

CHROME & FERROCHROME PRODUCTION PLANT



CHIEF MINISTER'S OFFICE
BOARD OF INVESTMENT & TRADE
GOVERNMENT OF BALOCHISTAN



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1 MARKET OVERVIEW

There are a number of small deposits and occurrences of chromite in various parts of Pakistan, but commercial production has been almost entirely restricted to Balochistan. Pakistan has belts of the highest grade of chromite ore deposits in Balochistan, where the Chromite ores deposits are estimated at around 500 million tones available with an annual production of 20,000 tons per year. In Balochistan chromite is being produced from Muslim Bagh, Khanozai (Pishin District), Nasai (Kila Saifullah), Gawal, Wadh (Lasbela), Sonaro (Khuzdar), and Zhob District.

Pakistan's chromite grade ranges between 28%-56% and it produces both metrological and refractory grades of chromite. However, despite huge reserves and production, Currently, the raw ore is transported to Karachi and it is refined in the beneficiation plants located there due to lack of modern processing and value addition activities in the province

Chromite is used directly in industrial foundry and refractory sands or converted into sodium dichromate for further refinement into other chemicals and chromium metal, but the main consumption is in ferrochrome furnaces to produce an alloy used by the steel industry. Over 95% of chromium consumption is attributable to metallurgical applications, with stainless steel alone represented 78% of consumption in 2019. Trends in stainless steel production are, therefore, the main determinant for chromium demand.

The metallurgical industry uses chromite ore (also known as chrome ore) to produce chromium ferroalloys and metal. It is also used in the chemical industry to make sodium dichromate which is both a chemical industry product and an intermediate product used to make other chromium chemicals. Chrome ore is mainly used to smelt special alloys with elements such as cobalt, nickel, and tungsten. These special steels and special alloys are crucial materials for the aerospace, automotive, shipbuilding, and defence industries.

In addition, chrome ore is also used in the refractory industry to produce refractory materials, including shapes, plastics, and foundry sands. These refractory materials are then used in the production of ferrous and nonferrous alloys, glass, and cement. It is useful in the refractory industry because it retains its physical properties at high temperatures and is chemically inert.

2 INVESTMENT POTENTIAL

Baluchistan is having large deposits of chromite ore, estimated at around 500 million tons and with an annual production of 20,000 tons per year. However, the raw chromite ore is transported to Karachi and is refined in the beneficiation



plants located there. This means the impurities in the ore are also transported to Karachi, thus increasing the transportation costs.

Despite the everlasting demand for stainless steel production, there is no ferrochrome production unit in the country. Ferrochrome is an alloy comprised of iron and chromium used primarily in the manufacturing of stainless steel.

The presence of huge deposits of Chrome could be utilized to establish Ferro Chrome Industry. Key investment opportunities in the Chromite sector are;

- Chromite processing plant for the production of upgraded chrome
- State of the art Ferrochrome production plant

Ferrochrome production will allow the steel industry to get the raw material from indigenous local resources and at a lower cost and larger quantity and will also reduce steel manufacturer's dependence on imports of ferrochrome.

3 SCOPE OF THE PROJECT

Setting up a Chromite Beneficiation Plant will enrich the Chromite content of the ores, liberate them from unwanted rock material and other minerals and eventually separate the final product into uniform grain sizes. In other words, the purpose of beneficiation is to render the ore physically and chemically suitable for further treatment. This will give savings to the plant owners in the form of low transportation costs & profit through the value-added product.

Chromium is used in stainless steel and other alloys. Chromium plating, for example on cars and bicycles, produces a smooth, silver finish that is highly resistant to corrosion. It is also used as a pigment for glass, glazes, and paint, and as an oxidizing agent for tanning leather.

The metal is also widely used as a catalyst. Chromium is not found as a free element in nature but is found in the form of ores. The main ore of chromium is chromite, which is found in a significant amount in the province. To isolate the metal commercially, chromite ore is oxidized to chromium (III) oxide (Cr_2O_3). The metal is then obtained by heating the oxide in the presence of aluminium or silicon.

