D.G.Khan Cement Company Limited- Khairpur Project
Kallar Kahar, District Chakwal

ENVIORNMENTAL IMPACT ASSESSMENT (EIA)

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May 25, 2004

2.0 DESCRIPTION OF THE OBJECTIVES OF PROPOSAL

This proposal has been prepared according to the format provided in the document "Guidelines for the preparation and review of Environmental Reports, October 1997.

The proposal aims at ensuring through details that the project activity will not adversely affect any element / segment of environment from human health to environmental settings around (population, water, air, soil, structures, wildlife, vegetation, biodiversity or else). On the contrary, it will bring financial uplift of the people of the area directly through providing jobs and ultimately contribute to the economy of the country.

This EIA report describes details of the project activity from raw materials to the manufacturing of cement. It takes stock of all sorts of wastes to be generated during construction and while in regular production and the measures to be adopted to ensure that the environmental health and health of the population around are protected. The existing environmental setting around the project site--biodiversity, socio- economic pattern of life existing in the project area are also described.

The major elements of the EIA report include:

i- Executive or non-technical summary (title and location of the project, name of the proponent, name of the organization preparing the environment report, brief outline of the report, major impacts, recommendations for mitigation and compensation and proposed monitoring),

ii- Description of the objectives of the proposal,

iii- Description of the proposal and its alternatives (status of the proposal in the project cycle, description of planning, design and implementation stages, requirements for raw materials, water, energy and equipment),

iv- Discussion of the proposal and current land use and policies (current land use controls in the context of the Government policies),

v- Description of existing and expected conditions (boundaries adopted to study various aspects of the study),

vi- Evaluation of the impacts and their mitigation (assessment of any impact on the local population, relevant environmental data, gaps in knowledge, compliance with relevant environmental standards, assessed significance of the impacts, possible measures for avoiding or mitigation the impacts)

vii- Environmental management plan, monitoring plan and proposed training (description of the actions, schedule for implementation, assigning responsibility for implementation, monitoring program to assess performance, reporting and reviewing procedures and outline of training needs).

For further details refer to individual and respective sections of this report.

3.0 DESCRIPTION OF THE PROPOSAL AND ITS ALTERNATIVES

3.1 The status of the proposal in the project cycle (Pre-feasibility, feasibility or detailed design)

The proposal forms pre-feasibility part in the project cycle.

3.2 Description of the planning, design and implementation stages

3.2.1 Planning

Pre- planning study of the project has been completed and includes availability of raw material; quality and quantity of raw materials, land, water and energy sources etc.
Feasibility study gives details about financial and technical aspects of the project along with other essential elements of the report in totality. The feasibility report concludes the viability of project both financially and technically.
Steps to be taken, as pointed out in the study are being

taken of which the present EIA forms an important first step. Details regarding various aspects of the project activity are being worked out at financial managers and technical expertise levels. M/S F.L Smidth Denmark will transfer technology for this project. They are in contact with their Pakistani counterparts.

3.2.2 Design

After finalization of negotiations base line data on all the required aspects of the plant will be communicated to the Danish counterpart company for preliminary designing of the plant. After approval of the preliminary design both by the local and the foreign expertise, detailed engineering will be carried out.

However, so far a lot of necessary background homework, has been completed and the project relevant information is being gathered to boost the speed of the project activity. The data so gathered will be tailored, if so required, to suit the technical requirements of the plant design and other technical requirements.

3.2.3 Implementation

The implementation stages of the project activity are as below:

Stage I

i-finalization of the background information and
ii- design data procurement and processing.

Stage II

The following designing activities will start concurrently:

i- designing for civil construction work,
ii- designing for electrical work,
iii- designing for mechanical work,
iv- detailed engineering of all the afore mentioned activities.

Stage III

The following work mostly will start concurrently:

i- civil work,
ii- construction of the plant
iii- construction of the basic infra structures like roads, water supply system, electricity etc;
iv- construction of roads, pathways etc. within the plant battery limits
v- installation of the plant
vi- trial operation of the plant to go for the final tuning up,
vii- based on the above findings/experiences any additions , deletions or alterations to be made in the project infra structure and other facilities as the final touches and
viii- final commissioning of the plant on full scale.

3.3 The requirements for raw materials, water, energy and equipment

3.3.1 Raw materials

The raw materials used for the manufacturing of Portland cement are mainly limestone (calcareous material) and clay/shale (argillaceous material). These are complemented by the so called correcting admixtures containing a considerable amount of oxides. The raw materials and other related requirements for a cement plant of 3300 tons /day are given below:

Raw Materials (Major)	Requirement per ton of cement
1. Limestone	1.35
2. Clay/shale	0.35
3. Laterite	0.01
4. Gypsum	0.05

The limestone requirement for 70 years period of 3300 tons/day of cement production is 81 million tons and requirement of clay is estimated as 21 million tons. This estimate is based upon 320 plant working days in one year.

To identify the suitable deposits of limestone and clay for the proposed cement manufacturing plant, the geological investigation

in the area was carried out. The investigation comprised of geological mapping, sampling, reserves estimation, structural interrelationship of various rock units and other related studies. The studies revealed the availability of extensive deposits of Sakesar, Nammal and Chorgali limestone of early Eocene age and kamlial and alluvial clay deposits of Miocene and quaternary age respectively. The analysis of raw materials revealed that these are of good quality for a cement manufacturing plant. The cement raw materials and their workable reserves in the project area are given below.

1. Limestone Deposit No.1	157 million tons
2. Limestone deposit No.2	341 million tons
3. Clay deposits No.1	160 million tons
4. Clay deposit No. 2	70 million tons

The limestone deposit No.1 is the principal calcareous raw material and is located at a distance of about 1 km to the south of the proposed plant site. The deposit mainly comprises of Sakesar limestone with a thin cover of limestone of Chorgali formation. The **Sakesar limestone** is cream coloured to the light grey, hard, jointed fractured and contains calcite veinlets.
The average chemical analysis of the samples from the limestone outcrop shows the following results:

CaO	52.96 %
SiO_2	2.14 %
Al_2O_3	0.66 %
Fe_2O_3	0.23 %
MgO	1.15 %
K_2O	0.01 %

And others to complete 100.0% composition.

The overlying **Chorgali formation** comprises of grey to brownish grey limestone with subordinate shape. The average chemical analysis from the limestone outcrop indicate the following results:

CaO	53.24 %
SiO_2	1.87 %
Al_2O_3	0.73%
Fe_2O_3	0.54 %
MgO	1.07 %
K_2O	0.11 %

And others to complete 100.0% composition.

