

Chapter 5

Analysis of Alternatives



CHAPTER - 5

ANALYSIS OF ALTERNATIVES

5.0 PREAMBLE

Alternatives considered for the proposed project are evaluated and discussed with particular emphasis on environmental considerations.

The project alternatives discussed here include the rationale for the proposed project siting, raw materials availability and transportation and production technology, etc. Prior to arriving at a decision regarding establishment of a greenfield cement plant at Derba, the following options were considered:

- ☐ No project option
- ☐ Establishment of a new cement plant close to the quarry for production of cement.

5.1 NO PROJECT OPTION

The 'No project option' implies that cement production will not occur at the project site and the site would continue to remain abandoned. No socio-economic benefits would accrue to the nearby communities and the government.

A development activity in an area inevitably involves its alteration from the environmental point of view. However, to manage this alteration, an analysis of the project must also consider all the socio-economic elements in question in addition to ensuring the maximum protection of environment by use of latest, state-of-the-art technologies.

Failure to implement the proposed project would involve the following:

- ☐ Failure to rationalize the use of natural resources available in the project area which can be used to manufacture cement
- ☐ Loss of opportunity to increase revenue capacity at local, Regional and Federal levels
- ☐ Loss of opportunity to create direct employment for hundreds of Ethiopians and indirect employment to several other hundreds more through multiplier effect in terms of downstream socio-economic benefits and consequent improvement in the living conditions of local population in the project area.

Therefore, choosing the "No project option" will mean a loss of preliminary investments on the project and there would be no benefit to the nation. No new employment opportunities would be created. Nonetheless there will be no alteration of the environment apart from nature induced changes that would invariably have no significant impact.

5.2 ESTABLISHMENT OF GREENFIELD CEMENT PLANT IN THE VICINITY OF MINING AREA

The location of a new cement plant is normally determined by the following parameters

- ☐ Raw material availability
- ☐ Market for cement

- ❑ Energy supply
- ❑ Infrastructural requirements
- ❑ Socio-economic conditions

Fig. 5.1 shows the factors affecting the location of a plant in diagrammatic form.

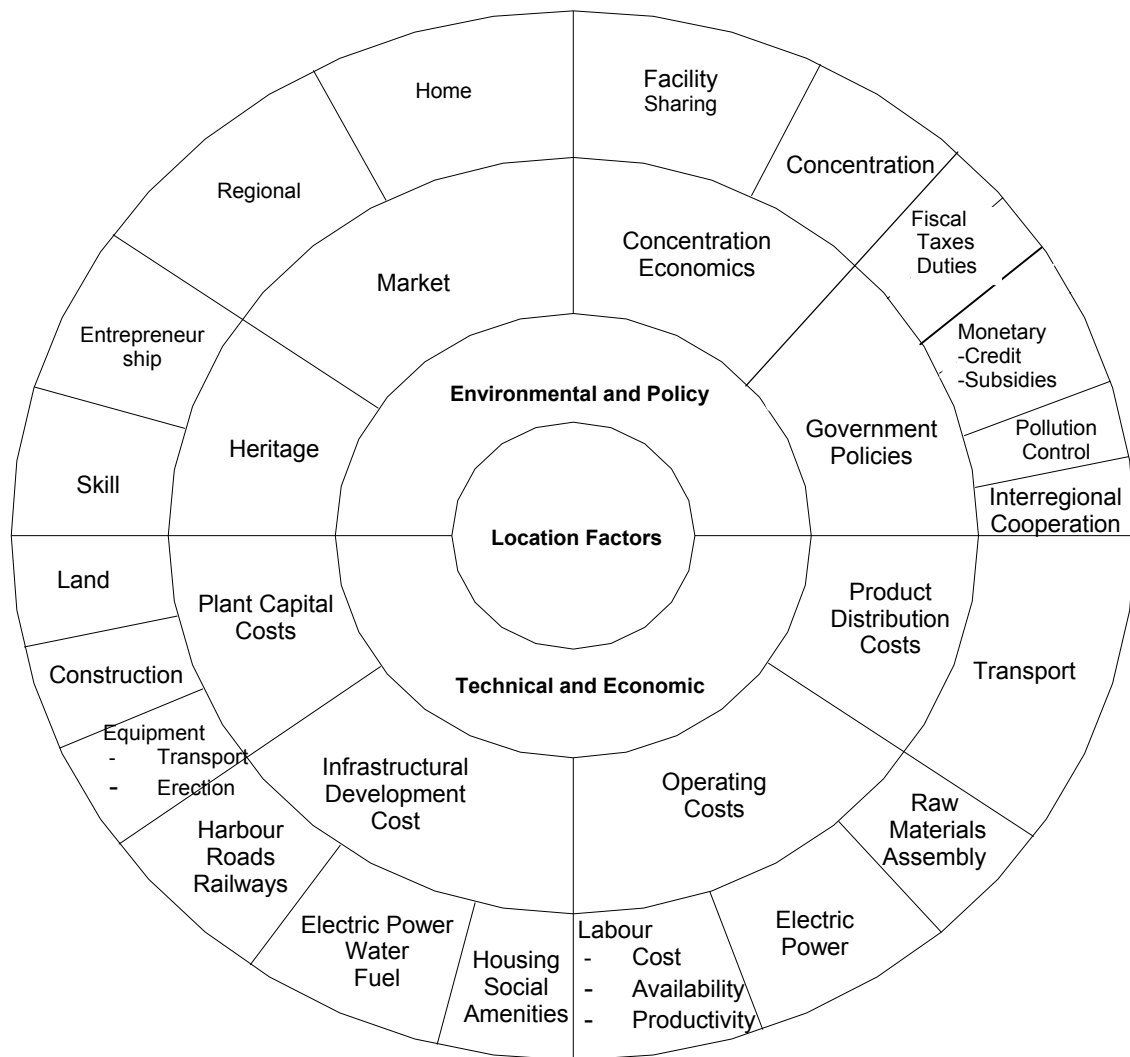


Fig. 5.1 : Plant Location Factors

The following major parameters have been taken into account when deciding the location of the new cement plant:

5.2.1 PROCESS TECHNOLOGY

Well known and established, dry process shall be used for manufacturing of cement. A production process technology has been recommended which consumes only the minimum possible process water and cooling water. The installation of bag filters instead of ESPs eliminates the need of water spray towers for exhaust gas conditioning.



