

FERROALLOYS PRODUCTS IN THE GULF REGION

By

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BACKGROUND

Ten years ago, the Gulf Organization for Industrial Consulting (GOIC) which is a non-profit making organization formed by the Gulf Cooperation Council (GCC) countries and based in Doha, Qatar, had taken an initiative in promoting this industry in the Gulf region when GOIC and Elkem of Norway jointly prepared a detailed feasibility study for Silicon Metal and Ferro Silicon. They had then concluded that it was not feasible to produce these products, at that time, in the Gulf region.

In late 80's, however, GOIC by itself decided to start afresh a study for Ferro Silicon only and produced one based on Mannesmann Demag furnaces with a conclusion that it is feasible to produce this alloy in the Gulf. The study was published in February, 1990 showing the viability of setting up 25,000 tpy Ferro Silicon-75 Plant in the Gulf.

United Gulf Industries Corporation (UGIC), which is a GCC private share holding company based in Bahrain, purchased this study and began to promote the idea in the Gulf. The high electrical power requirement necessary for this project, was available only in Jubail Industrial City located in the Kingdom of Saudi Arabia. However, a huge investment to upgrade the nearest substation in the Industrial City of Jubail was required. Hence, UGIC decided to expand the project to include other alloys in order to justify the huge cost. It then conducted a detailed feasibility to produce Ferro Manganese (10,000 tpy), Silicon Manganese (30,000 tpy), Ferro Silicon (25,000 tpy) and Silicon Metal (10,000 tpy) having four submerged electrical furnaces, to utmost utilization of electrical power availability. An industrial license was then obtained to produce these products from the Ministry of Industries and Electricity of Saudi Arabia on August 4, 1992.

Jubail Industrial City situated in the Eastern Province of Saudi Arabia was selected to be the most convenient location to start such an industry for the reasons that the infrastructure provided and encouragement given by the Saudi Government for locating industries there was found to be extremely encouraging. Besides, its proximity to the related industries, abundant availability of potable water, sea water for cooling, low electric power tariff, fuel gas and other infrastructure were found to be attractive incentives. The site of "SABAYEK" is next to Saudi Iron & Steel Co. (HADEED), which would be the major consumer of certain alloys. The site is located 17 Km. away from commercial port and 40 Km. away from the international airport. These facilities definitely serve the needs of such a prodigious industry exceptionally well and contributed in identifying the location of "SABAYEK" there. The availability of Government's loan up to 50% of the total cost of the investment at '0' interest term was another factor that weighed heavily in setting up this industry in the Kingdom of Saudi Arabia.

The site comprising of 200,000 m² (20 hectares) was granted to SABAYEK by the Royal Commission for Jubail and Yanbu, which is the governing authority of both these Industrial Cities. Another piece of land is also made available for possible expansion, in the future. Majority of Saudi Basic Industries Corporation's [SABIC] important industries are located in this city and are backed by supporting industries in the secondary industries area.

THE PLANT

An approved site layout for the Plant is shown in Figure 1. The proposed Plant will be capable of producing ferroalloys and silicon metal in accordance with the international standards. As shown, in order to avoid contamination, separate product lines have been included for each alloy, comprising raw material storage, day bins, raw material weighing system, and burden transport, furnaces, tapping system, product treatment, dedusting plants and dust handling system.

The design of the Ferro-alloy Plant takes advantage of the techno-economic concepts developed by Mannesmann Demag and BHP Engineering, with particular reference to:

- ◇ Raw material handling, batching and weighing
- ◇ Furnace design and computer control
- ◇ Hot metals handling
- ◇ Product handling and storage
- ◇ Dedusting plants

The Plant is designed to be built with standardized facilities as much as possible such as raw-material handling to facilitate a module type extension of the product unit. The capacity of the stockpile has been designed for a minimum of 2 month's stock for imported materials and a minimum of 1 month's stock for local materials.

From the stockpile the raw materials will be loaded by front-end loaders into a dump hopper feeding the day bins via belt conveyors. The day bins for each system will contain a 48 hours supply of raw materials for the furnaces, allowing loading to take place during the day shift only. The required furnace feed will be batch weighed under the day bins via a separate weigh bin system, subsequently blended and fed to the furnace charge bins located above each furnace.