The chemical composition indicate that both the limestone from both the deposits is of high grade and contains all the chemical constituents within permissible limit for the production of Portland cement.

The workable reserves of the limestone within the lease area are estimated as 157 million tons. The limestone deposit No.2 is the other potential deposit and lies at a distance of about 2-4 km from the proposed plant site. It dominantly belongs to Nammal and Sakesar formations and delineated further into limestone block No1 and 2. The limestone is cream to grey, weathering light gray, thin to medium bedded, nodular and contains marly and shaly intercalations. The average chemical analysis of the limestone outcrop revealed the following composition:

CaO	53.67 %
SiO_2	1.53 %
Al_2O_3	0.71 %
Fe_2O_3	0.27 %
MgO	1.12 %

And others to complete 100.0% composition.

The analysis indicates that this limestone deposit is also suitable for the cement manufacturing. The workable reserves of the limestone within the leased areas are estimated as 341 tons.

As far as argillaceous deposit is concerned, the clay deposit No. 1 is present at a distance of about 1 km east of the proposed cement plant site. The clay is of fluvial origin and extends over a vast plain land/ridges. It is light brown, massive, soft, calcareous and has a thickness of about 15 meters. The average chemical analysis of the clay outcrop samples is as below:

SiO_2	57.91 %
Al_2O_3	13.95 %
Fe_2O_3	4.24 %
CaO	8.89 %
MgO	2.37 %
K_2O	1.19 %
Na_2O	0.36 %
Cl	0.01 %

And others to complete 100.0% composition.

The analysis results indicate that all the elements of the clay are

within permissible limits for manufacturing cement. The clay reserves up to a workable depth of 12 meters within the selected area are estimated as 54 millions tons.
The clay deposit No.2 is the additional argillaceous deposit and located in Chak-Khusi- Khohkar Bala area at a distance of 3-4 km from the plant site. The clay belongs to the Kamlial formation of Middle to late Miocene age. It is brown, compact, bedded calcareous and contains alternation of sandstone and siltstone at regular intervals. The average chemical analysis of the clay is as follows:

SiO_2	59.45 %
Al_2O_3	12.58 %
Fe_2O_3	4.05 %
CaO	8.62 %
MgO	2.37 %
K_2O	1.07 %
Na_2O	0.36 %
Cl	0.01 %

And others to complete 100.0% composition.

The deposits of the clay are estimated 79 million tons.

Above data shows that the major raw materials required for the cement industry are readily available in the area near the proposed site of cement manufacturing plant. Their quantity and quality are within the prescribed limits for manufacturing of cement.

3.3.2 Water

Underground water is the major source for irrigation and other uses in the area. There are no canals in the area. The proposed cement plant is based on Dry Process hence no wastewater will be produced. However, around 10-15 m^3/hr will be required for in process cooling operations and will be absorbed therein. An additional volume of about 92m^3 /hr will be required for cooling towers and fire fighting. This water need will be fulfilled by using underground water. The present depth of water table in the area ranges from 80-85 feet. Turbines will be installed at "Malkana" village, at a distance of about 4-5 km from the proposed site and water will be pumped to the plant site.

3.3.3 Energy

Electricity, the other requirement for running the plant, will be provided from the WAPDA supply. However, there is likelihood to go for self generation at a later stage. The total requirement of energy to run the plant is 28 MW.

3.3.4 Equipment

The equipments for the cement manufacturing plant will be supplied by F.L Smidth (Denmark). In this regard an agreement have been signed with F.L. Smidth. F.L.Smidth is considered as the No.1 in the world regarding designing and supply of equipments for cement manufacturing plants.

The list of the major equipments to be used in the cement manufacturing plant are attached as **ANNEXURE-I.**

3.4 The planed operational characteristics-hours of operation, processes, Products.,

3.4.1 Hours of operation

The plant will operate 320 days per year. The production activity will continue for 24 hours with three eight hourly shifts/ day.

3.4.2 Process

The preparation of cement involve mining; crushing; and grinding of raw materials (principally limestone and clay) ; calcining the materials in a rotary kiln; cooling the resulting clinker; mixing the clinker with gypsum; milling; storing and bagging the finished cement. The dry process (to be used in the present project) using preheaters and preclaciner is both economically and environmentally preferable over wet process. The energy consumption in the dry process is approximately half than that of wet process. So, it is clear that dry process to be used in the current project will ensure that plant will be run in an environmentally sustainable manner.

Manufacturing Process and Allied Activities (Brief)

The major activities involved in the production of Portland cement are as follows:

1. Crushing of Limestone and Clay
2. Storage of raw materials
3. Raw Material grinding
4. Raw meal, blending storage and kiln feed
5. Clinker Production - Kiln, Preheater and Kiln Cooler
6. Cement grinding
7. Packing
8. Storage
9. Transporting for sale

Process flow sheet is also included under section # 3.5.3

3.4.3 Products

Portland cement will be the final product. The rated capacity of the plant is 6,500 tons/day.

3.5 Visual aids (maps of the area, site and plant layout, flow charts of production, and photographs of the site and similar projects)

