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UNIDO
Vienna, Austria
28 September 1967
16 January 1968

Report on the SIS mission to

Bolivia

by M.C. Verghese, Officer in Charge
Fertilizer Industries Unit - UNIDO

[Bolivia - 67/127 (BOL-1)]

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2. Letter from Ing. Mario Balcasar, Y.P.F.B., dated 6 December 1967.
3. Schematic proposal of Y.P.F.B. for use of gas.

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I. INTRODUCTION.

The director of the Technical Co-operation Division of UNIDO led a group of experts, consisting of an expert each on metallurgical industries, food industries and industrial estates, in August 1967 to Bolivia. At this time it was the intention to include an expert on the production of fertilizers, chemicals and petrochemicals in the mission. Unfortunately, the staff member in charge of this industry was on other missions and it was decided that he should visit La Paz some time in September. As such the writer of this report carried out the above mission from 15 September to 19 September, both days inclusive.

The objects of the mission were as follows:

1. to identify how UNIDO can assist the Government of Bolivia in the field of industrial development, particularly in the following industries, namely:
fertilisers and explosives,
chemicals, and
petrochemicals production,
2. to meet the authorities of the Government in charge of the above industries and to discuss with them the present plans and future needs,
3. to familiarise the authorities concerned in Bolivia regarding what assistance UNIDO can extend in industrial development, particularly in the industries mentioned above.

Mr. Russell L. Ferguson, petroleum economist working with Y.P.F.B. (Yacimientos Petroliferos Fiscales Bolivianos) was requested by the Resident Representative to assist and to arrange all the contacts and the meetings.

Mr. Moscoso, Director General of Industries, was also requested to assist in general and to be the contact man with the Government.

The writer wishes to express his gratitude for the assistance given by Mr. Ferguson and Mr. Moscoso in making the mission a success.

The Resident Representative, Mr. Fernandez, was not in station but had made all the arrangements for assistance of the UNDP officers.

Mention should be made of the valuable discussions held with Mr. Moco S. Sumbulovic, UN expert on industries, who is handling the following projects:

- production of cement
- production of cement asbestos pipes and sheets
- production of magnesite bricks
- production of bentonite clays.

Discussions were also held with Mr. Noel W. Griffin, who is the metallurgist attached to the Special Fund Project of the Institute for Investigations of Minerals and Metallurgy. It was pointed out by Mr. Griffin that at present large quantities of tailings of sulphur containing material are produced during the operation of tin and copper mining and beneficiation which could be utilized for sulphuric acid production. He was of the opinion that sulphuric acid produced in the country will economize processes for leaching of metallurgical ores and that many processes could not be carried out economically in Bolivia without sulphuric and hydrochloric acids.

II. GENERAL PICTURE OF THE ECONOMY AND INDUSTRY.

The two major Special Fund projects which will have an effect on

industrialization in Bolivia sponsored by UN with UNDP funds are the Petroleum Institute, which has sub-contracted many activities in the and petroleum prospecting production areas to the French Petroleum Institute, and the Institute on Mineral Production, which will also have a great effect on the economy of the country.

The work of Mr. Ferguson, petroleum economist, and Mr. Sumbulovic, expert on industries, is also extremely valuable.

Bolivia is a large country with no outlet to the sea, surrounded by Brasil on the East and North, Peru and Chile on the West and Argentina and Paraguay on the South. The population is estimated at 4 million, out of which 3 million are American Indians.

La Paz, the capital city, has a population of 90,000 and the other big cities are: Santa Cruz, Cochabamba, Oruro, Sucre, Camiri, Tarija and Trinidad.

The economy of the country depends mainly on the production and export of tin, copper, antimony gold and other minerals, which accounts for 60 to 70 per cent of the exports. The second largest industry is crude oil and gas production, of which Bolivian Gulf Oil produces 25000 barrels per day and the Y.P.F.B. 8000 barrels per day.

Cash and food crop production are concentrated in certain regions and the major crops are potato, maize, sugarcane and wheat. Meat production is not sufficient to meet the needs and imports are made mainly from Argentina .

Transport is the main bottleneck as the country is mountainous and the large cities are at distances of 300 to 500 km. There is a Special Fund project studying the transport situation in the country.

To improve the economy the industries which have to be improved and developed are therefore mainly in the minerals and in the petroleum

and gas production areas. The Y.P.F.B. is actually engaged in the production of crude oil refining to meet the internal demands. They are also trying to export gas and LPG to Argentina and Brasil. The only project so far accomplished by the Y.P.F.B. is the one to treat 10 million cubic feet of gas and to produce LPG to the extent of 700 barrels per day, out of which 300 to 400 barrels will be shipped by rail to Campo Durin in Argentina. The contract for this plant has been placed with Howe-Baker of Houston, Texas, USA.

The most important project which will help the economy of the country and the agricultural and industrial production is the fertiliser and explosives project which till now has been handled by the Y.P.F.B. Their plans are mainly based on a 1964 study by M.W. Kellogg of USA, which has been revised and updated by Y.P.F.B. The present plans are to install a 75 tons per day ammonia plant at Santa Cruz where the natural gas is and to transport it by pressure tank trucks to Oruro, where nitric acid to the extent of 120 tons per day and ammonium nitrate to the extent of 150 tons per day will be produced. In addition a plant for mixed fertilizers is also planned at Oruro.

The total investment for the project is estimated at 10 million US dollars. The most important effect on the economy by this project is that it will supply 10,000 tons per year of ammonium nitrate for industrial explosives which are now used for mining purposes and are now imported. This will save the country 3 million dollars a year. But unfortunately the use of fertilizers in Bolivia is very marginal and consequently the ammonium nitrate project both for explosive purposes as well as for fertilizers has to be extremely small. Although the economy of scale of ammonia plants is very significant, due to the peculiar circumstances in Bolivia, a small scale plant could be economical because:

a. of cheap natural gas

b. there is a large demand for ammonium nitrate for explosives

c. the balance of production can be used as fertilizer.

The following steps are necessary to absorb the balance of fertilizers from such a unit which can be used in the country:

1. study the possibilities of export to Brazil and Argentina,
2. develop a market for fertilizers in the country which will boost the agricultural production.

The present consumption of ammonium nitrate for explosives and the estimated fertilizer consumption in Bolivia are given in the following tables:

Table 1

Import of ammonium nitrate into
Bolivia for fertilizer and
industrial explosive purposes (1966?)

<u>Used by</u>	<u>Tons/Year</u>
1. Cement factories, Y.P.F.B. and C.B.F.	100
2. Construction of highways	2,900
3. Mines (Combol and private)	7,200
4. Others	<u>1,400</u>
Total	11,600

Table 2

Forecast of the estimated consumption
of fertilizers in Bolivia by various
local and international groups (by 1975?)