5.2.2 PUBLIC POLICY

FDRE supports the establishment of private industries outside the established commercial and industrial centers in order to decentralize economic activities. Further, there is currently a large upsurge in demand for cement in the target market area i.e. in and around Addis Ababa for construction and development. This demand cannot be met from the existing cement plants due to their limited production capacities. Therefore, the decision to locate a new cement plant in Derba not far from Addis Ababa is a key for living standard development in Ethiopia.

5.2.3 RAW MATERIALS AVAILABILITY

Sufficient mineable reserves of the raw materials, limestone and clay of suitable quality occur in large quantities in the vicinity at a distance of 7 km (crow fly) from the plant site.

5.2.4 PLANT LOCATION

Three possible plant locations have been considered. The three options are shown in **Fig. 5.2**.

Option 1 (Mugher, in the valley): This option would entail minimal transportation for limestone. However, other materials like pumice, coal, clay, which are available at a higher altitude, will have to be brought down to the valley. There is no road at present linking the highs to the valley area. Thus, a new 14 km long road shall have to be built. In addition cement shall have to be transported from the valley to the highlands, which shall be difficult.

Air emission dispersion would be difficult, as a stack of almost 800 m shall be required to disperse the stack emissions above the plateau.

Moreover, contiguous adequate flat land to the tune of 125 ha for location of plant is not available in the valley.

Option 2 (Derba): This village has a good road connection. However, locating the plant close to habitation of Derba village is not advisable since it would lead to detrimental impacts on the local population.

Option 3 (8 km from Derba): About 8 km from Derba village, adequate flat area is available which is suitable for locating the plant with a residential complex. A road shall have to be built from Derba to the site over 8 km distance. The plant site can be connected to the mining area in the valley by a 7 km long belt conveyor for transportation of limestone. The site is also far from habitation of Derba village.

Thus Option 3 i.e. location of plant about 8 km from Derba has been selected to allow for minimal site disturbance and to avoid a site close to habitation.

5.2.5 LIMESTONE TRANSPORTATION

For the transportation of limestone and marl from the quarry to the plant, several options have been studied.

- ☐ Transportation through road
- ☐ Conventional belt conveyor system



- ❑ Pipe conveyor
- ❑ Tramway / Ropeway

Each of the above options is discussed briefly.

Option 1 (Road transport): Looking at the sharp fall in contours, it is difficult to construct a haul road with moderate light gradient to transport raw materials. Road construction will also involve several high capacity bridges and culverts to cover large gorges and rivers. Looking at the difficulties in road construction and the high cost of road transportation as compared to mechanized transport, this option is not being proposed for the project.

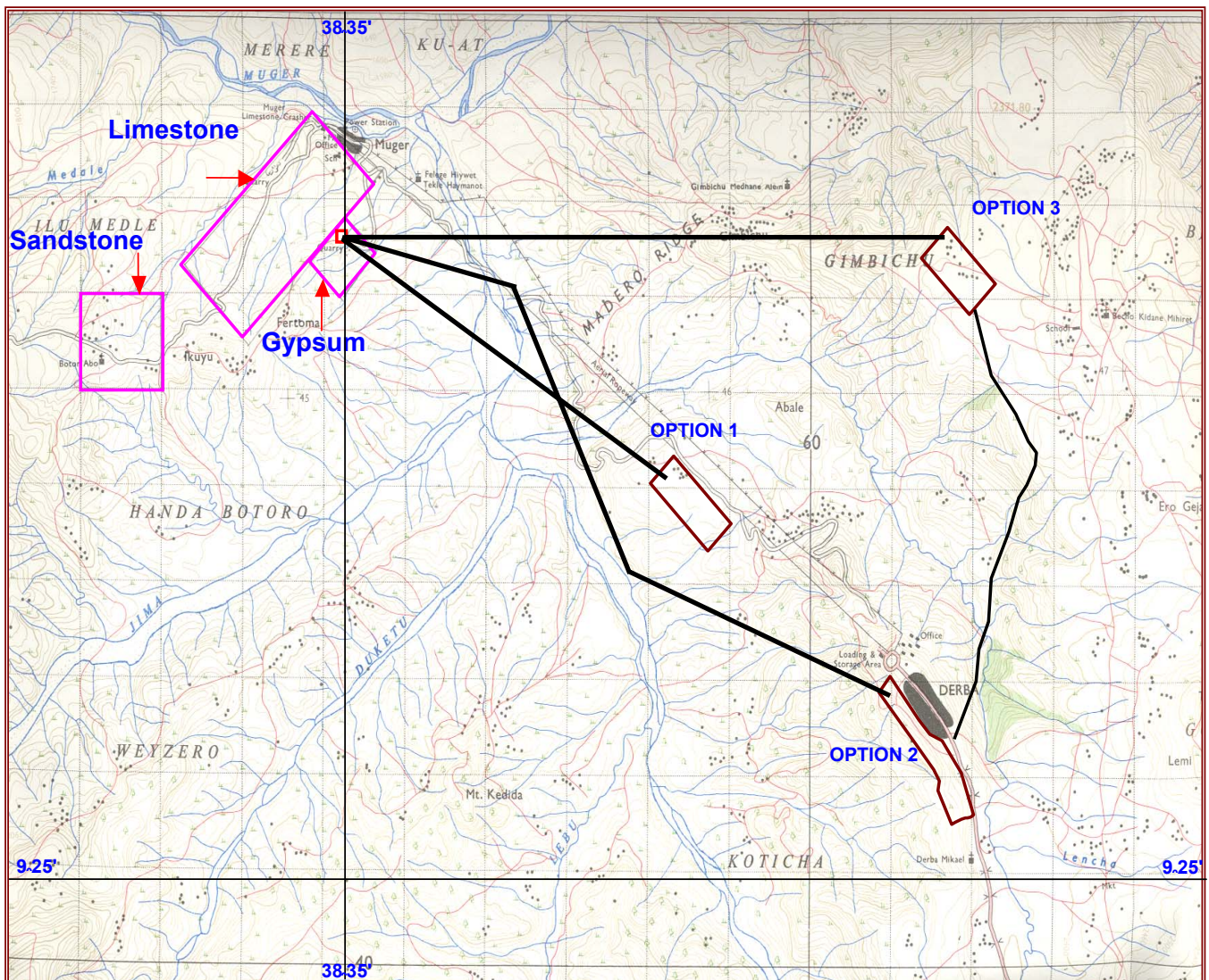


Fig. 5.2 : Alternative Plant Locations Evaluated

Option 2 (Conventional Belt Conveyor System) : For the transportation of material an enclosed conveyor belt system will be used. The conveyor will feed the limestone/ marl directly to the stockpile.

