IN TRIPLICATE

Ref: QEPCPL/NEPRA/Generation, 001
Date: 5 September 2015

The Registrar
National Electric Power Regulatory Authority (NEPRA)
NEPRA Tower, Ataturk Avenue (East), G-5/1
Islamabad.

SUBJECT: APPLICATION FOR GRANT OF GENERATION & DISTRIBUTION LICENSE

FOR SITARA COAL-FIRED POWER PROJECT 38.5 MW (GROSS) AT 32 Km Sheikhupura road, Faisalabad.

Dear Sir

We, Sitara Chemical Industries Ltd. is a company incorporated under the laws of Pakistan, acting through Mr. Haseeb holding CNIC No.33100-8730749-7 our Director and duly authorized representative hereby apply to the National Electric Power Regulatory Authority ("NEPRA") for the grant of Generation & Distribution License to the Company pursuant to Section 15 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 ("NEPRA Act").

I, Haseeb Ahmed, being the duly authorized representative of the Company hereby certify that the documents-in-support attached with this application are prepared and submitted In conformity with the provisions of the National Electric Power Regulatory Authority Licensing (Application and Modification Procedure) Regulations, 1999 ("Licensing Regulations"), and undertake to abide by the terms and provisions of the Licensing Regulations. I further undertake and confirm that the information provided in the attached documents-in-support is true and correct to the best of my knowledge and belief.

In the sum of Rs 168,840/-. Being the license application fee calculated in accordance with Schedule II to the Licensing Regulations is also attached herewith. It is further pointed out that generation of this coal power plant shall be distributed to adjacent chemical industry located within 2 km distance and also to its sister concerns and neighboring industries.

Therefore, we are requesting for generation and distribution license so that electricity produced by coal power plant is distributed accordingly.

We thank you in advance for your kind consideration and look forward to your early and favorable response.

Yours sincerely

Haseeb Ahmed

Director

CERTIFICATE OF INCORPORATION

(Under section 23 of the Companies Act, 1913 (VII of 1913)

No. K-105/6641. of 1981-82

I hereby certify that SITARA CHEMICAL INDUSTRIES LIMITED

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_ _ _ _ _

is this day incorporated under the Companies Act, 1913 (VII of 1913), and that the company is Limited By shares as a Public Company

Given under my hand at KARACHI

this 8TH day of SEPTEMBER

one thousand nine hundred and EIGHTYONE

Fee Rs. 16580/-

SEAL

THE SEAL OF JOINT REGISTRAR JOINT STOCK COMPANIES
KARACHI
SIND

SYED ZAHEER AHMED
Asstt. Registrar of Joint Stock Companies
SIND.

CERTIFICATE FOR COMMENCEMENT OF BUSINESS

(Under section 103 (2) of the Companies Act, 1913 (VII of 1913)

I hereby certify that the SITARA CHEMICAL INDUSTRIES LIMITED — — which was incorporated under the Companies Act, 1913 (VII of 1913), on the 8TH day of SEPTEMBER 19 EIGHTY ONE and which has filed a duly verified declaration in the prescribed form that the conditions of clauses (a) to (d) of sub-section (1) of section 103 of the said Act have been complied with, is entitled to commence business.

Given under my hand at KARACHI this 9TH day of MARCH one thousand nine hundred and EIGHTY TWO

Fee Rs. 50/-

THE SEAL OF JOINT REGISTRAR JOINT STOCK COMPANIES SEAL KARACHI SIND

SYED ZAHEER AHMED
Asstt. Registrar,
Joint Stock Companies
SIND.

SITARA CHEMICAL INDUSTRIES LTD.

601-602, Business Center,
Mumtaz Hasan Road, Karachi - 74000
Phones : (021) 2413944 - 2420620
Fax : (021) 2415452
E-mail : sitarako@cyber.net.pk
Website : www.sitara.com.pk

October 30, 2007

The Registrar
Securities & Exchange Commission
Of Pakistan
Company Registration Office
State Life Building
Wallace Road
Karachi.

Dear Sir,

FILING OF PETITION UNDER SECTION 21 OF THE COMPANIES ORDINANCE, 1984 (ORDINANCE XLVII OF 1984) FOR CONFIRMATION OF ALTERATION IN THE MEMORANDUM OF ASSOCIATION OF THE COMPANY

We are filing petition u/s. 21 of the Companies Ordinance, 1984 alongwith following documents in duplicate regarding confirmation of amendment/addition/alteration/substitution in sub clauses of object clause-III of Memorandum of Association of the Petitioner Company.

1. Petition
2. Annexure-I Comparative chart of Memorandum of Association.
3. Annexure-II Reasons for proposed alteration.
4. Annexure-III Pattern of the holding of its shares.
5. Annexure-IV Names and addresses of creditors.
6. Form-26 'Special Resolution'.
7. Memorandum of Association duly amended.
8. Copy of Notice of the 26th Annual General Meeting.
9. Minutes of the 26th Annual General Meeting.
10. Affidavit.
11. Audited Accounts for the year ended June 30, 2007.
12. Original paid challan No. 1090697 dated 10.10.2007 for Rs. 5,000/- being filing fee for Application of amendment in Memorandum of Association
13. Original paid challan No. 1090698 dated 10.10.2007 for Rs. 200/- being filing fee of Form 26.
14. Memorandum and Articles of Association before amendments.
15. No objection Certificates received from Creditors.

It is therefore requested to please approve the amendment/addition/alteration/substitution made in the Memorandum of Association of the Company at your earliest and oblige.

Thanking you,

Yours truly,
For SITARA CHEMICAL INDUSTRIES LIMITED

(MAZHAR ALI KHAN)
Corporate Secretary

31 OCT 2007
Securities and Exchange Commission of Pakistan
Company Registration Office
4th Floor, State Life Building No.3
KARACHI.

PLANT : 32 K.M. Faisalabad-Sheikhupura Road, Faisalabad-37631 Ph : 041-4689141-45 Fax: 041-4689147-48
FAISALABAD OFFICE : Sitara Tower, New Civil Lines, Chowk, Faisalabad. Ph : 041-2600747 & 2600108 Fax : 041-2629210
ISLAMABAD : Malik Complex, Flat # 7, 2nd Floor, 80-East Plaza, Blue Area, Islamabad-44000
Ph: 051-2872042-2270853 Fax : 051-2277284
LAHORE : Suit # 110-A, First Floor, Siddiq Trade Centre Main Boulevard, Gulberg, Lahore.
Ph: 042-5787476-8 Fax : 042-5787479

[No. Add.Reg.com/2005]

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN
Company Registration Office, Karachi Region
4th floor State Life Bldg.No.2, Wallace Road, Karachi /88834

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PETITION UNDER SECTION 21 OF THE COMPANIES ORDINANCE, 1984

ORDER

IN THE MATTER OF SITARA CHEMICALS INDUSTRIES LIMITED

This is an application made under section 21 of the Companies Ordinance 1984 seeking confirmation of special Resolution passed by the petitioner company on 20.10.2007 amending the Memorandum of Association so as to insert sub-clauses (47 to 66) and the existing sub-clauses 47 to 51 be are hereby re-numbered as 67 to 71. Sub-clauses (47 to 66) proposed to be added in the Memorandum of Association are as per Annexure-A.

2- The alteration is sought to diversify company's business and utilize funds for higher return and also to enable the company to enlarge and extend the scope of business activities for more profitable purposes. The creditors of the company have given in writing that they have no objection to the requisite amendment.

3- In view of the above, special Resolution passed by the company on 20.10.2007 is hereby confirmed. Further actions according to the requirements of law shall be taken by the petitioner.

(JAWED HUSSAIN)
ADDITIONAL REGISTRAR OF COMPANIES

Announced:
Karachi, November 29, 2007

ANNEXURE-A

OBJECTS OF MEMORANDUM OF ASSOCIATION OF SITARA CHEMICALS INDUSTRIES LIMITED.

47. To carry on the business as manufacturer, traders, producers, assemblers, fabricators, importers, exporters, buyers, sellers, suppliers, distributors, commission agents, selling agents, dealers, distributors, and dealers in all kinds of vehicles, automobile, tractors, agricultural equipments, engineering goods, tools and implements, gas conversion kits, light and heavy mechanical goods, machineries, automobile spares parts, mobile servicing unit, dumpers, bulldozers, measuring and testing equipments and allied products and representatives of agricultural and marine machineries, equipments and implements including tractors, engines, harvesters, cultivators, ploughs, generators, multipurpose engines, power tillers, power plants, spreaders, sprayers, dusters, drying equipments, poultry and dairy farming and its equipments, fishing boats, tugs, trawlers, cold storage machines and solar energy equipment.

48. To carry on the business of manufacturing, importing, exporting, dealing, assembling, repairing, hiring, leasing, running motor cars, motor cycles, motor rickshaws, motor boats, motor launches, motor lorries, motor vans, motor ships, auto cycles, trucks, buses, pickups, vans, cars, tractors, aero planes, seaplanes, gliders, helicopters, military vehicles, and other conveyances of all descriptions whether propelled or assisted by means of petrol, steam, gas, electricity, animal, solar, atomic, electronic or other powers and engines, chassis, bodies and other accessories or ancillaries used in this connection.

49. To carry on the business of iron-founders, mechanical engineers, machinists, manufacturers, dealers, importers and exporters of all kinds of auto parts, accessories, implements, tools, gas generators, engines, types, rubber goods, tubes, bodies, chassis, carburetors, magnets, silencers, radiators, sparking plugs, paraffin vaporizers, speedometers, self-starters, gears, wheels, parts and accessories of all kinds which may be useful for or conducive to the carrying on of the business of the Company.

50. To provide modern and innovative services and products in the field of information technology, computers and communications including designing, developing, improving, marketing, selling, licensing and complete implementation of information technology, computers software and communication systems and its related services.

51. To carry on the business as manufacturers / developers of computer internet programmers and word processors, data processors, outsourcing services and related issues, computer aided drafting specialists, software developers, computer based composers and publishers, consultants,

designers, wholesalers, retailers, agents, general merchants, dealers, suppliers and distributors of computer software, hardware, ancillary and allied equipments.

52. To obtain, develop, promote, deal in, supply connections and provide back up, support services and training for Electronic Mail, Internet or any other forms of computer or electronically transmitted or based communication technology that might be developed in future including all related hardware, software and ancillaries.

53. To provide Information Technology (IT) and related services, including but not limited to IT enabled remote services, such as customer relationship management, data processing, back office services, graphic deign and other data-intensive professional services, which includes design, development and integration of software as well as any other technology intensive manufacturing or services (whether real or virtual).

54. To set up and run steel mills for producing steel, steel billets, alloy steel ingots and all kinds and sizes of re-rolled sections, i.e. flats, angles, rounds, squares, hexagons octagons, rails, joints, channels, steel strips, sheet, plates, deformed bars, plain and cold twisted bars, bright bars, shafting, steel structures and all kinds of allied products.

55. To carry on the business of steel mills, iron founders, iron masters, iron and steel converters, mechanical engineers, manufacturers of steel billets, steel sheets, iron sheets, iron bars, Iron beams, pipes, guarders, nuts, bolts, screws, agricultural implements and all kinds of machinery parts, automobile parts, tool makers, brass founders, metal workers, boiler makers, mill-weights, mill stores, wood workers, painters, metallurgist, electrical engineers, gas generators, framers printers, dyers and merchants and to buy, sell, manufacture, repair, convert, alter, let on hire, and deal in machinery implements, rolling stocks, and hardware of all kinds and to carry on any other allied business as permissible under law.

56. To carry on all or any of the business of manufacturers, processors, importers, exporters and dealers in sheet metal (ferrous and non-ferrous) and sheet metal articles of all kinds and in particular aluminum and steel doors, windows, lever and automatic door closers, galvanized buckets, fire buckets, bath tubs, mugs, drums, tanks, tin containers and other articles for carry or storing water, oil and other solid or liquid material, all kinds of steel and metal furniture, chimneys, pipes, ridging, ventilators, roofing, dustbins, hand carts and all such other articles.

57. To carry on the business of general trader, manufacturer, importer, exporter, producer, buyer, seller, supplier, distributor, commission agent, shopkeeper, wholesaler, retailer and dealer in all kinds of pharmaceutical, drugs, medicines, chemicals, antibiotics, pharmaceuticals, nutraceuticals, cosmeceuticals, herbal, ayurvedic, aromatherapy, physiochemical,

traditional Chinese medicines, bacteriological, biotechnological and biological products, medical & diagnostic products, dental products, diagnostic & dental equipments, laboratory chemicals, hypodermic needles, hypodermic syringes, blades, knives, scalpels, anatomical, orthopedic, surgical instruments/ equipments, soap, washing powder, detergents oleaginous, perfumes, scent, toilet requisites, wax, candles, polishes, all kinds of medical / pharmaceutical and commercial items and allied products and all substances, apparatus and things capable of being used in connection with such products or required by customers dealing with the Company.

58. To work and act as examiners of pharmaceuticals, medicines and drugs manufactured by the manufacturers and others including Government, semi-Government bodies and also to carry on the profession of pathologists and examiners of soils and materials.

59. To carry on the business of refining, blending, processing, storing, transporting, supplying, selling, distributing, importing, exporting and dealing all kinds of petroleum, petroleum products, petrochemicals, chemicals, oils, gas, hydrocarbons and allied products.

60. To purchase or otherwise acquire, manufacture, refine, treat, reduce, distil, blend, purify, pump, store, hold transport, use experiment with, market, distribute, exchange, supply, sell and otherwise dispose of, import, export and trade and generally deal in any and all kinds of petroleum and petroleum products, oils and chemicals and any products, by products and derivatives thereof.

61. To carry on all or any of the business as manufacturers, traders, buyers, sellers, indenters, importers, exporters, distributors, agents, brokers, factors, stockists, commission agents and dealers of all kinds of leather garments, hosiery garments, knitwear, handicrafts, fabrics, leather goods, leather garments, readymade garments, towels, carpets, dress, uniforms, military uniforms, school uniform, durries, mats, rugs, namdas, blankets, shawls, tweeds, linens, flannels, bed sheets, spreads, quilts, scarfs, belts, embroidery, tapestry and all other articles of silk, cotton, woolen and worsted materials and all sorts of apparels, dressing materials, mixed, blended products, nylon, polyester, fibre, yarn, hosiery and mixed fabrics, natural silk fabrics, garments and all kinds of textile products.

62. To carry on the business of printers, publishers, stationers, lithographers, stereotypes, electrotypers, art printers, photolithographers, chromolithographers, photographic printers, engravers, embossers, die-sinkers, die-stampers, envelope manufacturers, bookbinders, machine rulers, numerical printers, calendar and dairy printers, paper makers, paper bags and card board manufacturers.

63. To print and publish general books, technical books, children's books, low priced paperbacks, text books, newspapers, magazines, periodical, journals, quotations, reports and other literary works and undertakings, and also run book clubs and lending libraries.

64. To conduct, encourage, promote, support, arrange and organize seminars, symposiums, exhibitions, fairs, conferences, lectures, workshops, demonstrations and other similar activities for promotion of education and educational books, literatures and to promote the business of printing and publishing or other business interests of any person, companies, firms, individuals, associations, local or government bodies, foreign governments, and international agencies, in Pakistan and any part of world for and on behalf of customers and for that purpose to carry out market surveys, researches, training programs and other activities.

65. To carry on the business of manufacturers, processors, designers, buyers, sellers, exporters, importers, and/or otherwise dealers in all kinds of card board packing, corrugated packing, pillow packing, plastic packing, polythene packing, gunny bags, containers, bottles, hollow wares, whether made of plastic or any man made fibre, leather or of other material including light and low density polythene, polypropylene, plastic and other man made fibrous material, use in manufacture of card board, packing, corrugated packing, pillow packing, plastic packing, polythene packing, gunny bags, etc.

66. To carry on the business of general traders, manufacturers, commission agents, buyers, sellers, importers, exporters, suppliers and dealers in automobiles, vehicles, steel and iron products, chemicals, medicines, pharmaceutical, machineries & mills works, petroleum products, oils, chemicals, leather garments, gold, silver, wheat, cotton, rice, sugar, pulses, beans, cereals, tea, corn, oats, barley, rye, flaxseed, grain sorghums, mil feeds, butter, eggs, wool, fats and oils (including lard, tallow, cottonseed oil, peanut oil, soybean oil, and all other fats and oils), cottonseed meal, cottonseed, peanuts, soybeans, soybean meal, livestock, livestock products, and frozen concentrated orange juice, food, fabrics, textile goods apparels, readymade garments, engineering goods, automobiles parts, marbles & hardware items, computer software & hardware, electric & electronics products and all other goods and articles as may be included by the company for the purpose of trading along with all services, rights, and interests in which contracts for future delivery are presently or in the future dealt.

THE COMPANIES ORDINANCE, 1984

PUBLIC COMPANY LIMITED BY SHARES

MEMORANDUM OF ASSOCIATION

OF

SITARA CHEMICAL INDUSTRIES LIMITED

I. The name of the Company is "SITARA CHEMICAL INDUSTRIES LIMITED."

II. The Registered Office of the Company will be situated in the Province of Sindh.

III. The objects for which the Company is established are all or any of the objects set out or stated in the following distinct clauses and the scope of any of them unless otherwise so required by the context or meaning thereof shall not be deemed to limit or affect the scope of any other or others of them.

OBJECTS

1. To carry on the business of manufacturers, exporters and importers, and dealers in heavy chemicals, caustic soda, alkalis, drugs, essences, cordials, acids, pharmaceuticals, medicinal, chemical, industrial and other preparations and articles of any kind whatsoever, mineral and other waters, cement, oils, paints pigments and varnishes, paint and colour grinders, wholesale and retail chemists and druggists, analytical chemists, drysalters, oil and colourmen, makers of and dealers in proprietory articles of all kinds of electrical, chemical photo graphical, surgical and scientific apparatus and materials and in any similar or allied business and either in connection with the said business or as distinct or separate businesses.

2. To own, prospect for explore, acquire by lease, licence, purchase or otherwise, open work, develop and maintain natural deposits of salt, brine, natron, soda kieselguhr nitrates and other chemical substances of all kinds, clay and sand pits, slate, stone and limestone quarries, coal mines, copper mines, and mineral, mineral oil, nitrate and mining properties of all kinds and to carry on and conduct the business of working and getting and supplying to other persons such salts, brine and other substances, clay, sand, quarriable substances, coal, copper oil, nitrates and minerals of all kinds.

3. To manufacture, prepare and treat quarriable and mineral substances or products of all kinds obtained as aforsaid for sale or use or for manufacturing, building or any other purposes or processes and to manufacture therefrom every kind of product.

4. To refine, treat and render merchantable and fit for use natural deposits of salt, brine, natron, soda, kieselguhr nitrates and other chemical substances of all kinds obtained as aforesaid and to manufacture therefrom, by any forms of plan or process, every kind of chemical and other products and by products.

5. To carry on the business of manufacturers and producers of fats, fertilizers, manures, dips, sprays, vermifuges, fungicides medicines and remedies of all kinds for agricultural, fruit-growing or other purposes or as remedies for men or animals and whether produced from vegetable or animal matter or by any chemical process.

6. To fix atmospheric nitrogen by synthetic ammonia or by any other process and to manufacture its derivative compounds.

7. To carry on the trades or business of manufacturers of and dealers in explosives, ammunition, fireworks and other explosive products and accessories of all kinds and of whatsoever composition and whether for military sporting, mining or industrial purposes or for pyrotechnical display or for any other purpose.

8. To carry on the trades or business of manufacturers of ballistic and pyrotechnic apparatus and other articles and things of a similar or analogous description or use or of and in the several component parts thereof.

9. To carry on business as manufacturers of manure, paper pulp, paper glass, bricks, pottery, terra cotta, and sanitary and disinfecting preparations, coke, cement and artificial stone.

10. To buy, sell, manufacture, refine, manipulate, import, export and deal both in wholesale and retail in commodities, substances, apparatus, articles and things of all kinds capable of being used or which can conveniently be dealt in by the company in connection with any of its objects.

11. To resell, exchange and purchase, mortgage, let out for hire, cultivate or otherwise deal with lands, buildings, machinery, engines, plants and materials and other things necessary or useful for the purpose of the company and also to purchase, sell or contract for the purchase or sale for immediate or further delivery and either for cash or on credit or cotton, wool, silk, hemp, flax, jute, yarn cotton seed and its by-products waste and cloths of various fibrous articles, iron and other metals and all stores and materials, chemicals and things, necessary or useful for ginning, preparing, combing, spinning, weaving, manufacturing, dyeing, mercerising, printing and bleaching purposes, also metals, stores and other articles and things for the use of any licence or invention for the excercise of any methods or process useful for the Company's business and all other products of the Company.

12. To carry on the business of waterproofers and manufacturers of india-rubber, lether, imitation leather, leather cloth, plastics, oil cloth, linoleums tarpaulin, hospital sheetings and surgical bandages.

13. To carry on all or any of the business of egineers, iron, brass and other metal founders, machinists, tool makers, wire drawers, tube, pipe and tank manufacturers, moulders, metallurgists and metal workers, fitters, mill rights, galvanisers, japanners, electroplaters and enamellers.

14. To carry on the bussiness of an electric and or gas supply company in all its branches and in particular to construct, laydown, establish, fix and carry out all necessary cables, wires, lines, accumulators, lamps and works and to generate, accumulate, distribute and supply electricity for the purpose of light, heat, motive powers or otherwise to cities, towns, streets, docks, markets, theaters, buildings and places both public and private.

15. To carry on the business of a water-works company in all its branches to sink wells and shafts and to make, build, construct, laydown and maintain reservoirs, water-work cisterns, culverts, filler beds, main and other pipes and appliances and to execute and do all other works and things necessary or convenient for obtaining, storing, selling, delivering, measuring and distributing water or otherwise for the Company.

16. To purchase, construct, build, maintain, charter, affreight, hire and let out for hire or for chartering and affreightment and to otherwise obtain the possession of and carry on, use and dispose of and employ or turn to account railways, tramways, wharves, piers, docks, ships, lighters, launches, boats and vessels of all kinds, locomotive, wagons and other rolling stock, and otherwise provide for the conveyance of property of all kinds and to purchase or otherwise acquire any shares or interest in any railways, tramways, wharves, ships, vessels or rolling stock or in any companies possessed of or interested in the same.

17. To purchase take on lease, or in exchange or otherwise acquire, erect, maintain, equip, construct, reconstruct, repair, renovate or adopt movable or immovable property including buildings, residential bungalows, labour lines, quarters, offices, chawls, place of worship, school, hospitals, dispensaries, canteens, erection rooms, clubs, warehouses, godowns, [illegible], erection, workshops, mills, factories foundries, or places for manufacturing plants, machinery, spindles, looms presses, engines, tools, electric light, accessories, implements, appliances, apparatus, articles and other things as may necessary or convenient for the purpose of the Company and for the welfare of the employees and also to extend the business of the Company by purchasing, acquiring, getting transferred, adding to, altering, enlarging all or any, of the buildings, factories, premises, places being the property of the Company or on all or any of the lands for the time being the property or in possession of the Company and by expanding from time to time such sum or sums of money as may be necessary or expedient for improving, adding to, altering, repairing and maintaining the buildings, structures, machinery, plant and property for the time being of the Company and to sell or mortage or let out on hire all or any portion of the same as may thought desirable.

18. To acquire by purchase, lease, exchange or otherwise, lands, buildings and hereditaments of any tenure or description, and any estate or interest therein, and any rights over or connected with land, and either to retain the same for the purpose of the Company's business or to turn the same to account as may seem expedient.

19. To construct, carry out, maintain, improve, manage, work, control and superintend any markets, reservoirs, waterworks, tanks, bridges and works in connection therewith, hydrualic works, electrical works, and factories, coolie lines and houses, and bustees, villages, and other works and conveniences, which may seem, directly or indirectly conducive to any of objective of the Company, and to contribute to, subsidise or otherwise aid or take part in any such operations.

20. To establish and maintain laboratories for the purpose of research in chemicals, drugs, acids, alkalis, pharmaceuticals and other chemicals and minerals, to patent, copyright and otherwise protect any discoveries, formulae and inventions resulting from such research.

21. To apply for purchase or otherwise acquire any patents, brevets, invention, licences, concessions and the like conferring any exclusive or non-exclusive or limited right to use or any secret or other information as to any invention which may seem capable of being used for any of the purposes of the Company or the acquisition of which may seem calculated, directly or indirectly, to benefit the Company, and to use, exercise, develop or grant licences in respect of or otherwise turn to account the property, rights or information so required.

22. To enter into any arrangements with any Government or with any authority, public, municipal, local railway or otherwise or with any other person that may seem conducive to the Company's objects or any of them and to obtain from any such Government, authority or persons any rights, privileges and concessions and dispose of or turn to account the same.

23. To acquire and undertake all or any part of the business, property, and liabilities of any person or company carrying on any business which this Company is authorised to carry on or pessessed of property suitable for the purpose of the Company.

24. To enter into partnership or into any arrangement for sharing profits into any union of interests, joint-venture, reciprocal concessions or co-operation with any person or persons or company or companies or corporation or corporations carrying on or engaged in, or about to carry on or engaged in or being authorised to carry on or engaged in any business or transaction which the Company is authorised to carry on or engaged in or any business or transaction capable of being conducted so as directly or indirectly to benefit the Company.

25. To sell or dispose of the undertaking of the Company or any part thereof for such consideration as the Company may think fit and in particular for shares, debentures or securities of any other Company.

26. To promote any company or companies for the purpose of acquiring all or any of the property, rights and liabilities of this Company or for any other purpose which may seem, directly or indirectly, calculated to benefit this Company.

27. To acquire by subscription, purchase or otherwise and to accept and take, hold or sell shares or stocks in any company, association or undertaking.

28. To borrow money, from time to time required for any of the purposes of the Company by receiving advances of any sum or sums of money with or without security upon such terms as the directors may be deem expedient, and in particular by taking deposits from or by cash credits or current or overdraft account with any individual, firm or company including the agents of the Company or any banker or bankers (whether with or without giving security) or by mortgaging or selling or receiving advances on the sale of any lands, buildings, machinery, goods or other property of company, or by the issue of debentures or debenture-stock, perpetual or otherwise charged upon all or any of the company's properties including its uncalled capital or by such other means as the Directors may in their absolute discretion deem fit.

29. To draw, make, accept, discount, execute and issue bills of exchange, Government and other promissory notes, bills of lading, warrants, debentures and other negotiable or transferable instruments or securities concerning this Company.

30. To open any current, overdraft, cash credit accounts or fixed accounts with any banker and to pay money into and draw money from any such account.

31. To guarantee the payment of money unsecured of secured by or payable under or in respect of promissory notes, bonds, debentures, debenture-stock, contracts, mortgages, charges, obligations, instruments, and securities of any Company or of any authority, supreme, municipal, local or otherwise or of any person whomsoever, whether incorporated or not incorporated and generally to guarantee or become securities for the performance of any contracts or obligations.

32. To create any depreciation fund, reserve fund, sinking fund, insurance fund, dividend-equalisation fund, redemption fund or any other special fund whether for depreciation or for repairing, improving, extending or maintaining any of the properties of the Company or for any other purpose.

33. To establish and support, or aid in the establishment and support of associations, institutions, funds, gratuities, trusts and conveniences calculated to benefit employees or ex-employees of the Company or its predecessors in business or the dependents or connection of such persons and to grant pensions and allowances and to make payments towards insurance and to subscribe or guarantee money for charitable, religious, educational or any other benevolent objects or for any exhibition for any public, general or useful objects.

34. To promote, conduct, manage contribute to or otherwise assist any arrangement for sharing profits, union of interest, co-operation or other scheme for the benefit of the employees of the Company which may appear either directy or indirectly to benefit the Company and to pay gratuity, pension, bonus, extra remuneration or compensation of any kind to any contractor, officer, servant or workman or other employee of the Company as the Company or its Directors may from time to time think fit.

35. To remunerate any person or company for services rendered, or to be rendered, in placing or assisting to place or guaranteeing the placing of any shares in the Company's capital or any debentures, debenture-stocks or other securities of the Company or in or about the formation or promotion of the Company or the acquisition of property by the Company or the conduct of its business.

36. To adopt such means or making known the products of the Company as may seem expedient and in particular by advertising in the press, by circulars, by purchase and exhibition of works of art or interest, by publication of books and periodicals and by granting prizes, rewards and donations.

37. To sell, improve, manage, develop, exchange, lease, mortgage, dispose of, turn to account or otherwise deal with all or any part of the property and rights of the Company.

38. To carry on the business of general manufacturers and to manufacture, buy, sell and deal in apparatus, machinery, materials and articles of all kinds.

39. To carry on any other business which may seem to the Company capable of being conveniently carried on in connection with any of the above or calculated, directly or indirectly, to enhance the value of or render profitable any of the Company's property or rights.

40. To establish and conduct agencies and branches in any part of the world for the purpose of the Company and to undertake the management, supervision, or control of the business or operations of any person or persons whether incorporated or not incorporated or company or companies having objects altogether or in part similar to those of this Company.

41. To pay all costs, charges and expenses incurred or sustained in or about the promotion and establishment of the Company or which the company shall consider to be preliminary including therein the cost of advertising, commission of underwriting, brokerage, printing and stationery and expenses attendant upon the formation of agencies,branches and local board.

42. To distribute all or any of the property of the Company amongst the members in specie or kind.

43. To set up Polyvinyl Chloride plant for manufacturing and selling of Ethylene, Ethyline Dichloride (EDC), Vinyl Chloride Monomer (VCM) and Polyvinyl Chloride (PVC).

44. To carry on the business of manufacturer of textile and allied products.

45. To carry on the business of manufacturer, producer, buyer and seller of plant and machinery for the purpose of ginning, pressing, solvent oil extraction from various seeds, oil refining and manufacturing of ghee.

46. To manufacture, develop, import, export computers and computer softwares and hardwares and its related services, including maintainance, training, documentation, conversion and system integration.

47. To carry on the business as manufacturer, traders, producers, assemblers, fabricators, importers, exporters, buyers, sellers, suppliers, distributors, commission agents, selling agents, dealers, distributors, and dealers in all kinds of vehicles, automobile, tractors, agricultural equipments, engineering goods, tools and implements, gas conversion kits, light and heavy mechanical goods, machineries, automobile spares parts, mobile servicing unit, dumpers, bulldozers, measuring and testing equipments and allied products and representatives of agricultural and marine machineries, equipments and implements including tractors, engines, harvesters, cultivators, ploughs, generators, multipurpose engines, power tillers, power plants, spreaders, sprayers, dusters, drying equipments, poultry and dairy farming and its equipments, fishing boats, tugs, trawlers, cold storage machines and solar energy equipment.

48. To carry on the business of manufacturing, importing, exporting, dealing, assembling, repairing, hiring, leasing, running motor cars, motor cycles, motor rickshaws, motor boats, motor launches, motor lorries, motor vans, motor ships, auto cycles, trucks, buses, pickups, vans, cars, tractors, aero planes, seaplanes, gliders, helicopters, military vehicles, and other conveyances of all descriptions whether propelled or assisted by means of petrol, steam, gas, electricity, animal, solar, atomic, electronic or other powers and engines, chassis, bodies and other accessories or ancillaries used in this connection.

49. To carry on the business of iron-founders, mechanical engineers, machinists, manufacturers, dealers, importers and exporters of all kinds of auto parts, accessories, implements, tools, gas generators, engines, types, rubber goods, tubes, bodies, chassis, carburetors, magnets, silencers, radiators, sparking plugs, paraffin vaporizers, speedometers, self-starters, gears, wheels, parts and accessories of all kinds which may be useful for or conducive to the carrying on of the business of the Company.

50. To provide modern and innovative services and products in the field of information technology, computers and communications including designing, developing, improving, marketing, selling, licensing and commissioning, implementation of information technology, computers software and communication systems and its related services.

51. To carry on the business as manufacturers, developers of computer internet programmers and word processors, data processors, outsourcing services and related issues, computer aided drafting specialists, software developers, computer based composers and publishers, consultants, designers, wholesalers, retailers, agents, general merchants, dealers, suppliers and distributors of computer software, hardware, ancillary and allied equipments.

52. To obtain, develop, promote, deal in, supply connections and provide back up, support services and training for Electronic Mail, Internet or any other forms of computer or electronically transmitted or based communication technology that might be developed in future including all related hardware, software and ancillaries.

53. To provide Information Technology (IT) and related services, including but not limited to IT enabled remote services, such as customer relationship management, data processing, back office services, graphic deign and other data-intensive professional services, which includes design, development and integration of software as well as any other technology intensive manufacturing or services (whether real or virtual).

54. To set up and run steel mills for producing steel, steel billets, alloy steel ingots and all kinds and sizes of re-rolled sections, i.e. flats, angles, rounds, squares, hexagons octagons, rails, joints, channels, steel strips, sheet, plates, deformed bars, plain and cold twisted bars, bright bars, shafting, steel structures and all kinds of allied products.

55. To carry on the business of steel mills, iron founders, iron masters, iron and steel converters, mechanical engineers, manufacturers of steel billets, steel sheets, iron sheets, iron bars, Iron beams, pipes, guarders, nuts, bolts, screws, agricultural 47. implements and all kinds of machinery parts, automobile parts, tool makers, brass founders, metal workers, boiler makers, mill-weights, mill stores, wood workers, painters, metallurgist, electrical engineers, gas generators, framers printers, carriers and merchants and to buy, sell, manufacture, repair, convert, alter, let on hire, and deal in machinery implements, rolling stocks, and hardware of all kinds and to carry on any other allied business as permissible under law.

56. To carry on all or any of the business of manufacturers, processors, importers, exporters and dealers in sheet metal (ferrous and non-ferrous) and sheet metal articles of all kinds and in particular aluminum and steel doors, windows, lever and automatic door closers, galvanized buckets, fire buckets, bath tubs, mugs, drums, tanks, tin containers and other articles for carry or storing water, oil and other solid or liquid material, all kinds of steel and metal furniture, chimneys, pipes, ridging, ventilators, roofing, dustbins, hand carts and all such other articles.

57. To carry on the business of general trader, manufacturer, importer, exporter, producer, buyer, seller, supplier, distributor, commission agent, shopkeeper, wholesaler, retailer and dealer in all kinds of pharmaceutical, drugs, medicines, chemicals, antibiotics, pharmaceuticals, nutraceuticals, cosmeceuticals, herbal, ayurvedic, aromatherapy, physiochemical, traditional Chinese medicines, bacteriological, biotechnological and biological products, medical & diagnostic products, dental products, diagnostic & dental equipments, laboratory chemicals, hypodermic needles, hypodermic syringes, blades, knives, scalpels, anatomical, orthopedic, surgical instruments/ equipments, soap, washing powder, detergents oleaginous, perfumes, scent, toilet requisites, wax, candles, polishes, all kinds of medical / pharmaceutical and commercial items and allied products and all substances, apparatus and things capable of being used in connection with such products or required by customers dealing with the Company.

58. To work and act as examiners of pharmaceuticals, medicines and drugs manufactured by the manufacturers and others including Government, semi Government bodies and also to carry on the profession of pathologists and examiners of soils and materials.

59. To carry on the business of refining, blending, processing, storing, transporting, supplying, selling, distributing, importing, exporting and dealing all kinds of petroleum, petroleum products, petrochemicals, chemicals, oils, gas, hydrocarbons and allied products.

60. To purchase or otherwise acquire, manufacture, refine, treat, reduce, distil, blend, purify, pump, store, hold transport, use experiment with, market, distribute, exchange, supply, sell and otherwise dispose of, import, export and trade and generally deal in any and all kinds of petroleum and petroleum products, oils and chemicals and any products, by products and derivatives thereof.

61. To carry on all or any of the business as manufacturers, traders, buyers, sellers, indenters, importers, exporters, distributors, agents, brokers, factors, stockists, commission agents and dealers of all kinds of leather garments, hosiery garments, knitwear, handicrafts, fabrics, textiles, goods, leather garments, readymade garments, towels, carpets, dress, uniforms, military uniforms, school uniform, durries, mats, rugs, namdas, blankets, shawls, tweeds, linens, flannels, bed sheets, spreads, quilts, scarfs, belts, embroidery, tapestry and all other articles of silk, cotton, woolen and worsted materials and all sorts of apparels, dressing materials, mixed, blended products, nylon, polyester, fibre, yarn, hosiery and mixed fabrics, natural silk fabrics, garments and all kinds of textile products.

62. To carry on the business of printers, publishers, stationers, lithographers, stereotypes, electrotypers, art printers, photolithographers, chromolithographers, photographic printers, engravers, embossers, die-sinkers, die-stampers, envelope manufacturers, bookbinders, machine rulers, numerical printers, calendar and dairy printers, paper makers, paper bags and card board manufacturers.

63. To print and publish general books, technical books, children's books, low priced paperbacks, text books, newspapers, magazines, periodical, journals, quotations, reports and other literary works and undertakings, and also run book clubs and lending libraries.

64. To conduct, encourage, promote, support, arrange and organize seminars, symposiums, exhibitions, fairs, conferences, lectures, workshops, demonstrations and other similar activities for promotion of education and educational books, literatures and to promote the business of printing and publishing or other business interests of any person, companies, firms, individuals, associations, local or government bodies, foreign governments, and international agencies, in Pakistan and any part of world for and on behalf of customers and for that purpose to carry out market surveys, researches, training programs and other activities.

65. To carry on the business of manufacturers, processors, designers, buyers, sellers, exporters, importers, and/or otherwise dealers in all kinds of card board packing, corrugated packing, pillow packing, plastic packing, polythene packing, gunny bags, containers, bottles, hollow wares, whether made of plastic or any man made fibre, leather or of other material including high and low density polythene, polypropylene, plastic and other man made fibrous material, use in manufacture of card board, packing, corrugated packing, pillow packing, plastic packing, polythene packing, gunny bags, etc.

66. To carry on the business of general traders, manufacturers, commission agents, buyers, sellers, importers, exporters, suppliers and dealers in automobiles, vehicles, steel and iron products, chemicals, medicines, pharmaceutical, machineries & mills works, petroleum products, oils, chemicals, leather garments, gold, silver, wheat, cotton, rice, sugar, pulses, beans, cereals, tea, corn, oats, barley, rye, flaxseed, grain sorghums, mil feeds, butter, eggs, wool, fats and oils (including lard, tallow, cottonseed oil, peanut oil, soybean oil, and all other fats and oils), cottonseed meal, cottonseed, peanuts, soybeans, soybean meal, livestock, livestock products, and frozen concentrated orange juice, food, fabrics, textile goods apparels, readymade garments, engineering goods, automobiles parts, marbles & hardware items, computer software & hardware, electric & electronics products and all other goods and articles as may be included by the company for the purpose of trading along with all services, rights, and interests in which contracts for future delivery are presently or in the future dealt.

67. To amalgamate with any other company having objects altogether or in part similar to those of this Company.

68. To cultivate, grow produce or deal in any agricultural products and to carry on all or any of the business of farmers, dairy, poultry and provisions of all kinds, growers of and dealers in corn, hay and straw, seeds men and nurserymen, and to buy, sell and trade in any of the above business or any other business associated with the farming interest which may be advantageously carried on by the Company.

69. To carry on the business of manufacturers, processors, packers, bottlers and canners of and deal in all kinds of ice creams, edible ices, frozen confectioners and all kinds of raw frozen dehydrated processed and prepared foods and food products, dairy products, and meat, fish, poultry, vegetables, fruits and fruit juices, pastes, powders and syrups and other non alcoholic refreshments and in all kinds of raw materials, herbs spices, essences, preservatives, edible colors, ingredients and condiments and to buy, sell, manufacture, treat, product, process, prepare, pack, bottle, can, import, export, market, distribute or otherwise deal in any or all of the foregoing.

70. To do all or any of the above things, either as principals, agents, trustees contractors, or otherwise and either alone or in conjunction with others, and either by or through agents, sub-contractors, trustees, or otherwise, and either alone or in conjunction with others and to do all such things as are incidental or conducive to the attainment of the above objects.

71. The Company shall not engage in banking or the business of any investment company or in any unlawful business and that nothing in the object clause shall be construed to entitle it to engage in such business.

And it is hereby declared that the word "Company" save when used in reference to this Company, in this clause, shall be deemed to include any partnership or other body or persons, whether incorporated or not incorporated whether domiciled in Pakistan or elsewhere.

IV. The liability of the members is limited.

V. The authorized capital of the Company is Rs.600,000,000/- (Rupees Six Hundred million) divided into 60,000,000 (Sixty million) Ordinary shares of Rs.10/- each, out of which 40,000,0000 (Forty million) are Class "A" shares and 20,000,000 (Twenty million) are Class "B" shares, with power to increase or reduce the capital, to divide the shares in the capital for the time being into several classes. The share capital shall comprise of one or more kinds of shares and different classes of shares under each kind as permitted by the Companies Share Capital (Variation in Rights and Privileges) Rules, 2000 as amended from time to time, with such preferential, deferred, qualified or special rights, privileges or conditions attached thereto as may be determined by or in accordance with the Articles of Association of the Company and to consolidate or sub-divide the shares and issue shares of higher or lower denominations

We the several persons whose names, addresses and descriptions are subscribed are desirous of being formed into a Company in pursuance of this Memorandum of Association, and we respectively agree to take the number of Shares in the Capital of the Company set opposite our respectively names.

Names, Addresses and Description of Subscribers	No. of Shares	Signature of Subscribers
Haji Abdul Ghafoor s/o. Late Haji Aziz Din 139-C, Peoples Colony, Faisalabad, Businessman.	ONE	-Sd-
Haji Bashir Ahmed s/o. Late Haji Aziz Din 139-C, Peoples Colony, Faisalabad, Businessman.	ONE	-Sd-
Mst. Naziran Begum w/o. Haji Bashir Ahmed 139-C, Peoples Colony, Faisalabad,House Wife.	ONE	-Sd-
Mrs. Safia Begum w/o. Haji Abdul Ghafoor 139-C, Peoples Colony, Faisalabad, House Wife.	ONE	-Sd-
Mr. Tariq Mahmood s/o. Haji Abdul Ghafoor 139-C, Peoples Colony, Faisalabad, Businessman.	ONE	-Sd-
Mr. Muhammad Anis s/o. Haji Bashir Ahmed 139-C, Peoples Colony, Faisalabad, Businessman.	ONE	-Sd-
Mr. Muhammad Adrees s/o. Haji Bashir Ahmed 138-C, Peoples Colony, Faisalabad, Businessman.	ONE	-Sd-
Mr. Javed Iqbal s/o. Haji Abdul Ghafoor 139-C, Peoples Colony, Faisalabad, Businessman.	ONE	-Sd-

Dated the 31st day of August, 1981

-Sd-
Witness to the above signatures:-
MUHAMMAD YOUSUF ADIL
FCA, FCMA,
21/4 Writers Chambers,
Dunnolly Road,
Karachi.

Certified to be True Copy

Joint Registrar of Companies

THE COMPANIES ORDINANCE, 1984

PUBLIC COMPANY LIMITED BY SHARES

ARTICLES OF ASSOCIATION

OF

SITARA CHEMICAL INDUSTRIES LIMITED

PRELIMINARY

1. The regulations contained in Table "A' in the first Schedule to the Companies Ordinance, 1984 shall not apply to the Company except to the extent and as hereinafter expressly incorporated. In case of any conflict between the provisions referred to and the provisions herein contained and the incorporated Regulations of Table 'A' the provisions herein contained shall prevail.

Company to be governed by the Articles & Table 'A' not to apply

INTERPRETATION

2. In the interpretation of these Articles, words importing the singular shall include the plural, and vice versa and words importing the masculine gender shall include feminine gender and words importing persons shall also include corporate bodies.

The "Articles" means these Articles as originally framed or as altered from time to time in accordance with law.

Articles

"Commission means Securities and Exchange Commission of Pakistan.

Commission

The "Board" means Board of Directors.

Board

"Chief Executive" means an individual who subject to the control and directions of the directors, is entrusted with, the whole or substantially the whole, of the powers of management of the affairs of the company and includes a director or any other person occupying the position of the Chief Executive, by Whatever name called, and whether under a contract of service or otherwise.

Chief Executive

Company	The "Company " means " Sitara Chemical Industries Limited".
Director	The "Directors" means the Directors for the time being
Dividend	"Dividend" includes bonus.
Documents	"Document includes summons, notice, requisition, order other legal process voucher and register.
Month	"Month" means calender month according to English Calender.
Office	The "Office" means the Office for the time being of the Company
Ordinance	The "Ordinance" means the Companies Ordinance 1984.
Proxy	"Proxy" includes Attorney duly constituted under Power of Attorney
Register	The "Register" means the of Members to be kept in pursuance to Section 147 of the Ordinance.
Registrar	The "Registrar" means the Registrar of Joint Stock Companies, having jurisdiction on the Company.
Redeemable Capital	"Redeemable Capital" included finance obtained on the basis of participation Term Certificate (PTC), Musharika Certificate, Term Finance Certificate (TFC) or any other security or obligation not based on interest, other than an ordinary share of a company, representing an instrument or a certificate of specified denomination, called the face value, evidencing investment of the holder in the capital of the company on terms and condition of the agreement for the issue of such instrument or certificate or such other certificate or instrument as the Federal Government may, by notification in the official gazette, specify for the purpose.
Section	"Section" means Section of the Ordinance.
Seal	The "Seal" means the common seal of the Company.
Security	"Security" means any share, scrip, debenture, participation term certificate, Modaraba Certificate, Bond, pre-organisation certificate or instrument commonly known as security.
Writing	"In Writing" and written include printing, lithography and other modes of representing or reproducing words in visible form.
Year	"Year" means calender year according to English Calender.
Expression	Words and phrases uses herein but not defined shall be assigned the same meaning as given to them in the Ordinance.