<u>Organisation</u>	<u>Tons/Year</u> <u>of nitrogen</u>
1. Organización de Estados Americanos (OEA)	26,400
2. Servicio Agrícola Interamericano	40,500
3. FAO	85,000
4. M.W. Kellogg	27,700

The areas in which UNIDC can assist the country are discussed in the next section, but at this point the major issue in the whole development of the gas, fertilizer and petrochemical industry must be mentioned. As mentioned earlier Y.P.F.B. has been handling this project till 14 September. On that date a presidential decree was announced in the

newspapers, stating that a new corporation will be established to handle these industries. This decree created a political uproar in the country. The workers of Y.P.F.B. went on a one day's strike in protest and naturally the top Y.P.F.B. management was entirely against this idea. This development happened while the writer was in La Paz. Hence the situation was not calm for discussing any of the projects objectively. However, the President has appointed a committee to study the situation and to report to him in a few days time. It is clear that whoever handles this project, whether the Y.P.F.B., the Ministry of Mines or a new organization, they will need extensive UNIDO assistance in the development of the industry, in market studies and market development. Immediately assistance will be required to evaluate tenders received and for subsequent negotiations.

III. ASSISTANCE NEEDED FROM UNIDO.

1. As per annexure 2, tenders for an ammonia and ammonium nitrate project is expected by 15 February 1968. The project consists of the following:

- a. ammonia plant of capacity 75 tons/day,
- b. nitric acid plant of capacity 120 tons/day,
- c. ammonium nitrate plant of capacity 150 tons/day,
- d. mixed fertilizer plant of capacity 100 tons/day.

Recommendation

As ascertained during discussions and as per the letter dated 6 December 1967 from Ing. Mario Balcazar (annexure 2) and as per cable from Mr. Wilfredo Plucker, the Government is requesting a fertilizer expert for a period of two months to assist in evaluations of tenders received for the above project and in assisting in subsequent negotiations.

Estimated cost : \$ 5000.

A job description is attached to this report. We shall locate a suitable expert expeditiously. He will work with the Y.P.F.B.

2. It is expected that when the presently sanctioned fertilizer project comes into production by 1970-1971, it would be necessary to have completed a thorough market survey for fertilizers, not only in Bolivia but also in those parts of Brazil and Argentina which can be supplied from the Santa Cruz and Oruro project. The market survey should make clear the conditions that have to be satisfied to increase internal consumption, such as reduced prices, storage and transport facilities, credit facilities, etc. The market survey should also establish projected demands by 1970 and 1975 to assist the Government for future planning.

Recommendation

It is recommended that UNIDO should provide the Government with an expert to study and survey the fertilizer market in Bolivia and in surrounding regions for a period of 6 months.

Estimated cost : \$ 12,000.

A job description for the expert is attached to this report.

3. There is scope in Bolivia to develop the market for fertilizers. For this three or four regions in the country should be selected for intensive work in the following:

- a. soil survey,
- b. demonstration plots using various types of fertilizers on various crops,
- c. demonstration of best fertilizer dosages and types,
- d. working out cost-yield ratios.

Such studies are bound to increase the market for fertilizers and increase the agricultural out-put.

Recommendation

A Special Fund project with UNIDO as Participating and Executing Agency in conjunction with FAO of the type we are now carrying out in Pakistan is recommended for Bolivia. This will immediately require an expert to be sent to Bolivia to help the Government prepare such a project.

An expert familiar with fertilizer production, usage and market development is recommended for 6 months. Estimated cost for expert : \$ 12,000.

Estimated UNDP contribution : \$ 1,000,000. (if the Special Fund project materializes)
A job description is attached.

4. During discussions with Y.P.F.B. it was indicated that they are planning projects for ethylene production and a gas separation project. Y.P.F.B. will be interested to get the services of an expert in this field to assist them in the planning and execution of the projects.

Recommendation

A petrochemical expert to work with the Y.P.F.B. for a period of one year is recommended.

Estimated cost : \$ 23,100.

A job description is attached.

5. During discussions with Mr. N.W. Griffins of the Mineral Development Institute, which is a Special Fund project, he indicated that there is scope to develop a sulphuric acid industry using copper and iron pyrites available in the country. The mining and metallurgical industry on the export of which the economy heavily depends will be greatly benefitted if sulphuric acid is locally produced.

Recommendation

The services of an expert in sulphuric acid production using copper and iron pyrites for a period of one year. The expert should be attached to the Special Fund project in the Institute for Investigations of Minerals and Metallurgy.

Estimated cost : \$ 23,100.

A job description is attached herewith.

6. Bolivia has thus far not built or operated ammonia, nitric acid and ammonium nitrate projects. There are many qualified and outstanding petrochemical and other engineers in the petroleum field. But it will be

necessary to train a few selected engineers in similar plants in foreign countries in the fertilizer field.

Recommendation

It is recommended that under the UN Fellowships programme 10 qualified Bolivian engineers and chemists are given training for a minimum period of 6 months each in the nitrogen fertilizer works of the Tennessee Valley Authority in the USA in the following fields:

- | | |
|-------------------------------|---|
| a. ammonia plant | 1 production engineer
1 maintenance engineer |
| b. nitric acid plant | 1 production engineer
1 maintenance engineer |
| c. ammonium nitrate plant | 1 production engineer
1 maintenance engineer |
| d. instrumentation | 1 engineer |
| e. analytical lab | 1 chemist |
| f. marketing and distribution | 2 candidates |

Estimated cost of 60 man months of fellowships training in USA : \$ 25,000.

Draft job description for approval by the Government of
BOLIVIA

Request from the Government of Bolivia for assistance
under Special Industrial Services

Job description: (SII-)

- Post title:** Chemical Engineer - Fertilizer Expert.
- Duration:** Two months.
- Date required:** Before end of February 1968.
- Duty station:** La Paz with travel to different parts of Bolivia as necessary.
- Duties:** The expert will work in the Yacimientos Petroliferos Fiscales Bolivianos (YPFB) in La Paz. He will assist the YPFB in evaluating the tenders received for a synthetic ammonia, nitric acid and ammonium nitrate project. He will assist the YPFB in choosing the most suitable and most economical process for each unit. He will also analyze the financial terms and conditions accompanying each offer and assist in choosing the one most suited for the country. He will further assist the YPFB in subsequent negotiations to clarify points in the offers and help YPFB to come to a final decision on the choice of the successful contractor. If the YPFB requests, the expert will also assist in contract negotiations and in concluding suitable contracts.
- Qualifications:** A chemical engineer experienced in the production process for ammonia, nitric acid and ammonium nitrate, with experience in erection and operation of such plants. He must have had extensive experience in the analysis of tenders and in negotiations for concluding a contract.
- Language(s):** Spanish essential. English desirable.
- Background information:** The Government of Bolivia has requested global tenders for the following:
- (a) Ammonia plant of capacity 75 tons per day using natural gas.
 - (b) Nitric acid plant of capacity 120 tons per day.
 - (c) Ammonium nitrate plant of capacity 150 tons per day.
 - (d) Mixed fertiliser plant of capacity 100 tons per day.