Option 3 (Pipe Conveyor) : Pipe conveyor is a modern material transportation system, which eliminates several constraints like training of conveyor, spillage, nuisance dust



generation, covering of conveyors etc. associated with other means of transport systems. The conveyor can accept steep angles and inclinations and protect material from natural weather conditions. For the distance of 7 km a single conveyor will be required. Pipe conveyor will feed to the limestone/ marl stockpile directly. However, the equipment is comparatively more expensive.

Option 4 (Ropeway) : Ropeways are conventional material transportation system, which have been used for tackling sharp inclinations/ altitude differences since ages. Due to the rope capacity, bucket filling time and bucket movements, ropeways are generally designed only upto a maximum capacity of 600 tph. Due to limitations in the design capacity of ropeways and very high maintenance requirements, this option is not proposed for this project.

Based on the above discussions, a belt conveyor system consisting of four belt conveyors has been selected for the transportation of limestone and marl from the crusher to the pre-blending stockpiles. The capacity of the conveyor is proposed as 1,250 tph considering a 25% margin on the limestone and marl crusher. The other corrective sand and additive gypsum shall also be transported through the same conveyor during off time of limestone crusher.

5.2.6 MARKET

According to a comprehensive market survey carried out, the new cement plant at Derba shall take a large share of the domestic market. **DMC** is expected to command a market share of around 37% in its first year of operation, which will increase to 41% in its fourth year of operation. **DMC** will achieve 100% capacity utilization in its fourth year of operation.

Based on the current and estimated future demand of various types of cement, a product mix of 30% OPC and 70% PPC is proposed.

5.2.7 ENERGY SUPPLY

The availability of power in Ethiopia is largely based on hydro-electric generation and may be considered reliable. The main feeder line passes close to Chancho. A substation shall be constructed here and a power line at 132 kV will be drawn over a distance of 20 km. Sufficient power is available for supply to the plant.

5.2.8 FUEL SUPPLY

Imported coal has been considered as the main fuel for the plant. Use of agricultural waste may also be explored for calciner firing in the future, as large quantities of agricultural waste are available in the nearby areas.

5.2.9 SOCIO-ECONOMIC CONDITIONS

There are a number of small communities around the proposed project site. A sizeable reservoir of semi-skilled and unskilled labor can be recruited in the nearby areas, thus creating employment and improving the living standards of the people in the vicinity. Skilled personnel can be recruited in the neighbouring towns of Derba, Chancho, Addis Ababa, etc. Bus transport will be provided for employees of **DMC** between Derba and the plant site during normal and shift changing hours. As an added facility, transport will be provided for the workers up to Addis during weekends.



A large number of local people shall benefit from the direct and indirect employment opportunities that shall be created with the establishment of the plant. The details are provided in ESMP Report.

Chapter 6

Environmental & Social Impact Assessment



CHAPTER - 6

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT

6.0 PREAMBLE

Actual and foreseeable events, including operational and typical events are evaluated. Processes that may create risks to the environment are considered and are analyzed in terms of key potential environmental impacts.

The environmental impacts include all those that are beneficial or adverse, short or long term (acute or chronic), temporary or permanent, direct or indirect, and local or regional. The adverse impacts include all those leading to harm to living resources, damage to human health, hindrance to other activities, impairment of quality for use, damage to cultural resources, and damage to physical structures. For each identified potential environmental impact, the associated environmental risk is assessed based on its likelihood and significance. The impacts assessment is performed in three steps:

- ❑ Step 1: Identification of interactions between activities and environmental receptors
- ❑ Step 2: Identification of potentially significant environmental impacts
- ❑ Step 3: Evaluation of all significant environmental impacts

In Step 1, based on the project description and environmental baseline description, a detailed matrix of activities and environmental receptors is prepared and it is determined whether an interaction exists between an activity and a receptor.

In Step 2, based on the interactions identified in Step 1, potentially significant impacts due to the proposed changes are identified. The impacts may be beneficial/ adverse, direct/ indirect, reversible/ irreversible and short-term/ long-term.

In Step 3, all the potentially significant impacts are evaluated. A qualitative evaluation is used whereby an adverse impact is rated as “low”, “medium” or “high”. The impact rating is based on two parameters: the “significance of impact” and the “likelihood of occurrence of impact”. The significance depends mainly on the nature and size of the activity and the environmental sensitivity, while the likelihood of occurrence depends mainly on nature of the activity and the control measures in place. The details of criteria adopted for impact assessment are as follows:

Impact Rating		Criteria
Nature of impact	Beneficial	Positive
	Adverse	Negative
Duration of impact	Short term	Impacts shall be confined to a stipulated time
	Long term	Impacts shall continue till the end of plant life
Likelihood of occurrence	Negligible	<10%
	Low	10-40%
	Medium	40-60%
	High	60-80%
	Very high	80-100%



Impact Rating		Criteria
Significance of impact	Slight	Very difficult to notice impacts
	Minor	Noticeable impacts only
	Localized	Noticed by adjacent locality and may have direct impacts
	Major	Have direct sustainable impacts
	Massive	Ability to change the system
Potential impact level	Low	Has practically no impact
	Medium	Has impact in local area
	High	Has impact in region

The likely impacts of the proposed plant would be:

- ☐ Due to construction phase and development phase which would be regarded as temporary or short term
- ☐ Due to operation, which would have long term impacts.
- ☐ Due to closure, which would have long term impacts

The construction, operation and closure phases of the proposed project comprise of various activities each of which has been considered to assess the impact on one or other environmental parameter.

6.1 IMPACTS DURING CONSTRUCTION AND DEVELOPMENT PHASE

Construction and development activities normally spread over pre-construction, preparatory construction, machinery installation and commissioning stages and end with the induction of manpower and startup.