BUSINESS

3. The business of the Company shall include the several objects in the Memorandum of Association or any of them. — Object

4. The Director shall have to the restrictions on the commencement of business imposed by section 146, if and far, as those restriction are binding upon the company. — Commencement

SHARES

5. The authorized capital of the Company is Rs.600,000,000/- (Rupees Six Hundred million) divided into 60,000,000 (Sixty million) Ordinary shares of Rs.10/- each, out of which 40,000,0000 (Forty million) are Class "A" shares and 20,000,000 (Twenty million) are Class "B" shares, with power to increase or reduce the capital, to divide the shares in the capital for the time being into several classes. The share capital shall comprise of one or more kinds of shares and different classes of shares under each kind as permitted by the Companies Share Capital (Variation in Rights and Privileges) Rules, 2000 as amended from time to time, with such preferential, deferred, qualified or special rights, privileges or conditions attached thereto as may be determined by or in accordance with the Articles of Association of the Company and to consolidate or sub-divide the shares and issue shares of higher or lower denominations — Share Capital

(a) The share capital of the company shall comprise of Ordinary, class "A" and class "B" shares with respective rights, benefits and privileges and obligations, as conferred upon each class by or under the provisions of these Articles.

(b) Class "A" shares may at any time be converted into Class "B" shares, exercisable in writing to the Company by the shareholders holding not less than 90% of the total paid up capital of the Company.

(c) Within 2 days of the receipt of the notice exercising the conversion option referred in 5(b), such shares shall be automatically re-designated.

(d) Class "B" shares shall not be converted into Class "A" shares at any time.

(e) Class "A" shares shall in all respects carry voting rights and Class "B" shall have no voting rights, for the purpose of Section 178(5) of the Companies Ordinance, 1984 or for passing any Special Resolution.

(f) For so long as the share capital of the company is divided into different classes, the rights attached to either class, may only be varied or abrogate with the consent in writing of the shareholders holding not less than 90% of the total paid up capital of the Company.

(g) In the event of any conflict or inconsistency between the provisions of Article 5 and any other Article, the former shall prevail.

Allotment of Shares under the control of the Director

6. Subject to the provisions of these Articles and the provisions of section 86 the shares shall be under the control of the Directors who may allot or otherwise dispose of the same to such persons on such terms and conditions, and either at a premium or at par and such times, as the Directors thicnk, fit, and with full power to give to any person the right to the call for the allotment of any share either at par or at premium for such time and for such consideration as the Directors think fit.

Variation of Share holders Rights.

7. If any time the share capital is divided into different classes of shares, the rights attached to any class (unless otherwise provided by the terms of issue of the shares of that class) may subject to the provisions of Section 108 be varied with the consent in writing of the holders of three fourths of the issued shares of that class, or with the sanction of a special resolution passed at a separate general meeting of the holders of the shares of the class. To every such separate General Meeting the provisions of these regulations relating to General Meeting shall mutaits mutandis apply, but so that necessary quorum shall be three persons at least holding or representing by proxy and having twenty five percent of the issued shares of that class.

(a) Subject to the provisions of the Companies Ordinance, 1984 and without affecting rights of holders of Class "A" shares and Class "B" shares inter se, the Board may, from time to time, increase the Company's share capital by such sum, to be divided into shares of such classes and such amounts as the Board shall prescribe, subject to :

Any further issue of share capital shall be divided into Class "A" shares or Class "B" shares or both categories and shall also be subject to the following :

i) Class "A" shares shall be offered to Class "A" shareholders proportionately and Class "B" shares shall be offered to Class "B" shareholders proportionately; and

ii) The amount of further issue of capital shall be divided into Class "A" shares and Class "B" shares in proportion of such `shares that have been issued and allotted as fully paid up at the time of such further issue.

If the whole or any part of the shares offered under sub-article 7(a) is declined or is not subscribed, the directors may allot and issue such shares in such manner as they may deem fit, subject to the provision of section 86 of the Companies Ordinance, 1984.

Allotment and minimum subscription

8. The Directors shall in making the allotments duly observe the provisions of section 68 to 73 as may be applicable to the Company. The minimum subscription upon which the Directors may proceed to allotment as defined in Sub - Section 8 of Section 68 is fixed at Rs. 500,000/= Nothing herein contained shall prevent the Directors from issuing fully paid-up shares either on payment of the entire nominal value thereof in cash or in satisfaction of any outstanding debt or obligation of the Company.

9. Save as herein otherwise provided, the Company shall be entitled to treat the registered holder of any share as the absolute owner thereof and accordingly shall not, except as ordered by a court of competent jurisdiction or as by statute required be bound to recognise any equitable, contingent, future, partial or other claim to or interest in such share on the part of any other persons. Trusts not recognised

10. Share may be registered in the name of any limited Company or other corporate body. Unless the Directors otherwise consent in any case, not more than four persons shall be registered joint-holders of any share. Company and Corporate Body may hold shares

11. As provided in section 87, the Directors may issue shares against the outstanding balance of loan, advances, credits or other long term (over three years) non-interest bearing securities in the manner provided in any contract with any scheduled bank or financial institution not exceeding twenty percent of such balance. Issue of shares to banks and financial institutions

12. The Directors may issue to banks or financial institutions either severally, jointly or through a syndicate, Redeemable Capital in consideration of any funds, moneys, accommodations received or to be received by the company whether in cash or in specie or against promise, guarantee, undertaking or indemnity issued to or in favour or benefit of the Company. Issue of Redeemable Capital

13. No share shall be offered for subscription except upon the term that the amount payable on application shall be the full amount of the nominal value of the share. Offer for Subscription

CERTIFICATE

14. Every person whose name is entered as a member in the register of members shall, without payment, be entitled to receive, within ninety days after allotment or within forty-five days of the application or registration of transfer, a certificate under the seal specifying the share or shares held by him and the amount paid up thereon. Certificate

15. In respect of a share or shares held jointly by several persons, the Company shall not be bound to issue more than one certificate and delivery of a certificate for a share to one of several joint holders shall be sufficient delivery to all. Joint Holder

16. If a share certificate is defaced, lost or destroyed, it may be renewed on payment of such fee, if any, not exceeding one rupee, and on such terms, if any, as to evidence and indemnity and payment of expenses incurred by the company in investigating title, as the directors think fit. Within forty-five days of the application directors shall issue certificate to the applicant. Duplicate Certificate

17. Except to the extent and in the manner allowed by section 95, no part of the funds of the company shall be employed in the purchase of, or in loans upon the security of the company's shares. Prohitbtion on purchase of its own shares

TRANSFER OF SHARES

Registration of Transfer

18. The directors shall not refuse to transfer any fully paid shares unless the transfer deed is defective or invalid. The directors may also suspend the registration of transfers during ten days immediately preceding a general meeting or prior to the determination of entitlement or rights of the shareholders by giving seven days previous notice in the manner provided in the Ordinance. The directors may decline to recognise any instrument of transfer unless.

(a) a fee not exceeding two rupees as may be determined by the director is paid to the company in respect thereof: and

(b) the duly stamped instrument of transfer is accompanied by the certificate of the shares to which it relates, and such other evidence as the directors may reasonably require to show the right of the transferor to make the transfer.

If the directors refuse to register a transfer of shares , they shall within one month after the date on which the transfer deed was lodged with the company send to the trasnferee and the transferor notice of the refusal indicating the defect or invalidity to the transferee, who shall after removal of such defect or invalidity be entitled to re-lodge the transfer deed with the Company

Execution of Transfer

19. The instrument of transfer of any share in the company shall be executed both by the transferor and the transferee, and the transferor shall be deemed to remain holder of the share until the name of the transferee is entered in the register of members in respect thereof. No transfer shall be made to an infant or person of unsound mind.

Form of Transfer

20. Shares in the company shall be transferred in any usual or common form which the directors shall approve.

TRANSMISSION OF SHARES

Share of Deceased

21. The executors, administrators, heirs or nominees as the case may be, of a deceased sole holder of a share shall be the only persons recognised by the company as having any title to the share. In case of a share registered in the name of two or more holders, the survivors or survivor, or the executors or administrators of the survivor or survivors, shall be the only persons recognised by the company as having any title to the share.

Nomination by Members

22. A member / shareholder may deposit with the company a nomination conferring on one or more persons the right to acquire the interest in the shares therein specified in the event of his death. Regulations of section 80 will apply in case of all such nominations.

23. Any person becoming entitled to a share in consequence of the death or insolvency of a member shall, upon such evidence being produced as may produced as may from time to time be required by the directors, have the right , either to be registered as member in respect of the share or instead of being registered himself, to make such transfer of the share as the deceased or insolvent person could have made: but the directors shall, in either case, have the same right to decline or suspend registration as they would have had in the case of a transfer of the share by the deceased or insolvent person before the death or insolvency.

24. A person becoming entitled to a share by reason of the death or bankruptcy or insolvency of the holder shall be entitled to the same dividends and other advantages to which he would be entitled if he were the registered holder of the share, except that he shall not, before being registered as a member in respect of the share, be entitled in respect of it to exercise any right conferred by membership in relation to meetings of the company

Entitlement of Dividend

ALTERATION AND FURTHER ISSUE OF CAPITAL

25. The company may, from time to time, by special resolution increase the share capital by such sum, to be divided into shares of such amount, as the resolution shall prescribe. The new shares shall be subject to the same provisions with reference to transfer, transmission and otherwise as the shares in the original share capital.

Increase in Share Capital

26. The Company may, be Ordinary Resolution, subject to the provisions of the Companies Ordinance, 1984 :

Consolidation Division, subdivision and Cancellation of Shares

a. Consolidate and divide the whole or any part of its share capital into shares of larger amount than its existing shares:

b. Sub-divide its shares, or any of them into shares of smaller amount than is fixed by the memorandum; or

c. cancel shares which, at the date of the passing of the resolution in that behalf, have not been taken or agreed to be taken by any person, and diminish the amount of its share capital by the amount of the share so cancelled:

Provided that, in the event of consolidation or sub-division of shares, the rights attaching to the new shares shall be strictly proportional to the rights attaching to the previous shares so consolidated or sub divided.

Provided further that where any shares issued are of a class which is the same as that of shares previously issued the rights attached to the new shares shall be the same as those attached to the shares previously held.

Offer for new shares

27. Subject to provisions of Section 86 all new shares shall, before issue be offered to such person at the date of the offer are entitled to receive notice from the company of general meetings in proportion, as nearly as the circumstances admit, to the amount of the existing shares to which they are entitled. The offer shall be made by notice specifying the number of shares offered, and limiting a time within which the offer, if not accepted will be deemed to be declined, and after the expiration of that time, or on the receipt of an intimation from the person to whom the offer is made that he declines to accept the shares offered, the directors may dispose of the same in such manner as they think most beneficial to the company. The directors may likewise so dispose of any new shares which (by reason of the ratio which the new shares bear to shares held by persons entitled to an offer of a new shares) cannot, in the opinion, of the directors, be conveniently offered under this regulations.

Reduction of shares

28. The company may, by special resolution, reduce its share capital, capital redemption reserve and share premium account in any manner subject to, any incident authorised and consent required by sections 96 to 106 under the Companies Ordinance, 1984

Surrender of shares

29. Subject to the provisions of the Ordinance, the Directors may accept from any member the surrender of all or any of his shares on such terms as shall be agreed.

GENERAL MEETING

Statutory Meeting

30. Subject to provision of section 157 the Statutory General Meeting of the company shall be held within a period of not less than three months and not more than six months from the date of entitlement of commencement of business.

Annual General Meeting

31. A general meeting to be called annual general meeting, shall be held as may be determined by the Directors in accordance with the provisions of section 158, within eighteen months from the date of incorporation of the company and thereafter once at least in every calendar year within a period of six months following the close of its financial year and not more than fifteen month after the holding of its last preceding annual general meeting as may be determined by the directors.

Extra Ordinary General Meeting

32. All general meetings of a company other than the statutory meeting or an annual general meeting mentioned in section 157 and 158 respectively shall be called extraordinary general meetings.

Calling of an Extra Ordinary General Meeting

33. The directors may, whenever they think fit, call an extraordinary general meeting, Extraordinary general meetings shall also be called on such requisition, or in default may be called by such requisitionists, as is provided by section 159. If at any time there are not within Pakistan sufficient directors capable of acting to form quorum., any director of the company may call an extraordinary general meeting in the same manner as nearly as possible as that in which meetings may be called by the directors.

NOTICE AND PROCEEDINGS OF GENERAL MEETING

34. Twenty-one days' notice at the least (exclusive of the day on which the notice is served or deemed to be served, but inclusive of the day for which notice is given) specifying the place, the day and the hour of meeting and, in case of special business the general nature of that business, shall be given in manner provided by the Ordinance for the general meeting, to such persons as are , under the Ordinance or the regulations of the company, entitled to receive such notices from the company but the accidental omission to give notice to, or the non-receipt of notice by, any member shall not invalidate the proceedings at any general meeting. In case of extraordinary meeting a shorter notice may be given with the consent of Registrar as provided in section 159 and for passing a special resolution meeting may be convened on a shorter notice with the consent of all the member as provided in section 2(1) (36). Notice

35. All business shall be deemed special that is transacted at an extraordinary general meeting, and also all that is transacted at an annual general meeting with the exception declaring a dividend, the consideration of the accounts, balance sheet and the reports of the directors and auditors, the election of directors, the appointment of, and the fixing of the remuneration of the auditors. Special Business

36. No business shall be transacted at any general meeting unless a quorum of members is present at that time when the meeting proceeds to business; save as herein otherwise provided, members having twenty five percent of the voting power present in person or through proxy and three members personally present shall be a quorum. Quorum

37. Resolution in general meeting regarding appointment and removal of directors, variation in the right of shareholders and investment in associated undertakings shall be passed by specified majority as per the Ordinance. Resolution of specific majority

38. If within half an hour from the time appointed for the meeting a quorum is not present, the meeting, if called upon the requisition of members, shall be dissolved; in any other case, it shall stand adjourned to the same day in the next week at the same time and place, and if at the adjourned meeting a quorum is not present within half an hour from the time appointed for the meeting, the members present, being not less than three, shall be a quorum. Adjouned Meeting

39. The chairman of the board of directors, if any, shall preside as chairman at every general meeting of the company, but if there is no such chairman, or if at any meeting he is not present within fifteen minutes after the time appointed for the meeting, or is unwilling to act as chairman , any one of the directors present may be elected to be chairman, and if none of the directors is present, or willing to act as chairman, the members present shall choose one of their number to be chairman. Chairman

Power to Adjourn General Meeting

40. The Chairman may, with the consent of any meeting at which a quorum is present (and shall if so directed by the meeting), adjourn the meeting from time to time' but no business shall be transacted at any adjourned meeting other than the business left unfinished at the meeting from which the adjournment took place. When a meeting is adjourned for ten days or more, notice of the adjourned meeting shall be given as in the case of an original meeting save as aforesaid, it shall not be necessary to give any notice of an adjournment or of the business to be transacted at an adjourned meeting.

Adoption of Resolution

41. At any general meeting a resolution put to the vote of the meeting shall be decided on a show of hands unless a poll is (before or on the declaration of the result of the show of hands) demanded. Unless a poll is so demanded, a declaration by the chairman that a resolution has, on a show of hands, been carried, or carried unanimously, or by a particular majority, or lost and an entry to that effect in the book of the proceedings of the company shall be conclusive evidence of the fact, without proof of the number or proportion of the votes recorded in favour of, or against, that resolution.

Demand for Poll

42. A poll may be demanded only in accordance with the provisions of section 167.

Manner and Time of Taking Poll

43. If a poll is duly demanded, it shall be taken in accordance with manner laid down in section 168 and the result of the poll shall be deemed to be the resolution of the meeting at which the poll was demanded. A poll demanded on the election of chairman or on a question of adjournment shall be taken at once.

Casting Vote

44. In case of an equality of votes, whether on a show of hands or on a poll, the chairman of the meeting, at which the show of hands takes place, or at which the poll is demanded, shall have and exercise a second or casting vote.

VOTES OF MEMBERS

Right to vote

45. Subject to any rights or restrictions for the time being attached to any class or classes of shares, on a show of hands every member present in person shall have one vote except for election of directors in which case the provisions of section 178 shall apply. On a poll every member shall have voting rights as laid down in section 160.

Vote may be given either personally or by proxy and voting by Corporation Representative

46. Where a corporation is a member of the Company a person duly appointed by resolution of directors to represent such corporation at a meeting of the Company in accordance with the provisions of Section 162 shall not be deemed to be an instrument of proxy of power of attorney and the production at the meeting of a copy of such resolution certified as being a true copy by a Director of such corporation or by the Chief Executive thereof (if any) shall on production at the meeting accepted by the Company as sufficient evidence of the validity of his appointment.

47. In case of joint-holders, the vote of the senior who tenders a vote, whether in person or by proxy, shall be accepted to the exclusion of the votes of the other joint-holders; and for this purpose seniority shall be determined by the order in which the names stand in the register of members. vote of joint holders

48. A member of unsound mind or in respect of whom an order has been made by any court having jurisdiction in lunacy, may vote, whether on show hands or in a poll, by his committee or other legal guardian, and any such committee or guardian may on a poll, vote by proxy. Vote by member of unsound mind

49. The instrument appointing a proxy shall be in writing under the hand of the appointor or of his attorney duly authorised in writing. A proxy must be a member. Deposit of instrument of Proxy

50. The instrument appointing a proxy and the power-of-attorney or other authority (if any) under which it is signed, or a notaraly certified copy of that power or authority, shall be deposited at the registered office of the company not less than forty-eight hours before the time for holding the meeting at which the person named in the instrument proposes to vote and in default the instrument of proxy shall not be treated as valid. Proxy to be in writing

51. An instrument appointing a proxy may be in any usual or common form or as near thereto which the directors shall approve Form of Proxy

52. A vote given in accordance with the terms of an instrument of proxy shall be valid notwithstanding the previous death or insanity of the principle or revocation of the proxy or of the authority under which the proxy was executed, or the transfer of the share in respect of which the proxy is given, provided that no intimation in writing of such death, insanity, revocation or transfer as aforesaid shall have been received by the company at the office before the commencement of the meeting or adjourned meeting at which the proxy is use. Validity of Proxy

DIRECTORS

53. At the time of adaptation of the articles following were the first directors of the Company; Directors

1. **Haji Abdul Ghafoor s/o. Late Haji Aziz Din**
2. **Haji Bashir Ahmed s/o. Late Haji Aziz Din**
3. **Mst. Safia Begum w/o. Haji Abdul Ghafoor**
4. **Mst. Naziran Begum w/o. Haji Bashir Ahmed**
5. **Mr. Muhammad Adrees s/o. Haji Bashir Ahmed**
6. **Mr. Tariq Mehmood s/o. Haji Abdul Ghafoor**
7. **Mr. Javed Iqbal s/o. Haji Abdul Ghafoor**
8. **Mr. Muhammad Anis s/o. Haji Bashir Ahmed**
9. **Mr. Mohammad Farooq Khan**

Number of Directors

54 Subject to the provision of the Ordinance, the Company may from time to time in annual general meeting increase or decrease the number of directors. However such number shall not in any case be less that seven.

Nominated Directors

55. The Company may have directors nominated by the company's creditors or other special interest by virtue of contractual arrangements.

Alternate Directors

56. A Director who is about to leave or is absent from Pakistan may with the approval of the Directors appoint any person to be an Alternate Director during his absence from the country provided such absence shall not be less than for a period of three months and such appointment shall have effect and such appointee whilst he holds office as an Alternate Director, shall be entitled to notice of the Meeting of Directors and to attend and vote thereat accordingly but shall ipso facto vacate office when his appointor returns to the Country or office. Any appointment and removal under the Article shall be effected by notice in writing under the hand of Director making the same.

Remuneration of Director

57. The remuneration of a Director for performing extra services, including holding of the office of Chairman , and the remuneration to be paid any Director for attending the Meeting of the Directors or a committee of Directors shall from time to time be determined by the Company in general meeting subject to the provisions of the Ordinance.

POWERS AND DUTIES OF DIRECTORS

Management of Business

58. The business of the company shall be managed by the directors, who may pay all expenses incurred in promoting and registering the Company and may exercise all such powers of the company as are not by the Ordinance or any statutory modification thereof for the time being in force, or by these regulations, required to be exercised by the company in general meeting, subject nevertheless to the provisions of the Ordinance or to any of these regulations, and such regulations being not inconsistent with the aforesaid provisions, as may be prescribed by the company in general meeting but no regulation made by the Company in general meeting shall invalidate any prior act of the directors which would have been valid if these regulations had not been made.

Power to Appoint Attorney

59. The Directors may from time to time by power of attorney under the Company's Seal, appoint any person or persons to be the attorney(s) of Company for such purposes and with such powers, authorities and discretions (not exceeding those vested in or exercisable by, the Director under these presents) and for such period and subject to such conditions as the Directors may from time to time think fit. Any such attorney(s) may, if authorised by the Directors delegate all or any of the powers vested in him/them.

60. The directors shall duly comply with the provisions of the Ordinance or any statutory modification thereof for the time being in force, and in particular with the provisions in regard to the registration of the particulars of mortgages and charges affecting the property of the company or created by it, to the keeping of a register of the directors, and to the sending to the registrar of an annual list of members, and a summary of particulars relating thereto and notice of any consolidation or increase of share capital or sub division of shares, and copies of special resolutions and copy of the register of directors and notification of any changes therein. Duties of Directors

61. Subject to the provisions of Section 196 the Directors may from time to time at their discretion borrow such sum or sums as they may think fit for the purpose of the company including from any banks and financial institutions and secure the payment or repayment of such sum or sums in such manner and upon such terms and conditions as they think fit by mortgage or charge upon the whole or any part of the property present and future or any such other way as the Directors may think expedient. The company may raise and secure payment of any sum by issue of Redeemable Capital. The Redeemable Capital may be issued at a discount, premium or otherwise with special privilege as to redemption, conversion into shares with voting rights and their subsequent reconversion into Redeemable Capital. Power to Borrow

62. The Directors shall cause a proper register to be kept in accordance with Section 135 of all mortgages and charges specially affecting the property of the company and shall duly comply with the requirements of section 121,122 and 129 in regard to registration of mortgages and charges and shall also duly comply with the requirements of section 130 and to keeping a copy of every instrument creating any mortgage or charge and the requirements of section 132 as to giving intimation of the payment or satisfaction of any charge or mortgage created. Mortgages and Charges

63 Every director or his relative who is in any way, whether directly or indirectly, concerned or interested in any contract or agreement entered into, or to be entered into, by or on behalf of the company shall disclose the nature of his concern or interest at the meeting of the directors, as required by section 214. Disclosure of interest by Directors

64. The directors shall cause minutes to be made in books provided for the purpose. Minutes Books

a. of all appointments of officers made by the directors;

b. of the names of the directors present at each meeting of the directors and of any committee of the directors;

c. of all resolutions and proceedings at all meetings of the company and of the directors and of committees of directors.

and every director present at any meeting of directors or committee of directors shall sign his name in a book to be kept for that purpose.

DISQUALIFICATION OF DIRECTORS

Ineligibility

65. No person shall become director of the Company if he suffers from any of the disabilities or disqualifications mentioned in Section 187 and if already a director, shall cease to hold such office from the date he so becomes disqualified or disabled. Provided, however, that no director shall vacate his office by reason only of his being a member of any company which has entered into contracts with, or done any work for the company of which he is director, but such director shall not vote in respect of any such contract or work, and if he does so vote, his vote shall not be counted.

PROCEEDINGS OF DIRECTORS

Meetings of Directors

66. The Directors may meet together for the despatch of business, adjourn and otherwise regulate their meetings, as they think fit. The quorum for a meeting of Directors shall not be less than one-third of their number or four whichever is greater. Questions arising at any meeting shall be decided by a majority of votes. In case of an equality of votes, the Chairman shall have and exercise a second or casting vote. A Director may and the secretary on the requisition of a Director shall, at any time, summon a meeting of Directors. It shall not be necessary to give notice of a meeting of Directors to any Director for the time being absent from Pakistan.

Minimum number of meetings

67. The Directors shall meet at least twice a year as required by section 193.

Delegation of Power to Committee

68. The directors may delegate any of their power not required to be exercised in their meeting to committees consisting of such member or members of their body as they think fit; any committee so formed shall , in the exercise of the powers so delegated conform to any restrictions that may be imposed on them by the directors.

Chairman

69. The directors may elect a chairman of their meeting and determine the period for which he is to hold office, but if no such chairman is elected, or if at any meeting the chairman is not present within ten minutes after the time appointed for holding the same or is unwilling to act as chairman, the directors present may choose one of their member to be chairman of the meeting.

Chairman of Committee Meeting

70. A committee may elect a chairman of its meetings, but if no such chairman is elected, or if or if at any meeting the chairman is not present within ten minutes after the time appointed for holding the same or is unwilling to act as chairman, the members present may choose one of their member to be chairman of the meeting.

Proceedings of Committee Members

71. A committee may meet and adjourn as it thinks proper. Questions arising at any meeting shall be determined by a majority of votes of the members present. In case of an equality of votes, the chairman shall have and exercise a second or casting vote.

72. All acts done by any meeting of the directors or of a committee of directors or by any person acting as a director, shall notwithstanding that it be afterwards discovered that there was some defect in the appointment of any such directors or persons acting as aforesaid, or that they or any of them were disqualified, be as valid as if every such person had been duly appointed and was qualified to be a director. Validity of Directors Act

73. A resolution in writing signed by all the Directors or affirmed by them through telex or telegram shall be as valid and effectual as if it had been passed at a meeting of Directors duly convened and held. Resolution in Writing

ELECTION AND REMOVAL OF DIRECTORS

74. The First Directors of the Company shall retire from their offices at the first Annual General Meeting of the Company, and directors shall be elected in their place in accordance with section 178 for a term of three years, unless they resign earlier become disqualified for being Directors or otherwise cease to hold office. Period of Office

75. The Directors shall comply with the provisions of sections 174 to 178, sections 180 and 184 relating to election of Directors and matters ancillary thereto. Election

76. A retiring director shall be eligible for re-election. Eligibility

77. Any casual vacancy occurring on the board of directors may be filled up by the directors, but the person so chosen shall be subject to retirement at the same time as if he had become a director on the day on which the director in whose place he is chosen was last elected as director. Casual Vacancy

78. The number of directors determined by the Board shall be elected to hold office by the members in general meeting in the following manner: Mode of Election

a. A member shall have such number of votes as is equal to the product of the number of voting shares or securities held by him and the number of directors to be elected.

b. A member may give all his votes to a single candidate or divide them between more than one of the candidates in such manner as he may choose:

c. The candidate who gets the highest number of votes shall be declared elected as Director and then the candidate who gets the next highest number of votes shall be so declared and so on until the total number of Directors to be elected has been so elected.

Removal

79. The Company may by resolution in general meeting remove a director appointed under Section 176 or Section 180 or elected in the manner provided for in Section 178.

Provided that a resolution for removing a director shall not be deemed to have been passed unless the number of votes cast in favour of such a resolution is not less than:

(i) The minimum number of votes that were cast for the election of a director at the immediately preceding election of directors, if the resolution relates to removal of a director elected in the manner provided in sub-section (5) of Section 178; or

(ii) The total number of votes for the time being computed in the manner laid down in sub-section (5) of Section 178 divided by the number of directors for the time being, if the resolution relates to removal of a director appointed under section 176 or section 180.

Vacation of office

80. A director shall ipso facto cease to hold office if:

a. he becomes ineligible to be appointed a director on any one or more of the grounds enumerated in Section 187.

b. he absents himself from three consecutive meetings of directors or from all the meetings of the directors for a continuous period of three months, whichever is the longer, without leave of absence from the directors;

c. he or any firm of which he is a partner or any private company of which he is a director:

(i) without the sanction of the company in general meeting accepts or holds any office of profit under the company other than that of Chief Executive or legal or technical adviser or a banker: or

(ii) accepts a loan or guarantee from the company in con_ travention of section 195.

CHIEF EXECUTIVE

81. The director of the company as from a date not later than the fifteen day after the date of its incorporation appoint any individual to be the chief executive of the Company. — First Appointment

82. The chief executive appointed as aforesaid shall, unless he earlier resigns or otherwise ceases to hold office, upon the first annual general meeting of the company or, if a shorter period is fixed by the directors at the time of his appointment, for such period. — Form of Office

83. Within fourteen days from the date of election of directors under section 178 or the office of the Chief Executive falling vacant, as the case may be, the directors of a company shall appoint any person, including an elected director to be the chief executive, but such appointment shall not be for a period exceeding three years from the date of appointment. — Subsequent Appointment and Term of Office

84. On the expiry of his term of office under section 198 or 199 a chief executive shall be eligible for reappointment. — Eligibility for Reappointment

85. The chief executive retiring under section 198 or 199 shall continue to perform his functions until his successor is appointed unless non-appointment of his successor is due to any fault on his part or his office is expressly terminated. — Continuation of Office until Appointment of Successor

86. The terms and conditions of appointment of a chief executive shall be determined by the directors. — Terms and Conditions

87. The chief executive shall, if he is not already a director of the company, be deemed to be its director and be entitled to all the rights and privileges, and subject to all the liabilities, of that office. — Deemed to be Director

88. No person who is ineligible to become a director of a company under section 187 shall be appointed or continue as the chief executive of the company. — Ineligibility

89. The directors of a company by resolution passed by not less than three fourths of the total number of directors for the time being, or the company by a special resolution, may remove a chief executive before the expiration of his term of office notwithstanding any thing contained in these articles or in any agreement between the company and such chief executive. — Removal

SEAL

Common Seal

90. The Company shall have a common seal and the Directors shall provide for the safe custody thereof. The Seal shall not be affixed to any instrument except by the authority of a resolution of the Board or by committee of Directors authorised in that behalf by the Directors and two directors or one Director and the secretary of the Company shall sign every instrument to which the common seal is affixed.

Official Seal

91. The Directors may provide for the use in any territory, district or place not situated in Pakistan, of an official seal which shall be facsimile of the common seal of the Company, with addition on its face of the name of every territory, district or place where it is to be used. The provision of section 213 shall apply to the use of such official seal.

DIVIDENDS AND RESERVES

Declaration of Dividend

92. The Company in general meeting may declare dividends but no dividend shall exceed the amount recommended by the directors.

Interim Dividend

93. The directors may from time to time pay to the members such interim dividends as appear to the directors to be justified by the profits of the company.

Dividend out of Profit only

94. No dividends shall be paid otherwise that out of profit of the year or any other undistributed profits.

No dividend out of Capital Profit

95. No dividend shall be declared or paid out of profits made from sale or disposal of any immovable property or assets of a Capital nature comprises in the undertaking except after such profits are set off or adjusted against losses arising from the sale of any such immovable property or assets of Capital nature.

Dividend in Proportion to Amount paid

96. Subject to the rights of persons (if any) entitled to shares with special rights as to dividends, all dividends shall be declared and paid according to the amounts paid on the shares, but if and so long as nothing is paid upon any of the shares in the company, dividends may be declared and paid according to the amounts of the shares.

Dividend in Specie

97. Any general meeting declaring a dividend may resolve that such dividend be paid wholly or in part by the distribution of specific assets and in particular, of paid up shares debentures or debenture stock of the company or any other company or in any one or more such ways.

98. The directors may before recommending any dividend, set aside out of the profits of the company such sums as they think proper as a reserve or reserves which shall, at the discretion of the directors, be applicable for meeting contingencies or for equalizing dividends, or for any other purpose to which the profits of the company may be properly applied, and pending such application may, at the like discretion, either be employed in the business of company or be invested in such investments (other than shares of the company) as the directors, may subject to the provisions of the Ordinance, from time to time think fit. Reserve Fund

99. The Directors may carry forward any profits which they may think prudent not to distribute, without setting them aside as a reserve. Retention of Profit

100. Any General Meeting may resolve that moneys investments or other assets forming part of the Company standing to the credit of the reserve funds or in the hands of the company and available for dividend or representing premiums received on the issue of shares and standing to the credit of the shares premium accounts be capitalised and distributed amongst such of the shareholders as would be entitled to receive the same if distributed by way of dividend and in the same proportions on the footing that they become entitled thereto as capital and that all or any part of such capitalised funds be applied on behalf of such shareholder in paying up in full any unissued shares of the Company which shall be distributed accordingly and that such distribution or payment shall be accepted by such shareholders in full satisfaction of their interest in the said capitalised sum. Capitalisation of Reserve

101. Dividend shall be paid only to registered holders of such shares or to his banker or to his order to a financial institution nominated by the shareholder. Dividend to Registered holder only.

102. A transfer of shares shall not pass the right to any dividend declared thereon before the registration of the transfer. Effect of transfer

103. The Directors may retain the dividends payable upon shares in respect of which any person is under the transmission clause entitled to become a member or which any person under that clause is entitled to transfer until such person shall become a member in respect thereof or shall duly transfer the same. Retention in certain cases

104. Any one of the several persons who are registered as the joint holders of any share may give effectual receipts for all dividends and payments on account of dividends in respect of such share. Dividend to Joint holders

105. Unless otherwise directed any dividend may be paid by cheque or warrant sent through the post to the registered address of the member entitled, or in the case of joint holders to the registered address of that one whose name stands first on the register in respect of the joint holders and every cheque or warrant so sent shall be made payable to the order of the person to whom it is sent. Mode of payment

Unclaimed dividends

106. All dividends unclaimed for one year after having been declared may be invested or otherwise made use of by the Directors for the benefit of the Company until claimed.

Time of Payment

107. The dividends shall be paid within the period laid down in Section 251

Notice of Dividend

108. Notice of any dividend that may have been declared shall be given in manner hereinafter mentioned to the person entitled to share therein, the company may give such notice by advertisement in newspaper circulating in the Province in which the registered office of the company is situated.

BOOKS AND ACCOUNTS

Books of Account

109. The directors shall cause to be kept proper books of account as required under section 230.

Place where Books of Account kept

110. The books of account shall be kept at the registered office of the company or at such other place as the directors shall think fit and shall be open to inspection by the directors during business hours.

Inspection by Members

111. The directors shall from time to time determine whether and to what extent and at what time and place and under what conditions or regulations the accounts and books or papers of the company or any of them shall be open to the inspection of members not being directors, and no member (not being a director) shall have any right of inspecting any account and books or papers of the company except as conferred by law or authorised by the directors or by the company in general meeting.

Annual Accounts

112. The directors shall as required by Sections 233 and 236 cause to be prepared and to be laid before the company in general meeting such profit and loss account or income and expenditure account and balance sheet duly audited and reports as are fererred to in those sections.

Presentation of Annual Accounts before Annual General Meeting

113. A balance sheet, profit and loss account, income and expenditure account and other reports referred to in Article 112 above shall be made out in every year and laid before the company in the annual general meeting made up to date not more than six months before such meeting. The balance sheet and profit and loss account or income and expenditure account shall be accompanied by a report of the auditors of the company and the report of directors.

When Accounts Settled

114. Every account of the Company when audited and approved by a general meeting shall be conclusive except as regard any errors discovered therein within three months next after the approval thereof. Whenever any such error is discovered within that period the account shall forth with be corrected and thenceforth shall be conclusive.

115. A copy of the balance sheet and profit and loss account or income and expenditure account and reports of directors and auditors shall, at least twenty one days preceding the meeting, be sent to the persons entitled to receive notices of general meeting in the manner in which notices are to be given hereunder. Copies to be Sent to Members

116. The directors shall in all respects comply with the provisions of sections 230 to 236 Compliance with Ordinance

AUDIT

117. Auditors shall be appointed and their duties regulated in accordance with sections 252 to 255. Audit

NOTICES

118. A notice may be given by the company to any member either personally or by sending it by post to him to his registered address or (if he has no registered address in Pakistan) to address, if any within Pakistan supplied by him to the company for the giving of notice to him. Where a notice is sent by post services of the notice shall be deemed to be effected by properly addressing prepaying and posting a letter containing the notice and unless the contrary is proved, to have been effected at the time at which the letter would be delivered in the ordinary course of post. Mode of Service of Notice

119. If a member has no registered address in Pakistan, and has not supplied to the company and address within Pakistan for the giving of notice to him a notice addressed to him or to the shareholders generally and advertised in a newspaper circulating in the neighbourhood of the registered office of the company shall be deemed to be duly given to him on the day on which the advertisement appears. Notice by Newspaper

120. A notice may be given by the company to the joint holders of a share by giving the notice to the joint-holder named first in the register in respect of the share. Notice to Joint Holders

121. A notice may be given by the company to the persons entitled to a share in consequence of the death or bankruptcy or insolvency of a member by sending it through post in a prepaid letter addressed to them by name, or by the title or representatives of the deceased or assignee of the insolvent or by any like description, at the address (if any) in Pakistan supplied for the purpose by the person claiming to be so entitled, or (until such an address has been so supplied) by giving the notice in any manner in which the same might have been given if the death or bankruptcy or insolvency had not occurred. Notice to person entitled to transmission

Notice of General Meeting

122. Notice of every general meeting shall be given in some manner herein before authorised to:

a. every member of the company except those members who, having no registered address within Pakistan, have not supplied to company an address within Pakistan, for the giving of notices to them, and also to.

b. every person entitled to a share in consequence of the death or bankruptcy or insolvency of a member, who but for his death or bankruptcy or insolvency would be entitled to receive notice of the meeting; and

c. to the auditors of the company for time being.

SECRECY

Secrecy

123. Every Director, Chief Executive, Secretary, Auditor, Trustee, Member of Committee, Officer, Servant, Agent, Accountant or other person employed in the business of the Company shall, if so required by the Directors before entering upon his duties, sign a declaration pledging himself to observe a strict secrecy respecting all transactions of the Company with the customers and the state of accounts with individuals and in matters relating thereto and shall by such declaration pledge himself not to reveal any of the matters which may come to his knowledge in the discharge of his duties except when required to do so by the Directors or by any meeting or by a court of law or by the person to whom such matters relate and except so far as may be necessary in order to comply with any of the provisions in these presents contained.

Members' Access in Company Premises

124. No member or other person (not being a Director) shall be entitled to enter upon the property of the Company or examine the Company's premises or pro-perties without the permission of a Director, subject to Article 82, to require discovery of or any information respecting any detail of the Company's trading or any matter which is or may be in the nature of a trade secret, mystrey of trade or secret process or of any matter whatsoever which may relate to the conduct of the business of the Company and which in the opinion of the Directors will be inexpedient, in the interest of the members of the Company, to Communicate.

RECONSTRUCTION

125. On any sale of the undertakings of the Company the Directors or the liquidators on a winding up may, if authorised by special resolution, accept fully paid shares, debentures or securities of any other Company, either then existing or to be framed for the purchase in whole or in part of the property of the Company, and the directors (if the profits of the company permit), or the liquidators (in a winding up), may distribute such shares or securities, or any other property of the company amongst the members without realisation, or vest the same in trustees for them, and any Special Resolution may provide for the distribution or appropriation of the cash, shares or other securities, benefits or property, otherwise than in accordance with the strict legal rights of the members or contributories of the Company, and for the valuation of any such securities or property at such price and in such manner as the meeting may approve, and all holders of shares shall be bound to accept and shall be bound by any valuation or distribution so authorised, and waive all rights in relation thereto save only such statutory rights (if any) as are, in case the Company is proposed to be or is in the course of being wound up, incapable of being varied or exclude by these present. Reconstruction

126. If the Company is wound up, the liquidator may, with the sanction of a special resolution of the Company and any other sanction required by the Ordinance, divide amongst the members, in specie or kind, the whole or any part of the assets of the Company, whether they consist of property of the same kind or not. Division of assets in Specie

127. For the purpose aforesaid, the liquidator may set such value he deems fair upon any property to due to divided as aforesaid and may determined how such division shall be carried out as between the members or different classes of members. Valuation by Liquidator

128. The Liquidator may, with the like sanction, vest the whole or any part of such assets in trustees upon such trusts for the benefit of the contribution as the liquidator, with the like sanction, thinks fit, but so that no member shall be compelled to accept any shares or other securities whereon there is any liability. Assets in Trust

INDEMNITY

129. Subject to provisions of section 194 every directors, chief executive, officer or agent for the time being of the company may be indemnified out of the assets of the Company against any liability incurred by him in defending any proceeding, whether civil or criminal, arising out of his dealing in relation to the affairs of the company, except those brought by the Company against him, in which judgement is given in his favour or in which he acquitted or in connection with any application under Section 488 in which relief is granted to him by the Court. Directors' and others' right to indemnity

ARBITRATION

130. Whenever any difference arises between the Company on the one hand and any of the members, their executors, administrators or assigns on the other hand, touching the true intent or construction, or the incident or consequences of these Articles or of the statutes, or touching anything there or thereafter done, executed, omitted or suffered in pursuance of these Articles or of the statutes or touching any breach or alleged breach of these Articles, or any claim on account of any such breach or alleged breach, or otherwise relating to the premises, or to these Articles or to any statute affecting the Company or to any of the affairs of the Company every such difference shall, as a condition precedent to any other action at law be referred in conformity with the Arbitration Act, 1940 or any statutory modification thereof and any rules made thereunder, to the decision of an arbitrator to be appointed by the parties in difference, or if they cannot agree upon a single arbitrator to the decision of two arbitrators of whom one shall be appointed by each of the parties in difference, or in the event of the two arbitrators not agreeing, then of an umpire to be appointed by the two arbitrators, in writing, before proceeding on the reference, and such decision shall be final and binding on the parties.

Difference to Referred to Arbitrator

We the several persons whose names, addresses and descriptions are subscribed below are desirous of being formed into a Company in pursuance of this Articles of Association, and we respectively agree to take the number of Shares in the Capital of the Company set opposite our respectively names.

Names, Addresses and Description of Subscribers	No. of Shares	Signature of Subscribers
Haji Abdul Ghafoor s/o. Late Haji Aziz Din 139-C, Peoples Colony, Faisalabad, Businessman.	ONE	-Sd-
Haji Bashir Ahmed s/o. Late Haji Aziz Din 139-C, Peoples Colony, Faisalabad, Businessman.	ONE	-Sd-
Mst. Naziran Begum w/o. Haji Bashir Ahmed 139-C, Peoples Colony, Faisalabad,House Wife.	ONE	-Sd-
Mrs. Safia Begum w/o. Haji Abdul Ghafoor 139-C, Peoples Colony, Faisalabad, House Wife.	ONE	-Sd-
Mr. Tariq Mahmood s/o. Haji Abdul Ghafoor 139-C, Peoples Colony, Faisalabad, Businessman.	ONE	-Sd-
Mr. Muhammad Anis s/o. Haji Bashir Ahmed 139-C, Peoples Colony, Faisalabad, Businessman.	ONE	-Sd-
Mr. Muhammad Adrees s/o. Haji Bashir Ahmed 138-C, Peoples Colony, Faisalabad, Businessman.	ONE	-Sd-
Mr. Javed Iqbal s/o. Haji Abdul Ghafoor 139-C, Peoples Colony, Faisalabad, Businessman.	ONE	-Sd-

Dated the 31st day of August, 1981

-Sd-
Witness to the above signatures :
MUHAMMAD. YOUSUF ADIL
FCA, FCMA,
21/4 Writers Chambers,
Dunnolly Road,
Karachi.

Certified to be true copy
Joint Registrar of Companies

The type, technology, model, technical details and design of facilities:

Principle on Unit Selection:

1) Main equipment will be Chinese-made equipment with proven design;

2) The main and auxiliary equipment has advanced technology, good quality, high reliability and availability;

3) The unit has high efficiency.

The project is a newly built project. At this stage, it is proposed to construct 1x35 MW superheated units and FGD device, with no expansion being considered.

Main equipment and Parameters

Boiler

Boiler capacity and main data

Boiler type	Circulation Fluidization Bed (CFB)
Rated steam capacity (BMCR)	150t/h
Rated steam pressure	9.8MPa
Rated steam temperature	540℃
Feed water temperature	215℃

Boiler thermodynamic property

Flue gas loss	6.52%
Unburnt carbon thermal loss	0.91%
Surface radiation and convection heat loss	1%
Uncounted thermal loss	0.52%
Calculated thermal efficiency (based on LHV)	91.05%
Manufacturing allowances	1%

Guaranteed thermal efficiency (as per design fuel, LHV rated condition)	90.05%
Furnace volume thermal load	114KW/m^3
Furnace cross section thermal load	3.3MW/m^2
Hot air temperature of primary air pre-heater outlet	165℃
Hot air temperature of secondary air pre-heater outlet	165℃
Cold air temperature of air pre-heater inlet	20 ℃
Excess air coefficient of economizer outlet	1.34
Temperature of flue gas before economizer	522℃
Temperature of flue gas after economizer	259℃
Excess air coefficient of air pre-heater outlet	1.4
Flue gas temperature of air pre-heater outlet	140℃

Steam Turbine

Main Technical Specification

Turbine type: high temperature, high pressure, single casing, extraction and Condensing type

Data under rated output conditions (T-MCR)

Rated output: 35MW e

Rated pressure before main steam valve: 8.83MPa (a)

Rated temperature before main steam valve: 535℃

Rated inlet flow rate: 132.29 t/h

Max. Output: 38.5 MWe without steam extraction

Max. Inlet flow rate: 146, 78 t/h

Heater stage: 4

Feed water temperature (TMCR) : 215°C

Working speed: ~5000 r/min

Rotation direction (viewed from turbine to generator): CCW

Winter no-regulation extraction pressure : 1.9 MPa (a)

Extraction temperature: 210°C (spray water decrease temperature)

Extraction flow rate: 25t/h

Spray water temperature: 158°C (13.8MPa)

Extraction steam back water temperture : 85°C

Extraction steam back water rate : 80%

Extraction steam back water location : Deareator

Max. Allowable cycle range: **47.5 ~ 51.5** Hz

Generator

Technical specifications for Generator

Generator rating:

Rated power	40MWe
Rated capacity	44MVA (subject to power rating specified)
Rated voltage	11KV± 10%
Rated power factor	0.8
Frequency	50Hz
Rated rotating speed	3000r/min
Insulation class of stator winding	F

Insulation class of rotor winding	F
Short circuit ratio	≥0.55
Efficiency	≥98.2%
Number of phases	3
Number of poles	2
Stator connection	Y (six terminals)
Power frequency testing voltage	As specified in IEC standard
Noise (at 1m away from stator frame & 1.2m height above the floor)	< 90dB(A)
Stator multi Glue or less Glue mica insulation , soaked insulation VPI process	Manufacturers to fill
Transient over load capacity of generator	
Generator start/stop time	10000 times
Overhaul cycle of generator	4years
Fluctuation withstand capacity of generator	Frequency :±2%; Stator voltage deviation:±5%
High-speed dynamic balancing	3000 r/min X120% ,2min

REGULATION # 3(5)(h)

Feasibility report

We are not applying under any policy; therefore there is no requirement of Feasibility Report applying by NEPRA.

