances, resulting from a rapid rise in government expenditures and limited growth in revenues, were increasingly financed by central bank credit, thereby fuelling inflation. In the period 1980-82, the external situation was aggravated by drought and depressed world market prices for the country's main exports. The balance of payments deteriorated rapidly, exacerbated by rapidly increasing external debt service payments, and external arrears accumulated.

Faced with a deteriorating situation, the Government implemented a recovery program in late 1983 with support from the World Bank and the IMF. The programme consisted of a devaluation of the currency, the Guinean peso, increases in produced prices, and steps to liberalise domestic trade. However, due to a sharp deterioration in the prices of the country's major export products, delays in the implementation of institutional reforms, and the inability to control the fiscal deficit, the adjustment process lost momentum in 1985. In 1986, domestic financing of a worsening fiscal deficit kept the inflation rate in the 45 percent range and contributed to the further deterioration of the external accounts.

B. Recent Developments.

Against this background the Government prepared a comprehensive medium-term economic adjustment program in early 1987 in close co-operation with the World Bank and the IMF. The programme aims at re-establishing internal and external equilibria, stimulating growth, improving resource allocation and normalising relations with foreign creditors.

During 1987, the Government vigorously implemented the policy measures envisaged in the adjustment program. These included a substantial devaluation of the exchange rate, accelerated removal of price controls, the adoption of tight fiscal policies, the liberalisation of marketing arrangements, and retrenchments in the public sector.

C. Exchange Rate and Trade Policies.

Under the program, the Government implemented a flexible exchange rate policy aimed at reducing the divergence between the official and parallel exchange rates. In May 1987 the Guinean-Peso was devalued by 60 percent, from PG263 to PG650 per US$. Notwithstanding the official devaluation, the parallel exchange rate depreciated rapidly and the spread widened - reaching 50 percent in November 1987 - reflecting delays in the arrival of imports through official channels and an associated expansion of domestic liquidity. By January 1988, the arrival of official imports, and the related withdrawal of liquidity as well as the continued depreciation of the official exchange rate, had resulted in the virtual elimination of the gap. The first quarter of 1989 has seen a renewed widening of the gap to about 30 percent.

D. Trade and Price Liberalisation

The private section has responded enthusiastically to the elimination of trade restrictions, especially in the marketing of agricultural crops. Import licences for commercial imports are now issued automatically, except for a short negative list including PETROLEUM PRODUCTS. All prices have been liberalised, with the exception of rice and PETROLEUM, and the retail prices of these goods have been raised close to import parity levels.

E. External Debt and Creditworthiness.

For the foreseeable future, external debt will continue to be a heavy burden. exports even in good years covering only 25% of imports. The trade balance is mainly made up by development assistance External debt continues to rise and Guinea Bissau has been included in the World Bank's list of economically distressed countries in Sub Sharan Africa since its debt service ratio is significantly over 30%.

The Ministry of Natural Resources and Industry is the government institution responsible for the petroleum sector. The ministry supervises three public enterprises: DICOL, GUINEGAZ and PETROGUIN. These three hydrocarbon companies must wait in line with other parastatal organisations such as Health, Education, Agriculture, Fisheries etc etc for a share of the International Assistance. As their credit worthiness in the open market is virtually zero, all payments have to be cleared before deliveries are made. Almost all of the problems of these companies can be traced to a common source - lack of hard currency.

SUMMARY

Guinea-Bissau's economy relies heavely on the import, storage and distribution of petroleum products used for power generation, industry, transport, farming, fishing, illumination, artisanal activities and cooking.

Economic development can not be achieved without schedule fuel imports to match the country's needs; without safe and secured facilities to store the imported products and without the safe handling and adequate distribution and storage of products in consumer sales points throughout the country.

Due to limited foreign currency earnings the country suffers from:

- lack of fuel resulting in electric power outages and rationing,
- unsafe and unsecured storage depots at DICOL and GUINE-GAZ,
- lack of adequate transport fleet and a total lack of river transport to sales points, outside the capital, that can only be reached by barges during the wet season,
- insufficient sales points, or total lack of sales points for butane, in the capital and in regional centers,
- inexistence of storage and distribution depots in rural areas,
- total lack of maintenance, total lack of vital spare parts and replacement equipment,
- lack of adequately trained personnel for the safe handling of hydrocarbon products,
- lack of supervisory personnel to oversee the operation and maintenance of existing facilities.

To safeguard its present assets and to spur economic activity Guinéa - Bissau needs to do the following:

- rehabilitate its petroleum product depot at DICOL and its butane storage depot at GUINE-GAZ. By any standard these facilities have outlived their useful lives since they have been built more than twenty years ago,
- train or hire qualified personnel to run the existing facilities in accordance with industry standards and regulations,
- invest in the adequate distribution and storage of products in regional centers.

To ease the burden of fuel imports and to preserve its forests which are being depleted of their wood for cooking Guinéa-Bissau needs to:

- discourage fuel theft,
- rehabilitate its electric power transportation and distribution networks,
- invest in the construction of hydroelectric power plants,
- encourage the private sector (local as well as foreign) to invest in the import, storage and distribution of petroleum products,
- encourage petroleum exploration,
- introduce electric power generation by burning of farming residues,
- introduce better charcoal making techniques and more efficient household stoves.

To generate foreign currency income the country ought to:

- tax fuel and lube imports, in usd, by private concerns.
- tax vehicule and engine-generator imports, in usd, by private concerns,
- introduce a fuel value added tax, in usd, for international fishing vessels in its waters; revenues from this tax will be used for the building of a fishing port to supply theses vesels in fuels and other neccessities,
- build-up its reserves in jet fuels for resale, at a profit, to international carriers.

1. STORAGE CAPACITY

1.1 DICOL Depot

- Based on availability of fuel (i.e.supply constrained by lack of foreign currency) there is enough storage capacity at the depot. Per 1988 supply rates there are enough storage days to provide the required security stocks:

	TANKAGE		STORAGE CAPACITY	
	M3	TONS	MONTHS	DAYS
Diesel	9,470	7,952	4.4	132
Gasoline	3,200	2,367	5.9	177
Jet A1	4,000	3,193	10.6	318
Kerosene	1,600	1,290	26.0	780

- Based on increase of supply over the last ten years the rate of growth for the next three years, in M3, will be as follows:

	1989	1990	1991
Gasoline at 2.9% growth rate	6,912	7,112	7,318
Kerosene at 2.0%.....	750	765	780
Jet A1 at 5.2%.....	6,320	6,450	6,995
Diesel at 6.6%.....	28,921	30,829	32,864

The number of stock-days will then be:

	1989	1990	1991
Gasoline	168	164	159
Kerosene	768	753	738
Jet A1	228	223	206
Diesel	120	112	105

Per present growth rate the security stock-days are more than the required 75 to 90 days recommanded by industry standards.

1.2 Estimated Fuel Demand

1.2.1 Electrical Power Generation

All of the electrical power in Guinea-Bissau is generated by diesel driven engine-generators. Public utility power is supplied by EAGB the state-owned company. In the city of Bissau the power plant has three units in operation (group III rated at 1,000 KW, group VI at 2,200 KW and group VII at 2,200 KW) while one unit being repaired will be commissioned in May 1989 (group V rated at 1,700 KW). There are several projects to install additional units in Bissau:
- a 4,000 KW unit financed by BADEA to be installed in 1989,
- six 700 KW units financed by the USSR and to be installed in a new

plant next to the city airport. Construction of the plant will begin in 1989 and the commissioning of the last unit is programed for 1992. The other major power plant, located in Bafata, consists of seven 450 KW units. The plant was a donation from the USSR and is operated and maintained by russian technicians.

There are other small generating stations in Bolama, Cacheu, Farim, Bissora, Canchungo for a total installed capacity of 3,200 KW. Most of the plants are either out of operation, for lack of spare parts and maintenance, or operate only a few hours a day for lack or for rationing of fuel. Lack of fuel and rationing results in black-outs in Bissau as well as the rest of the country. This has led to the proliferation of engine-generator sets of all sizes and makes. It is estimated (i.e. exact figures are not available) that there is an installed capacity of 10 to 12 megawatts.
There were several studies made in 1984, 1986 and 1987 to assess the power demand in the country 1/. From these studies we have estimated the fuel demand to match this power demand; figure 1 shows the fuel demand for 1990 up to the year 2000. To reduce fuel imports there is a project to build two hydro-electric power plants on the Corubal river. Figure 2 shows the fuel savings that would be realized should the first plant near Saltinho be built as planned by 1995. This plant, at a cost of 60 million usd, will generate 13,000 megawatthours from January to June, and 70,000 megawatthours from July to December (i.e. the wet season).

1.2.2 Transportation and Fishing

Table 4 shows the details of the transport and fishing fleets in the country. Excluded from this list are the various international fishing fleets that operate, under licence, in Guinea-Bissau waters. The national fleet is composed of two joint-venture companies, GUIALP with Algeria and ESTRELLA DO MAR with the USSR and a state-owned company called SEMAPESCA. There are also small fishing boats using gasoline or diesel depending on their sizes.
Road transport consists of gasoline cars (i.e. light vehicules and taxis) as well as diesel-engine vehicules (i.e. buses, trucks, pick-ups, tractors as well as light vehicules). From the number of vehicules imported since 1986 and the trend of an additional 1,000 vehicules per year one can see the burden of additional fuel on imports. Table 5 shows the estimated demand for transport and fishing from 1990 up to the year 2000 and Table 1 summarizes the total estimated demand. It is obvious that DICOL can not, at the present time, satisfy the demand resulting in: long lines of vehicules at the pump, outages of electric power, rationing, direct imports by others 2/ (819 tons of fuel and lube were imported in 1988) and direct purchase of fuel and supplies on the high seas or Dakar by fishing vessels.
The storage capacity of DICOL's depot, to meet the estimated demand, will be, in months, as follows:

	1990	1995	2000
Diesel (without Saltinho)	2.4	1.8	1.3
Diesel (with Saltinho)	2.4	2.5	1.9
Gasoline	3.4	2.4	1.1

1/ Electric Master Plan, Ministry of Energy
2/ Tables 16 to 23

Therefore if Saltinho hydro-electric plant is built by 1995, as planned for the moment, storage tanks will have to be built after 1995; otherwise, if the plant construction is pospcned, storage tank construction should begin in 1990 to satisfy the required security stock-days provided DICOL intends to satisfy the demand and can have access to the funds for the purchase of fuel. An Additional 10,000 M3 of storage will satisfy the needed 2.5 to 3.5 month stocks for diesel. Under the same conditions, DICOL will have to increase its storage by 3,200 M3 for gasoline. For lube oil the shortages are filled now by direct imports by others; this policy should be encouraged.

1.3 Service Stations

Table 25 shows the location and the number of filling stations in the country. Most of the stations visited are run-down with sometimes pumps broken down and pumping done by hand. None of these have fire extinguishers in working condition. There are several stations closed-down (at least one in Bissau and two in Bafata). Based on population centers 3/ we have determined the capacity needed in gasoline and diesel for transportation. Table 8 shows the estimated demand for these major centers. Table 6 shows stock-days available at these service stations. These figures explain the long lines of vehicules at the pump and the heavy traffic, at the depot, to get to the service station located inside. Additional service stations are needed as follows:

	1990		1995		2000	
	gasl.	dies.	gasl.	dies.	gasl.	dies.
Bissau	3x30	3x40	3x30	3x30	3x30	3x40
Canchungo	--	--	--	--	--	--
Bula	--	--	3x30	3x30	--	--
Farim	2x10	--	--	2x10	--	--
Gabu	2x10	2x10	--	--	--	--
Bafata	2x30	2x30	--	--	--	--
Buba	2x10	--	--	2x20	--	--
Catio	--	--	--	--	--	--
Bubaque	--	--	--	--	--	--
Total		11		10		3

1.4 Regional Centers

The country consists of a mainland with several deltas and a number of islands such as Bubaque which is being developed as a major tourist attraction. Due to heavy rainfall during the wet season several roads are unaccessible due to flooding of low lying regions. In addition DICOL's transport fleet is old and is not large enough to assure a constant supply to all regions. This results in severe shortages in most areas or no supply at all during the rainy season. This hampers considerably the economic activities of these regions.

3/ Population projection by 1979 census.

It has become necessary to build storage depots at points accessible all year around. Water transport to these points by barges and dedicated road tankers for each area seems to be the answer. These depots should be installed close to the power generating stations as they exist now or as planned, in accordance with the Electrification Master Plan. Tables 7 and 8 show the estimated fuel demand for power generation and transport and the recommanded location of the storage depots.

Bafata area

The Bafata depot will deserve also Gabu. If Bafata port facilities can not accomodate barge movement and landing, then the depot should be built either at Xime (approximately 40 Kms from Bafata) or Bambadinca (approximately 21 Kms from Bafata). Facilities exist at Xime for barge landing in about 5 meters of water; also electric power is available at about 200 meters from the pier.

Bolama area

Bolama is the capital of the island of Bolama. Main economic activities consist of peanut and cotton cultures. This is an area that can be developed as a tourist resort. Even though gasoline consumption figures are not known, there is an old service station that can be reactivated; facilities for barge landing exist.

Cacheu area

Cacheu is the capital of the northwest area. The main activities of this area revolve around fishing, rice and peanut production. Cacheu depot can also deserve Canchungo (29 Kms away on paved road) and Bula (57 Kms away on paved road). Port facilities exist for barge landing. Port facilities should be considered at Sao-Vicente to deserve Bula and Canchungo in case of constant flooding of Cacheu road.

Catio area

Catio is the capital of the southeast region. Catio is located inland, about 15 Kms from Cadique-Nalu where barge facilities up to 600 tons exist. The main activities of this area are rice and peanut production.

Farim area

Farim east of Cacheu is the main center of the northeast area. Main production consist of peanuts and rice. Farim, located on the Cacheu river, is accessible by barge and can accomodate 4,000 ton barges.

Mansoa area

Mansoa is accessible by road from Bissau (71 Kms away). The depot in mansoa will also deserve Bissora and Mansaba, respectively 25 and 30 Kms from Mansoa. Mansaba is also accessible by road from farim.

Bubaque area

Bubaque is the capital of the island of Bubaque. Main activities are tourism and fishing. Tourist attraction is at its start and can be developed further, with proper infrastructures to attract foreign currency income. Bubaque has port facilities to accomodate barges.

Buba area

Buba, located on the Buba river, has facilities to accomodate barge landing.

The storage depots should be equipped with:
- dual load and transfer pumps with filters
- electric power substation with protection, grounding and distribution board.
- perimiter lighting and barbed wire fencing
- dual meters, and truck loading facilities
- drain facilities, separator/decanter and a burn pit to avoid river pollution
- fire fighting facilities

A 100 D.W.T. barge will be needed for transport through the following routes:
- Bafata (200 Kms round trip)
- Bolama-Buba-Catio (300 Kms roud trip)
- Cacheu-Farim (500 Kms roud trip)
- Bubaque (130 Kms roud trip)

The utilization factor for this barge will be 80%. For a 150 D.W.T. barge this factor will be reduced to 70%. Total cargo to be transported will be 870 tons per month (300 tons of gasoline and 570 tons of diesel fuel). By 1995 an additional load of 537 tons will have to be barged. At that time an additional barge will be needed or a security stock of less than one month will have to be considered. Table 10 shows the required storage tanks needed for each area.

