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Workshop on Case Studies of Aluminium Smelter
Construction in Developing Countries

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BACKGROUND PAPER
ON THE
IRANIAN ALUMINIUM COMPANY (IRALCO)^{1/}

by

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I. Introduction of the Iralco Plant

The idea of establishing an aluminium smelter in Iran was originated from the technical assistance of the UNIDO to Government of Iran.

The preliminary study was begun in 1965 at Ministerial level, and later, the results of the feasibility study concluded the establishment of an aluminium smelter in the city of Arak, located in the Central province of Iran. The investigation about the form of Iranian Aluminium Company was started in mid 1966 and consequently the IRALCO was formally constituted in 1967, within the framework of the Regional Cooperation for Development (R.C.D.).

The shareholders of the Company are Industrial Development and Renovation Organization (IDRO), which is subsidiary of Iran Government, Reynolds International of the United States, and Pakistan Government. The shares allocated to the above mentioned Companies were 82.5% , 12.5% and 5%, respectively.

The Iralco plant has a rated capacity of 45,000 tons per annum, which can be arranged to produce up to 50,000 tons per year.

Engineering and design of the plant was carried out mainly by Reynolds International Ltd., based

on the Engineering and know-how agreement signed on 4th of July, 1969.

The construction contract was awarded to Consortium KHD/BBC (Kloechnner-Humboldt-Deutz and Brown Boveri of W. Germany). The construction of the plant including the unloading and storage facilities at Bandar Shahpour harbour (Persian Gulf), began in Oct. 1969 and ended in May 1972.

Technical and Economical Characteristics of The Plant

The reduction pots are prebaked (Troutdale type) and uncovered. There are two pot lines (4 pot rooms) and 140 pots in each pot lines. Two cranes in each pot room are used for loading the pots. The amperage in each line is 63-68 K. Am. and voltage per pot is 4-5 volts. The dimensions of prebaked anode are 520x402x407 mm and its weight is about 121 kg.

120 M Watt power is required to operate the plant, with the full capacity. The power is supplied through two 230 kv power lines, which are part of the power grid system. Two main transformers reduce the voltage to 20 kv. Eight silicon type rectifiers provide D.C. current for 2 pot lines. The amperage efficiency is 85-87 percent. The average total power consumption is about 900,000,000KWH per annum (for production of 48,000 tons of Aluminium

per year).

The carbon complex (carbon paste, carbon bake and Rodding) produce 40,000 m tons of Anode blocks, per year.

There are one homogenizing furnace 4 holding furnaces, one pig casting unit, 2 vertical D.C. casting units, and other accessories, in the cast house. The existing production schedule is to produce 14,400 mt/ann. of 10,50 and 1,000 pound pure ingots (\$99.5-\$99.70), 3,600 mt/ann. of foundry alloy, 18,000 mt/ann. of 7-inch and 8-inch 6063 billet, and 12,000 mt/ann. of 8-inch EC and 1,000-pound EC sow. The above mentioned schedule is based on the maximum capacity of the plant, assuming that the 120 Mw of power is available. But due to energy shortage which is the result of dramatic growth of industries and residential buildings in Iran the supply of power was reduced to 67 mw on average during 1976, and the production was decreased to 32,000 tons per annum. The initial selling program was based on 75% of the total products to be exported, but later on, due to increase in the consumption of aluminium in Iran and the current development of mill product capacity, most of the products is being absorbed by local market. The report issued by Iralco on Jan., 1977, indicates that a total of 168,000 tons of aluminium has been produced since the beginning of the plant

and almost 110,000 tons (60% of the total production) of aluminium has been absorbed by local market.

The fixed capital investment for the existing plant was about us \$ 58,8 million.

The total number of Iralco personnel is 1,250 for 3 shifts, including the administrative staff.

Iralco Expansion Program

Due to availability of sources of energy in Iran and rapid increase in market demand (specially in local market), the Iralco expansion program became activated in early 1973.

The results concluded from the Techno-economical study had indicated that the expansion of the plant up to 120,000 tons per year would be feasible.

Since at the time of establishing the primary smelter considerable experiences had been gained in the field of the construction and operation of the existing smelter, therefore, IDRO decided to award the engineering and project procurement to Technolog Inc., Engineering and Industrial Consultant, affiliated company to IDRO. Furthermore, in order to avoid unnecessary expenses for provision of engineering knowhow, the policy of the expansion was based on duplication of the

existing facilities, as much as possible and modification of the equipment which had created maintenance problems due to their unsatisfactory operation, in the existing smelter.