3.5.1 Location map

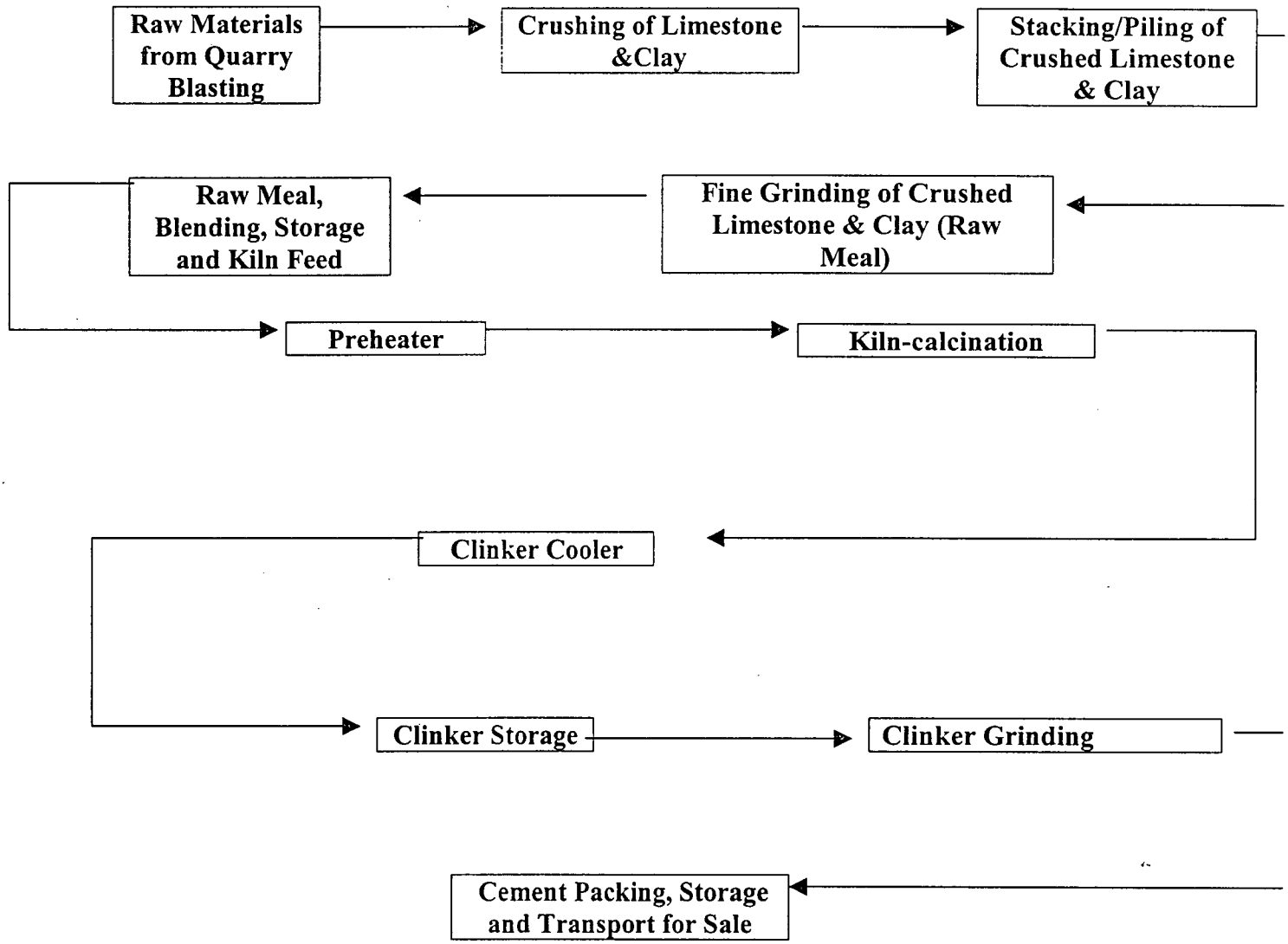
The location map is attached as the **ANNEXURE-II**

3.5.2 Plant layout

The plant layout is attached as the **ANNEXURE-III.**

3.5.3 Flow chart/sheet of production process

Flow chart/sheet of production process is given below:



3.6 Comparison of proposal options (size, siting, technology, Layout, energy, sources, sources of raw material):

3.6.1 Size

The size of the project production capacity has been selected out of various background options on the basis of its being an

economic viability, investment restrictions i.e. funding capacity, ensured availability of raw materials, and export potential of the product. The finally adopted parameters of the project size were the best suited to the commercial viability of the project.

3.6.2 Siting

The present proposed siting of the project is most suitable due to the abundant raw material reserves (Clay and Limestone) in nearby mountains for sufficient time period.

There are sufficient reserves of raw material (Clay and limestone) in the Kallar Kahar region, which are yet to be utilized. The siting of the present project will make it possible to consume the sufficiently available raw materials and convert them into Portland cement as value added product. This will add to the economic activity within the country and earn foreign exchange through export of the finished cement.

3.6.3 Technology

The technology involved in the manufacturing of Portland cement is universal in nature. The present production unit for the manufacturing of cement will be designed on the basis technology by M/S F.L Smidth-Denmark. In this regard, an agreement has been signed with M/S F.L Smidth. The latest state of the art technology will be used for optimal utilization of the raw materials, the fuel, the power and the equipment in order to produce cement at the lowest possible costs.

3.6.4 Layout

Keeping in view Health, Safety, Environment, economic factors and operational requirements (also including HAZOP) the present lay out has been finalized.

3.6.5 Energy sources

The total requirement of energy for running the cement plant stands at 28 MW.The energy requirement will be fulfilled from WAPDA National. However, at a later stage is proposed to go for captive production.

3.6.6 Sources of raw material

As described in detail under section 3.3.1 that principal raw materials calcareous (limestone) and argillaceous (clay) are available in the area to fulfill the requirement of a cement plant having capacity of 6,500 tons/day for 70 years. Data obtained from laboratory analysis of raw materials as presented in the serial # 3.3.1 of this report reveal that the raw materials meet the specifications required for the cement manufacturing. Installation of a cement plant in the area would certainly contribute to utilize the unexplored raw material present in the area. This will be a value addition to these raw materials.

3.7 Summary of the technical, economic and environmental features of the proposal

This proposal describes in due details the various aspects of the project including technical, economical and environmental features. A brief resume of each one of these is given hereunder.

3.7.1 Technical

This EIA report briefly explains technical aspects of the project including from raw materials to finished product. It also describes manufacturing process, allied activities, flow sheet diagram of the complete manufacturing process indicating the waste generation points and plant location. It also takes account of the status of various technical aspects of project related utilities including power utilization in various activities. Necessary details of relevant technical features are given at respective parts in this proposal. For details reference may be made to the appropriate sections of this proposal.

3.7.2 Economic

The total cost of the project stands at 160 millions U.S Dollars.

3.7.3 Environmental

This proposal, through sketches and manufacturing process details, takes into account the sources of wastes generation from the project activity, their nature and managing them in

environmentally sustainable fashion. Potential environmental impacts and their proper mitigation measures to minimize the effects are also described in the relevant sections.
The proposal incorporates into it Environmental Management Plan, monitoring plan, and proposed training program to mange environmental issues and problems effectively. Details are given under respective sections of this report.
Environmentally sensitive areas of special or unique value including biodiversity, scientific, cultural, visual and heritage have also been described. The proposal also takes into account the inbuilt stringent mechanism incorporated in the designing of the plant in order to run the plant in an environmentally safe fashion.

4.0 Discussion of proposal and current land use and policies

4.1 Land use

Land around the project site is used for cultivation. Agriculture is the major source of income of the people. There is not any Government policy to restrict industrial activity in the project area.