FUEL DEMAND for ESTIMATED POWER DEMAND

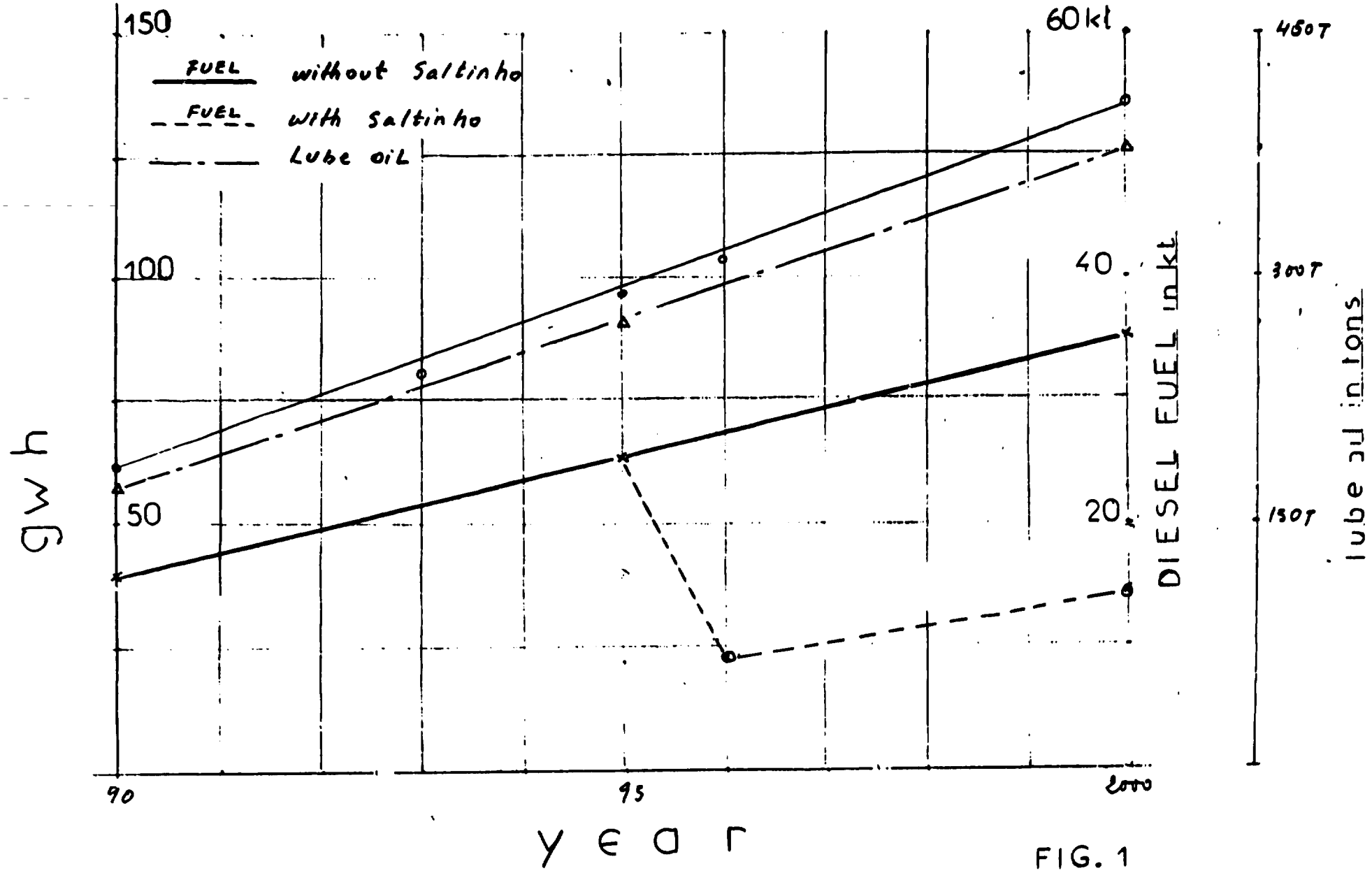

FIG. 1

TOTAL EST. FUEL & LUBE DEMAND

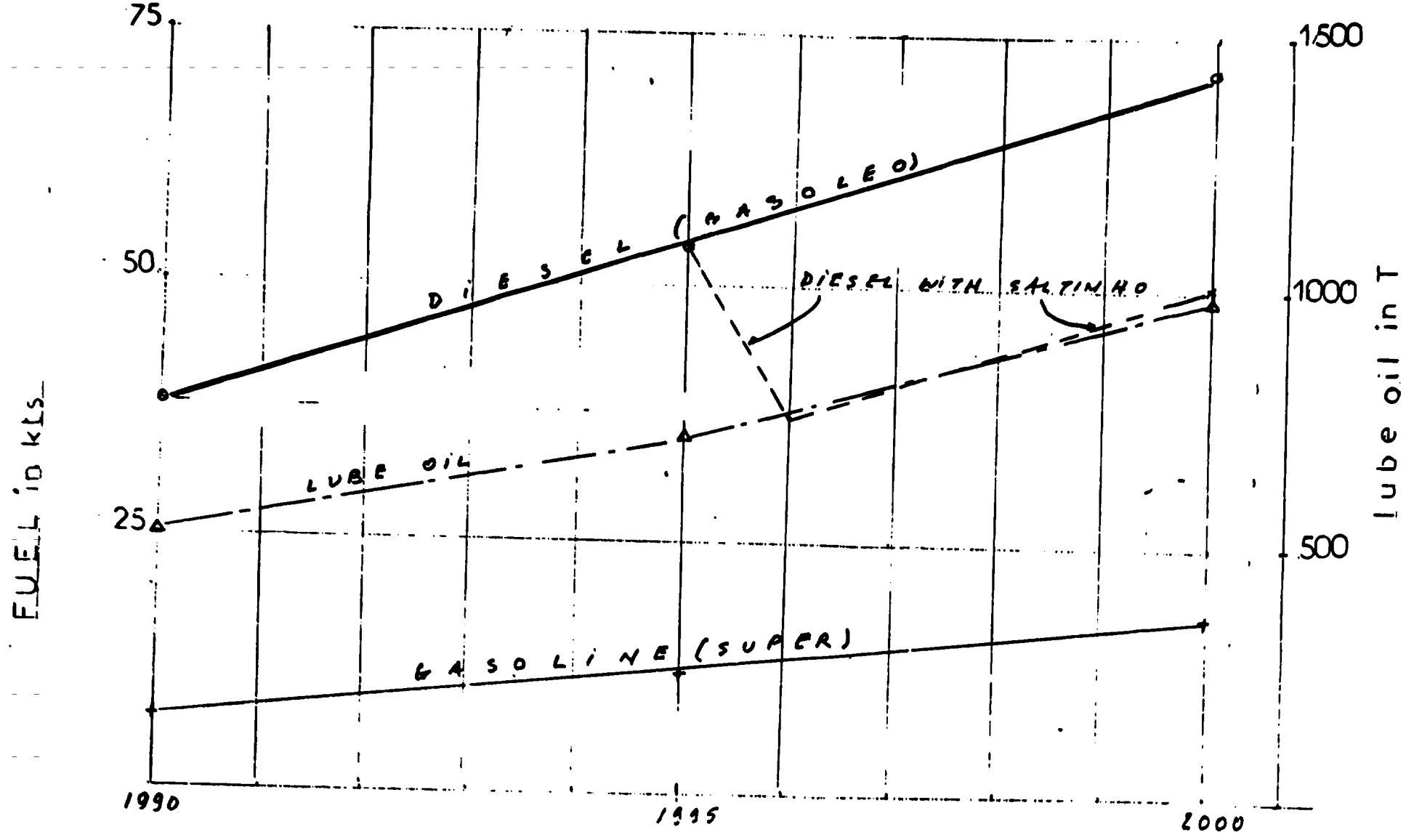

FIG. 2

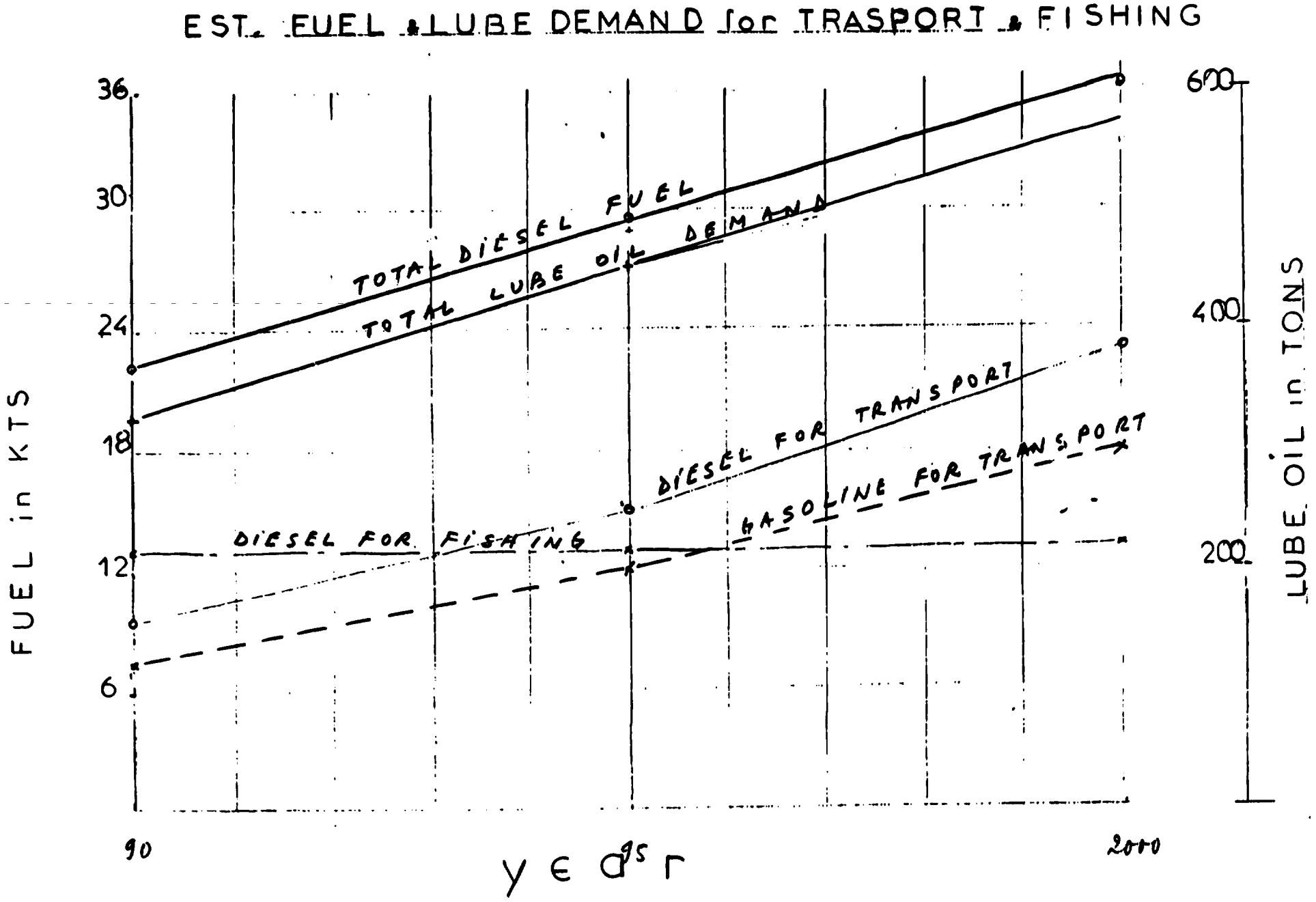
EST. FUEL & LUBE DEMAND for TRASPORT & FISHING
36
30
24
18
12
6
FUEL in KTS
600
400
200
LUBE OIL in TONS
TOTAL DIESEL FUEL
TOTAL LUBE OIL DEMAND
DIESEL FOR TRANSPORT
GASOLINE FOR TRANSPORT
DIESEL FOR FISHING
90
95
2000
year

FIG. 3

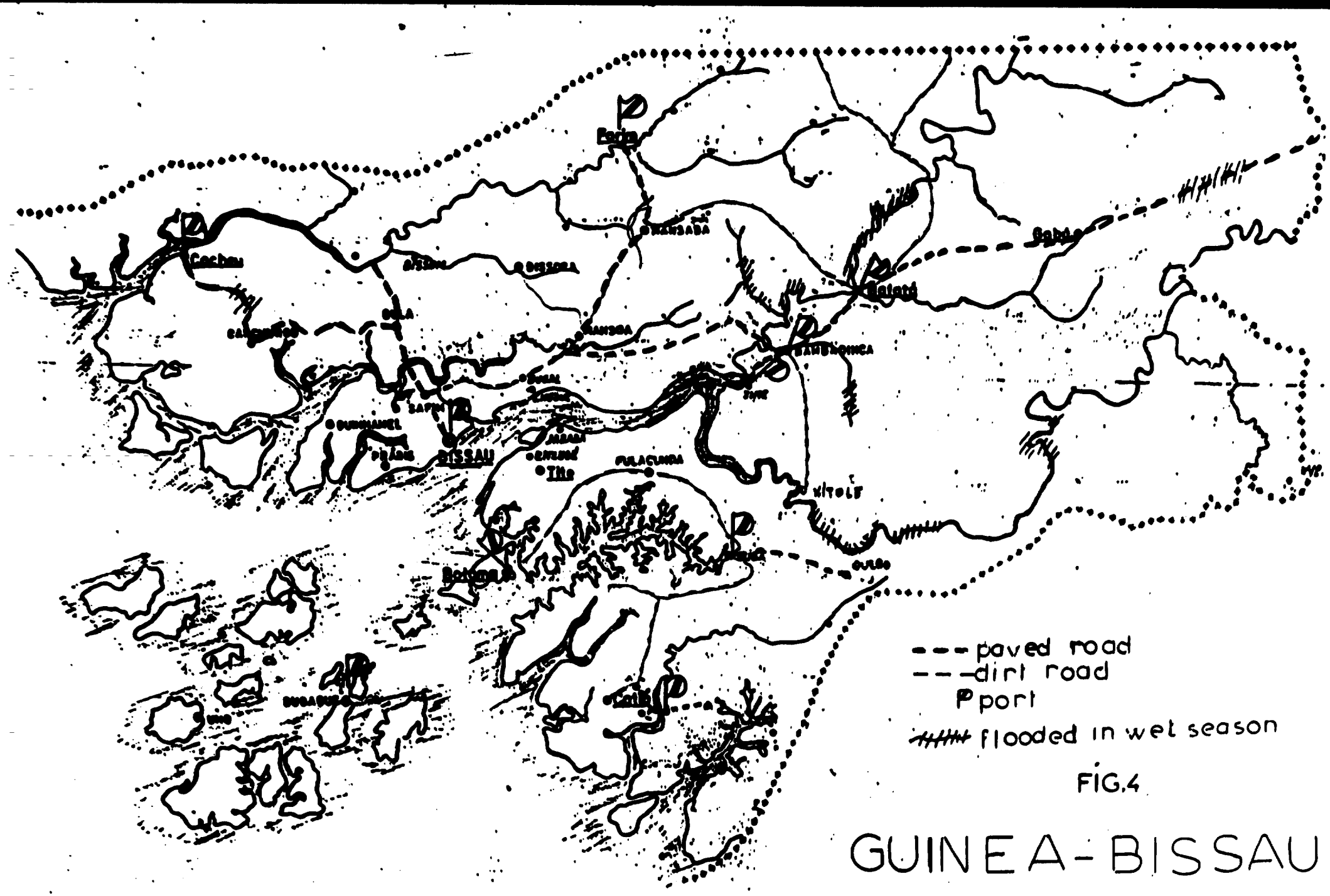

FIG.4

GUINEA-BISSAU

TABLE 1

ESTIMATED FUEL AND LUBE OIL DEMANDS IN TONS

	1990	1995	2000
DIESEL			
Transport	9,400	15,280	22,838
Ships/Army/Constr.	12,970	13,069	13,426
Power Generation	16,000	25,000	35,300
Total 1 in Tons	38,370	53,349	71,564
Total 1 in M3	45,700	63,540	85,233
Power Generation Less Saltinho Power	16,000	9,168	14,232
Total 2 in Tons	38,370	37,515	50,496
Total 2 in M3	45,700	44,680	60,140
GASOLINE (SUPER)			
Transport/Fishing	7,456	12,116	18,106
Transport/Fishing in M3	10,080	16,380	24,480
LUBE OIL			
Diesel transport	100	162.50	242.80
Gasoline Transp.	90	146.20	218.00
Ships/Army/Constr.	138	139	142.70
Power Generation	172	271	380
Total	500	718.70	983.50

TABLE 2

NUMBER OF VEHICULES IN GUINEA-BISSAU

Basis: 1. 7,000 vehicules in 1989 with 60% gasoline and 40% diesel
2. Assume 60% of vehicules running for 1989
3. Growth of 1,000 vehicules/yr as shown by trend since 1986
4. Assume 70% of vehicules running from 1990 until 2000

	1989	1990	1995	2000
Nb. of Veh. registered	7,000	8,000	13,000	18,000
Nb. of Veh. running	4,200	5,600	9,100	13,600
Gasoline Vehicules	2,520	3,360	5,460	8,160
Diesel Vehicules	1,680	2,240	3,640	5,440

TABLE 3

FUEL AND LUBE OIL CONSUMPTION FOR VEHICULES

Basis: 1. Per breakdown of year 1986 assume for gasoline vehicules 30,000 Km/yr at 10 liters/100 Km and 30 liters of lube/yr.
2. Per breakdown of year 1986 assume for diesel vehicules 50,000 Km/yr at 10 liters/100 Km and 50 liters of lube.

	1989		1990		1995		2000	
	fuel	lube	fuel	lube	fuel	lube	fuel	lube
Gas. M3	7,560	75.6	10,080	100.8	16,380	163.8	24,480	244.8
Dies.M3	8,400	84	11,200	112	18,200	182	27,200	272
Gas. Tons	5,592	67.6	7,456	90	12,116	146.2	18,106	218
Dies Tons	7,053	75	9,400	100	15,281	162.5	22,838	242.8

TABLE 4

NUMBER OF VEHICULES AND FISHING VESSELS IN GUINEA-BISSAU

	1986	1987	1988	1989
GASOLINE				
Light Vehicules	1695			
Taxis	465			
Army	n.a.			
Light Fish.	n.a			
DIESEL				
Interurb. Buses	330			
Light Vehicules	850			
Heavy Vehicules	88			
Bissau Buses	18			
Ambulances	22			
Light Trucks	176			
Tractors	120			
Army	n.a.			
Imports	-	570	1,257	1,000
Total	3,764	4,324	5,581	6,681

FISHING VESSELS

Estrella do Mar	2x750 Hp 3x800 Hp 2x1,000 Hp 4x305 Hp 1x1150 Hp 1x600 Hp	total of 8,800 Hp
Semapesca	1x400 Hp 3x500 Hp 2x150 Hp	total of 2,200 Hp
Guialp	2x1100 Hp	total of 2,200 Hp

notes: 1. Data provided by Customs, Ministry of Energy, Ministry of Transport and Ministry of Fishing.
2. Guialp will be operational second semester 1989.
3. Half of Semapesca fleet not operational.
4. as of mid-February 1989, 153 vehicules were imported. This confirms the actual trend of 1,000 imports per year.

TABLE 5

FUEL AND LUBE OIL CONSUMPT. FOR FISHING VESSELS. ARMY AND CONSTR.

Basis: 1. Vessels go out for 35 days, are in port for 9 days after each trip and for 2 months repair: total nb. of days out to sea is 250 days.
2. Growth of fishing vessels (joint-ventures or national co.) is unpredictible at this stage; assume no growth between 1990 and 2000.
3. 0.180 liter per Hphour.

	1989		1990		1995		2000	
	fuel	lube	fuel	lube	fuel	lube	fuel	lube
Est. do Mar	9,328	93.28	9,328	93.28	9,328	93.28	9,328	93.28
Semapesca	1,166	11.66	1,166	11.66	1,166	11.66	1,166	11.66
Guialp	1,166	11.66	2,332	23.32	2,332	23.32	2,332	23.32
M.E.S*	780	7.80	780	7.80	780	7.80	780	7.80
SOMEC*	612	6.12	612	6.12	612	6.12	612	6.12
Soares Da Costa*	412	4.12	412	4.12	412	4.12	412	4.12
Others*	360	3.60	360	3.60	360	3.60	360	3.60
Army/Navy*	360	3.60	400	4.00	500	5.00	800	8.00
Light Fishing Vessels*	50	0.50	50	0.50	75	0.75	100	1.00
Total-M3	14,234	142.30	15,440	155.40	15,565	155.65	15,990	159.9
Total Tons	11,951	127.0	12,970	138.0	13,069	139	13,426	142.7

*sources: Ministry of Energy

TABLE 6

GASOLINE/DIESEL STOCK DAYS IN SERVICE STATIONS
PER ESTIMATED DEMAND

		CAPACITY EN M3		STOCK DAYS							
				1989		1990		1995		2000	
		Gasoline	Diesel	Gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel
I	BISSAU	43	25	3.7	1.7	2.5	1.3	1.5	0.8	1,0	0.5
II	CANCHUNGO	40	30	49.0	33.2	37.0	25.0	22.7	15.4	15.2	10.3
III	BULA	21	15	23.4	15.1	17.5	11.3	10.8	6.9	7.2	4.6
IV	FARIM	5	10	6.2	11.1	4.6	8.3	2.8	5.1	1.9	3.4
V	GABU	5	8.5	5.7	8.5	4.1	6.4	2.7	3.9	1.7	2.6
VI	BAFATA	8.5	8.5	3.9	3.5	2.9	2.7	1.8	1.6	1.2	1.1
VII	BUBA	5	16	4.6	13.4	3.5	10.0	2.1	6.1	1.4	1.9
VIII	CATIO	20	30	27.7	25.2	20.9	18.8	12.9	11.6	8.6	7.7
IX	BUBAQUE	10	10	56.2	50.6	41.5	37.6	25.5	22.9	17.1	15.4

TABLE 7

ESTIMATED DIESEL FUEL DEMAND VS. ESTIMATED POWER GENERATION DEMAND
FOR REGIONAL CENTERS

REGION	1990				1995				2000			
	Peak* KWh	MWh Year	Tons Year	M3	Peak* KWh	MWh Year	Tons Year	M3	Peak* KWh	MWh Year	Tons Year	M3
BAFATA	935	4,086	1,065	1,271	1659	7267	1889	2254	2326	10188	2649	3160
GABU	386	1690	439	524	697	3053	794	947	978	4284	1114	1329
BOLAMA	195	854	222	265	298	1035	339	404	417	1826	475	567
CATIO	175	767	199	237	402	1760	458	546	563	2466	641	765
CACHEU	96	421	109	130	216	946	246	293	304	1331	346	413
FARIM	213	933	243	290	397	1739	452	539	557	2440	634	756
BISSORA	128	561	146	174	312	1367	355	424	437	1914	498	594
MONSABA	87	381	99	118	195	854	222	265	273	1196	311	371
MONSOA	159	696	181	216	427	1870	486	580	598	2619	681	812
CACHUNGO	318	139	362	432	487	2133	555	662	683	2992	778	928
BULA	181	793	206	246	398	1743	453	540	558	2440	635	758
BUBAQUE	114	499	130	155	167	731	190	227	234	1025	266	317

* Sources : Master Plan

TABLE 8

ESTIMATED GASOLINE/DIESEL TRANSPORT DEMAND

REGION	POPUL.* IN 1990	% POP.	ESTIMATED DEMAND IN M3							
			1989		1990		1995		2000	
			Gasoline	Diesel	Gasoline	Diesel	Gasoline	Diesel	Gasoline	Diesel
I BISSAU	146,000	63.48	4800	5340	6398	7110	10,398	11,398	15540	17266
II CANCHUNGO	9000	3,92	296	330	395	439	642	713	960	1066
III BULA	10000	4,34	328	363	438	486	711	790	1062	1180
IV FARIM	9000	3.92	296	330	395	439	642	713	960	1066
V GABU	10,000	4.34	328	363	438	486	711	790	1062	1180
VI BAFATA	24,000	10.44	788	875	1052	1170	1710	1900	2556	2840
VII BUBA	12,000	5.22	395	437	526	585	855	950	1278	1420
VIII CATIO	8,000	3.47	264	290	350	388	568	632	849	945
IX BUBAQUE	2,000	0.87	65	72	88	97	143	159	213	237
			7,560	8,400	10,080	11,200	16,380	18,200	24,480	27,200

* FROM MASTER PLAN AND CENSUS 1979

TABLE 9
CAPACITY OF TANKAGE FOR 1 MONTH STOCK IN M3 FOR REGIONAL CENTERS

REGION	Gasoline 1990		Diesel		Gasoline 1995		Diesel		Gasoline 2000		Diesel	
	D	T	D	T	D	T	D	T	D	T	D	T
BAFATA/GABU	1490	124	3451	288	2421	202	5891	491	3618	301	8509	709
BOLAMA	NA	-	265	22	NA	-	404	33.7	NA	-	567	47
CATIO	350	29	625	52	568	47	1496	125	849	71	1710	142
CACHU/CANCHUNGO BULA	833	69	1733	144	1353	128	2998	250	2022	168	5808	484
FARIM	395	33	729	61	642	53	1252	104	960	80	1822	152
MONSOA/BISSORA MONSABA	NA	-	508	42	NA	-	1249	104	NA	-	1777	148
BUBAQUE	88	7	252	21	143	12	386	32	213	18	554	46
BUBA	526	44	585	49	855	70	950	79	1278	106	1420	118

D= Demand T= Stock Needed

TABLE 10

TANK SIZES NEEDED FOR
REGIONAL CENTERS FOR ONE MONTH SECURITY STOCK

	1990		1995		2000		TOTAL
	gasol.	diesel	gasol.	diesel	gasol.	diesel	
Bafata	200	300	--	300	100	100	1,000
Bolama	50	50	--	--	--	--	100
Catio	50	50	--	100	50	--	250
Cacheu	100	200	100	200	--	100	700
Farim	50	100	--	--	50	50	250
Monsoa	50	50	50	50	50	50	300
Bubaque	50	50	--	--	--	--	100
Buba	50	50	50	50	--	50	250
Total	600	850	200	700	250	350	2,950

TABLE 11

BARGE SIZE FOR TRANSPORT

DIRECTION	ROUND TRIP KMS	CARGO TONS	Nb.DAYS Per TRIP	DAYS UTILIZATION 100 DWT	150 DWT
Bafata	200	334	2	8	8
Bolama-Buba-Catio	380	195	3	6	6
Cacheu-Farim	500	247	3	9	6
Bubaque	130	79	1	1	1
			Total	24	21

TABLE 12

NUMBER OF AEGB CUSTOMERS IN CITY OF BISSAU

YEAR	M.V	H.V	TOTAL
1981	32	3949	3981
1982	33	4520	4553
1983	46	4775	4821
1984	64	5495	5559
1985	67	5596	5563
1986	73	6500	5873
1988	150	7200	7350 1/

NUMBER OF EAGB CUSTOMERS OUTSIDE BISSAU

CITY	1977	1986	1988 2/
Bafata	150	700	770
Gabu	100	525	577
Bissora	40	140	165
Bolama	143	250	275
Cacheu	63	100	110
Catio	78	200	220
Canchungo		550	605
Bubaque		130	143
Farim		230	243
Mansaba		90	99
Bula.		250	275
Total		3165	3485

*source: EAGB and Ministry of Energy.
notes : 1/ there are 2,000 pending requests for hook-up.
2/ estimated.

1.5 GUINE-GAZ

Butane sales have been stagnant for lack of supply due to shortages of foreign currency for importation. Generally imports have been limited to 600 tons per year. Storage consists of two 250 ton spheroids and four 50 ton cylinders for a total capacity of 700 tons.