The global tenders are expected to be in the hands of YPFB by 15 February 1968 and the Government of Bolivia has requested UNIDO assistance for an expert in assisting YPFB to analyze the bids.

Draft job description for approval by the Government of
BOLIVIA

Request from the Government of Bolivia for assistance
under special Industrial Services

Job description: (ECL-)

- Post title: Fertilizer Economist - Market Survey Specialist.
- Duration: Six months.
- Date required: As soon as possible.
- Duty station: La Paz with travel to different parts of Bolivia as necessary.
- Duties: The expert will work in the Ministry of - - - and will co-operate with the Ministry of Agriculture, Ministry of Industry, Ministry of Oil and the Yacimientos Petroliferos Fiscales Bolivianos (YPFB). His duties inter alia will be as follows:
- (a) Undertake a complete market survey for fertilizers in Bolivia.
 - (b) Study the possibilities of exporting fertilizers to parts of Brazil and Argentina adjacent to Bolivia.
 - (c) Undertake a survey of the requirements of industrial explosives.
 - (d) Determine the demand for internal use of fertilizer and explosives by 1970 and 1975. The survey should also study conditions that have to be satisfied for increasing internal consumption and make recommendations what steps should be taken by the government.
- Qualifications: An economist who is thoroughly familiar with market surveys for fertilizer and industrial explosives and for the projection of consumption in the future. He should have experience in similar type of work in developing or developed countries.
- Language(s): Spanish. English desirable.
- Background information: The Government of Bolivia has requested global tenders for the followings:
- (a) Ammonia plant of capacity 75 tons per day using natural gas.
 - (b) Nitric acid plant of capacity 120 tons per day.

- (c) Ammonium nitrate plant of capacity 150 tons per day.
- (d) Mixed fertilizer plant of capacity 100 tons per day.

It is expected that when the above fertilizer project comes into production by 1971 it would be necessary to have completed a thorough market survey of fertilizers. This will give the government data for future planning. The projections for 1970 and 1975 should be reviewed at the appropriate times.

Draft job description for approval by the Government of
BOLIVIA

Request from the Government of Bolivia for assistance
under Special Industrial Services

Job description: (EOL-)

Post title: Chemical Engineer - Fertilizer Expert.

Duration: Six months.

Date required: As soon as possible.

Duty station: La Paz with travel to different parts of Bolivia.

Duties: The expert will work in the Ministry of - - - in co-operation with the Ministry of Agriculture, Ministry of Industry, Yacimientos Petroliferos Fiscales Bolivianos (YPFB), and others. He will draw up a feasibility study and plan of operations for a special fund project in Bolivia for the development of the market for fertilizers. The plan should consist of a selection of three or four regions in the country for intensive work in the following:

- (a) Soil survey.
- (b) Demonstration plots using various types of fertilizers on various crops.
- (c) Demonstration of best fertilizer dosages and types.
- (d) Working out cost-yield ratios.

The expert should work out a project similar to the project of special fund in Pakistan, namely, PAF-66 Promotion of Fertilizer Use and Market. UNIDO will be the participating and executing agency with FAO as a sub-contractor. The expert will assist the government in preparing the request in the approved form for submission to the special fund.

Qualifications: A chemical engineer/fertilizer expert who is experienced in the preparation of special fund projects in the field of fertilizer market development.

Language(s): Spanish. English desirable.

Background information: The Government of Bolivia has requested global tenders for the following:

- (a) Ammonia plant of capacity 75 tons per day using natural gas.
- (b) Nitric acid plant of capacity 120 tons per day.
- (c) Ammonium nitrate plant of capacity 150 tons per day.
- (d) Mixed fertilizer plant of capacity 100 tons per day.

The Government of Bolivia feels that a project to develop the future market for fertilizers will increase the demand, which can be met by production of cheap fertilizers using indigenous natural gas. The use of fertilizers will in turn increase the agriculture output of the country and the economy can shift partly from its heavy reliance on export of metal ore products.

Draft job description for approval by the Government of
BOLIVIA

Request from the Government of Bolivia for assistance
under Special Industrial Services

Job description: (EOL-)

Post title: Chemical Engineer - Petrochemical Expert.

Duration: One year.

Date required: As soon as Possible.

Duty station: La Paz with travel to different parts of Bolivia.

Duties: The expert will work in the Yacimientos Petroliferos Fiscales Bolivianos (YPFB). He will assist the YPFB in developing projects such as for ethylene production using natural gas and also projects for gas separation using wet natural gas.

Qualifications: A petrochemical engineer who has extensive experience in gas separation methods and in ethylene production.

Language(s): Spanish. English desirable.

Background information: The Government of Bolivia has requested global tenders for the following:

- (a) Ammonia plant of capacity 75 tons per day using natural gas.
- (b) Nitric acid plant of capacity 120 tons per day.
- (c) Ammonium nitrate plant of capacity 150 tons per day.
- (d) Mixed fertiliser plant of capacity 100 tons per day.

The YPFB is exploring possibilities of using their vast resources of gas for various petrochemical production such as ethylene. There is scope for a project for gas separation and for exporting the products.

Draft job description for a () by the Government of
BOLIVIA.

Request from the Government of Bolivia for assistance
under Special Industrial Services

Job description: ()

- Post title:** Chemical Engineer - Expert on sulfuric acid from pyrites.
- Duration:** One year.
- Date required:** As soon as possible.
- Duty station:** Oruro with travel to different parts of Bolivia as required.
- Duties:** The expert will be attached to the Mineral Development Institute. He will study the possibilities for the economic production of sulfuric acid from copper and iron pyrites available in the country. He will also study the present and future requirements for sulfuric, hydrochloric and nitric acids in the country, the present prices and the economics and impact of producing acids, particularly sulfuric, indigenously.
- Qualifications:** A chemical engineer experienced in the production of sulfuric acid from pyrites and in analyzing present and future requirements for acids in mining, metallurgical and other industries.
- Language(s):** Spanish. English desirable.
- Background information:** At present the special fund is developing a Mineral Development Institute in order to assist the country in improving beneficiation methods and recovery methods for tin, copper, and other ores. It is considered very important that for the development of the leaching and metallurgical industries, acids, especially sulfuric and hydrochloric, have to be produced economically from local raw materials. The expert is expected to work with the Institute and study the possibilities of developing the sulfuric acid industry in Bolivia.