4.2 Regulatory framework

Salient features of Government policies for facilitating investment in Pakistan are described as under:

4.3 Deregulation of the economy

The Government of Pakistan is following the policy of deregulation of the economy and privatization of the state owned companies.

4.4 Import policy

Import policy has been liberalized and there is an increased reliance on development of the industrial sector and enhancement of international trade.

4.5 Infrastructure facilities

Infrastructure facilities such as road network, water and power supply, means of transportation and communications etc. are being improved speedily.

4.6 Incentives

To keep Pakistan competitive in international markets and support the viability of investments in the country, the following incentives are available to both foreign and local investors:

a- initial depreciation allowance (IDA),
b- amortization and
c- normal tax rates.

5.0 DESCRIPTION OF EXISTING AND EXPECTED CONDITIONS

5.1 Spatial and temporal boundaries adopted for the various aspects of the study

Presently existing natural environmental and industrial status in the project site area covering a vast distance around and foreseeing the possibility of industrial growth in future have been taken into consideration while describing existing and expected conditions.

5.2 Existing (baseline) condition of the biophysical and socio-economic environment, trends and anticipated future environmental conditions should the project not go ahead

The project site is situated in the area where most of the land around is under agricultural use. The area can be classified as "Arid Zone" and underground water is mostly used for irrigation purposes. There is no canal, river or any other water distributory in the area. Average land holdings vary between 15-20 canals. Agriculture is the major source of earning for most of the people. Wheat, barley, cereals, brassica, peanuts are major crops of the area.

ICI Soda Ash is around 30 km. and Dandot Cement Company Ltd; is situated at a distance of 27 Km from the project site. Due to the absence off any other industry in the area, there are very less sources and opportunities of employment for the people. Apart from agricultural activity, many people are of the area are also serving in the armed forces.

The project site is at a distance of about 12 Km from Kallar Kahar and 15 km from Choha-Saiden Shah.

Kallar Kahar has approximate population of 30,000.0. The basic health and educational facilities are available in the area. Due to easy accessibility by motorway, Kallar Kahar has become a famous tourist spot.

The area as a whole is virgin environmentally. Therefore, the available carrying capacity of the environment in the area is not yet utilized. The project under the prevalent conditions is not going to effect the environment adversely. This is further substantiated by the fact that all type of wastes to be generated from the project activity will be disposed off in environmentally sustainable fashion and in accordance with the requirements of the National Environment Quality Standards as applicable to the pollution aspects of the project.

Obviously, the future trends in environment, in case the project does not go ahead, will not change. However, at the same time since the required environmental management level is to-be put in place, therefore in the case of the project activity there will not be any adverse effects on the environment either. Rather, the project will contribute in the creating employment opportunities for the people of the area, utilize the unharnessed raw materials (clay and lime stone) and convert them into value added product (cement) from the export of which the country will earn a lot of foreign exchange. .

5.3 Environmentally sensitive areas of special or unique value

(Physical resources of the project area: Topography and geology; Soils and Climate; water; **Ecological resources:** Fisheries and aquatic biology, Biodiversity, Forestry, Wildlife scientific institutions, Socio-economic and Cultural and other heritage)

5.3.1 Physical resources of the project area

Physical resources of the project area are highlighted as below.

5.3.1.1 Topography and geology

Kallar Kahar is included in the "Salt Range". There are small hills having average height between 300 to 600 meters. The proposed plant site is located at a latitude of 32 °, 43'53''N and longitude 72 ° 48' 46'' E in the survey of Pakistan. The potwar plateau and the salt ranges are located to the south of the mountainous north and lie between the Indus river on the west and the Jehlum river on the east. Their northern boundary is formed by the Kalla Chitta ranges and the Margalla Hills. Their southern

boundary is formed by the salt ranges themselves. The Soan basin is located between the northern and southern ranges. The Kalla Chitta ranges rise to an average height of 450-900 meters and extend across 72 Km. The western half is composed of sand stone and eastern half of lime stone. The ranges are cut by deep valleys. The Margalla hills, which extends eastwards into the Kurang river, appear a few miles north of the eastern extremity of the Kalla Chitta ranges. They attain an average height of 900 meters with several peaks rising as high as 1200 metes. The southward slope is steep. The main potwar plateau extend north of the salt ranges. It is an undulating area 300-600 meters in altitude. Small hills of bare rock rise steeply above the surface. There are few large hills in the region, including Khairi Murat (1000 meter) which is the largest and most spectacular extending 39 Km southwards from Rawalpindi. The soan river dominants the area and it is tributaries have cut gullies and ravines into the land, forming typical badland topography, these gullies and raviens are called khaderas. The soan and other rivers have also produced large tracks of alluvial plains, which are suitable for farming. The salt ranges are steep towards the south and slope gently into the potwar plateau in the north.
The potwar plateau at and the salt ranges are rich in mineral resources, including rock salt, gypsum, limestone, coal and oil.

5.3.1.2 Soils

As described above that the western half of salt range is composed of sand stone and eastern half of lime stone.
The mountain ranges are cut by deep valleys. The main Potwar plateau extend north of the salt ranges. It is an undulating area 300-600 meters in altitude. Small hills of bare rock rise steeply above the surface. The Soan river dominants the area and it is tributaries have cut gullies and ravines into the land, forming typical badland topography, these gullies and raviens are called khaderas. The soan and other rivers have also produced large tracks of alluvial plains, which are suitable for farming. The salt ranges are steep towards the south and slope gently into the potwar plateau in the north.
The potwar plateau at and the salt ranges are rich in mineral resources, including rock salt, gypsum, limestone, coal and oil.

5.3.1.3 Climate

Like in other major parts of the province of Panjab, the site observes four seasons summer, winter, spring and autumn during twelve months of the year. Due to the height from sea level the temperature in the summer remains moderate. Due very less rain the area is calcified as arid zone.

5.3.1.4 Water

Mostly underground water is used for drinking as well as for irrigation purposes. As also earlier specified there is no canal, river or any other water source present in the area. The depth of water table in the area is 80-90 feet. However turbines and tubewells are installed at a depth of 300- 400 feet to ensure supply of water. At some of the places even animal driven wells (Rahats-Persian wheels) are still present.

As earlier described, the requirement of water for the plant is approximately 10-15 m^3/hr, which will be fulfilled from the underground water source present in the "Malkana" village, at a distance of about 4-5 km from the proposed site.