The chromium industry comprises the mining of chromite ore and the manufacturing of chromium chemicals and metal, ferrochromium, stainless steel, and chromite refractory products. Several trends are taking place simultaneously in the chromium industry. Internationally, chromite ore production is moving from independent producers to vertically integrated producers. In other words, chromite ore mines tend to be owned and operated by ferrochromium or chromium chemical producers or by refractory product manufacturers.

Chromite ore is predominantly used in the production of ferrochrome – an alloy of chrome and iron containing between 50% and 70% chromium. The production of steel is the largest consumer of ferrochrome, especially stainless-steel production which contains between 10% and 20% ferrochrome content.

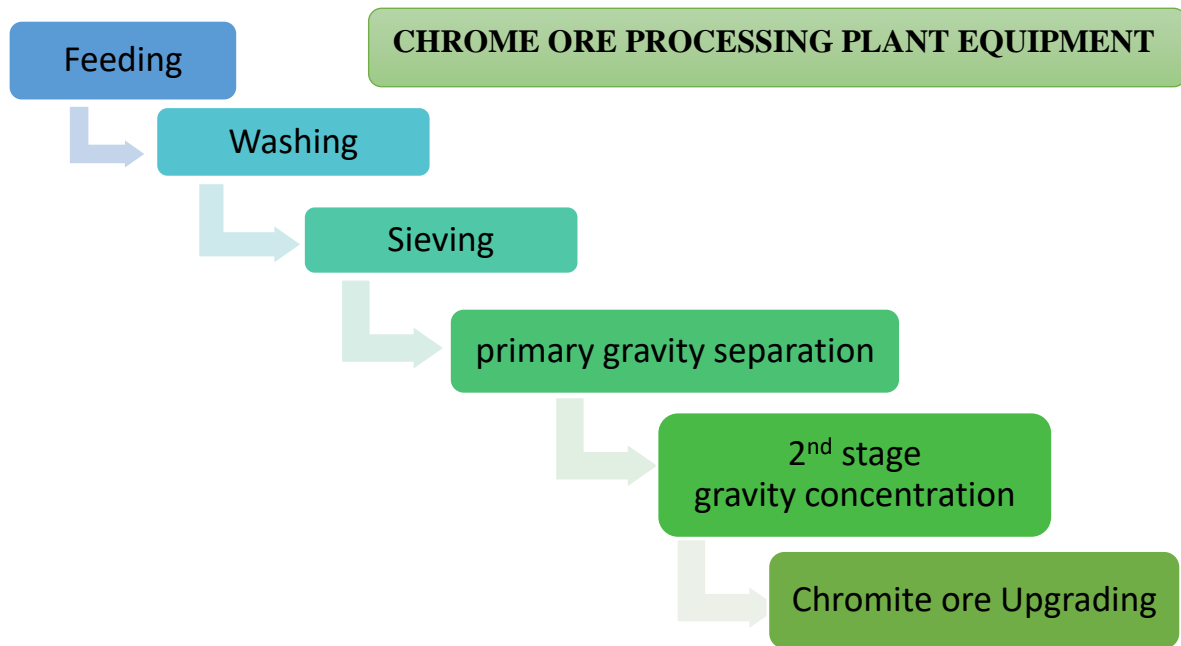
The process of chromite ore mining can be divided into 2 areas:

FEED PREPARATION

The feed preparation stage involves the introduction of various physical separation equipment including crushers, screens, and grinding mills. The principal function of this stage is size reduction in preparation for the concentration phase.

CONCENTRATION

The concentration phase introduces hydro-cyclone technology and spirals to produce the chrome concentrate from which the final product will be derived. The wastewater from this process will report to tailings dams where an additional filtration stage may be employed.



3.1 CHROME ORE PROCESSING PLANT EQUIPMENT

Chrome ore Feeding: can be vibration feeding machine, feeding hopper, belt feeder, wheel loader, or excavator feed directly. Usually will make a grizzly bar on a vibration feeder or hopper to remove big waste stones firstly.

Chrome ore Washing: chrome ore trommel scrubber washer is for washing chrome ore raw material with much sticky clay, chromite ore washing trommel screen is for wash chromite ore raw material that without much sticky clay.