Fe_2O_3	16.18
CaO	2.23
MgO	3.24
Na_2O	0.27
K_2O	1.16
Mn_3O_4	0.03
TiO_2	1.36
P_2O_5	1.14
SO_3	4.08
Phosphorus in coal(A.D.)	0.75
Undetermined	
Ash Fusion Temperature (ºC)	**Reducing**
I.D.T. (deformation)	1200
S.T. (softening)	1220
H.T. (hemispherical)	1270
F.T. (fluid)	1320
Ash Fusion Temperature (ºC)	**Oxidizing**
I.D.T. (deformation)	1250
S.T. (softening)	1350
H.T. (hemispherical)	1410
F.T. (fluid)	1420
Hardgrove Grindability Index (HGI)	48

REGULATION # 3(5)(i)

Prospectus

Introduction

The project proponent Sitara Chemical Industries Ltd (SCIL) aimed to install 35MW coal fired power plant at Faisalabad. The proposed project would be installed in close proximity of existing Sitara Chemicals Industries.Ltd (SCIL) at 32km Faisalabad -Sheikhupura road. The total area occupied by the proposed project would be 16 acres of land. Imported and local coal would be utilized as fuel for the generation of power from steam turbines.

This IEE has been prepared to conform with the requirements of the Pakistan Environmental Protection Act 1997 (PEPA), the Pakistan Initial Environmental Examination and Environmental Impact Assessment Review Regulations 2000 and the guidelines provided in the Pakistan Environmental Assessment Procedures, 1997. SCIL has involved SGS Pakistan (Private) Limited to undertake the required assessment. This report presents the IEE process and its findings, project alternatives, project impacts, and mitigation measures to be implemented during the execution of the proposed activities.

Salient features of facility

Coal

Coal Quality

Coal imported from Indonesia/South Africa will be used for the project. The analysis of design coal is given in the table below.

Description	Characteristics
Proximate Analysis (% ar)	
Total Moisture	10.3
Inherent Moisture	5.5
Ash	5.8
Volatile Matter	39.39
Fixed Carbon	44.52
Chlorine	0.0095
Specific Energy (as received)	
Gross Calorific Value (Kcal/kg)	6502
Ultimate Analysis (% ar)	
Carbon	56.61
Hydrogen	4.65
Nitrogen	1.59
Oxygen	10
Sulphur	1.58
Ash Analysis (%)(DB)	
SiO_2	48.22
Al_2O_3	22.34

Coal Consumption

Coal Consumption	1x35MW
Hourly Coal Consumption (t/h)	25.2
Daily Coal Consumption (t/d)	604.8
Annual Coal Consumption (10^3 t/a)	181.44

Note: 1) Daily operation hours are taken as 20.

2) Annual operation hours are taken as 7200.

Electricity

The I&C system in the main power building used 400/220 VAC power supply, dual circuitry power supply mode. The two circuitries respectively connect with the different section of the corresponding low voltage auxiliary bus bars. When a circuitry failure, the power switch device will immediately switches to another circuitry, and output the power failure alarm to DCS system at the same time.

AC400V power source supplies power to the equipment such as motor operated valve, electrical actuator etc.

AC220V general power source supplies power to the various general panels, on-site instrument and so on.

DCS system uses 220VAC power, dual circuitry supply. The one circuit is connected with UPS, and the other circuitry is connected with the low voltage auxiliary bus bar. When a power failure, the contactor will immediately switches to another circuitry, and output the power failure alarm to DCS system at the same time.

The balance of plant I&C control power is supplied by the electric supply system of related balance of plant.

The DC110V power supply for protection and control is connected with DC system of electrical.

SITARA CHEMICAL INDUSTRIES LTD.

P.O Box 449, Faisalabad-Pakistan
Tel : 041-4689141 (5 Lines)
Fax : 0092-41-4689147 & 4689148
E.mail : scil@sitara.com.pk
Web : www.sitara.com.pk

Project cost information regarding sources and amounts of equity, debt

	Rs in millions
Estimated project Cost	3.100

Source of Finance

Syndicated Diminishing Musharaka Facility	66.67%	2,000
Equity (Own Sources)	36.67%	1,100

PLANT : 32-KM, Faisalabad-Sheikhupura Road, Faisalabad-37631
ISLAMABAD OFFICE : Malik Complex, Flat # 7, 2nd Floor, 80-East Plaza, Blue Area, Islamabad-44000
Tel # 051-2872042, 2270853 Fax # 051-2802339
LAHORE OFFICE : 110-A 1st Floor, Siddique Trade Center, 72-Main Bulevard, Gulberg Lahore.
Tel# 042-35787476-8 Fax # 042-35787479
KARACHI OFFICE : 601 602 Business Centre, Mumtaz Hassan Road, Karachi - 74000
Tel # 021-32413944, 32415452, 32420620, Fax # 021-32415452

Social impact on environment

Physical Features & Topography

The proposed geographical location for the power plant is adjacent to Sitara Chemical Industries Ltd located at 32km Faisalabad -Sheikhupura road where major industrial and commercial units are located at Lahore-Sheikhupura-Faisalabad road.

The project lies in district Faisalabad and it has detail background history. Faisalabad previously known as Lyallpur was established as a Mandi Town in 1895 as a part of the program of colonization of West Punjab. It was formerly a part of Tehsil Jhang of Multan Division. The city of Faisalabad is situated in the center of the lower Rachana Doab, the area between Chenab and Ravi rivers, which has a mild slope from North-East to South-West with an average of about 0.2 to 0.3 meter drop per kilometer or about 1 to 1.5 feet per mile. The city is situated at an elevation of about 183.35 meters above the Sea level. The topography is however marked by valleys, local depression and relatively high ground.

Seismicity

Pakistan lies on an active seismic belt of earth. Seismic observations indicate that hundred of shocks originate every year. Mostly, these seismic waves are of low intensity and do not have significant effect. According to seismic zones of UN-Habitat the project area falls under Zone 2A.

Geology and Soil

The city is located on the "Bar Upland" which is relatively older alluvium deposit as found in the central part of the road. Because of its elevation above the bordering flood plains, the upland is generally beyond the reach of flood spills, which is the significant physiographic feature of the alluvial plan. Like other Punjab plains, the alluvium is quaternary and has been deposited on semi-consolidated tertiary rocks or on a basement of metamorphic and igneous rocks of Precambrian age. It emanates from the mountain ranges of the north and has been deposited by the present and ancestral streams. The deposition is predominantly fluviatilo sediments.

Climatic Zone

The meteorological data from Faisalabad has been used to identify the baseline climatic condition of the project area and surroundings. The proposed project lies in arid climate region which has hot summers and moderately cold in winter. It is located in the region that encounters four seasons, the hot summer starts from May and continues till July, monsoon starts from July and continues to September while winter season end in February starting from November and spring season lasts for two months from March and April. The last five years annual rain fall data from 2009 to 2013 shows variation between -1 - 243.1 mm.

Water Resources

Surface waters resources are usually exposed to the surface of earth in the form of mobile and immobile situation which includes snow-clad mountains, rivers, on-river streams, rain, sleet, wetlands and oceans.

Among surface waters, district & near the project extremities there is a distributory canal (Rakh Branch) which is used for the irrigation purpose and etc.

The groundwater table in the project area normally exists 40 to 50 ft below the ground level and contains high level of salinity.

Floral Attributes of the Project Area

Most of the study area comprises of agricultural lands especial of wheat crop with presence of shrubs and grass in the surroundings. Based upon observations during the field visit many species of plants were directly observed in the project area. A detailed list is provided in Chapter 4 of the report. The major common species are Albizzia lebbek, Alhaji maurorum, Dalbergia sissoo Roxb, Acacia nilotica, Azadirachta indica
(L.) Adelb.

Faunal Attributes of the Project Area

Based upon observations during the field visit many species of birds were directly observed in the project area. The most favorite habitat of the Avian fauna were found in the surroundings of the study area especially trees in agricultural fields and Tamarix shrubs. Most common species includes House sparrow, House crow, Red vented Bulbul, Myna and Chiffchaff. All these species are also commonly found in other ecological zones of the country.

Total 10 mammalian species have been recorded. Dense vegetation provide living shelter to the mammals like Asiatic Jackal, Five Stripped Palm Squirrel, Indian Crested Porcupine, Indian Desert Jird, Indian Gerbil, Cape Hare, Small Indian Mongoose, House Mouse, House Rat, and Jungli Cat. All the 10 species are commonly found in the project areas as well as in country and no any significant threat can be expected from any activity. During the study several types of burros and droppings were found which indicate the presence of respected reptiles. None of the reptiles and mammalian species found here are listed under any category of the IUCN Red List. Ten species of reptiles were also recorded including snakes, lizards and agamas. Only one species i.e. Indian cobra is listed as Data Deficient in the IUCN Red

SCHEDULE III

3. Fuel: type, imported / indigenous, supplier, logistics, pipelines etc.

Fuel: Type, Imported/indigenous, Supplier, Logistics, pipelines etc.

Coal Source

Annual coal consumption of the 1 X 35MW units will be 180,000 ton. It's proposed to select cheap and reliable commercial coal from international coal market. The background and tendency of coal market, as well as coal quality, price, current and future production capacity, and transportation expense will be analyzed in this chapter. It's recommended that coal of Indonesia be as the main coal and coal of South Africa and local coal be an effective supplement. The coal boilers are designed to mix two or three kinds of coal from different countries according to coal price in different periods.

Imported Coal

Indonesia Coal

According to the statistical data from National Energy and Mineral Resources Department in 2013, the coal reserves in Indonesia are 58 billion tons. The proved reserves are 19.3 billion tons and 5.4 billion in them can be used for being exploited for commercial purpose. The coal reserves in many places have not been proved, the total reserves are estimated more than 90 billion tons. In Indonesia, the anthracite takes up 0.36%, bitumite 14.38%, sub bituminous
26.63%, and lignite 58.63%. The Indonesia coal has the following characteristic: high moisture, low ash content, low sulfur content, and high volatile matter. The sub bituminous calorific value is 5700-7200kcal/kg, volatile matter 3742.15%, and sulfur content
0.10~1.66%.

Generally, coal-bearing stratums are smooth with low burying depth and easy to be explored in Indonesia coalmines. The present exploring coalmines are open-pit mines. Indonesia coalmines are explored in scale and centralized way. Five large coal producers' production capability takes up more than 75% of the whole national coal production. Each producer's coal production capacity is from 15000000 ton to 35000000 ton. Indonesia coal production has been developing rapidly in recent 20 years from less than 100,000,000 ton in 2000 to 386,000,000 ton in 2012. Indonesia domestic demands for coal are very low with only 20% of the producing coal. Thus about 300,000,000 ton coal needs to be exported so that the credibility of the coal source can be guaranteed.

Indonesia mainly produces lignite. The percentages of production capacity for lignite, sub-bituminous and soft coal are 59%, 27% and 14%. there is only 0.5% soft coal. The main index of the coal like water content. volatile component. ash content. calorific value and etc. are nearly the same as the

coal type designed for the boilers of this project. Indonesia coal mines are mainly located near the coastal area or inland areas near water system. Several exclusive wharfs for coal exporting in some port have been established surrounding the coal production areas. Coal from the coal districts are firstly transported from coal districts to the commodity storage yard or inland river wharfs by land way, then shipped to the loading port(or coal wharf) or the anchorage for large vessel shipping.
The tonnage of the outbound vessel can reach 50000 ton. The shipping distance is 3900 miles from main ports of Indonesia to Qasim Port of Pakistan which is the shortest distance from the coal supplying port.

South Africa Coal

According to data from World Energy Council, the indicated reserves of soft coal, anthracite, sub-anthracite and lignite are 30,156,000,000 ton in South Africa (in which 81.5% low rank bitumite, 13.1% high rank bitumite and 5.4% soft coal), ranking the 6th after US, Russia, China, India and Australia. It takes up 10.6% of the global measured reserves. Nineteen coalfields of South Africa distributed in the area of 700km from north to south and 500m from east to west. 12.9 million ton of the measured reserves are in Witbank, Highveld, En-nelo, South Rand, Natal and Water burg coalfield. Witbank Coal mine has the largest coal production capacity, and the secondary is Highveld coalmine and the total coal production of these two coal fields takes up more than 80% of the total production.
As the main coal producing country, South Africa ranks the 5th after US, China, Russia and Australia. The coal resource centralized in the eastern area: Mpumalanga's coal production takes up 83% and Limpopo is the secondary. As shown in the following picture, 39% of South Africa's coal is used for power generation, and nearly 20% for manufacturing synthetic fuel. South Africa is the only country which produces liquid fuel by coal commercially in the world.
Since 2000, coal production capacity is keeping stable with 220,000,000 ton to 260,000,000 ton in South Africa and 100,000,000 to 120,000,000 ton is used for chemical material and industrial fuel consumption. In recent years, South Africa's exporting coal is about more than 70,000,000 ton and takes up about 27% of the whole production. More than 97% of the coal
was exported from Richard Port and coal exporting to Asian area is increasing while to other areas is decreasing.
From the credibility of the coal supplying, coal production from main exporting enterprises of South Africa can completely meet the demands for thermal coal of coal power plant in this project. The coal transportation. especially the exporting coal is mainly by the way of Transnet railway transportation and the transportation capacity is 68,000,000 ton. Now the exclusive coal transportation railway is expanded and the capacity will rise to 81.000.000 ton per year. the throughput of Richard Port will expand to 105,000.000 ton and

these infrastructure and logistical lines can guarantee the coal transportation channels.

Indigenous Coal

Pakistan coal resource spread in Sind province, Baluchistan Province, Punjab Province and northwestern provinces. According to estimation from Geological Survey of Pakistan-GSP,

coal resource volume in Pakistan is about 186,200,000,000 ton of which 184,000,000,000 ton was in Sind Province (176,000,000.000 ton in Thar, 1300,000,000 ton in Lakhra, 3,700,000,000 ton in Sonda Thatta and etc.), in addition, Baluchistan 217,000,000 ton, Punjab Province 235,000,000 ton, northwest provinces 90,000.000 ton.

The coal include lignite and sub-bituminous, and the calorific value is from 2,780 to 7,227 kilo calories. In Thar region in the south of Sind province, there is the largest fair lignite mine in the world.

Coal Quality

Coal imported from Indonesia/South Africa will be used for the project. The analysis of design coal is given in the table below.

Description	Characteristics
Proximate Analysis (% ar)	
Total Moisture	10.3
Inherent Moisture	5.5
Ash	5.8
Volatile Matter	39.39
Fixed Carbon	44.52
Chlorine	0.0095
Specific Energy (as received)	
Gross Calorific Value (Kcal/kg)	6502
Ultimate Analysis (% ar)	
Carbon	56.61
Hydrogen	4.65
Nitrogen	1.59
Oxygen	10
Sulphur	1.58
Ash Analysis (%)(DB)	
SiO_2	48.22
Al_2O_3	22.34
Fe_2O_3	16.18
CaO	2.23
MgO	3.24

Na_2O	0.27
K_2O	1.16
Mn_3O_4	0.03
TiO_2	1.36
P_2O_5	1.14
SO_3	4.08
Phosphorus in coal(A.D.)	0.75
Undetermined	
Ash Fusion Temperature (ºC)	**Reducing**
I.D.T. (deformation)	1200
S.T. (softening)	1220
H.T. (hemispherical)	1270
F.T. (fluid)	1320
Ash Fusion Temperature (ºC)	**Oxidizing**
I.D.T. (deformation)	1250
S.T. (softening)	1350
H.T. (hemispherical)	1410
F.T. (fluid)	1420
Hardgrove Grindability Index (HGI)	48

Coal Consumption

Coal Consumption	1x35MW
Hourly Coal Consumption (t/h)	25.2
Daily Coal Consumption (t/d)	604.8
Annual Coal Consumption (10^3 t/a)	181.44

Note: 1) Daily operation hours are taken as 20.
2) Annual operation hours are taken as 7200.

Fuel for Ignition and Combustion Support

Light fuel oil from free international fuel oil market will be mainly used for the project. In power plant area, the highway traffic conditions are good to ensure fuel oil supply. When unloaded in the jetty, the fuel oil will be transported into the plant by highway.

Coal Transportation

The coal for the power plant may be from Indonesia and South Africa will be transported by ship. According to the port situation of the export countries which was selected, the coal loading port also can be decided initially. The shipment ports are separately Tanjung Bara port in Indonesia and Richards Bay port in South Africa.

The distance between the national coal loading ports and Pakistan Qasim port is shown in this table as follows:

SN	SHIPMENT PORT	UNSHIP PORT	SEA MILE
1	Tanjung, Bara Port	Qasim Port	3900
2	Richards Bay Port	Qasim Port	4300

According to the analysis of the route of voyage. the distance from Richard Bay of South Africa to Qasim of Pakistan is about 4200-4300 nm, about 17 days at sea; the distance is about 3900nm from Tanjung Bara port of Indonesia to Qasim of Pakistan, about 16 days at sea.

Supply of Desulfurization Absorbent

The installed capacity of the project is 1x35MW, and wet desulphurization device will be installed for the project. 60,256 tons of limestone will be used as FGD absorbent for the 1x35MW unit every year.

According to the document provided by the Owner, the quality of the limestone for this project is as follows:

No.	Parameter	Unit	Test Result
1	CaCO3	%	90-95
2	MgCO3	%	0.5-3
3	Fe2O3 (Iron)	%	0.5-3
4	Al2O3 (Alumina)	%	0.5-3
5	Total Inerts	%	3-7

There are large amounts of high quality limestone in NWFP Province, Punjab Province, Sindh Province, Balochistan Province, and Northern area of Pakistan. They are widely used in road construction, building construction, sanitation and hygiene, and water treatment. Currently, the limestone output in Pakistan is about 8700.000 t, which is mainly used in cement production. road construction, building construction, and chemical industry. For this project, the required 115,800 tons of limestone every year can be purchased locally, and then transported to the power plant by truck.

Supplier of fuel

1. Lucky commodities Traders
2. Al-Awan Trading company
3. Petro coal synergy Pvt.
4. General tech corporation
5. Sea trade group

SCHEDULE III

4. Emission values

Emission values

Particulate Matter (PM) Treatment Option

Particulate matter treatment technologies are Fabric Bag Filter (FBF), cyclones and wet scrubbers. For the proposed CFB boiler, Fabric Bag Filter (FBF) is the preferred alternative to control particulate matter emission in the flue gas. The exhaust hot flue gas from the boiler will carry the fine particle pass flows through the heat recovery area and then the fine particle will be captured by the FBF and transported to dry fly ash silos. The clean flue gas shall induce by induced draft fan and exhaust through chimney. The FBF has been selected to control PM emission since FBF can be applied to wide range of system sizes and should have no effect on combustion system performance. Besides that, FBF will enable the proposed project to meet the Pakistan NEQS emission standard.

SO2 Treatment Option

Several techniques are used to reduce SO2 emissions from coal combustion. Imported coal from Indonesia and South Africa will be used with less sulphur value to avoid the SO2 emissions. Flue gas desulfurization (FGD) systems are in current operation on several lignite-fired utility boilers. Post combustion FGD techniques can remove SO2 formed during combustion by using an alkaline reagent to absorb SO2 in the flue gas. Flue gases can be treated using wet, dry, or semi-dry desulfurization processes of either the throwaway type (in which all waste streams are discarded) or the recovery/regenerable type (in which the SO2 absorbent is regenerated and reused). Details on CFB technology and its efficiency for control of Sox emissions are described in Section 3.10.3. Based on the proposed design of CFB, SO2 emission will be controlled by wet type FGD, with limestone is selected as SOx emission treatment option, due to the high rate of removal, plus the system will yield a marketable by-product Gypsum.

NOx Treatment Option

NOx control technologies are mainly two categories: primary control technologies and secondary control technologies. Primary control technologies reduce the amount of NOx produced in the primary combustion zone. In contrast, secondary control technologies reduce the NOx present in the flue gas away from the primary combustion zone.

The standard practice of CFB Boilers, with low temperature and staged combustion, the oxidation of fuel nitrogen is suppressed resulting in very low NOx emissions. NOx emissions are <100 ppm with CFB.

TECHNOLOGY ALTERNATIVES CIRCULATING FLUIDIZED BED (CFB) BOILER

The proposed power plant will use circulating fluidized bed (CFB) technology boiler. The technology is described in Section 3.5.2 in detail. Below sections describe the CFB boiler technology's environmental and economic benefits:

Environmental Benefits of CFB Technology

The CFB combustion process facilitates steam generation firing a wide range of fuels while meeting the required emissions such as sulfur dioxide (SO2) and nitrogen oxides (NOx) even more effectively than World Bank guidelines. The major environmental benefit of selecting CFB technology is the removal of SO2 (90-95%) and NOx (emission is less than 100 ppm) in the combustion process. When the limestone is injected into the furnace, the following reactions occur.

Oxidation of sulfur: S+O2 --> SO2

Limestone is calcined to form calcium oxide CaCO3 --> CaO + CO2 -425 kcal/kg (of CaCO3) Sulfur dioxide gas reacts with solid CaO

SO2 + 1/2 O2 + CaO --> CaSO4 (Solid) +3740 kcal/kg (of S)

The resulting calcium-sulphate-based ashes are chemically stable and are easily disposed. This ash can be used as raw material for cement manufacturing, soil stabilization, concrete blocks, road base, structural fills, etc. Limestone injection is required for fuels with sulfur greater than >0.5%. Lime (CaO) and unburned carbon content must be considered in re-use applications, depending on the fuel being fired. NOx present in flue gas generally comes from two sources: the oxidation of nitrogen compounds in the fuel (fuel NOx) and reaction between the nitrogen and oxygen in the combustion air (thermal NOx). With low temperature and staged combustion, the oxidation of fuel nitrogen is suppressed resulting in very low NOx emissions. NOx emissions are <100 ppm with CFB. CO and hydrocarbon emissions in the CFB boiler are well controlled.

Economics of CFB Technology

CFB boiler has 8-15 percent lower capital costs as well as 5-10% lower operating costs than a pulverized coal (PC)-fired boiler because of the FGD system. In general, CFB-based power plants provide low emissions control costs and low O&M costs, which lead to lower life cycle costs. Since maintenance areas are very minimal in the CFB boiler, the availability of the boiler is relatively higher. The CFB design allows emissions reduction without significant capital cost, since SO2 and NOx removal are inherent within the combustion process.

Conclusion

Even though a number of competing technologies are available in the market for steam and electric power generation, CFB is an excellent choice due to its fuel flexibility, wider turndown without support oil/gas, superior environmental performance, lower operating and maintenance costs, and safe, reliable and simple boiler operation.

SCHEDULE III

5. Cooling water source: tube wells, sea/river/canal, distance from source, etc.

Cooling Water Sources

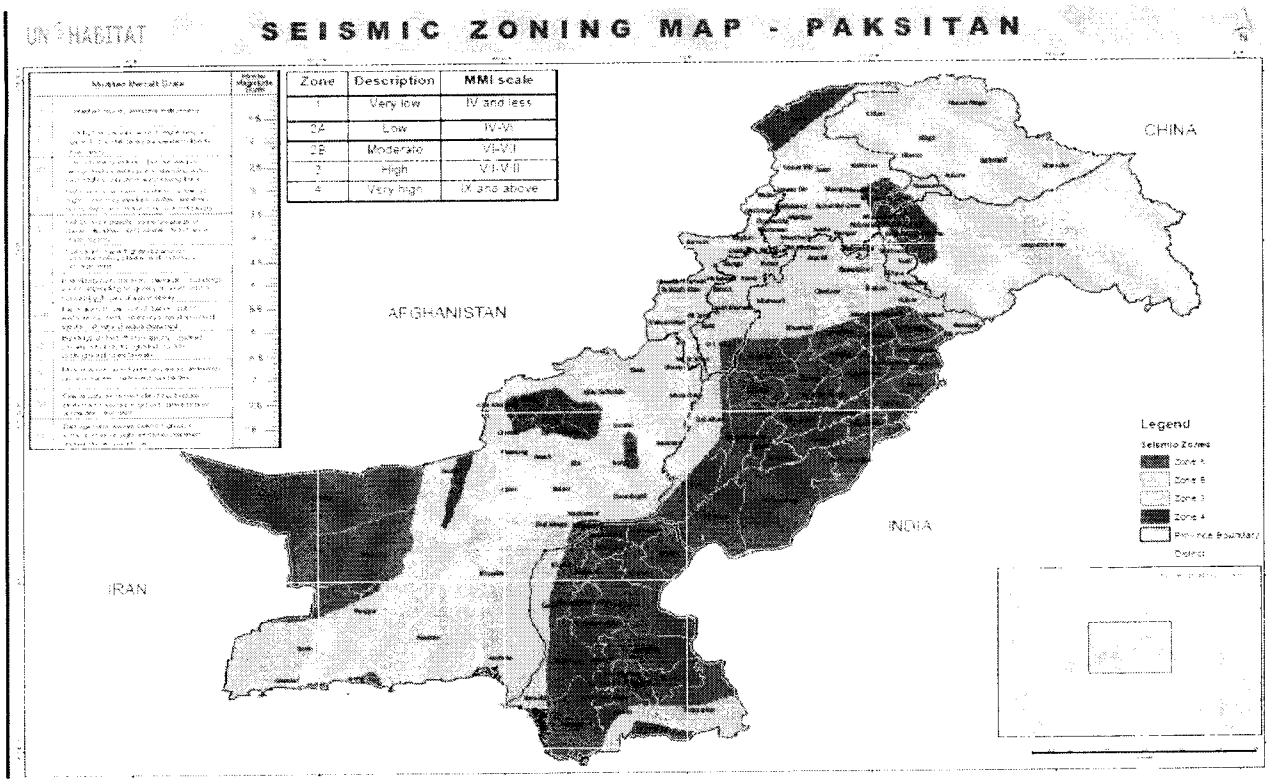
Surface waters resources are usually exposed to the surface of earth in the form of mobile and immobile situation which includes snow-clad mountains, rivers, on-river streams, rain, sleet, wetlands and oceans.

Among surface waters, district & near the project extremities there is a distributory canal (Rakh Branch) which is used for the irrigation purpose and etc.

The groundwater table in the project area normally exists 40 to 50 ft below the ground level and contains high level of salinity.

Water Source

The project area lies in the district of Faisalabad; the groundwater table normally exists 40 to 50 ft below the ground level and contains high level of salinity. Deep well water from a borehole of 505 ft depth will be used for project purposes by means of a water turbine.



SCHEDULE III

6. Interconnection with National Grid Co. distance and name of nearest grid, voltage level (single line diagram)

Since we are not using National Grid so this clause is not applicable.

SCHEDULE III

7. Infrastructure: roads, rail, staff colony, amenities

Information Regarding Infrastructure:

The information regarding infrastructure of the project is as follow:

Infrastructure of staff colony

The project`s living facilities include China sub-contractor bachelor hostel. Living area is located in the northeast of the factory area, covers an area of 8000 square meters. China bachelor hostel can accommodate 100 people.

Infrastructure of road

The length of the road which is designed in the plant is about 2000 meters. There are two main roads into the plant, one is located in the north side of the plant, and the other road is located in the east of the plant.

Infrastructure of construction

Production facilities mainly include equipments repository, staff office, and construction crane etc. Total area of the plant is 81676 square meter. According to the construction requirements, 20t and 40t capacity gantry cranes, tower cranes and batching units are required in the plant.

Infrastructure of construction and lives water

Construction and lives water will be provided by Deep Well Water Turbine (DWT) installed by KSB. The discharge of water turbine have pipeline of DN200 to supply water to living and office area and for subcontractor construction. The estimated daily consumption quantum is around 200m3/hr. The sewage water will be discharged after treatment.

Infrastructure of construction and Lives electricity

The project site team is contacting with FESCO to provide electricity connection point with capacity of 1250A, 11kV grade. We will construct a 11kV substation at site and hooked it up with 400V system through existing 132 kV substation facility for distribution of 400v at SCIL caustic plants. We proposed to set up 10 low voltage breakers, 11kv grade at site and distributed at SCIL, M4, BMR and chimney area , lives and office area respectively.

In the meanwhile, we also consider SCIL existing power plant and FESCO for the standby use. At present we have 132kV grid station available in SCIL permission with 03 feeders. We will also connect the 132 kV substations to site by using 11kV lines in order to give supply to SCIL caustic plants.

SCHEDULE III

8. Project cost, information regarding sources and amounts of equity, debt.

Project cost information regarding sources and amounts of equity, debt

		Rs in millions
Estimated project Cost		3.100
Source of Finance		
Syndicated Diminishing Musharaka Facility	66.67%	2,000
Equity (Own Sources)	36.67%	1,100

SCHEDULE III

9. Project commencement and completion schedule with milestones

SCHEDULE SITARA 30 MWe (Net) Coal Fired Power Plant	**698 days**	**1-Feb-14**	**30-Dec-15**
PROJECT MILESTONE	**685 days**	**7-Feb-14**	**24-Dec-15**
Sign Design and consultation Contract	0 days	7-Feb-14	7-Feb-14
Kick Off Meeting close	0 days	20-Mar-14	20-Mar-14
Actual Earth Work at Access Road Start	0 days	20-Apr-14	20-Apr-14
Complete Plot Plan	0 days	21-Oct-14	21-Oct-14
1st Pouring Concrete Foundation (Plant Area)	0 days	30-Oct-14	30-Oct-14
1st Steel Structure erection (Boiler)	0 days	29-Mar-15	29-Mar-15
Chimney to Top Completed	0 days	19-Apr-15	19-Apr-15
Steam Turbine Start Installation	0 days	15-Aug-15	15-Aug-15
Turbine and Coal bunker Building Roof Finished	0 days	28-Apr-15	28-Apr-15
Steam Drum Hoisting finished	0 days	20-Jul-15	20-Jul-15
Steam Turbine capping	0 days	15-Nov-15	15-Nov-15
Hydraulic Test Of Boiler	0 days	20-Sep-15	20-Sep-15
Unit Start Up and Test	0 days	24-Dec-15	24-Dec-15
Requisition main Sub Contracting	**277 days**	**10-Feb-14**	**13-Nov-14**
Requisition for Tophography & Bathimetry Work	2 days	10-Feb-14	11-Feb-14
Re[redacted]tion for detail Soil Investigation Work	7 days	31-May-14	6-Jun-14
Site Clearing and Earth Work	20 days	20-Mar-14	8-Apr-14
Boiler turbine and generator	60 days	10-Jun-14	8-Aug-14
Civil Work construction package	30 days	15-Jul-14	13-Aug-14
Mechanical / Electrical Installation package	30 days	15-Oct-14	13-Nov-14
Chimney Work	10 days	1-Sep-14	10-Sep-14
Engineering	**585 days**	**10-Feb-14**	**17-Sep-15**
Basic design	**261 days**	**10-Feb-14**	**28-Oct-14**
General/Configuration design Complete	20 days	10-Feb-14	1-Mar-14
General/Configuration design Reviewd & Revised	30 days	2-Mar-14	31-Mar-14
Basic design Complete	60 days	20-Aug-14	18-Oct-14
Basic design Reviewd & Revised	20 days	9-Oct-14	28-Oct-14
Detail design preparation	**162 days**	**8-Oct-14**	**18-Mar-15**
Enginner submission of Technical Specification of other equipments.	60 days	8-Oct-14	6-Dec-14
Sitara complete submission of Design basic data of the project for detail des	7 days	10-Oct-14	16-Oct-14
Si[redacted]omplete submission of detail Soil investigation report	7 days	10-Oct-14	16-Oct-14
E[redacted]ment venders complete submission of Equipment data of the projec	**150 days**	**20-Oct-14**	**18-Mar-15**
Detail design	**346 days**	**7-Oct-14**	**17-Sep-15**
Mechanical drawings	**193 days**	**8-Oct-14**	**18-Apr-15**
Power island(ST building) auxiliary equipment installation drawings	**120 days**	**23-Nov-14**	**22-Mar-15**
Main steam pipeline drawings	90 days	28-Nov-14	25-Feb-15
Steam Tutbine building piping drawings(first batch,main feed pipeline, stear	100 days	30-Oct-14	6-Feb-15
Circulating Water System Pipeline	90 days	6-Nov-14	3-Feb-15
Water Treatment System Pipeline	80 days	6-Nov-14	24-Jan-15
Desalination System Pipeline	90 days	15-Nov-14	12-Feb-15
Compressed Air System Pipeline	45 days	10-Dec-14	23-Jan-15
Ignition Oil System Pipeline	60 days	10-Dec-14	7-Feb-15
Steam Tutbine building piping drawings(second batch,compressed air syster	150 days	8-Oct-14	6-Mar-15
Air duct and flue duct drawings	90 days	15-Oct-14	12-Jan-15

Power island(Boiler area) auxiliary equipment installation drawings	90 days	15-Nov-14	12-Feb-15
Coal handling system mechanical drawings	60 days	15-Dec-14	12-Feb-15
Other Mechanical drawings	150 days	20-Nov-14	18-Apr-15
Electrical drawings	182 days	30-Oct-14	29-Apr-15
Lightning & grounding drawings	110 days	30-Oct-14	16-Feb-15
Generator associcated electrical drawings	90 days	10-Nov-14	7-Feb-15
Transformer drawings	90 days	30-Nov-14	27-Feb-15
11kV electrical drawings	120 days	15-Nov-14	14-Mar-15
415V electrical drawings	120 days	30-Nov-14	29-Mar-15
Electrical cable drawings	90 days	30-Jan-15	29-Apr-15
Other electrical drawings completed(including cable for protection)	120 days	30-Dec-14	28-Apr-15
I&C drawings	131 days	30-Dec-14	9-May-15
DCS drawings completed	130 days	30-Dec-14	8-May-15
I&C drawings completed	100 days	30-Jan-15	9-May-15
Civil Engineering	**346 days**	**7-Oct-14**	**17-Sep-15**
Earth works engineering	90 days	7-Oct-14	4-Jan-15
STEAM TURBINE BUILDING & AUXILIARIES	120 days	10-Nov-14	9-Mar-15
BO[redacted] HOUSE AND AUXILIARIES	90 days	26-Oct-14	23-Jan-15
STACK	60 days	21-Nov-14	19-Jan-15
COOLING WATERWAYS FACILITIES	90 days	26-Jan-15	25-Apr-15
COAL HANDLING FACILITIES	110 days	3-Feb-15	23-May-15
ASH HANDLING FACILITIES	90 days	28-Feb-15	28-May-15
BOP FACILITIES BUILDINGS	120 days	1-Apr-15	29-Jul-15
ADMINISTRATION BUILDING	90 days	21-Dec-14	20-Mar-15
ELECTRICAL BUILDING & AUXILIARIES	90 days	28-Feb-15	28-May-15
OTHER CIVIL STRUCTURES AND FOUNDATIONS	120 days	21-May-15	17-Sep-15
Procurement	**631 days**	**1-Feb-14**	**24-Oct-15**
Detail Engineering	7 days	1-Feb-14	7-Feb-14
Bidding Process - PO	7 days	1-Feb-14	7-Feb-14
Civil Work	594 days	10-Mar-14	24-Oct-15
Sub Contracting	279 days	10-Mar-14	13-Dec-14
Topography & Bathimetry	30 days	10-Mar-14	8-Apr-14
Bidding Process - PO	30 days	10-Mar-14	8-Apr-14
Soil Investigation	30 days	20-Sep-14	19-Oct-14
Bidding Process - PO	30 days	20-Sep-14	19-Oct-14
Temporary Facility	45 days	3-Jun-14	17-Jul-14
Bidding Process - PO	45 days	3-Jun-14	17-Jul-14
Earth Work for Access Road	45 days	20-Apr-14	3-Jun-14
Bidding Process - PO	45 days	20-Apr-14	3-Jun-14
Civil Work for Access Road (include Concrete and Wiremesh Supply)	45 days	20-Apr-14	3-Jun-14
Bidding Process - PO	45 days	20-Apr-14	3-Jun-14
Site Clearing & Earth Work for Plant	25 days	10-Aug-14	3-Sep-14
Bidding Process - PO	25 days	10-Aug-14	3-Sep-14
Chimney Work	56 days	19-Oct-14	13-Dec-14
Bidding Process - PO	56 days	19-Oct-14	13-Dec-14
Steel Structure Erector	45 days	20-Oct-14	3-Dec-14

Bidding Process - PO	45 days	20-Oct-14	3-Dec-14
Civil work Building foundation Work	45 days	15-Sep-14	29-Oct-14
Bidding Process - PO	45 days	15-Sep-14	29-Oct-14
Material	**494 days**	**18-Jun-14**	**24-Oct-15**
Concrete Material (Batching Plant and the access road outside the plant)	35 days	18-Jun-14	22-Jul-14
Bidding Process - PO	30 days	18-Jun-14	17-Jul-14
#1 Material Delivery to Site (batching plant)	20 days	3-Jul-14	22-Jul-14
Concrete Material (Ready Mix) for plant civil work (include for the plant Ro	400 days	20-Sep-14	24-Oct-15
Bidding Process - PO	30 days	20-Sep-14	19-Oct-14
#1 Material Delivery to Site	360 days	30-Oct-14	24-Oct-15
Sewer Drainage Material	127 days	10-Feb-15	16-Jun-15
Bidding Process - PO	45 days	10-Feb-15	26-Mar-15
#1 Material Delivery to Site (Plant Road)	120 days	17-Feb-15	16-Jun-15
Perimeter Wall Concrete Material & Install	30 days	1-Dec-14	30-Dec-14
Bidding Process - PO	30 days	1-Dec-14	30-Dec-14
#1 Material Delivery to Site	14 days	8-Dec-14	21-Dec-14
Iron Fencing Material	30 days	15-Feb-15	16-Mar-15
Bid[redacted] Process - PO	30 days	15-Feb-15	16-Mar-15
#1 Material Delivery to Site	14 days	22-Feb-15	7-Mar-15
Metal Roofing Siding Material	134 days	1-Feb-15	14-Jun-15
Bidding Process - PO	45 days	1-Feb-15	17-Mar-15
#1 Material Delivery to Site	120 days	15-Feb-15	14-Jun-15
Insulation Material	45 days	25-Feb-15	10-Apr-15
Bidding Process - PO	45 days	25-Feb-15	10-Apr-15
#1 Material Delivery to Site (Chimney)	14 days	12-Mar-15	25-Mar-15
Steel Door Material	104 days	15-Mar-15	26-Jun-15
Bidding Process	30 days	15-Mar-15	13-Apr-15
#1 Material Delivery to Site	90 days	29-Mar-15	26-Jun-15
Rebar Material	45 days	1-Mar-15	14-Apr-15
Bid Process	45 days	1-Mar-15	14-Apr-15
#1 Material Delivery to Site	14 days	15-Mar-15	28-Mar-15
Alumunium Door & Window	104 days	15-Mar-15	26-Jun-15
Bidding Process	45 days	15-Mar-15	28-Apr-15
#1 Material Delivery to Site	90 days	29-Mar-15	26-Jun-15
Ceiling Material	75 days	30-Mar-15	12-Jun-15
Bidding Process - PO	45 days	30-Mar-15	13-May-15
#1 Material Delivery to Site	60 days	14-Apr-15	12-Jun-15
Anchor Bolt Material	104 days	13-Feb-15	27-May-15
Bidding Process - PO	15 days	13-Feb-15	27-Feb-15
#1 Material Delivery to Site	90 days	27-Feb-15	27-May-15
Grouting Material for Steel Structure	187 days	15-Oct-14	19-Apr-15
Bidding Process - PO	30 days	15-Oct-14	13-Nov-14
#1 Material Delivery to Site	180 days	22-Oct-14	19-Apr-15
Mechanical Work	**376 day**	**20-Jul-14**	**30-Jul-15**
Turbine Hall	**376 days**	**20-Jul-14**	**30-Jul-15**
Bridge Crane of Main Power House	137 days	21-Nov-14	6-Apr-15

Bidding Process - PO	10 days	21-Nov-14	30-Nov-14
Manufacture	120 days	1-Dec-14	30-Mar-15
Bridge Crane of Main Power House Delivery FOB	7 days	31-Mar-15	6-Apr-15
Steam Turbine Main Equipment	376 days	20-Jul-14	30-Jul-15
Bidding Process - PO	20 days	20-Jul-14	8-Aug-14
Steam Turbine Main Equipment manufacture	300 days	20-Aug-14	15-Jun-15
Steam Turbine Main Equipment Delivery (CFR Karachi)	45 days	16-Jun-15	30-Jul-15
Generator	276 days	20-Jul-14	21-Apr-15
Bidding Process - PO	20 days	20-Jul-14	8-Aug-14
Steam Turbine Main Equipment manufacture	240 days	20-Aug-14	16-Apr-15
Generator Manufacture & Delivery FOB	5 days	17-Apr-15	21-Apr-15
Deaerator and Water Tank	135 days	20-Nov-14	3-Apr-15
Bidding Process - PO	15 days	20-Nov-14	4-Dec-14
Deaerator and Water Tank Manufacture & Delivery FOB	120 days	5-Dec-14	3-Apr-15
Electric Feed Pump	162 days	10-Nov-14	20-Apr-15
Bidding Process - PO	12 days	10-Nov-14	21-Nov-14
Electric Feed Pump Manufacture & Delivery FOB	150 days	22-Nov-14	20-Apr-15
Bo[redacted] House	**368 days**	**20-Jul-14**	**22-Jul-15**
Boiler	**271 days**	**20-Jul-14**	**16-Apr-15**
Bidding - PO	20 days	20-Jul-14	8-Aug-14
Unit steal structure Manufacture	140 days	20-Aug-14	6-Jan-15
Unit steal structure Delivery FOB	10 days	7-Jan-15	16-Jan-15
Boiler steam drum Manufacture	195 days	20-Aug-14	2-Mar-15
Boiler steam drum Delivery FOB	15 days	3-Mar-15	17-Mar-15
Unit all other parts Manufacture	225 days	20-Aug-14	1-Apr-15
Unit others Delivery FOB	15 days	2-Apr-15	16-Apr-15
Fan facilities	142 days	25-Nov-14	15-Apr-15
Bidding Process - PO	15 days	25-Nov-14	9-Dec-14
Manufacture	120 days	10-Dec-14	8-Apr-15
Delivery FOB	7 days	9-Apr-15	15-Apr-15
Bag Filter	145 days	30-Oct-14	23-Mar-15
Bidding Process - PO	15 days	30-Oct-14	13-Nov-14
Ma[redacted]cture	120 days	14-Nov-14	13-Mar-15
Deliv[redacted]y FOB	10 days	14-Mar-15	23-Mar-15
All the refractorily and heat insulating material	225 days	10-Dec-14	22-Jul-15
Bidding Process - PO	15 days	10-Dec-14	24-Dec-14
Delivery FOB	120 days	25-Mar-15	22-Jul-15
Auxiliary Equipment	250 days	29-Oct-14	5-Jul-15
Coal Feeding System	135 days	21-Dec-14	4-May-15
Bidding Process - PO	15 days	21-Dec-14	4-Jan-15
Coal Feeding System Delivery FOB	120 days	5-Jan-15	4-May-15
Compressed Air System	177 days	15-Dec-14	9-Jun-15
Bidding Process - PO	15 days	15-Dec-14	29-Dec-14
Compressed Air System Delivery FOB	120 days	10-Feb-15	9-Jun-15
Fuel Oil System	145 days	13-Nov-14	6-Apr-15
Bidding Process - PO	15 days	13-Nov-14	27-Nov-14

Fuel Oil System Delivery FOB	130 days	28-Nov-14	6-Apr-15
Ash Removal System	135 days	21-Nov-14	4-Apr-15
Bidding Process - PO	15 days	21-Nov-14	5-Dec-14
Ash Removal System Delivery FOB	120 days	6-Dec-14	4-Apr-15
Water Treatment System	165 days	8-Nov-14	21-Apr-15
Bidding Process - PO	15 days	8-Nov-14	22-Nov-14
Water Treatment System Delivery FOB	150 days	23-Nov-14	21-Apr-15
Main Cooling Water System	177 days	29-Oct-14	23-Apr-15
Bidding Process - PO	15 days	29-Oct-14	12-Nov-14
Main Cooling Water System Delivery FOB	140 days	5-Dec-14	23-Apr-15
Waste water device	135 days	10-Dec-14	23-Apr-15
Bidding Process - PO	15 days	10-Dec-14	24-Dec-14
Waste water System Delivery FOB	120 days	25-Dec-14	23-Apr-15
Coal handling System	183 days	8-Nov-14	9-May-15
Bidding Process - PO	10 days	8-Nov-14	17-Nov-14
Coal Jetty System Delivery FOB	120 days	10-Jan-15	9-May-15
Fire Fighting Equipment	135 days	21-Feb-15	5-Jul-15
Bid[redacted]g Process - PO	15 days	21-Feb-15	7-Mar-15
Fire Fighting Equipment Delivery FOB	120 days	8-Mar-15	5-Jul-15
Brack making plant	226 days	15-Nov-14	28-Jun-15
Bidding Process - PO	15 days	15-Nov-14	29-Nov-14
Brake making Equipment Delivery FOB	150 days	30-Jan-15	28-Jun-15
Flue Gas Gesulfurization(FGD) unit	210 days	25-Nov-14	22-Jun-15
Bidding Process - PO	15 days	25-Nov-14	9-Dec-14
Manufacture	180 days	10-Dec-14	7-Jun-15
Delivery FOB	15 days	8-Jun-15	22-Jun-15
Limestone handling plant	192 days	30-Nov-14	9-Jun-15
Bidding Process - PO	15 days	30-Nov-14	14-Dec-14
Limestone handling Equipment Delivery FOB	120 days	10-Feb-15	9-Jun-15
Pipeline and Valves	156 days	28-Jan-15	2-Jul-15
First Bidding Process - PO	25 days	28-Jan-15	21-Feb-15
First batch delivery FOB	90 days	22-Feb-15	22-May-15
Seco[redacted] Bidding Process - PO	25 days	9-Apr-15	3-May-15
Seco[redacted] batch delivery FOB	60 days	4-May-15	2-Jul-15
Electric	**262 day**	**29-Oct-14**	**17-Jul-15**
Electric Equipment	**214 days**	**29-Oct-14**	**30-May-15**
High and Low Voltage Switch Cabinet	**135 days**	**29-Oct-14**	**12-Mar-15**
Bidding Process - PO	15 days	29-Oct-14	12-Nov-14
High Voltage Switch Cabinet Delivery FOB	120 days	13-Nov-14	12-Mar-15
Low Voltage Transformer	135 days	29-Oct-14	12-Mar-15
Bidding Process - PO	15 days	29-Oct-14	12-Nov-14
Low Voltage Transformer Delivery FOB	120 days	13-Nov-14	12-Mar-15
DC System(110V 220V)	120 days	21-Nov-14	20-Mar-15
Bidding Process - PO	30 days	21-Nov-14	20-Dec-14
DC System(110V 220V) Delivery FOB	90 days	21-Dec-14	20-Mar-15
Electric Control and Protection System	170 days	21-Nov-14	9-May-15