• SUBMERGED ARC FURNACES

The submerged arc furnaces will be of 'open type' design equipped with a gas hood to collect the furnace off-gas, incorporating a movable chain curtain. The four furnaces will be standardized as technically appropriate.

The furnace charging bins will be located symmetrical to the furnace and will feed the furnace via charging tubes and vibrating feeders to the charging chute mouth pieces. Furnace 1 will have choke-feed and therefore does not have vibrating feeders. The mouth pieces will be located around the electrode assemblies to ensure an even distribution of material into the reaction zone.

The electrode's (Soederberg or pre-baked type) electrical supply will be provided via water-cooled copper contact clamps. The contact clamps and electrode pressure rings extend below the furnace roof and will be located just above the furnace burden. An automatic electrode regulating and slipping system will be located on the slipping floor to provide the required control over electrode power and consumption.

Three of the four furnaces (only for production of Si metal and FeSi) will be equipped with a furnace shell rotating mechanism.

The three single-phase transformers will be located symmetrically around each furnace to minimize the length of the water-cooled high-current lines and to minimize any electrical system losses.

The furnace control system will be Programmable Logic Control (PLC) computer-based to integrate the raw material weighing, de-dusting plants and furnace control. The control panels will incorporate manual controls for the furnace electrode functions and essential safety alarms and trips.

MDH PLC programmed Electrode Controllers will be included for optimal management of power input to the furnaces.

A supervisor computer for process and production management of the individual plant sections will be included. The computer displays graphic mimic screens of all functions and generates alarm and production reports.

- **HOT METAL AND PRODUCT HANDLING**

The alloys produced by each furnace will be tapped into refractory-lined ladles and cast into flat moulds made of cast-haematite.

The products, after cooling in intermediate storage bays, will be transported to the crushing and screening plant. The product will be fed into the crusher by a front end loader and sized through a series of screening operations to obtain the desired marketable products.

Three separate product handling lines will be provided. The crushers, screens and equipment will be of similar type to minimize spare parts inventory.

- **DE-DUSTING PLANTS**

Four (4) de-dusting plant systems each dedicated to one furnace will be provided to clean the furnace off-gases. The gas will be cooled by the intake of ambient air at the furnace gas hood in order to maintain the filter baghouse inlet operating temperature.

After separation of the dust from the off-gases, the dust will be transported pneumatically to the dust silos and dust handling equipment for further preparation to a salable product.

The cleaned off-gases will meet the local standards of pollution and environmental control.

THE DISTINCT FEATURE OF THE PLANT

The plant as described above has the following distinct features which makes it different from other ferroalloys plants:

1. **STANDARDIZATION**

The submerged furnaces have been standardized as much as possible although they may be used to produce different products.

- All are semi-open
- All have similar transformers
- All furnaces rating is 27 MVA each

2. FOUR DIFFERENT PRODUCTS

The plant is the only plant in the world that can produce four different products, namely, Ferro manganese or Ferro chrome, Silicon manganese, Ferro silicon and Silicon metal. Contamination problems have been addressed very strongly in the design of these furnaces.

3. FLEXIBILITY

The design of these furnaces and the associated auxiliaries have been designed in such a manner that each furnace has to be capable of producing at least two different products. For example, Furnace No. 1 can produce Ferro manganese or Silicon manganese. Furnace No. 2 can produce Silicon manganese or Ferro silicon. Furnace No. 3 can produce Ferro silicon or Silicon metal, and Furnace No. 4 can produce Ferro Silicon or Silicon metal.

The plant can produce different combinations of mix depending upon the market situation.

4. THE EXPANSION

The layout is designed to satisfy future expansion program. The infrastructure of SABAYEK plant is designed to house additional two furnaces without major additional cost to the existing infrastructure.

THE IMPACT

- ▣ The project will complement the efforts for an integrated manufacturing sector as 70% of its products will replace imports.
- ▣ The project will provide to the region a positive interaction with the changes in the international industrial scene with respect to market and the industrial development.
- ▣ It is an energy based industry which will benefit from the regional relative advantage.
- ▣ It will help in the development of local raw materials, particularly quartz.
- ▣ The products produced at the plant will be internationally competitive in terms of quality and pricing as highest quality requirements have been ensured while selecting the state of the art plant/machinery and technology.

GULF FERRO ALLOYS CO. (SABAYEK)
PLANT
 At Jubail Industrial City - Kingdom of Saudi Arabia