The requirement of water is so minor that it will virtually have no effect on the underground water resources of the area after installation of the plant.

5.3.2 Ecological resource

5.3.2.1 Fisheries and aquatic biology

The only water body present in the area is the famous "Kallar Kahar Lake" having total area of 1700 canals. The lake is a game reserve and habitated by some aquatic life like migratory birds. Although from our observation and interviews of the people sensed that there could be some very small number of fish, yet the Wild Life Protection Department Officials negated presence of any fish therein. There is no commercial fishing activity in the area.
There are some species of common aquatic plants present at the banks of lake.

5.3.2.2 Biodiversity

Natural capital of a country mainly includes all of a country's wilderness areas and scenic landscapes, including also with their associated flora and fauna.

Pakistan has a total of nine major ecological zones. The contribution of the "Natural capital" is recognized at three distinct levels: species, genera, and communities (habitat and ecosystem). Both collectively and within each level, the range or variety of the resources is referred to as the " Biological Diversity". The term has relevance for each of Pakistan's administrative units—district, province, and particularly country. The more the number of species, genera, and habitats and ecosystems present within these units, the greater is said to be the Biodiversity. The biodiversity of the area, with this background, is discussed as under:

5.3.2.3. Forestry

There are no protected forests in the area. However, there are some reserved forests, while the rest of the forests are un-classed. The major species of trees present in the forests include Phullai, Kaho, Sanatha and Kikar. Apart from these mostly shrubs are present on the mountains. The names of the forests in Kallar Kahar and adjoining area (with special reference to the project site), as obtained from Divisional Forest Office Chakwal, are as under:

Forest Name	Area (Acres)
▪ Bakhshi Wala	1417
▪ Surla	9632
▪ Bagga	3542
▪ Nigri	815
▪ Rangapur	896
▪ Malkani	463.25
▪ Samarkand Shumali	5406
▪ Samarkand Janoobi	8209
▪ Matiala	1440
▪ Thochak	2298

Distribution of the forests and their location is presented as **ANNEXURE-IV.**

5.3.2.4 Wildlife

According to the information obtained from Divisional Wildlife Office, the major species of wildlife present in the area are as under:

Mammals

- Urial
- Jackals
- Foxes

Reptiles

- Snakes
- Lizards

Birds

- Peacocks
- Partridges (Black and Grey)
- Sissies
- Sparrows
- Doves

Migratory Birds

Kallar Kahar Lake, which is present at a distance of about 12 Km from the site, is the major habitat for migratory birds particularly in winter. The following species of the migratory birds of migratory birds have been reported:

- Ducks
- Wild Ducks
- Herons

Surla forest is a Wildlife Sanctuary and it is a breeding place particularly for birds. According to the wildlife act, no person can even fire a bullet upto a distance of 2-Km from the Wildlife Sanctuary.

Famous Kallar Kahar lake is the game reserve due to the presence of migratory birds etc.

5.3.2.5 Scientific institutions

With the exception of some school or college level laboratories there are no scientific institution worth mentioning in the vicinity of the project site.

5.3.2.6 Socio-economic

Socio economic aspects are discussed as under:

5.3.2.7 Cultural and other heritage

The historical monuments of the area include two shrines of the Muslim holy saints. Apart from these, there are some old Hindu temple of Shiva's Temple Series in Katas around 13--20 Km from the project site). These temples are rarely visited by Hindu pilgrimages, tourists or else. They are in very shabby condition. Neither conservation process is going nor they are preserved.

5.4 Existing socio- economic conditions

The existing socio-economic conditions, as prevailing in the villages of around project site, are described as under:

5.4.1 Population and communities

The project site is situated approximately 38 km from Chakwal city, on Kallar-Kahar- Choha Saiden Shah Road at a distance of 12 km from Kallar Kahar and 15 Km from Choha-Saiden Shah. Kallar Kahar and Choha Saiden Shah are Tehsils of District Chakwal.

There are small villages around the project site. The most significant among those are Khairpur, Mallot, Dlaialpur, Badshahpur, Khohkar Bala and Malkana.

There are schools upto secondary level in the near by villages, whereas three colleges upto intermediate level are present in Kallar Kahar. Health facilities are reasonably available in the area. Apart from the dispensaries in villages, one hospital of Fauji Foundation is present in Kallar Kahar.

Approximate population of the villages, their distances from the project site, presence of health and educational facilities and other relevant informations obtained after actual site surveys are presented in the next table.

Name of the village/town	Distance from the project site (approx. Km.)	Approximate Population	Health/ Educational Facilities	Drinking Water Status
1. Khairpur	1.5	8,000.0	-High School one each for Boys and Girls - Dispensary	-Facility of drinking water by Govt. Supply lines and hand pumps, tube wells etc.
2. Mallot	4.0	1500	-Primary School one each for Boys and Girls	----do-----
3. Dlailpur	5.0	5,000	- High School for Boys and Middle School for Girls -Dispensary	------do---- ------do-----
4. Badshahpur	6.5	7,000.0	- Primary Schools one each for Boys and Girls	
5. Khohkar Bala	5.0	8,000.0	- Primary Schools one each for Boys and Girls	-----do------
6. Tehsil Kallar Kahar	12.0	30,000.0	- High Schools one each for Boys and Girls -Cadet College - PAF College -Govt. College These Colleges are upto intermediate level - Hospital by Fauji Foundations - Some Private Clinics and Hospitals	-Facility of drinking water by Govt. Supply lines

5.4.2 Industries

The only industries present upto a distance of 35 km from the project site are as under:

1. ICI-Soda Ash, approximately 27 Km from the project site
2. Dandot Cement Company Limited at a distance of about 30 km from project site in District Chakwal.

Due to abundant availability of raw material for cement and two more cement factories are also in the process of installation. The installation of the new industries in the area will play a major role in the elimination of unemployment.

5.4.3 Cultural and aesthetic values

Purely old traditional village pattern of life typical of the common villages of Panjab prevails in some areas. Most of the people follow quite old type of life and traditions.. Agriculture is the main source of income for the people. The average land possessed by a person varies between 15-20 canals. Old methods like use of animal driven wells (Persian wheels-Rahats) for irrigation and use of animals for ploughing are still commonly practiced. Even the units of weights and measures used for the weighing of crops etc are very primitive.

Due to unavailability of proper employment opportunities, many people are also serving in the armed forces of the country.