To determine needed demand, a seperate study will have to be made to determine each family income, its hability to pay for butane gas and its hability to accept this new form of cooking energy, especially in rural areas where wood and charcoal are extensively used. However we can assume that families that are able to pay for their electric and water bills (i.e. customers hooked- up presently) are also in the position to pay for one 13 Kg butane bottle per month. Based on this assumption and on the number of customers as shown on table 12 we can say that there are approximately 12,000 families that can afford to purchase butane bottles. Sales growth will follow population growth as predicted by the 1979 census:

	1979	1988	1990	1995	2000
Population	767,700	900,000	960,000	1,060,000	1,150,000
Customers	--	12,000	12,800	14,200	15,340
Demand in ton/year	--	1,872	1,997	2,215	2,390
Nbr of 13 Kg bottles	--	12,000	12,800	14,200	15,340

GUINE-GAZ has presently 3,000- 13 Kg and 500- 55 Kg cylinders most of which are in poor condition; accidents have occured in the past as a result. GUINE-GAZ needs to do the following:

- upgrade its bottling facilities (see section on rehabilitation)
- replace all cylinders
- purchase two trucks for hauling to sales points, at service stations and grocery stores
- transport cylinders to major cities
- purchase 3,000- 3 Kg containers to accustom rural areas with this new form of energy and allow Bissau residents to easily transport the bottles (i.e. presently customers sometimes tranport by hand, or roll the bottles on the ground, to the depot for filling after having paid for the gas at the city office located two miles away from the depot).

2. REHABILITATION/REVAMPING OF FACILITIES

2.1 General Comments

We recommand that the revamping of the facilities be done on a comprehensive program and not on a "piece by piece" basis for the following reasons:
- it will be costlier on a "piece by piece basis"
- it is necessary to check the engineering design of the facilities after all the modifications and additions that have occured since the depot was first commissioned
- safer and more efficient installation

Therefore an engineering contractor should be hired to do the following:
- as built of facilities (i.e. drawings)
- evaluate adequacy of design of existing facilities
- establish construction drawings
- establish specifications for equipment, materials and construction
- go out for bids for equipment and materiels
- select equipment and materials and establish delivery schedules
- purchase, expedite, inspect and deliver equipment and materials
- prepare bid documents for construction; select contractor
- mobilize the successeful contractor
- inspect the constructed facilties; follow construction progress
- test and commision the facilities
- establish "as built" drawings
- establish list of spare parts and a parts inventory control
- establish equipment operating and maintenance manuels
- establish facilities operating and safety procedures
- train personel and deliver the facilities to DICOL

2.2 Unloading facilities/Piping

Unloading facilities consist of a newly built jetty in 8 meters of water, 300 meters south of the depot, able to berth 145 meter-10,000 D.W.T. tankers. The terminal consist of the following lines, each equipped with a check and a block valve:

3x6 inch product discharge
1x6 inch spare pipeline
1x4 inch butane discharge line
1x3 inch vapor phase line
1X3 inch water/fire water line with one hydrant
1x3 inch slop line

Midway on the jetty block valves have been installed on a platform for barge loading; in addition a bypass line was installed between the slop and water lines and branch lines from these same two lines run to the eastern part of the platform. The pipelines continue on to the depot with two sets of block valves and an expansion loop on each line. At south-eastern part of the depot piping runs parallel to south wall of the depot on sleepers (at exception of the butane and the vapor phase lines which continue north towards the GUINE-GAZ depot); piping is then buried at the south gate before entering a piping pit,inside the depot,and reemerging to continue, on sleepers, towards the pump house. All piping is new, zinc coated above ground

and wrapped when buried. All valves are 150 pound rated except inlet block valves at tanks 302, 304, 305 and 307 which are 300 pound rating. Connecting pipe for transfer of product between tanks, for unloading from tankers at the pier and for product loading at the pumps is made-up of flexible pipe.

Recommandations

- Unearth all buried piping and verify that it is properly coated and wrapped (i.e.Wrapp hanging loose on 4 inch butane and 3 inch vapor phase lines and tied around the pipes with steel string wire). Provide mechanical protection for these two lines from south-eastern corner of the depot (i.e.buried only at a foot from grade).
- Vehicule cross-over steel structure at south-eastern of the depot is about 3 meters wide. This is not wide enough for safe crossing by large vehicules or trucks; extend width to 5 meters.
- Replace all buried piping, under road, running from tank farm 1 to tank farm 2 and future tank farm 3 being built presently by the cubans. Heavy corrosion and pitting higly visible now. Coat and wrapp as per industry standards.
- Old above grade piping shows signs of external corrosion (i.e. rust and flaking). All old piping should be replaced to avoid contamination of products by internal deposits.
- Paint all above grade piping and color code.
- Tag all lines and all valves.
- As poducts are moved through flexible piping, in header area, considerable spillage occurs (i.e.flexible piping is emptied of its content by hand on half-drums sitted on grade below fixed piping and valves; the recuperated product is then moved, in a bucket, by an operator across the traffic road between the truck loading area and the drum filling area and dumped into drums). For safety and for less product loss it is recommended that the flexible pipes be discarded and permanent piping, with all necessary bypasses for transfer and loading, be installed.
- Install pipe anchors on pipelines between the terminal and the barge landing platform to prevent the free movement of piping between the expansion loop and the terminal.
- Install drain valves at lowest point of product pipelines at the lowest grade point near the terminal.

2.3 Storage Facilities

All storage tanks, as listed in table 26, are dome-roof tanks except tank 313. Two additional 2,000 M3 jet storage and two 50 M3 aviation-gas tanks are now being added. The 50 M3 tanks will be installed in tank farm 1 and the 2,000 M3 tanks in tank farm 3. Installation dates for these tanks is as follows:

TANK Nb.	YEAR
300 to 309	1962
310 and 311	1976
312 and 313	1976
314 and 315	1989

Tanks 306 and 308 were destroyed by an explosion that occured in October 1988. The roof of tank 308 was torn by the explosion. The

explosion was caused by a general-purpose motor-starter placed temporarely between the two tanks.
The piping to the jet fuel tanks is now being replaced by separate inlet and outlet lines to the product pipeline and loading header area with dual block valves at the inlet and a single block valve on the outlet line. All other tanks, at the exception of tank 309, have a single line and a single block valve for loading and unloading. All tanks have sliding level gages.

Recommandations

- Remove tanks 306 and 308. If this is not feasible, then both tanks should be emptied and cleaned internally; there are enough fumes still being generated, in tank 308, by the mixture of burned fuel and foam to create an explosion hazard.
- Empty all other tanks and inspect for sediment build-up, scaling, surface corrosion and pitting. Clean, repair (i.e. one tank shows signs of seepage through a manhole) , sandblastand repaint as per industry standards.
- Install separate inlet and outlet lines with proper number of valves for ease of operation and to avoid product contamination. There is more product being lost now by spillage than can be unnecessarely stored in an additional line to the tanks.
- Inspect all P/V valves and repair or replace if necessary.
- Install sample taking facilities at terminal in product pipelines to check product quality (i.e. water contamination) during tanker unloading).
- As all tanks have flat bottoms, install filters and filter-seperator inside the depot for incoming jet and aviation-gas fuels being unloaded from the tankers. With proper piping and recirculation pumps these same filters and filter-separators can remove any remaining water or sediments from the tanks.
- Clean and drain all new piping before putting into operation (i.e. dirt, sand, welding rods, tools etc, left out during construction)
- Check proper grounding of all tanks; check continuity of grounding mats at connection points and at ground rods; check electrical continuity at valves and piping flanges.

2.4 Loading System

- In pump house they were six transfer/loading pumps, each dedicated to one product. Only three pumps remain; two inside the pump house for jet fuel and gasoline and one underneath the E slop tanks for diesel. A very complex set of valves, bypass lines, flying pipes are used for receiving of fuel pumped by ship tankers, transfer of product from one tank to another, loading of road tankers and drums.
- The 15 Kw jet fuel pump leaks through its seals (approximately one gallon per hour at standstill). A temporary hose connects the seal to a pan in the header area outside the pump house; jet fuel leaks to the floor and to the cable trench inside the pump house.
- Lube oil leaks through the gasoline transfer pump seal to the floor and seeps through the foundation.
- All other pump-motor sets have been removed. Foundation bolts have corroded since and the foundation of the kerosene pump is chipping

away. The cable trench is soaked with a mixture of dirt and fuel and the shield of the cables has rusted.
- The diesel fuel pump located underneath the E slop tanks has lube oil leaking through its seal to the foundation and floor. The start-stop pushbutton for the motor is placed in a wooden junction box!
- Transfer lines then run from the pump house piping headers to filters, water filter-separators for jet fuel, then to loading arms or flexible piping for jet fuel loading.
- There were three filter-separators for jet fuel and aviation gas. One has been removed and one is presently disconnected. There were seven loading arms; of the remaining four three are leaking through flanges.
- When loading gasoline or diesel road tankers fuel leaks heavely through flanges between the loading arms and pipe. For the time it takes to fill the road tankers several gallons of fuel are spilled. A bucket is placed underneath to catch the fuel; most of the fuel runs to the ground underneath the road tanker to the traffic road between the loading arm area and the drum filling area.
- There are three drum filling points at the drum filling platform, each dedicated to one product: gasoline, diesel and kerosene. Each point is fitted with 2-200 liter gaging reservoirs, a metering valve and dual hoses for drum filling. The gaging tanks and the metering valves are inoperative and are bypassed; metering is done with a manuel dip-stick regarless of the shape of the drums (some drums are pretty well deformed outward on the walls).
- Gasoline and diesel are also pumped to a service station in front of the lube storage building inside the plant. The pumps at the service station are hand operated. These pumps were dedicated to DICOL's vehicule fleet; instead they are used to service government, international organizations cars and deliver fuel to anyone in possession of a "requisition" paper. There are at least 30 cars per hour going to this service station trough the already crowded depot.

Recommandations

- Replace all loading pump-motor sets. Purchase one stand-by unit for each set with spare parts for two year or three year operation.
- Check foundations, recure and replace corroded anchor bolts.
- Remove all wiring in cable trench inside the pump house; clean and dry the trench.
- Replace all pressure gages on suction and discharge of pumps.
- Remove all starters inside the building; new starters should be located in the new motor control center.
- Remove the start-stop pushbutton and its wooden box located next to the diesel pump-motor set and replace by an explosion-proof unit.
- Replace all filters.
- Replace all loading arms.
- Replace the two inoperative filter-separators.
- Replace the loading pump start-stop pushbuttons inside the pump house and at the loading arms platform.
- Replace the metering valves and hoses at the drum filling points.
- Close the depot to vehicule traffic. Use the service station for DICOL's vehicules only. Build additional service stations in the city of Bissau (see section 1.3).

- Remove and replace all inoperative wiring and lighting in the pump house, underneath the E tanks, around the loading arms area and in the drum filling area. Remove the temporary incandescent lights inside the pump house above the loading pumps. Check for grounding continuity and proper bonding.

2.5 Skimmer/Slop System

One oil separator with a bay and a skimmer is located south of the pump house. It was equipped with a pump to transfer contaminated fuel to a 10 M3 vertical decanter vessel located next to the separator. Piping runs to a transfer pump (now removed) to pump dewatered fuel to the 4x10 M3 E slop tanks or to pump slop tanks content to the terminal at the pier. Liquids drained from storage tanks run by gravity in gutters to the inlet of the oil separator. Excess liquid or water from the separator is drained to the river, trough 10 inch pipes, south of the depot.

Recommandations

- Replace all pumps.
- Reconnect and recommission the whole system.
- To prevent pollution of the river place a branch line from the slop transfer line outside the depot to a burning pit south of the depot. The burning pit can also be used for fire-fighting drills.

2.6 Water/Foam/Fire Fighting System

- Water comes from two wells, one west of the utility building and the other south of the lube storage building. The water well pumps have been removed or abandonned. Water pumping and transfer system is located in a building next to the main water storage tank next to the utility building. In this building there are three pump-motor sets (2-10 Hp, 1-15 Hp), a 2-M3 pressure tank, 2-1 M3 surge tanks, electrical starters, lighting and wiring. Everything in this building has rusted and has been abandonned.

From the main open-air water storage tank piping runs to two water pumps, one electric motor-driven, one diesel engine-driven, inside the utility building. There is also in this building a third pump, motor driven, rated at 55 Kw and 90 M3/hour but not connected to the system. The diesel-engine pump has been out of operation for some time and has been abandonned. Piping then runs to headers outside the utility building, to the foam generator system, to storage tanks for cooling purposes and to fire hydrants througout the depot (7 around tank farm 1, one by tank farm 2, 2 in drum loading area, 2 by drum making facilities, one by skimmer/seperator area, one by truck loading area and one at the terminal).

Water is now being provided by CICER, a brewery 500 meters north of the depot, through a 1.5 inch line. This line runs unprotected above grade, over ditches. Water is available only when CICER is operating (i.e.production of beer is limited to a few hours a day due to lack of raw materials).

- The foam system consists of a liquid chemical storage tank located outside the utility room, water/chemical mixing valves, a 4 inch header with block valves and another header with isolating valves

to independant foam lines to each storage tank and each slop tank.
- There are several hand fire extinguishers around the plant. None of them is in working condition.

Recommandations

- Replace all well pump motor sets
- Replace the diesel water pump set; install an independant fuel storage tank for this set
- Connect the spare electric-motor driven pump to the system; check the adequacy of piping against the pump head.
- Empty and repair the chemical storage tank; the chemical is leaking through the manhole and the sight gage isolating valves.
- Check all buried piping for corrosion and pitting.
- Recommission pressure and surge tanks.
- Provide an electric sump pump to remove spilled water inside the water handling building. Provide also a hand pump.
- Install fire figting turrets (total of 10) in all three tank farms, one at barge landing area and at least one at the terminal.
- Provide hand extinguishers (total of 20) in administration building, in management building, in maintenance building, in laboratory room (now being built), in spare parts storage room, in lube storage building, in drum filling area, in truck loading area, in drum making area and in service station.
- Provide cart-wheel extinguishers (total of 5); one in utility building, one in drum filling area, one in lube storage building, one in the terminal and one in drum making area.
- Purchase spare parts for all equipment for two to three year operation.
- Conduct fire figthing drills in conjunction with the city fire department.
- Install a separate hot telephone line to the city fire department.
- Install a fire siren with actuating buttons or handles at stategic locations.

2.7 Airport Facilities

- The fuel depot consists of 4-50 M3 buried tanks, two of which are not being used (one empty ,buckled at bottom shell,interior surface corroded at points and body inclined away from the mechanical drain pump; the other full of water). There are also two filter-separators (one for inlet and the other for outlet), two 10Hp electric motor driven pumps (one for loading and the other for unloading) and tanker truck fleet consisting of:
    - 2-10 M3 road tankers (only one is operational)
    - 3 servicer trucks (only the 20 M3 unit is operational)
    - 1 trailer with 14 M3 capacity
- Other facilities include an underground water storage tank with a motor driven pump, an administration building, a hangar for the tanker fleet and a spare parts storage and maintenance shop.
- Fire protection consists of several hand extinguishers, none of which works and a cart-wheel fire unit.

Recommandations

- Recommission the two unused tanks: drain all water, dry, check for surface corrosion, clean, reprime and recoat; For the tank that has settled, relocate the mechanical drain pump on lower end of slope.
- Check for differential pressure build-up on filter-separators and replace filter elements on a routine basis.
- Check and replace filters of truck servicer.
- Empty fueler trucks and check internal coating for corrosion.
- Purchase spare parts for fuelers that can be salvaged.
- If DICOL's policy is to increase sales (i.e. airplanes do not stop for lack of fuel or refuel at DAKAR or nearby airports) then another 20 M3 fueler with a 20 to 30 M3 trailer should be purchased.
- Check all fire extinguishers and replace those that can not be recharged.
- Install a telephone hot line to the airport fire department.
- Purchase spare parts for motor pump sets and filter elements.

2.8 Filling Stations and Road Tanker Fleet

Table 25 shows details of service stations and tanker trucks in the capital and in the rest of the country.
All service stations are in poor condition: motor pumps not working at certain locations; filling done by hand; lighting not working; fire extinguishers not available or abandonned; excessive spillage as evidenced by soaked grounds.
Road tanker fleet is old and consists of too many makes (i.e.some trucks donated by different countries) with no meters or meters that have been removed. Several road tankers have been abandonned, due to lack of spare parts, and lay half stripped in the depot.

Recommandations

- Replace pump motor sets in service stations
- Refuse to fill customer's plastic containers in service stations.
- Install adequate lighting
- Replace fire extinguishers.
- Recommission abandonned service stations (Shell in Bissau, Mobil and BP in Bafata, etc.)
- Purchase new road tankers equipped with meters.
- Purchase spare parts for service stations and road tankers for two to three year operation.

2.9 Safety/Security

We can definetly state that DICOL's depot is unsafe and not secured. Besides the run-down condition of the installation we noticed a total lack of awarness of danger at several occasions while handling dangerous products:
- While pipe welding was carried out at 3 meters from the pump house, operators were emptying, by hand, the contents of flexible piping into buckets resulting in spillage on the ground and on the operators clothing.
- While an operator was checking the overheating of the diesel transfer pump motor by putting one hand on the motor frame he was at the same time actuating the start-stop pushbutton of the motor placed in a home-made wooden juction box!

- Electric bonding of a road tanker was established only after filling of the truck was well underway
- An operator showed us a spare motor for the product transfer pumps which was stored in the utility building: neither the enclosure nor the terminal junction box of the motor are of explosion-proof design!
- Moving of fuel in open buckets across the depot's roads with heavy vehicule traffic.
- Splillage of product in the drum filling area by removal of excess product by hand (i.e. measurement with a dip-stick).
- Excess lube oil on the floor in the drum making area
- Leakage of fuel from customer's road tankers.
- Spilled fuel underneath road tankers being loaded at the loading arms area, aroud transfer pumps, in the piping headers outside the pump house.
- Spilled and leakage of lube oil around pumps, around abandonned diesel generators and diesel water pump.
- Lack of fences around tank farm 2;
- Lack of perimeter lighting to discourage intruders.
- Large amounts of fuel in skimmer/separator.
- Access to or regress from the various buildings blocked by abandonned cars, trucks, pick-ups, road tankers, piping, valves and containers. This will limit access to the fire department vehicules and can cause injury to personnel in case of emergency or fire.
- "Taking" of fuel by DICOL's personnel in plastic containers.

Recommandations

Hire a Safety engineer to:
- establish and apply safety procedures and instructions
- identify all possible sources of fire, explosion and apply corrective measures.
- train personnel on their own safety and safety of the depot.
- conduct fire drills with all personnel.
- simulate emergency situations which could occur at the depot and establish effective measures to deal with these situations and make sure that all personnel know their role when these emergencies occur.
- train all personnel to be familiar with the fire alarm system and the correct procedure for calling the city fire department.
- train all personnel for first aid treatment
- install washing facilities for removal of product when in contact with skin or clothing.
- establish procedures for entering a pit, a tank or doing "hot" work.
- establish procedures for doing repairs.

2.10 Fuel Loss and Fuel Theft

Earlier reports have dealt with this problem at lenght; The following table shows losses in liters for the years 85,86 and 87: (data for 1988 was not ovailable)

	1985	1986	1987	TOTAL
Gasoline "regular"	115,791	76,401	--	192,192
Gasoline "super "	357,228	370,873	417,767	1,145,868
Diesel	139,243	50,217	152,015	341,475
Jet A1	66,639	12,3[illegible]	46,565	125,550
Kerosene	32,775	29,1[illegible]	39,005	100,906
Aviation-gas	24;943	12,671	--	37,614
Total	736,619	557,634	655,352	

As compared to consumption for the same periods losses expressed in percentages represent: 8.5% for "regular", 8.7% for "super", 0.56% for diesel, 7.3% for kerosene, 1.25% for jet A1 and 21.0% for aviation-gas.
Except for aviation-gas losses, which can not be explained, we notice that the products that have experienced heavy losses are gasoline and kerosene; products that are used for vehicules and home use. Secondly the figures listed above reflect the losses experienced by DICOL and do not reflect the losses "downstream". For example Bissau EAGB power generating station "received", in accordance with DICOL,for 1987 and 1988 respectively 6,540,496 and 8,123,755 liters of diesel fuel, yet temporary installation of meters, for the same periods at the power station, showed actual receipt of only 6,141,449 and 7,780,470 liters respectively which represent to EAGB a lossof 6.5% and 4.2%. It is hard (or easy) to explain how 735,022 liters of fuel can dissapear in a 2 mile journey between the depot and the power station.
These losses can be attributed to:
- spillage (not more than 2%)
- shrinkage (not more than 1%)
- theft (5 to 6%)

Since there are no figures on downstream losses (i.e. Bafata power station, service stations, large consumers, etc..) we can assume that theft takes care of 10% of imports. By observing DICOL's employees "taking" fuel in plastic containers and bottles, we can predict that no more than 1,000 liters per week or 50,000 liters per year are removed in this manner. This represent only 2% of total fuel losses. The question remains: WHO is stealing the fuel???

Recommandations

- Hire a "loss" prevention officer who will, for two years, investigate fuel theft and who will answer only to government officials and to the Ministry of Justice.
- Provide metering facilities at all large customers such as AEGB, army, fishing fleets, etc;;;
- Provide meters at all loading arms.
- New road tankers should be purchased with integrated meters.
- Install permanent piping as explained elsewhere in this report.
- Replace drum metering valves at filling points.
- Install meters on incoming product pipelines.
- Install laboratory equipment in lab room to test quality and density of products unloaded by ship tankers.

- seal openings of road tankers leaving the depot.
- Recommission skimmer- separator and slop tanks.
- Confiscate bottles and plastic containers entering or leaving the depot; check contents of cars, buses and trucks leaving the depot.
- Install fence and perimiter lighting around all of the depot's facilities; patrol the area at night.