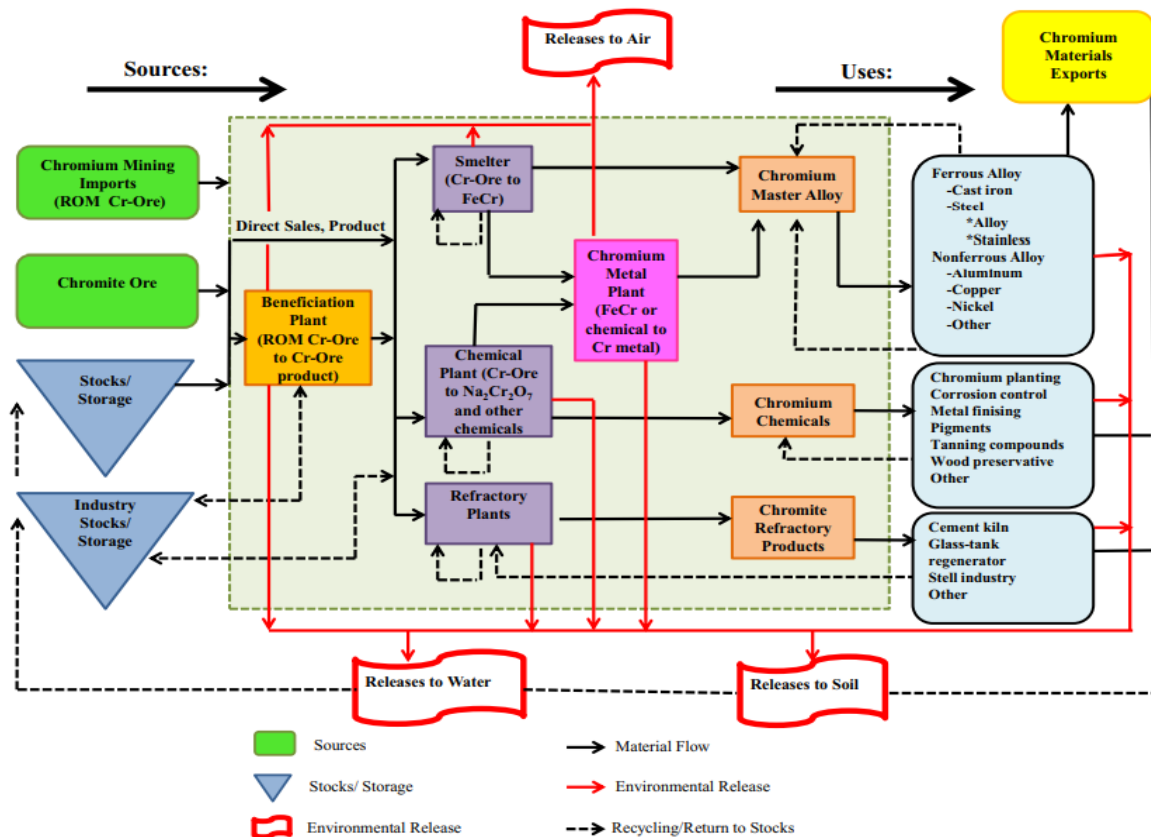
Chrome ore Sieving: after washing, then sieve out some bigger waste stones, the under-screen slurry will go to the next separation machine. This sieving process can use a trommel screen or vibration screen or chrome-ore high-frequency vibration.

Chrome ore Primary Gravity Separation: it is for primary chrome ore concentration process; jig separator or spiral chute separator are the best choices of chrome ore gravity mining equipment. The concentrated ore discharged from them will send to the second stage concentration machine.

Second Stage Concentration process: the concentrate ore from the chrome ore jig machine or spiral chute separator will go to the chrome ore shaking table concentration machine for final concentration, can get high-grade chrome ore concentrate. Shaking table is a good concentration effect mining equipment for chrome ore processing plant.

Chromite ore Upgrading: if chrome ore with a higher grade is required, a high-intensity magnetic separator can be used to upgrade it. The chrome ore magnetic separator is also important chrome ore mining equipment for final upgrading.