Pre-construction phase involves completion of all legal formalities from various statutory bodies, surveys/ studies required, finalization of contract for procurement of machinery/ equipments, recruitment and hiring of requisite skilled, semi-skilled manpower and labour, provision of space and other facilities like water supply, disposal of wastewater and solid waste, etc. on temporary basis for the contracted labour to be employed and provision for storage of machinery and materials to be used for construction.

Preparatory construction phase mainly consists of setting up of construction camp, transportation of machinery and materials to be used for construction, clearing and leveling of land, transportation of machinery/ equipment to the site, construction of foundations, buildings and approach roads required for installation of the same, etc.

Machinery installation and commissioning phase involves activities like cutting, welding and construction of buildings and other facilities, laying of cables and pipelines, installation of machinery, etc. Start up involves testing of plant for any type of leakages and designed capacity.

The details of activities and actions to be undertaken and their impacts during construction and development phase are summarized in **Table 6.1** and described below:



Sn	Component	Activities	Potential Impacts
1	Movement of manpower, machinery and materials	<ul style="list-style-type: none"> □ Increase in traffic movement □ Encroachment of area for parking & camping □ Washing and maintenance of vehicles 	<ul style="list-style-type: none"> □ Disturbance to community & its safety □ Contribution of dust and gaseous pollutants like SO₂, NO_x, CO, VOC to ambient air quality □ Contribution to ambient noise level □ Employment to locals □ Business opportunities to locals
2	Site clearing, leveling & excavation	<ul style="list-style-type: none"> □ Operation of heavy earth moving machinery & equipment □ Removal of vegetation at site □ Piling of soil □ Storage of oil □ Disturbance to groundwater by intersection of shallow aquifer □ Operation of D.G sets 	<ul style="list-style-type: none"> □ Disturbance to native vegetation and habitats □ Change in Land use pattern □ Disturbance to existing nearby land users creating visual impact □ Contribution of dust and gaseous pollutants like SO₂, NO_x, CO, VOC to ambient air quality □ Contribution to ambient noise level □ Disposal of solid waste & waste water □ Employment to locals □ Business opportunities to locals
3	Civil Construction	<ul style="list-style-type: none"> □ Transportation and storage of construction materials □ Storage of oil □ Operation of construction equipment & machinery □ Storage of waste material □ Exploitation of water resources □ Operation of D.G sets 	<ul style="list-style-type: none"> □ Disturbance to existing nearby land users creating visual impact □ Contribution of dust and gaseous pollutants like SO₂, NO_x, CO, VOC to ambient air quality □ Contribution to ambient noise level □ Disposal of solid waste & waste water □ Employment to locals □ Business opportunities to locals



Sn	Component	Activities	Potential Impacts
4	Mechanical Construction	<ul style="list-style-type: none"> ❑ Transportation of equipment, metal sheets etc. ❑ Operation of cutting and welding machines ❑ Storage of oil ❑ Storage of waste material ❑ D.G set operation 	<ul style="list-style-type: none"> ❑ Contribution of dust and gaseous pollutants like SO₂, NO_x, CO, VOC to ambient air quality ❑ Contribution to ambient noise level ❑ Disposal of solid waste and waste water ❑ Employment to locals ❑ Business opportunities to locals
5	Camp	<ul style="list-style-type: none"> ❑ Construction of temporary accommodation ❑ Supply of fuel and other material ❑ Supply of domestic water ❑ Storage of domestic waste ❑ Medical facilities ❑ Recreational facilities ❑ Supply of electricity 	<ul style="list-style-type: none"> ❑ Disturbance to existing nearby land users creating visual impact ❑ Contribution of dust and gaseous pollutants like SO₂, NO_x, CO, VOC to ambient air quality ❑ Contribution to ambient noise level ❑ Disposal of solid waste & waste water ❑ Price hike of essential commodities ❑ Cultural and aesthetic features ❑ Influx of outsiders/ foreigners ❑ Employment to locals ❑ Business opportunities to locals

Table 6.1: Impacts During Construction Phase

6.1.1 COMPONENTS CREATING RISKS TO NATURAL ENVIRONMENT

The components of the construction and development phase that could result in effects on the natural environment include the following:



6.1.1.1 Land Use

The total land acquired for the proposed plant is 125 hectares. This land is basically agricultural and grazing land and has been acquired by Oromiya Regional Government from individual landowners after paying compensation as required under Ethiopian statutes. The acquisition of grazing land shall lead to adverse impacts on livestock rearing.

6.1.1.2 Ambient Air Quality

The sources of air emission during construction and development phase will include site clearing, vehicles used for transportation of men and materials to the site and operation of construction equipment. Emissions from these are expected to result in degradation of air quality, primarily in the working environment affecting construction employees. However, SPM in the ambient air will be coarse and would settle within a short distance close to the construction site so measures will need to be taken to protect workers. Hence, dust and other emissions are unlikely to spread sufficiently to affect the surroundings of the construction site.

Traffic to the site during construction will be more intensive and much heavier than at present in normal operating conditions. In turn, it will subject existing roads to more stress. The increase in traffic shall also lead to an increased accident risk to livestock in the neighbouring areas.

Gaseous emissions like SO₂, NO_x, CO, HC are also anticipated as a result of burning of fuel to accomplish construction phase due to operation of machinery/ equipment.

Site clearing is proposed to be limited and confined to the plant area only. Moreover, the standard facilities/ infrastructure for dust suppression shall be implemented.

Thus the impact shall be adverse and for a short term which shall be localized in extent.

6.1.1.3 Noise Level

The general noise levels due to construction and development activities such as working of heavy earth moving equipment and machinery installation may sometimes go up to 85 dB(A) at the work sites during day time. The workers in general are likely to be exposed to an equivalent noise level of 85 dB (A) in an 8-hour shift for which all statutory precautions as per law will be implemented. Use of proper personal protective equipment shall further mitigate any adverse impact of noise to the workers. By using standard practice of operation, these impacts can be minimized and made insignificant.

Thus the impact shall be adverse and for a short term which shall be localized in extent.

6.1.1.4 Water Resources

During the construction phase of proposed plant, total water requirement is estimated as 250 to 300 m³/ day depending upon type of construction activities at site. This requirement of water will be drawn through ground water. The impacts on the water resources during construction and development phase shall be adverse, for short term and localized in nature.



6.1.1.5 Waste Water

The wastewater generated during construction and development phase shall be mainly from domestic activities. Since most of the workers will be from local area, wastewater generated will be minimal. The domestic waste so generated in campsite shall be treated in portable Sewage Treatment Plant (STP), which shall be provided at the site. The treated domestic wastewater will be used in dust suppression and construction activities.