2.11 Electrical Facilities

- Power was supplied by three engine-driven 380 Volt,3 phase, 50 Hz generators: one rated at 50 Kw and the other two at 25 Kw each. The switchgear consists of free standing panels: one control panel for each engine-generator and a motor control section for power distribution and protection.
Each generator panel consists of a circuit-breaker, voltage regulating rheostat, ampmeters, voltmeter, engine speed control, diesel-engine start-stop pushbuttons and lube oil pressure alarm and shutdown lights. In addition each generator panel is provided with synchronizing gear for parallel operation.
One panel consists of a circuit-breaker, selector switch, watthour meter, voltmeter and phase ampmeters for connection to stand-by outside utility power. As the generators have been stripped and removed, main power is supplied to this panel from CICER through an exposed fuse box mounted on the depot's west wall. The power cable from the fuse box to the utility room runs along the north wall, above grade, unprotected (the water pipe from CICER runs parallel, above grade, to tne power cable). Often power is not available due to rationing by CICER to save fuel (i.e. no production of beer due to shortages of raw materials).
Another panel with similar gear supplies power to the near-by GUINE-GAZ.
The 3 motor control sections consist of circuit-breakers, start-stop pushbuttons and indicating lights to all the plant motors (i.e. transfer pumps and water pumps), lighting contactors for indoor and outdoor lighting, ON-OFF switches to the drum making facilities, as well as alarm lights and start-stop switches for the diesel-driven fire pump.
The only sections in use are the incoming power, the feed power to GUINE-GAZ, feed to the drum making area and a portion of the lighting contactors. Most wiring inside the panels has been disconnected from the terminal boards and is a source of danger to personnel as well as a potential source of short circuits and resulting fires.
- Around tank farm 1 lighting consists of screw-type bulbs mounted on 10 meter poles with a weather-proof junction box at the base, some of which are ungrounded. Around tank farm 2 lighting consists of sodium-vapor lamps mounted on 10 meter poles with lighting starters in weather-proof enclosure at the base of the poles; none of the poles are grounded. Lighting on the pier up to the termina' consists of screw-type bulbs mounted on 5 meter poles, none of which is grounded. Lighting inside the pump house, over and below the slop tanks, over the loading arms and in the drum filling area is of

explosion-proof design but is inoperative. Temporary lighting inside the pump house, consisting of screw-type bulb with no guard, has been installed.
- Cables consist of PVC insulated, 600 volt and tape shield wiring. The shield shows signs of heavy corrosion and most wiring has been abandonned. Temporary wiring, with no supporting steel wiring, goes from the pump house to the slop tank area and dangles about 2 meters from the ground. Cables and junctions boxes inside the pump house have severely rusted. 3-conductor cable, inside the utility room, to the 50 Kw generator exposed live 10 cm from the floor. Insulation of cables to outdoor lighting poles west of tank farm 2 has been cut and copper conductors are exposed live. Temporary cable from the switchgear to a disconnect switch inside the utility building runs on the floor unprotected.
- The start-stop switch for the diesel transfer pump is installed in a home-made wooden junction box!

Recommandations

- Remove from utility room all diesel engines and abandonned generators and pumps. Lube oil, fed by a wall mounted tank, still leaks from the engines to the floor and present a fire hazard. Remove also the lube oil tank.
- Remove all switchgear, control panels and motor control sections from the building.
- As the building can not accomodate large-size generators, extend the building to the east; or better build another utility building to accomodate also a maintenance shop and a garage for maitenance of DICOL's vehicules.
- Install a continuous duty generator to carry DICOL's load as well as GUINE-GAZ base load. The approximate size of this generator is 150 Kw. CICER power supply will then be used as stand-by power.
- Install an emergency set to carry only critical loads and the electric fire pump. The approximate size of this generator is 50 Kw.
- Install a perimeter fence to enclose all of DICOL's facilities and install perimeter lighting to prevent theft or vandalism.
- Replace all motor pump sets as explained elsewhere in this report.
- Check the adequacy and the continuity of the grounding system. Remove all TEE connections and replace by thermoweld joints. Replace all grounding anodes. install additionel ground wells to obtain the desired low resistance.
- Run at least two ground cables to the pier and the terminal to form a ground loop; ground all lighting poles and junction boxes. Run ground cables to tanks 312, 313, to the two new 2,000 M3 jet fuel tanks and the 50 M3 aviation gas tanks.
- Replace screw-type bulbs in hazardous areas (as defined by API standards) with mercury vapor or sodium-vapor lamps and with starters located away from the hazardous area or in explosion-proof enclosures. Replace housing of sodium-vapor lamps at tank farm 2 with explosion-proof enclosure or relocate the starters.
- Remove the start-stop switch by the diesel transfer pump; replace by explosion-proof design.
- Replace all wiring. Install cables in conduit or run in properly designed trenches. Provide proper seals and ensure filling of seals.

- Check the electrical bonding in piping around flanges and valves to prevent static charges build-up.
- Replace all inoperative lighting with fixtures designed for the area.
- Do not use the spare 10 Hp motor (now in the utility room) in classified hazardous areas.

2.12 GUINE-GAZ Unloading/Loading Facilities and Piping

- Unloading piping consists of a 4 inch product and a 3 inch vapor phase pipelines from the newly built DICOL jetty and terminal. The two new lines run along the other pipelines to the south-eastern corner of DICOL's depot where they connect to the old 4 and 3 inch lines. The lines continue on to the GUINE-GAZ fence where they enter a metering shed. The meter has been out of operation for some time and bypass lines are used for unloading of butane. Separate piping then runs to the 250 ton spheroids and the four 50 ton horizontal cylinders. The spheroids and the horizontal vessels can be connected either in parallel or in series (i.e.vessels can be separetly loaded). All vessels are equipped with vapor return, bypass and drain lines. Drain lines from the spheroids go to drain pit outside the fence while those from the horizontal cylinders go to a drain tank.
- Loading facilities consist of two main 7.5 Kw/380 Volt/3 Phase/50 Hertz motor driven pumps, for transfer from the spheroids to the horizontal vessels, with return bypass and vapor lines, mounted on a skid at the base of the spheroids.
- The spheroids are equipped with dual P/V valves, temperature and pressure gages. Alarms for low level, high level and very high level are provided in an alarm panel near the skid. Motor start-stop and emergency stop pushbuttons are also mounted in an explosion-proof panel next to the alarm panel. An emergency switch actuates a horn mounted on the control building. The 50 ton cylinders are also equipped with dual P/V valves, temperature and level gages; however 3 out of the 4 level gages are out of operation. Piping shows external rust; piping flanges are heavely corroded.

Recommandations

- Replace the two incoming lines from the southeast corner of DICOL's depot to the metering shed. Coat and wrapp properly before burying at proper depth as per industry standards.
- Replace the flow meter and strainers in the metering shed.
- Replace rusted flanges and valves.
- Replace the inoperative level gages.
- Replace the corroded piping in the drain lines.
- Sandblast corroded piping, prime and repaint.
- Sandblast horizontal vessels steel footings, reprime and repaint
- Ground horizontal cylinders at footings seperately.
- Install high level alarms on horizontal vessels and connect to horn alarm system.

2.13 Bottling Facilities

Loading and bottle filling facilities consist of the following:
- two transfer pumps, of which one is out of order, driven by two 3 Hp, 380 Volt, 3 Ph. motors which transfer butane liquid from the horizontal vessels to a pipe header in the covered bottling area.
- Piping then branches to two 55 Kg and three 13 Kg cylinder filling stations. Only one 55 Kg and one 13 Kg stations are still in operation with leaking hoses; the other stations have been stripped.
- The filling stations consist of an automatic fill-stop FISHER control valve and a platform scale. the valve has a filling hose and a stop hose connected to a trip valve on the scale.
- Control air (for operation of the FISHER valve) is supplied by a 3 Hp compressor equipped with a storage receiver and stored in a building next to the control building. Air lines are provided with pressure regulators and moisture filters.
- In filling area there is also a vacum compressor for emptying of bottles and a water trough for cylinder testing.

Recommandations

- Purchase two 3 Hp transfer motor-pump sets with spare parts for two to three year operation.
- Replace corroded valves and flanges around the pumps.
- Replace the suction and discharge pressure gages at the pumps.
- Ground the frame of the electric motors.
- Replace the filling stations that have been stripped; purchase hose sets for those in operation; purchase spare hoses for two to three year operartion.
- Replace paint baking oven and draft fan.
- Ground the frame of the air compressor motor.
- Sandblast, prime and repaint the piping.

2.14 Water/Fire Fighting System/Safety/Security

The water system consists of a well, a well pump (now removed), piping to an underground 100 M3 tank, one 20 Hp electric motor-driven pump, one 20 Hp diesel-driven pump (both pumps now abandonned), piping that runs to the top of spheroids and the horizontal vessels with spray nozzles for cooling purposes and six hydrants around the plant. The water system is totally inoperative. The few hand fire extinguishers available in the plant are out of order.

Recommandations

- Replace the well pump-motor set.
- Replace the 20 Hp electric motor-pump set.
- Replace the 20 Hp diesel-engine motor pump set.
- Replace corroded pipe and pipe that has been dismantled.
- Purchase 6 hand fire extinguishers.
- Purchase two cart-wheel dry powder fire extinguishers; place one in transfer pump area and one in cylinder filling area.

Recommandations

- DICOL's new switchgear and generators should be sized to carry GUINE-GAZ loads; otherwise a seperate emergency generator to carry critical loads, such as the electric fire pump, should be purchased.
- Remove the distribution board; purchase a new switchgear (in the case of a new generator) and motor control center to be placed in an extension of the control building or a new building; leave the maintenance room to storage of spare parts, maintenance tools and minor repairs.
- Check the wiring to all loads and replace where defective.
- Replace all flood lights and ground all lighting pole frames.
- Ground all motor frames and electrical devices.
- Check the bonding and electrical continuity of piping.
- Ground each 50 ton vessel separatly and at two points.
- Check grounding continuity of the whole plant, replace corroded grounding electrodes; drive additional rods to obtain low resistance needed.
- Provide perimeter fence lighting.
- Remove the general-purpose light switch and the floodlights in the cylinder filling area.

3. ORGANIZATION DEVELOPMENT

3.1 DICOL's Organization Structure

Figure 17 shows the present organization structure (or the desired structure since some posts remain vacant) developed with the assistance of PETROGAL.

- Personnel administration is combined with finance and accounting.
- Quality control function does not exist.
- Safety function does not exist or combined with the maintenance function.
- Loss prevention function does not exist.
- The maintenance function is under the operations function.
- Engineering and development functions do not exist.
- Training function does not exist.

Recommandations

- Provided that the depot is rehabilitated on a comprehensive program an outside company should be hired to run the depot for two years, to develop DICOL's organization, to establish all necessary procedures for Operations, Maintenance, Safety and Loss Prevention and train all of DICOL's personnel and engineers to take over at the end of the two year period.
- Should it be not possible to go this route then we recommand that the organization be restuctured as shown on figure 17, and that engineers and selected personnel should be sent for six months training in a similar installation outside of Guinea-Bissau. Training should be conducted for the following functions:
    - operation manager
    - maintenance manager

- personnel administration manager
- engineering/development engineer
- safety/quality control/loss prevention engineer

3.2 GUINE-GAZ organization structure

Figure 17 shows the present organization of GUINE-GAZ.
- The general manager, his secretary and an accountant/clerck for handling of payment vouchers are located in an office in the city of Bissau.
- The superintendant at the depot, which has had no training in handling of hydrocarbons, is assisted by personnel for cylinder filling, refrigerator repair, an electrician, a mechanic and several guards.

Recommandations

- Operations, Maintenance and Safety function should be combined with those of DICOL's under one single responsability.
- Should this not be feasible then we recommand the following:
  - reorganize to a stucture similar to that proposed for DICOL.
  - train all personnel on handling of hydrocarbons.
  - train in similar installations outside of Guiné-Bissau:
    - an operation manager.
    - a safety/quality control engineer.
    - a finance/accounting manager.
    - maintenance technicians to handle all repairs, maintenance and spare parts inventory control.

3.3 DICOL's Maintenance

- As most equipment is broken down, stripped or removed and since virtually no spare parts are available there is no maintenance carried out except on trucks, cars and buses.
- There are no manufacturer's equipment parts lists.
- The maintenance shop which has a couple of filling station meters and parts has been turned into a garage for vehicule repairs..
- The parking lot next to the maintenance shop (intended originally as managment's parking) has been turned into a dump for broken-down trucks, cars, pick-ups all awaiting spare parts for repairs.
- The spare parts shop contains very little spare parts.
- The west end of the lube storage building has been turned into a valve park.
- Broken-down pumps, meters, valves, piping and stripped electric motors are being stored in the area next to the future Operations Manager office.

Recommandations

If the complete revamping of the depot is undertaken then we recommand that the following actions be taken:
- Construct a new building east of the depot and south of GUINE-GAZ facilities to house: maintenance shops, road tanker fleet and a garage. This building can also house the new generators and the new switchgear and motor control center for both DICOL and GUINE-GAZ.

- Remove and dump outside the depot all unsalvagable vehicules, all scraps and abandonned loading arms, fire hydrants,etc...
- Grade the area south and outside the depot for storage of pipe. cable reels, valves fittings, etc..
- Provide in maintenance shop equipment and tools for maintenance. minor repairs and testing.
- Equip the garage to carry out the neccessary vehicule repairs or subcontract to an outside garage if feasible.
- Establish a Maintenance function in parallel with the Operation function and hire or train a maintenance manager to establish maintenance procedures, carry out the work on a scheduled basis, keep records and establish an inventory control and spare parts ordering system.
- Housekeeping should be part of the Maintenance function to keep alleys and roads clear, to remove dry grass, to care for flower beds and to paint buildings

3.4 GUINE-GAZ Maintenance

If the revamping of the facilities is carried-out as recommanded in this report then the following actions should be taken:
- Combine the maintenance activities of both DICOL and GUINE-GAZ into the proposed maintenance and utility building. If this is not possible then we recommand the following:
- Establish a Maintenance function and hire or train a maintenance manager to establish procedures, to carry-out the work on a scheduled basis, collect records, establish an inventory control and spare parts ordering system.
- House keeping should be integrated into the Maintenance function to keep alleys and road clean, to carry out painting of buildings and to remove dead grass and weeds.

4. TRAINING

4.1 DICOL

DICOL has a technical service agreement with PETROGAL to provide training in Bissau and in Portugal. In the past, we were told, PETROGAL provided the following training and courses:
- organization: job description and interrelationship between various departments.
- maintenane: welding, motor rewinding, vehicule repairs, etc..
- administration: salary administration, record keeping, fuel movements, accounting.
- quality control: quality sampling and tests.
- safety: hydrocarbons, type of fires, fire fighting.

In addition, for the last two years, PETROGAL has assigned an advisor called "assessor" to DICOL to act as the Administration, Finance and Accounting manager and who continuously provides guidance to DICOL's personnel in his field of expertise.
In general DICOL's operators are dedicated and motivated and do the best they can to handle the products with the tools at hand; however they seem unaware of dangers in handling highly dangerous products.
DICOL, with the assistance of PETROGAL, have established yearly training programs to upgrade the level of all employees especially those in a supervisory position.Table 27 shows the program for 1989.

Recommandations

- Find the funds necessary to keep-up with this continuous training program to be carried-out either by PETROGAL or by others.
- establish a training monitoring and assessement program to evaluate the results and to modify the training program to best suit DICOL's needs.

4.2 GUINE-GAZ

GUINE-GAZ's personnel has had no training for handling hydrocarbons. Again, in this plant, the personnel is dedicated to getting the job done but unfortunatly lacks the knowledge to handle dangerous products.

Recommandations

Table 18 shows the recommanded training required for 1989.
- find the funds necessary to carry-out this comprehensive program and, if possible, combine with DICOL's.
- establish a training monitoring and assessement program to evaluate the results and to modify the training program to best suit GUINE-GAZ needs.

5. RAISING OF FUNDS/ATTRACTING OF FOREIGN CURRENCY

Recommandations

- We have noted in previous chapters that fuels and lube oil was directly imported by international organizations, embassies and private users who often resale the products at large profits either in foreign currency or in Pesos converted in the parallel market. We recommand that the products imported by private concerns and users be taxed; a 200 USD/ton would produce 100,000 USD per year.
- Impose a foreign currency tax on all imported vehicules (except those imported by international organizations). Assuming a tax of 5,000 USD on 500 new vehicules and 1,000 USD on 500 used vehicules, 3,000,000 USD per year can this way be levied. This amount can be set aside for purchase of approximately 15,000 tons of fuel per year, on a planned and scheduled basis.
- Impose a 100% foreign currency tax on all generator imports (on real purchase value and not on declared value!) and have all generators over 5 KVA registered. Impose a yearly licence fee in Pesos. This will raise revenue and discourage generator imports which impose additional burdens on fuel imports.
- Have all foreigners residing in Guinea-Bissau, on whose earnings are in foreign currency, pay their electric and water bills in foreign currency.
- Enter into negociations with the private sector, local as well as international, for construction and operation of additional depots and service stations. Include a foreign currency tax on fuel imports and sales.

- Some of the major sources of foreign currency income, which has so far escaped taxation, are the numerous international fishing fleets that operate in Guinea-Bissau waters. Due to lack of fuel (and lack of legislation) vessels purchase their fuel and supplies in Dakar, Las-Palmas or even at sea. Table 15 shows the number of vessels that have, as of the end of February 1989, obtained fishing licences. It is recommanded that a value added tax on fuel usage be imposed on these vessels. Total fuel consumption is estimated at 70,000 tons per year, which, at 50 to 100 USD/ton should bring between 3.5 to 7 million USD dollars of revenue per year. These revenues should be used to: revamp DICOL's facilities, build a fishing port with fuel storage and supply shops for these vessels and create 500 to 1,000 new jobs. Once the fishing port is built create legislation to have the fishing vessels get fuel and supplies in Bissau.

6. ALTERNATE FUELS/ENERGY SOURCES

6.1 Fuel-Oil

Conversion to heavy fuel-oils of generating units should be considered only once economic benefits derived from this conversion can be demonstrated. At today's prices there is only a 20 to 22 USD per ton differential between diesel fuel and fuel-oil. Assuming that EAGB can satisfy the present demand estimated at 43,630 MWh (per Electric Master Plan) the fuel demand would be 11,336 tons for diesel or 11,676 tons for fuel-oil. The cost savings will be approximately 195,000 USD per year, while the costs for conversion will be approximately 1.5 to 2 million USD: new product pipeline and storage at DICOL (estimated at 1,000,000 USD), new tranport fleet (150,000 USD), additional storage at the power generating stations, mainly Bissau and Bafata (150,000 USD). heaters and generating unit conversion kits (100 to 200,000 USD); additional costs for heavier maintenance and consumption of spare parts should also be taken into account. Considering only the power being generated by EAGB, which is approximately 27,000 MWh for Bissau and 5,000 MWh for the rest of the country, the fuel consumption is 8,320 tons for diesel and will be 8,570 tons for fuel-oil. The cost savings in fuel will be 143,000 USD; it will take 13 years to offset the capital investment costs. The option to switch to fuel-oil should be considered if and when:
- DICOL 's facilities are rehabilitated (i.e.any funds available shoud go first to preserve present assets).
- EAGB is in a position to satisfy the estimated demand and goes ahead with its programs of rehabilitation of its tranmission and distribution networks, of addition of one 4 MW units at Bissau, construction of the new power plant at Bissau (i.e. russian program) and the replacement of units IV and V at the present Bissau power generating station.
- Saltinho power plant construction is postponed beyond 1995.

If all these conditions are satisfied then this option should be exercised around 1995. Per today's value of the dollar the cost of reconversion will be approximately 2,5 .000 USD for: one 6 inch product line, pumps, meters, filters, 1 ,000 M3 storage tank and 3 road tankers for DICOL depot; pumps, ters, heaters, 4x100 M3

tanks and generator unit conversion kits for EAGB power plants in Bissau: pumps, filters, heaters, meters and 2x200 M3 storage tanks at Bafata; pumps, meters, filters, heaters at Cacheu and Catio and a 100 to 150 M3 storage tank at both locations. Additional piping, foundations, electrical distribution boards and wiring will be needed at all locations. The following table shows the savings that will be realized, for diesel at 181 USD/ton and fuel-oil at 159 usd/ton.

YEAR	GWh DEMAND	DIESEL FUEL TONS	DIESEL FUEL COST in 1,000 USD	FUEL-OIL TONS	FUEL-OIL COST in 1,000 USD	SAVINGS 1,000 USD
1995	96.8	26,168	4,555	25,923	4,122	0,433
1996	103.6	26,936	4,875	27,744	4,413	0,462
1997	110.8	28,808	5,214	29,672	4,718	0,496
1998	118.9	30,914	5,595	31,814	5,063	0,532
1999	126.9	32,994	5,972	33,984	5,403	0,569
2000	135.8	35,308	6,391	36,367	5,782	0,609
2001	145.5	37,830	6,847	38,965	6,195	0,652
2002	155.5	40,430	7,318	41,643	6,621	0,697
2003	166.3	43,238	7,826	44,535	7,081	0,745
2004	178.0	46,280	8,377	47,668	7,579	0,798
2005	190.4	49,504	8,960	50,989	8,107	0,853

6.2 Hydroelectric power

- There are two projects for two separate dams, one near Saltinho and the other near Cusselinta on the Corubal river.
The Saltinho site would produce 18 MW and Cusselinta 40 MW. The first project will consist of 3-6 MW units that will produce 81 GWh in the first phase and 102 GWh in the second phase. The study that was made on this first project concluded that the project was economically viable if the price of diesel fuel was over 145 USD/ton; under this value a diesel-engine generating plant would be cheaper with a useful life of 20 years while the hydroelectric plant life was assumed to be 40 years. The study was conducted in 1985 and the price was estimated at 46.2 million USD; at today's cost the price would be between 55 and 60 million USD.

Recommandation

Based on today's price of diesel fuel(i.e. 181 USD/ton) it is suggested to go ahead with the project.