3.2 CHROMITE PROCESSING STAGES

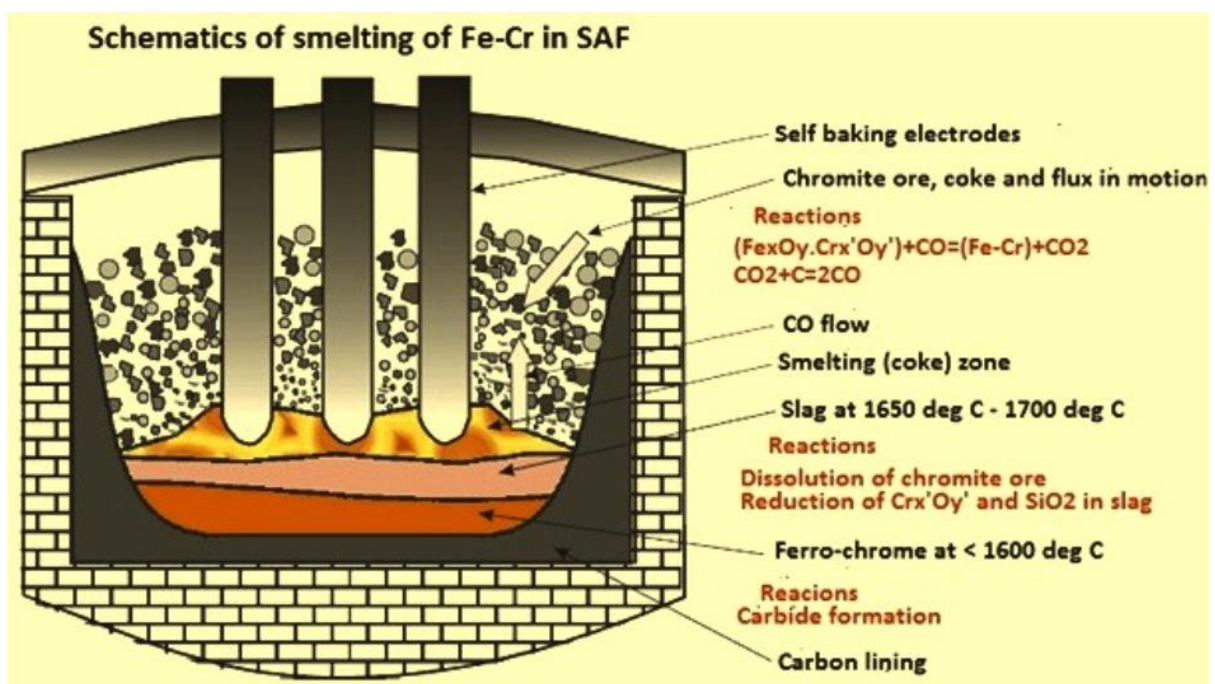


3.3 FERROCHROME PRODUCTION PROCESS

Over 80% of the world's ferrochrome output is utilized in the production of stainless steel. Stainless steel is dependent on chromium for its appearance and its corrosion resistance. The average chromium content in stainless steel is 18%. FeCr is also used when it is desired to add chromium to carbon steel.

Ferrochrome production is essentially a high-temperature carbothermic reduction operation. Chrome ore (an oxide of chromium and iron) is reduced by coke (and coal) to form the iron-chromium-carbon alloy. The heat for the process is provided typically from the electric arc formed between the tips of the electrodes in the bottom of the furnace and the furnace hearth

is very large cylindrical furnaces known as “submerged arc furnaces.” As the name implies the three-carbon electrodes of the furnace are submerged into a bed of mainly solid and some liquid mixture made up of solid carbon (coke and/or coal), solid oxide raw materials (ore and fluxes) as well as liquid FeCr alloy and molten slag droplets that are being formed. In the process of smelting, huge amounts of electricity are consumed. The tapping of the material from the furnace takes place intermittently. When enough smelted ferrochrome has accumulated in the hearth of the furnace, the tap hole is drilled open and a stream of molten metal and slag flows out down a trough into a chill or ladle. The ferrochrome solidifies in large castings, which are crushed for sale or further processed.



3.4 PREFERRED LOCATION FOR FERROCHROME INDUSTRY:

Bostan and Lasbela Special Economic Zone (SEZ) are preferred two locations for establishing Ferrochrome production plant as these locations are not only close to chromite producing districts of Muslim Bagh, Khanozai (Pishin District), Nasai (Kila Saifullah), Gawal, Wadh (Lasbela), and Sonaro (Khuzdar) but also close to CPEC routs which will give it easy access while transporting finished goods to steel industry located in various parts of the country.