Thus the impact during construction and development phase shall be adverse, for short term and localized in nature.

6.1.1.6 Soil & Solid Waste

During construction and development phase, solid waste such as excavated top layers, debris, metal waste and oil and grease from construction machines will be generated. This waste may contaminate the plant site temporarily and would be restricted to a small area. Excavated top layers will be used for backfilling and as soon as construction is over all waste will be cleared as soon as possible.

During the construction and development phase, hydraulic oil, fuels and lubricating oils would be used. There is potential for accidental spills while re-fuelling or servicing vehicles and through breakage due to wear and tear. Procedures for maintenance of equipment would ensure that this risk is minimized and cleanup response is rapid if any spill occurs.

During construction phase, waste oil shall be generated as and when lubricating oil is changed. Waste oil shall be collected through the drain ports and stored in leak proof steel drums and sent to the "Spent Oil Storage Site" of. The waste oil drums shall be properly identified with label of what is contained in Oromiya/ Amahrik and English and shall be disposed off through licensed vendors or stored for later use in kiln if the required permit is obtained from authorities.

The solid waste generated by workers as municipal waste will be minimal as most of them belong to the local area. Solid waste shall be disposed off on municipal waste disposal site allocated by local administrative authorities. Other solid waste like debris, metal pieces, cotton waste, etc. so generated will be collected and segregated and will be disposed off in municipal approved site.

The impact of solid waste during construction and development phase shall be adverse, for short term and localized in nature.

6.1.2 COMPONENTS CREATING RISKS TO SOCIO-ECONOMIC ENVIRONMENT

The components of the construction and development phase that could result in effects on the socio-economic environment include the following:

6.1.2.1 Disturbance to Community Resources and Safety

□ Disturbance to Topography

Construction and development activities are proposed to be confined to a limited area, which would be very small as compared to total study area. Thus the impact on topography shall be adverse, long term and localized.



☐ Impact on Ecology

The potential impacts to ecology as a result of the project are habitat losses associated with land take, habitat degradation, and disturbance caused by construction activity and operations. Given the ecology of the mountains and minimal land take requirements, impacts on the site are considered to be insignificant.

During construction and development phase, disturbance to vegetation shall be localized and confined to a limited area only.

☐ Road crossings and traffic

There are safety risks related to transportation of construction workers and machinery and materials through public roads due to increase in the local traffic and also, there is a requirement for warning signs to minimize damage to the third-party vehicles. In addition, risks to public need to be managed. There will be a higher risk of accidents to animals due to increased traffic on these roads.

Existing road conditions up to Derba are good to take the load during construction and development phase. However, four bridges on the road from Chanco to Derba are old and narrow and new bridges will be constructed along side these before arrival of heavy plant machinery and equipment.

The issue of right of way along the road and the conveyor belt from mines to plant has been addressed with the consent of Zonal and Wereda administration officials. A Committee involving elders and government officials has been established to follow up and resolve issues related to right of way. This committee is accountable to the Wereda Council headed by the Wereda chief administration.

6.1.2.2 Employment and Socio-economic

In addition to permanent staff, the labour strength engaged in the construction shall be about 1,500 persons depending upon construction activities, since many items of construction are labour intensive. Most of the unskilled and semi-skilled labour will be by and large available from the nearby villages. Thus, impact on the physical and aesthetic resources will be minimal.

Further local skilled, semi skilled and unskilled labourers will get direct and indirect employment during the construction phase. This might also result in a steep rise in agricultural wages in the surrounding villages, especially at the time of harvesting for short duration.

Thus the impact on employment and socio-economic scenario shall be mainly beneficial, short term and localized.

6.2 IMPACTS DURING OPERATION OF PLANT AND MINES

The Operation phase of the proposed cement project shall mainly comprise of the following:

- ☐ Excavation of limestone from the captive mines
- ☐ Crushing of limestone
- ☐ Transportation of limestone from mines to plant site



- ☐ Transportation of other additives to the plant site
- ☐ Preparation of raw meal by adding additives to limestone
- ☐ Clinkerisation of raw meal
- ☐ Cooling and heat recovery
- ☐ Blending & grinding of clinker by adding additives
- ☐ Packing & Despatch

The details of main activities and actions to be undertaken and their impacts during operation phase of plant and mines are summarized in **Table 6.2 & 6.3** respectively:

Sn	Component	Activities	Potential Impacts
1	Transportation of raw materials and products	<ul style="list-style-type: none"> <input type="checkbox"/> Increase in traffic movement <input type="checkbox"/> Washing and maintenance of vehicles 	<ul style="list-style-type: none"> <input type="checkbox"/> Disturbance to community & its safety <input type="checkbox"/> Contribution of dust and gaseous pollutants like SO₂, NO_x, CO, VOC to ambient air quality <input type="checkbox"/> Contribution to ambient noise level <input type="checkbox"/> Disposal of solid waste & waste water
2	Operation of plant	<ul style="list-style-type: none"> <input type="checkbox"/> Crushing of limestone and other raw materials <input type="checkbox"/> Preparation of raw meal <input type="checkbox"/> Clinkerisation of raw meal <input type="checkbox"/> Cooling and heat recovery <input type="checkbox"/> Blending & grinding of clinker by adding additives <input type="checkbox"/> Packing & Despatch 	<ul style="list-style-type: none"> <input type="checkbox"/> Air emissions from operations are Dust, NO_x, SO₂, GHG and unburnt hydrocarbons. <input type="checkbox"/> Increase in noise level <input type="checkbox"/> Waste water generation is mainly anticipated from: <ul style="list-style-type: none"> ○ Water treatment plant ○ Domestic usages in plant <input type="checkbox"/> Solid waste is anticipated to be generated mainly from wastewater treatment plant as dry sludge, waste lubricating oil from machinery/ equipments and municipal waste from domestic usages <input type="checkbox"/> Accidental spillage of oil, if any.
3	Socio-economic	<ul style="list-style-type: none"> <input type="checkbox"/> Acquisition of land <input type="checkbox"/> Payment of taxes and royalty <input type="checkbox"/> Direct and indirect employment <input type="checkbox"/> Development of infrastructure like road, medical, transportation etc 	<ul style="list-style-type: none"> <input type="checkbox"/> Loss of grazing area <input type="checkbox"/> Change in Land use pattern <input type="checkbox"/> Business opportunities to locals <input type="checkbox"/> Employment to locals <input type="checkbox"/> Demand for drivers <input type="checkbox"/> Regional development <input type="checkbox"/> Saving of foreign exchange