- There have been several studies to determine the hydroelectic potential of several neighboring countries in the western part of Africa. The idea is to pool electrical power generated by hydroelectric plants built in different countries into a grid system to satisfy the demand of each country especially those that do not have hydrocarbon potential. This would reduce the capital investments of poorer countries when costs are averaged-out. An organization called L'Union Des Producteurs D'Electricité En Afrique

tanks and generator unit conversion kits for EAGB power plants in Bissau; pumps, filters, heaters, meters and 2x200 M3 storage tanks at Bafata; pumps, meters, filters, heaters at Cacheu and Catio and a 100 to 150 M3 storage tank at both locations. Additional piping, foundations, electrical distribution boards and wiring will be needed at all locations. The following table shows the savings that will be realized, for diesel at 181 USD/ton and fuel-oil at 159 usd/ton.

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(UPDA) was formed to pursue this idea. The first study grouped the following countries: Ivory-Coast, Liberia, Niger, Guinea-Conakry, Burkina-Fasso and Sierra-Leone. The second being done now, under FAD/BAD financing, groups the following countries: Mali, Senegal, Mauritania, Gambia and Guinea-Bissau. The third planned study will group Cameroun, Gabon, Tchad, Zaïre, Congo, Rwanda and Burundi. This study will cost approximately 3 million French Francs.

Recommandation

It is recommanded that funding be made available to pursue this third study.

6.3 Residues from Sugar Cane and rice

- The United States Agency for International Development (USAID) has already demonstrated that bagasse, the residue from the cane after juice extraction can be used to produce electric power. The residue from the crushed cane could also be used to create methanol as a high value organic fertilizer. This system of producing power from a gas turbine using biomass could give higher efficiency ratings and involve lower capital costs USAID has been involved in several projects of this type in the West-Indies and South-East Asia.

Recommandation

It is suggested that USAID be contacted for development of a prototype for Guinea-Bissau testing and eventual production.

- USAID believes also that power plants burning rice residues (rice husks and rice straw) are feasible. There exists already a rice mill, in the United-States, that converts rice husks into electricity.

Recommandation

It is suggested that USAID be asked to develop a prototype for testing in Guinea-Bissau and eventual production.

6.4 Solar Energy and Charcoal Stoves

Recommandations

- A study should be conducted in Guinea-Bissau to determine the efficiency of using solar power for telecommunications, water pumping for agriculture, drying of wood and rice. Any recommandation should have a training program for local maintenance .
- Wood and charcoal are extensively used for cooking in open stoves with very low efficiency. Other types of stoves should be developed (or introduced) that use less wood or charcoal and have higher thermal efficiencies.
- Often charcoal is produced by simple combustion of tree tranks (without cutting down the tree),thus leaving most of the tree to rut (i.e.large branches). Introduce in the country better charcoal making techniques and carry out extensive training in the country.

TABLE 13 DICOL'S TRAINING PROGRAM 1989

SUBJECT	COURSE CONTENT	NUMBER OF PERSONNEL 1/		COSTS			
		BISSAU	PORTUGAL	BISSAU 2/	PORTUGAL	TEACHER 3/	SUPPLIERS
Computers	Billing,salery Administra. Accounting,Cost control, Budgets,Trehds, statistics Inventory controls	6 for 4 months	5 for 6 months	9×10^6 pesos	-	32,000 $	30,000 $ 4/
Finances	Accounting, Cash Flow Audits, Purchase Requisitions	continuous	2 for 6 months	3×10^6 pesos	-	60,000 $	-
Quality control	Control Measurements, Hydrocarbon characteristics lab test équipment		1 for 4 months	1.5×10^6 pesos	-	-	60,000 $
Safety/fire Protection	Fuels characteristics, types of fires, explosion sources, Emergency handling, fire fighting equipment	-	2 for 4 months	3×10^6 pesos	-	-	-
Operations	Fuels characteristics, fuel handling,Equipment Stock movements.	-	1 for 6 5/ months	1.5×10^6 pesos	-	-	-
Maintenance	Welding,electrical motor rewinding, car repair etc....	-	2 for 4 months	3×10^6 pesos	-	-	-
Teach equipment 6/		-	-	-	-	-	20,000 $
	Total			21×10^6 pesos		92,000 $	110,000 $

Notes :
1/ Costs for Personnel in BISSAU by DICOL; Costs for DICOL'S personnel in PORTUGAL by PETROGAL
2/ Costs shown are for travel
3/ Teacher in BISSAU : travel ticket ?,000$ + 1,000$/week + 100$ per diem
4/ Equipment + Software dev.
5/ On his return will become the operations Manager.
6/ DICOL will need, to conduct training locally : T.V video, slide projector,vieuwgraph projector books supplies, Xerox machine for approximate cost of 20,000 $.

TABLE 14

GUINE-GAZ PROPOSED TRAINING PROGRAM

SUBJECT	COURSE CONTENT	NUMBER OF PERSONNEL		COSTS			
		BISSAU	OUTSIDE	BISSAU 2/	OUTSIDE 3/	TEACHER 4/	SUPPLIER
Computers	Billing,salary, accounting, cost control Budgets,trends, statistics inventory.	6 for 4 months	3 for 6 months	$4.5X10^6$ pesos	54,000 $	32,000 $	30,000 $
Safety	Fuel characteristics, types of fires, handling of fires, etc.	-	1 for 4 months	$1.5X10^6$ pesos	12,000 $	-	-
Quality control	Control measurements etc.. Lab équipment	-	1 for 3 months	$1.5x10^6$ pesos	9,000 $	-	- Combine with DICOL
Operations	Fuels,Managment stock Movement		2 for 6 months	$3x10^6$ pesos	36,000 $	-	
Maintenance	Managment, Electrical Mecanical, inventory etc..	-	4 for 6 months	$6x10^6$ pesos	72,000 $	-	-
Tech. Equipt.		-	-	-	-	-	20,000 $
	Total :			$16.5x10^6$	183,000 $	32,000 $	50,000 $

Notes : 2/ Costs are from plane ticket
3/ 2,000 month/man living allowance + 2,000 $/month/man for courses
4/ Teacher in BISSAU - Travel ticket 2,000 $ + 1,000 $/week + 100 $ per diem
5/ Training materiel + Equipment : T.V video, slide projector,viewgraph, Books, Xerox machine 20,000 $

TABLE 15

INTERNATIONAL FISHING VESSELS IN GUINEA-BISSAU WATERS 1/

COUNTRY	N.b VESSELS 1988	1989 2/	HP INSTALLED 1988	1989	CONSUMPTION TONS/YR 1988	1989
USSR	13	14	11,500	12,385		
Italy	9	9	8,655	8,655		
Senegal	24	13	14,000	7,195		
Spain	24	14	10,000	6,370		
China	10	8	5,000	4,800		
France	12	14	5,700	6,900		
Korea	9	7	4,000	3,426		
Portugal	10		5,000			
Greece	4		3,000			
Cameroun	1		800			
Gambia	2		1,600			
Total	118		69,255		68,562	

notes: 1/ sources: Ministry of Fishing
2/ number of vessels registered as of February 1989

TABLES

TABLE 16

DIRECT FUEL AND LUBE IMPORTS BY INTERNATIONAL ORGANIZATIONS AND EMBASSIES IN 1986

MONTH	BY	KG		IN
Jan.	--	--		
Feb.	--	--		
Mar.	UNDP	diesel	4,290	1 R.T.
		diesel & super	19,605	2 R.T.
Apr.	Sweden	diesel & super	2,530	11 D
May	France	diesel & super	15,019	2 R.T.
Jul.	USA	super	10,000	1 R.T.
Aug.	USSR	super	3,000	
Sep.	URSS	super	10,000	1 R.T.
	Sweden	super & diesel	10,021	2 R.T.
	Sweden	super & diesel	135,500	730 D
Oct.	France	super & diesel	20,000	2 R.T.
Nov.	UNICEF	lube,super & diesel	5,867	62 D
	Sweden	lube & diesel	4,020	21 D
Dec.	France	lube,super & diesel	22,770	
	Sweden	super & diesel	373,300	2000 D
	UNDP	diesel	21,230	110 D
	Total		657,152	

Sources: Customs
R.T.= Road Tanker, D= Drum

TABLE 17

DIRECT FUEL AND LUBE IMPORTS BY INTERNATIONAL ORGANIZATIONS AND EMBASSIES IN 1987

MONTH	BY	KG		IN
Jan.	USSR	diesel	15,000	
Feb.	UNICEF	diesel	8,415	1 R.T.
	UNDP	super	1,580	1 R.T.
Jun.	UNICEF	diesel	17,363	2 R.T.
	USA	super	10,000	1 R.T.
Jul.	France	lube	630	3 D
Aug.	UNICEF	lube & diesel	16,310	2 R.T.
	USSR	diesel	3,000	
Sep.	USSR	diesel	4,000	
	France	super	33,270	
	USA	super	7,215	
	UNICEF	lube & super	6,660	41 D
	Sweden	super	2,595	15 D
		diesel	46,808	244 D
		diesel	17,300	100 D
	FAD	lube & super	23,650	122 D
Oct.	UNICEF	diesel	8,454	1 R.T.
Nov.	France	diesel & super	26,648	2 R.T.
Dec.	France	diesel	10,080	1 R.T.
	Total		258,978	

Sources: Customs
R.T.= Road Tanker, D= DRUM

TABLE 18

VEHICULE IMPORTS AND FUEL AND LUBE IMPORTS BY PRIVATE CONCERNS IN 1987

MONTH	VEHICULES	KG		IN
Jan.	54	diesel	20,575	107 D
feb.	51	diesel	62,554	339 D
Mar. to Jun. 1/	239	diesel	45,000	
		super	40,000	
		lube	90,000	
Jul.	87	diesel	5,439	35 D
Aug.	50	--	--	
Sep.	54	diesel	865	
Nov.	52	--	--	
Dec.	99	--	--	
Total	570		294,913	

Source: Customs
R.T.= Road Tanker, D= Drum
note: 1/ values for fuel and lube estimated (i.e. records destroyed by water)

TABLE 19

DIRECT FUEL AND LUBE IMPORTS BY INTERNATIONAL ORGANIZATIONS AND EMBASSIES IN 1988

MONTH	BY	KG		IN
Jan.	Sweden	diesel & super	13,703	72 D
	Sweden	super & lube	37,150	190 D
	FAO	lube	27,160	112 D
Feb.	UNICEF	diesel & super	16,643	2 R.T.
Mar.	France	diesel,super & lube	21,355	3 R.T.
Apr.	Sweden	diesel & lube	12,833	
	Sweden	super	1,730	10 D
May	UNICEF	super & diesel	23,914	3 R.T.
Jun.	UNDP	super & diesel	15,000	62 D
	Sweden	super	1,384	8 D
	USA	lube	674	3 D
Jul.	UNICEF	diesel	8,594	1 R.T.
	France	diesel	12,200	1 R.T.
		super	12,093	1 R.T.
Aug.	UNICEF	diesel & super	14,740	
Sep.	Sweden	lube	9,015	50 D
		super	14,640	1 R.T.
		diesel	50,218	1 cargo
	UNICEF	diesel	8,547	1 R.T.
Oct.	Sweden	diesel	2,179	
		super	2,000	23 D
	N.P.L.	diesel	18,782	110 D
	UNICEF	diesel	10,000	1 R.T.
Nov	France	diesel & super	16,816	2 R.T.
	Sweden	diesel	1,800	
Dec.	France	lube, diesel & super	11,945	
	Total		365,115	

Sources: Customs
R.T.= Road Tanker, D= Drum

TABLE 20
VEHICULE AND FUEL AND LUBE IMPORTS BY PRIVATE CONCERNS
IN 1988

MONTH	VEHICULES	KG		IN	
Jan.	79	lube	16,087	80	D
		lube	229		
		diesel	8,000	38	D
Feb.	87	lube	2,042	9	D
		lube	6,120	30	D
Mar.	97	jet	1,500	15	D
		diesel	3,314	18	D
		super	3,760	20	D
Apr.	86	lube	4,400	22	D
		lube	56,368	271	D
		lube	9,700		
		diesel	7,346		
		lube	5,900	23	D
May	116	lube	5,630	31	D
		diesel	29,469	153	D
		lube	2,215	12	D
Jun.	92	lube	2,400	12	D
		lube	2,764	14	D
		diesel	1,200		
Jul.	139	super	23,600	150	D
		super	23,600		
		diesel	28,950	150	D
		lube	15,689		
Aug.	126	--			
Sep.	103	lube	1,045	5	D
Oct.	78	diesl	3,400	16	D
Nov.	94	diesel	10,000	2	R.T.
		lube	13,000	63	D
		lube	8,000	48	D
		lube	600	3	D
Dec.	160	super	1,000	5	D
		super	1,200	6	D
		lube	9,000	45	D
Total	1,257	lube	160,102		
		super	53,160		
		diesel	101,679		

TABLE 21

DIRECT FUEL AND LUBE IMPORTS BY SHIPS IN 1988

NO.	COUNTRY	FLAG	KG		PORT	NAME OF SHIP
192	USSR	USSR	diesel	70,000	Bissau	APPE
			super	17,000	Bissau	APPE
			lube	36,600	Bissau	APPE
266	Conakry	Antig.	super	16,000	Buba	CON-OIL I

TABLE 22

VEHICULE AND FUEL AND LUBE IMPORTS BY DIRECT CONCERNS
AS OF MID-FEBRUARY 1989

MONTH	VEHICULES	KG		IN
Jan.	64	lube	7,780	
Feb.	89	lube	14,620	
		lube	1,150	8 D
		lube	3,600	
		lube	2,000	
		diesel	4,000	
		diesel	3,000	
		super	3,000	
		lube	16,136	80 D
		lube	32,800	160 D
		lube	25,455	2,108 D
Total	153		113,541	

TABLE 23
DIRECT FUEL AND LUBE IMPORTS BY INTERNATIONAL ORGANIZATIONS
AND EMBASSIES AS OF MID-FEBRUARY 1989

MONTH	VEHICULES	KG		IN
Jan.	UNICEF	lube & diesel	3,198	16 D
	Sweden	lube	230	
	UNDP	super	8,000	40 D
	UNICEF	diesel	16,902	1 R.T.
	OMS	lube	3,750	
Feb.	USSR	diesel	8,000	
	UNICEF	super	365	
	USSR	diesel	15,000	
	Sweden	diesel	9,650	50 D
	Total		55,445	

TABLE 24

SERVICE STATIONS IN THE COUNTRY

	Capacity in M3		
	Super	Normal	Diesel
CENTER/BISSAU			
A. Crim	9,840	5,000	9,840
Ronda	9,840	5,000	9,840
Avenida	5,000	8,000	5,000
NORTH			
Canchungo	30,000	10,000	30,000
Bula	16,000	---	5,000
Farim	5,000	---	10,000
SOUTH			
Buba	5,000	---	16,000
Catio	10,000	10,000	30,000
Bubaque	---	10,000	10,000
EAST			
Bafata	8,500	---	8,500
Gabu	5,000	---	8,500
Total	104,180	48,000	142,680

TABLE 26

DICOL'S STORAGE CAPACITY

TANK Nb.	DIESEL	SUPER	REGULAR	JET A1	KEROSENE	TOTAL
301		800				800
302				800		800
303		800				800
304				800		800
305				800		800
307				800		800
309	800					800
310		1,600				1,600
311					1,600	1,600
312	2,170					2,170
313	6,500					6,500
300				800		800
Total	9,470	3,200		4,000	1,600	18,270
Ser. Stat.	143	152				
Airport				200		
314	in constr.			2,000		2,000
315	in constr.			2,000		2,000
1988 consumption	26,036	6,553		4,517	735	37,841

TABLE 25

FUEL CONSOMPTION

1977 - 88 (000m3)

	1977	78	79	80	81	82	83	84	85	86	87	88*	% ano
Gasóleo	12.872	13.965	16.527	17.672	14.930	17.267	19.658	19.222	19.534	17.851	22.799	26.036	+ 6.6
Gasolina-Normal	3.172	2.512	2.820	2.214	2.508	2.834	1.630	2.440	1.509	.752	0	0	
-Super	1.600	2.186	1.490	2.124	2.563	2.848	4.461	3.852	4.349	4.451	4.374	6.553	+ 2.9
Jet Al	1.998	1.834	2.398	2.191	2.358	2.327	1.240	2.122	2.746	3.844	3.355	4.517	+ 7.7
Gasolina de avião	.307	.397	.160	.162	.104	.140	.150	.242	.137	.045	0	0	-
Petroleo	.856	.786	1.027	.939	1.010	.968	.310	.530	.506	.433	.454	.735	- 1.4
TOTAL	20.801	21.680	24.422	25.302	23.473	26.384	27.442	29.105	28.781	27.376	30.982	37.841	+ 5.6
Lubricantes (TONELADO)	?	?	-	29	83	297	277	364	377	637	358	NA	
Butano (TONELADO)			-				600	600					

* Estimado

Tonelado Gasóleo = 1.191 m3
" Gasolina-Normal = 1.347 "
" " -Super = 1.352 "
" Jet Al = 1.253 "
" Gasolina de Avião = 1.364 "
" Petro = 1.240 "
" Média = 1.195 "

Importacões de Produtos Derivados de Petróleo

Tonelados 1988

Fornecedor	Nairo	Data de Descarga	Gasoleo	Gasolina (Super)	Jet A1	Petroleo	Totai	Lubricantes
BP Senegal	Camião Cisterna	19 Abril	177	-	-		177	
"	Save	27 Abril	3885	859	991		5735	
"	First Carrier	23 Junio	2818	1070	1849		5737	
"	Tomde 1	26 Junio	1971	-	-		1971	
"	Petro-Pyle	8 Julio	3795	-	-		3795	
"	Camião Cisterna	11 Novembro	207	-	-		207	
"	Asma	22 "	2832	-			2832	
"	Camião Cisterna	10 Decembro	-	25	-		25	
	Napetcot	15 "	502	626	-		1198	
	TOTAL		16187	2650	2840	-	21677	

Volume média das descargas no barcos 6 X 3545 tonelados -

" " " no Camião 3 X 136 "

PREVISIONS DE POPULATION POUR LES PRINCIPAUX CENTRES (1985 - 2005)

COMMUNE	1979	1985	1987	1990	1995	2000	2005
SECTEUR BISSAU	109214	122993	127962	137801	155909	176396	199576
FARIM	4677	5267	5480	5901	6677	7554	8547
MANSABA	2170	2444	2543	2738	3098	3505	3965
BISSORA	3868	4356	4532	4880	5522	6247	7068
MANSOA	5259	5922	6162	6636	7508	8494	9610
MACRA	1023	1152	1199	1291	1460	1652	1869
BULA	4136	4658	4846	5219	5904	6680	7558
CANCHUNGO	4738	5336	5551	5978	6764	7653	8658
CACHEU	2473	2785	2898	3120	3530	3994	4519
BAMBADINCA	2333	2627	2733	2944	3330	3768	4263
XIME	483	544	566	609	690	780	883
BAFATA	12843	14463	15048	16205	18334	20743	23469
MAFANCO	768	865	900	969	1096	1240	1403
GABU	7524	8473	8816	9493	10741	12152	13749
PITCHE	635	715	744	801	906	1026	1160
BUBA	434	489	509	548	620	701	793
NHALA	200	225	234	252	286	323	365
MANPATA	648	730	759	818	925	1047	1184
QUEBO	2591	2918	3036	3269	3699	4185	4735
BINTA	523	589	613	660	747	845	956
CATIO BOLANTE	4890	5507	5729	6170	6981	7898	8936
CUFAR NOVO	514	579	602	648	733	829	938
MATO FARROBA	1151	1296	1349	1452	1643	1859	2103
CONTUBOEL	2774	3124	3250	3500	3960	4480	5069
BOLAMA	2669	3006	3127	3368	3810	4311	4877
PIRADA	1328	1496	1556	1676	1896	2145	2427
TITE	1222	1376	1432	1542	1744	1974	2233
JUBUDUL	250	282	293	315	357	404	457
GANTOURE	419	472	491	529	598	677	766
BIGENE	1618	1822	1896	2042	2310	2613	2957
TITOLE	330	372	387	416	471	533	603
BUBAQUE	1215	1368	1424	1607	1734	1962	2220

TABLEAU III 4.4 - 1

REPUBLIQUE DE GUINEE - BISSAU : PREVISIONS EN ENERGIE ELECTRIQUE

PERIODE 1985 - 2005 (MODELE ANALYTIQUE : RECAPITULATION)

ANNEE	VILLE DE BISSAU		PROVINCE		TOTAL PAYS	
	Pmax app [KW]	EN.ann. [MWH]	Pmax app [KW]	EN.ann. [MWH]	Pmax app [KW]	EN.ann. [MWH]
1985	5337	31239	2002	9293	7339	40532
1986	5642	33043	2283	10590	7925	43633
1987	6151	35750	2606	12082	8757	47832
1988	6562	38066	2985	13832	9547	51898
1989	6999	40426	3422	15855	10421	56281
1990	7670	43326	3929	18197	11599	61523
1991	8208	46072	4516	20914	12724	66986
1992	8821	49159	5196	24067	14017	73226
1993	9486	52381	5987	27733	15473	80114
1994	10243	56004	6906	31999	17149	88003
1995	11074	59828	7977	36969	19051	96797
1996	11849	64016	8535	39557	20384	103577
1997	12679	68497	9133	42326	21811	110823
1998	13566	73292	9772	45289	23338	118581
1999	14516	78422	10456	48459	24972	126881
2000	15532	83912	11188	51852	26720	135764
2001	16619	89786	11971	55481	28590	145267
2002	17782	96071	12809	59365	30591	155436
2003	19027	102796	13706	63520	32733	166316
2004	20359	109991	14665	67967	35024	177958
2005	21784	117691	15692	72725	37476	190415