4 REGULARITIES for MINING LICENSES IN BALOCHISTAN

Exploration License: Up to an area of 1,000 sq. km. for a period up to 3 years

Reconnaissance License: Right to search granted over an area of 100 to 10,000 sq. km. in respect of a mineral or group of minerals for 2 years

Mineral Deposit Retention License: license between the exploration and mining stages for 2 years

Large Scale & Small-scale Mining License: Granted for a period from 10 to 30 years

Small Scale Prospecting License: Period of 2 years

4.1 RULES FOR EXPLORATION LICENSE

The following documents will be required for the Exploration License application under rule 10 & 26 of Balochistan Mineral Rules, 2002.

- Five copies of the comprehensive geological description of the area of land over which the license is sought.
- Five copies of the geological Map of the applied area (A3 size) covering all the geological features, structure, formation, etc.
- Location of the area with reference to the magisterial district; (Refer rule 18(1)(d))
- The extent of the area and the boundaries by reference to identifiable physical features and co-ordinate reference points; (Rule 26(1)(b) and (C)).
- The potential for a nature of mineralization in the applied area (Rule 26(1)(i)).
- The program of exploration operations proposed to be carried on, the estimated expenditure in respect thereof, and the period within which the operation will be carried on;(Rule (1)(d)(i)).
- A report containing particulars of the state of the environment in the area to which the application relates, including any existing damage to the environment, the anticipated effect and likely adverse impact which the proposed exploration operations may have on the environment; including measures for the prevention of pollution, disposal of waste and the rehabilitation of land; (Rule 26(d)(ii)).
- Proposals for the control or elimination of any particular risks (whether health, safety, or otherwise) involved in exploration operations proposed to be undertaken.

- Particulars of the applicant’s technical and financial resources to carry out the exploration operations and those of any person to be engaged to provide such resources, together with supporting documentary evidence and copies to relevant contractual agreements; (Rule 18(1) (f) and 26 (1)(e)).
- A copy of the Memorandum and Articles of Association of the company and an attested copy of the certificate of incorporation/registration of the company in Pakistan.
- Proposals in respect of the matters specified in rule 13(1)(b) to (h).
- Annual reports and audited financial statements of the company for the last three (3) years.
- List of Directors/ Shareholders with the address.
- CVs of Technical officers.
- Bank Certificate (Local Bank).
- Application fee for Exploration License Rs: 240,000/- and application form fee Rs.6,000/- as specified in the First Schedule to the rules (Rule 10 (1) (c)).

5 REGULARITIES FOR THE CHROME & FERROCHROME PRODUCTION PLANT

- A) Registration of the Business organization
- B) NOC from Balochistan Environmental Protection Agency - BEPA
- C) Registration of boiler and pressure vessel

5.1 ENVOIRMENTAL PROTECTION ACT 2012

The following Environmental protection act is required for the establishment of the industry under all sectors.

- 1) The investor came with the business proposal.
- 2) Review of business proposal
- 3) Category of Business
 - a) Business falls under schedule I
 - i) An Initial Environment Examination report is required by a third party
 - ii) A review Fee of PKR.50,000
 - b) Business Falls under Schedule II
 - i) An Environment Impact Assessment report is required by the third party

- ii) A review Fee of PKR.100,000
- c) Business doesn't fall under schedule I and II
 - i) The project has significant Environment Impact
 - ii) The project has no significant environmental impact
 - iii) Shall remit a PKR 25,000 fee to the Balochistan Environment Protection agency

6 THE POLICIES OF THE GOVERNMENT OF BALOCHISTAN

6.1 LIBERAL INVESTMENT POLICY

- All economic sectors open to Foreign Direct Investment.
- Equal treatment to local and foreign investors.
- 100 % foreign equity allowed.
- No Government sanction is required for major industrial units.
- Attractive tax / tariff incentives package.
- Remittance of Royalty, Technical & Franchise Fee, Capital, Profits, and Dividends allowed.

6.2 FOREIGN INVESTMENT FULLY PROTECTED

- Foreign Private Investment (Promotion & Protection) Act, 1976.
- Protection of Economic Reforms Act, 1992
- Foreign Currency Accounts (Protection) Ordinance, 2001