Most of the old people are illiterate but awareness and importance of education is attracting the people to send their wards to schools mostly up to primary level and some inclination to high school education is also shown.

Mostly, customs and rituals are primitive in nature. Some modernization in the existing cultural values is appearing among those educated and economically well off and those frequently mixing with urban society.

6.0 EVALUATION OF IMPACTS AND MITIGATION MEASURES

Evaluation of impacts and mitigation measures are described below.

6.1 Assessment of any environmental impact on local population and the environment during construction and operational phase

The project site is surrounded by small villages. No big human settlement is around. Population in these villages is very thin. Considering the environmental management measures to be adopted and the thin population around, there is not going to be any adverse impact on the population and environment around. However, systematic account of the same is given hereunder.

6.1.1 During construction

Likely impacts to occur during construction phase are described as below:

6.1.1.1 Pollution impacts

Major sources of pollution during construction phase could be moving vehicles transporting construction and raw materials. Human settlements small in size are situated far from the project site. Minor addition to the existing noise levels, dust/particulates and gaseous emissions from the auto exhausts will be dissipated by the unutilized vast carrying capacity of the ecosystems. Vehicles will be visiting the project site at different intervals of time. There will not be any stampedes of vehicles. This will further ensure that the environmental pollution does not adversely affect the people and environment.

During civil works, mechanical operations/activities, installation and fitting of machinery and plant parts, and other construction or fabrication activities noise and dust could be the pollutants. The levels of all sorts of pollution will be very small. Their magnitude will not increase to the level of being nuisance because these activities will be at very low profile. Even further, their level will be diluted by the unutilized carrying capacity of the environment like in the above case.

6.1.1.2 Tree cutting

The land around the project site is agricultural, there are no trees, bushes or shrubs in or around project site or even in the query areas. As such there is no question of cutting of trees during construction or operational phase of the project.

6.1.2 During operation stage

During operation stage of the plant, environment management order shall be enforced according to the details given in the Environmental Management Plan and following environmentally sustainable practices i.e. through monitoring, treatment of wastewater to the required levels of the NEQS, harnessing the particulates from stack and keeping noise levels also to the NEQS permissible levels. For further details refer to serial # 6.4 and section # 7.

Thus protection of human health and all other segments of environment is safeguarded both during construction and operational phases.

The Environment Management Plan provides safeguards against any likely adverse environmental impacts from the project operation. For more details refer to Mitigation Measures (serial # 6.4) and the Environmental management plan, monitoring plan and proposed training section (section # 7) of this EIA report.

6.2 Potential socio-economic impacts

During construction phase about 500 people from the area around will get jobs. With a family size of 6, some 3000 humans will get their livelihood. Similarly, during regular operational phase 150 people will be absorbed. According to the same calculation 900 human beings will earn livelihood.

Thus the project activity will become a source of earning and raise living standard of those to work in the project operation which indirectly prompts a cross section of the people to send their children to school and improvement in their social status.

6.3 The relevant environmental data and predictive methods used and any underlying assumptions made

6.3.1 Base line environmental data

Primary baseline project site-specific Environment data were monitored between April 7 to 9, 2004 by site visit under "No Activity State".

Environmental data was collected through actual onsite monitoring for ambient air quality of the site, noise levels and through laboratory testing of various water samples. The underground water samples were collected from five different locations around the project site from various depths to assess the quality of underground water of the area. Further to this water sample was also collected from famous Kallar Kahar Lake.

Required details of monitoring are reported as under. While, background details are summarized hereunder, the monitored data are reported in the relevant Annexures.

6.3.1.1 Ambient Air Quality

Gaseous pollutants and particulates were monitored on the project site. Details of the monitoring and the site specific environmental data generated are given under respective headings as below.

6.3.1.1.1 Gaseous

For zero/base line (primary) data, Ambient Air Quality monitoring was carried out at eighteen points around the project site. Ambient gaseous monitoring was also carried out at two out of six limestone kilns already functioning in the area. These Kilns are situated in the area at a distance of about 15-25 km from the site. These kilns are used for limestone production. Low grade coal as the fuel and they are major source of ambient air pollution in the area. There is no environmental management concept during operation of these kilns. With the dirty coal in use and absence of stacks, the very crude lime manufacturing results in heavy smoke pollution especially of SO_2, NO_x, CO particulates. The payments are as meager ranging up to about Rs.50.0 / day. The general physical conditions of

these workers shows that they are already victim of a host of respiratory diseases due to the gaseous emissions and PM.

The equipment, used during ambient monitoring to generate background/ baseline data, is made by DRAGER, Germany. The monitored parameters include Sulphur dioxide (SO_2), Nitrogen oxides (NO_x--NO and NO_2) and Carbon monoxide (CO) The monitored results are given in the **ANNEXURE-V.** While the data regarding ambient air monitoring carried out two limestone kilns are presented in the **ANNEXURE-VI.**

6.3.1.1.2 Particulates

Particulates monitoring was carried out at four monitoring locations, one in each direction of the proposed plant site. Iso-Kinetic the Casella System (Instrument) designed to comply with BS 3405 and ISO-9096 for compliance monitoring of particulate matter was used for this monitoring. The base line/background data generated are exhibited in the **ANNEXURE-VII.**

6.3.1.1.3 Noise Levels

So also, Noise Levels monitoring in the area around project site was carried out. Fourteen locations were monitored for existing noise levels using LEADER Sound Level Meter, Japan. The results are reported in the **ANNEURE-VIII.**

6.3.1.1.4 Water Quality

To assess the water quality of the area, a total of five water samples, from different depths and sources were collected. The detail of sampling points and other relevant information is as below:

Sampling Location	Source & Depth
1. Mallot	Well Water –80 Feet
2. Khairpur	Hand pump—70 feet
3.Malkana	Tube well
4.Badshah Pur	Tube Well –425 feet
5. Chak Khooshi	Water Pump

The detailed analysis of these samples is presented in the **ANNEXURE IX TO ANNEXURE XIII.**

Furthermore, two surface water samples were collected, one from Kallar Kahar lake and one from a small rain water pond The detailed analysis of these samples are presented in the **ANNEXURE XIV & XV.**

6.3.2 Gaps in knowledge and uncertainties encountered

The required information virtually on all desired elements of the EIA report were available on investigation. As such no specific uncertainty was encountered.

6.4 Compliance with relevant environmental standards

6.4.1 Effluents

The present cement production project is based upon dry process; hence no effluent will be discharged whatsoever.