Sn	Component	Activities	Potential Impacts
		<ul style="list-style-type: none"> etc ❑ Implementation of Welfare schemes like drinking water supply, education, health etc ❑ Demand of local products and agricultural products ❑ Development of green belt 	<ul style="list-style-type: none"> ❑ Increase in per capita income ❑ Increase in literacy rate ❑ Change in living standards

Table 6.2 : Impacts During Operation Phase of Plant

Sn	Component	Activities	Impacts
1	Operation of Mines	<ul style="list-style-type: none"> ❑ Drilling ❑ Blasting ❑ Loading & transportation of raw materials ❑ Operation of mining machinery/equipment 	<ul style="list-style-type: none"> ❑ Air emissions from operations are Dust, NO_x, SO₂, and VOCs. ❑ Generation of noise and vibrations from blasting ❑ Waste water generation is mainly anticipated from: <ul style="list-style-type: none"> ○ Workshop ○ Domestic usages ❑ Solid waste is anticipated to be mainly generated as: <ul style="list-style-type: none"> ○ Dry sludge from wastewater treatment plant ○ Waste lubricating oil from machinery/ equipments ○ Municipal waste from domestic usages ❑ Accidental spillage of oil, if any.
2	Socio-economic	<ul style="list-style-type: none"> ❑ Payment of taxes and royalty ❑ Direct and indirect employment ❑ Development of infrastructure like road, medical, transportation etc ❑ Implementation of Welfare schemes like drinking water supply, education, health etc ❑ Demand of local products and agricultural products 	<ul style="list-style-type: none"> ❑ Business opportunities to locals ❑ Employment to locals ❑ Demand for drivers ❑ Regional development ❑ Change in Land use pattern ❑ Saving of foreign exchange ❑ Increase in per capita income ❑ Increase in literacy rate ❑ Change in living standard



Sn	Component	Activities	Impacts
		<ul style="list-style-type: none"> ❑ Development of green belt ❑ Acquisition of land, relocation of households 	

Table 6.3 : Impacts During Operation Phase of Mines

6.2.1 COMPONENTS CREATING IMPACTS ON NATURAL ENVIRONMENT

The components of the operation phase that could result in effects on the natural environment include the following:

6.2.1.1 Ambient Air Quality

Greenhouse Gas Emissions

Cement Plants have significant emissions of Greenhouse Gases. GHG emissions, especially CO₂ are mainly associated with fuel combustion and with the calcination of limestone, which in its pure form is 44% CO₂ by weight. Roughly 50% of the emitted CO₂ originates from the fuel and the balance 50% from the conversion of raw material.

As per calculations, around 1.67 mio tonnes of CO₂ will be generated per annum during production of 2.46 mio tonnes of cement per annum.

CO makes a minor contribution to GHG emissions (<0.5-1% of total emitted gases). These emissions are normally related to the organic matter content of the raw material.

The proposed measures for CO₂ emission prevention and control, in addition to proper smoothing of kiln operations, include the following:

- ❑ Production of blended cement, i.e. PPC, which has the potential to significantly reduce the fuel consumption and subsequently the CO₂ emissions per tonne of final product.
- ❑ Selection of Preheater-Precalciner process to promote energy efficiency

The proposals for reduction and control for GHGs at the proposed plant once it is operational include Carbon Financing, which may include the Ethiopian Government's Clean Development Mechanism, among others.

Waste heat recovery for power generation is also considered BAT technology, but due to high heat demands for raw material drying there will not be enough remaining waste heat left to make this option viable.

The impacts of GHG emissions are considered to be adverse, high, long term and regional in extent.

Stack Emissions

The major sources of emissions from the operation of cement plant are shown in **Fig. 6.1** (Adapted from AP-42, Section 11.6). Emissions released from the plant during operation phase will get dispersed in the atmosphere and finally reach the ground at a specified distance from the sources.