Bidding Process - PO	20 days	21-Nov-14	10-Dec-14
Electric Control and Protection System Delivery FOB	150 days	11-Dec-14	9-May-15
CCTV	70 days	21-Jan-15	31-Mar-15
Bidding Process - PO	10 days	21-Jan-15	30-Jan-15
CCTV Delivery FOB	60 days	31-Jan-15	31-Mar-15
Lighting System	100 days	20-Feb-15	30-May-15
Bidding Process - PO	10 days	20-Feb-15	1-Mar-15
Lighting System Delivery FOB	90 days	2-Mar-15	30-May-15
Cable and Tray	90 days	31-Mar-15	28-Jun-15
Power Cable	90 days	31-Mar-15	28-Jun-15
Bidding Process - PO	15 days	31-Mar-15	14-Apr-15
Power Cable Delivery FOB	75 days	15-Apr-15	28-Jun-15
Control and Computer Cable	75 days	31-Mar-15	13-Jun-15
Bidding Process - PO	15 days	31-Mar-15	14-Apr-15
Control and Computer Cable Delivery FOB	60 days	15-Apr-15	13-Jun-15
Cable Tray	75 days	31-Mar-15	13-Jun-15
Bidding Process - PO	15 days	31-Mar-15	14-Apr-15
Ca[redacted]Tray Delivery to Site	60 days	15-Apr-15	13-Jun-15
I&C	184 days	15-Jan-15	17-Jul-15
DCS	120 days	15-Jan-15	14-May-15
Bidding Process - PO	20 days	15-Jan-15	3-Feb-15
DCS Delivery FOB	100 days	4-Feb-15	14-May-15
Instrument and apparatus	110 days	30-Mar-15	17-Jul-15
Bidding Process - PO	20 days	30-Mar-15	18-Apr-15
Instrument Delivery FOB	90 days	19-Apr-15	17-Jul-15
Construction	**628 day**	**12-Apr-14**	**30-Dec-15**
Civil Work	**554 days**	**12-Apr-14**	**17-Oct-15**
SITE INVESTIGATION	201 days	12-Apr-14	29-Oct-14
Topography & Bathimetry	30 days	12-Apr-14	11-May-14
Soil Investigation	30 days	30-Sep-14	29-Oct-14
SITE DEVELOPMENT	141 days	21-Jul-14	8-Dec-14
Site Preparation Acess Road	60 days	21-Jul-14	18-Sep-14
Tem[redacted]ary Facility	90 days	10-Sep-14	8-Dec-14
STEAM TURBINE BUILDING & AUXILIARIES	150 days	30-Nov-14	28-Apr-15
STEAM TURBINE BUILDING & AUXILIARIES construction	150 days	30-Nov-14	28-Apr-15
BOILER HOUSE AND AUXILIARIES	150 days	5-Nov-14	3-Apr-15
BOILER AND AUXILIARIES construction	150 days	5-Nov-14	3-Apr-15
STACK	120 days	21-Dec-14	19-Apr-15
STACK construction	120 days	21-Dec-14	19-Apr-15
COOLING WATERWAYS FACILITIES	120 days	25-Feb-15	24-Jun-15
COOLING WATERWAYS FACILITIES	120 days	25-Feb-15	24-Jun-15
COAL HANDLING FACILITIES	120 days	5-Mar-15	2-Jul-15
COAL HANDLING FACILITIES	120 days	5-Mar-15	2-Jul-15
ASH HANDLING FACILITIES	90 days	30-Mar-15	27-Jun-15
ASH HANDLING FACILITIES	90 days	30-Mar-15	27-Jun-15
FGD FACILITIES BUILDINGS and FOUNDATIONS	90 days	1-May-15	29-Jul-15

FGD FACILITIES BUILDINGS and FOUNDATIONS	90 days	1-May-15	29-Jul-15
LIMESTONE HANDLING FACILITIES BUILDINGS and FOUNDATIONS	100 days	22-Mar-15	29-Jun-15
LIMESTONE HANDLING FACILITIES BUILDINGS and FOUNDATIONS	100 days	22-Mar-15	29-Jun-15
ADMINISTRATION BUILDING	100 days	20-Jan-15	29-Apr-15
ADMINISTRATION BUILDING	100 days	20-Jan-15	29-Apr-15
BRACK MAKING PLANT FACILITIES & AUXILIARIES	150 days	30-Mar-15	26-Aug-15
BRACK MAKING PLANT FACILITIES & AUXILIARIES	150 days	30-Mar-15	26-Aug-15
OTHER CIVIL STRUCTURES AND FOUNDATIONS	120 days	20-Jun-15	17-Oct-15
OTHER CIVIL STRUCTURES AND FOUNDATIONS	120 days	20-Jun-15	17-Oct-15
Mechanical / Electrical Installation	**243 day**	**29-Mar-15**	**########**
Boiler System	**232 days**	**29-Mar-15**	**15-Nov-15**
Boiler Body	232 days	29-Mar-15	15-Nov-15
Boiler Steel Structure Body Platform Lift	120 days	29-Mar-15	26-Jul-15
Steam Drum	3 days	20-Jul-15	22-Jul-15
Air Preheater	10 days	20-Jul-15	29-Jul-15
Economizer	10 days	1-Aug-15	10-Aug-15
Superheater	30 days	15-Aug-15	13-Sep-15
Water Wall	60 days	30-Jul-15	27-Sep-15
Cyclone Separator	15 days	12-Jul-15	26-Jul-15
Body Pipeline	30 days	30-Aug-15	28-Sep-15
Body Metal Structure	30 days	30-Aug-15	28-Sep-15
Hydraulic Test of Boiler	2 days	20-Sep-15	21-Sep-15
Insulation work,wear resistant material pouring&masonry	40 days	20-Sep-15	29-Oct-15
Acid Cleaning	7 days	24-Sep-15	30-Sep-15
Ignition, Furnace Drying, Steam Line	10 days	6-Nov-15	15-Nov-15
Air Fan	40 days	31-Jul-15	8-Sep-15
Primary & Secondary Air Fan	30 days	31-Jul-15	29-Aug-15
Induced Draft Fan	40 days	31-Jul-15	8-Sep-15
Bag Filter	80 days	8-Jul-15	25-Sep-15
Body	60 days	8-Jul-15	5-Sep-15
Heat insulation work	20 days	6-Sep-15	25-Sep-15
Air and flue gas duct	40 days	30-Aug-15	8-Oct-15
Air duct	30 days	30-Aug-15	28-Sep-15
Flue gas duct	30 days	9-Sep-15	8-Oct-15
Turbine erection	**160 days**	**20-Jun-15**	**26-Nov-15**
Lifting and erection of turbine house crane	40 days	20-Jun-15	29-Jul-15
Complete Steam Turbine Generator with Auxilliary Equipment	90 days	15-Aug-15	12-Nov-15
Turbine total debugging	7 days	20-Nov-15	26-Nov-15
Auxiliary erection	**173 days**	**6-Jun-15**	**25-Nov-15**
Deaerator erection	25 days	1-Aug-15	25-Aug-15
Feed up water pump erection	30 days	20-Aug-15	18-Sep-15
Sampling and blowdown system erection	25 days	15-Aug-15	8-Sep-15
Coal handling system erection	70 days	3-Jul-15	10-Sep-15
Water treatment equipment erection	50 days	6-Jun-15	25-Jul-15
Circulating water device, piping erection	60 days	30-Jun-15	28-Aug-15
Ash handling system	30 days	13-Sep-15	12-Oct-15

Brack making system erection	90 days	28-Aug-15	25-Nov-15
FGD Plant erection	90 days	7-Aug-15	4-Nov-15
Limestone handling plant erection	90 days	15-Aug-15	12-Nov-15
Air compressed system erection	30 days	13-Aug-15	11-Sep-15
Fire-fighting system erection	45 days	20-Sep-15	3-Nov-15
Waste water treatment system erection	30 days	30-Sep-15	29-Oct-15
Other miscellaneous erection	120 days	10-Jul-15	6-Nov-15
Electrical installation, thermal control installation	**170 days**	**10-Jun-15**	**26-Nov-15**
HV & LV board Installation	60 days	19-Jun-15	17-Aug-15
Transformer installation	45 days	10-Jun-15	24-Jul-15
Cable laydown and support installation	90 days	11-Aug-15	8-Nov-15
Control room, panel board, site device	60 days	20-Jul-15	17-Sep-15
Device connection	30 days	11-Sep-15	10-Oct-15
Back power transmission	7 days	11-Oct-15	17-Oct-15
Electric device test&debugging	20 days	18-Oct-15	6-Nov-15
Instrument measuring point installation	90 days	15-Jul-15	12-Oct-15
DCS device installation	60 days	30-Jul-15	27-Sep-15
Co[redacted]l cable lay down, connection	90 days	5-Aug-15	2-Nov-15
DCS system debugging	15 days	12-Nov-15	26-Nov-15
Commissioning	29 days	2-Dec-15	30-Dec-15
Boiler, turbine, electric, thermal control system combination debugging	15 days	2-Dec-15	16-Dec-15
BTG total start generating power, 72 hours run-in	7 days	24-Dec-15	30-Dec-15

SCHEDULE III

10. ESSA (Environmental and Social Soundness Assessment)

ENVIRONMENT PROTECTION DEPARTMENT

Government of the Punjab
National Hocky Stadium, Lahore.

NO. DD (EIA)/EPA/F-604(IEE)/1301/2014/683
Dated: 09 /06/ 2015

To

Mr. Haseeb Ahmed,
Proponent,
M/s Sitara Chemical Industries Ltd (Coal Power Plant),
P.O. Box No. 442,
Faisalabad.

Subject: **DECISION OF EPA PUNJAB FOR THE INSTALLATION OF M/S SITARA CHEMICAL INDUSTRIES (INSTALLATION OF 35-MW COAL FIRED POWER PLANT) LOCATED AT 32-KM FAISALABAD-SHEIKHUPURA ROAD, TEHSIL & DISTRICT FAISALABAD**
(Under Section 12 of PEPA, 1997 (Amended 2012) read with IEE/EIA Regulations, 2000)

1.	Description of Project:	Installation of 35-MW Coal Fired Power Plant, over an area of 15-Acre.
2.	Location of Project:	The project site is located at 32-Km Faisalabad-Sheikhupura Road, Tehsil & District Faisalabad.
3.	Date of Receiving	16.07.2014

4. After review of the IEE Report, Site Inspection Report by DOE and other relevant record, the Environmental Protection Agency, Punjab accords approval for the construction phase of the Project subject to the following conditions:

(i) The proponent shall ensure compliance of National Environmental Quality Standards (NEQS) by installing wet scrubbers in compatible with NEQS.
(ii) Mitigation measures suggested in the IEE Report and Environmental Management & Monitoring Plan (EMMP) shall be strictly adhered to minimize any negative impacts on soil, ground water, air and biological resources of the project area. The proponent shall depute staff to monitor compliance of EMMP.
(iii) Monitoring shall be carried out during the entire period of the project activities. Monitoring reports of the whole operation shall be submitted to EPA, Punjab on monthly basis.
(iv) The proponent shall install pollution abatement equipment / treatment plant i.e wet scrubber / Electrostatic Precipitator / cyclone / fabric filters etc. in compatible with NEQS.
(v) The proponent shall ensure compliance of Minamata Convention ratified by Pakistan in October, 2013.
(vi) The proponent shall install waste water treatment facility and shall dispose of wastewater after proper treatment in conformity with the NEQS.
(vii) Arrangements shall be made for safe disposal of solid and hazardous waste. The solid waste shall be retained within the unit boundary / premises and shall be disposed off in an environment friendly way at a suitable disposal facility.
(viii) The proponent shall ensure that strict and efficient health and safety measures are in place for protection of workers backed by a comprehensive emergency response system while working on super structure.
(ix) The proponent shall provide proper firefighting arrangements in the factory.
(x) The proponent shall take measures for proper storage of fuel.
(xi) At least 90% unskilled and to the extent possible skilled jobs shall be given to locals after providing them proper training.

P.T.O

(xii) The proponent shall dispose of sludge ask in a proper scientific way after considering its Environmental Impacts separately by preparing its Environmental Impact Assessment Report.

(xiii) The proponent shall obtain NOCs of other concerned departments.

(xiv) Compensation shall be provided to inhabitants in case of loss of property, shops, business etc. in accordance with the rates that are agreed upon. All conflicting issued regarding compensation, etc. should be settled amicable before or during the project activities.

(xv) The proponent shall plant at least 15000 trees of minimum height 6-7 feet especially of indigenous species in and around the project area on available space in consultation with District Officer (Environment) within six months.

(xvi) The proponent shall appoint an Environmental Manager and shall convey the name of the Environmental Manager (having at least qualification of MS Environmental Sciences along with his complete Mailing Address and Phone Numbers).

(xvii) The proponent shall take effective measures for safe transportation of Fuel.

(xviii) The proponent shall install on line Air Pollution Monitoring Analyzers for major pollutions like particulate matter CO, SO_2, NO_x, HC and Mercury.

5. The proponent shall be liable for correctness and validity of information supplied to this department by the consultant.

7. The proponent shall be liable for compliance of Regulations 13, 14, 17 and 18 of IEE/EIA Regulations, 2000, regarding approval, confirmation of compliance, entry, inspections and monitoring.

9. This approval is accorded only for the construction phase of the project. The proponent shall obtain approval for operational phase of the project in accordance with Regulation 13(2) (b) and Regulation18 of the IEE/EIA Regulations, 2000.

9. Any change in the approved project shall be communicated to EPA, Punjab and shall be commenced after obtaining the approval.

10. This approval shall be treated as null and void if all or any of the conditions mentioned above is/are not complied with. This approval does not absolve the proponent of the duty to obtain any other approval or consent that may be required under any law in force and is subjudice to legal proceedings in any legal for a / court.

11. This approval shall be valid (for commencement of construction) for a period of three years from the date of issue under Regulation16 of IEE / EIA Regulations, 2000.

(AMEN HANIF)
ASSISTANT DIRECTOR (EIA)
for Director General, EPA, Punjab
Ph: # 042-99232228

NO. & DATE EVEN.

A copy is forwarded for information to:

1. The Director (North), EPA, Punjab, Lahore.
2. The District Officer (Environment), Faisalabad w.r.t his letter No. 51/DOE/EPA/FSD dated 19.09.2014. He is requested to ensure compliance of the above mentioned conditions / measures under intimation to this office.

(AMEN HANIF)
ASSISTANT DIRECTOR (EIA)
for Director General, EPA, Punjab

Initial Environmental Examination (IEE)

35MW COAL FIRED POWER PLANT

At Sitara Chemical Industries Limited (SCIL), Faisalabad

SITARA CHEMICAL INDUSTRIES LIMITED (SCIL)
FAISALABAD

(Draft Report)
March, 2014

Prepared By

SGS PAKISTAN (PRIVATE) LIMITED

SGS

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Annex –E: Air Dispersion Modeling Report

Acronyms

APHA	American Public Health Association
BHU	Basic Health Unit
BOD	Biological Oxygen Demand
CBD	Convention on Biological Diversity
CFCs	Chlorofluorocarbons
COD	Chemical Oxygen Demand
CMS	Conservation of Migratory Species of Wild Animals
CBD	Convention on Biological Diversity
COD	Chemical Oxygen Demand
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPAs	Environmental Protection Agencies
FGDs	Flue gas Desulfurization Units
GHG	Green House Gases
HSE	Health, Safety and Environment
HCFC	Hydrochlorofluorocarbons
hr	Hour
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IUCN	International Union of Conservation for Nature
kg	Kilogram
Km^2	Square Kilometre
KV	Kilovolt
MW	Mega Watt
m	Meter

million cu m	Million Cubic Meter
mg/kg	Milligram per Kilogram
mg/l	Milligram per Litre
mg/m^3	Milligram per Cubic Meter
mcf/d	Million cubic feet per day
NEP	National Environmental Policy
NEQS	National Environmental Quality Standards
NOX	Nitrogen Oxides
NCS	National Conservation Strategy
NGO's	Non Governmental Organizations
OSHA	Occupational Safety and Health Administration of the United States
PEPA	Pakistan Environmental Protection Act 1997
PEPC	Pakistan Environmental Protection Council
PRCS	Pakistan Red Crescent Society
PM	Particulate Matter
PPE's	Personal Protective Equipment
ppm	Parts per Million
SOx	Oxides of Sulphur
sq km	Square Kilometer
SCIL	Sitara Chemical Industries Limited
TOC	Total Organic Carbon
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
UC's	Union Councils
UNCED	United Nation Conference on Environment and Development
UNFCCC	United Nation Framework Convention on Climate Change

USEPA	Unites States Environmental Protection Agency
WHO	World Health Organization
WAPDA	Water and Power Development Authority

1 Introduction

This chapter presents the data relevant to the undertaking of the Initial Environmental Examination (IEE) carried out by SGS Pakistan (Pvt) Limited for the Installation of 35MW Coal Fired Power Plant (CFPP) and details of the project title and project proponent, IEE consultants, the project rationale and the approach taken to the IEE study.

1.1 Project Title and Project Proponents

1.1.1 Project Title

The proposed project to which this Initial Environmental Examination (IEE) relates is entitled as *"Installation of 35MW Coal Fired Power Plant (CFPP) at Faisalabad"*. Imported and local coal would be utilized as fuel for the generation of power from steam turbines. A key map showing the location of the project area is shown in **Figure 1.1.** The proposed project would be installed in close proximity of existing Sitara Chemicals Industries Ltd (SCIL) at 32km Faisalabad -Shiekhupura road. The total area occupied by the proposed project would be 16 acres of land.

1.1.2 Project Proponent

The proponent for the proposed installation of 35MW coal fired power plant is "Sitara Chemical Industries Ltd (SCIL)". The project proponent refers to the organization which will invest and be responsible for the project initiation and safe operation.

Sitara Chemical Industries Ltd (SCIL), a unit of Sitara group founded by Haji Abdul Ghafoor (late) and Haji Bashir Ahmed, was established in 1981. SCIL began producing caustic soda in 1985, initially at a rate of 30 metric tons per day. The plant's production capacity was gradually increased over the years to current level of 610 metric tons per day. In addition, various by-product facilities have been added and expanded from time to time to cope with growing demand. SCIL produces caustic soda, liquid chlorine and allied products at a chemical complex.

Textile Division established in 1990 and its spinning unit of Sitara Group is engaged in the production of top quality Polyester / Cotton (PC) and Polyester / Viscose (PV) having daily production capacity of 22080 spindles (45,000 Lbs Approx.). Agri Division starts commercial operations in 2003. Gases Division Sitara Chemicals is the largest chlor alkali complex on national basis. Besides manufacturing Caustic Soda and various allied chemicals, the company has been able to set up independent plants of some more gases i.e. 1: Oxygen (O_2), 2: Nitrogen (N_2), 3: Carbon Dioxide (CO_2), 4: Nitrous Oxide (N_2O) in the same premises, during last one and half year. Specialty Division's aim is to be the leading service-driven company in the specialty chemicals industry, for national and international markets. SCIL commitment is to contribute to the success of its customers, to combine technology and innovations with superior application skills for the success of customers operations.

Sitara Chemical Industries Ltd (SCIL) is intent to install the proposed project of 35MW coal fired power plant in conjunction with their existing facility located at 32-KM Faisalabad-Shiekhupura road.

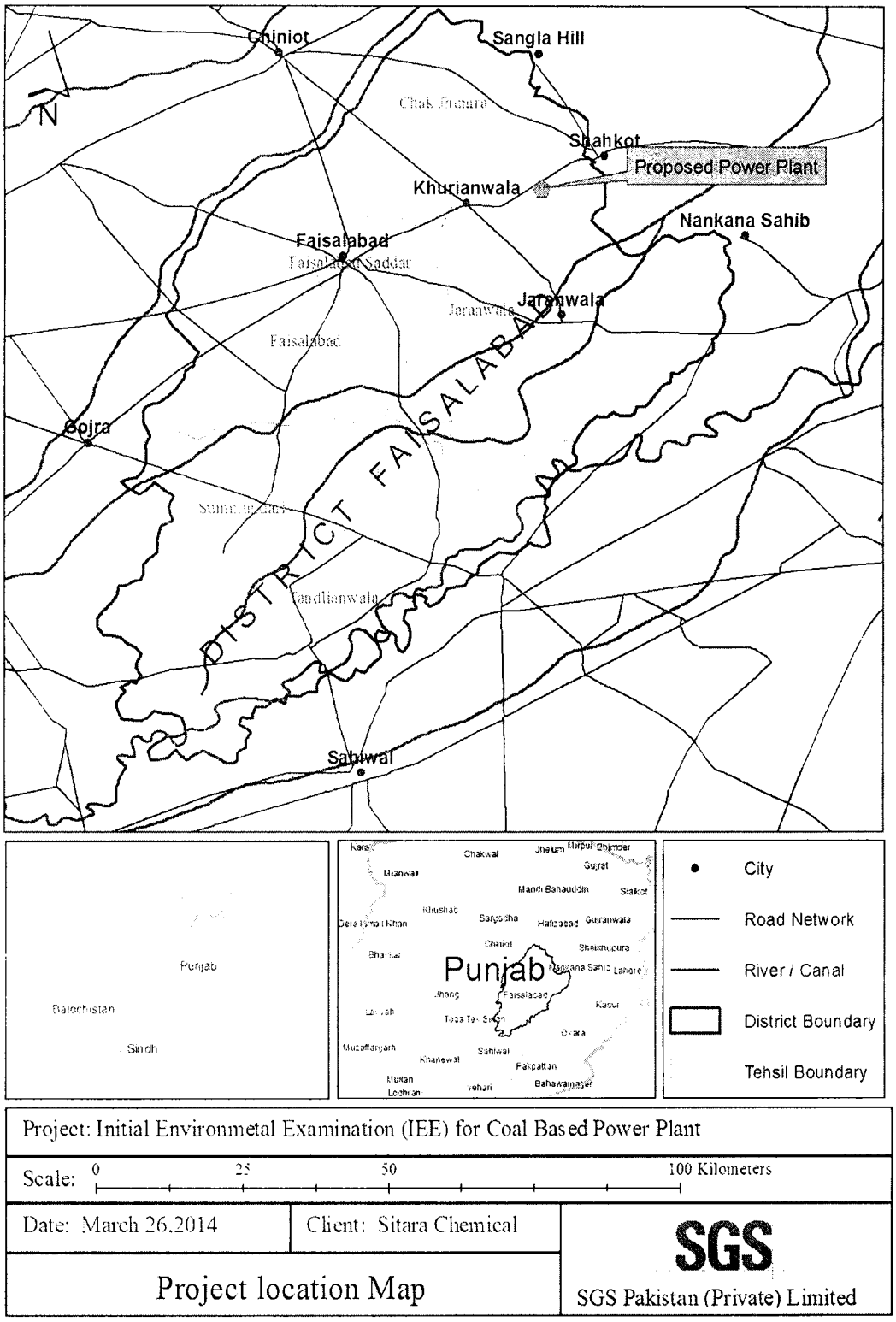
1.2 IEE Consultants

The IEE study was carried out by team of SGS Pakistan comprising of Environmentalist, Sociologist, Environmental Chemist and sector experts with diversified experience on local and international assignments. The detail of the project team deputed on this assignment is attached as **Annexure-I.**

1.3 IEE Requirement

The IEE has been prepared to conform with the requirements of the Pakistan Environmental Protection Act 1997 (PEPA), the Pakistan Initial Environmental Examination and Environmental Impact Assessment Review Regulations 2000 and the guidelines provided in the Pakistan Environmental Assessment Procedures, 1997.

Figure 1.1: Project Location



1.4 IEE Process

1.4.1 Overview of IEE

IEE is a systematic process to identify, predict and evaluate the environmental impacts of proposed actions and projects. The process is applied prior to major decisions and commitments being made. Wherever appropriate, social, cultural and health effects are considered as an integral part of IEE. Particular attention is given to practical implementation of IEE to prevent and mitigate significant adverse effects of proposed undertakings.

1.4.2 Objective of IEE

The overall objective of the IEE is as follows:

- Identify and investigate all impacts of the proposed project on the physical, biological, and socio-economic environment;
- To propose mitigation measures that would help SCIL in conducting the operation in an environmental sustainable manner; and
- To develop an Environmental Management Plan that would assist SCIL in the effective implementation of the recommendations of the IEE.

1.4.3 Scope of IEE

This IEE covers the installation/construction and operational activities of 35MW coal fired power plant at Sitara Chemical Industries Ltd (SCIL). The scope of the IEE includes:

- Construction activities at the proposed project site
- Relevant off site construction activities
- Operation of the plant

1.4.4 Spatial Scope

Impacts are assessed within the area of influence of the proposed project defined as:

- *Immediate Area of Influence*: at immediate foot print of proposed Installation location.

- *Direct Area of Influence*: within the proposed project site boundary and 5km radius of surrounding area.

1.5 IEE Methodology

The IEE project passes through series of stages prior to report preparation. The IEE process and the approach followed for the proposed project is defined below:

1.5.1 Scoping

Scoping is an early stage of the process and is designed to ensure that the environmental studies provide all the relevant information on:

- the impacts of the project, in particular focusing on the most important impacts;
- the alternatives to the project;
- other environmental sensitivities to be addressed at early stage.

The IEE process started with the scoping. The purpose of scoping was to identify:

- the important issues to be considered in an IEE;
- the appropriate time and space boundaries of the IEE study;
- the information necessary for decision-making;
- the significant effects and factors to be studied in detail.

The scoping was followed by data collection describes in subsequent section.

1.5.2 Data Collection

Following literature review and data collection was carried out for IEE:

- A generic description of the proposed project and its related activities was collected from Sitara Chemical Industried Ltd (SCIL).
- Legislative review of the applicable laws, regulations, guidelines and standards from various organisations and literature search.
- Baseline of the area's environmental and socio-economic settings was collected through literature search and field surveys.

1.5.3 Baseline

The environmental impact is measured through a change in the environment, resulting from a designated action or activity. In order to identify such a change, it is essential to have as complete as practicable understanding of the nature of the existing environment, prior to its interaction with the proposed activity. This translates into the need to characterize the existing baseline environmental conditions, including establishing prevailing conditions for a range of environmental media, particularly air, water, soil and groundwater, flora and fauna and the human environment.

This was achieved through a detailed review of all secondary resources (i.e. existing documentation and literature); and the undertaking of project specific baseline studies and surveys to collect supplementary data in the following areas:

- Geology;
- Flora and fauna;
- Water quality characteristics;
- Soil quality;
- Traffic;
- Ambient air quality;
- Noise conditions;
- Socio-economic conditions;
- Archaeology.

Both the existing secondary sources and literature studies were conducted and integrated into one coherent description of baseline characteristics.

1.5.4 Stakeholder Consultation

Communities within the project area were consulted during the fieldwork to record their concerns and suggestions.

1.5.5 Evaluation of Alternatives

To establish an environmentally sound preferred option for achieving the objectives of the proposed project, site and technology alternatives were studied in collaboration with the project proponent. Technology selection was made taking in to consideration environmentally, economically and socially suitable as well as technically feasible options.

1.5.6 Impact Assessment and Mitigation

The information collected in the previous phases was used to assess the potential environmental impacts of the proposed project activities. The impact assessment approach is provided in **Table 1.1.** Detailed methodology is included in **Chapter 6** of the report. Mitigation measures were evaluated to reduce the impacts of project activities on environment. The issues studied during impact assessment include potential impacts on:

- Physical environment of the area
- Biological environment of the area
- Socio-economic environment of the area

Table 1.1: Impact Assessment Approach

Impact Characteristics	*Categories*
Nature of the Impact	**Direct**: The environmental parameter is directly changed by the project. **Indirect**: The environmental parameter changes as a result of change in another parameter.
Duration of the impact	**Short term**: Lasting only till the duration of the project such as noise from the construction activities. **Medium term**: Lasting for a period of few months to a year after the project before naturally reverting to the original condition. **Long term:** Lasting for a period much greater than medium term impacts before naturally reverting to the original condition.
Geographical Location of the impact	**Local**: Within the area of project i.e. operation site and access road. **Regional**: Within the boundaries of the project area. **National**: Within the boundaries of the country. **Global**: Trans-boundary impacts
Timing	Construction Operation

Impact Characteristics	Categories
Likelihood of the impact	**High:** High likelihood of occurrence during lifetime of operation, Regular/continuous part of operations. **Moderate:** Moderate possibility of occurrence during lifetime of operation, Periodic/occasional part of operations. **Low:** Unlikely to occur during lifetime of operation.
Reversibility of the impact	**Reversible**: When a receptor resumes its pre-project condition. **Irreversible**: When a receptor does not or cannot resume its pre-project condition.
Significance of the impact	**Major, Moderate, Minor, Negligible and Beneficial** Based on the consequence, likelihood, reversibility, geographical extent, duration, level of public concern and conformance with legislative or statutory requirements.
Consequence severity of impact	**High:** ❑ Serious/catastrophic damage to environment ❑ Direct legislative requirement ❑ Corporate requirement ❑ Serious threat to corporate reputation/profitability/ability to do business. **Medium:** ❑ Measurable damage to the environment ❑ Subject to potential future legislation ❑ Potential to affect reputation/cost ❑ Implication/reduced efficiency **Low:** ❑ Negligible damage to the environment ❑ No risk to business

1.6 Organization of the Report

This report has been structured in the following manner:

Chapter 2 *(Legal Framework)* gives an overview of policy and legislation along with international guidelines relevant to IEE.

Chapter 3 *(Project Description)* provides the description of the proposed project, its layout plan and associated activities, raw material details and utility requirements. This chapter also provides the technology options assessed for the project.

Chapter 4 *(Description of Baseline Environment)* provides a description of the micro-environment and macro-environment of the proposed project site. This chapter describes the physical, ecological and socioeconomic resources, land of project area and surroundings.

Chapter 5 *(Impact Assessment)* describes the potential environmental and social impacts of proposed project on the different features of the micro and macro-environment using the matrix method.

Chapter 6 *(Environmental Management Plan)* explains the mitigation measures proposed for the project in order to minimize the impacts to acceptable limits. It also describes implementation of mitigation measures on ground and monitoring of environmental parameters against likely environmental impacts.

Chapter 7 *(Conclusion)* summarizes the report and presents its conclusions.

The last Chapter is followed by the references and series of **Annexes** that provide supporting information.

1.7 Contact Details

Mr. Haseeb Ahmed
Director
Sitara Chemical Industried Ltd.
32km Faisalabad Sheikhupura Road, Fasialabad.
Postal Add: P.O.Box #442, Faisalabad.
Phone: +92-41-4689141-5 Ext.333
Fax: +92-41-4689147-4689148
Email: director@sitara.com.pk
Web: www.sitara.com.pk

Mr. Shahzad Iqbal
Senior Manager Commercial & Material Management
Sitara Chemical Industried Ltd.
32km Faisalabad Sheikhupura Road, Fasialabad.
Postal Add: P.O.Box #442, Faisalabad.
Phone: +92-41-4689141-5 Ext.333
Fax: +92-41-4689147-4689148
Email: shahzad.iqbal@sitara.com.pk
Web: www.sitara.com.pk.

2 Legal Framework

This chapter provides an overview of the environmental policies, legislation, and guidelines that may have relevance to the proposed project. These include national environmental policy, legislation and guidelines; and international conventions and guidelines. Sitara Chemical Industries Ltd (SCIL) will be required to adhere to the relevant requirements of the policies and legislation during the construction and operation of the proposed activities; which has also been incorporated in the mitigation measures and the EMP provided in the IEE.

2.1 Constitutional Provision

According to the Constitution of Pakistan, the legislative powers lie with the federal parliament and the legislative assemblies of the four provinces of Pakistan. The Fourth Schedule of the constitution provides two lists of issues. One list, the Federal Legislative List, includes issues on which only the federal government has legislative powers. The second list, the Concurrent Legislative List includes issues on which both the federal and the provincial governments have legislative powers. If a particular legislation passed by a provincial assembly comes into conflict with a law enacted by the national assembly, then according to the constitution, the federal legislation will prevail over the provincial legislation to the extent of the inconsistency. The subject of 'environmental pollution and ecology' is included in the concurrent list of the constitution. Thus, allowing both the federal and provincial governments to enact laws on the subject. To date, only the federal government has enacted laws on environment, and the provincial environmental institutions derive their power from federal law. Article 9 of the constitution defines the right to life as a fundamental right in these words "No person shall be deprived of life or liberty save in accordance with law".

2.2 National Environmental Policy, 2005

The National Environmental Policy (NEP) was approved by the Pakistan Environmental Protection Council (PEPC) in its 10th meeting on 27th December, 2004 under the chairmanship of the Prime Minister of Pakistan and thereafter

approved by the Cabinet on 29th June 2005. NEP is the primary policy of Government of Pakistan that addresses the environmental issues of the country. The broad Goal of NEP is, "To protect, conserve and restore Pakistan's environment in order to improve the quality of life of the citizens through sustainable development". The NEP identifies the following set of sectoral and cross-sectoral guidelines to achieve its Goal of sustainable development.

Sectoral Guidelines:

Water and sanitation, Air quality and noise, Waste management, Forestry, Biodiversity and Protected areas, Climate change and Ozone depletion, Energy efficiency and renewable, agriculture and livestock, and Multilateral environmental agreements.

Cross Sectoral Guidelines:

Poverty, Population, Gender, Health, Trade and environment, Environment and local governance and Natural disaster management.

The NEP suggests the following policy instruments to overcome the environmental problems through out the country:

- Integration of environment into development planning,
- Legislation and regulatory framework,
- Capacity development,
- Economic and market based instrument,
- Public awareness and education, and
- Public private civil society partnership.

NEP is a policy document and does not apply to projects. However, Sitara Chemicals Industried Ltd (SCIL) should ensure that the project should not add to the aggravation of the environmental issues identified in NEP and mitigation measures should be adopted to minimise or avoid any contribution of the project in these areas.

2.2.1. National Conservation Strategy

Before the approval of National Environmental Policy (NEP) the National Conservation Strategy (NCS) was considered as the Government's primary policy document on national environmental issues. At the moment this strategy just exists as a national conservation program. The NCS identifies 14 core areas including conservation of biodiversity; pollution prevention and abatement; soil and water conservation; and preservation of cultural heritage, and recommends immediate attention to these core areas in order to preserve the country's environment.

NCS does not directly apply to power generation projects. However, SCIL should ensure that the project should not add to the aggravation of the 14 core environmental issues identified in the NCS and mitigation measures should be adopted to minimise or avoid any contribution of the project in these areas.

2.3 National Environmental Legislation

The definition of environmental law can be derived from the legal definition of 'environment'. In Section 2(x) of the Pakistan Environmental Protection Act 1997 (PEPA 1997) environment is defined to include air, water, land and layers of the atmosphere; living organisms and inorganic matter; the ecosystem and ecological relationships; buildings, structures, roads, facilities and works; social and economic conditions affecting community life; and the interrelationship between these elements. From this definition, an environmental law can be considered to include all laws that are designed to, or that directly or indirectly affect, the management of natural resources including the control of pollution of these natural resources.

By this definition, environmental laws include a) laws that have been specifically enacted to protect the environment such as the PEPA 1997, and b) laws relating to subject such as forest, water resources, wildlife, land, agriculture, health, and town planning.

2.3.1. Pakistan Environmental Protection Act 1997

The Pakistan Environmental Protection Act, 1997 (PEPA) is the basic legislative tool empowering the government to frame regulations for the protection of the

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2.3.1. Pakistan Environmental Protection Act 1997

The Pakistan Environmental Protection Act, 1997 (PEPA) is the basic legislative tool empowering the government to frame regulations for the protection of the

environment. The PEPA is broadly applicable to air, water, soil, marine and noise pollution, as well as the handling of hazardous waste. Penalties have been prescribed for those contravening the provisions of the Act. The powers of the federal and provincial Environmental Protection Agencies (EPAs) were also considerably enhanced under this legislation and they have been given the power to conduct inquiries into possible breaches of environmental law either of their own accord, or upon the registration of a complaint.

Under section 12 of PEPA, no project involving construction activities or any change in the physical environment can be taken unless an IEE or EIA as required is conducted and a report submitted to the federal or provincial EPA.

2.3.2. Pakistan Environmental Protection Agency Review of IEE and EIA Regulations, 2000

The Pakistan Environmental Protection Agency Review of IEE and EIA Regulations, 2000 (the 'Regulations'), prepared by the Pak-EPA under the powers conferred upon it by the PEPA, provide the necessary details on the preparation, submission, and review of the Initial Environmental Examination (IEE) and the Environmental Impact Assessment (EIA). The Regulation classifies projects on the basis of expected degree of adverse environmental impacts and lists them in two separate schedules. Schedule I lists projects that may not have significant environmental impacts and therefore require an IEE. Schedule II lists projects of potentially significant environmental impacts requiring preparation of an EIA.

2.3.3. Approval from Punjab Environmental Protection Agency

As per the 2000 Regulations, SCIL will be required to submit the IEE report to Punjab Environmental Protection Agency (Punjab EPA) and seek approval on the same from PEPA. 10 hard copies and 2 soft copies of the IEE report will need to be submitted to Punjab EPA. Punjab EPA will grant its decision on the IEE as per the rules and procedures set out in the 2000 Regulations.

2.3.4. The National Environmental Quality Standards (NEQS)

The NEQS promulgated under the PEPA 1997 specify standards for industrial and municipal effluents, gaseous emissions, vehicular emissions, and noise levels. The PEPA 1997 empowers the EPA's to impose pollution charges in case of non-

compliance to the NEQS. Standards for disposal of solid waste have as yet not been promulgated.

During the project, NEQS will apply to all type of effluents, emissions and noise levels from construction camp, commissioning and operation of the proposed project and associated facilities.

NEQS for municipal and industrial effluents, drinking water, ambien air quality, NEQS for motor vehicle exhaust and noise are provided in **Table 2-1** to **Table 2-5** respectively. While NEQS for gaseuos pollutants from industrial sources are provided in **Table 2-6**, while **Table 2-7** provide Pakistan Standards for sulphur dioxide and nitrogen oxides for power plants operating on oil & coal.

Table 2-1: NEQS for Municipal and Industrial Effluents [a]

Parameters	Existing Standards	Revised Standards		
		Into Inland Waters	Into Sewage Treatment [b]	Into Sea
Temperature [c]	40°C	=<3°C	=<3°C	=<3°C
pH Value	6-10	6-9	6-9	6-9
Biochemical Oxygen Demand (BOD5) at 20°C [d]	80	80	250	80
Chemical Oxygen Demand (COD) [d]	150	150	400	400
Total Suspended Solids (TSS)	150	200	400	200
Total Dissolved Solids (TDS)	3500	3500	3500	3500
Grease & Oil	10	10	10	10
Phenolic Compounds (as phenol)	0.1	0.1	0.3	0.3
Chlorides (as Cl')	1000	1000	1000	SC
Fluoride (as F')	20	10	10	10
Cyanide (CN') total	2	1.0	1.0	1.0
An-ionic detergents (as MBAS) [e]	20	2.0	20	20
Sulphate (SO'')	600	600	1000	SC
Sulphide (S')	1.0	1.0	1.0	1.0
Ammonia (NH3)	40	40	40	40
Pesticides [f]	0.15	0.15	0.15	0.15
Cadmiumg	0.1	0.1	0.1	0.1
Chromium (trivalent & hexavalent) [g]	1.0	1.0	1.0	1.0
Copper	1.0	1.0	1.0	1.0
Lead	0.5	0.5	0.5	0.5
Mercury	0.01	0.01	0.01	0.01

Parameters	Existing Standards	Revised Standards		
		Into Inland Waters	Into Sewage Treatment [b]	Into Sea
Selenium	0.5	0.5	0.5	0.5
Nickel	1.0	1.0	1.0	1.0
Silver	1.0	1.0	1.0	1.0
Total Toxic Metals	2.0	2.0	2.0	2.0
Zinc	5.0	5.0	5.0	5.0
Arsenic	1.0	1.0	1.0	1.0
Barium	1.5	1.5	1.5	1.5
Iron	2.0	8.0	8.0	8.0
Manganese	1.5	1.5	1.5	1.5
Boron	6.0	6.0	6.0	6.0
Chlorine	1.0	1.0	1.0	1.0

Source: SRO 549 (I)/2000 Dated August 10, 2000, Ministry of Environment, Local Govt. & Rural Development, Pakistan

Notes

[a] All values are in mg/l, unless otherwise defined

[b] Applicable only when and where sewage treatment is operational and BOD5=80 mg/L is achieved by the sewage treatment system

[c] The effluent should not result in temperature increase of more than 3°C at the edge of zone where initial mixing and dilution take place in the receiving body. In case zone is defined, use 100 meters from the point of discharge

[d] Assuming minimum dilution 1:10 on discharge, lower ratio would attract progressively stringent standards to be determined by the Federal Environmental Protection Agency. By 1:10 dilution means, for example that for each one cubic meter of treated effluent, the recipient water body should have 10 cubic meter of water for dilution of this effluent

[e] Modified Benzene Alkyl Sulphate; assuming surfactant as biodegradable

[f] Pesticides include herbicide, fungicides and insecticides

[g] Subject to the total toxic metals discharge should not exceed level of total toxic metals

Table 2-2: NEQS for Drinking Water, 2010

Parameters	Standards value for Pakistan	WHO Standards
Physical & Bacterial		
E. Coli	Must not Detectable in 100 ml sample	Must not Detectable in 100 ml sample
Colour	≤15 TCU	≤15 TCU
pH	6.5-8.5	6.5-8.5
Taste	Non Objectionable/Acceptable	Non Objectionable/Acceptable
Odour	Non Objectionable/Acceptable	Non Objectionable/Acceptable
Turbidity	<5	<5
Total Hardness as $CaCo_3$	<500 mg/l	---
Total Dissolved Solids (TDS)	<1000	<1000

Parameters	Standards value for Pakistan	WHO Standards
Chemical - Essential Inorganic(mg/l)		
Aluminium (Al)	≤0.2	0.2
Antimony (Sb)	≤0.005 (p)	0.02
Arsenic (As)	≤0.05 (p)	0.01
Barium (Ba)	0.7	0.7
Boron (B)	0.3	0.3
Cadmium(Cd)	0.01	0.003
Chloride (Cl)	<250	250
Chromium (Cr)	≤0.05	0.05
Copper (Cu)	2	2
Toxic Inorganic mg/l		
Cyanide (CN)	≤0.05	0.07
Fluoride (as F)	≤1.5	1.5
Lead (Pb)	≤0.05	0.01
Manganese (Mn)	≤0.5	0.5
Mercury (Hg)	≤0.001	0.001
Nickel (Ni)	≤0.02	0.02
Nitrate (No_3)*	≤50	50
Nitrite (No_3)*	≤3 (p)	3
Selenium (Se)	0.01(p)	
Residual Chlorine	0.2-0.5 at consumer end 0.5-1.5 at source	---
Zn (Zn)	5.0	3
Organic		
Pesticide mg/	---	PSQCA No.4639-2004 Page No. 4 Table No. 3 Serial No. 20-58 may be consulted***
Phenolic Compounds(as Phenols) mg/l	---	≤ 0.002
Polynuclear aromatic hydrocarbons(as PAH g/l)	---	0.01 (By GC/MS Method)
Radioactive		
Alpha Emitters bq/L or pCi	0.1	0.1
Beta Emitters	1	1

* Indicates priority health related inorganic constituents which need regular monitoring

*** PSQCA Pakistan Standards Quality Control Authority

Table 2-3: NEQS for Ambient Air Quality

Pollutants	Time-weighted average	Concentration in Ambient Air		Method of measurement
		Effective from 1st January 2009	Effective from 1st January 2012	
Sulphur Dioxide (SO_2)	Annual Average*	80 µg/m^3	80µg/m^3	Ultraviolet Fluorescence method
	24 hours**	120 µg/m^3	120 µg/m^3	
Oxides of Nitrogen as (NO)	Annual Average*	40 µg/m^3	40 µg/m^3	Gas Phase Chemiluminescence
	24 hours**	40 µg/m^3	40 µg/m^3	
Oxides of Nitrogen as (NO_2)	Annual Average*	40 µg/m^3	40 µg/m^3	Gas Phase Chemiluminescence
	24 hours**	80 µg/m^3	80 µg/m^3	
Ozone (O_3)	1 hour	180 µg/m^3	130 µg/m^3	Non dispersive UV absorption method
Suspended Particulate Matter (SPM)	Annual Average*	400 µg/m^3	360 µg/m^3	High Volume Sampling, (Average flow rate not less than 1.1 m^3/minute
	24 hours**	550 µg/m^3	500 µg/m^3	
Respirable Particulate Matter PM_{10}	Annual Average*	200 µg/m^3	120 µg/m^3	β Ray absorption method
	24 hours**	250 µg/m^3	150 µg/m^3	
Respirable Particulate Matter $PM_{2.5}$	Annual Average*	25 µg/m^3	15 µg/m^3	β Ray absorption method
	24 hours**	40 µg/m^3	35 µg/m^3	
	1 hour	25 µg/m^3	15 µg/m^3	
Lead (Pb)	Annual Average*	1.5 µg/m^3	1 µg/m^3	ASS Method after sampling using EMP 2000 or equivalent Filter paper
	24 hours**	2 µg/m^3	1.5 µg/m^3	
Carbon Monoxide (CO)	8 hours**	5 µg/m^3	5 µg/m^3	Non Dispersive Infrared (NDIR) method
	1 hour**	10 µg/m^3	10 µg/m^3	

* Annual Arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval

** 24 hourly/ 8 hourly values should be met 98 % of the in a year. 2 % of the time. It may exceed but not on two consecutive days.