FIGURES

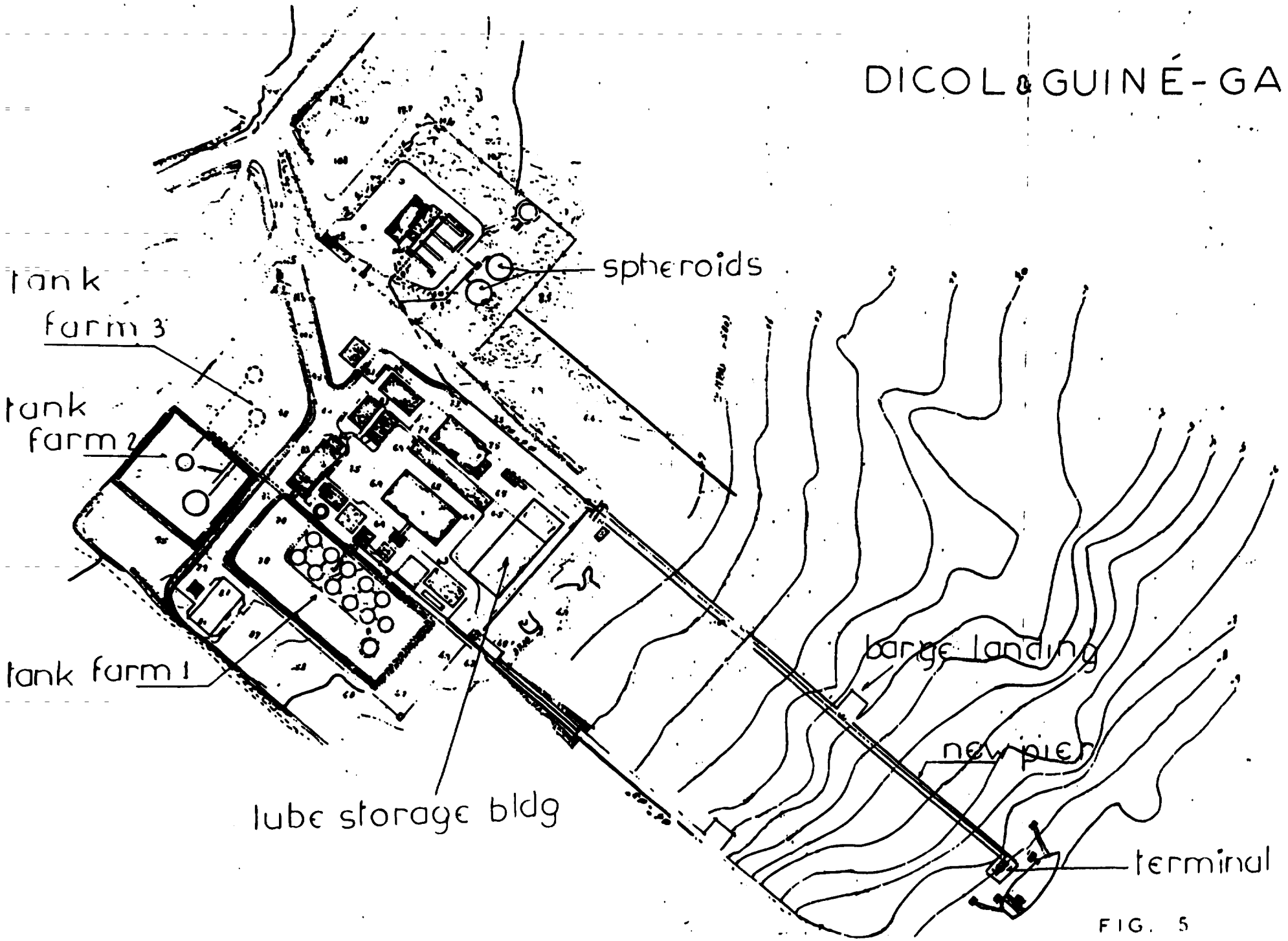

DICOL & GUINÉ-GAZ
spheroids
tank farm 3
tank farm 2
tank farm 1
lube storage bldg
barge landing
new pier
terminal