Yacimientos Petroliferos Fiscales Bolivianos

No. 1237

APARTADO CORREO
40
DIRECCION CABLEGRAFICA
YACIBOL

EDIFICIO Y. P. F. B.
LA PAZ-BOLIVIA

GERENCIA
GENERAL

Annexure 1

October 27th, 1967
GCT-DGP-13130/8025

MR. M. C. VERGHESE
CHIEF
FERNANDEZ
RAILWAYS PLATY 12
VIENNA 1010, AUSTRIA

Dear Mr. Vergheese:

I was sorry to be away from Bolivia when you visited here last September. At that time I was in U.S.A. attending a Seminar for Latin America Fertilizer Executives, sponsored by Tennessee Valley Authority.

As you were probably been told, YPFB is getting ready to install, as soon as possible, the first Fertilizer Complex in Bolivia, intended to produce Ammonium Nitrate. At a second stage we hope to produce N-P fertilizers, by importing phosphate rock or triple superphosphate, since the suspected phosphate deposits in Bolivia are not yet well evaluated, and it will take some time to get them ready for exploitation.

The information you requested to Mr. R. Ferguson is given below:

1.- Reserves and present production of natural gas from Bolivian Gulf and YPFB areas.

As for January, 1967, the proved gas reserves were:

Bolivian Gulf Oil Co.	1,940,509 SCF
Y P F B	160,109 SCF
Bolivian Oil Co.	3,109 SCF
	<u>2,103,727 SCF</u>

Present Production: (for May, 1967)

Bolivian Gulf Co.	1,896,906,000 SCF
Y P F B	815,527,440 SCF
Bolivian Oil Co.	66,749,423 SCF
	<u>2,779,182,863 SCF</u>

Yacimientos Petroliferos Fiscales Bolivianos

Form. 102.267

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EDIFICIO Y. P. F. B.
LA PAZ - BOLIVIA

GERENCIA
GENERAL

GGL-DCP-13130/8028

Pag. 2

2.- Gas Analysis

Enclosed please find gas analysis of some of the more important Bolivian gas fields.

3.- Imports of explosives, in metric tons

Dynamite	1965	1966
60 # 1.1/8 x 8"	1,316 Tons	727 Tons
40 # 1.1/8"	75 Tons	33 Tons
60 # 7/8 x 8"	72 Tons	43 Tons
40 # 7/8 x 8"	43 Tons	26 Tons

*Imported by
COMACAL only
(State owned company)*

We were unable to obtain information on dynamite prices.

Ammonium Nitrate

	1965	1966
Explosive type	1,316 Tons 95 \$us/Ton	2,106 Tons 97.05 \$us/Ton.

4.- Imports of Fertilizers

	1964		1965	
	Tons	\$us.	Tons	\$us.
N-Fertilizers	1,670	185,000	2,714	296,000
P-Fertilizers	915	95,000	664	69,000
K-Fertilizers	381	44,000	316	34,000
	<u>2,966</u>	<u>324,000</u>	<u>3,694</u>	<u>399,000</u>

Prices are CIF Pacific Port.

5.- Deposits of Potassium Nitrate, Borax, Phosphates and Potash

Although during the last two years some geological work has been done in order to locate above mentioned deposits, no definite reports are yet available. The Bolivian Geological Service expects to be able to furnish the requested information by March or April, 1968.

At the present time there is no production at all. The only other raw material for fertilizing production which is found in Bolivia, and is being exploited and exported, is sulphur.

Yacimientos Petroliferos Fiscales Bolivianos

Form. 10887

APARTADO CORREO

EDIFICIO Y. P. F. B.

GERENCIA

DIRECCION GENERAL DE YACIMIENTOS

LA PAZ - BOLIVIA

GENERAL

YACIBOL

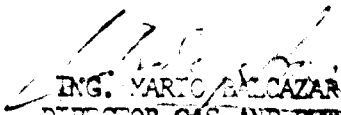
GSE-IGP-13133/8028

Pag. 3

Till the end of this month we expect to send out to several companies the basis for the participation in the "tender" for our project. This means that by early February, 1968, we will be ready to evaluate the different proposals we hope to receive. UNIDO Technical Assistance for that purpose will be highly appreciated; so we request you to kindly send us information on the proper steps we should take to apply for such assistance.

Very truly yours,

YACIMIENTOS PETROLIFEROS FISCALES BOLIVIANOS


ING. MARIO BALCAZAR ARANTBAR
DIRECTOR GAS AND PETROCHEMICAL

MBA/MLJ

Pozo No. 5 - C. Santa

Compañía : BOLIVIAN TRADING CO. Formación Patana

COMPONENTE	Porcentaje M. G. L.
Dióxido de Carbono	0,80
Nitrógeno	1,67
Metano	85,40
Etano	8,26
Propano	1,45
Iso-Butano	0,27
Normal-Butano	0,97
Iso-Pentano	0,10
N-Pentano	0,52
Hexanos	0,36
Heptanos +	0,34
T O T A L	100,00
Galones de C ₃ + por 1.000 pies cúbicos = 1.394	

ANALISIS
KARBON

Senyawa	Persentase (%)
Metana	78,5
Etilena	12,7
Propena	3,0
Isoprena	0,5
Butadiena	2,1
Stirena	0,2
Heptena	0,1
Okтана	0,1
Nonana	2,1

Jumlah	100,0

4.2.4. ...

COMPONENTE	Caudal de de
Nitrógeno	0.00	--	--	0.40	...
Dióxido de Carbono	--	--	--	--	--
Metano	67.00	10.00	10.00	10.00	77.00
Etano	7.33	7.33	7.33	7.29	14.62
Propano	3.00	10.00	7.00	3.00	10.00
Iso-Butano	0.32	2.00	1.00	1.00	1.00
n-Butano	1.00	1.00	1.00	1.00	1.00
Iso-pentano	0.10	3.75	1.00	0.29	0.29
n-Pentano	0.11	7.00	0.44	0.56	0.43
Hexanos	0.17	10.00	11.00	0.72	0.31
Heptanos +	0.24	11.00	12.00	4.16	0.55
T O T A L	100.00	100.00	100.00	100.00	100.00

Propiedades de los Heptanos (Residuo del líquido del Separador)

Gravedad específica	0.7890
Gravedad a 1	47.8 o.
Peso molecular	145.
Cals/1000 CV 63+	3.129

PARAMETRO

ANALISIS DE CONTROL

COMPOSICION

Composición Vol %

Densidad con relación al aire 0,7213

C ₁	-	70,70 %
CO ₂	-	0,10 %
C ₂	-	27,50 %
C ₃	-	0,36 %
iC ₄	-	0,24 %
nC ₄	-	0,15 %
iC ₅	-	0,10 %
nC ₅	-	0,02 %
C ₅ +	-	0,68 %

Poder Calorífico Superior
a 14,7 y 60° F 1.205
BTU/pie³

100,00 %

100/mi³

Yacimientos Petroliferos Fiscales Bolivianos

APARTADO COMERCIO

403

DIRECCION CARBOGRAFICA

YACIBOL

EDIFICIO Y. P. F. B.