Table 2-4: NEQS for Motor Vehicle Exhaust and Noise

Parameter	Standard	Measuring method
Smoke	40% or 2 on the Ringlemann scale during engine acceleration mode	To be compared with Ringlemann Chart at a distance of 6 meters or more

Parameter	Standard	Measuring method
Carbon monoxide	New Vehicle 4.5% Used Vehicle 6%	Under idling conditions, non-dispersive infrared detection through gas analyser
Noise	85 dB (A)	Sound-meter at 7.5 meters from the source

Source: Qadar (2003)
Notes: [a]10 years or older

Table 2-5: NEQS for Noise

S.No.	Category of Area/Zone	Effective from 1st July, 2010		Effective from 1st July,2012	
		Limit dB(A) Leq*			
		Day Time	Night Time	Day Time	Night Time
1	Residential Area (A)	65	50	55	45
2	Commercial Area (B)	70	60	65	55
3	Industrial Area (C)	80	75	75	65
4	Silence Zone (D)	55	45	50	45

***dB(A) Leq:** Time Weighted average of the level of sound in decibels on scale A which is relatable to human hearing

Note:

1. Day time hours: 6.00 a.m to 10.00 p.m
2. Night time hours: 10.00 p.m. to 6 a.m.
3. Silence zone: Zones which are declared as such by the competent authority. An area comprising not less than 100 meters around hospitals, educational institutions and courts
4. Mixed categories of area may be declared as one of the four above-mentioned categories by the competent authority

Table 2-6: NEQS for Selected Gaseous Pollutants from Industrial Sources

Parameter	Source of Emission	Standard
Smoke	Any	40% or 2 Ringlemann scale or equivalent smoke number
Particulate Matte [b]	Boilers and furnaces:	
	Oil Fired	300
	Coal Fired	500
	Cement Kilns	300
	Grinding, crushing, clinker coolers and related processes, metallurgical processes, converter blast furnaces and cupolas	500
Hydrogen chloride	Any	400
Chlorine	Any	150

Parameter	Source of Emission	Standard
Hydrogen flouride	Any	150
Hydrogen sulfide	Any	10
Sulfur oxides[c]	Sulfuric acid/Sulfonic acid plants	5,000
	Other plants except power plants operating on oil and coal	1,700
Carbon monoxide	Any	800
Lead	Any	50
Mercury	Any	10
Cadmium	Any	20
Arsenic	Any	20
Copper	Any	50
Antimony	Any	20
Zinc	Any	200
Oxides of Nitrogen[d]	Nitric acid manufacturing unit	3,000
	Other plants except power plants operating on oil or coal:	
	Oil Fired	400
	Coal Fired	600
	Cement Kilns	1,200

Notes:
[a] All values are in mg/Nm^3, unless otherwise defined
[b] Based on the assumption that the size of the particulates is 10 micron or more
[c] Based on 1% Sulfur content in fuel oil. Higher content of Sulfur will cause standards to be pro-rated
[d] In respect of the emissions of the sulfur dioxide and nitrogen oxides, the power plants operating on oil or coal as fuel shall, in addition to NEQS specified above, comply with the following standards.

Table 2-7: Pakistan Standards for Sulphur Dioxide & Nitrogen Oxides for Power Plants Operating on Oil & Coal

A. Sulfur Dioxide

Sulphur Dioxide Background Levels			Standards	
			Criterion I	Criterion II
Background Air Quality (SO_2 basis)	Annual Average ($\mu g/m^3$)	Maximum 24-Hour Interval ($\mu g/m^3$)	Maximum SO_2 Emissions (tons/day/plant)	Maximum Allowable 1-Year Average Ground Level Increment to Ambient ($\mu g/m^3$)
Unpolluted	<50	<200	500	50
Moderately polluted[1]	50	200	500	50
Low				
High	100	400	100	10
Very polluted[2]	>100	>400	100	10

For intermediate values between 50 and 100 µg/m3 linear interpretation should be used.
No project with sulphur dioxide emissions will be recommended.

B. Nitrogen Oxide

Nitrogen Oxides	
Annual arithmetic mean of ambient air concentrations of nitrogen oxides (expressed as NO_2) should not exceed	100 $\mu g/m^3$ (0.05 ppm)
Maximum emission levels for stationary source discharges, before mixing with the atmosphere: For fuel fired steam generators as Nanogram (10° –gram) per joule of heat input.	
Liquid fossil fuel	130 ng/J of heat input
Solid fossil fuel	300 ng/J of heat input
Lignite fossil fuel	260 ng/J of heat input

2.3.5. Self-Monitoring & Reporting Rules (SMART)

Pakistan Environmental Protection Council constituted an Environmental Standards Committee in 1996 to devise realistic modalities for NEQS enforcement and simplified monitoring procedures with the consultation of representatives of industrial interest groups, non-governmental organizations (NGOs) and other stakeholders. Their efforts succeeded in the bringing up of "Self-Monitoring and Reporting System for Industry". As per the rules set by this system, industries have to monitor effluents and emissions in compliance with the NEQS and report it to provincial or federal EPAs. This system classifies industry into three categories A, B and C each corresponding to a specified reporting frequency.

Thermal Power Plants (Coal Fired) are classified as Category-A for monitoring of both liquid effluents and gaseous emissions. All industrial units in Category-A are required to submit environmental monitoring reports on monthly basis and they shall maintain a record of the times during which start-up and upset conditions occur, and shall mention the total time elapsed in such conditions in its monthly environmental monitoring report.

2.3.6. Canal and Drainage Act, 1873

Canals are defined as channels, pipes and reservoirs constructed and maintained by the Government for the supply for storage of water. Under section 27 of the Act a person desiring to have a supply of water from a canal for purposes other than irrigation shall submit a written application to a Canal Officer who may, with the

sanction of the Provincial Government give permission under special conditions. The Act under section 61 also prohibits the damaging, altering, enlarging or obstructing the canals without proper authority.

The Canal and Drainage Act (1873) prohibits corruption or fouling of water in canals (defined to include channels, tube wells, reservoirs and watercourses), or obstruction of drainage.

These acts have relevance to the project as the project water requirements will be met through canal water. Any abstraction of water from the canal will only be allowed after getting formal approval from the concerned irrigation department.

Although the area surrounding the power plant has the presence of irrigation network, however the project activities will be limited to existing plant boundary and will not cause any physical damage to the canals..

2.3.7. The Forest Act 1927

This act is applicable to all regions of Pakistan. It includes procedures for constituting and managing various types of forests, such as reserved forests and protected forests. The act empowers the provincial forest departments to declare any forest area as reserved or protected. The act empowers the provincial forest departments to prohibit the clearing of forests for cultivation, grazing, hunting, removing forest produce; quarrying and felling, lopping and topping of trees, branches in reserved and protected forests. It also defines the duties of forest related public servants, and penalties for any infringement of the rules.

The project area is located outside of the any protected forest therefore the project will not contravene with any provisions of this Act.

2.3.8. Antiquities Act 1975

The protection of cultural resources in Pakistan is ensured by the Antiquities Act of 1975. Antiquities have been defined in the Act as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, national monuments etc. The act is designed to protect antiquities from destruction, theft, negligence, unlawful excavation, trade and export. The law prohibits new construction in the proximity of a protected antiquity and empowers the

Government of Pakistan to prohibit excavation in any area, which may contain articles of archaeological significance.

No antiquity protected under the law was identified in the vicinity of the proposed project during fieldwork for the IEE. Furthermore, the project site is unlikely to contain any buried antiquity. However, the project staff will be instructed before ground preparation and earthworks to report any archaeological artifact or what may appear to be an archaeological relic to the project management. In case of such a discovery, appropriate action will be taken.

2.3.9. Pakistan Penal Code, 1860

The Pakistan Penal Code (1860) authorises fines, imprisonment or both for voluntary corruption or fouling of public springs or reservoirs so as to make them less fit for ordinary use.

2.4 Framework of Environment and Wildlife Institution in Pakistan

The Federal Ministry of Environment was the main government organization responsible for the protection of environment and resource conservation. It is headed by a federal minister. The Ministry works with PEPC, and the Federal and Provincial EPAs formed under the PEPA 1997. The roles, responsibilities and authorities of PEPC and the EPA's are defined in the PEPA 1997. However, after 18th constitutional amendment, the said ministry has been devolved into provinces and federal ministry is working under the umbrella of Ministry of Climate Change. Now, Pakistan Environmental Protection Agency is an attached department of the Ministry of Climate Change and responsible to implement the Pakistan Environmental Protection Act 1997, in the country, an Act to provide for the protection, conservation, rehabilitation and improvement of environment, for the prevention and control of pollution, and promotion of sustainable development. Pakistan Environmental Protection Agency also provides all kind of technical assistance to the Ministry of Climate Change.

The PEPC has been formed by the Federal Government. Its members include the Prime Minister of Pakistan, as the Chairperson; the Minister for Environment as the vice-Chairperson; Governors of the Provinces; Ministers in charge of the subject of environment in the Provinces; Secretary to the Federal Government in-

charge of the Ministry of Environment; Director General Federal EPA; heads of other federal and provincial departments; environmentalists and community representatives including scientists. The functions and powers of the Council include formulation of national environmental Policy, enforcement of PEPA 1997, approval of the NEQS, incorporation of environmental considerations in to national development plans and policies and provide guidelines for the protection and conservation of biodiversity in general and for the conservation of renewable and non-renewable resources.

The Federal government has also formed the Federal EPA, which is headed by a Director General and has wide-ranging functions given in PEPA 1997. These include the preparation and co-ordination of national environmental policy for approval by the PEPC, administering and implementing the PEPA 1997 and preparation, revision or establishment of NEQS. The Provincial Environmental Protection Agencies are formed by the respective Provincial Governments. A Director General who exercises powers delegated to him by the Provincial Government heads each Provincial EPA. IEE's and EIA's are submitted to provincial EPA's for approval.

The National Council for Conservation of Wildlife (NCCW) is responsible for formulation of national wildlife policies, co-ordination with provincial wildlife department on the implementation of these policies and co-ordination with international organisations on matters related to international treaties/conventions. The NCCW works under the Ministry of Climate Change, and is headed by the Inspector General Forests. NCCW comprises of an advisory council, which is chaired by the Minister of Climate Change and includes representatives from all Provinces, AJK and Northern Areas, NGOs, members of civil society and other federal ministries. A small NCCW secretariat is based in Islamabad handles the day-to-day affairs and the implementation of policies and recommendations of the advisory council. At provincial level almost each province has a wildlife department and a wildlife protection act.

2.5 National Environmental Guidelines

2.5.1. The Pakistan Environmental Assessment Procedures, 1997

The Pakistan Environmental Protection Agency prepared the Pakistan Environmental Assessment Procedures in 1997. They are based on much of the existing work done by international donor agencies and Non Governmental Organisations (NGO's). The package of regulations prepared by PEPA includes:

- *Policy and Procedures for Filing, Review and Approval of Environmental Assessments;*
- *Guidelines for the Preparation and Review of Environmental Reports;*
- *Guidelines for Public Consultation:* These guidelines are a part of a package of regulations and guidelines. It provides assistance throughout the environmental assessment of project by involving the public which can lead to better and more acceptable decision-making.
- *Guidelines for Sensitive and Critical Areas; and*
- *Sectoral Guidelines-for Environmental Reports Major Thermal Power Stations:* Sectoral guidelines for environmental reports major thermal power stations deals with major thermal power plants which will be defined as those producing electrical energy from fossil fuels (coal, gas, oil). The guideline is prepared to assist project proponents to identify the key environmental parameters those are required to be addressed to develop mitigation measures and alternatives that need to be considered in the actual IEE.

2.6 International Conventions & Treaties

2.6.1. Convention on Biological Diversity

The Convention on Biological Diversity was adopted during the Earth Summit of 1992 at Rio de Janeiro. The Convention requires parties to develop national plans for the conservation and sustainable use of biodiversity, and to integrate these plans into national development programmes and policies. Parties are also required to identify components of biodiversity that are important for conservation, and to

develop systems to monitor the use of such components with a view to promoting their sustainable use.

2.6.2. The Convention on Conservation of Migratory Species of Wild Animals, 1979

The Convention on the Conservation of Migratory Species of Wild Animals (CMS), 1979, requires countries to take action to avoid endangering migratory species. The term "migratory species" refers to the species of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries. The parties are also required to promote or co-operate with other countries in matters of research on migratory species.

The Convention contains two appendices. Appendix I contain the list of migratory species that are endangered according to the best scientific evidence available. For these species, the member states are required to endeavour to:

- Conserve and restore their habitats.
- Prohibit their hunting, fishing, and capturing, harassing and deliberate killing.
- Remove obstacles and minimize activities that seriously hinder their migration.
- Control other factors that might endanger them, including control of introduced exotic species.

Appendix II lists migratory species, or groups of species, that have an unfavourable conservation status as well as those that would benefit significantly from the international co-operation that could be achieved through intergovernmental agreements.

2.6.3. The Convention on Wetlands of International Importance, Ramsar 1971

Pakistan is a signatory to the said Convention. The principal obligations of contracting parties to the Convention are:

- To designate wetlands for the List of Wetlands of International Importance.
- To formulate and implement planning so as to promote wise use of wetlands, to carry out an EIA before transformations of wetlands, and to make national wetland inventories.

- To establish nature reserves on wetlands and provide adequately for their wardening and through management to increase waterfowl populations on appropriate wetlands.
- To train personnel competent in wetland research, management and wardening.
- To promote conservation of wetlands by combining far-sighted national policies with coordinated international action, to consult with other contracting parties about implementing obligations arising from the Convention, especially about shared wetlands and water system.
- To promote wetland conservation concerns with development aid agencies.
- To encourage research and exchange of data.

So far 19 sites in Pakistan have been declared as wetlands of International Importance or Ramsar Sites.

None of these wetlands is located within or in close vicinity of the project area.

2.6.4. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

This convention came into effect in March 1973 at Washington. In all 130 countries are signatory to this convention with Pakistan signing the convention in 1976.

The convention requires the signatories to impose strict regulations (including penalisation, confiscation of the specimen etc.) regarding trade of all species threatened with extinction or that may become so, in order not to endanger further their survival.

The Convention contains three appendices. Appendix I include all species threatened with extinction, which are or may be affected by trade. The Convention requires that trade in these species should be subject to strict regulations. Appendix II includes species that are not necessarily threatened presently but may become so unless trade in specimen of these species is subject to strict regulations. Appendix III includes species which any contracting party identifies as subject to regulations in trade and requires other parties to co-operate in this matter.

2.6.5. International Union for Conservation of Nature and Natural Resources (IUCN) Red List

The red list is published by IUCN and includes those species that are under potential threat of extinction. These species have been categorised as:

- *Endangered: species that are sent to be facing a very high risk of extinction in the wild in the near future, reduction of 50% or more either in the last 10 years or over the last three generations, survive only in small numbers, or have very small populations.*
- *Vulnerable in Decline: species that are seen to be facing a risk of extinction in the wild, having apparent reductions of 20% or more in the last 10 years or three generations.*
- *Vulnerable: species that are seen to be facing a high risk of extinction in the wild, but not necessarily experiencing recent reductions in population size.*
- *Lower Risk: species that are seen to be facing a risk of extinction that is lesser in extent that for any of the above categories.*
- *Data Deficient: species that may be at risk of extinction in the wild but at the present time there is insufficient information available to make a firm decision about its status.*

2.6.6. Minamata Convention on Mercury

Minamata convention is signed by Pakistan on October 03 2013. The objective of the Convention is to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds. It's Article 8, specifically address to control and "where feasible" reduce emissions of mercury and mercury compounds, (i.e. "total mercury") to the atmosphere through measures to control emissions from point source categories (Annex D) such as coal-fired power stations and non-ferrous metal smelters (e.g. aluminium smelters)".

2.7 International Guidelines

2.7.1. World Bank Guidelines on Environment

The principal World Bank publications that contain environmental guidelines are listed below.

- *Environmental Assessment-Operational Policy 4.01. Washington, DC, USA. World Bank 1999.*
- *Environmental Assessment Sourcebook, Volume I: Policies, Procedures, and Cross-Sectoral Issues. World Bank Technical Paper Number 139, Environment Department, the World Bank, 1991,*
- *Environmental Assessment Sourcebook, Volume III: Guidelines for Environmental Assessment of Energy and Industry Projects. World Bank Technical Paper No. 154, Environment Department, the World Bank, 1991.*
- *Environmental Health and Safety (EHS) guidelines, International Finance Corporation (IFC) World Bank Group, 2008.*

The first two publications provide general guidelines for conducting EIAs, and address EIA practitioners as well as project designers. While the Sourcebook in particular has been designed with Bank projects in mind, and is especially relevant for the impact assessment of large-scale infrastructure projects, it contains a wealth of useful information, for environmentalists and project proponents. The Sourcebook identifies a number of areas of concern, which should be addressed during impact assessment. It sets out guidelines for the determination of impacts, provides a checklist of tools to identify possible biodiversity issues and suggests possible mitigation measures. Possible development project impacts on different areas such as wild lands, wetlands and forests are also identified and mitigation measures suggested.

The EHS guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP).

These guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs. Application of the EHS Guidelines to existing facilities may involve the

establishment of site-specific targets, based on environmental assessments and/or environmental audits as appropriate, with an appropriate timetable for achieving them.

The EHS guidelines for thermal power plants were published in December 2008 and include information relevant to combustion processes fueled by gaseous, liquid and solid fossil fuels and biomass and designed to deliver electrical or mechanical power, steam, heat, or any combination of these, regardless of the fuel type (except for solid waste which is covered under a separate Guideline for Waste Management Facilities), with a total rated heat input capacity above 50 Megawatt thermal input (MWth) on Higher Heating Value (HHV) basis. It applies to boilers, reciprocating engines, and combustion turbines in new and existing facilities. A detailed description of industry activities for this sector and guidance for Environmental Assessment (EA) of thermal power projects is also provided in these guidelines.

World Bank guidelines on effluent, drinking water, ambient air quality, noise and World Bank emission guidelines for combustion turbine are provided in **Table 2-8** to **Table 2-12** respectively.

Table 2-8: World Bank Effluent Guideline Values

Parameter	*Value*
pH	6-9
Total Suspended Solids (TSS)	50 mg/l
Oil & Grease	10 mg/l
Total Residual Chlorine	0.2 mg/l
Chromium (Total)	0.5 mg/l
Copper	0.5 mg/l
Iron	1.0 mg/l
Zinc	1.0 mg/l
Lead	0.5 mg/l
Cadmium	0.1 mg/l
Mercury	0.005 mg/l
Arsenic	0.5 mg/l

Parameter	Value
Temperature Increase	3°

Table 2-9: WHO Drinking Water Guidelines

S/No	Parametric Tests *	WHO
1	Aluminum	0.2
2	Ammonium	1.5
3	Antimony	0.005
4	Arsenic	0.01
5	Barium	0.7
6	Boron	0.3
7	Cadmium	0.003
8	Chloride	250
9	Chromium	0.05
10	Coliforms, total /100ml	0
11	Coliforms,E.Coli/100ml	0
12	Color	15cu
13	Copper	1 - 2
14	Cyanide	0.07
15	Fluoride	1.5
16	Hardness	NS
17	Iron	0.3
18	Lead	0.01
19	Manganese	0.1- 0.5
20	Mercury	0.001
21	Molybdenum	0.07
22	Nickel	0.02
23	Nitrate/Nitrite, total	NS
24	Nitrates(NO_3)$^-$	50
25	Nitrites(NO_2)$^-$	3
26	Odor	NS
27	pH	6.5 - 8.5
28	Phosphorous	NS
29	Phenols	NS
30	Potassium	NS
31	Selenium	0.01
32	Silica Dioxide(SiO_2)	NS
33	Silver	NS
34	Solids, Total dissolved	1000
35	Sodium	200

S/No	Parametric Tests *	WHO
36	Sulfate	250
37	Turbidity(Non-microbial)	5 NTU
38	Zinc	3.0

Abbreviations/Explanations:

NS=No Standards | JTU=Jackson Turbidity Units | NTU=Nephelometric Turbidity Units cu=Color Units | MPN Coliforms, Total or E.Coli/100ml | Pt-Co = Platinium Cobalt Standards | EEC=European Economic Community for Environmental Legislation USEPA= United States Environmental Protection Agency | TON=Threshold Odor Number *mg/l (milligrams per litre) except where notified.

Table 2-10: World Bank Ambient Air Quality Guidelines

Pollutant	Average Concentration	Guideline Value in ug/m^3
Sulphur dioxide (SO_2)	24-hour	20 (guideline value)
		125 (*Interim target-1)
		50 (Interim target-2)
	10 minute	500 (guideline value)
Nitrogen dioxide (NO_2)	1-year	40 (guideline value)
	1-hour	200 (guideline value)
Particulate Matter (PM_{10})	1-year	20 (guideline value)
		70 (Interim target-1)
		50 (Interim target-2)
		30 (Interim target-3)
	24-hour	50 (guideline value)
		150 (Interim target-1)
		100 (Interim target-2)
		75 (Interim target-3)

* In addition to guideline values, interim targets are given for each pollutant. These are proposed as incremental steps in a progressive reduction of air pollution and are intended for use in areas where pollution is high. These targets aim to promote a shift from high air pollutant concentrations, which have acute and serious health consequences, to lower air pollutant concentrations. If these targets were to be achieved, one could expect significant reductions in risks for acute and chronic health effects from air pollution. Progress towards the guideline values should, however, be the ultimate objective of air quality management and health risk reduction in all areas.

Table 2-11: World Bank Noise Level Guidelines

Receptor	Daytime 7:00-22:00	One Hour LAeq (dBA) Nighttime 22:00-7:00
Residential; Institutional; Educational	55	45
Industrial; Commercial	70	70

Table 2-12: World Bank Emission Guidelines (in mg/Nm^3 or as indicated) For Combustion Turbine

Combustion Technology / Fuel	Particulate Matter (PM)	Sulfur Dioxide (SO_2)	Nitrogen Oxides (NOx)	Dry Gas, Excess O_2 Content (%)
Combustion Turbines		NDA/DA	NDA/DA	
Natural Gas =15MWth to < 50MWth	N/A	N/A	25ppm	15
Fuels other than Natural Gas=15MWth to < 50MWth	N/A	0.5% S or lower % S (0.2%S) if commercially available without significant excess fuel cost	74ppm	15

Notes:
-N/A/ - no emissions guideline: Higher performance levels than these in the Table should be applicable to facilities located in urban / industrial areas with degraded airsheds or close to ecologically sensitive areas where more stringent emissions controls may be needed.; MWth is heat input on HHV basis; Solid fuels include biomass; Nm3 is at one atmosphere pressure, 0 C.; MWth category is to apply to the entire facility consisting of multiple units that are reasonably considered to be emitted from a common stack except for NOx and PM limits for turbines and boilers. Guidelines values apply to facilities operating more than 500 hours per year with an annual capacity utilization factor of more than 30 percent.

2.8 International and National Environment and Conservation Organizations

2.8.1. International and National NGOs

International environmental and conservation organisations such as IUCN and the World Wide Fund for nature (WWF) have been active in Pakistan for some time.

Both these organisations have worked closely with government and act in an advisory role with regard to the formulation of environmental and conservation Policies. Since the convening of the Rio Summit, a number of national environmental NGO's have also been formed, and have been engaged in advocacy, and in some cases, research.

2.9 SCIL Corporate Requirements

2.9.1. Corporate HSE (Health, Safety, Environment) Policy

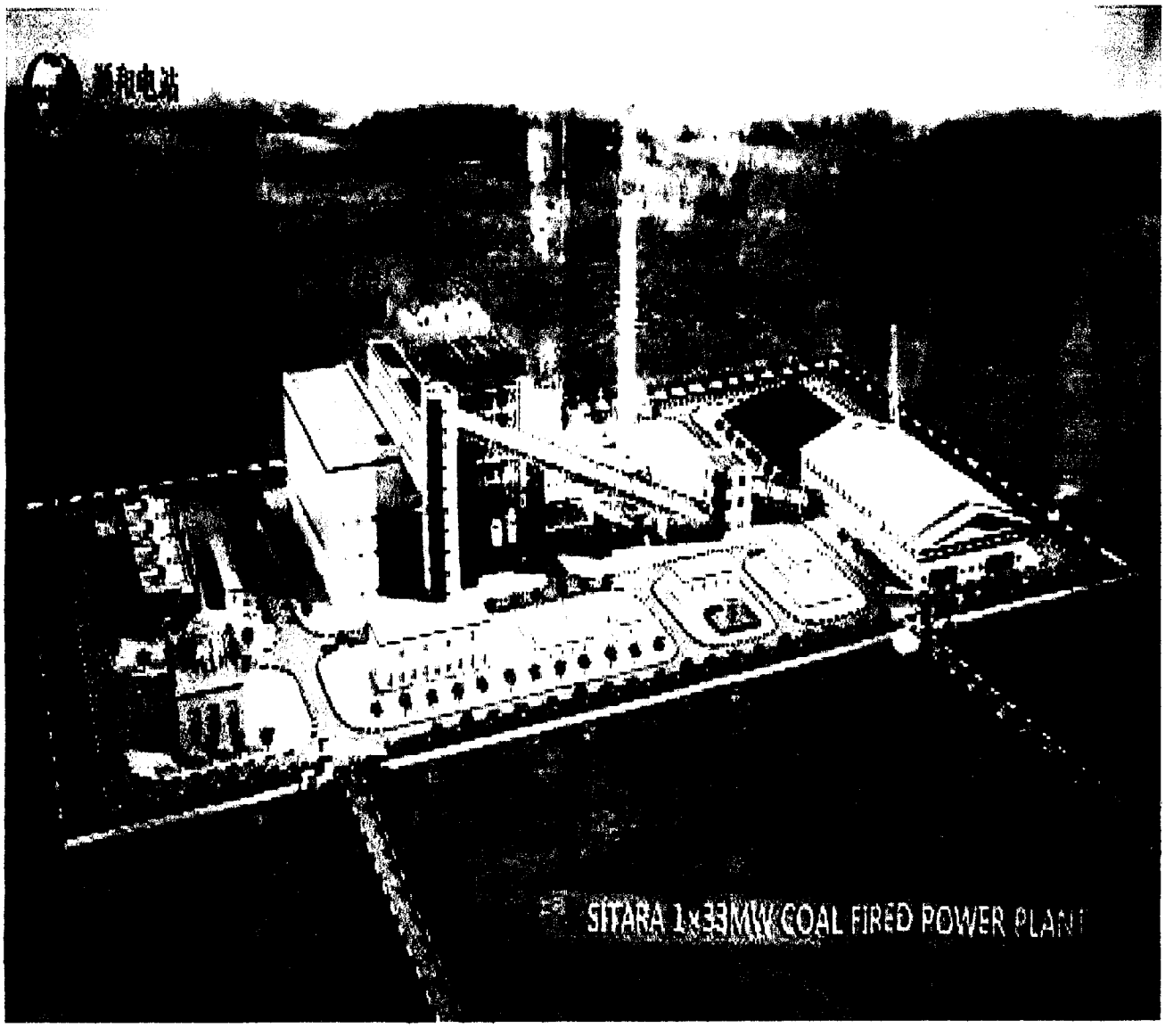
Sitara Chemical Industries Ltd (SCIL) is committed to enhance its contribution towards the community it operates in by continuing to maintain its social responsibility focus on Environment, Water Conservation, Education, Health and other social uplift programs.

Sitara Chemical Industries Ltd (SCIL) is committed to continual improvement of its Environmental Management System (EMS) by adoption of appropriate pollution prevention measures and complying with all relevant environmental legislation /regulations through training, teamwork and procedures as implemented from time to time.

Sitara Chemical Industries Ltd. is also committed to remain alert and advance to continuously grow as a Quality Symbol for its products and in meeting industrial and consumer requirements, through training, team work, and procedures, on time, every time.

35MW Coal Fired Power Project (Sitara Chemicals)

Feasibility Study Report



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Chapter I General

1.1 Introduction

The project proponent Sitara Chemical Industries Ltd (SCIL) aimed to install 35MW coal fired power plant at Faisalabad. The proposed project would be installed in close proximity of existing Sitara Chemicals Industries.Ltd (SCIL) at 32km Faisalabad -Sheikhupura road. The total area occupied by the proposed project would be 16 acres of land. Imported and local coal would be utilized as fuel for the generation of power from steam turbines.

This IEE has been prepared to conform with the requirements of the Pakistan Environmental Protection Act 1997 (PEPA), the Pakistan Initial Environmental Examination and Environmental Impact Assessment Review Regulations 2000 and the guidelines provided in the Pakistan Environmental Assessment Procedures, 1997. SCIL has involved SGS Pakistan (Private) Limited to undertake the required assessment. This report presents the IEE process and its findings, project alternatives, project impacts, and mitigation measures to be implemented during the execution of the proposed activities.

1.2 Assessment Methodology

This study has been conducted using standard environmental assessment methodology, in accordance with national and international environmental guidelines. The study evaluates the proposed project according to the environmental assessment requirements of the Pakistan Initial Environmental Examination and Environmental Impact Assessment Review Regulations 2000.

In addition, the environmental international guidelines such as the World Bank environmental guidelines and International Finance Corporation (IFC) guidelines have been consulted.

1.3 Project Location

The project pertains to the installation of 35MW coal fired power plant is adjacent to Sitara Chemical Industries.Ltd located at 32km Faisalabad Sheikhupura road. The proposed project lies in the Union Council 28, Johal town, tehsil Jaranwala, district Faisalabad. A key map showing the location of project area is shown in Figure ES 0.1.

1.4 Proposed Project Activities

The proposed project will entail the following activities:

- Construction and Commissioning Activities
- Operation Activities

Purpose and Scope of the Study

The purpose of this IEE is to evaluate the activities associated with the proposed project according to the Pakistan Initial Environmental Examination and Environmental Impact Assessment Review Regulations 2000 and international environmental guidelines, such as those of the World Bank and IFC.

The specific objectives of this IEE are to:

- Assess the existing conditions in the project area and develop a baseline of its current environmental and socioeconomic conditions:
- Assess the proposed activities of the project to Identify their potential impact, evaluate these effects, and determine their significance;
- Propose appropriate mitigation and monitoring measures that can be incorporated into the project's design to remove or reduce negative impact as far as possible, and to control and monitor any residual impact (i.e. the effects that remain after mitigation measures are implemented);
- Prepare an IEE report for submittal to Punjab Environmental Protection Agency.

1.5 Project Alternatives

A number of alternatives to the main technology/philosophy proposed for the project were considered. It includes a discussion of the alternatives, their criteria for selection, comparison and selection of the preferred option that is most practicable within the defined economic, social, environmental and safety constraints. Project Alternatives were evaluated taking into consideration the principles of sustainable development and other defined criteria. In particular it outlines the following project options:

- The "No Development Option";
- Preferred and alternative Site Options
- Technology Alternative

All the above alternatives were analyzed and most feasible option was adopted.

1.6 Environmental and Socio-economic Baseline Studies

The project area is defined as 'the areas where the project related activities to be carried, include the proposed project site and surroundings and the areas that can interact with various aspects of the project. The environmental impact of any activity or process is assessed on the basis of a deviation from the baseline or normal situation. Following are the main components of the baseline:

- Physical Environment
- Biological Environment

- Socioeconomic Environment

The baseline data on above components were collected through desk-top surveys, literature review; field surveys; existing information sources and data purchase, meetings and data gathering from various organizations.

1.7 Description of the Environment

1.7.1 Physical Features & Topography

The proposed geographical location for the power plant is adjacent to Sitara Chemical Industries Ltd located at 32km Faisalabad -Sheikhupura road where major industrial and commercial units are located at Lahore-Sheikhupura-Faisalabad road.

The project lies in district Faisalabad and it has detail background history. Faisalabad previously known as Lyallpur was established as a Mandi Town in 1895 as a part of the program of colonization of West Punjab. It was formerly a part of Tehsil Jhang of Multan Division. The city of Faisalabad is situated in the center of the lower Rachana Doab, the area between Chenab and Ravi rivers, which has a mild slope from North-East to South-West with an average of about 0.2 to 0.3 meter drop per kilometer or about 1 to 1.5 feet per mile. The city is situated at an elevation of about 183.35 meters above the Sea level. The topography is however marked by valleys, local depression and relatively high ground.

1.7.2 Seismicity

Pakistan lies on an active seismic belt of earth. Seismic observations indicate that hundred of shocks originate every year. Mostly, these seismic waves are of low intensity and do not have significant effect. According to seismic zones of UN-Habitat the project area falls under Zone 2A.

1.7.3 Geology and Soil

The city is located on the "Bar Upland" which is relatively older alluvium deposit as found in the central part of the road. Because of its elevation above the bordering flood plains, the upland is generally beyond the reach of flood spills, which is the significant physiographic feature of the alluvial plan. Like other Punjab plains, the alluvium is quaternary and has been deposited on semi-consolidated tertiary rocks or on a basement of metamorphic and igneous rocks of Precambrian age. It emanates from the mountain ranges of the north and has been deposited by the present and ancestral streams. The deposition is predominantly fluviatilo sediments.

1.7.4 Climatic Zone

The meteorological data from Faisalabad has been used to identify the baseline climatic condition of the project area and surroundings. The proposed project lies in arid climate region which has hot summers and moderately cold in winter. It is located in the region

that encounters four seasons, the hot summer starts from May and continues till July, monsoon starts from July and continues to September while winter season end in February starting from November and spring season lasts for two months from March and April. The last five years annual rain fall data from 2009 to 2013 shows variation between -1 - 243.1 mm.

1.7.5 Water Resources

Surface waters resources are usually exposed to the surface of earth in the form of mobile and immobile situation which includes snow-clad mountains, rivers, on-river streams, rain, sleet, wetlands and oceans.

Among surface waters, district & near the project extremities there is a distributory canal (Rakh Branch) which is used for the irrigation purpose and etc.

The groundwater table in the project area normally exists 40 to 50 ft below the ground level and contains high level of salinity.

1.7.6 Floral Attributes of the Project Area

Most of the study area comprises of agricultural lands especial of wheat crop with presence of shrubs and grass in the surroundings. Based upon observations during the field visit many species of plants were directly observed in the project area. A detailed list is provided in Chapter 4 of the report. The major common species are Albizzia lebbek, Alhaji maurorum, Dalbergia sissoo Roxb, Acacia nilotica, Azadirachta indica (L.) Adelb.

1.7.7 Faunal Attributes of the Project Area

Based upon observations during the field visit many species of birds were directly observed in the project area. The most favorite habitat of the Avian fauna were found in the surroundings of the study area especially trees in agricultural fields and Tamarix shrubs. Most common species includes House sparrow, House crow, Red vented Bulbul, Myna and Chiffchaff. All these species are also commonly found in other ecological zones of the country.

Total 10 mammalian species have been recorded. Dense vegetation provide living shelter to the mammals like Asiatic Jackal, Five Stripped Palm Squirrel, Indian Crested Porcupine, Indian Desert Jird, Indian Gerbil, Cape Hare, Small Indian Mongoose, House Mouse, House Rat, and Jungli Cat. All the 10 species are commonly found in the project areas as well as in country and no any significant threat can be expected from any activity. During the study several types of burros and droppings were found which indicate the presence of respected reptiles.

None of the reptiles and mammalian species found here are listed under any category of the IUCN Red List. Ten species of reptiles were also recorded including snakes, lizards and agamas. Only one species i.e. Indian cobra is listed as Data Deficient in the IUCN Red

List.

1.7.8 Socioeconomic Environment

A detailed socioeconomic survey was carried out in and around the project area. The purpose of the survey was to enumerate, evaluate and assess the existing social, cultural and economic conditions and to determine the communities' requirements. During field survey, public consulation was carried with different age group of community members. A total of 26 community members were interviewed during field survey.

The proposed project lies in the UC-28, Johal town, tehsil Jaranwala, district Faisalabad. Sitara Chemicals Limited is situated in north side of the proposed project, Chak 97 RB Johal lies in south, Chak 93 RB Chitti Kalan in the east while Ahmed town is situated in the west side of the proposed coal based power plant. The project area is mixed with agricultural and barren lands, industrial and residential activities. The estimated population in the nearest Chaks of the project area is expected to be more than 50 thousands individuals. There is no specific tradition on specific occasion and are same as other cities of Punjab.

There are no clashes found in the area, people live peacefully however there is a combination of different cast and creeds and religions because district Faisalabad is industrial city and people from different cities live for the jobs and different business. Major casts dwelling there, are Sheikh, Araeen and Rajput.

District Faisalabad is an industrial and commercial city having multi-occupations. The main occupation of the people is business and jobs in different industries. The remaining small portion of the population is having different occupation including government and private services as well as agriculture. The women also assist their men in the economic activity in different fields of business, service, education and other institutions. Women mostly serve in schools, colleges and hospitals. Faisalabad is generating large number of employment opportunities for its locals and outsiders. Industrial areas are using manpower, while nearby towns are providing business opportunities to the residents. The source of irrigation in the areas is the Canal (Rakh branch) which is near to the project area. Agriculture is one of the most important economic activities in the project area.

The literacy ratio of the district Faisalabad is 60%, with a split of 60% for males and 40% for females. There are sharp differences in the literacy ratios by sex and areas. There are different government and private sector school near the vicinity of project area. People go to Faisalabad and other cities of Pakistan for university education. Hospitals exist in the project area. There is government hospital or Basic Health Unit (BHU) available at Chak 91 and 96 RB. The nearest BHU from the project site is in Chak No. 91 and 96 RB serving for general health. One male doctor with other staff covers the population. There is a Sitara primary heath care unit in Chak No. 61.

The project area is rich in the means of transportation. The nearest main road is Lahore-Sheikhupura-Faisalabad road which connects the locals with other major urban areas like, Shahkot, Kharrianwala and Faisalabad. Chinchi (four seated vehicle supported by

bike), Rickshaw, bikes and some buses are the means of transport for the residents of the area. Power supply line goes all along the project area, and approximately 90% of the community is able to acquire electricity.

The general public from the communities didn't express any major concern regarding the proposed project. The main concerns which were identified during survey of project area are as follows:

- Priority for employment should be given to residing communities; and
- Sitara chemicals should provide more electricity to nearby areas as they have practiced in the past.

1.7.9 Potential Project Impact and Mitigation

The potential impacts associated with the proposed project construction and operation activities included: soil erosion due to earthwork, vehicle movement; minimal soil contamination; increase in water consumption, air pollution, generator exhausts and fuel combustion, waste generation, noise and disturbance; loss of vegetation and habitat; increased pressure on the wildlife of the area.

The physical scarring caused by clearing and leveling during plant site construction activities could lead to alteration of soil quality by removal of topsoil, loses of plant cover and limited soil erosion induced by disturbance to native soil. The land is almost cleared and leveled and no major earthwork is required.

Water will be required during proposed project activities. Ground water will be primary source of water supply which will be extracted from ground water through the installation of tube wells. The water in the area is abundant and groundwater is available at 40-50ft depth. A water management plan will be developed. The plan will also include strategies to minimize water use (and therefore volume of discharge) and maintain reserves.

The ambient air quality of the area may be affected by exhaust emissions from the generators, vehicles and combustion of coal. The pollutants may impair human health and ecological environment and other materials. The emissions include sulphur dioxide, oxides of nitrogen, carbon monoxide, carbon dioxide, and particulates (which may contain trace metals). A significant impact will be interpreted if the concentration of pollutants in the ambient air exceeds the NEQS or recognized international guidelines for ambient air quality such as World Bank and World Health Organization (WHO) ambient air quality guidelines.

The fuel used for the proposed project will be imported coal from Indonesia and South Africa and local coal will only be used as back-up. Monitoring of Ambient air parameters (PM10, SO2, and NoX) emissions should be carried out to ensure compliance with the NEQS and World Bank emission guidelines.

SCIL will implement a thorough waste management plan to ensure that any impact resulting from waste generation and management shall be minimal. The recyclable waste will be disposed off, as per waste management plan. No hazardous chemical will be uncontrollably discharged into the environment. A waste management plan will be

developed and implemented by considering the best technological and environmental options and will apply the "Reduce, Re-use, Recycle" hierarchy.

All waste disposals will be according to waste management plan as developed later before start of construction phase. Recycling of ash will be the preferred option for ash disposal. SCIL is planning to construct a bricking making unit in the future for utilization of ash. This ash can also be given to the cement and construction industry by consulting and entering into agreements with cement factories and other construction industries for utilization of the ash.

Noise has the potential to cause an impact to nearby communities and working personnel. To avoid the impact of noise, it will be ensured that vehicles and other potentially noisy equipment used are in good condition. All on-site personnel will use required personal protective equipment (PPE) in high noise areas that will be clearly marked.

To mitigate the project's impacts on the biological resources of the area, following measures will be incorporated into its design;

- Clearing of vegetation will be kept to an absolute minimum.
- Local wood for fuel will not be used.
- A 'no-hunting, no-trapping, no-harassing' policy will be strictly enforced.
- All the wastes will be properly handled, stored and disposed through implementation of an effective waste management plan.

Chapter II Project Details and Prospective

[Regulations 3 (6) and Schedule III of the National Electric Power Regulatory Authority Licensing (Application and Modification Procedure) Regulations, 1999]

1. General

The facility includes a coal-fired electric Power Plant located on the site and the Company Interconnection Facilities (but excluding the Power Purchaser Interconnection Facilities) having a design capacity of approximately 35MW (gross ISO).

The description set out herein below is intended to be an indicative broad outline only; and, may change in accordance with evolving Project needs.

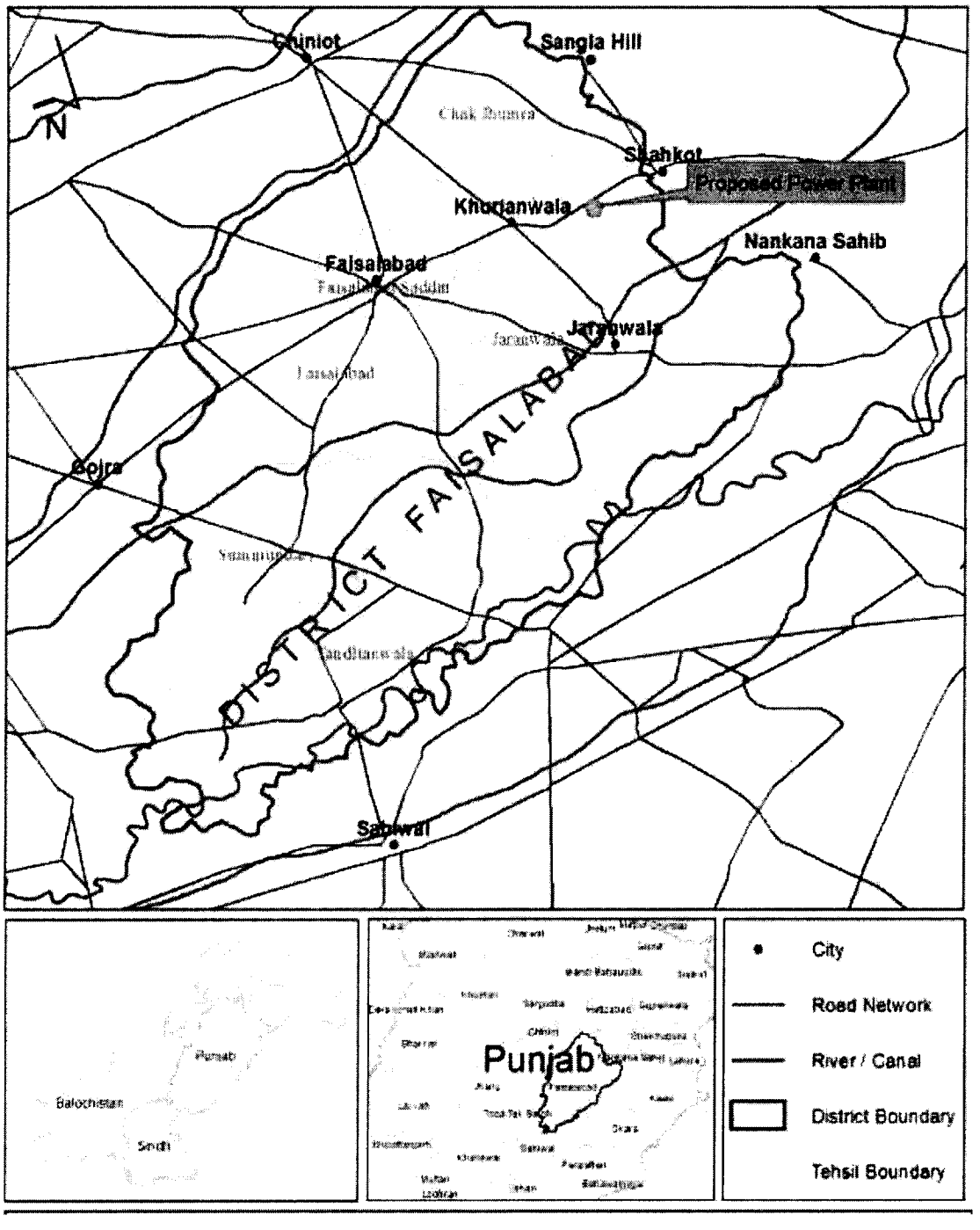
2. Power Plant

The Power Plant consists of one set of 35MW unit with one boiler, steam turbine and generator. The boiler is fueled by imported sub-bituminous coal which will be transported by means of railway and 22-wheeler trucks. Mechanical draft cooling tower will be used for cooling water. Boiler adopts limestone addition for desulphurization. The Power Plant connects with grid by 11kV outgoing transmission system.