FIG. 5

DICOL DEPOT

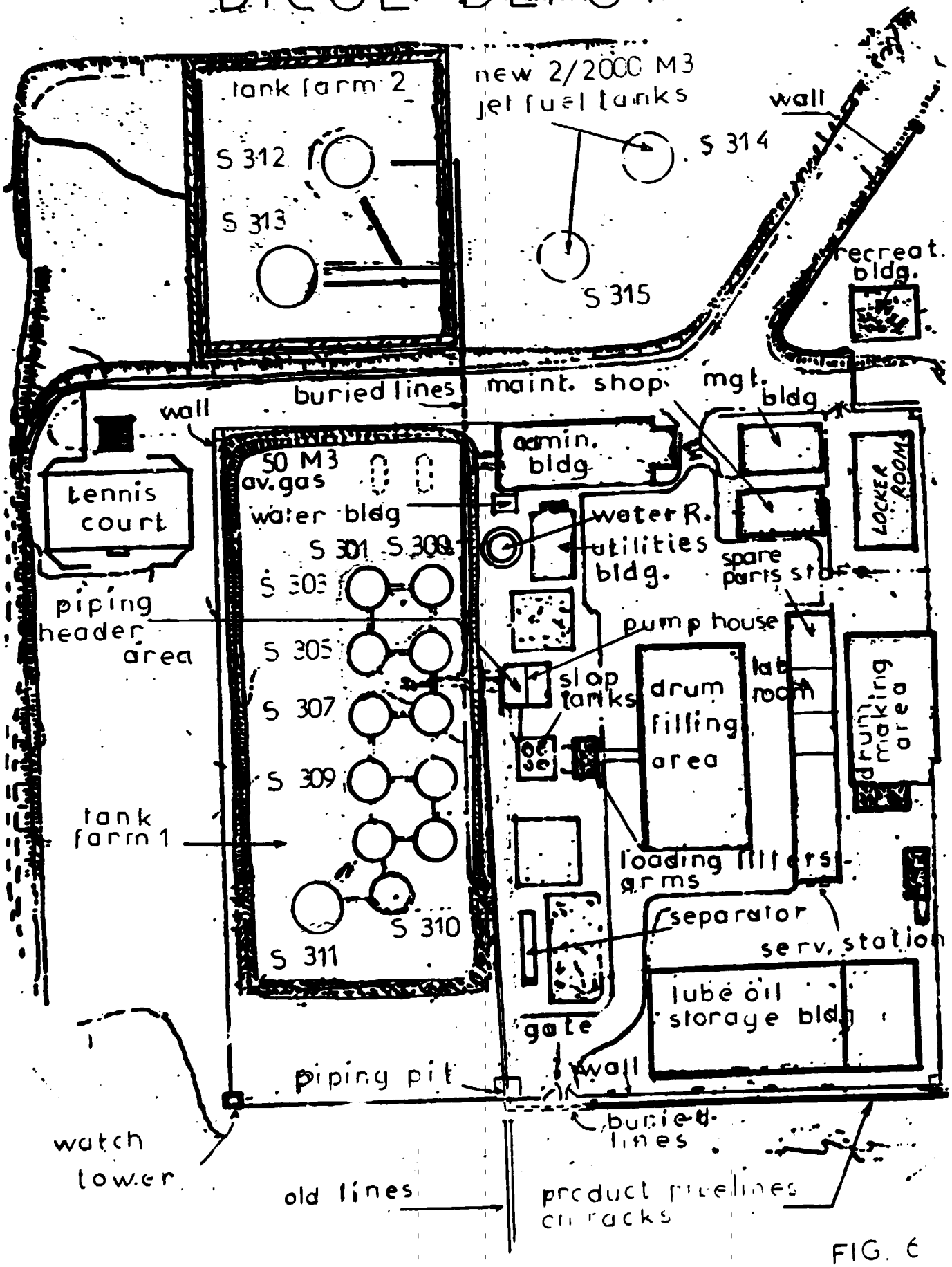


FIG. 6

JET FUEL SYSTEM

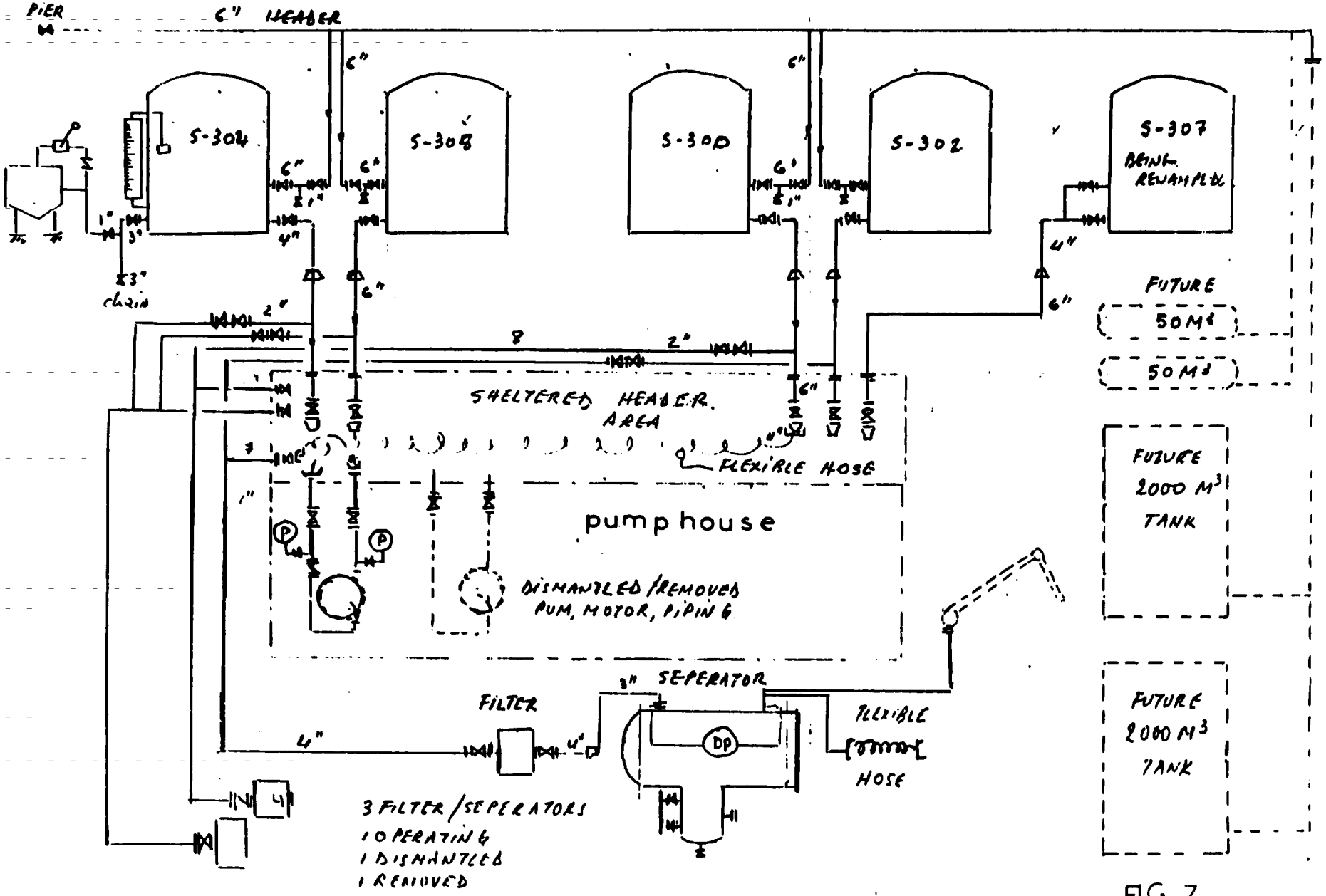


FIG. 7

DIESEL FUEL SYSTEM

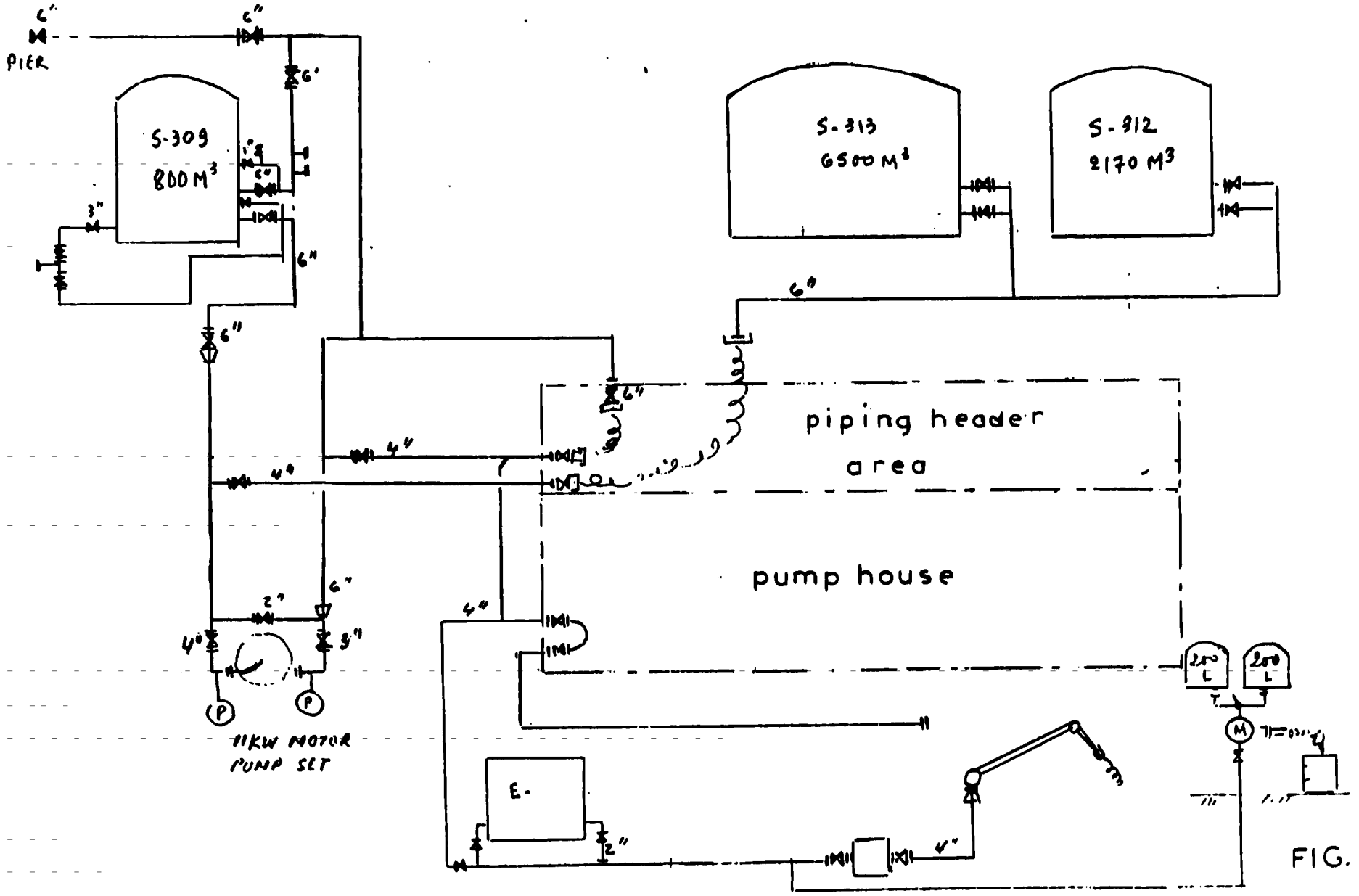


FIG. 8

GASOLINE SYSTEM

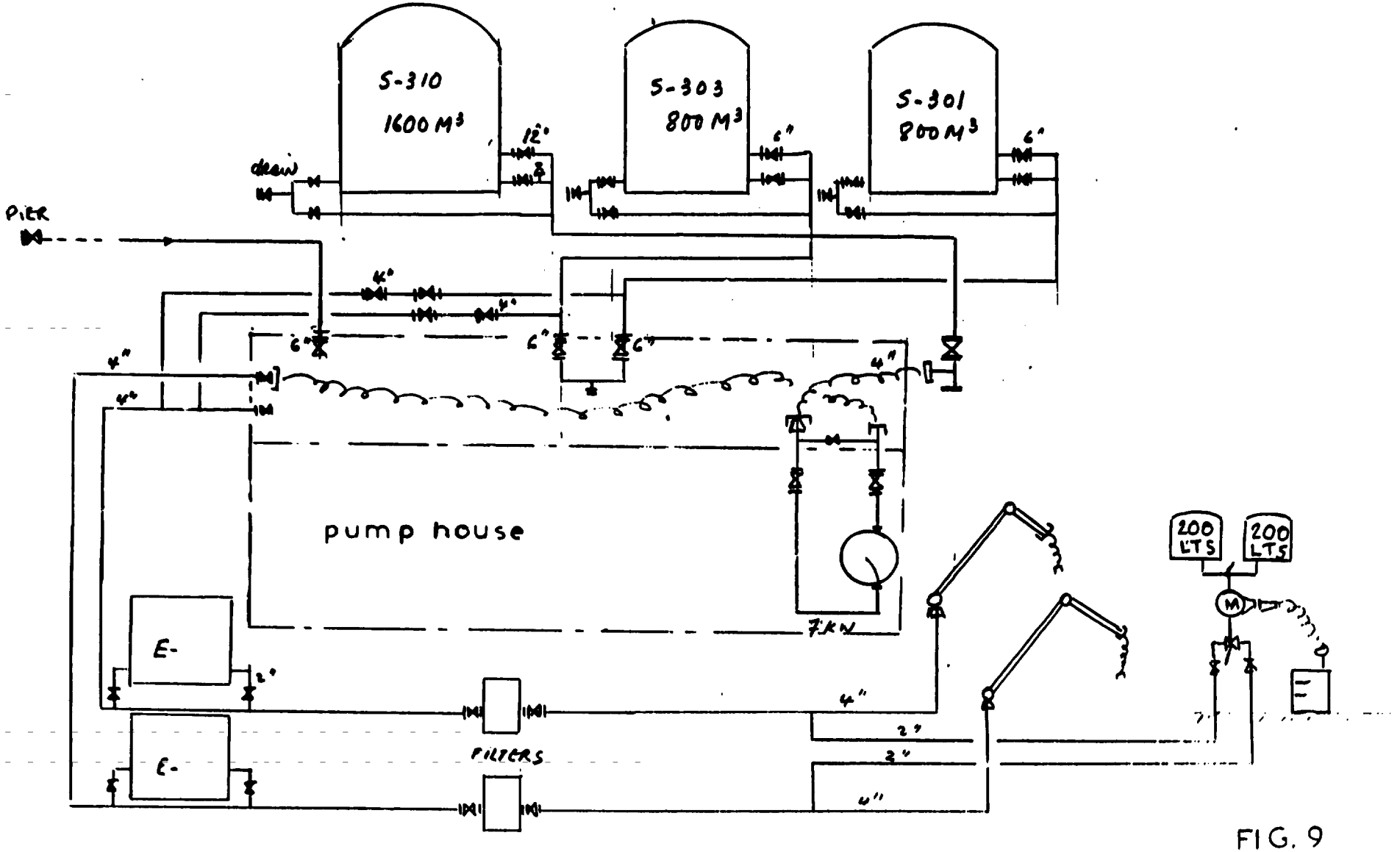


FIG. 9

KEROSENE SYSTEM

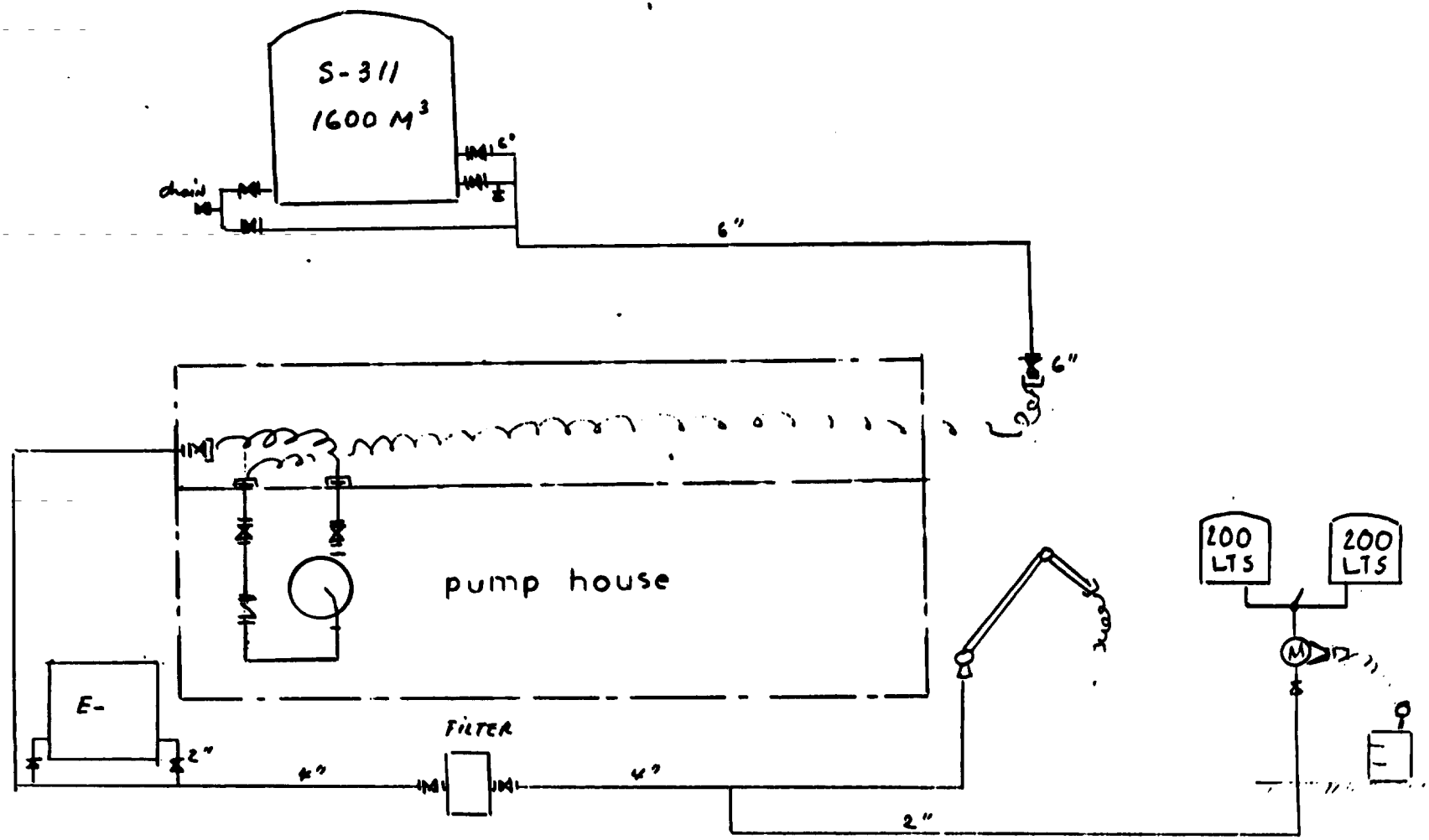


FIG 10

WATER SYSTEM

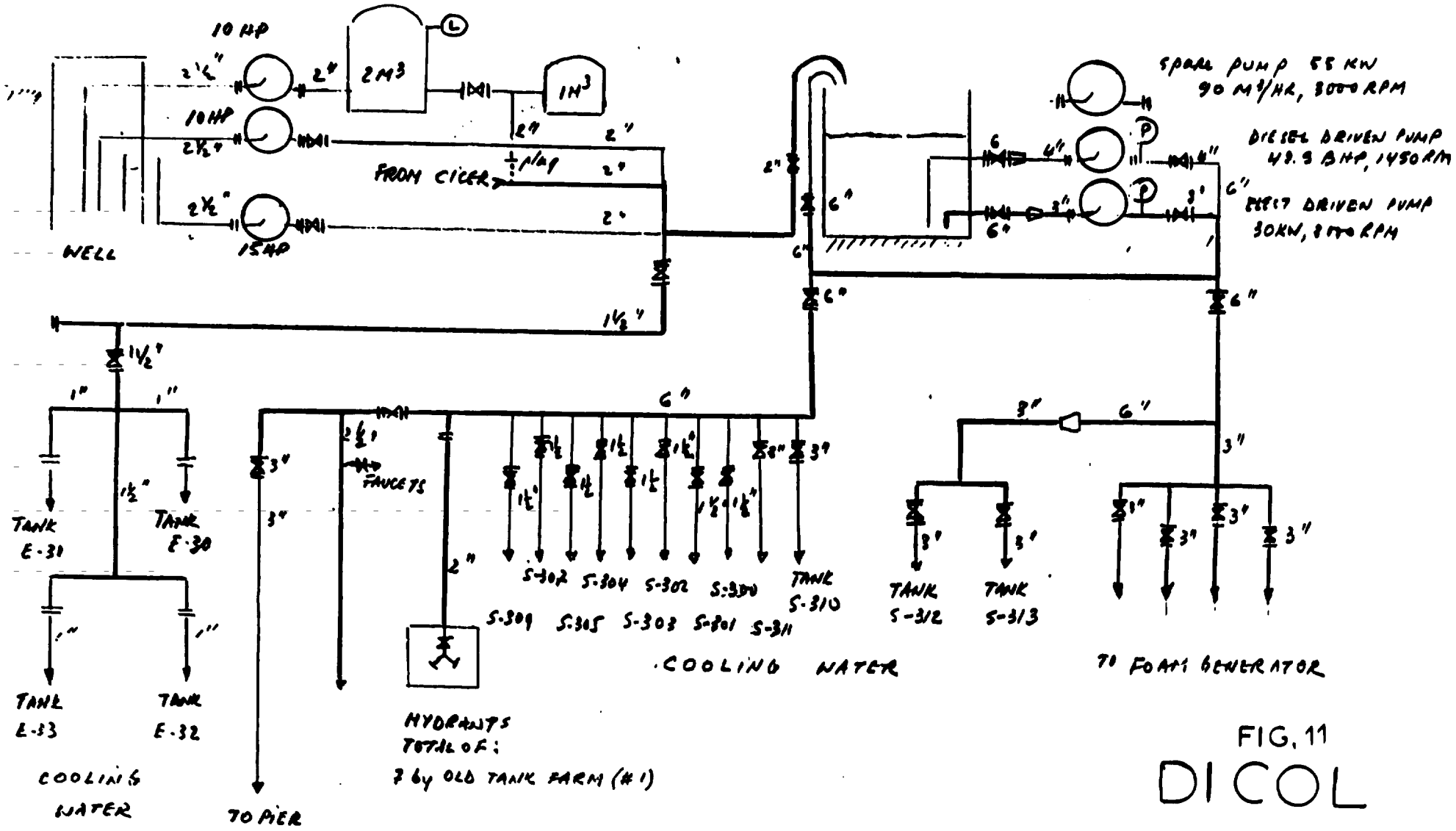
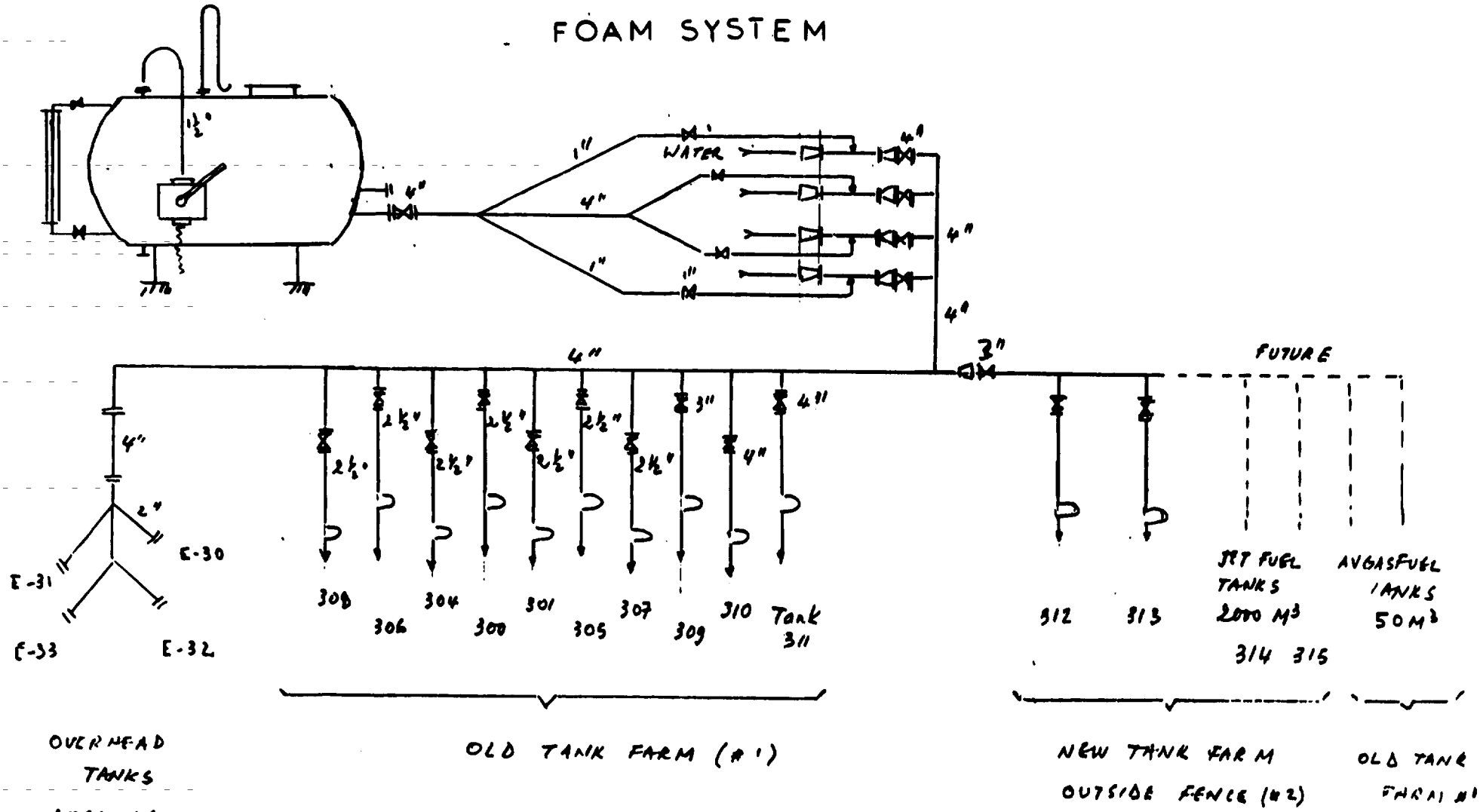


FIG. 11

DICOL

—— IN OPERATION NOW, WHEN ELECTRIC POWER FROM CICER IS AVAILABLE

FOAM SYSTEM



DICOL

FIG 12

1 CM = 5M

GUINE-GAZ

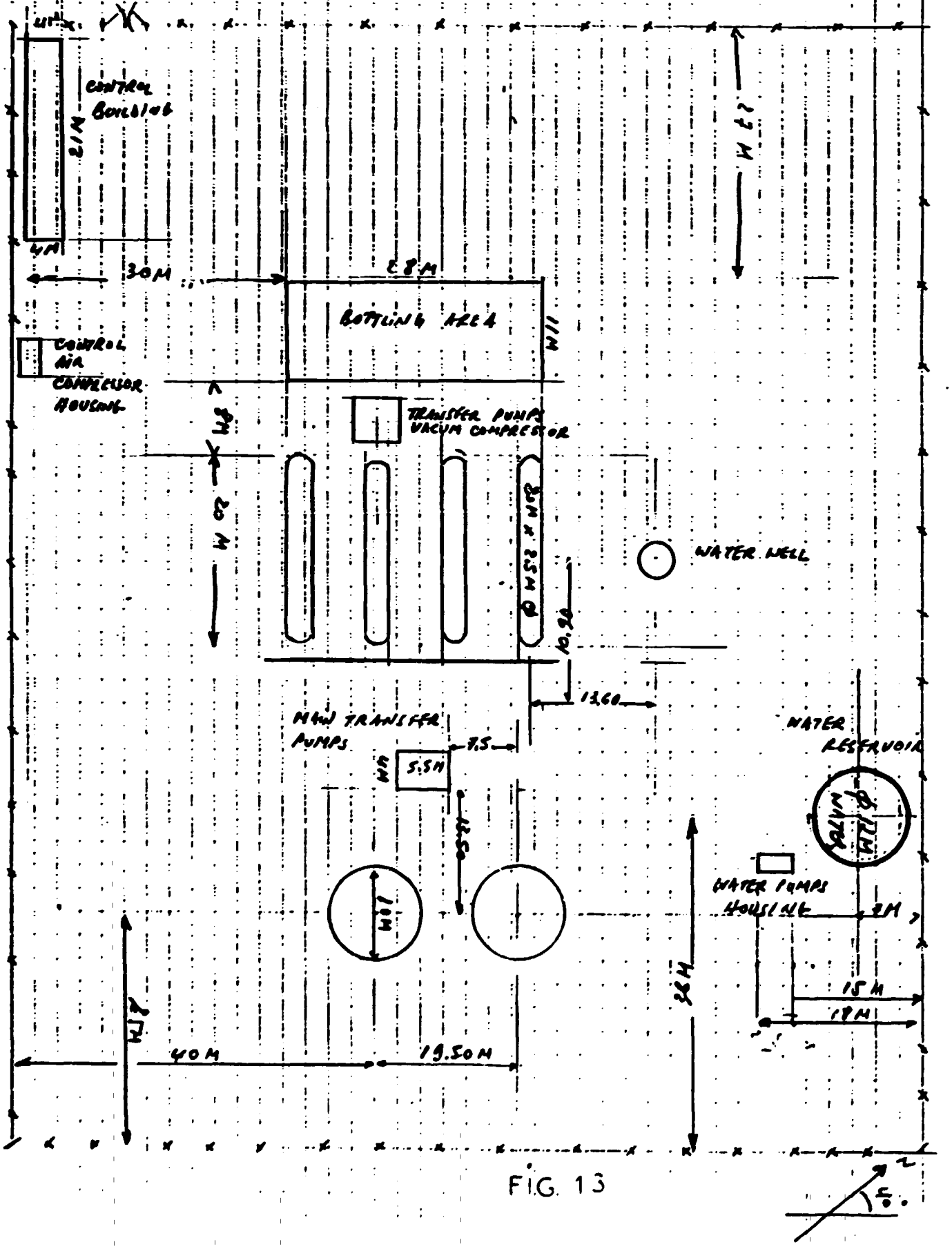


FIG. 13

FLOW DIAGRAM

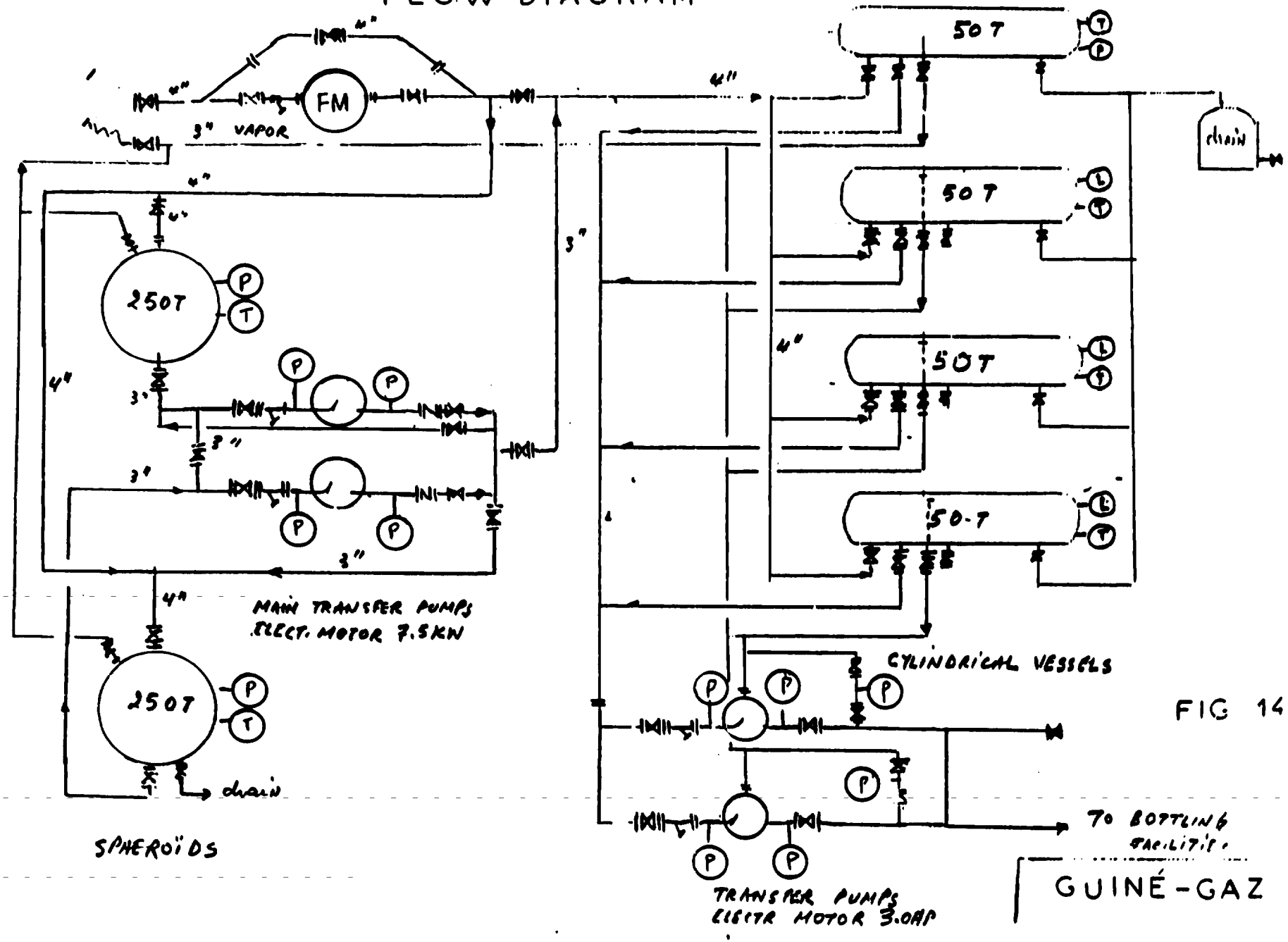
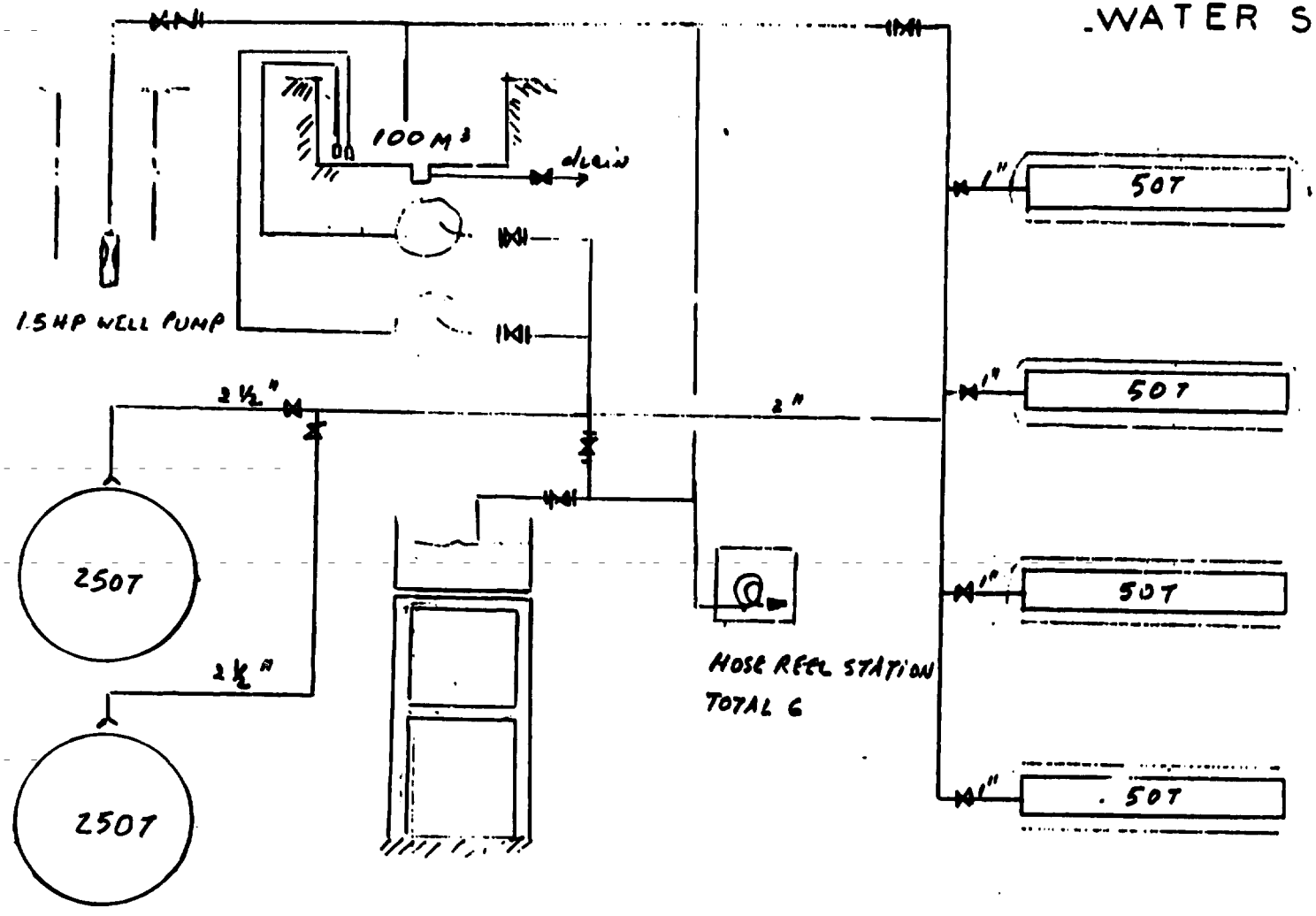