6.4.2 Emissions

6.4.2.1 Gaseous

The gaseous emissions including Carbon Monoxide (CO), Sulphur Dioxide (SO_2) and Nitrogen Oxides (NOx) will remain within prescribed limits of the National Environment Quality Standards (NEQS) through stringent in built mechanism, proper mitigation measures and achieving maximum fuel burning efficiency.

The sources of gaseous emissions include kiln and engines of power house (if installed at some time). High quality imported coal having very low sulphur content (0.5 %) will be used in the kiln. This will certainly keep the emissions of Sulphur Dioxide within prescribed limits of the National

Environment Quality Standards (NEQS). However, at some later there is likelihood of using local coal in mixture with the imported coal. Emissions of SO_2 will remain within the prescribed limits of the NEQS because the strong alkaline conditions in the kiln where the gas is to be produced will be absorbed (in situ). This will not only keep the emissions of SO_2 within prescribed limits of the NEQS, but also result in the formation of Calcium Sulphate (Gypsum), which is a component of raw material for cement industry.

Emissions of NOx will be minimized by stringent in build mechanism like installation of" low NOx burners". The detail of these burners is presented under Serial # 6.6 of this report.

So also, the emissions of CO will remain within prescribed NEQS limiting values by achieving maximum fuel burning efficiency.

6.4.2.2 Particulate matter

The sources of Particulate Matter (P.M) emissions will be Kiln, Cement Mill and Coal Mill.

The emissions of Particulate Matter (P.M) from all the above mentioned sources will remain within prescribed limits of the NEQS through the installation of electrostatic precipitators.

The concentration of particulate matter that can result from the raw material crushing and grinding activities will be minimized by adequate sprinkling of water.

6.4.2.3 Noise Levels

Noise levels within plant will be minimized by proper repair and maintenance of the equipment/ machinery. Timely replacements of parts of machinery and equipment will be ensured in order to avoid excessive sound levels during plant operational condition.

Noise levels at plant boundary walls will be in compliance with the NEQS limiting values. Boundary walls of the plant also act as excellent buffer against high noise levels. Thus, public in near by areas will not be effected by noise levels.

Noise levels within plant can exceed the limiting values prescribed by the NEQS. So, the workforce working in the high noise areas will be provided with ear muffs/plugs as the case may be, in order to avoid excessive noise levels.

6.5 Assessed significance of the impact stating the standards or criteria used as a basis for judgment

All possible environmental impacts and their solutions are duly reported at serial # 6.4 above besides in other relevant parts of this proposal. Necessary data as desired have also been reported. The impacts have been assessed against the National Environment Quality Standards, Pakistan.

Estimated amounts of gaseous emissions are as below. The benchmark data reported here were calculated based on the practical measurements of such gases in many similar other cases of various industries.

Estimated amounts of gaseous emissions

Stack Reference	Sulphur dioxide (SO_2) ppm	Nitrogen oxides [NOx ($NO+NO_2$)] ppm	Carbon monoxide (CO) ppm	Particulate matter (P.M.) mg/Nm^3
Kiln	0-5	400-450	200-250	40.0-45.0

Estimated amount of Particulate Matter Emissions

Stack Reference	Particulate Matter-- mg/Nm^3
1. Kiln Cooler	30-35
2. Cement Mills	40-45
3. Coal Mills	100-150

6.6 Possible measures for avoiding or mitigation the impact

Cleaner production helps to reduce pollution. It also helps to minimize resources in puts ultimately cutting upon wastes quantities. The priority in the cement industry is to minimize the increase of particulate matter levels by reducing the mass loads emitted from the stacks., from fugitive

emissions and from other sources. Collection and recycling of dust in kiln gases is required to improve the efficiency of the operation and to reduce the atmospheric emissions. By keeping the in built mechanisms dust emissions can be reduced upto 0.2 kg/metric ton of clinker production. For this purpose appropriate electrostatic precipitator will be installed. NOx emissions from kiln will be reduced by proper designing, installation of low NOx preclaciner vessel and an optimum level of excess air. Additionally, low NOx burners are also being installed which will very effectively control the emissions of NOx. The dry process to be used in the present cement production project have an advantage over wet process in achieving very less NOx emissions. The emissions of Nitrogen Oxides will be further reduced by after burning in a reducing atmosphere and recovering the energy of gases in preheater.

Use of low sulphur coal will ensure that emissions of Sulphur Dioxide remain well within the prescribed limits of the NEQS. The analysis of raw material does not show presence of sulphur in raw materials. Further more, due to the highly alkaline atmosphere of the kiln upto 95% of the Sulphur Dioxide will be absorbed in the kiln and will result in the formation of Gypsum, an important component among the raw materials. Therefore, the principle of Cleaner Production i.e. Reduce, Recycle and Reuse (3Rs) has been observed while going for waste management at the conceptual levels of the project.

6.6.1 Wastewater

As described earlier that dry process will be practiced in the production of cement. Hence, there will be no generation of polluted/wastewater. No residential colony is proposed at the project site, hence there will not be any generation of sewage water either.

6.6.2 Emissions –gaseous and particulate matter

As described earlier under serial # 6.6 the plant has stringent in built mechanism using latest state of the art technology for the production of cement in an environmentally sustainable fashion. The details of the mitigation measures for minimization of gaseous emissions to be adopted rather inbuilt in the plant designing are as under.

Nitrogen Oxides-NOx:

Installation of preheater and low NOx preclaciner will keep the emissions of NOx in flue gases with permissible limits of the NEQS.

Low NOx preclaciner consists of a lower part (reduction zone) and an upper section (the combustion zone, where the tertiary air is added). The reduction zone is of quadratic form (refractory lined), where the upper section consists of refractory lined cylinder. The characteristic feature of the preclaciner is the homogenous mixing of raw meal, fuel and combustion air. Tertiary air drawn from kiln hood will be used as combustion air. The fuel (Coal) is supplied to the riser duct below the reduction zone of the calciner via two burners. The combustion in the reduction part of the calciner is only sustained by excess oxygen from the combustion in the kiln and oxygen from false air from the kiln inlet seal. The combustion will remain incomplete due to the lack of oxygen. The gases formed by this incomplete combustion in the lower part of the calciner (reduction zone) combines with the kiln gases from the burning zone. This means that the NOx formed in the burning zone of the kiln can be reduced by the reaction with the gases formed by the incomplete combustion in the reduction part of the calciner according to the following reactions:

$$C + NO \longrightarrow N + CO$$

$$CO + NO \longrightarrow N + CO_2$$

The tertiary air as mentioned above supplied to the bottom of the upper part of the calciner. The combustion in the calciner is completed, which means that there are no combustibles like CO in the exit gases from preheater.