To follow the policy, IDRO decided to award the contract of manufacturing and installation of the pot assemblies and other accessories to Machine Sazi Arak (M.S.A.), which is a subsidiary of IDRO and its plant is located next to Iralco site.

The preliminary schedule had called for the expansion of pot lines (3 more pot lines), cast house and casting facilities, and also modification and increase in the capacity of carbon complex facilities. But later on, when the regulation for environmental pollution control was issued, supply of the pollution control facilities were included in the schedule of the expansion project. Total estimated cost of the project was us \$ 120 million including the dry scrubbing pollution equipment (us \$ 20 million).

The expansion project is proceeding slowly, due to limited amount of funds. Based on the new estimate, the project has already been delayed for two years in respect to initial time schedule. It is anticipated that the project will be continued up to mid 1980, and by that time all facilities will be utilized to increase the production capacity to 120,000 tons per year. The feasibility study of

establishing a power generating plant in Iralco is under study. The results concluded from feasibility study will indicate that whether to proceed with (a) full power generating plant or (b) stand-by and emergency power generating plant.

The expansion program of cast house has been given priority over the other programs, since the demand for billet is increasing rapidly and Iralco has decided to remelt the existing products in Iralco stock and reproduce billet. The existing and future pots will be hooded and equipped with the dry scrubbing equipment. Also the raw material handling will be modified using belt conveyers, in order to decrease the pert and protect the area from the pollution.

Bandar Shahpour bulk unloading facilities will be also duplicated to the size that can satisfy both the needs of the existing and expansion program.

Future Aluminium Market in Iran

The outline of the results concluded from the market study in Iran, which was carried out by Alumiran (another fully-owned subsidiary of IDRO) is tabulated as follow:

YEAE	IRALCO	EXPORTED	IMPORTED	LOCAL COSUMPTION	POPULATION	PERSONAL CONSUMPTION PER ANNUM
1000 Metric Tons					Million	Kg.
1973	38	21	14	31	31.4	1
1974	50	19	16	47	33.1	1.4
1975	45	13.5	30	61.5	34.1	1.8

The last column of the above table indicates the increase of %40 of the personal consumption of Aluminium per year, within 3 years (1973-1975).

According to the above mentioned study it is anticipated that the annual personal consumption of aluminium will increase with a average rate of %30 per year within next 10 years.

By consideration of %2.4 of annual increase in number of the population, it is estimated that the annual aluminium Consumption in Iran will be increased up to 600,000 tons, in 1985.

Since Iralco plant (existing and expanded) will be producing 120,000 tons per annum, therefore, it is planned to establish another aluminium smelter in Iran, in order to make the local market self-sufficient from imported aluminium products.

The tentative schedule has been based on establishing an aluminium smelter in Persian Gulf Coast with a capacity of 150,000 tons per year.

The techno-economic study for establishment of such a plant together with the study for raw material supply will be carried out in early future.

II. Construction Program of Iralco Expansion

The following points are some of the problems which I have been facing with through my experience in Technolog, as the project director to Iralco Expansion.

I would like to discuss about these points and express my personal opinion to the participants of the workshop.

Raw Materials

Supply of raw materials (alumina) for Iralco existing and expanded plants:

a) Short range planning

- Purchasing alumina from international markets
- Investment for exploration and development of the bauxite in the countries which have considerable quantity of bauxite and have already established some alumina producing plants

b) Long range planning

- Investigation about existence of bauxite resources and the quantity of the mines, in Iran.
- Investigation about establishing the alumina plant, in Iran.
- Investigation about the other sources of raw materials such as alunite, and subsequently, the study about the process of producing aluminium, utilizing the pots with the new kind of raw materials.

Time Schedule of Iralco Expansion

- Preparation of time schedule and C.P.M. for Iralco expansion when the schedule of budget allocation is not defined for procurement of the project and when the duration of each activity is also not defined due to shortage of construction material and manpower.
- System of updating the project progress report considering the above mentioned conditions.