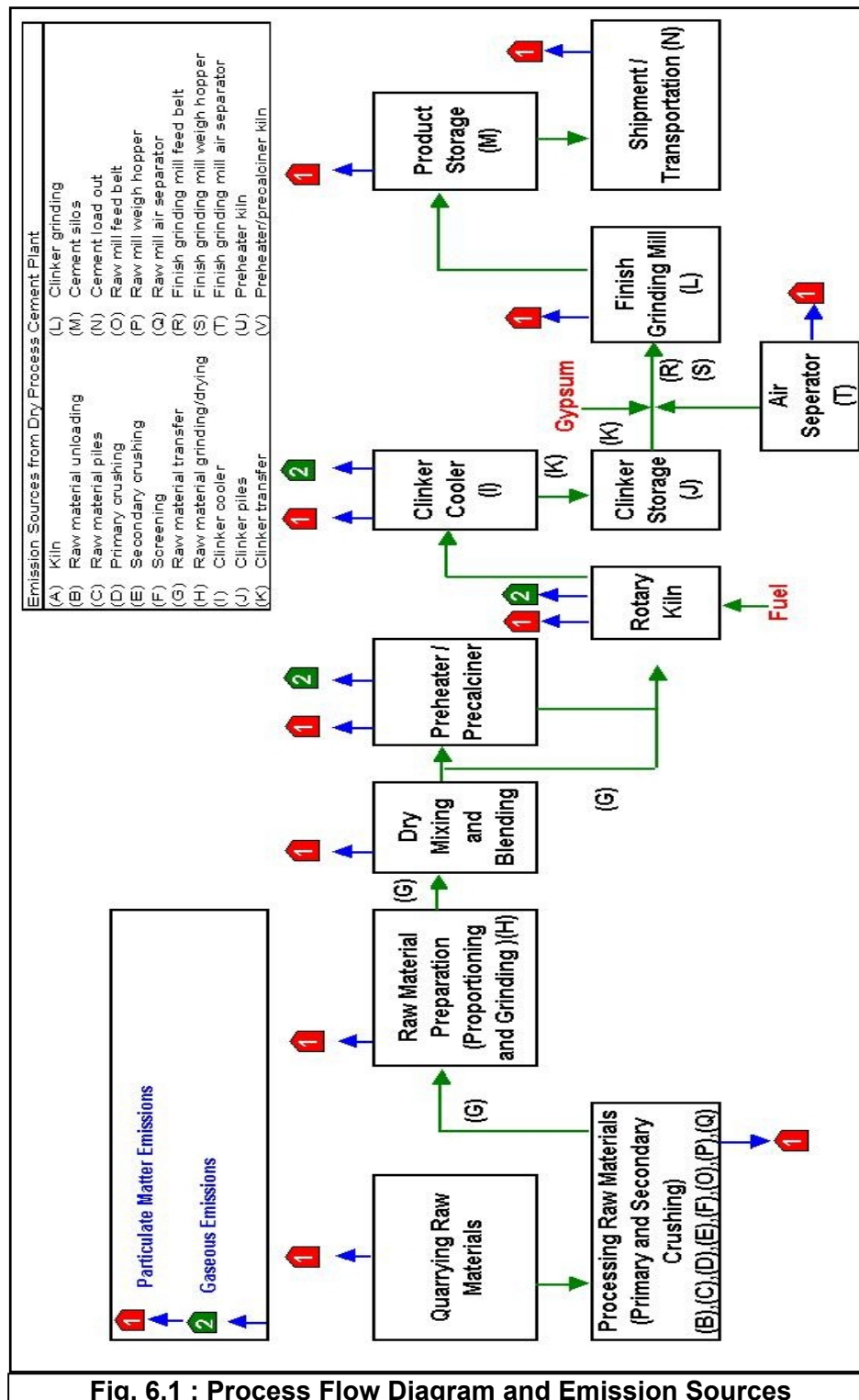


Fig. 6.1 : Process Flow Diagram and Emission Sources



Point Source Emissions

The pollutant emitted from the cement plant is Particulate matter. Sources of PM at cement plants include (1) limestone mining and crushing, (2) raw material storage, (3) grinding and blending (4) clinker production, (5) finish grinding, and (6) packaging and loading. The largest emission source of PM within cement plants is the pyroprocessing system that includes the kiln and clinker cooler exhaust stacks. Dust from the kiln is collected and recycled into the kiln thereby producing clinker from the dust. However, some of the dust is discarded or leached before returning it to the kiln. Additional sources of PM are raw material storage piles, conveyors, storage silos, and unloading facilities.

The sources of particulate emission from the proposed cement plant constitute flue gases from Kiln and cooler. Other sources of particulate system include ventilation systems from Limestone weigh feeder, Raw material storage silo, Raw meal blending silo, Clinker stock pile, Clinker transport to cement mill, Clinker Transport at discharge end, Clinker Hopper at cement mill section, Cement Silo and Packing Machines.

All the pollution control equipment in the proposed cement plant are designed for an outlet emission of less than 25 mg/Nm^3 . It is proposed to install a bag house for raw mill/Kiln, bag filter for coal mill, cement mill and ESP for cooler. At all other sources, it is proposed to install suitable bag filter systems. The dust collected from the various pollution control equipment will be recycled in the cement manufacturing process.

Sulphur dioxide is generated both from the sulphur compounds in the raw materials and from sulphur in the fuel. However, the alkaline nature of the cement provides for direct absorption of SO_2 into the product, thereby mitigating the quantity of SO_2 emissions in the exhaust stream. SO_2 emissions of the kiln are influenced by the operation of the raw mill kiln, where considerable amount of SO_2 generated in the kiln process gets absorbed in the raw material (about 80%).

Oxides of nitrogen are generated during fuel combustion by oxidation of chemically bound nitrogen in the fuel and by thermal fixation of nitrogen in the combustion air. As flame temperature increases, the amount of thermally generated NO_x increases, and the amount of NO_x generated from fuel increases with the quantity of nitrogen in the fuel. In the cement manufacturing process, NO_x is generated in the burning zone of the kiln and the burning zone of a precalcining vessel. Fuel use affects the quantity and type of NO_x generated.

In order to control NO_x emission of kiln, an automatic kiln control system will be installed for maintaining constant burning conditions in kiln thereby reducing the NO_x emission. A well designed burner system shall limit the core flame temperature to ensure a reasonably low value of NO_x generation.

In view of the firing technique of keeping a positive oxygen balance, emission of CO shall be minimal.

Emissions from various stacks have been considered as point sources; there are about 23 major point source emissions from the proposed plant. Each point source is identified based on the location of the each stack and emission strength and flue gas properties.

The list of point sources and their characteristics are discussed in **Table 6.4**. For the purpose of air pollution modeling, controlled emissions at the outlet of each pollution control system have been considered.



Area Source Emissions

Area source emissions are described as the emissions generated during the handling of raw material and other intermediate material in the plant. In cement plants, the major area source emissions will be the dust generation from clinker stockpile and raw material stockpiles etc. However, in the proposed cement plant, a closed clinker stockpile has been proposed and suitable ventilation system with bag filter is proposed and hence the emissions from the stockpiles have been considered as point sources with controlled emissions.

6.2.1.2 Dispersion Modelling

The sources of emissions from the proposed cement plant are given in **Table 6.4**. The particulate emission at the outlet of pollution control systems has been computed based on the design parameters to achieve the outlet concentration of 30 mg/Nm³ though the filters are designed to maintain 25 mg/ Nm³. In addition to the particulate matter, the possible impacts due to release of gaseous pollutants has been considered for the prediction of cumulative ground level concentration of SO₂ and NO_x.

Incremental Ground Level Concentrations (GLCs) of particulate matter, SO₂ and NO_x have been predicted by *Industrial Source Complex Short Term model Version-3 (ISCST 3)* Breeze software developed by U.S. Environmental Protection Agency (USEPA). This model uses a steady state, sector-averaged Gaussian plume equation for application in complex terrain (i.e. terrain stack or release height) and stability classes developed by Pasquill and Gifford.

The details of main stacks attached to proposed unit are given in **Table 6.4**.