FIG 14

GUINÉ-GAZ

WATER SYSTEM



1/20 HP ELEC MOTOR PUMP

1/20 HP DIESEL DRIVEN PUMP

FIG. 15

GUINÉ-GAZ

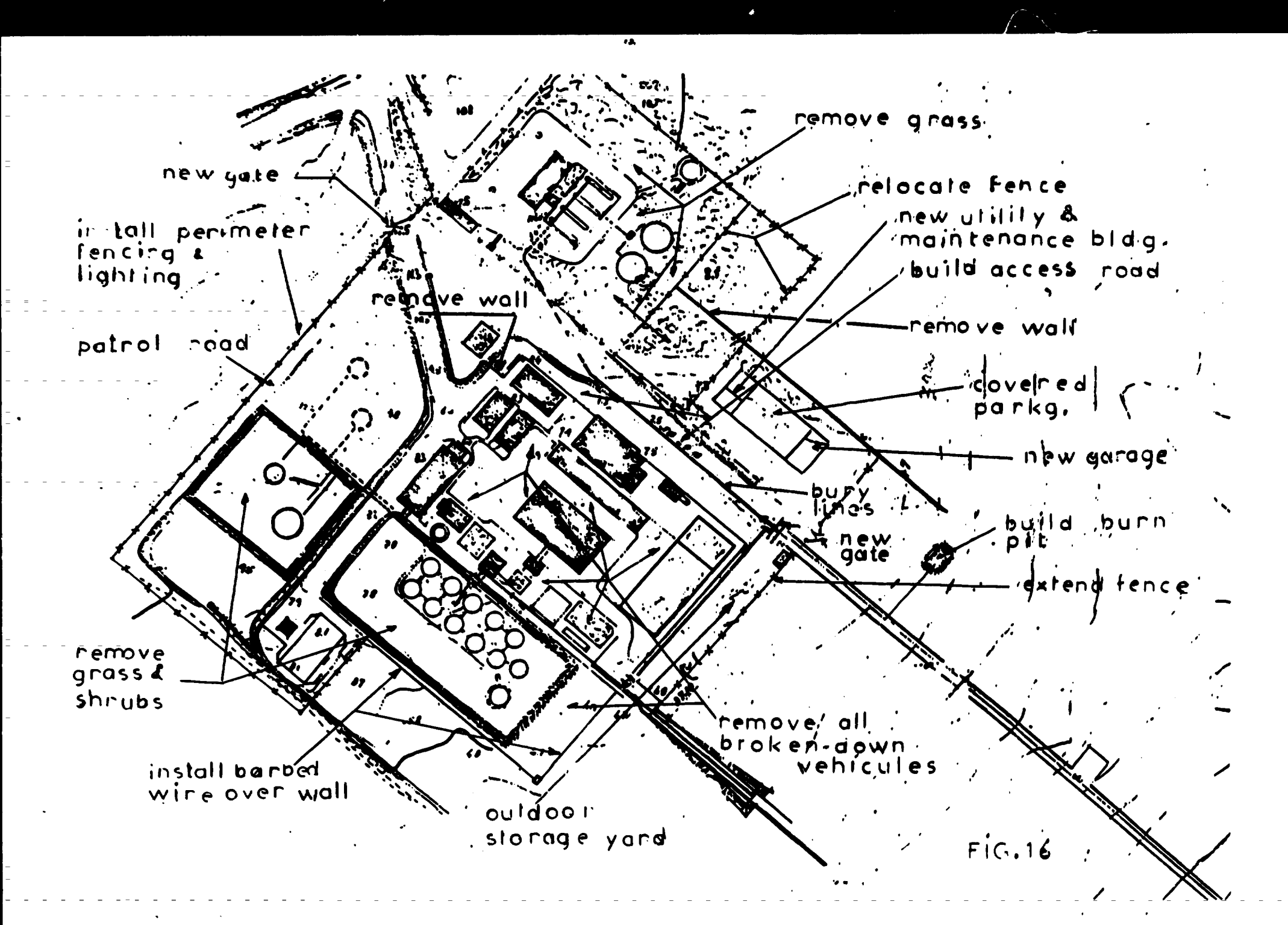
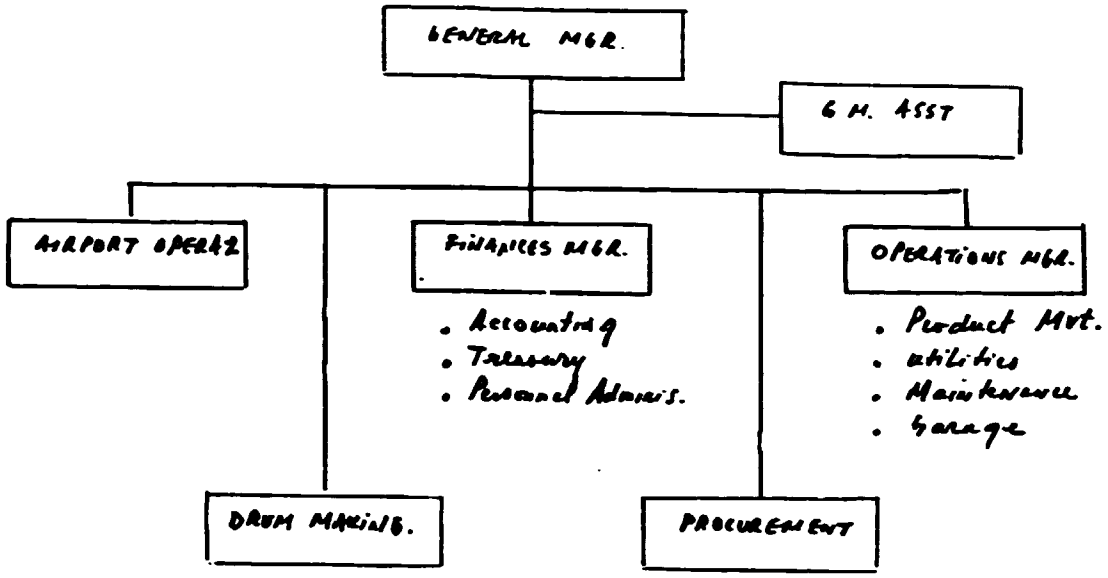

remove grass
new gate
relocate fence
new utility & maintenance bldg.
install perimeter fencing & lighting
build access road
remove wall
remove wall
patrol road
covered parkg.
new garage
bury lines
build burn pit
new gate
extend fence
remove grass & shrubs
remove all broken-down vehicules
install barbed wire over wall
outdoor storage yard

FIG. 16

DICOL'S ORGANIZATION CHART



GUINÉ-GAZ ORGANIZATION CHART

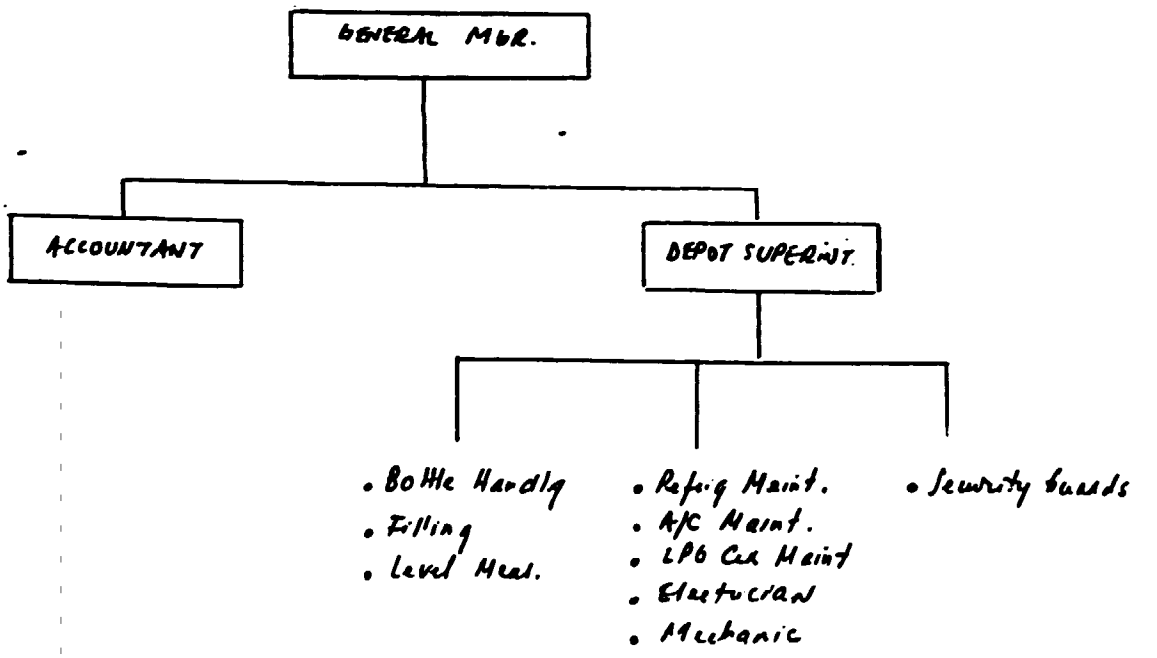
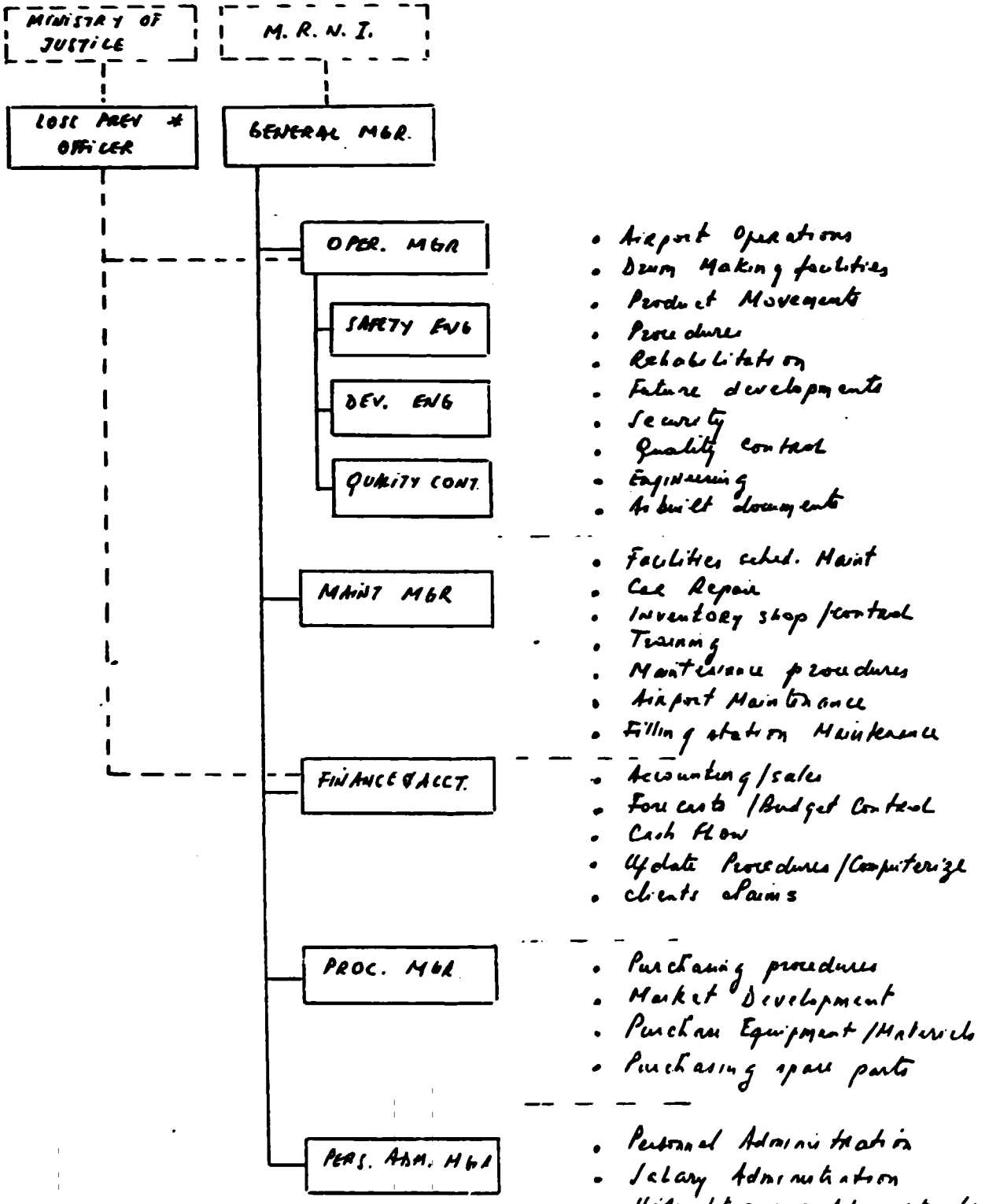


FIG. 17

PROPOSED ORGANIZATION CHART



* AFTER INVESTIGATION COMPLETED, the GENERAL MANAGER will BE held ACCOUNTABLE FOR LOSSES.

FIG. 18

SCHEDULE for REHABILITATION

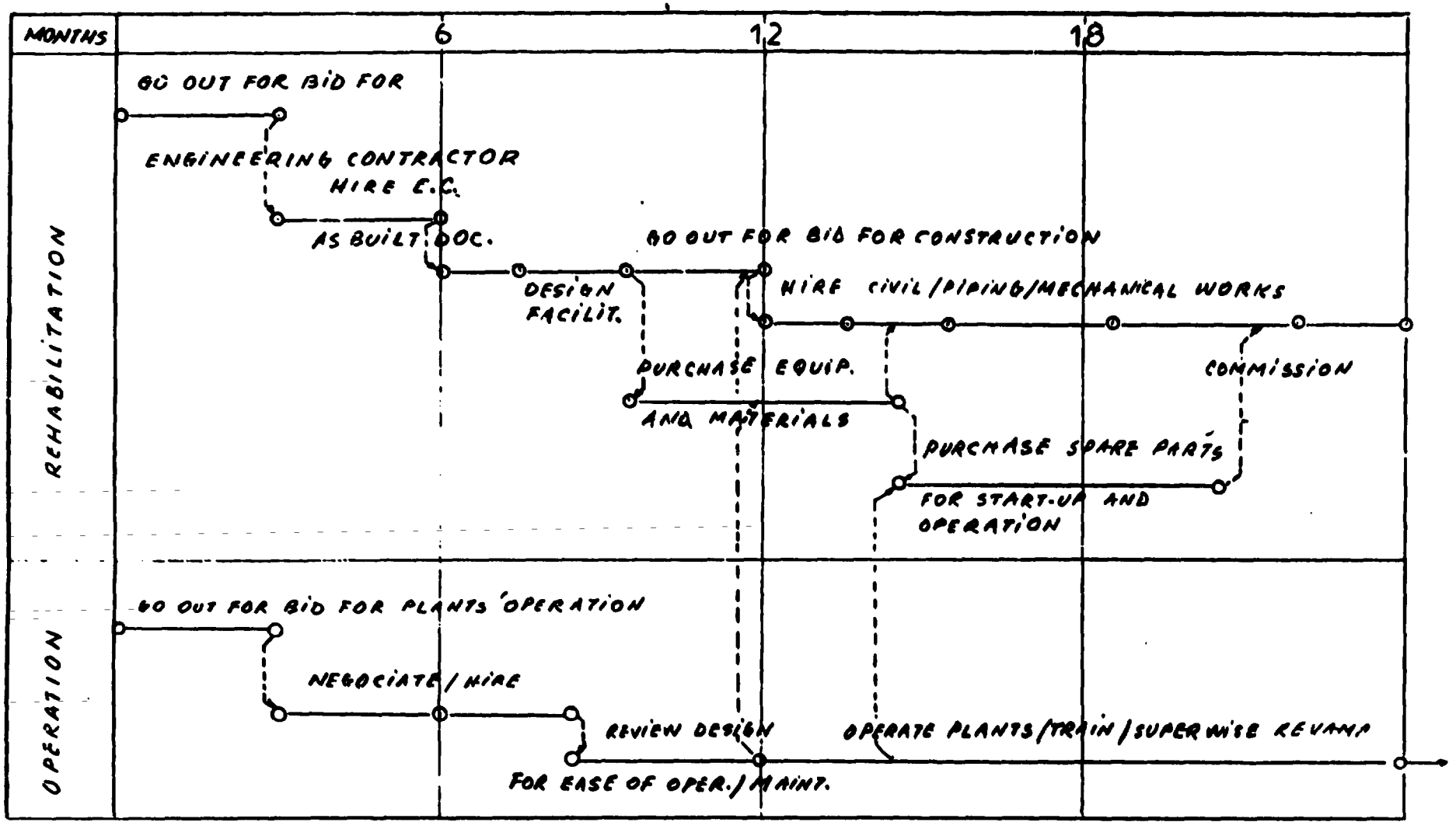


FIG. 19

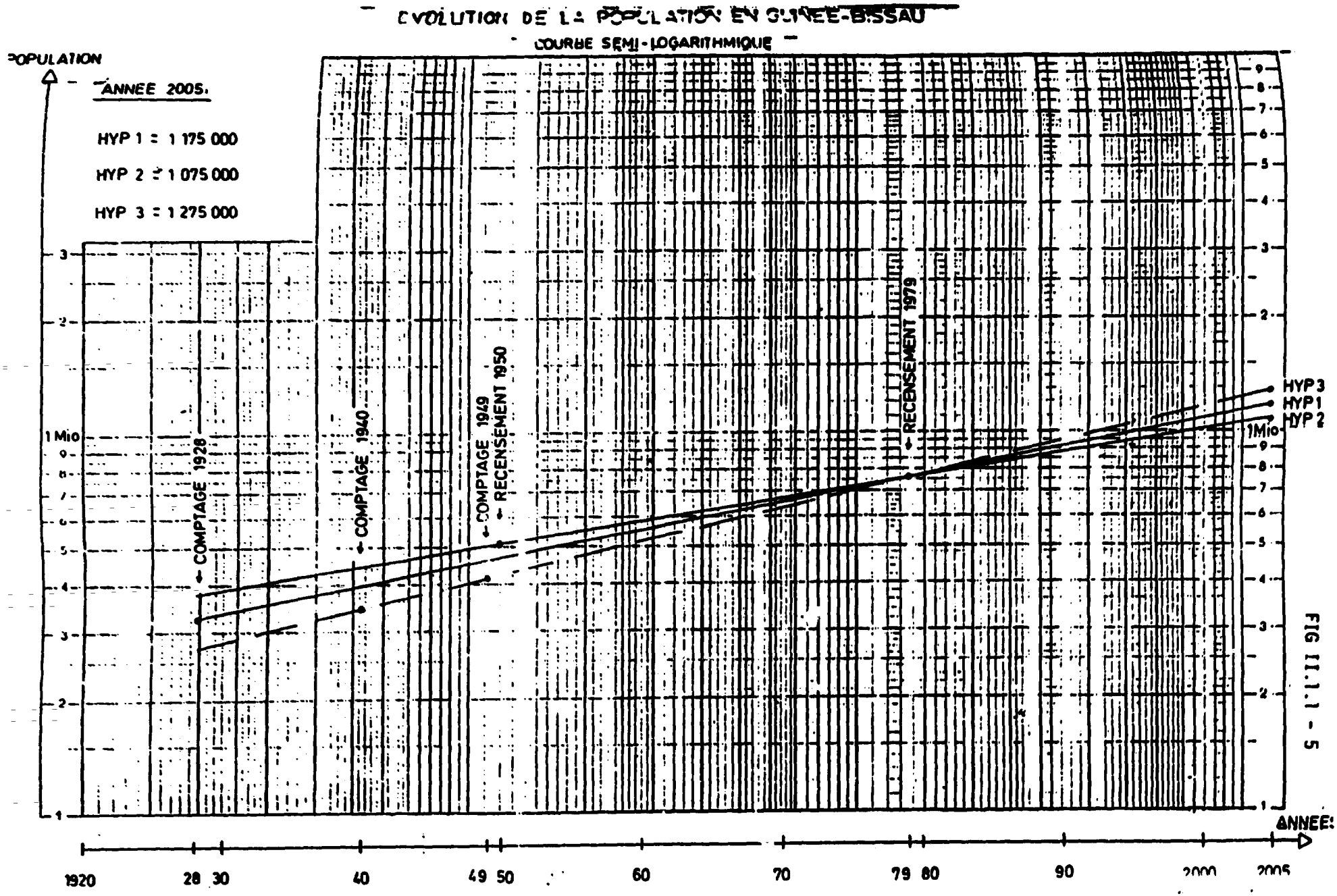

EVOLUTION DE LA POPULATION EN GUINEE-BISSAU
COURBE SEMI-LOGARITHMIQUE
POPULATION
ANNEE 2005.
HYP 1 = 1 175 000
HYP 2 = 1 075 000
HYP 3 = 1 275 000
1 Mio
← COMPTAGE 1928
← COMPTAGE 1940
← COMPTAGE 1949
← RECENSEMENT 1950
← RECENSEMENT 1979
HYP 3
HYP 1
HYP 2
1Mio
ANNEE
1920
28
30
40
49
50
60
70
79
80
90
2000
2005

FIG II.1.1 - 5

References

1. Report of the joint UNDP/World Bank Energy Sector Assessment Program: Guinea-Bissau Issues and Options in the Energy Sector. Report No. 5083-GUB, August 1984

2. Ministério dos Rer sos naturais e Industria da Guiné-Bissau. Direcção Geral de ergia; Aproveitamento do Rio Corubal. Barragen Hidroéle_ ica de Saltinho- Memorandum, Agosto de 1986

3. Guinea-Bissau- Supply and Distribution of Petroleum Products; S.L. Kikeri, consultant, Oct. 1988

4. Ministère des Ressources Naturelles et de l'Industrie- Rapport Industriel de l'Entreprise Publique DICOL; Louis Berger International Inc., New-Jersey, USA; Janvier 1989

5. Estructura Orgânica da DICOL; PETROGAL

6. Rapport EDF (Electricité de France) sur EAGB; 1986

7. Etude du secteur d'Electricité en Guinée-Bissau (MASTER PLAN) Etude technique et socio-économique; Société Générale pour l'Industrie, Bruxelles, Belgique; Janvier 1986

8. UNIDO- Rapport de Mission de Programmation de l'ONUDI en Guinée - Bissau; L. Alexandrenne et B. Diallo; Janvier 1985

9. African Review; September 1988 .

10. EAGB, Bissau; Relatorio anual 1987; Direcção de Produção

11. EAGB, Bissau; Relatorio anual 1988; Direcção de Produção

12. Os preços dos Productos Deri los do Petroléo na República da Guiné-Bissau; William G. Matthews Associates Ltd.; Ottawa, ontario, Canada