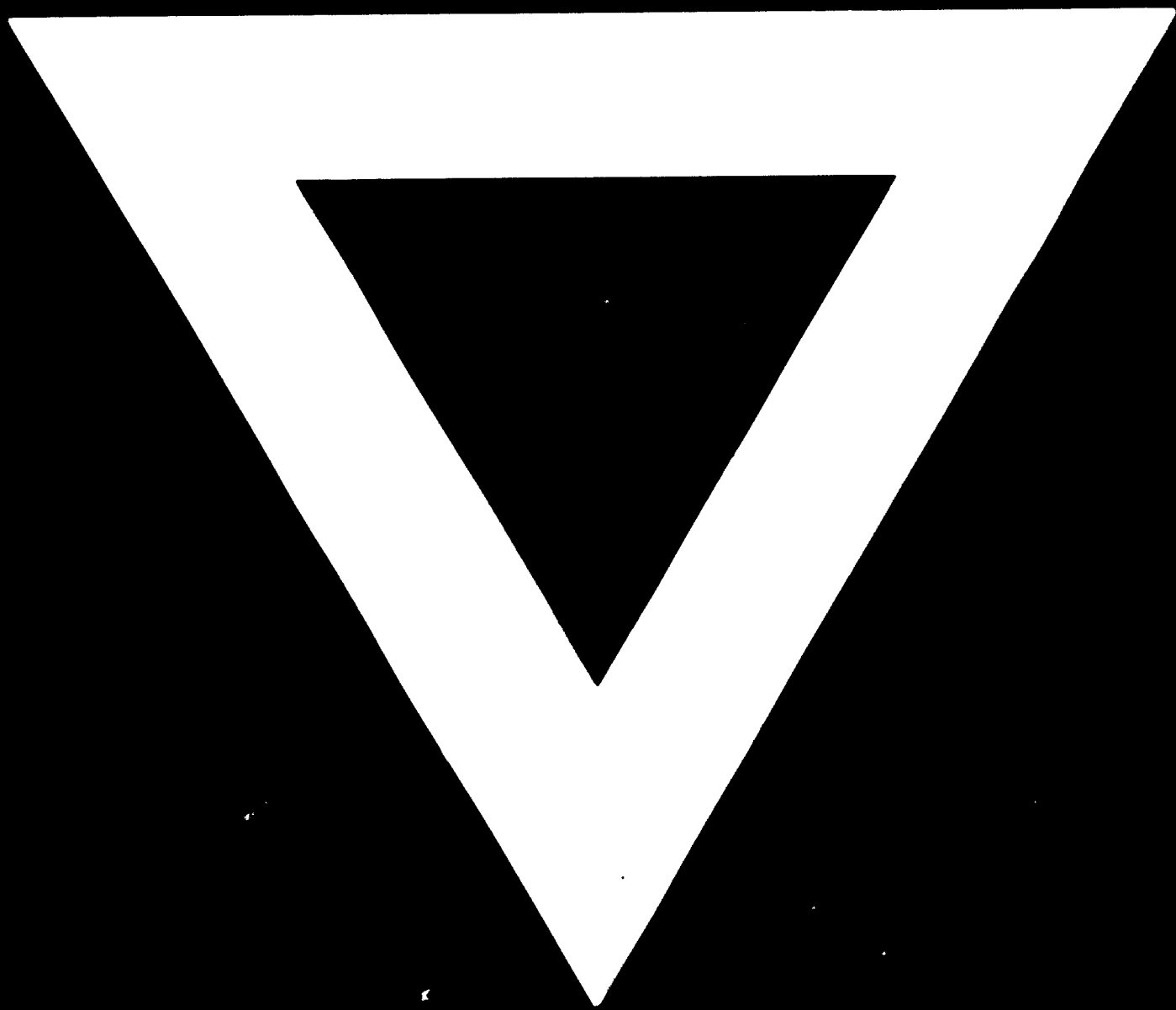
Pollution Control Facilities (dry scrubing system) for Iralco Existing and Expanded Plants

- How we could meet the above 90 efficiency of the system when the pots are uncovered type
- How we can guarantee the performance of dry scrubing system when the contract for pot hooding and dry scrubers are placed with two different Contractors.
- Testing procedure for commissioning such a project.

The Manpower for Iralco Expansion

- Automation of the aluminium production process in pot rooms, using computer and automatic equipment, in order to minimize the number of workers.

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