LA PAZ - BOLIVIA

GERENCIA

GENERAL

Annexure 2

December 6th, 1967

00L-DGP-14960/9838

Mr. M.C. VERGHESI
UNIDO
FELDERHAUS
RATENAU PLATY 12
VIA 1010, ANNERIA

Dear Mr. Verghese:

With reference to our letter 00L-DGP-13137/8026 of October 27th, 1967, we want to call your attention to the information given with reference to the points one, three and four.

In point one, the proved reserves are the actual production and viceversa. In point three, the quantity of Ammonium Nitrate indicated, explosive type is considering only the importations of Comibol (the state owned company) and not the total imports.

The real figures to be considered are as follows:

	<u>Tons/year</u>	
1) Cement factories, YPFB and CBF	100	Ammonium Nitrate.
2) Construction of highways	2.900	"
3) Mines (Comibol & Privates)	7.200	"
4) Others	1.400	"
Total	11.600	"

Last year alone, Intermaco a subsidiary of Grace & Co. has imported to the country over 10.000 Tons. of Ammonium Nitrate.

In point four, the figures given were for actual consumption of the country. The use of Ammonium Nitrate as a fertilizer is not widely used because of the high selling price, the ignorance of the people on the use of fertilizers and the almost nonexisting credit facilities for the farmers.

Yacimientos Petroliferos Fiscales Bolivianos

Form. 00257

APARTADO CORREO
401
DIRECCION CABLEGRAFICA
YACIBOL

EDIFICIO Y. P. F. B.
LA PAZ-BOLIVIA

GERENCIA
GENERAL

GGL-DSP-14000/9838

Pag. 2

The farmer, will not risk to buy any fertilizer unless it is proved to them the advantages of the use of fertilizers to improve their crop. This can only be done by experiments performed on the field.

The following forecast has been prepared by several local and international agencies on the estimated consumption of fertilizers in Bolivia..

	<u>In Tons/year of Nitrogen</u>
Organización de Estados Americanos (OEA)	26.400
Servicio Agrícola Interamericano (Point four)	40.500
FAO	85.000
Kellog Report	27.700

All this information is contained on the report "Complejo de Fertilizantes y Explosivos, Estudio de Pre-Factibilidad", a copy of which you received while you were here. The tenders for this project was sent out on November 6, 1967 and the deadline for receiving the proposals is February 15, 1968. For your information we are attaching a copy of the English version of the invitation.

We expect to need qualified technical assistance to evaluate the proposals and subsequent negotiations, for approximately two months, beginning February 15, 1968. The formal request for assistance is now being processed through the appropriate government channels.

Very sincerely yours,

YACIMIENTOS PETROLIFEROS FISCALES BOLIVIANOS


ENG. MARIO BALCAZAR A.
DIRECTOR GAS AND PETROCHEMICAL.

JAM/mij.

BASIC FOR PRIVATE TENDER

1.0. PURPOSE

This invitation covers the general conditions for the presentation of a definite and complete proposal for total financing and preliminary engineering studies, in order to proceed, as a - second stage, with Basic and Detailed Engineering, Supply of Materials and Construction of a Petrochemical Fertilizer - Complex in Bolivia, based on a "Turn - key" proposal and/or a Joint Venture with YPFB.

2.0. GENERAL CONDITIONS

2.1. Form for submitting the proposals-

The proposals shall be submitted in an envelope sealed with wax. The envelope shall be marked with the YPFB address and shall carry the following note on its right hand side: "INVITACION PRIVADA PROPUESTA PARA COMPLEJO PETROQUIMICO DE FERTILIZANTES Y EXPLOSIVOS".

2.2. Date and place for submitting the proposals-

The proposals shall be submitted before 6 p.m. of - February 13, 1968, in the offices of the Legal Department, 5 th. Floor, Office 500, Y.P.F.B. Building, or be mailed to "Y.P.F.B., Dirección Legal, P.O. Box 401, La Paz, Bolivia". Requests for extension of the submission deadline will not be granted.

Proposals received after the submission deadline will be considered valid, if they have been stamped by the La Paz Post Office prior to or on the deadline date.

2.3. Additional Clauses-

2.3.1. YPFB reserves the right to reject any or all of the proposals, or to declare the tender withdrawn.

2.3.2. YPFB will have the right to ask authorized representatives of the tendering companies for clarification of their proposals and discussion of their financing terms, without signifying any obligation on the part of YPFB.

YPFB, will have the right also to those tendering companies that have been judged as, offering the best conditions, to make more detailed proposals by preparing more extensive engineering studies and justifying their estimated investment figures.

2.4. The Judging of the proposals-

Five days after the date set for submitting the proposals, the Administrative Council of YPFB will convene in order to open the proposals.

Once they have been opened, YPFB within a maximum of thirty (30) days, will evaluate them for decisions to be taken by the Administrative Council.

3.0. TECHNICAL SPECIFICATIONS

3.1. YPFB has prepared Pre-Feasibility Studies for the erection of a Fertilizer and Explosives Complex in Bolivia. This study includes a market evaluation, technical aspects regarding the most suitable type of installations, and an economic evaluation showing the profitability of the whole project.

Enclosed is a complete copy of this study.

3.2. It is advised that, being only a pre-feasibility study, the following, items of the study should be considered as - having only tentative values:

- Capacities of the Plants
- Site for erection of the complex (there are the alternatives to locate all the plants in the City of Santa Cruz; or one of the plants in Santa Cruz and the rest in the City of Oruro, as described in the enclosed study)
- Investment Figures
- Operating Capital
- Selling Prices for the final Products
- Buying Prices for the Raw Materials.

3.3. The execution of the project shall consider the following steps:

3.3.1. Re-evaluation of YPFB's Pre-Feasibility Study: This re-evaluation to be done jointly by highly specialized personnel from the company which is awarded the tender, YPFB's personnel and technical assistance which YPFB might consider advisable to obtain.

3.3.2. Basic and Detailed Engineering Studies: Both studies to be done in close coordination with - and in the presence of YPFB's personnel, and following the conclusions and recommendations that might be established with the re-evaluation, as set forth in paragraph 3.3.1.

3.3.3. Purchase of Materials: With YPFB's supervision.

- 3.3.4. Construction of the Plants: This phase shall contemplate the maximum utilization of Bolivian labor, but the company awarded the tender shall supply all the technical supervision that is necessary for the erection of the plants.
- 3.3.5. Start-up and Operation of the Plants: During the guarantee period specified by the suppliers of the processes and equipment. This activity shall include all the time necessary for the training of the Bolivian personnel in the operation and maintenance of the installations.
- 3.3.6. Technical Assistance: To the commercial organizations, either private or government owned, which will be in charge of the marketing of the products to be produced in the Complex. This assistance shall be both, technical and economic, and shall include a plan for promotion and education of the customer in the usage and handling of the explosives and fertilizers.