Sulphur Dioxide-SO_2:

Emissions of Sulphur Dioxide will be reduced by using imported high quality coal having very low Sulphur levels (0.5 %). Further, the data obtained after raw material analysis do not show any presence of Sulphur in raw material.

Due to highly alkaline conditions in the kiln, upto 90 % of the Sulphur Dioxide will be absorbed and results in the formation of Gypsum, which is an important component of the raw material.

Carbon Monoxide-CO:

Achieving maximum fuel burning efficiency and proper adjustment of the system will minimize emissions of CO.

Further to this online analyzer will be installed to continuously monitor the emission behaviour from the stack of kiln.

6.6.3 Particulate Matter:

Mechanical systems such as electrostatic precipitators will trap the particulate matter and act as preconditioned for downstream bag houses to be installed for the minimization of particulates emissions. These mitigation measures are already incorporated in the designing of the plant.

6.6.4 Noise Levels

Noise levels within plant will be minimized by proper repair and maintenance of the equipment/ machinery. Timely replacements of parts of machinery will be ensured in order to cut upon sound levels during plant operational condition.

Noise levels at plant boundary walls will remain in compliance with the NEQS limiting values with boundary walls to act as a buffer against noise levels. At certain points within plant, noise levels can exceed the NEQS limiting value. The workers working in these areas will use ear plugs/muffs to minimize the ill effects of noise pollution and this will be enforced.

6.6.5 Solid wastes

Very less quantity of solid waste will be generated from the plant operation. Particulate Matter collected in the electrostatic precipitator could be a source of solid waste, but this can be used as additive in cement production.

On the over all basis an adequate environmental management plan is going to be put in place and keep it operational. This will further ensure environmental compliance with the NEQS of all wastes.

7.0 ENVIRONMENTAL MANAGEMENT PLAN, MONITORING PLAN AND PROPOSED TRAINING

According to EIA guidelines matrices as followed in the preparation of this proposal, this part takes into account the followings:

i- description of the proposed mitigation actions,

ii- schedule for mitigation,

iii- assigning responsibility for implementation (by name or position) ,

iv- monitoring program to assess performance,

v- reporting and reviewing procedures, and

vi- training needs.

7.1 Description of the proposed mitigation actions

A summary the mitigation measures actions to be adopted against all possible type of pollutants to be generated from the project operation is given hereunder. For more details reference be made to serial # 6.0.

7.1.1 Effluents

As described earlier that dry process will be involved in the production of cement. So, there will be no effluent discharged from the industry.

7.1.2 Gaseous emissions and particulate matter

Gaseous and particulate matter emissions will be controlled through in built stringent mechanism already incorporated in the designing of plant. For details, please refer to the serial # 6.6.2 and 6.6.3 of this report.

7.1.3 Noise levels

As described above that noise levels within plant will be minimized by proper repair and maintenance of the equipment/ machinery. Timely replacements of parts of machinery will be ensured in order to cut upon sound levels during plant operational condition.

Noise levels at plant boundary walls will remain in compliance with the NEQS limiting values with boundary walls to act as a buffer against noise levels. At certain points within plant, noise levels can exceed the NEQS limiting value. The workers working in these areas will use ear plugs/muffs to minimize the ill effects of noise pollution and this will be enforced.

7.1.4 Solid wastes

Very less quantity of solid waste will be generated from the plant operation. Particulate Matter collected by the Electrostatic Precipitator could be a source of solid waste, but this can be used as additive in cement production

7.2 Schedule for mitigation

As stated above that mitigation measures to be adopted to cut down the quantity of wastes are incorporated in the designing of the plant in order to run the cement manufacturing plant in an environmentally sustainable fashion.

7.3 Assigning responsibility for implementation (by name or position)

For effective environment management, responsibilities are set for each operation as follows:

Official concerned	Responsibility
1-General Manager	i-Over all in-charge of all the environmental management (E.M.) set up. ii- He will be responsible to ensure smooth functioning of the E.M. system iii-Daily progress on the state of the environmental status will be reported to him in writing. iv-All other E.M. matters , issues and problems will be reported to him for rectification. v-He will work as bridge between the Government concerned authorities and the inside E.M. vi-He will be answerable to the higher management in all matters relating to E.M.
2- Shift Engineer	i-During his shift timings, he will be responsible to look into smooth functioning of the process in environmentally sustainable fashion. ii-He will be responsible to rectify any problem regarding environmental matter. iii- He will directly report all matters of E.M. to the G.M.
3- Plant Operator	i- He will record emissions behaviour on hourly basis and will report to the Shift Engineer.
4- Laboratory Chemist	i- He will be responsible to carry out all tests regarding environmental monitoring which includes Gaseous

	emissions monitoring, particulates monitoring, sound levels monitoring etc. according to the monitoring scheduled described below in section 7.4, and will report to the concerned Manager

7.4 Monitoring program to assess performance:

According to the " Guidelines for Self- Monitoring and Reporting by the Industry," Final Report, March 1998, approved by Pakistan Environmental Protection Council (PEPC), in August 1999, the Cement Industry falls under "Category A" regarding monitoring of gaseous emissions.

Under such condition parameters like Carbon Monoxide (CO), Sulphur Dioxide (SOx), Nitrogen Oxides (NOx) and Particulates to be monitored and reported on monthly basis for normal plant conditions.

7.5 Reporting and reviewing procedures

Monitoring schedule, as explained at serial # 7.4, will be adhered to and all the data to be monitored will be scrutinized at the level of Shift Engineer and on monthly basis at the G.M. level. The data will be documented according to appropriate format. Discrepancies will be duly addressed to. For presentation of the data to the Government Agencies, approved data recording format will be used.

7.6 Training needs

Environment Management staff at the plant will be trained especially in the following fields:

7.6.1 Environmental Monitoring

It is necessary to train the relevant plant staff for gaseous emissions, particulates and sound levels monitoring in order to report the monitored data on monthly basis for assessment of smooth functioning of the plant.

7.6.2 Environment quality control laboratory

Although for the emissions monitoring online analyzer will be installed on stack, but it is also needed to have portable flue gas analyzer, particulate matter monitoring instruments and sound levels meters in plant quality control laboratory.