2.1 Ambient Conditions

2.1.1 Site Location

The proposed geographical location for the power plant is adjacent to Sitara Chemical Industries Ltd located at 32km Faisalabad -Shiekhupura road. The proposed project lies in the Union Council 28, Johal town, tehsil Jaranwala, district Faisalabad. Sitara Chemical Industries Ltd (SCIL) is situated in north side of the proposed project, Chak 97 RB Johal lies in south, Chak 93 RB Chitti Kalan in the east while Ahmed town is situated in the west side of the proposed coal based power plant. The project area is mixed with agricultural and barren lands, industrial and residential activities. The total area occupied by the proposed project is 19 acres of land. Land for the proposed power plant is owned by SCIL.



2.1.2 Transportation

Sitara Chemical Industries Ltd. is geographically adjacent to main Sheikhupura-Faisalabad road, has favorable internal traffic conditions, only 18 km from the national railway lines, and only 42 km from Faisalabad Airport.

2.1.3 Site Conditions

The city is situated at an elevation of about 191 meters above the Sea level. The topography is however marked by valleys, local depression and relatively high ground.

2.1.4 Meteorology

The meteorological data from Faisalabad has been used to identify the baseline climatic condition of the project area and surroundings. The last five years data was obtained from Pakistan Meteorology Department meteorological station at Faisalabad to have an overview of the area's climatic regime. The last five years annual rain fall data from 2009 to 2013 shows variation between 1-243.1 mm, monthly minimum temperature in the area varies from 3.5 to 28.6 C° and mean monthly minimum temperature were found 16.6 - 41.9 C°. The relative humidity in project region varies from 19 to 70 %. The highest humidity in the area was recorded70 %, which was in the month of August 2010. The monthly average of wind speed is ranging from 0.4 to 7.6 Knots. Regular meteorological elements for the project are shown in following table.

Mean Monthly Precipitation (mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2009	12.2	18.4	12.0	34.8	12.1	5.0	60.6	163.9	49.4	8.5	-1.0	0.0
2010	1.4	8.7	8.0	3.5	7.8	5.8	243.1	224.3	40.6	0.0	0.0	1.5
2011	0.0	34.4	8.1	16.8	10.3	68.7	151.4	89.9	165.3	-1.0	0.0	-1.0
2012	6.6	8.0	1.0	39.1	3.7	0.2	98.2	19.4	138.5	28.2	0.0	18.4
2013	2.5	59.5	4.8	25.4	7.0	98.6	3.0	159.0	2.0	13.0	3.3	0.0

Mean Monthly Minimum Temperature (C)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2009	6.1	8.6	13.3	18.4	24.4	25.7	26.8	26.4	23.5	16.5	9.9	5.0
2010	4.7	8.3	15.5	21.0	25.0	26.5	26.5	25.6	23.2	19.0	10.2	4.5
2011	3.8	8.7	13.3	18.3	25.6	27.5	26.7	26.5	24.5	18.6	13.5	4.6
2012	3.5	5.5	12.6	19.2	24.6	27.7	27.7	26.9	24.3	17.2	11.4	6.6
2013	4.3	8.9	13.7	19.6	24.2	27.5	28.6	27.3	25.3	21.1	10.8	7.1

Mean Monthly Maximum Temperature (°C)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2009	20.2	23.4	28.3	34.0	40.4	41.0	38.0	37.0	35.6	33.5	26.2	22.6
2010	16.6	22.5	30.9	38.8	40.7	40.4	36.5	34.9	34.3	33.6	27.8	21.7
2011	16.9	21.4	27.9	33.1	40.9	39.4	36.0	35.0	33.7	33.1	28.6	22.5
2012	18.6	20.2	27.7	33.4	39.4	41.9	39.0	37.1	34.3	31.5	26.9	20.5
2013	17.8	20.6	28.1	34.1	40.4	40.1	38.1	35.9	36.9	33.8	26.5	21.5

Mean Monthly Relative Humidity (Mean) at 1200 UTC (%)

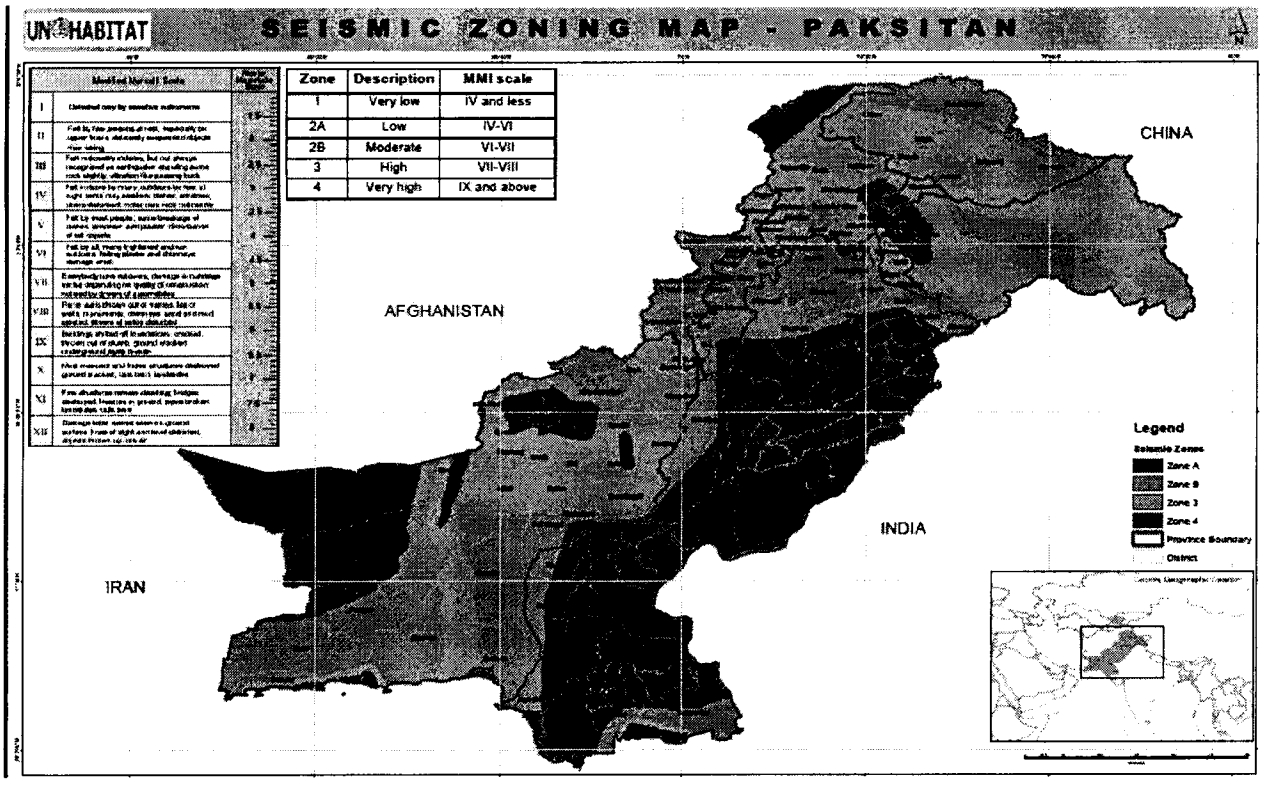
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2009	55	47	39	29	21	24	48	55	47	34	47	43
2010	67	44	37	19	19	27	55	70	53	42	40	48
2011	50	53	39	28	23	37	57	63	63	40	47	42
2012	42	33	31	36	20	26	45	53	57	41	46	54
2013	47	57	40	27	19	37	49	59	45	46	45	55

Mean Monthly Wind Speed at 1200 UTC (Knots)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2009	1.1	2.5	3.8	6.9	4.9	7.1	6.4	7.6	4.6	0.9	0.8	0.5
2010	1.9	3.7	4.5	5.4	5.9	6.8	5.9	5.2	4.0	2.2	0.4	0.5
2011	1.8	2.6	3.9	6.0	5.7	5.4	4.2	4.8	4.0	3.2	0.7	0.8
2012	2.5	4.4	4.2	5.4	4.6	7.0	6.3	6.5	5.4	2.3	0.7	1.1
2013	1.4	4.5	4.7	6.1	6.7	6.4	5.8	6.1	6.3	2.5	0.7	1.0

2.1.5 Water Source

The project area lies in the district of Faisalabad; the groundwater table normally exists 40 to 50 ft below the ground level and contains high level of



salinity. Deep well water from a borehole of 505 ft depth will be used for project purposes by means of a water turbine.

2.1.6 Seismic Condition

Pakistan lies on an active seismic belt of earth. Seismic observations indicate that hundred of shocks originate every year. Mostly, these seismic waves are of low intensity and do not have significant effect. According to seismic zones of UN-Habitat the project area falls under Zone 2A.

2.1.7 Geology and Geotechnical Engineering

The Project site is relatively stable region and favorable for construction by reason of active faults are far away from the Project site and no strong earthquake hit the site before even if seismic geological structure of the region is fairly strong.

The city is located on the "Bar Upland" which is relatively older alluvium deposit as found in the central part of the Doad. Because of its elevation above the bordering flood plains, the upland is generally beyond the reach of flood spills, which is the significant physiographic feature of the alluvial plan. Like other Punjab plains, the alluvium is quaternary and has been deposited on semi-consolidated tertiary rocks or on a basement of metamorphic and igneous rocks of Precambrian age. It emanates from the mountain ranges of the north and has been deposited by the present and ancestral streams. The deposition is predominantly fluviatilo sediments.

2.2 Reference Conditions

2.2.1 Meteorological conditions

1. Temperature:
 Max= 50°C
 Min= 0°C
2. Relative Humidity= Avg: 20-30% (Annual)
3. Barometric Pressure= 760mmHg
4. Rainfall= Avg: 50mm/month
5. Earthquake= Seismic Factor (k)

2.2.2 Wind Speed

Design wind speed is 110 Km/hour.

2.2.3 Coal Quality

Coal imported from Indonesia/South Africa will be used for the project. The analysis of design coal is given in the table below.

Description	Characteristics
Proximate Analysis (% ar)	
Total Moisture	10.3
Inherent Moisture	5.5
Ash	5.8
Volatile Matter	39.39
Fixed Carbon	44.52
Chlorine	0.0095
Specific Energy (as received)	
Gross Calorific Value (Kcal/kg)	6502
Ultimate Analysis (% ar)	
Carbon	56.61
Hydrogen	4.65
Nitrogen	1.59
Oxygen	10
Sulphur	1.58
Ash Analysis (%)(DB)	

SiO_2	48.22
Al_2O_3	22.34
Fe_2O_3	16.18
CaO	2.23
MgO	3.24
Na_2O	0.27
K_2O	1.16
Mn_3O_4	0.03
TiO_2	1.36
P_2O_5	1.14
SO_3	4.08
Phosphorus in coal(A.D.)	0.75
Undetermined	
Ash Fusion Temperature (°C)	**Reducing**
I.D.T. (deformation)	1200
S.T. (softening)	1220
H.T. (hemispherical)	1270
F.T. (fluid)	1320
Ash Fusion Temperature (°C)	**Oxidizing**
I.D.T. (deformation)	1250
S.T. (softening)	1350
H.T. (hemispherical)	1410
F.T. (fluid)	1420
Hardgrove Grindability Index (HGI)	48

2.3 Capacity of the Plant at Reference Conditions

The Project has following design ratings at reference site conditions based on LHV of the fired coal:
Gross Capacity of Power Plant: 35MW
Net Capacity of Power Plant: 30MW
Gross Efficiency of Power Plant: 41%
Net Efficiency of Power Plant: 38%

2.4 Performance Curves

The Company will provide all performance and correction factors/curves for the units which include but not limited to the following:
Turbine exhaust steam pressure versus output (base load) and heat rate
Power factor versus output
Unit start-up curves

2.5 Civil Structure Safety Design Factor

The design peak ground acceleration is 0.12g; the corresponding seismic intensity is VII as per Richter scale, the design basic wind speed is 110km/h.

2.6 Description of the Plant

2.6.1 PROPOSED PLANT SPECIFICATIONS

A 35MW coal fired power plant (CFPP) will be installed at SCIL site. The basic design parameters for CFPP are:
Capacity: 35 MW
Power Technology: Circulating Fluidized Bed (CFB) type Coal Fired Boiler, Capacity: 150 TPH @ P: 9.8 MPa & Temp: 540^{o}C. Lime Stone Injection to remove SOx in furnace.
Steam Turbine and Condenser: Condensing Steam Turbine / Generator, **Capacity:** 35MW equipped with bleed steam facility.
Steam Conditions: Steam flow rate: 150TPH @ P: 9.8 MPa and Temp: 540^{o}C.
Fuel: Imported coal will be used 100% .Local coal up to max.6% sulfur will also be used as a back-up.
Cooling System: Water Cooled Condenser (WCC) backed by Cooling Towers
Emission Controls: Lime Injection, Fabric Bag Filter (FBF) and Flue Gas De-sulfuirization (FGD).

2.6.2 MAJOR SYSTEMS OF THE PROPOSED PLANT

The major systems of the proposed plant include: Coal handling and processing system

A. Circulating Fluidized Bed (CFB) Boiler
B. Steam turbine and condenser
C. Electrical power generator and power export system
D. Flue gas treatment system
E. Cooling water system
F. Ash handling system
G. Utilities and waste management system

H. Boiler feed water treatment system
I. Fire fighting system.

Simplified schematic diagram of the proposed power plant is shown in Figure 3.2.

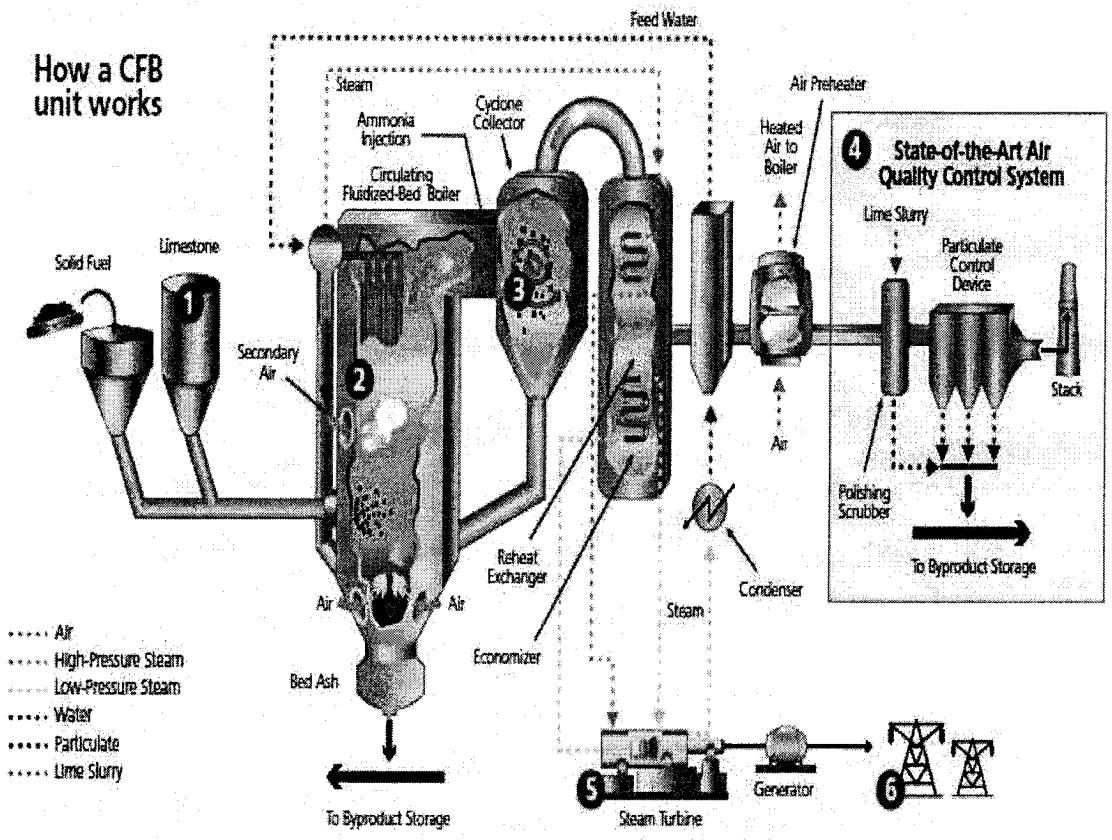
Coal for the power plant will be received at the coal yard, part of the coal storage, processing and supply system (A). Coal will be from Indonesia or South Africa. Within this system the coal will be processed for feeding into the boiler. The heat from the combustion of coal in the Circulating Fluidized Bed (CFB) Boiler (B) will be used to generate steam at high pressure. The steam will then be fed into the steam turbine (C), where it will rotate the turbine to generate mechanical energy. The steam, after passing through the turbine, will be condensed back to water and to be re-injected into the boiler. The steam turbine will operate the power generator (D), which will generate electricity. The voltage of the electricity will then be increased or 'stepped-up' and exported through the high tension transmission system.

Flue gas from the boiler is normally laden with pollutants, oxides of nitrogen, particulate matter and sulfur dioxide. The gas will be passed through a series of treatment units (E) before being discharged to the atmosphere. In the treatment system, pollutants from the gas will be removed. Cooling water is required for condensation of the steam at the low-pressure end of the steam turbine. The water will be obtained from the cooling water system (F).

The water source for the proposed project will be the ground water.

Bottom ash from the boiler and fly ash from the flue gas treatment system will be collected and disposed of through the ash handling system (G). Finally, several supporting systems (H) are also required for plant operations. These include the water treatment system for feeding the boiler and the effluent treatment and disposal systems for the wastewater generated by the plant.

The new coal-fired power plant will be erected adjacent to SCIL existing facility. It will consist of two 35MW CFB, coal fired units, and one unit will be installed in the first stage whereas the second unit will be installed later on in second stage. Coal will be imported from Indonesia or South Africa and transported by shipping while inland transport from Karachi (Kemari Port) to Faisalabad (SCIL site) by KLP Road through truck / trailers (22 Wheeler) of carrying capacity 70-80 Tons (approx) or through railway bogies from Karachi (Kamari Port / City Railway Station) to Faisalabad (Sangla Hill Railway Station). The bottom ash will be disposed-off by land filling while fly ash will be sent to brick and construction industry and will be used as cement additive.



2.7 TECHNOLOGY DESCRIPTION OF THE PROPOSED POWER PLANT

2.7.1 FUEL INPUT

Fuel (crushed 6 -12 mm x 0 size) and limestone are injected into the furnace or combustion chamber of the boiler while air (primary and secondary) is blown in, to "fluidize" the mixture. The fluidized mixture burns at a relatively low temperature and produces heat. The limestone absorbs sulfur dioxide (SO2), and the low-burning temperature limits the formation of nitrogen oxide (NOX) - two gases associated with the combustion of solid fuels.

2.7.2 CIRCULATING FLUIDIZED BED (CFB) BOILER

Circulating Fluidized Bed (CFB) technology utilizes the fluidized bed principle in which the particles are suspended in a stream of upwardly flowing air (60-70% of the total air) which enters the bottom of the furnace through air distribution nozzles. The balance of combustion air is admitted above the bottom of the furnace as secondary air. While combustion takes place at 840-900C, the fine particles (<450 microns) are elutriated out of the furnace with flue gas velocity of 4-6 m/s. The particles are then collected by the solids cyclone and circulated back into the furnace. This combustion process is called circulating fluidized bed (CFB). The particles'

circulation provides efficient heat transfer to the furnace walls and longer residence time for carbon and limestone utilization. Similar to pulverized coal (PC) firing, the controlling parameters in the CFB combustion process are temperature, residence time and turbulence.

2.7.3 CYCLONE COLLECTOR

The cyclone is used to return ash and unburned fuel to the combustion chamber for re-burning, making the process more efficient.

2.7.4 STATE-OF-THE-ART AIR QUALITY CONTROL SYSTEM

After combustion lime is injected into the "polishing scrubber" to capture more of the SO2. A "bag house" (particulate control device) collects dust particles (particulate matter) that escape during the combustion process.

2.7.5 STEAM TURBINE

The high-pressure steam spins the turbine connected to the generator, which converts mechanical energy into electricity.

2.7.6 TRANSMISSION LINES

The electricity produced from the steam turbine/generator is routed through substations along transmission lines and delivered to SCIL use.

2.7.7 DESIGN COAL SPECIFICATION

The main fuel for the SCIL power plant will be imported coal, local coal will only be used as a back-up with maximum 6% sulfur content. The design specification of selected international and local coal is given in below Table 3.2.

Parameters	*Test Results*			
	Indonesia	*South Africa*	*Pakistan*	
Carbon	69.64%	73.13%	60.09%	50.90%
Hydrogen	4.90%	3.93%	5.88%	5.06%
Nitrogen	1.68%	1.72%	1.86%	1.54%
Oxygen	10.53%	7.41%	24.72%	21.05%
Sulphur	1.65%	0.59%	0.68%	2.72%
Total Moisture	5.5%	8.1%	12.92%	10.86%
Ash	6.1%	13.22%	6.76%	18.73%

.2.7.8 COAL TRANSPORTATION AND HANDLING

Coal will be imported from Indonesia and South Africa and transported by shipping while inland transport from Karachi to Faisalabad (SCIL site) by KLP Road through truck / trailers or through railway bogies from Karachi to

Faisalabad. For transportation of coal, trucks and railways will be used as under:

Option -1: Coal will be transported from Karachi to Faisalabad (Gatti station) via train from Gatti station to SCIL site through trucks; or
Option -2: Coal will be transported from Karachi to SCIL site via trucks;
Coal yard will be designed without crane and will have steel structure. Coal shed will be designed with a crane of 05tons capacity with steel structure cover. The coal yard and coal shed will be integrated together. Coal consumption of the boiler is roughly 17tons per hour. Considering two shifts operation 17hors×17tons, but SCIL will have coal bunker capacity of 250tons.

2.8 POWER PLANT CONSTRUCTION

The proposed power plan will be take approximately 18 months for construction installation and commissioning. SCIL plans to start the construction activity for the proposed power plant by end of October, 2014 and expected to commission/operation will be started by end of December, 2015.
Typical activities that are conducted during the civil construction are listed below:

- Construction camp setup and mobilization of contractors
- Excavation for foundations
- Laying of foundations
- Masonry work
- Concrete work
- Asphalt work (pavement, roads, etc.)
- Finishing (plastering, painting, etc.)

The power plant and ancillary equipment, brought to site by road in sections, will be erected on site and commissioned. Typical activities that are conducted during plant erection are listed below:

- Site fabrication (equipment/pipe supports, equipment assemblies, etc.);
- Placement of the vessels and equipment (Steam turbine) on the foundations;
- Laying of pipes; Welding, joining, etc.
- Electrical installation (cabling, switchgears, transformers, etc.)
- Instrument installation (field instruments, control room instruments, instrument cabling, etc.); and
- Painting etc.

2.8.1 RESOURCES CONSUMPTION AND SUPPLIES

2.8.1.1 Staffing

It is expected that around 100~150 skilled and unskilled personnel will be required during construction activities of the project. Local people will also be hired for unskilled and semi-skilled work during project activities.

2.8.1.2 Water & Electricity Sourcing

Water required during peak construction period will be taken from groundwater well(s). Potable water collected for the power plant will meet NEQS for drinking water and WHO guidelines.

Electricity from WAPDA/SCIL captive power plant will be the primary source during the construction, testing and commissioning phase and afterward. Other supplies required during the construction phase include office and camp supplies.

2.8.1.3 Construction Material Sourcing

During the construction, a large amount of construction material will be required. This will include steel, cement, sand, and aggregates for road and pavement construction. Construction material will be mainly procured from Faisalabad district.

2.8.2 WASTE DISCHARGE

2.8.2.1 Gaseous Emissions

The primary source of gaseous emissions during construction activities will be diesel-engine driven generator exhaust and the transportation vehicles. Other emission sources include construction machinery, vehicle exhaust emissions, and dust emissions from excavation and other field activities.

2.8.2.2 Waste Disposal

Temporary pits will be dug and lined to act as septic tanks for the domestic waste water from the construction camp. The outflow from the septic tanks will be collected and evaporated in lined channels to prevent contamination of the underlying surface water aquifer. Waste material will be disposed off as per waste management plan.

2.8.2.3 Testing and Commissioning

After the completion of plant construction, fabrication, and installation of systems, the plant will be tested and commissioned.

2.8.3 DEMOBILIZATION AND SITE RESTORATION

On completion of the construction and commissioning phase, the construction contractor will demobilize from site and construction camp removed. Temporary infrastructure will be decommissioned and sites restored. This will involve:

- Removing the temporary construction camp
- Closing all the temporary waste pits
- Removing all waste and leftover construction materials from site
- Leveling and restoration of areas.

2.9 POWER PLANT OPERATIONS

A brief description of the whole process of coal fired power plant (CFPP) is mentioned below, while details of process and technology are discussed in Section 3.4 and 3.5 above:

1. The proposed power plant will be 'Coal Fired Power Plant' based on imported coal (Indonesia and South Africa) and local coal will be used as back-up.

2. Coal storage shed will be constructed at project site.

3. Lime stone will be injected into furnace to treat sulfur content in coal feed to minimize SOx emissions in ambient air.

4. Circulating Fluidized Bed (CFB) type boiler is the main technology selected for steam source.

5Highly refined quality water of EC < 0.1 µS/cm is fed into the boiler to avoid internal scaling.

6. Exhaust gases will be passed through FGD & FBF to minimize its corrosively for ambient air.

7. Emission of flue gases will be done through Stack of approximately 80m height for emission dispersions.

8. Super heated steam @ P: 9.8 MPa & T: 540°C will be produced to generate power through condensing type steam turbine generators (STG).

9. Low pressure exhaust steam is passed through Water Cooled Condenser (WCC) equipped with Cooling Tower for cold water supplies.

10. Bottom ash will be disposed-off by land fill. While fly ash will be disposed-off through brick making plant and used as cement additive.
The proposed power plant will produce about 35MW gross. The design of the plant will comprise of one condensing steam turbine / generator with capacity 35MW (Net) equipped with bleed steam facility. Imported coal from Indonesia or South Africa with low sulfur content will be used to generate power. Imported coal will be blended with local coal.

2.9.1 RESOURCES CONSUMPTION - OPERATIONAL PHASE

2.9.1.1 Staffing

It is expected that around 100 personnel skilled and unskilled staff will be appointed during operational phase of the project. Local people will also be hired during project activities.

2.9.1.2 Water consumption

Ground water for the plant operations would be extracted from ground water aquifer through tube wells. Approximately 2.5 cusec of raw water will be required during operation phase.

Main water usage will be the replacement for the cooling tower blow down. Other water uses will include generation of demineralized water for various plant operations, water for staff colony, horticulture etc.

2.10 WASTEWATER DISCHARGE AND TREATMENT SYSTEM

The water discharge from the proposed power plant can be categorized as, process wastewater, sanitary wastewater, storm water and coal ash. The major wastewater stream for the proposed plant will be cooling tower blow down. Other wastewater sources will include plant low volume wastes and sanitary wastewater. Power plant low volume wastes will include floor drain wastes, boiler blow down, demineralized regeneration wastes and filter backwash. SCIL will ensure appropriate treatment of wastewater if needed before discharge into natural drain.

2.11 ASH DISPOSAL

Recycling of ash will be the preferred option for ash disposal. SCIL can generate revenue by a proper planning of ash disposal. SCIL will adopt following options for ash disposal:

- Brick making;
- Sold to cement factory; or
- Landfill

SCIL is planning to construct a brick making unit in the future for utilization of ash. This ash can also be given to the cement and construction industry by consulting and entering into agreements with cement factories and other construction industries for utilization of the ash. The last option for ash final disposal includes landfill. SCIL will develop and manage a landfill area for the final disposal of ash. Meanwhile, lined ash disposal areas will be developed
in stages to store surplus ash that cannot be recycled.

2.12 PROJECT ALTERNATIVES

Alternatives are generated and examined to determine the best method of achieving project objectives, while minimizing environmental impacts. The analysis of some of the alternatives is not as exhaustive or strategic as would be required for public sector projects as the decision to invest in a particular sector is made by the project proponent. In some instances there will be an overlap between alternatives and mitigation measures, as alternative design, location, and technology are also a way of impact mitigation.

2.12.1 NO DEVELOPMENT OPTION

Pakistan, like most developing countries, faces a shortfall of power because of the excess of industrial and residential demand over the existing power-generating capacities. The installed capacity in Pakistan

comprised of hydel, thermal power plants including WAPDA, Electric Supply Companies, Independent Power Producers (IPPs), and nuclear.
The proposed project offers a chance to improve the country's energy balance and somehow to decrease the gap between the power requirement and power production. The 'No-action' or no development option shall prevent from exploring the potential to produce power. Loss of employment and development of infrastructure, are the other losses which will be a result of 'No-Action' option.

2.12.2 SITE SELECTION CRITERIA

The site proposed in the premises of SCIL, for the power plant is the most suitable on account of followings:

- Land is owned by the proponent and no additional land is acquired hence, there is no issue related to resettlement

- From management, safety, security and environmental point of view, single facility will be comparatively easy to handle.
- Locating the plant at other site will require additional resources like land, separate offices etc which has been avoided.

2.12.3 TECHNOLOGY ALTERNATIVES CIRCULATING FLUIDIZED BED (CFB) BOILER

The proposed power plant will use circulating fluidized bed (CFB) technology boiler. The technology is described in Section 3.5.2 in detail. Below sections describe the CFB boiler technology's environmental and economic benefits:
Environmental Benefits of CFB Technology
The CFB combustion process facilitates steam generation firing a wide range of fuels while meeting the required emissions such as sulfur dioxide (SO2) and nitrogen oxides (NOx) even more effectively than World Bank guidelines. The major environmental benefit of selecting CFB technology is the removal of SO2 (90-95%) and NOx (emission is less than 100 ppm) in the combustion process. When the limestone is injected into the furnace, the following reactions occur.
Oxidation of sulfur: S+O2 --> SO2
Limestone is calcined to form calcium oxide CaCO3 --> CaO + CO2 -425 kcal/kg (of CaCO3) Sulfur dioxide gas reacts with solid CaO
SO2 + 1/2 O2 + CaO --> CaSO4 (Solid) +3740 kcal/kg (of S)
The resulting calcium-sulphate-based ashes are chemically stable and are easily disposed. This ash can be used as raw material for cement manufacturing, soil stabilization, concrete blocks, road base, structural fills, etc. Limestone injection is required for fuels with sulfur greater than >0.5%. Lime (CaO) and unburned carbon content must be considered in re-use applications, depending on the fuel being fired. NOx present in flue gas generally comes from two sources: the oxidation of nitrogen compounds in the fuel (fuel NOx) and reaction between the nitrogen and oxygen in the combustion air (thermal NOx). With low temperature and staged combustion, the oxidation of fuel nitrogen is suppressed resulting in very

low NOx emissions. NOx emissions are <100 ppm with CFB. CO and hydrocarbon emissions in the CFB boiler are well controlled.

2.12.3.1 Economics of CFB Technology

CFB boiler has 8-15 percent lower capital costs as well as 5-10% lower operating costs than a pulverized coal (PC)-fired boiler because of the FGD system. In general, CFB-based power plants provide low emissions control costs and low O&M costs, which lead to lower life cycle costs. Since maintenance areas are very minimal in the CFB boiler, the availability of the boiler is relatively higher. The CFB design allows emissions reduction without significant capital cost, since SO2 and NOx removal are inherent within the combustion process.

2.12.3.2 Conclusion

Even though a number of competing technologies are available in the market for steam and electric power generation, CFB is an excellent choice due to its fuel flexibility, wider turndown without support oil/gas, superior environmental performance, lower operating and maintenance costs, and safe, reliable and simple boiler operation.

2.12.4 ENVIRONMENTAL CONTROL TECHNOLOGY

2.12.4.1 Particulate Matter (PM) Treatment Option

Particulate matter treatment technologies are Fabric Bag Filter (FBF), cyclones and wet scrubbers. For the proposed CFB boiler, Fabric Bag Filter (FBF) is the preferred alternative to control particulate matter emission in the flue gas. The exhaust hot flue gas from the boiler will carry the fine particle pass flows through the heat recovery area and then the fine particle will be captured by the FBF and transported to dry fly ash silos. The clean flue gas shall induce by induced draft fan and exhaust through chimney. The FBF has been selected to control PM emission since FBF can be applied to wide range of system sizes and should have no effect on combustion system performance. Besides that, FBF will enable the proposed project to meet the Pakistan NEQS emission standard.

2.12.4.2 SO2 Treatment Option

Several techniques are used to reduce SO2 emissions from coal combustion. Imported coal from Indonesia and South Africa will be used with less sulphur value to avoid the SO2 emissions. Flue gas desulfurization (FGD) systems are in current operation on several lignite-fired utility boilers. Post combustion FGD techniques can remove SO2 formed during combustion by using an alkaline reagent to absorb SO2 in the flue gas. Flue gases can be treated using wet, dry, or semi-dry desulfurization processes of either the throwaway type (in which all waste streams are discarded) or the recovery/regenerable type (in which the SO2 absorbent is regenerated and reused). Details on CFB technology and its efficiency for control of Sox emissions are described in Section 3.10.3. Based on the proposed design of CFB, SO2 emission will be controlled by

wet type FGD, with limestone is selected as SOx emission treatment option, due to the high rate of removal, plus the system will yield a marketable by-product Gypsum.

2.12.4.3 NOx Treatment Option

NOx control technologies are mainly two categories: primary control technologies and secondary control technologies. Primary control technologies reduce the amount of NOx produced in the primary combustion zone. In contrast, secondary control technologies reduce the NOx present in the flue gas away from the primary combustion zone.
The standard practice of CFB Boilers, with low temperature and staged combustion, the oxidation of fuel nitrogen is suppressed resulting in very low NOx emissions. NOx emissions are <100 ppm with CFB.

2.12.5 SELECTION OF IMPORTED COAL FOR THE PROJECT

Pakistan is currently embarking on diversifying its fuel mix for power generation. One of the proposed strategies is to import coal for newly designed boilers. SCIL placed a preference on Indonesian coals due to low sulfur varieties. Other similar coal is available in South Africa and Australia. Indonesian coal has been selected for its large quantity of coal reserves spread out over the majority of its country. An estimate made in 2010 shows that Indonesia has over 100 billion tons of coal inferred reserves, with over 20 billion tons proven reserves. Indonesian coal is, by large, sub-bituminous, with low ash, low sulfur, high volatilities and average gross calorific value. The main fuel for the SCIL power plant will be imported coal, local coal will only be used as a back-up with maximum 6% sulfur content. The design specification of selected international and local coal is provided in Table 3.2 above.

2.13 HEALTH, SAFETY AND ENVIRONMENTAL MANAGEMENT STANDARDS

The construction and operational phase of the project will have to meet the requirements of health, safety and environmental standards and HSE Policy of SCIL. SCIL standards highlight commitment on prioritizing health and safety of all its employees, contractors and visitors involved in its activities and confer overriding commitment towards minimizing impact of its activities on the natural environment. Moreover, following procedures and arrangements will be done during all phases of project activities.

- Personal Protective Equipments (PPE's);
- Complete first Aid Facility;
- Fire Protection & Prevention;
- Emergency preparedness plan and procedures. Safety measures for excavation / openings;
- Proper House Keeping;
- Maintenance & Equipment Inspections;
- Electricity Safety;
- Safe usage of Hand & Power Tools;
- Standard Scaffoldings & Ladders;
- Proper hoisting, cranes & lifting etc;
- Standard welding procedures;
- Safe handling of hazardous materials: Chemicals & Gas Cylinders;
- Safe working above ground levels;
- Necessary Weather Protection Measures;
- Safe working at confined places;
- Avoid working at fragile roofing & materials;
- Strict compliance of 'Warning signs;
- Proper Waste Management plan and procedures.

2.14 Training & Development

The contractor shall provide training, including on-site and training in the English language, so that such training is complete before commencement date, for suitably qualified and experienced O&M personnel in accordance with Progress Event schedule, to provide such personnel with the knowledge required to operate the Power Station in accordance with the O&M manuals, the manufacturer`s instructions and guidelines, and the level of competence of a reasonable and prudent operator.

The contractors shall undertake to train at site installation, operation and maintenance of the offered plant equipments, engineering personnel selected by the owner. The period and nature of training for the individual personnel shall be agreed upon mutually between the contractors and the owner covering the following areas as a minimum in order to enable these personnel to individually take the responsibility of operating and maintaining the power station in a manner acceptable by the owner.

i. Training on flue gas analyzers, as well as other Steam Generators/Turbine Generators/related E & I system equipment including related electrical areas such as generators and excitation system.

ii. Training for special packages for various PLC/DCS based systems.

The contractors shall provide the training equipment and material during training period. All the software, films, video CDs, transparencies, notes etc. used in the training programme shall remain the property of the owner at the end of the agreement.

The contractors supervisory and erection personnel deputed to site works shall continuously and intensively instruct and train the Owner`s personnel engaged in erection or operation and maintenance of the plant at site during erection, testing and commissioning as well as during operation and maintenance. This shall cover all aspects of site work on the plant including special instructions and care required in attending to various jobs, whether or not they are incorporated in the relevant manuals.

Chapter III Fuel Supply

3.1 Coal Source

Annual coal consumption of the 1 X 35MW units will be 180,000 ton. It's proposed to select cheap and reliable commercial coal from international coal market. The background and tendency of coal market, as well as coal quality, price, current and future production capacity, and transportation expense will be analyzed in this chapter. It's recommended that coal of Indonesia be as the main coal and coal of South Africa and local coal be an effective supplement. The coal boilers are designed to mix two or three kinds of coal from different countries according to coal price in different periods.

3.1.1 Imported Coal

3.1.1.1 Indonesia Coal

According to the statistical data from National Energy and Mineral Resources Department in 2013, the coal reserves in Indonesia are 58 billion tons. The proved reserves are 19.3 billion tons and 5.4 billion in them can be used for being exploited for commercial purpose. The coal reserves in many places have not been proved, the total reserves are estimated more than 90 billion tons. In Indonesia, the anthracite takes up 0.36%, bitumite 14.38%, sub bituminous
26.63%, and lignite 58.63%. The Indonesia coal has the following characteristic: high moisture, low ash content, low sulfur content, and high volatile matter. The sub bituminous calorific value is 5700-7200kcal/kg, volatile matter 3742.15%, and sulfur content
0.10~1.66%.

Generally, coal-bearing stratums are smooth with low burying depth and easy to be explored in Indonesia coalmines. The present exploring coalmines are open-pit mines. Indonesia coalmines are explored in scale and centralized way. Five large coal producers' production capability takes up more than 75% of the whole national coal production. Each producer's coal production capacity is from 15000000 ton to 35000000 ton. Indonesia coal production has been developing rapidly in recent 20 years from less than 100,000,000 ton in 2000 to 386,000,000 ton in 2012. Indonesia domestic demands for coal are very low with only 20% of the producing coal. Thus about 300,000,000 ton coal needs to be exported so that the credibility of the coal source can be guaranteed.

Indonesia mainly produces lignite. The percentages of production capacity for lignite, sub-bituminous and soft coal are 59%, 27% and 14%. there is only 0.5% soft coal. The main index of the coal like water content. volatile component. ash content. calorific value and etc. are nearly the same as the coal type designed for the boilers of this project.

Indonesia coal mines are mainly located near the coastal area or inland areas near water system. Several exclusive wharfs for coal exporting in some port have been established surrounding the coal production areas. Coal from the coal districts are firstly transported from coal districts to the

commodity storage yard or inland river wharfs by land way, then shipped to the loading port(or coal wharf) or the anchorage for large vessel shipping. The tonnage of the outbound vessel can reach 50000 ton. The shipping distance is 3900 miles from main ports of Indonesia to Qasim Port of Pakistan which is the shortest distance from the coal supplying port.

3.1.1.2 South Africa Coal

According to data from World Energy Council, the indicated reserves of soft coal, anthracite, sub-anthracite and lignite are 30,156,000,000 ton in South Africa (in which 81.5% low rank bitumite, 13.1% high rank bitumite and 5.4% soft coal), ranking the 6th after US, Russia, China, India and Australia. It takes up 10.6% of the global measured reserves. Nineteen coalfields of South Africa distributed in the area of 700km from north to south and 500m from east to west. 12.9 million ton of the measured reserves are in Witbank, Highveld, En-nelo, South Rand, Natal and Water burg coalfield. Witbank Coal mine has the largest coal production capacity, and the secondary is Highveld coalmine and the total coal production of these two coal fields takes up more than 80% of the total production.

As the main coal producing country, South Africa ranks the 5th after US, China, Russia and Australia. The coal resource centralized in the eastern area: Mpumalanga's coal production takes up 83% and Limpopo is the secondary. As shown in the following picture, 39% of South Africa's coal is used for power generation, and nearly 20% for manufacturing synthetic fuel. South Africa is the only country which produces liquid fuel by coal commercially in the world.

Since 2000, coal production capacity is keeping stable with 220,000,000 ton to 260,000,000 ton in South Africa and 100,000,000 to 120,000,000 ton is used for chemical material and industrial fuel consumption. In recent years, South Africa's exporting coal is about more than 70,000,000 ton and takes up about 27% of the whole production. More than 97% of the coal was exported from Richard Port and coal exporting to Asian area is increasing while to other areas is decreasing.

From the credibility of the coal supplying, coal production from main exporting enterprises of South Africa can completely meet the demands for thermal coal of coal power plant in this project. The coal transportation. especially the exporting coal is mainly by the way of Transnet railway transportation and the transportation capacity is 68,000,000 ton. Now the exclusive coal transportation railway is expanded and the capacity will rise to 81.000.000 ton per year. the throughput of Richard Port will expand to 105,000.000 ton and these infrastructure and logistical lines can guarantee the coal transportation channels.

3.1.2 Indigenous Coal

Pakistan coal resource spread in Sind province, Baluchistan Province, Punjab Province and northwestern provinces. According to estimation from Geological Survey of Pakistan-GSP,

coal resource volume in Pakistan is about 186,200,000,000 ton of which 184,000,000,000 ton was in Sind Province (176,000,000.000 ton in Thar,

1300,000,000 ton in Lakhra, 3,700,000,000 ton in Sonda Thatta and etc.), in addition, Baluchistan 217,000,000 ton, Punjab Province 235,000,000 ton, northwest provinces 90,000.000 ton.
The coal include lignite and sub-bituminous, and the calorific value is from 2,780 to 7,227 kilo calories. In Thar region in the south of Sind province, there is the largest fair lignite mine in the world.

3.2 Coal Quality

Coal imported from Indonesia/South Africa will be used for the project. The analysis of design coal is given in the table below.

Description	Characteristics
Proximate Analysis (% ar)	
Total Moisture	10.3
Inherent Moisture	5.5
Ash	5.8
Volatile Matter	39.39
Fixed Carbon	44.52
Chlorine	0.0095
Specific Energy (as received)	
Gross Calorific Value (Kcal/kg)	6502
Ultimate Analysis (% ar)	
Carbon	56.61
Hydrogen	4.65
Nitrogen	1.59
Oxygen	10
Sulphur	1.58
Ash Analysis (%)(DB)	
SiO_2	48.22
Al_2O_3	22.34
Fe_2O_3	16.18

CaO	2.23
MgO	3.24
Na_2O	0.27
K_2O	1.16
Mn_3O_4	0.03
TiO_2	1.36
P_2O_5	1.14
SO_3	4.08
Phosphorus in coal(A.D.)	0.75
Undetermined	
Ash Fusion Temperature (°C)	**Reducing**
I.D.T. (deformation)	1200
S.T. (softening)	1220
H.T. (hemispherical)	1270
F.T. (fluid)	1320
Ash Fusion Temperature (°C)	**Oxidizing**
I.D.T. (deformation)	1250
S.T. (softening)	1350
H.T. (hemispherical)	1410
F.T. (fluid)	1420
Hardgrove Grindability Index (HGI)	48

3.3 Coal Consumption

Coal Consumption	1x35MW
Hourly Coal Consumption (t/h)	25.2
Daily Coal Consumption (t/d)	604.8
Annual Coal Consumption (10^3 t/a)	181.44

Note: 1) Daily operation hours are taken as 20.
2) Annual operation hours are taken as 7200.

3.4 Fuel for Ignition and Combustion Support

Light fuel oil from free international fuel oil market will be mainly used for the project. In power plant area, the highway traffic conditions are good to ensure fuel oil supply. When unloaded in the jetty, the fuel oil will be transported into the plant by highway.

3.5 Coal Transportation

The coal for the power plant may be from Indonesia and South Africa will be transported by ship. According to the port situation of the export countries which was selected, the coal loading port also can be decided initially. The shipment ports are separately Tanjung Bara port in Indonesia and Richards Bay port in South Africa.

The distance between the national coal loading ports and Pakistan Qasim port is shown in this table as follows:

SN	SHIPMENT PORT	UNSHIP PORT	SEA MILE
1	Tanjung, Bara Port	Qasim Port	3900
2	Richards Bay Port	Qasim Port	4300

According to the analysis of the route of voyage. the distance from Richard Bay of South Africa to Qasim of Pakistan is about 4200-4300 nm, about 17 days at sea; the distance is about 3900nm from Tanjung Bara port of Indonesia to Qasim of Pakistan, about 16 days at sea.