Summarizing, the proposal shall indicate a fixed amount for engineering, materials, supervision of erection, start-up and initial operation until the Bolivian personnel are capable on their own, and the marketing. The construction will be done through local sub-contractors, but under the supervision of the proposing company. For this purpose, the proposal shall estimate the number of man hours necessary for each specialized trade required for the erection of the plants; besides, it shall estimate a fixed sum for civil engineering works, buildings warehouses, loading and unloading platforms.

3.4. Technical Documents-

The technical documents that shall be included in the proposal will not necessarily be limited to the following:

3.4.1 Process

- a) Processes flow diagrams.
- b) Process descriptions.
- c) Material balances for each process.
- d) Chemical and catalyst requirements.

3.4.2 Equipment List

3.4.3 Utilities.

- a) Summary of estimated utilities under normal conditions.

3.4.4 Plot Plans

- a) Plot plan for the process units.
- b) General lay out plan.

3.5 Schedule

- 3.5.1 Estimated schedule for the execution of the project and for each single step, as explained before, including the training for YPFB personnel.

3.6 Prime-Moving Equipment

In general, the tendency shall be towards the usage of natural gas engines for prime movers. Small equipment shall be moved by electric motors. Nevertheless, enough steam turbine shall be used in order to effect a proper recovery of process heat and for allowing an orderly shut-down in case of power failure. All the main process pumps shall have a spare, but a common spare pump may be used for a maximum of two services.

For maximum process flexibility, the reciprocating compressors shall be supplied in duplicate, in 75% capacity.

3.7 Raw Material

The raw material to be used shall be natural gas, from fields located close to Santa Cruz. The gas will be supplied

to the petrochemical complex by a gas line, under YPF's responsibility.

The approximate composition of the natural gas is as follows:

CO ₂ y N ₂	0.55 % mol
C ₁	89.45 "
C ₂	7.52 "
C ₃	2.38 "
i-C ₄	0.08 "
n-C ₄	0.04 "

3.8 Utilities

3.8.1 Electric Power: - The public electric power available in Santa Cruz has the following characteristics: 10,000 V. for the high voltage line, 50 cycles. For connecting, - to the industrial complex, a transformer substation shall be provided in order to make available the low voltage - power that will be required in the plants. A generator - shall also be provided for emergency lighting and instru-
mentation.

3.8.2 Water: The usage of water cooling shall be held down to a minimum, by using the maximum of air-cooling.

Water will be supplied from wells, to be drilled by YPF in the site of erection of the plants. The normal depth - of these wells is 60 meters.

The characteristics of this well water are:

Appearance	Clear
Color	Colourless
Sediment	none
Organic matter	contains
pH (potentiometric)	7.2 ppm.
1.- Total soluble salts (Aprox.)	242 ppm.
2.- Silica (photocolorimetric)	
SiO ₂	25 ppm.

3.- Sulphates (turbidimetric), SO_4^{2-}	20 ppm.
4.- Chlorides, Cl^-	10 ppm.
5.- Free Carbon Dioxide, CO_2	contains
6.- Gypsum, $CaSO_4$	-
7.- Phosphates (Photocolorimetric), PO_4^{3-}	-
8.- Sulphites, SO_3^{2-}	-
9.- Alkalinity to phenolphthalein, $CaCO_3$	0
10.- Alkalinity to methylorange, $CaCO_3$	100 ppm.
11.- Alkalinity Relationship:	
a) Bicarbonates, $CaCO_3$	-
b) Carbonates, $CaCO_3$	-
c) Hydroxides, $CaCO_3$	-
12.- Hardness, French Degrees:	
a) Temporary F°	15.2 ppm.
b) Permanent F°	-
c) Total F°	15.2 ppm.

The normal dew point in Santa Cruz for design purposes is 72° F.

3.8.3. Fuel: Natural gas will be used as fuel for furnaces, etc.

3.8.4. Fire Protection: The proposal shall contemplate as part of the project, the necessary fire protection systems, using water and also foam, if so required.

3.9. Products Dispatch:

All the finished products will be shipped by truck or rail. The proposals shall include the equipment necessary for bag-filling the products in polyethylene bags; mechanical conveyors, other filling equipment, etc. Nevertheless, it shall not, include investments in civil engineering works.

3.10. Layout of the Complex:

The terrain to be provided for the erection of the plants is conveniently flat for such purpose.

The layout of the proposed installations shall take into consideration the possible future doubling in capacity of the plants.

3.11 Communication System and Miscellaneous

An internal communication system shall be considered; also equipment for a maintenance shop, laboratory and other equipment required for the operation of the plants. The construction of the building will be done by local sub-contractors.

3.12 General

The proposals shall be submitted in accordance with the accepted practices in the fertilizer industry and shall include enough details to allow for easy comparison of processes and shall permit adjustments in case modifications are required.

It is emphasized that the Tender requisites are not for an absolute minimum cost plant. It is desired that a certain degree of caution shall be applied throughout the project, considering the remote location of the plants from supply sources of materials, but consistent with the whole economics of the project. This will mean that the design shall minimize and simplify maintenance requirements.

3.13 Santa Cruz Climatic Information

Months	Mean Ambient - Temperature, °C		Rain-fall mm	Predominant Winds
	Minimum	Maximum		
January	27.3	38.1	107.5	FROM N.O. TO S.E.
February	27.0	37.3	169.5	
March	27.1	38.4	144	
April	26.8	38.7		
May	26.4	35.8	235	
June	27.9	35.8	96.5	
July	-	-	81.7	
August	-	-		
September	19.3	34.0	27	
October	21.7	35.4	155	
November	22.8	37.0	198	
December	24.5	36.2	57	
Annual	25	36.6	1,293	

4.0 QUALIFICATION OF THE PROPOSING COMPANIES

4.1 YPFEB will accept proposals from well known and experienced companies capable of assuming indivisible responsibility for every stage of the project.

- a) The proponent organization shall demonstrate that it has executed repeatedly, with its own personnel the functions of design, engineering, supply of materials, construction supervision and marketing supervision.
- b) The basic processes required for the project are: Ammonia plant, Nitric Acid plant, Ammonium Nitrate plant and Granulation plant for preparing fertilizers and explosives. The proposing organization shall provide detailed and satisfactory evidence of having designed and erected several units of the type described above.
- c) In case the tenderer intends to use knowledge or engineering processes from organizations different from his, he shall present proof of the experience and responsibility of such other organization, as specified above. The same is valid for marketing organizations.
- d) Any proponent that cannot fulfill the above requisites will not be considered by YPFEB for the project.

5.0 DOCUMENTS TO BE SUPPLIED BY THE PROPOSING COMPANIES.

5.1 Quotations:-

The tenderer shall submit his proposal based on a total estimated price for a complete job.

The quoted price shall include all the engineering work, materials and equipment for the Complex, according to the information contained in the present Tender Basis. The price shall include all the costs and charges associated with the design, engineering, supply and purchase of materials and equipment, ship freights and delivery CIF Buenos Aires, Argentina.