3.6 Supply of Desulfurization Absorbent

The installed capacity of the project is 1x35MW, and wet desulphurization device will be installed for the project. 60,256 tons of limestone will be used as FGD absorbent for the 1x35MW unit every year.

According to the document provided by the Owner, the quality of the limestone for this project is as follows:

No.	Parameter	Unit	Test Result
1	$CaCO_3$	%	90-95
2	$MgCO_3$	%	0.5-3
3	$Fe2O_3$ (Iron)	%	0.5-3
4	$Al2O_3$ (Alumina)	%	0.5-3
5	Total Inerts	%	3-7

There are large amounts of high quality limestone in NWFP Province, Punjab Province, Sindh Province, Balochistan Province, and Northern area of Pakistan. They are widely used in road construction, building construction, sanitation and hygiene, and water treatment. Currently, the limestone output in Pakistan is about 8700.000 t, which is mainly used in cement production. road construction, building construction, and chemical industry. For this project, the required 115,800 tons of limestone every year can be purchased locally, and then transported to the power plant by truck.

Chapter IV: Plant Site Conditions

4.1 PHYSICAL ENVIRONMENT

Physical environment essentially illustrates baseline conditions of topography, geology/ soils, climate, surface water and groundwater of the project area, where necessary, of proposed project regardless of an EIA or IEE studies.

4.1.1 PHYSICAL FEATURES & TOPOGRAPHY

The proposed project lies in district Faisalabad where proponent (Sitara Chemical Industries Ltd (SCIL)) aims to install Coal Fired Power Plant (CFPP). The proposed geographical location for the power plant is adjacent to Sitara Chemical Industries Ltd located at 32km Faisalabad -Sheikhupura road. The following major industrial and commercial units are located at Lahore- Sheikhupura-Faisalabad road.

Aslam Chemical Industries, Sitara Chemicals, Habib Calco Weaving, Asim Textile, Ibrahim Fibers, Arshad Group, Al Barka Fabrics, Zahid Jee Textile, Bismillah Spinning Mills, Ahmed Din Textiles, Bebe Jan Colors Pvt. Ltd., Masood Textiles, Nagra Spinning, Madina Cooking Oil and Beacon Impex etc,

4.1.2 GEOLOGY AND SOIL

The city is located on the "Bar Upland" which is relatively older alluvium deposit as found in the central part of the Road. Because of its elevation above the bordering flood plains, the upland is generally beyond the reach of flood spills, which is the significant physiographic feature of the alluvial plan. Like other Punjab plains, the alluvium is quaternary and has been deposited on semi-consolidated tertiary rocks or on a basement of metamorphic and igneous rocks of Precambrian age. It emanates from the mountain ranges of the north and has been deposited by the present and ancestral streams. The deposition is predominantly fluviatilo sediments.

4.1.3 CLIMATE

Climatic Zone

The meteorological data from Faisalabad has been used to identify the baseline climatic condition of the project area and surroundings. The proposed project lies in arid climate region. The last five years data was obtained from Pakistan Meteorology Department, meteorological station at Faisalabad to have an overview of the area's climatic regime. The data from the Department of Metrology is included as Annex-B of the report while a brief description is given below:

Seasons and Rainfall

The proposed project is situated in district Faisalabad which has hot summers and moderately cold in winter. It is located in the region that encounters four seasons, the hot summer starts from May and continues till July, monsoon starts from July and continues to September while winter season end in February starting from November and spring season lasts for two months from March and April. The last five years annual rain fall data from 2009 to 2013 shows variation between -1- 243.1 mm.

Temperature

The ambient temperature of proposed project region varies from summer to winter. The change in temperature has a direct influence on the environment of the project area. Hot and dry conditions during summer season changes the air quality by increase in particulate matters due to drying of road pavements and open soil. According to last five years data, mean monthly minimum temperature in the area varies from 3.5 to 28.6 C° and mean monthly minimum temperature were found 16.6 - 41.9 C°.

Relative Humidity

The relative humidity in project region varies from 19 to 70 %. The highest humidity in the area was recorded 70 %, which was in the month of August 2010.

Wind Speed

The dust storms and hot winds blow continuously during the months of March to August. Wind speeds and seasonal patterns vary considerably in the project area. The monthly average of wind speed is ranging from 0.4 to 7.6 Knots.

4.1.4 WATER RESOURCES

Water resources of the area are discussed under two broad headings, surface water resources and groundwater resources.

Surface Water

Surface waters resources are usually exposed to the surface of earth in the form of mobile and immobile situation which includes snow-clad mountains, rivers, non-river streams, rain, sleet, wetlands and oceans. Surface resourced waters are highly susceptible to natural and anthropogenic derived contamination in terms of Chemical and Biological contamination and thus are not used for sensitive applications such as drinking directly, unless it is pre-treated.

Among surface waters, district & near the project extremities there is a distributory canal (Rakh Branch) which is used for the irrigation purpose and etc.

Ground Water

Ground water resources are found hidden and camouflaged into the surface of earth in the form of mobile and immobile state and exist as shallow and deep wells, confined and un-confined aquifers, springs and watersheds. Ground resourced waters are not easily susceptible to natural and anthropogenic derived contamination caused by Chemical/Biological pollution and thus is directly used for sensitive applications such as drinking even it is un-treated. Main visible pollutants such as turbidity, color and odor usually remain absent in ground extracted waters. Invisible biological contaminants such as Bacteria, Protozoa and Viruses are also not expected in sub-surface water regimes unless it is contaminated by un-expected upheaval.

Water constitutes an important section of Physical Environment of an IEE/EIA Study to define its magnitude, quality and occurrence throughout the entire project corridor. On geo-sphereic earth water is amounting to 3% as fresh water resource of the total water reserve. Of this groundwater comprises 95%, surface water 3.5% and soil moisture 1.5%. Out of all the fresh water on the earth, only 0.36% is readily available for diversity uses and applications. The project area lies in the district of Faisalabad; the groundwater table normally exists 40 to 50 ft below the ground level and contains high level of salinity.

4.2 ENVIRONMENTAL BASELINE

MONITORING

In order to assess the baseline conditions of the project area, following environmental components were monitored;

1. Ambient air quality monitoring,
2. Noise monitoring,
3. Soil sampling and analysis
4. Water sampling and analysis

Environmental baseline monitoring was conducted at different locations. The details of the sampling/ monitoring locations along with discussions on result are given subsequent sections. Pictorial over-view of environmental monitoring carried out in the project area is presented in Figure 4.8.

4.2.1 AMBIENT AIR QUALITY

Troposphere air is highly susceptible to hostile anthropogenic activities taking place at ground level or in vicinity of ground; which are mainly caused by fossil fuel combustion in industrial units and also caused by high density transportation through mobile & immobile vehicles. Degradation of fossil fuel under the impact of high temperature give rise to varying gaseous products composed mainly of CO2 in association with small amounts of particulates, CO, NOx and SOx etc. These pollutant gases changes the ambient concentration of air environment and could cause sufficient damage to ground level air ecology.

The proposed project is located in fairly open and clean air and is mostly surrounded by different industries, network of diverse agriculture lands and villages.

As such no viable air contaminants are expected in the air-shed of proposed project. However, most common airborne contaminants that are likely to be emanated from aforementioned sources giving rise to very low magnitude of these contaminants include Smoke, CO, NO, NO2 , SO2 and particulate matter.

In the absence of continuous and permanent air quality monitoring stations in the country, it is difficult to provide a concrete baseline on ambient air quality concentrations for criteria pollutant, such as, Carbon monoxide, Nitrogen dioxide, sulphur dioxide, and suspended particulate matter.

In order to collect the current baseline data for ambient air quality including SO2, NOx, NO, CO & PM, were monitored at project area to determine the magnitude of these pollutant gases. The air monitoring point is depicted in Figure 4.7.

Ambient air quality is measured with monitoring devices that have the capability to capture & analyze criteria air borne pollutants including CO, NO2 and SO2 at micro levels. The monitoring techniques of each of these pollutant gases based on USEPA defined standard methods depicted in Table 4.1.

Ambient Air Monitoring Methodology

Air Pollutant	*Monitoring Technique*	*Reference Method*	*Measurement Range*	*Lowest Detection Limit*
Carbon Monoxide (CO)	Gas Filter Correlation CO Analyzer	US EPA Designated Method RFCA-0981-054	0 - 100 mg/m³	0.01 mg/m³
Sulfur Dioxide (SO_2)	Pulsed Fluorescent Analyzer	US EPA Designated Method EQSA-0486-060	0 - 50 µg/m³ 0 - 100 mg/m³	0.01 µg/m³
Nitrogen Dioxide (NO_2)	Chemiluminescent Analyzer	US EPA Designated Method RFNA-1289-074	0 - 50 µg/m³ 0 - 100 mg/m³	0.01 µg/m³
Particulate Matter (PM_{10})	High Volume PM10 Sampler	40 CFR 50, Appendix J (US EPA)	2 - 750 µg/m³	2 µg/m³

NEQS for air quality standards have been introduced in Pakistan since 2010; therefore, the monitoring values of Carbon monoxide (CO), Sulphur dioxide (SO2), Nitrogen dioxide (NO2), and Particulate Matter (PM10) were compared with standards set by NEQS.

08 hours Air monitoring CO was found 1.89 mg/m3 inside the Sitara Chemical Limited and it was well complying NEQS guideline limit of 5.00 mg/m3 regulated at 8 hours monitoring.

24 hours Air monitoring pattern on NO2 indicates that it was below the detection limit as per below mentioned table (Table 4.2) and comply with NEQS, 2010.

24 hours Air monitoring of SO2 indicates that it was below the detection limit as per below mentioned table

Overall Air monitoring indicates that average 24 hours concentrations of CO, NO2 and SO2 were found below the permissible limits regulated by NEQS, 2010 for ambient air whereas Particulate Matter (PM10) was recorded 92.86 µg/m^3 inside the SCIL and the results were found well complying NEQS defined limit of 150 µg/m3 during 24 hour of measurement. Summary of ambient air quality monitoring is presented in Table 4-2.

Ambient Air Monitored Data

Parameter	*Unit*	*Duration*	*Inside the Sitara Chemicals*	*NEQS Limits*
Carbon Monoxide (CO)	mg/m^3	24 Hours	1.98	*5.0
Nitrogen Dioxide (NO_2)	$\mu g/m^3$	24 Hours	41.85	120
Sulfur Dioxide (SO_2)	$\mu g/m^3$	24 Hours	79.81	120
Particulate Matter (PM_{10})	$\mu g/m^3$	24 Hours	92.86	150

The meteorological conditions were also monitored with the help of meteorological station installed for 24 hrs to assess the trend of air movements.

4.2.2 NOISE MONITORING

Noise is an important environmental stressor and is essential part of baseline for IEE/EIA studies. Noise has become a very important "stress factor" in the environment of human. The term "noise pollution" has been recently used to signify the hazard of sounds which are consequence of modern day development, leading to health hazards of different type. The monitored data is presented in the following table. The detailed data has been attached as Annex-C of the report.

In the absence of reliable noise data, noise monitoring was conducted during field survey at 6 locations by utilizing Mastech Noise Meter and the LAeq was measured. The noise level was found in range of 41.2 -52.5 dBA at day time which comply the permissible limit of 75 dBA for Industrial area. Table 4.4 shows the summarized results of noise levels while noise measuring locations are also presented in Figure 4.7.

Meteorological Monitored Data

Monitoring Locations	Monitoring Parameters (Avg 24 Hrs)			
	Ambient Temperature (C°)	Wind Velocity	Humidity (%)	Atmospheric Pressure
Inside the SCIL	15	1.06	62	758.8

Results of Noise Monitoring

	Noise Levels (dB)				
N1					
52.5	43.1	41.2	42.7	44.5	43.6

4.2.3 SOIL QUALITY OF PROJECT AREA

In order to assess the quality of soil, two soil samples were collected from within the project area and near village and analyzed according to the standard methods.

Results of Soil Analysis

Parameters	Method/Technique	Unit	Results	
			Project Site	From Vicinity
pH @ 28.9 °C (1:5)	SW-846 Guidelines	-	7.85	8.03
Conductivity @ 28.9 °C (1:5)	SW-846 Guidelines	µS/cm	1560	7360
Grease & Oil	SW-846 Guidelines	mg/kg	BDL	BDL
Chloride	SW-846 Guidelines	mg/kg	129.91	3847.78
Chromium (Cr)	SW-846 Guidelines	mg/kg	13.66	10.56
Lead (Pb)	SW-846 Guidelines	mg/kg	9.72	11.64
Cadmium	SW-846 Guidelines	mg/kg	0.755	2.06
Zinc	SW-846 Guidelines	mg/kg	42.77	51.55
Ag	SW-846 Guidelines	µg/L	BDL	BDL
Arsenic (As)	USEPA 3050B	mg/kg	08.75	04.29
Selenium (Se)	USEPA 3050B	mg/kg	<00.50	<00.50
Barium (Ba)	USEPA 3050B	mg/kg	54.38	243.51
Mercury (Hg)	USEPA 7471B	mg/kg	<00.05	<00.05

4.2.4 WATER QUALITY MONITORING OF PROJECT AREA

In order to assess the quality of ground water, the physical and chemical parameters were analyzed for the determination of quality of ground water and concentration of components. The analysis results of the aforementioned parameters are tabulated below in Table 4.6 and Table 4.7.

Chemical Results of Ground Water

S.No.	Parameters	Method (APHA)	Unit	NEQS	Results	
					Hand Pump at Project Site	Chak 97 RB
1.	pH @ 29.5 °C	APHA4500H+ B		6.5-8.5	8.19	8.02
2.	Color	APHA 2120 C	Pt-Co		BDL	BDL
3.	Turbidity	APHA 2130 B	mg/L	<5	8	22
4.	Total Dissolved Solids (TDS)	APHA 2540 C	mg/L	<1000	912	542
5.	Chloride (Cl)	APHA 4500Cl- B	mg/L	250	49.95	70.32
6.	Total Hardness	APHA 2340 B & C	mg/L	-	252.2	240.9
7.	Fluoride	APHA 4500F- C	mg/L	≤1.5	0.76	1.92
8.	Nitrate	APHA 4500NO3 B	mg/L	≤50	11.86	8.21
9.	Nitrite	APHA 4500NO2 B	mg/L	≤3	BDL	BDL
10.	Cyanide (CN)	4500CN-E	mg/L	≤0.05	BDL	BDL
11.	Phenols	APHA 5530D	mg/L	≤0.002	BDL	BDL
12.	Cadmium (Cd)	APHA-3111 B	mg/L	0.01	BDL	0.002
13.	Total Chromium (Cr)	APHA-3111 B	mg/L	≤0.05	BDL	0.0043
14.	Copper (Cu)	APHA-3111 B	mg/L	2	0.0052	0.0027
15.	Lead (Pb)	APHA-3111 B	mg/L	≤0.05	BDL	BDL
16.	Nickel (Ni)	APHA 3120 B	mg/L	≤0.02	BDL	0.0107
17.	Zinc (Zn)	APHA-3111 B	mg/L	5.0	0.1029	0.422
18.	Manganese (Mn)	APHA-3111 B	mg/L	≤0.5	BDL	0.1262
19.	Aluminum (Al)	APHA-3111 B	mg/L	≤0.2	BDL	BDL
20.	Antimony (Sb)	APHA-3111 B	mg/L	≤0.005 (P)	BDL	BDL

S.No.	Parameters	Method (APHA)	Unit	NEQS	Results	
					Hand Pump at Project Site	Chak 97 RB
21.	Arsenic (As)	APHA 3120 B	mg/L	≤0.05 (P)	<0.005	<0.005
22.	Boron (B)	APHA 3120 B	mg/L	0.3	0.349	0.251
23.	Mercury (Hg)	APHA 3112 B	mg/L	≤0.001	<0.001	<0.001
24.	Selenium (Se)	APHA 3120 B	mg/L	0.01	0.008	<0.005
25.	Barium (Ba)	APHA 3120 B	mg/L	0.7	0.066	0.066
26.	Pesticides (Residual)	USEPA 8081-A	µg/L	-	<01.00	<01.00
27.	Chlorine	APHA-4500Cl B/C	mg/L	0.5-1.5	BDL	BDL

Microbiological Results of Ground Water

Parameters	*Method (APHA)*	*WHO Limits*	*NEQS*	*Results*	
				Hand Pump at Project Site	*Chak 97 RB*
Total Colony Count	9215	< 500 cfu / ml	-	2.4×10^3	1.9×10^3
Total Coli forms	9222 B	0 / 100ml	0 / 100ml	Absent	Absent
Faecal Coli forms (E Coli)	9222 D	0 / 100ml	0 / 100ml	Absent	Absent
Faecal Streptococci/ Enterococci	9230 C	0 / 100ml	0 / 100ml	Absent	Absent

4.3 Information Regarding Infrastructure:

The information regarding infrastructure of the project is as follow:

Infrastructure of staff colony

The project`s living facilities include China sub-contractor bachelor hostel. Living area is located in the northeast of the factory area, covers an area of 8000 square meters. China bachelor hostel can accommodate 100 people.

Infrastructure of road

The length of the road which is designed in the plant is about 2000 meters. There are two main roads into the plant, one is located in the north side of the plant, and the other road is located in the east of the plant.

Infrastructure of construction

Production facilities mainly include equipments repository, staff office, and construction crane etc. Total area of the plant is 81676 square meter. According to the construction requirements, 20t and 40t capacity gantry cranes, tower cranes and batching units are required in the plant.

Infrastructure of construction and lives water

Construction and lives water will be provided by Deep Well Water Turbine (DWT) installed by KSB. The discharge of water turbine have pipeline of DN200 to supply water to living and office area and for subcontractor construction. The estimated daily consumption quantum is around 200m3/hr. The sewage water will be discharged after treatment.

Infrastructure of construction and Lives electricity

The project site team is contacting with FESCO to provide electricity connection point with capacity of 1250A, 11kV grade. We will construct a 11kV substation at site and hooked it up with 400V system through existing 132 kV substation facility for distribution of 400v at SCIL caustic plants. We proposed to set up 10 low voltage breakers, 11kv grade at site and distributed at SCIL, M4, BMR and chimney area , lives and office area respectively.

In the meanwhile, we also consider SCIL existing power plant and FESCO for the standby use. At present we have 132kV grid station available in SCIL permission with 03 feeders. We will also connect the 132 kV substations to site by using 11kV lines in order to give supply to SCIL caustic plants.

Chapter V The type, technology, model, technical details and design of facilities:

5.1. Principle on Unit Selection:

1) Main equipment will be Chinese-made equipment with proven design;

2) The main and auxiliary equipment has advanced technology, good quality, high reliability and availability;

3) The unit has high efficiency.

The project is a newly built project. At this stage, it is proposed to construct 1x35 MW superheated units and FGD device, with no expansion being considered.

5.2 Main equipment and Parameters

5.2.1 Boiler

Boiler capacity and main data

Boiler type	Circulation Fluidization Bed (CFB)
Rated steam capacity (BMCR)	150t/h
Rated steam pressure	9.8MPa
Rated steam temperature	540°C
Feed water temperature	215°C

Boiler thermodynamic property

Flue gas loss	6.52%
Unburnt carbon thermal loss	0.91%
Surface radiation and convection heat loss	1%
Uncounted thermal loss	0.52%
Calculated thermal efficiency (based on LHV)	91.05%
Manufacturing allowances	1%
Guaranteed thermal efficiency (as per design fuel,	90.05%

LHV rated condition)	
Furnace volume thermal load	114KW/m^3
Furnace cross section thermal load	3.3MW/m^2
Hot air temperature of primary air pre-heater outlet	165°C
Hot air temperature of secondary air pre-heater outlet	165°C
Cold air temperature of air pre-heater inlet	20 °C
Excess air coefficient of economizer outlet	1.34
Temperature of flue gas before economizer	522°C
Temperature of flue gas after economizer	259°C
Excess air coefficient of air pre-heater outlet	1.4
Flue gas temperature of air pre-heater outlet	140°C

5.2.2 Steam Turbine

Main Technical Specification

Turbine type: high temperature, high pressure, single casing, extraction and

Condensing type

Data under rated output conditions (T-MCR)

Rated output: 35MW e

Rated pressure before main steam valve: 8.83MPa (a)

Rated temperature before main steam valve: 535°C

Rated inlet flow rate: 132.29 t/h

Max. Output: 38.5 MWe without steam extraction

Max. Inlet flow rate: 146, 78 t/h

Heater stage: 4

Feed water temperature (TMCR) : 215°C

Working speed: ~5000 r/min

Rotation direction (viewed from turbine to generator): CCW

Winter no-regulation extraction pressure : 1.9 MPa (a)

Extraction temperature: 210°C (spray water decrease temperature)

Extraction flow rate: 25t/h

Spray water temperature: 158°C (13.8MPa)

Extraction steam back water temperture : 85°C

Extraction steam back water rate : 80%

Extraction steam back water location : Deareator

Max. Allowable cycle range: **47.5 ~ 51.5** Hz

5.2.3 Generator

Technical specifications for Generator

Generator rating:

Rated power	40MWe
Rated capacity	44MVA (subject to power rating specified)
Rated voltage	11KV± 10%
Rated power factor	0.8
Frequency	50Hz
Rated rotating speed	3000r/min
Insulation class of stator winding	F
Insulation class of rotor winding	F

Short circuit ratio	≥0.55
Efficiency	≥98.2%
Number of phases	3
Number of poles	2
Stator connection	Y (six terminals)
Power frequency testing voltage	As specified in IEC standard
Noise (at 1m away from stator frame & 1.2m height above the floor)	< 90dB(A)
Stator multi Glue or less Glue mica insulation , soaked insulation VPI process	Manufacturers to fill
Transient over load capacity of generator	
Generator start/stop time	10000 times
Overhaul cycle of generator	4years
Fluctuation withstand capacity of generator	Frequency :±2%; Stator voltage deviation:±5%
High-speed dynamic balancing	3000 r/min X120% ,2min

Chapter VI - Control Metering and Protection:

I.I Project description

The project is newly-built power plant. Coal fired with 35 MW Capacity will be built.

I.II Abbreviations

- BOP: Balance of Plant
- BPC: Turbine Bypass Control
- BFPT: Boiler Feed Pump Turbine
- CCR: Central Control Room
- CEMS: Continuous Emission Monitoring System
- CCTV: Close Circuit Television
- DCS: Distributed Control System
- DEH: Digital Electro Hydraulic
- DAS: Data Acquisition System
- ESP: Electrostatic Precipitator
- ESR: Engineer station room
- ETS: Emergency Trip System
- ECS: electric control system
- EER: Electronic Equipment Room
- FSSS: Furnace Safeguard Supervisory System
- FSS: Fuel-firing safety system
- FGD: Flue Gas desulfurization
- • HVAC: Heating & Ventilation and Air Conditioning
- I/O: Input / Output
- LVS: Large Video Screen

- LCR: Local Control Room
- MEH: BFPT micro-electro-hydraulic control system
- METS: BFPT micro-emergency trip system
- MTSI: BFPT micro-supervisory instrument
- MCS: Modulating Control System
- NCS: Networked control system
- PLC: Programmable Logic Controller
- SBC: Soot Blower Control
- SCS: Sequence Control System
- SOE: Sequence of Event Recorder
- TSI: Turbine Supervisory Instruments System
- VMS: Vibration Monitoring System

6. General

6.1.1. Design Basis

1.1.1. Bidding, MOMs and Clarifications documents of the Project.

1.1.2. China's national and industry standard.

1.1.3. Drawing, documents and information provided by the manufacturer who supplies main equipment and auxiliary equipment.

6.1.2. Project Overview and Main Installations

1*150t/h circulating fluidized bed boiler and 1x35 MW turbine and auxiliary system will be built in the project.

6.1.3. I&C Design Scope

This design scope includes the thermal control of boiler and its auxiliary system, turbine and its auxiliary system, deaerator& feed water system, circulating water systematic.

6.2. Level of I & C

6.2.1. Control Mode

This term project uses a DCS monitoring system control method to control and regulate the boiler system, turbine system and auxiliary system. According to the arrangement of plant, some system will set DCS remote I/O stations, such as Circulating water pump system, Fuel oil pump system, etc.

Desulfurization system shall be controlled by DCS, its cabinets and operator stations are located in desulfurization control room. Desulfurization DCS system shall be the same manufacture as the plant DCS, through optical fiber cable communication each other.

The balance of plant will adopt PLC control or on-site control mode and the PLC control system will communicate with plant DCS system.

The unit is monitored and controlled via mouse/keyboard and LCD in the central control room. For safety and reliability, emergency measures are considered against "DCS" failure, that is, some hard manual operations are reserved (for example, MFT push button, Drum emergency water releasing valve push button, emergency stop turbine push button, AC lube oil pump start/stop push button, DC lube oil pump start/stop push button, etc.).

The DCS network of unit covers:

Control of boiler and its auxiliary system;

Control of turbine and its auxiliary system;

Control of auxiliary system (deaerator & feed water system, etc)

Electrical system

Circulating water system (DCS remote I/O station)

Fuel oil pump system (DCS remote I/O station);

The PLC system will cover:

Limestone milling system;

Coal handing system;

Ash handing system;

Air compress system;

CEMS;

Water treatment system;

Bag-type dedusting system.

6.3. Arrangement of Central Control Room and Electronic Equipment Room

Based on arrangement of thermal equipment and auxiliary production equipments in the main building, one Central Control Room (CCR) and one Electrical Equipment Room (EER) will be adopted for the main building thermal system.

6.3.1. Arrangement of Central Control Room

DCS operator stations, Electrical station, printer console and supervising screen etc are arranged in the central control room which is on 8.00mfloor.

The DCS station mainly houses LCD (not less than 24 inches), mouse/keyboard for the DCS.

Steam drum water level TV, steam drum electrical contact water level gauge, DCS graphic display screen, plant CCTV video display screen, and LED display screen are set on the supervising screen.

6.3.2. Arrangement of Electronic Equipment Room

The DCS cabinets, I&C power supply cabinets, turbine TSI cabinet, turbine DEH cabinet, turbine ETS cabinet and Electrical system cabinets etc are set in the electronic equipment Room which is on 8.00m floor. DCS engineer station and printers are set in engineer station room.

6.4. I&C Automation Function

A set of DCS will be provided for Units in the project. Its controllers and power

Supplies will be respectively provided according to Turbine, Boiler, Electrical, and Auxiliary

System (deaerator &feed water system, etc)

The automation function of DCS mainly consists of the following systems:

Data Acquisition System (DAS)

Modulating Control System (MCS)

Sequential Control System (SCS)

The DCS will be designed to achieve high levels of reliability by dual redundancy and provide self-diagnostics. Any single component failure will

not affect the operation of other parts of the system. The system parameters, alarm and self-diagnostic function will be highly displayed on LCD and printed out.

6.4.1. Data Acquisition System (DAS)

Data acquisition system (DAS) will continuously process all important measurement and status input signals of associated plant, to provide the operator with relevant operating information in time, so as to enable him to achieve safe plant performance, to inform him of any abnormal condition arising in the plant being monitored and to improve plant availability.

DAS will accomplish relative functions in the form of displays, logs and historical storage and retrieval and performance calculations.

Customized graphic displays (plant mimics) will be created in accordance with P&ID drawings and operation requirements. Reporting, printing, alarming and logging functions will be initiated by program control and/or operator demand. Any point in the database will be available. Sequence of event will be considered in DAS function with required input capacity to log trips, cause of trips and other important faults to diagnose the cause of plant trip with a resolution of one millisecond. A printer will be supplied for SOE.

6.4.2. Modulation Control System (MCS)

The control system will meet the requirements of unit start-up and shutdown. The parameters, under control will not exceed permissible limits from minimum coal firing load to 100%MCR.

For increase in reliability, the control system will be functionally distributed and adopt the single loop integrity philosophy. Dual or triple measurement philosophy will be adopted for important measured parameters.

For all control sub-systems, manual backup operation facility will be provided, generally including LCD keyboard soft manual operation. Transfer between auto and manual will be bi-directional and bump less.

The output signal of control system will be 4~20mA continuous signal with upper/lower limit, so as to guarantee safety of unit equipment in case of control system failure.

The control system will supervise the error between the settings and controlled variables. As the error exceeds limit, the system switches to manual mode and gives alarm.

The quantity and control mode of MCS are determined based on requirements for the thermal mechanical profession and relating equipments, mainly including following control systems:

- . Steam drum water level control
- . Furnace pressure control
- . Main steam temperature control
- . Coal feeder control
- . Primary air flow control
- . Secondary air flow control
- . Fuel bed pressure control
- . Fuel bed temperature control
- . Deaerator pressure control
- . Deaerator water level control
- . Condenser hot-well level control
- . Etc.

6.4.3. Sequential Control System (SCS)

Sequence Control System is part of DCS. It is used for start-up/shut-down the sub-group item. A sub-group item is defined as a certain equipment group of the power plant and all its relevant equipment.

The designed sub-group grade program perform automatic sequence operation, its objective is to reduce the operators routine operation during unit start-up/shut-down.

At automatic sequential control mode, all equipments in the function groups will start/stop automatically and sequentially according to the operator's key command and based on designed control logic, permission and judgment conditions.

At manual sequential control mode, operation guidance will be provided for the operator, and displayed on LCD in graph, including sequential operation, if the condition for this step is met, and the procedures for next step.

The SCS will have complete interlock and protection function, so as to guarantee safety of all controlled objects, systems and the whole unit. Hard wiring connection will be adopted for critical interlock and protection.

Main Function Groups:

Primary air fan group;

Secondary air fan group;

Induced draft fan group;

Reverse air fan group;

Feed-water pump group;

Condensate water pump group;

Drain pump group;

Lube oil pump group

Interlock

- Interlock of auxiliary equipment and valves by DCS:
- Interlock between working and standby auxiliary equipments;
- Interlock between auxiliary equipments and valves;
- Interlock is invalid in case the allowed auxiliary equipment condition is not met.
- Auto cut in of critical duty pumps provision to be incorporated in design through pressure switches.

6.5. Power Supply and Gas Supply

6.5.1 Power Supply

The I&C system in the main power building used 400/220 VAC power supply, dual circuitry power supply mode. The two circuitries respectively connect with the different section of the corresponding low voltage auxiliary bus bars. When a circuitry failure, the power switch device will immediately switches to another circuitry, and output the power failure alarm to DCS system at the same time.

AC400V power source supplies power to the equipment such as motor operated valve, electrical actuator etc.

AC220V general power source supplies power to the various general panels, on-site instrument and so on.

DCS system uses 220VAC power, dual circuitry supply. The one circuit is connected with UPS, and the other circuitry is connected with the low voltage auxiliary bus bar. When a power failure, the contactor will immediately switches to another circuitry, and output the power failure alarm to DCS system at the same time.

The balance of plant I&C control power is supplied by the electric supply system of related balance of plant.

The DC110V power supply for protection and control is connected with DC system of electrical.

6.5.2 Gas Supply

Instrument air is from power plant compressed air station, be treated with filter and dryer, and provide high quality compressed air for control equipment.

6.6. Selection of Main I&C Equipments

6.6.1 Distributed Control System (DCS)

The hardware system will be implemented using field proven experiential, advanced, reliable digital technology of the microprocessor-based distributed control type.

All control processor and I/O modules in the system will be of standardized, modular, plug-in construction and will clearly show the identification of all components and have applicable LCD diagnostic indications.

All modules in the system will be capable of on-line removal and replacement. Guidance and interlocks will be provided to prevent the operated modules and other modules from damage and faults during removal or insertion of the modules. Module addresses will not be position dependent but modules will function in any slot of a cabinet.

The number of types and sizes of modules will be kept to a minimum in order to reduce the extent and cost of spare parts required.

All DCS modules should be anti-corrosive coating.

6.6.1.1.1 Processor modules

Processor functions in the distributed processing units will be functionally dedicated to enhance reliability of system. The functional processor modules will utilize the process information gathered by the I/O processing functions to implement both modulating control and digital control.

If RAM is used it will be backed up by batteries to support storage. Batteries will be replaceable without interfering with equipment operation and the loosing of data.

All CPU load will not be exceed 60%load.

A processor module will be able to be removed, modified or restarted without affecting operation of other processor modules.

Upon failure of one processor module, the system will automatically switch to the redundant processor module in a bump less fashion and alarm the fault at the Operator Station.

The redundant processor module will have parallel access to the system and will continuously receive all changes (including those in configuration in the controlling processor module) and update itself while in the backup state.

6.6.1.1.2 Process input / output (I/O)

The I/O processing system will be as smart as is practical to reduce control system processing load and will perform functions such as scanning, data setting, digitalization inputs and outputs, linearization, cold junction compensation for thermocouple, process point quality checking and conversion of engineering units, etc. All signals of input and output will be processed by independent devices.

The detection of Open circuit, break circuit and input signal over the technical system permission for thermocouple, RTD and 4~20mA signal will be provided. Each function will be performed during the point is scanned.

A power failure of a processor module will not cause pulse inputs to lose readings accumulated at the time of the power failure, and will not limit the ability of accumulator for acquisition reading.

The signal processing for the thermocouples, RTDs, transducer inputs in a redundant scheme will be performed in separate modules. No individual I/O module failure should result in any other equipment failure or trip.

6.6.1.1.3 System cabinet

The system cabinets will contain all controllers, I/O modules, power supplies, Foreign

Device Interfaces, Network Interface Modules, Network Processor Modules etc.

System cabinets and termination cabinets will be capable of accepting cable entry from bottom. All cabinets will have front and rear access only.

All components within the cabinets will be pre wired to terminal blocks or utilize cable connectors.

Termination facilities for thermocouple extension wire will include reference junction temperature compensation.

All system cabinets shall be of NEMA4Xstandard

6.6.1.1.4 Engineering System

The engineering system is a part of the overall plant control system that will be operated from a workstation based located in the Engineering room.

The engineering system will be designed as a single engineering system that enables the engineer to access all system configurations with uniform user graphic interface. The licenser of the hardware supply will make the software development for the engineering and diagnostic systems.

The engineering system will enable to perform all detail engineering for commissioning, modification updating, documentations and on-line self-diagnostic routines.

6.6.1.1.5 Time synchronization

Accurate time synchronization will be provided for all control equipment and computers on site.

The real-time clocks within the control equipment will be synchronized to within 1 millisecond of local time by a GPS clock provided at the Power Station. The GPS clock will be connected to a suitable GPS antenna installed on the roof of the station or at another suitable location providing adequate visibility to GPS satellites.

6.6.1.1.6 Communication Network

TCP/IP protocol will adopt in DCS communication network.

High-speed data highway is an important technical mean that connecting the site controller (stations) and operator stations. The malfunction of high-speed data highway will lead to that operators are unable through LCD and keyboard/mouse to monitor and control the production process.

First of all, the entire highway should be fully redundant configuration. That is, all the operator stations, engineer stations and site control stations must be connected to the two redundant high-speed data highway. Once a high-speed data highway failing, without manual intervention, the system will automatically switch to another high-speed data highway, while the LCD will display alarm information to alert operator to inform maintenance staff for processing

Secondly, A high-speed data highway of the distributed control system failing, the whole distributed control system will not be affected. For example, an operator station failing, its influence is limited to local areas, and will not affect the normal running of the entire plant.

6.6.2 Security Monitoring System

Information and security monitoring system includes CCTV, Access Control System, Fire detection and alarm system, supervisory information system (SIS).

6.6.2.1 CCTV

CCTV will be installed for the project. The system includes 50 monitoring points (coal handling system is excluded). The CCTV subsystem will be placed at the following areas: turbine house subsystem, central control building subsystem, BOP subsystem, security subsystem. All cabinets for these areas will be placed at local EER.

6.6.2.2 Access Control System

Access Control System will be set for the project. The access control subsystem will be placed at the following areas: turbine house subsystem, central control building subsystem, BOP subsystem. All cabinets for these areas will be placed at local EER.

6.6.2.3 Fire detection and alarm system

A fire detection and alarm system will be set for the project. The system will be designed following Chinese fire code, and local related design specifications will be taken as reference. Fire detection and fire alarm zone comprises main power house zone, BOP zone, and non-plant area. A central control panel will be provided in CCR, and sub panels will be provided in zone of turbine house, water treatment plant zone, coal handling zone and non-plant zone. The central control panel and sub panel will be interconnected to form a looped network. The control and alarm console will be installed in CCR.

6.6.3 Turbine digital electro-hydraulic control system (DEH)

A digital electro-hydraulic control system (DEH) will be supplied by Turbine manufacturer and choose Woodward (505) brand.

6.6.4 Turbine emergency trip system (ETS)

The turbine emergency trip function will be implemented via PLC and will be supplied by Turbine manufacturer.

6.6.5 Turbine supervisory instrument (TSI)

A Turbine supervisory instrument (TSI) will be supplied by Turbine manufacturer and choose Bentley Nevada 3500 series.

6.6.6 Field Instrument

All field instruments and control system including process switch, transmitter, gauge for pressure, thermometer, level, flow, temperature and specialties, etc., primary elements for flow, temperature, will be supplied for normal control, protection, monitoring of the boiler, turbine and generator.

All field instruments will be NEMA4X standards.

All process connections with field instruments should be through Stainless Steel tubing and fittings

6.6.6.1 Pressure measurement

The transmitter will be smart type based on HART protocol. Pressure and difference pressure sensing elements shall be non hysteresis type unless otherwise specified.

The transmitter shall be 2-wire type and output signal will be 4~20mA.

All pressure gauges should be provided with isolation valves.

The process switches for pressure, temperature, flow will be of snap acting, single-pole, double-throw type (SPDT), able to switch 15 amps, continuous at 250 V ac or more and 0.5 amp continuous at 110Vdc or more.

6.6.6.2 Temperature measurement

The primary element of temperature measurement will be of the thermocouple, resistance temperature detector (3-wire) or thermometer.

Thermocouples (Type K) and Resistance Thermometer Detectors (RTD) are the most commonly used. All Temperature measurement gauges should be provided with separate thermo wells.

6.6.6.3 Flow measurement

Flow measurement device will adopt orifice plate, vortex flow meter, wing air flow measurement device and other types.

All flow transmitters should be provided with 3 way manifold valve block assembly.

6.6.6.4 Level measurement

Level measurement device will adopt differential head type, ultrasonic type, capacitance type, magnetic type, bi-color water indicator type and others type level meter.

6.6.7 Cable and Cable Tray

6.6.7.1 Cable tray will select hot-dip galvanizing type.

6.6.7.2 All power and control cables for 400/220 VAC should be PVC/SWA/PVC, Armored copper Cables of 1000 Volts.

Computer cables should be sub shield and total shielded copper cables of size 1.3 to 1.5mm2.

Thermocouple will select extension cables.

All instruments Cables should be shielded twisted pair 99.9%copper cable.

6.7 Configuration of main monitoring and control equipment

1) This project will adopt state-of-the-art DCS control system, since it has high cost/ performance ratio, and can fully utilize system functions. Besides, it can also prolong unit service life, save operation and maintenance expense. Consequently, the producing cost can be reduced, and production managing level and market competitiveness can be improved.

2) Main I&C equipment

(I) Transmitters with internationally recognized brand (smart type) will be adopted.

(II) Critical logic switches of pressure, level, flow and temperature will adopt internationally recognized brands.

(III) Critical analyzers will adopt internationally recognized brands.

(IV) High temperature & pressure sampling valve, drain valve will adopt imported product.

3) Actuator

• Internationally recognized brands will be adopted for automatic adjusting elements and critical actuators. Intelligent integrated electric actuators will be selected.

6.8 I&C Laboratory

The laboratory equipment will be configured according to the requirement of I & C system. Special maintenance and testing equipment will be supplied together with individual automatic system.

Chapter VII Basic Design of Coal Fired Power Plant

7.1 Ash Handling System

7.1.1 Bottom ash

Bottom ash cooler, two (2) outlet for boiler;

7.1.2 Fly ash

- Bag filter hopper, four (3) ash outlets for bag house.
- Primary air heater (AH) hopper, two (2) outlets for boiler;

7.1.3 Basic data for design /planning

Basic data

Bulk density of the fly ash : 0.75-0.85 t/m3

Bulk density of the wet fly ash : 1.25 t/m3

Temp. Of the fly ash at the outlet of the Bag filter hoppers: 180 °C (max) temp. Of the fly ash at the outlet of the PAH hoppers: 250 °C (max) temp. Of the bottom ash at the outlet of the furnace

Chamber : 850 °C (max)

Ash Distribution:

Item	Amount (t/h)	
Unit Fly ash Bottom ash	Fly Ash	Bottom Ash
1x35MW	1.7	1.7

1) AH fly ash distribution:

Item	Amount (t/h)	
Unit Fly ash Bottom ash	AH Hopper	
1x35MW	0.425	

2) Bag filters Fly ash distribution:

Item			Amount (t/h)	
Unit	Fly ash	Bottom ash	Bag Filter Hopper	
1x35MW			1.275	

7.1.4 General introduction of the ash handling system (plant)

The system comprises of fly ash handling, bottom ash handling and transportation air supply system. The margin of the system design to meet normal operating requirements will be implemented.

7.1.5 Fly ash handling system

The fly ash handling system is provided to remove the fly ash from AH and Bag filter hoppers to transport the fly ash to one 500 m3 capacity fly ash silo by ash transfer piping system which dilutes phase pneumatic fly ash handling system.

Required transportation air for the pneumatic transport will be supplied by Roots blower air.

Air of the pneumatic transport from the boiler and Bag filter area, as well as the aerating air of the fly ash silo is discharged outwards through a Vent Filter (bag type) , combined with a Fan, placed on top of the fly ash silo.

7.1.6 Bottom ash handling system

An independent Bottom Ash System will be designed and installed (with some unburned coal) which fall down from the furnace, to the bottom ash silo for storage, by Chain-bucket conveyor, bucket elevator sequentially.

7.1.7 Transportation air supply system

Required transportation air for the fly ash handing system will be supplied by Roots blower (2X100% for 1 unit in principle). All the Roots blower will be installed under the Bag filter.

7.1.8 Control air supply

The control air supply for the complete ash transport, storage and unloading system is provided from the plant (for unit) common instrument air supply system.

7.1.9 System Control

The fly ash transport equipment for all Transmitters is fully automatic, except the hopper emergency discharge devices (by manual operation), with continuous operation.

-The fly ash silo unloading sub-system (including silo bottom Aeration) is operated locally.

- The bottom ash transport equipment is fully automatic.

-The bottom ash silo unloading sub-system is operated locally.

7.1.10 Bag filter to the Fly ash silo subsystem

The Transmitters will deliver the fly ash falling from the AH and Bag filter, AH and Bag filter hoppers to the Fly ash silo by continuous operation in automatic mode, one 150% capacity transmitter with pipelines is installed for each hopper of the AH and Bag filter .

7.1.11 Fly ash silo, its Venting, Aeration and Unloading Devices etc

There is one common fly ash silo for the Unit made of steel with the necessary aeration, ventilation and unloading devices, level switches and other accessories. The effective volume of silo is 200M3.

The two possibilities of unloading the silo:

-Dry ash unloading to bricking system by conveyor

-Fly ash conditioning and filling of truck by a Conditioning Unloader

7.1.12 Bottom Ash handling system

Bottom ash, from the furnace, will fall into a Chain-bucket conveyor by gravity via ash cooling. Bottom Ash from the Chain-bucket conveyor can be transported to the bottom ash silo via bucket elevator.

There is one common bottom ash silo for the Unit made of steel with the necessary aeration, ventilation and unloading devices, level switches and other accessories. The effective volume of bottom ash silo is 250M3.

The two possibilities of unloading the Bottom ash silo:

-Bottom ash unloading through an Emergency Chute

-Bottom ash conditioning and filling of truck by a Conditioning Unloader

7.2 Coal and Limestone Handling System

7.2.1 Design Basis

a) Statutory/mandatory code and standards.

b) Original document information submitted by the owner

c) MOM and comments between OWNER and SYEDI

7.2.2 Coal and limestone consumption

a. Coal consumption

No	Item	Unit	Design coal	
1	Quantity of boiler	Set	1x150t/h	1x150t/h+1x220t/h
2	Coal consumption per hour	t/h	16.32	40.26

Notes:

Coal consumption in the Table is calculated under rated operating condition of the boiler using designed coal type.

b. Limestone consumption

No	Item	Unit	Design coal	
1	Quantity of boiler	Set	1x150t/h	1x150t/h+1x220t/h
2	Coal consumption per hour	t/h	4	10

Notes:

Limestone consumption in the Table is calculated under rated operating condition of the boiler using import coal.

Coal

Coal will be transported by self unloading trucks (by Owner), the interface is ground hoppers on site.

Raw coal having size of (-) 150 mm will be received from mines by truck (by Owner).

Limestone

Limestone will be transported by self unloading trucks (by Owner), the interface is ground hoppers in limestone shed on site.

The size of uncrushed limestone shall be (-) 15 mm.

Bed material

Bed material will be transported by self unloading trucks (by Owner).

7.2.3 Coal Handling Systems

7.2.4 Coal stockyard

Coal shall be transported to the plant by self unloading trucks (by Owner).

Two (2) covered coal stockyard with Two (2) coal piles will be envisaged. The total store capacity of coal stockyard will be 9,600t, matching the coal consumption of 10days for 2 boilers.

Total Two (2) underground reclaim hoppers will be installed for unloading of coal transported by Two (2) Grab Crane.

One (1) vibrating feeder will be installed under each hopper. Two (2) numbers vibrating feeders will be installed.

2 bulldozers of minimum 400BHP diesel engines will be envisaged for dosing on coal yard and limestone shed.

7.2.5 Belt conveyors

The design capacity is 150t/h. The specification of belt conveyors is: belt width 650mm, belt velocity is 1.6m/s.