It shall be noted that all the materials, equipment, tools, etc. required for the plants will be imported into Bolivia free of custom duties.

The tenderer shall also quote the engineering supervision and specialized labor required for construction. Besides, he shall estimate the cost of Bolivians labor (although if this is subcontracted locally it will be subjected to a later adjustment) and the freight cost between Buenos Aires and Santa Cruz.

Finally, quoted prices for the operating and marketing assistance shall be given.

5.2 Royalties and Licence Fees

The proponent shall establish in his proposal all the cost for royalties payments, rights to be paid for practical use and license fees that might be required as a result of the utilization of the process, equipment, etc. contained in his proposal.

5.3 The proposals shall be submitted in duplicate, either in Spanish or English.

5.4 Any offer that might mean an improvement on the terms of the present Tender or the Pre-Feasibility Study, shall be included.

5.5 Once the proposal is approved, the tenderer qualified as the grantee shall submit to YPF, before the signings of the contract, the Corporation Charter proving the organization of his company, be this either private or state-owned.

5.6 Estimation of the Investment

The proposals shall present estimates for investment in equipment and materials construction and operating capital required for the following alternatives.

5.6.1. Capacities of the plants in accordance with the enclosed Pre-Feasibility Study (Ammonia Plant of 75 TPD, etc.)

5.6.2 Capacities of the plants different from the enclosed study, but stating the advantages in regard to investment or operation in comparison to those of paragraph 5.6.1. This estimate is optional.

In both cases, the capacities mentioned refer to metric tons per day.

5.7 The tenderer will submit for YPFB review a contract draft, that could be used as a basis for the final contract in case he is awarded the tender.

6.0 FINANCING

6.1 The tenderers shall include in their proposals a long-term financing plan, which shall contemplate, if possible, no payment on the part of YPFB until the plants are ready for operation.

6.2 The financing shall be complete for:

- a) Cost of foreign machinery and equipment, in foreign currency.
- b) Cost of Bolivian labor, in Bolivian currency or its equivalent in foreign currency.
- c) Cost of foreign labor, in foreign currency.
- d) Cost of freight and insurance.
- e) Cost of local materials in Bolivian currency or its equivalent in foreign currency.

YPFB might cover partially some expenses in bolivian pesos for construction purchase of land and with the supply of Bolivian raw materials.

6.3 Financing shall include the working capital necessary for the first stage operation of the industry. Financing shall also include all the stages of development as set forth in Article 3.0, including if necessary the costs of training Bolivian personnel in foreign countries.

7.0 PAYMENT TERMS

- 7.1 It is required that the tenderer establish the payment terms, cash and on a long-term basis in accordance with a financial plan proposed by him. In each case he shall specify the type of currency which is required.
- 7.2 YPFB is willing to make the payments in equal fixed amounts which will include a sinking fund plus interest, in periods not shorter than six (6) months. In case unequal payments are established, the first ones shall be lower than the later ones. These payments will start at least six (6) months after the petrochemical complex has been turned over to YPFB at its complete satisfaction, both technically and economically.
- 7.3 The total amount of the contract will be paid in no less than 7 years after the start-up of the plants.
- 7.4 If it is necessary, YPFB will be guaranteed by the Bolivian Central Bank.

8.0 OPERATION AND GUARANTEES

- 8.1 The proponent shall include as part of his proposal a statement of performance guarantee. Since any fertilizer industrial complex is vulnerable to failures in any of the process or utilities units, much credit will be given in the evaluation of the proposals to a careful selection of trustworthy processes and plant designs, which shall consider appropriate operational continuity.
- 8.2 The tenderer shall guarantee individually the performance of the process units according to the specified conditions.
- 8.3 The tenderer shall guarantee the total product yields of the complex.
- 8.4 Utilities consumptions shall be guaranteed for the whole complex, and detailed consumptions per process shall be given.
- 8.5 The time that will be taken by the initial start-up, acceptance testing. Other general operating conditions such as catalysts life, manpower requirements, etc, shall be established.
- 8.6 The tenderer shall establish the maximum obligation he is willing to assume in reference to the guarantee clauses mentioned above.

9.0 JOINT VENTURE

The tenderers may present proposals that contemplate the organization of a Joint Venture with YPFB. In this case, YPFB is legally required to retain 51% of the capital stock required for the petrochemical complex. If a joint venture is proposed, it will be necessary that the tenderers offer financing under the same conditions as set forth in Article 6.0. They may also offer to invest in the capital stock of the venture up to a maximum of 49%.

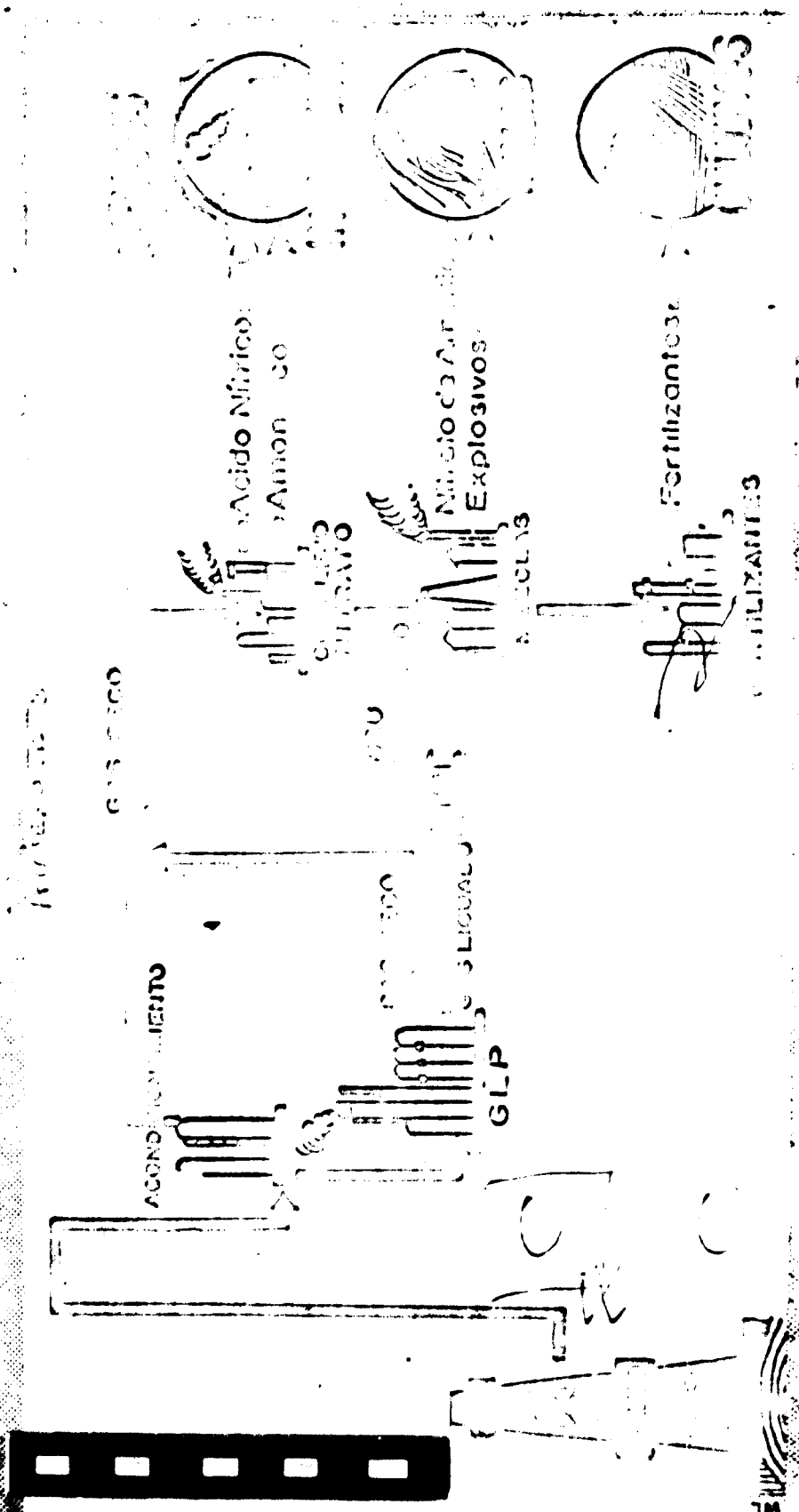
10.0 NON-EXECUTION OF THE PROJECT

If the re-evaluation of the enclosed Pre-Feasibility Study, in accordance with what is stated in Paragraph 3.3.1, should show that it is not desirable to go ahead with the project, or if this project should not be executed due to YPFB's fault, then YPFB will reimburse the reasonable expenses incurred by the grantee before such re-evaluation of the Pre-Feasibility Study.

11.0 EXPLANATORY INFORMATION

It is emphasized that it is not required that the tenderers submit a detailed investment study, but only one which is sufficiently complete to allow a comparison of the proposals. Much importance will be given to financing, type of processes proposed, experience and capability of the proposing companies, schedule and outline of work to be performed and description and terms of each subject under consideration, and improvements that might be offered in comparison to the Tender Specifications or enclosed Study.

From all the proposals, YPFB may select two or three tenderers, so that each of them, after re-evaluating YPFB's Studies and deciding with YPFB the final design basis, and establishing by themselves local conditions for erection of the plants, might be asked to submit a further proposal which will then be considered as final, after which no further modifications or quotations will be allowed.



CONDENSADOR LIQUIDO

GAS LIQUIDO

CONDENSADOR GASEOSO

GLP

SILICATO

NITRATO

NITRATO EXPLOSIVOS

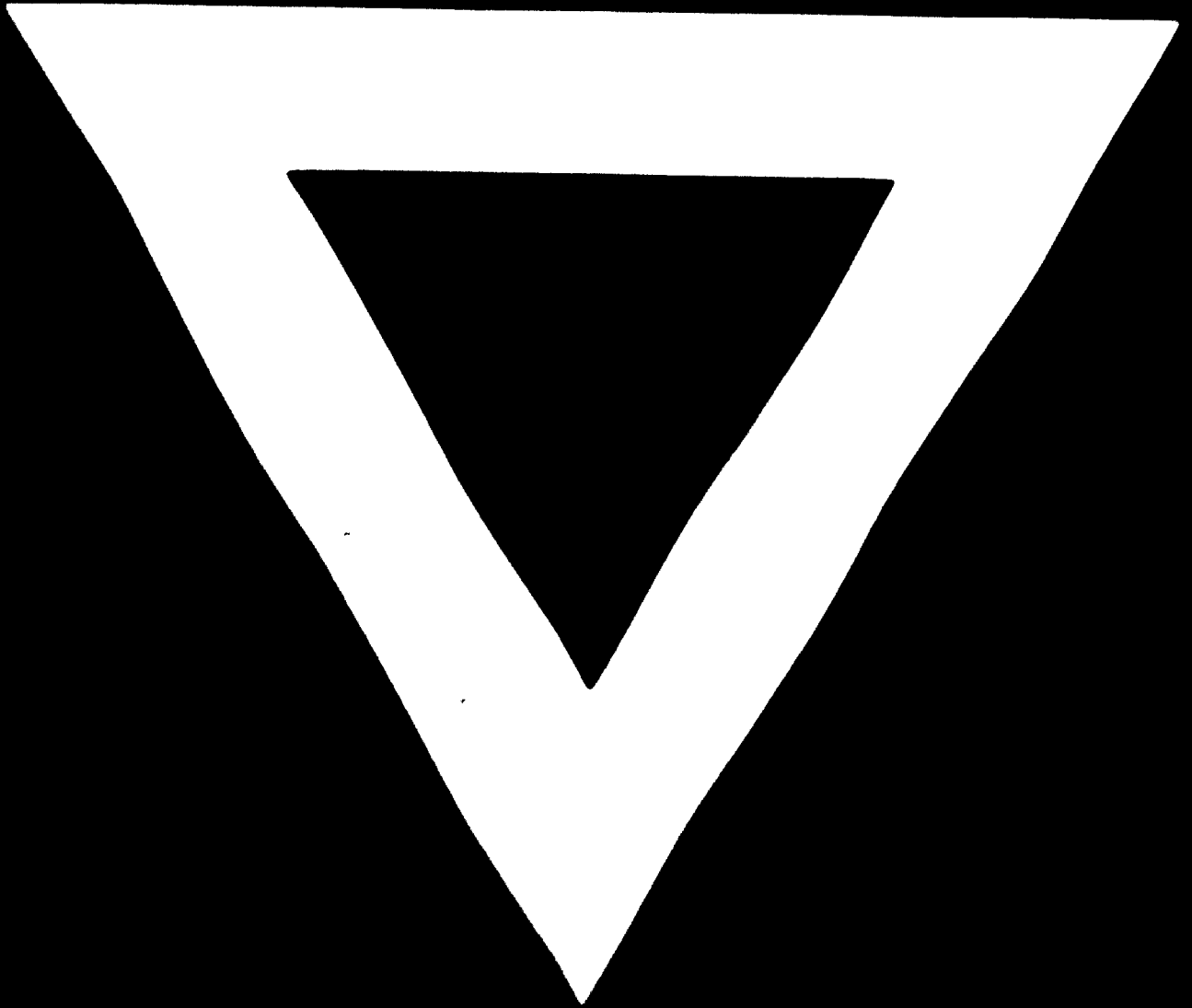
Fertilizantes

NITRATO

NITRATO EXPLOSIVOS

Fertilizantes





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