All belt conveyors will be one stream. All conveyor belts will be of fire resistant plied construction type.

All belt trestles will be designed with out-doors type. Conveyors shall be totally enclosed with Rain Cover.

7.2.6 Coal Screening and Crushing System

One set of screen will be installed in the coal crusher house. The capacity of screen is 150 t/h.

One set of crusher with capacity of 120 t/h will be installed under the screen. the input size will be (-)150mm, and output size (-)10mm.

7.2.7 Auxiliary system

2.4.1 Magnetic separator and metal detector

One magnetic separator and one metal detector will be installed above the C-01 belt conveyor.

2.4.2 Coal weighing device

One belt weigher will be installed on C-02 belt conveyor.

2.4.3 Belt protection switches

Protection switches will be installed along all conveyors including Pull-chord type emergency switches, Belt sway switch, Zero speed switch.

2.4.4 Dust suppression

Water dust suppression system at all both at coal discharge and loading points would be envisaged.

7.2.8 Limestone Handling Systems

7.2.9 Limestone storage shed

One limestone shed will be envisaged on-site with size of 24 m (length) x 15m (width) X 3m (height).The capacity of limestone pile will be 960t that can serve two boilers for 4days.

One underground hopper with vibrating feeder in it will be settled in limestone shed. The rated capacity of each feeder will be 15t/h.

The limestone will be loaded to the underground hopper by bulldozers.

7.2.10 Limestone belt conveyor

One belt conveyor will be installed transporting limestone from shed to limestone mill house. The design capacity is 15t/h. the specification of belt conveyors is: belt width 500mm, belt velocity 0.8m/s.

7.2.11 Limestone mill system

One (1) mill with rated capacity of 15t/h will be installed as limestone crusher. The input size of hammer crushers will be (-) 15mm and output size will be (-) 1mm. After milled, the limestone powder will be conveyed to limestone bunker by screw conveyor and bucket elevator.

7.2.12 Limestone powder feeding system

Four limestone powder discharge outlets are set under limestone bunker. One is for unit 1, another is reserved for unit 2, and the others are for FGD. Limestone powder from limestone bunkers will be conveyed to the furnace by diluted phase conveying system.

7.2.13 Bed material handling system

One (1) bed material bunker will be envisaged in bunker bay for boiler.

The bed material will be loaded through coal hoppers by bulldozers and transported by belt conveyors to bed material bunkers.

7.3 Water Treatment System

This Technical Specification is applicable to procurement, design, testing and acceptance of 150t/h circulating fluidized bed boiler unit for Pakistan SCIL 35MWe Coal-fired Power Plant, and proposes technical requirements for boiler function design, performance, erection, testing, etc.

The water source for this project is well water which was supplied by the owner.

7.3.1 Water source quality

Water analysis reports have been provided by the owner, the data is as follows.

Sr,#	Parameters	Reported value
1.	pH at 25°C	8.04
2.	Total Alkalinity as CaCO3(mq/L)	16.52
3.	Carbonates (mg/L)	826.00
4.	Bicarbonates (mg/L)	1007.72
5.	Hydroxyl (mg/L)	Not detected
6.	Total hardness as CaCO3 (mg/L)	198.40
7.	Calcium hardness as CaCO3 (mg/L)	70.00
8.	Magnesium hardness as CaCO3(mg/L)	128.40
9.	Total suspended solids (mg/L)	Not detected
10.	Total dissolved solids (mg/L)	1320.00
11.	Calcium as Ca" (mg/L)	28.00
12.	Magnesium as Mg' (mg/L)	30.81

13.	Potassium as 1(.+ (mg/L)	5.83
14.	Sodium as Na+ (mg/L)	255.55
15.	Chloride as Cl mg/L)	199.65
16.	Sulphate as S042 (mg/L)	231.51
17.	Conductivity at 25°C (11S/cm)	2106.00
18.	Nitrate as NO3 (mg/L)	5.62
19.	Nitrite as NO2 (mg/L)	Not detected
20.	Fluoride F (mg/L)	0.69
21.	Fe' (mg/L)	Not detected
22.	Fe" (mg/L)	Not detected
23.	NH4+ (mg/L)	Not detected
24.	Mn' (mg/L)	Not detected
25.	BOD 5 (mg/L)	1.79
26.	COD mr, (mg/L)	Not detected
27.	Total Silica (mg/L)	Not detected

Base on the MOM's of Kick off Meeting Dated 4-10th June2014, design base

Consider the max. TDS 1600 ppm

7.3.2 Water treatment system

System function

• To provide make-up water with its quality meeting the requirement of unit's safe and good operation.

• To provide high purity water to the places such as laboratories, sampling and any other system where high purity water is used as well.

• To provide high purity water for equipment cleaning, washing, testing and protecting when shut off, etc.

7.3.3 Description of system

a. System flow process

The principal flow diagram of water treatment system is as follows:

Well water → raw water tank → dual media filter → cartridge filter → first stage RO → ROP buffer tank → second stage RO → middle water reservoir tank → EDI device → Demin Water storage tank → using point

b. System scope

In this project, water treatment system is comprised of the following:

• ROP pre-treatment system

• ROP (first stage ROP +second stage ROP)

• EDI system

• ROP Chemical dosing system

Output of water treatment system

Output of system: 2x16m3/h

Quality of demineralized water

The quality of water treatment plant outlet water is as follows:

•Conductivity: 0.2μs/cm (25°C)

•Silica dioxide: 20μg/1

•PH: 8.8-9.3

c. Operating and controlling

The whole water treatment system will be operated automatically.

Reverse osmosis equipment will be shut down and turned into chemical cleaning step when either of following condition exists:

• Pressure drop of film exceeds the preset value.

• Desalination ratio of film less than the present value.

• Water output less than the preset value.

When either of following phenomenon occurs, reverse osmosis device will be shut down:

• Inlet water quality (includes SDI, free chlorine, pH) is not up to the requirements.

• There is a fault which cannot be solved in a short time.

d. Equipment location

In this project, the equipment and control& instrument panel will be located in the new building. The arrangement of the system is referred to the drawing YG-F1404C-H-07.

e. Chemical dosing system for turbine and boiler Plant

• To maintain water chemical condition of thermal system and prevent scaling & corrosion.

• To maintain appropriate pH value in feed water to prevent corrosion by injecting ammonia to Demine. Water pump outlet pipeline.

• To remove residual oxygen in feed water by injecting hydrazine to deaerator water tank's downstream.

• To improve pH value in boiler water and prevent residual hardness depositing in boiler by injecting phosphate.

f. System scope

Chemical dosing system consists of the followings:

• Ammonia injecting in DM water system

• Hydrazine injecting in feed water system

• Phosphate injecting in boiler water system

7.3.4 Design condition

a. **Chemicals**:

Hydrazine: liquid with concentration of 40 %(m/m), stored in barrel Ammonia: liquid with concentration of 30%, stored in steel bottle Tri-sodium phosphate: crystal with concentration of ≥95'/%

b. System description

Each unit will be equipped with one set of chemical dosing equipment which includes one set of ammonia dosing equipment, one set of hydrazine dosing equipment and one set of tri-sodium phosphate dosing equipment. The detailed system is referred to the drawing YG-F1404C-H-05.

c. Ammonia injecting in DM water system

Liquid ammonia in steel bottle will vaporize and be rationally injected into the agitating solution tank through transfer pump and measuring tank, then diluted to the concentration of 3%, finally pumped to DM water pump's outlet pipeline. PH value of DM water will be controlled to be 8.8-9.3 by ammonia injection.

d. Hydrazine injecting in feed water system

Concentrated hydrazine solution stored in barrel will be rationally injected into the agitating solution tank through transfer pump and measuring tank, then diluted to the concentration of 0.3%, finally pumped into deaerator water tank's downstream.

Residual oxygen in feed water will be controlled to be less than the limited value to weaken oxygen corrosion by hydrazine injection.

e. Phosphate injecting in boiler water system

Solid and powder phosphate is dissolved in agitating solution tank and diluted to the concentration of 1%, then pumped into steam drum. Phosphate dosage will be controlled by controlling P043- content.

f. Operating and controlling

In this project, ammonia and hydrazine metering pump's dosage can be regulated by frequency. Ammonia solution dosage in DM water will be adjusted by water flow and PH value of DM water. Hydrazine dosage in feed water will be regulated by feed water flow. Phosphate dosage will be controlled by manually.

g. Cooling Water Dosing System

The Cooling Water dosing system includes ant scale dosing system and Nalco dosing system.

Ant scale dosing system will be supplied for Cooling Water. In this system, one solution tank and two dosing pumps will be supplied for cooling water. During the normal operation, one dosing pump operates and one standby.

Nalco dosing system will be supplied for Cooling Water. In this system, one solution tank and two dosing pumps will be supplied for cooling water. During the normal operation, one use and one standby

h. Steam & water sampling system

Steam & water sampling and analyzing system are located in the main building.

Chemical laboratory, analysis instruments and equipment

In the project, chemical laboratory rooms shall be designed to perform the following operations:

•**Water analysis**: this is the chemical and physical analysis of water used in the steam power plant cycle process, especially the analysis of characteristics which may destruct and/or decrease the unit performance, such as: conductivity, PH, hardness, alkalinity, silica content, ammonium, oxygen, phosphate, iron, copper, sodium, etc.

• **Fuel oil analysis**: this is the chemical and physical analysis of fuel oils used in steam power plants, especially the analysis of characteristic which determine the unit performance, such as: heating value, specific gravity, viscosity, flash point, sediment, water content, ash, carbon residue, metal, sulphur, CHN (Carbon, Hydrogen, Nitrogen)

• **Coal analysis** and sample preparation: this is the chemical and physical analysis of coal used in steam power plants, in order to shop Equipment know the unit performance, handling characteristics and the constituents which can aggravate unit performance such as: heat value, water content, ash, volatile matter, HGI index, fixed carbon, phosphorus, sulphur, CHN(Carbon, Hydrogen, Nitrogen)

• **Lubricating oil analysis**: this is the chemical and physical analysis of lubricating oils used in steam power plants, in order to determine the performance of the oils. The analysis will establish the oil properties and composition including carbon residue, flash point, specific weight, neutrality, viscosity, surface tension, sulphur content etc.

• **Insulating oil analysis**: this is the chemical and physical analysis of insulating oil

for electric equipment, in order to determine the insulation capability, resistance to oxidation and impurities including insulation resistance, specific weight, flash point, neutrality, viscosity, surface tension and oxidation test etc.

• **Flue gas analysis**: this is the chemical and physical analysis of the flue gas in order to know the combustion quality and content of undesirable

substances in the gas, e.g. dew point, content of 02, CO2, CO, SO2, and NOx.

7.4 Heat and Ventilation system

7.4.1. Ventilating for the Turbine Hall

The heat that the equipments and the piping released is about 300kw, the released moisture is about 150kg/h. For the Turbine House Ventilation system, the total supply air flow is 18x104m3/h. Air exhaust through roof fan and fresh air entry through louvers(with filter).The fresh air absorbed residual heat and moisture, exhausted through roof fans. The Boiler open air layout, afterheat can exhaust directly.

7.4.2 Ventilation for Electrical Rooms

Mechanical ventilation will be equipped for Cable Spreader Room, Electrical room. Air exhaust through wall mounted axial fan and fresh air entry through openings and intake louvers for electrical room. Ventilation quantity should not less than 12 number of air changes per hour. Emergency exhaust air fan can be concurrently used as ventilation draft fan.

Emergency exhaust air fans will be provided for electronic equipment room and central control room. Air displacement not less than 6 number of air changes per hour.

7.4.3 Ventilation for Other Rooms

Mechanical ventilation will be equipped for Sample Room, Doing Room, and Chemical Rooms. Air exhaust through wall mounted axial fan and fresh air entry through door and windows

7.4.4 Air conditioning

For Central Control Room and Electronic Equipment Room

In order to ensure equipment, instrument and control element reliable operate, improve work comfort level. Air-cooled package thermostatic and humid static air conditioner will be provided for The Central Control Room and Electronic Equipment Room.

For Other Rooms

Split-type air conditioners will be provided for distribute room, DC

System room, electric precipitation control room, thermodynamic laboratory, office, duty shift room

7.5 General Civil Design

Technical specification for design of fossil fuel power plants" DL 5000-2000

"Technical stipulation for the design of civil structure of thermal power plant" DL

5022-2012

"Code of architectural design for thermal power plants" DL/T 5094-1999

"Code for design of small-size power plant" GB50049-94

"Design specification for concrete structure" GB 50010-2010

"Code for design of masonry structures" GB 50003-2001

"Load Code for the Design of Building Structures" GB 50009-2001

"Code for seismic design of buildings" GB 50011-2001

"Code for design of building foundation" GB 50007-2011

Control room arranged in the BC row operation floor.

Building and structure shall have structural design in accordance with the appropriate type of structure being selected to ensure the availability of advanced technology, safety and applicability, economy and quality.

1.2.8 With process production being guaranteed, the type of structure shall take into account the painting, fire-resistance, vibration resistance, explosion resistance, geological condition, construction technology, etc. and shall meet the requirements on structural intensity, rigidity and durability.

Natural condition for sitting and main technical data for design

Location, Topography

The project site comprises typical deposits of the Punjab plains. The sediments in the project have been deposited by two rivers viz. Ravi and Chenab. Locally, these are also known as Rachana Doab. These deposits are typically a few meters of cohesive silts and plastic clays underlain by fine to medium silty to fine sands. There are erratic incidents of strata. The project area has the following salient geological characteristics: No bedrock outcrops

are visible at the site. The overburden soils over the site area are visible as clay/silt clay on the surface. Thickness of the overburden soils is more than 30 meters the site area is generally flat and stable.

Climate Condition Air Temperature

Maximum 50°c

Average 25°C

Minimum 0'c

"Technical Code for Ground Treatment of Buildings" JGJ 79-2011

"Code for design of steel structures" GB 50017-2003

"Code for design of chimneys" GB 50051-2002

"Code for design of dynamic machine foundation" GB50040-96

"Technical code for designing load of main building in fossil fuel power plant" 5095-1999

"Code for fire protection design of buildings" GB50016-2006

"Code for fire--protection design power plant and substation" GB 50229-2006

"Technical code for building pile foundations" JGJ94-2008

7.5.1 Design principle

150t/h circulating fluidized bed boiler and 1 X 35MW condensing/steam turbine-generator set will be build in the project.

Electric equipment room is arranged in the bottom of the deaerator and coal bunker bay.

Set one chimney

Based on coal burn to consider boiler

The main power house according to turbine house, Deaerating and coal bunker bay, boiler house those sequence to layout, Deaerating and coal bunker bay is adopted frame structure, and boiler is open air layout.

Set 1 control room arranged in the BC row operation floor.

Building and structure shall have structural design in accordance with the appropriate type of structure being selected to ensure the availability of advanced technology, safety and applicability, economy and quality.

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7.5.3 Climate Condition

Air Temperature

Maximum temperature 50°C

Average temperature 25°C

Minimum temperature 0°C

Rainfall

Average monthly rainfall 50 mm

Relative humidity 20% to 30%

Maximum speed 30.6 m/sec

Barometric Pressure Design 760 mm Hg

Wind Speed 110 km/h

7.5.4 Seismic Information

The site in Pakistan region is located in the zone 2Aof seismic zone. as per the recently revised provisions (2007) of Building Code of Pakistan, for zone acceleration is 0.12 g.

7.5.5 Main design parameters

Life limit by design: 50 years

WS: 0.58kN/m2

Basic wind pressure: 0.58 kN/m2

Prefabricated concrete element M25—M50

c) Plain concrete and cushion course M10, M15

Impermeable concrete: M35 class mixed with expanding agent of 10% in cement usage, impermeable grade by design not less than S6, which could be appropriately selected according to structural stress and characteristics.

e) Secondary grouting: utilized shrinkage-free grouting material, microdilatancy fine gravel concrete or fine gravel concrete with one intensity grade higher than major concrete.

f) Structural durability of concrete: enclosed structural room inside on the ground to be designed as per Type I environment; Open structure on the ground to be designed as per Type II environment grade; Underground structure to be designed as per Type III environment grade's/C 0.45.

For underground structure, we also recommend that a dense impermeable concrete with maximum water-cement ratio (w/c) of 0.45 and with some suitable admixture should be used. A minimum cover of about 3 inches (75mm) should also be ensured for protection against chloride attack.

Relative degree of sulphate attack is considerable; cement in concrete will be use type V cements (see ASTM C-150 or BS4027).

Reinforced bar

Common reinforcement: common reinforcement(non prestressed reinforcement) used in concrete structure shall use Class A36 (Ultimate yield 40,000PSI equal to 275.8MPa), Class A4Olultimate yield 60,000PSI equal to 413MPa).

Unless otherwise specified, reinforced bar with diameter <12mm may utilize Class A36 and that with diameter 12mm may consider Class A40. T4 Steel

Generally, ordinary Portland cement will be used for upper structure and sulphate resistant cement will be used for foundation and structure which underground .the strength of cement should be as per the mixture of concrete which was issued by local quality management.

Aggregate

Utilize medium coarse sand and crushed gravel.

Wall

Building brick Will use local brick with thickness 225mm*112.5*75, quality follow ASTM C62, Crushing strength of 1st class of brick about 13.8MPa,extra wall thickness is 225mm,and inner wall thickness is 112.5mm.

V. Mortar

Generally, Type M, Type S, Type N mixed mortar.

High-strength bolt

Big hexagonal nut of high strength is sized M12-M30. Torsion-shear bolt is sized M16-M24 which class is 10.9 and 20MnTiB in material. Nut and washer class is 10H and HRC35-45 respectively.

Handrail

The handrail is adopted steel handrail.

7.5.6 Anti-corrosive requirement for steel structure

The steel structure surface is adopted sand blasting; descaling grade is Sa2.5, paint:

(1)Shop-Prime Coat, inorganic zinc 30pm (85 to 89 % zinc by weight);(2) Shop-Intermediate Coat, MIO epoxy, (3) Shop-finish Coat, MIO epoxy, the thickness of shop-intermediate coat and shop-finish coat should not less than 125pm, (4) Field Finish Coat, Aliphatic Polyurethane 50pm.

7.5.7 Soil base and foundation

The area of main power house +0.00m is equal to absolute elevation -0.160m.

According to the description of the soil investigation report, soil layer of the top is dark brown ,stiff to firm lean clay to silty caly, N value (SPT) is 7-11, the following soil layer (from 2.5m to 16m) dark Grey ,medium dense ,silty sand to poorly graded sand with silt . N value (SPT) is 7-23.the soil layer from depth 16m to 30m is dark grey ,medium dense,silty sand to poorly graded sand ,trace concretions value (SPT) is 20-30.

The ground foundation plan is initially prepared below, the heavy building such as main building and chimney etc will use piling foundation , and the other buildings (structure) adopt the shallow foundation.

7.5.8 Layout of the main power house

Main power house may be arranged in sequential configuration, steam turbine house -deaerating coal bunker- boiler island (boiler island to be separately designed by the manufacturer).

a) Turbine house

Turbine house may have a lateral span of 21.00m and total longitudinal length of 42.0m (to be made of reinforcement concrete structural and no expansion joint), with column spaced in 7.0m and one steam turbine inside. Steam turbine house is divided into ground floor and operation floor with vertical elevation of ±0.00m, 8.00 floors respectively.

±0.00m floor is provided to setup thermal machine and auxiliary machine, etc. Maintenance space is provided fixed end socket to satisfy with the need for maintenance of steam turbine. Structure at axis (A), (B) may set overhanging platform to facilitate the maintenance and traffic. Isolate Island platform is considered to prevent vibration load of steam turbine generator to transfer to main building. Steam turbine is oriented in longitudinal direction arrangement. Inside the steam turbine house, there is a bridge crane with lifting capacity of 75/20t, span of 19.50m, and elevation for crane beam-rail roof being 17.50m.

Deaerating and coal bunker bay

Deaerating coal bunker may have a span of 11.0m and 5 layers vertically, elevation of

±O.00m, 4.50m (pipe sandwich), 8.00m (operation floor), 15.500m (deaerator floor), 27.00m

(Coal transportation floor and coal bucket floor).

±O.00m is 415v ax power distribution roorn,(11kv a*power distribution room and staircase and so on; 8.00m floor between (3) and (5) axis is set central control room, between

(1) And (2) axis set staircase, washroom; 15.50m layer is arranged 1 set deaerator. 27.00m floor is set 1 conveyor belt. coal bunker is suspended in 27.00m below above beam.

Coal handling method is adopted fixed end coaling, between (1) and (2) axis add

Conveyor belt operate platform.

3- Traffic arrangement

a) Horizontal traffic

At the side of C row of column in deaerating room, there will be main longitudinal pathway with width bigger than 2m. At B row of column side in steam turbine house and in front of the boiler platform, there is secondary longitudinal pathway with width bigger than 1.2m. Both ends of main longitudinal pathway is accessed to the outer exit of factory building or sealed staircase. At both ends ±0.00m, 8.00m, there are lateral pathways in place to allow easy access from steam turbine house to deaerating coal bunker. Access of main equipment to steam turbine house may pass through the maintenance yard in the middle of steam turbine house and fall way at each floor in the top. Access to maintenance yard may be equipped with folding flat-opening steel door.

In front of the boiler platform ± 0.00m, there is longitudinal pathway with width bigger than 4.0m.

At fixed end and extension end, there are stairs connecting to each platform, which are provided to meet the requirement of equipment operation and safe evacuation in case of fire, the width of stair at fixed end is 1.2m, the width of stair flight at extension is 0.8m. In steam turbine house, there are steel stairs for site inspection and tour installed at the heater platform for turbine, via which you may go to the middle floor and operation floor of turbine house.

All entrances/exits, stairs and walkway for platform connecting each floor are equipped with conspicuous signs showing the direction and guidance of evacuation. Day lighting and ventilation Lighting in steam turbine house and deaerating coal bunker shall be made available in a combined way of natural and manual lighting. The whole factory building may be equipped with rectangular windows in dot arrangement. Natural ventilation will be enough for steam turbine house. Mechanical exhaust blower may be installed at the roofing. Natural ventilation is provided across the deaerating coal bunker with properly distributed air flow.

Roofing is properly inclined toward roof gutter to facilitate the collection of rainwater. Via rainwater pipe, rainwater is routed to the drainage system in the plant. The roof of steam turbine house will be covered with laminboard or the purpose of water-proof and heat resistance.

Ladder and pathway shall be properly arranged. Each structural element for main factory building hall is delivered in compliance with fire-proof criteria: Main power house (including steam turbine house, deaerating coal bunker) shall have

Class II fire-resistance. Fire hazard is classified as IV.

Fire door shall be installed for pathway door between steam turbine house and Deaerating coal bunkers that for distribution room in main power house, cable sandwich, and enclosed staircase.

Fire wall shall be installed underneath partition operation floor (8.00m floor) between steam turbine house and deaerating coal bunker, with fire-resisting limit of 4.0hr and fire-resisting limit of 1.0hr for area above the operation floor. Enclosed staircase wall shall have fire-resisting limit of 2.5hr while all other non load-carrying wall shall have fire-resisting limit of 1.0hr. Category B fire door should be established for switching room in the main power house, cable interlayer , closed staircase and control room.

7.5.9 Housekeeping and sanitary facilities

Since housekeeping and sanitary measure are designed for operation purpose and the technicians often appear at operation floor, the toilets could be considered at fixed end of deaerating coal.

Water flushing may be provided at coal conveying floor. Ditch may be provided to access to outside coal-water treatment unit.

Building enclosure

Outer wall for steam turbine house and deaerator coal bunker will be covered with brick wall with thickness 225mm. All doors and windows are made of aluminum alloy or steel. Distribution room may have door and window of louver and PVC door is applied_to the toilet.

Architectural style

For the purpose of safety, applicability, economy, with adoption of architectural design philosophy and in conjunction with local style of building, we are committed to create and build an elegant and practical main factory building with the taste of the times and in line with the local culture of architecture.

Fixed end is properly staggered with defined zoning. Adoption of substantiality and virtuality design, material application, colorful decoration, etc., will create an art background for architectural composition for the whole plant.

Outer vertical view and color for main factory building has fully taken into account the proper consistency of environment in the vicinity. Lucid and lively color may be painted on main factory building. Main color prefers light-color with color strip in some areas to make the vertical view vivid:

Arrangement and planning for underground facility

Underground ditch for main power house and equipment foundation shall be arranged according to the operation requirement, with channel and pit poured with waterproof concrete.

Industrial pit and ditch are formed without interference.

7.5.10 Structurure design for the main power house

Structural system for main power house

Main power house shall be laterally arranged with steam turbine house - deaerating coal Bunker. Framework system is formed with a row of column — roofing beam for steam turbine House - deaerating coal bunker. All the structure including frame column and beam and slab will be casting-in-situ reinforcement concrete material. The foundation will be piling Foundation.

Boiler frame and boiler top cover shall be designed by the boiler manufacturer. Platform structure in front of the boiler will be overlapped with C row of pillar and side pillar of boiler frame, with the base utilizing sliding connection. Sufficient vibration-proof slipping clearance shall be provided.

Longitudinal vertical view system

Longitudinal vertical view of main power house may use reinforcement concrete frame structure system, will build several longitudinal concrete beam at difference elevation as per the position of window and mechanical need.

Plane system

Platform for each floor will be structured by RC beam — cast-in-place concrete slab, and in checkered steel plate or steel grating plate for some areas.

Gable wall end for steam turbine house are all made of steel and enclosed with light structure. Connection of gable wall to outer pillar of steam turbine house, framework of deaerating coal bunker to roof truss shall be made available in a manner able to transfer the horizontal loading and enable free settlement.

Steam turbine house is adopted slope double skin insulated metal roofing, structure form is 21m span H shape steel beam support above roof (double skin insulated metal roofing),support layout meets the relative regulation requirement.

Crane beam in steam turbine house is provided with RC beam with a span of 7.0m and crane load of 5/20, which is defined as light-duty system.

According to mechanical design, boiler shall be equipped with 1 coal buckets of 250m3 in volume, with horizontal section of bucket shaped square. Coal hopper is adopted reinforcement concrete structure, through bolt transport coal bunker load to 27.0m coal handling level frame beam.

The foundation for steam-turbine generator is built in cast-in-place reinforced concrete framework. RC Foundation for plate-type is proposed.

Miscellaneous

Heater platform shall be structured in reinforced concrete frame construction. Settlement joint shall be considered between main framework and Steam Turbine Island. RC independent foundation is proposed.

Design on earthquake resistance:

Main power house is classified as Category C building, with calculation on earthquake influence and measure on earthquake resistance to be considered as per seismic design intensity (Class 7, 0.12g).

Measure to avoid heterogeneous settlement

In order to prevent heterogeneous settlement in structure, settlement joints are provided at areas between main framework structures, foundation of Steam Turbine Island, steel structure of platform for heater (considerable difference on counterforce at foundation base). For those unable to be disconnected, in addition to measures taken to increase the structural rigidity in the top, you shall try to maintain the same counterforce at foundation base or utilize the combined foundation.

7.5.11 Building (structure) behind the boiler

7.5.12. Chimney

A reinforced concrete chimney with outlet inside diameter of 3.20m and 80m height for propose boiler and extension boiler in future. The chimney is structured in single-drum reinforced concrete and the foundation is formed with slab reinforced concrete foundation, the foundation will be piling foundation. Tube wall is reinforcement concrete, and the inner lining material is acid-proof and water-proof castable refractories.

7.5.13 Support for steel flue, support for maintenance induced draft fan, and foundation of ESP

Support for steel flue and support for maintenance of induced draft fan are structured in cast-in-place reinforced concrete framework or steel framework, with independent foundation or piling foundation. Support for ESP will be steel structure to be supplied by the manufacturer, will use piling foundation.

7.5.13 Building (structure) outside the main power house

Oil tank is steel tank. Oil tank farm is baffled with brick wall to meet the requirement on fire criteria.

Oil pit for accident is built in a structure of cast-in-place reinforced concrete.

Foundations for drain tank and drain pump are built in a structure of reinforced concrete.

7.5.14 Pipe rack

Pipe rack support across the plant may be built in H steel column, beam or steel truss. The support over the road is built in steel truss or steel beam, with independent foundation in reinforced concrete.

7.5.15 Building (structure) for conveying coal

Building (structure) for conveying coal include trestle for conveying coal, crushing building, pit for accommodating coal to be dropped and dry coal shed etc.

7.5.16 Trestle for conveying coal

Coal-conveying trestle is structured in space steel truss: about 30m for distance between columns, independent foundation (or piling foundation) in RC at the bottom of column, Trestle members are made of H steel shape, square steel tube or angle steel. At the connection of trestle to coal crusher room and main power house, there are sliding bases, which has taken into account the width for seismic joint. According to process requirements, the trestle shall not be closed for both sides. Belt conveyer itself shall be equipped with belt cover. Walkway may be made of angle walkway beam + grating.

7.5.17 Tunnel

Underground coal-conveying corridor is structured in wall made of water-proof reinforced concrete, with box section and raft foundation. Over excavated areas will be filled with rubble concrete. Safety access to the ground shall be built to meet the fire-proof requirement.

7.5.18 Coal crusher room

It is structured in cast-in-place framework, with outside wall enclosed with brick wall and piling foundation. Each arrangement shall meet the process requirement and drainage for floor and roof and fire-resistance for the building shall be made available to satisfy the related criteria and regulation. For the purpose of process requirement, drainage for floor and roof and fire-

resistance for the building shall be made available to satisfy the related criteria and regulation.

7.5.19 Dry coal shed

Dry coal shed is structured in gabled steel frame. Wall and roof above the shed are baffled with single-layer color board. Column foundation is adopt piling foundation in RC material. The span of dry coal shed is 330m, the whole length is m, and the top elevation of grab bucket rail is m.

On the both sides of coal stack, there are coal retaining walls of RC with 4m height. Temperature expansion joint shall be arranged to meet the criteria. Steel structure within the height of coal pile shall be protected against corrosion or built in concrete.

7.5.20 Building (structure) for ash and slag

7.5.21 Air compressor house

Combined design shall be applied to air compressor house and ESP control room with plane dimension of 9.3x12m in 2 floors. The 1st floor is air compressor house and the 2nd floor is ESP control room.

The structure form is reinforced concrete frame structure, reinforced concrete is independent foundation. Roofing and floor are all adopted cast-in-place reinforced concrete floor slab, wall body is adopted local brick wall.

7.5.22 Ash silo

Ash silo and related supports are all in steel structure. Taking the driveway into account, we will install vertical supports for some intercolumns.

7.5.23 Chemical Building Structure:

7.5.24 DM water plant

DM water plant is arranged coal analysis room, water analysis room, distribution room, control room as well as dosing zone, producing water zone, water pump zone and so on. The coal analysis room, water analysis room, distribution room and control room are adopted reinforced concrete frame structure, cast-in-place reinforced concrete roofing slab, dosing zone, producing water zone and water pump zone are adopted steel structure. The design of DM water plant should pay attention to suitable corrosion measures.

7.5.25 Chemical dosing room

It is arranged at boiler area.

7.5.26 Administration office and other structures

7.5.27 Administration office building

Administration office building shall be designed based on the owner's requirement and management functions for those in the power plant of the similar size. .

The structure form is reinforced concrete frame structure, Roofing and floor are all adopted cast-in-situ reinforced concrete floor slab , wall body is adopted brick wall , reinforced concrete is independent foundation or piling foundation.

7.5.28 Mechanical repair shop and material storage

Total area is 42mX15m, set material storehouse and overhaul shop inner, adopted reinforced concreted frame structure, wall body is adopted brick wall, independent foundation or piling foundation.

7.5.29 Weighbridge room and control room

Weighbridge Room and control room is arranged near the weighbridge, take use of reinforced concrete frame structure.

7.5.30 High-voltage inverter room

High-voltage inverter room size is 27mx9m. The structure form is reinforced concrete frame structure, Roofing is adopted cast-in-place reinforced concrete slab, wall body is adopted brick wall, adopt piling foundation.

7.6 Basic design of electrical System

7.6.1 Design Scope of Electric Part

The scope of design includes all the electrical system of generator and auxiliary in the plant. The interface between the power plant and the outgoing lines will be defined at the outgoing feeder line gantry for connection line and ten feeder lines.

1.2 Main equipment data

1.2.1Main Data of Generator

Type WX16Z-054LLT

Rated output 5 OMVA

Number of phase 3

Rated voltage 11kV

Rated power factor 0.8

Rated frequency 50Hz

Rated current 2624A

Direct axis sub transient reactance 11.7% (saturated)

Short circuit ratio >0.55

Efficiency >98.2%

ELECTRIC

Insulation class

(Applied according to temperature rise of insulation: class **B)**

Speed 3000r/m

Excitation system brush-less excitation type

Cooling system air cooling system

The excitation control equipment will consist of an automatic voltage regulator (AVR) (with power factor controller). The AVR will as a minimum, be of the dual auto channel type with manual control device and appropriate auto/manual changeover circuits.

7.6.2 Electric Connections

The generator will be connected to the 11kV switchgear via non-segregated phase bus bar. The grounding transformer will be set at the neutral point of the generator. The 11kV bus is single bus. The low voltage bus including bus A, common bus and standby bus is from 3 set LV PDC transformers. The outgoing lines from 11kV bus are ten feeder lines and 1 connection line.

2.2.1 Excitation transformer

The excitation system is brush-less excitation type.

2.2.2 Current transformer

In order to meet the requirements of measurement, protection, energy metering and voltage regulation, the outlet side of generator are 3 groups CT equipped respectively.

2.2.3 Generator Circuit breaker

The Generator Circuit Breaker is installed at 11kV switchgear. The switchgear is metal armoring draw out cabinet.

2.2.3.2 Potential transformer

The generator PT will be installed in the PT cubicle. Two (2) sets of Potential transformer are equipped to generator in which one (1) set with voltage ratio 11k3/0.11N3/0.11/3 kV is used for protection and measurement, one (1) set with ratio11/A13/0.11N3 is used for excitation regulation.

2.2.2.3 Generator neutral point grounding equipment

The neutral point of generator is earthed through a distributed transformer whose secondary winding is loaded by a resistance.

(For the single line diagram of electrical main connection, refer to drawing no. D-01)

7.6.3 Equipment Selections

11kV switchgear circuit breaker: 4000A 40kA

1250A 40kA

(The details refer to Drawing No. D-01)

7.6.4 MV-LV Single Line Diagram and Equipment Selection

MV-LV Single Line Diagram

The 11kV motors and LV Unit Auxiliary Transformers are from 11kV single bus bar. The 3 PDC transformers include TR1, TR2 and (TkOi the TRO is the standby transformer for TR1 and TR2.

Capacity Calculation of PDC Transformer

The capacity of each PDC transformer is 1250kVA which is rated to supply loads for complete auxiliaries of unit.

0.4kV PDC/MCC

4.3.1 The PDC and MCC connection mode is applicable to 0.4kV system within power plant.

4.3.2 The 0.4kV system neutral point is solidly grounded.

Selection of Auxiliary Equipment

PDC transformers will be naturally air cooled dry type.

MV switch cabinet with withdraw out metal-clad and metal-enclosed type will be equipped with vacuum circuit breaker.

PDC and MCC, adopted switch cabinet of drawer model, will be equipped with air circuit breaker.

7.6.5 Electric Equipment Layouts

11kV and 0.4kV Switchgear

The 11kV distribution equipment is set on O.00m floor inside plant building.

PDC/MCC is located on O.00m floor of the plant building.

Generator Output System and Excitation Equipment

The 11kV bus bar is drawn out from output termination of the generator and Exciting transformer, then connect to Generator C.B switchgear through the no segregated phase bus. Exciting transformer, Neutral point equipment cubicle and excitation equipment cubicle are located in generator outlet chamber.

6 DC System and UPS

Unit DC System

The DC System is provided as follows: 110v dc system for power

This DC System will supply power to assigned loads, such as DC motors,

Emergency lighting, UPS device, etc. 110V DC system consists of the following major components:

One set of 900Ah (interim) batteries, one set of 180A battery charger, DC distribution panel.

110V DC system for refer to drawing No. D-05

All the DC equipment will be located at 8m level of plant building.

Unit UPS (Uninterrupted Power Supply System)

In this project, the unit will be provided with one set of 30kVA UPS, The Sizing

capacity UPS shall be including 20 % spare, which is sufficient to supply essential loads, such as instrument, control and computer system, etc. UPS will take AC 400/220V input as normal power source, and DC 110V from unit power DC system as emergency power source, AC 220V single phase output, 50Hz.

Unit UPS equipment will be located in UPS room at 8.0m level of plant building.

7.6.7 Electrical Protections and Metering

Protection

(1) Generator Protection

The Generator protection relay will be provided comprising the following:

a) Gen. differential

b) Gen. Voltage memory over current

c) Gen. Impedance

d) Gen. Negative phase sequence over current

e) Gen. Thermal overload

f) Gen. Stator earth fault

g) Gen. under/over voltage

h) Gen. Over excitation

i) Gen. Rotor earth fault

j) Gen. under/over frequency

k) Gen. Loss of excitation

1) Gen. Reverse power

(2)Transformer Protection

The PDC transformers protection system will comprise the following:

a) HV side over current

b) LV side over current

c) Neutral point zero-sequence over current

d) Winding temperature

The protection proposal diagram is shown on diagram No. D-02

Metering

In general, electrical parameters for electric system controlled in DCS will be sent to DCS o unit, and will be monitored in LCD.

Synchronization

One digital type automatic synchronization device and one set of manual synchronizing device will be applied for accurate, safe paralleling of generator to the network.

Generator Excitation System

The brush-less exciter system will be applied. The excitation system is made up of the following main equipment: Excitation transformer (ET), Automatic Voltage Regulator (AVR), Thyristor rectifier, field breaker, excitation control and protection devices, etc. The excitation system is of dual auto channel type with manual and auto manual change over circuit.

7.6.8 Building, Equipment Grounding and Lightning Protection

All equipment are connected to outdoor grounding using suitable grounding conductor. Minimum grounding conductor for equipment supplied from 220 V and 400 V will be 16 mm2 and equipment supplied from medium voltage (1 kv) will be 35 ^{2}. Copper bonding jumper having area at least 120 mm2 will be used at expansion joint or section of cable tray where required to ensure electrically continuity. Equipment such as switchgear and control cubicles will be provided with a main earth bar for the potential bonding to earth of all exposed conductive parts which may become alive under fault conditions.

Motors frame will be connected to building steel at the nearest practical location by a bare copper safety ground conductor. Small motor frames will be grounded through the conduit to cable tray system.

All equipment provided with ground bus bar such as: switchgear, MCC will be provided with grounding conductors bolted to both end of ground bus bars and connected to the nearest building steel.

Lightening rod of the lightning protection will be connected to ground grid through copper conductor, with the size of at least 120 mm2. At least two independent down conductor will be provided on each structure. Additional down conductor will be provided if the perimeter of the structure exceeds 75 meters, so that an additional down conductor is provided for each 30 meters of perimeters or fraction thereof

7.6.9 Outdoor Grounding

The grounding conductor size will be minimum 240 mm2 copper and be buried 600 mm below grade.

Ground rod will also be installed at locations that are subject to impulse current, such as arresters, lightning protection system ground conductors.

All above ground metallic object such as transformers, tanks, metal framing, long run expose piping and outdoor mechanical equipment will be connected to the grounding system in at least two places. All fences will be included in the grounding system.

7.6.10 Lighting

The lighting and small power system will be provided for the maintenance and operation of the whole Power Plant complete with distribution boards, lighting fittings, lamps, socket outlets, switches and all necessary cabling. Lighting will be High Pressure Sodium (HPS) luminaries for high bay and outdoor lighting and fluorescent luminaries for low bay and indoor lighting. The Central Control Room and other control room will be provided with a louver all ceiling which conceal all ventilating equipment and lighting luminaries. Road and yard lighting is preferred to be mounted on high mast. The Coal handling lighting including the bunker top conveyor floor of the boiler and similar place will be provided with HPS lighting with dust tight gasket fixtures suitable for Class II group G, Division 2 locations.

In general all lighting and all accessories located in hazardous areas will be suitable for the hazardous area usage.

Emergency lighting will be provided for personnel safety and for operational/access areas attended during an emergency. The emergency lighting will be supplied from the essential supply.

Emergency lighting will be provided for boiler galleries operating floor, control room, exit door, stairways, escape walkways, etc. Emergency lighting in the form of escape lighting will be provided for cable spreading floor, machine shop, locker, toilet and all normally inhabited areas.

Aircraft Obstruction Lighting;

Complete obstruction lighting for aircraft warning system will be provided for the stacks. The system will be accessible for maintenance. The lighting will have two power feeds equipped with automatic transfer switch. The normal power feed will be from power distribution panel and the emergency feed will be from emergency bus.

The areas of the power plant such as offices, control rooms, electrical control rooms, locker rooms and other indoor areas will provide 220V receptacles fed from the lighting panel.

7.6.11 Cabling

Cables will have copper conductors with extruded insulation/bedding/over sheath and be of the following or equivalent types

MV single core and multicore power cables will have XLPE insulation rated for restricted earth fault current, PVC bedding, galvanized steel or aluminum wire armor, PVC over sheath

The over sheath of single core power cables will have a suitable semi-conducting coating applied for over sheath testing,

LV single core and multicore power cables will be 600/1000V rating having either XLPE or PVC insulation, PVC bedding, galvanized steel or aluminum wire armor, PVC over sheath. The over sheath of single core power cables will have a suitable semi-conducting coating applied for over sheath testing. Earthing cables will be single core, PVC insulated colored as appropriate. Bare copper may also be used.

Multicore control cables will be 600/1000V rating, having PVC Insulation with numbered cores, PVC bedding, galvanized steel wire armor and PVC over sheath.

Multipair control cables will be twisted pair, having PVC insulation, an aluminum screen and drain wire, PVC bedding, galvanized steel wire armor, PVC over sheath. The conductors will be single stranded plain annealed copper identifiable by color coded insulation. Minimum conductor size is 0.5

mm2.Fire resisting cable tested to the highest test temperature will be used for essential circuits required to remain functional in the event of a fire. This will include the trip circuits necessary to safely, shut down the plant and isolate it from the Transmission System, fire detection and firefighting equipment and emergency communication and audible alarm circuits.

Cable Segregation and Separation;

In order to limit economic loss in the event of a fire or similar incident segregation by a fire barrier will be provided between cables in the following groups: generator unit, main and emergency supplies and alternate tripping supplies. Fire barriers and penetration seals through walls, floors and ceilings will have a minimum fire rating of at least one hour.

Adequate physical separation will be provided between power cables and control and instrumentation cables to minimize the effects of electrical interference and other disturbances including those associated with unbalanced circuit working.

Cable Rating;

Power cable conductor sizes will be determined having consideration for maximum conductor temperatures under sustained and three phases short-circuit/earth fault conditions, voltage regulation under steady state and motor starting conditions and, automatic disconnection time for protection by equi potential bonding. Cable Support and Fixing

! Adequate provision will be made in buildings for cable flats and risers, floor trenches, steel support structures, holes through walls/floors, ducts etc., for the accommodation of cable routes and access to plant and equipment. Enclosed cable ways will incorporate suitable personnel access and emergency escape routes. Heavy duty galvanized steel ladder rack or perforated tray will be used for cable support on major cable routes. For minor routes where the weight is not high, a light duty galvanized steel cable support system may be use.

All cables will be installed in a neat and orderly manner as far as possible arranged to allow removal of any single cable in a run without undue disturbance to adjacent cables. Adequate support will be provided with bearing surfaces free from sharp edges. The cables will be protected against mechanical and other potential hazards e.g., heat sources, at vulnerable positions. Care will be taken that cable minimum bending radii are not exceeded.

Single core cable will be installed in either trefoil or flat formation and secured using cleats.

7.6.12 Communication

The communication system will be furnished complete with required accessories, and devices for the following system:

A 200 extension solid state Private Automatic Branch Exchange (PABX) A solid state Public Address System / intercom will be used for throughout the plant.

A complete land mobile radiotelephone system will be provided for general plant communications including base station transceiver mobile transceiver and at least

20 batteries operated had held transceiver with the chargers.

Telephone instruments will be installed in all rooms, buildings and control rooms, coal and coal transfer areas, water treatment and other area indoor as required for operation and maintenance system.

The PABX will be fully compatible with address telephone system. Operating console will be provided with the PABX.

Public address system:

Public address system will be a complete solid-state public address/intercom

System designed for power plant. The system will consist of a "page" channel for individual calls by the use of loudspeakers and "party" channels for two way and group communications using handset station. It is preferred that the system have a distributed amplifier system.

The Public address system will be provided with handset station, which consists of hand set and amplifier cabinet. The hand set will be of telephone type with receiver and low impedance, noise canceling transmitter designed for close talking. The paging system will also be capable to be used as plant intercom system.

Public address equipment will be installed in all floors of the power house, all rooms, buildings and control rooms, boiler areas, chimney, coal and coal transfer areas, water treatment and other area indoor and outdoor as required for operation and maintenance system.

Except for office and similar area, all speakers for public address will be of the heavy duty industrial type with permanent magnet drive, provided with bracket for directional adjustment.

1 For hazardous area, the type of telecommunication equipment will be suitable for the hazardous area.

CCTV system

For boiler, Furnace Flame Monitoring TV, Drum Level TV, are provided and mounted on the BTG panel in the Unit Control Room, allowing for interfaces with the Closed Circuit TVs (CCTV).

For the Unit relative important parts and unattended BOP operating

conditions, operating status of some important auxiliary equipment and conditions in some dangerous areas such as, Oil Pump House, Turbine House, Boiler House, etc., Closed Circuit TV Monitoring System (CCTV) will transmit the field video signal to CCR, through Local cameras and the transmission cable, and real-time display on LCD Terminals, to visually monitor all the production and auxiliary production sites of the Power Station.

Three monitors will be arranged, one monitor located in the main control room, one monitor in coal handling control room, one in the gate house. Each monitor will be capable to be divided minimum 4 (four) sections.