Sn	Description	Stack Details											
		Control Equip.	Ht. (m)	Dia. (m)	Vel. (m/s)	Temp (0C)	Emission rate (g/s)			IFC Standard SPM (mg/ Nm³)	IFC standards		Design Cap. of PM (mg/Nm³)
							SPM	SO₂	NOx		SOx (mg/ Nm³)	Nox (mg/ Nm³)	
1	Coal Crusher	Bag Filter	20.5	0.55	15.21	25	0.09	0	0	50	-	-	25
2	Kiln / Vertical Roller Mill	Bag House	113.5	4.7	9.71	94	2.35	33.67	134.69	30	400	600	25
3	Clinker Cooler	ESP	40	4.4	15.16	250	5.76	0	0	50	-	-	25
4	Cement Mill	Bag Filter	10	1.3	9.7	62	0.187	0	0	50	-	-	25
	Cement Mill	Bag Filter	10	1.3	9.7	62	0.187	0	0	50	-	-	25
	Cement Mill	Bag Filter	10	1.3	9.7	62	0.187	0	0	50	-	-	25
	O-Sapa	Bag Filter	42	2.3	12.9	40	0.821	0	0	50	-	-	25
	O-Sapa	Bag Filter	40	2.3	12.9	40	0.821	0	0	50	-	-	25
	O-Sapa	Bag Filter	40	2.3	12.9	40	0.821	0	0	50	-	-	25
5	Packing Plant	Bag Filter	10.3	0.75	12.40	25	0.14	0	0	50	-	-	25
	Packing Plant	Bag Filter	10.3	0.75	12.40	25	0.14	0	0	50	-	-	25
	Packing Plant	Bag Filter	10.3	0.75	12.40	25	0.14	0	0	50	-	-	25
	Packing Plant	Bag Filter	10.3	0.75	12.40	25	0.14	0	0	50	-	-	25
	Packing Plant	Bag Filter	10.3	0.75	12.40	25	0.14	0	0	50	-	-	25
	Packing Plant	Bag Filter	10.3	0.75	12.40	25	0.14	0	0	50	-	-	25
	Packing Plant	Bag Filter	8.5	0.6	9.08	25	0.06	0	0	50	-	-	25
	Packing Plant	Bag Filter	8.5	0.6	9.08	25	0.06	0	0	50	-	-	25
	Packing Plant	Bag Filter	8.5	0.6	9.08	25	0.06	0	0	50	-	-	25
	Packing Plant	Bag Filter	8.5	0.6	9.08	25	0.06	0	0	50	-	-	25
	Packing Plant	Bag Filter	8.5	0.6	9.08	25	0.06	0	0	50	-	-	25
	Packing Plant	Bag Filter	8.5	0.6	9.08	25	0.06	0	0	50	-	-	25
6	Coal Mill	Bag Filter	46	1.6	14.78	95.3	0.41	0	0	50	-	-	25
7	Correctives Crusher	Bag Filter	22	0.65	14.95	25	0.09	0	0	50	-	-	25

Table 6.4 : Source Characteristics/ Release Characteristics



6.2.1.3 Application of ISCST-3

ISCST3 Model with the following options has been employed to predict the cumulative ground level concentrations due to emissions from the proposed cement plant.

- ☐ Area being rural, rural dispersion parameters are considered;
- ☐ Predictions have been carried out to estimate concentration values over radial distance of 10 km around the sources;
- ☐ Polar receptor network has been considered;
- ☐ Emission rates from the point sources and area sources were considered as constant during the entire period;
- ☐ Consideration of settling velocity of the particles for cement plant sources;
- ☐ The ground level concentrations computed were considered on basis without any consideration of decay coefficient;
- ☐ Calm winds recorded during the study period were also taken into consideration;
- ☐ 24 hourly mean ground level concentrations have been used for the period Aug-Sept 2007 as recorded at the meteorological station set up at Derba village.

6.2.1.4 Predicted Ground Level Concentrations

In order to estimate the worst-case scenario, the ground level concentration was computed considering the cement plant emissions as multi source emissions.

Suspended Particulate Matter (SPM): The Maximum 50, 24-Hr Average Concentration Values for source group are predicted and are given in **Table 6.5**.

Sn	Receptor		Conc. ($\mu\text{g}/\text{m}^3$)	Sn	Receptor		Conc. ($\mu\text{g}/\text{m}^3$)
	X	Y			X	Y	
1	400	-400	24.62755	26	400	0	10.06484
2	800	-400	16.77568	27	800	-1200	10.03888
3	800	-400	15.14638	28	400	-400	9.73432
4	800	-400	15.04345	29	1200	-400	9.58151
5	800	-400	14.56254	30	800	0	9.44078
6	800	-400	14.56219	31	800	-400	9.38678
7	800	-400	14.27173	32	800	-400	9.3435
8	800	-400	13.08895	33	800	-400	9.05476
9	800	0	13.03435	34	800	-400	8.93025
10	400	-400	12.99912	35	800	-400	8.89264
11	400	-400	12.21528	36	400	-400	8.83964
12	800	-400	12.03509	37	400	0	8.4714
13	800	-400	11.88534	38	400	-800	8.41985
14	800	0	11.85945	39	800	0	8.38327
15	800	-800	11.67374	40	800	-400	8.37889
16	800	-400	11.61069	41	400	-400	8.37422
17	800	-400	11.44688	42	800	0	8.28565
18	400	-800	11.44674	43	800	-400	8.19918
19	800	-400	11.20461	44	400	400	8.12846



Sn	Receptor		Conc. ($\mu\text{g}/\text{m}^3$)	Sn	Receptor		Conc. ($\mu\text{g}/\text{m}^3$)
	X	Y			X	Y	
20	400	-400	11.15705	45	800	-400	8.10888
21	400	-1200	10.98818	46	0	400	8.0376
22	400	-400	10.73729	47	800	-800	7.82001
23	800	-400	10.27876	48	800	-800	7.79127
24	800	-400	10.26515	49	0	800	7.77598
25	1200	-400	10.10403	50	1200	-400	7.7143

Note: All receptors are grid card type and distances are in meter

Table 6.5: 24 Hourly Average Incremental GLCs of SPM

Maximum 24 hourly average incremental GLC value for SPM has been found to be $24.62 \mu\text{g}/\text{m}^3$ at a distance of 0.4 km.

The predicted ground level concentrations of SPM are shown below in **Fig. 6.2**.

ISCST3 -BREEZE MODEL FOR SPM
(PLOT FILE OF 1ST HIGH 24 HR. VALUES FOR A TOTAL OF 2500 RECEPTORS)

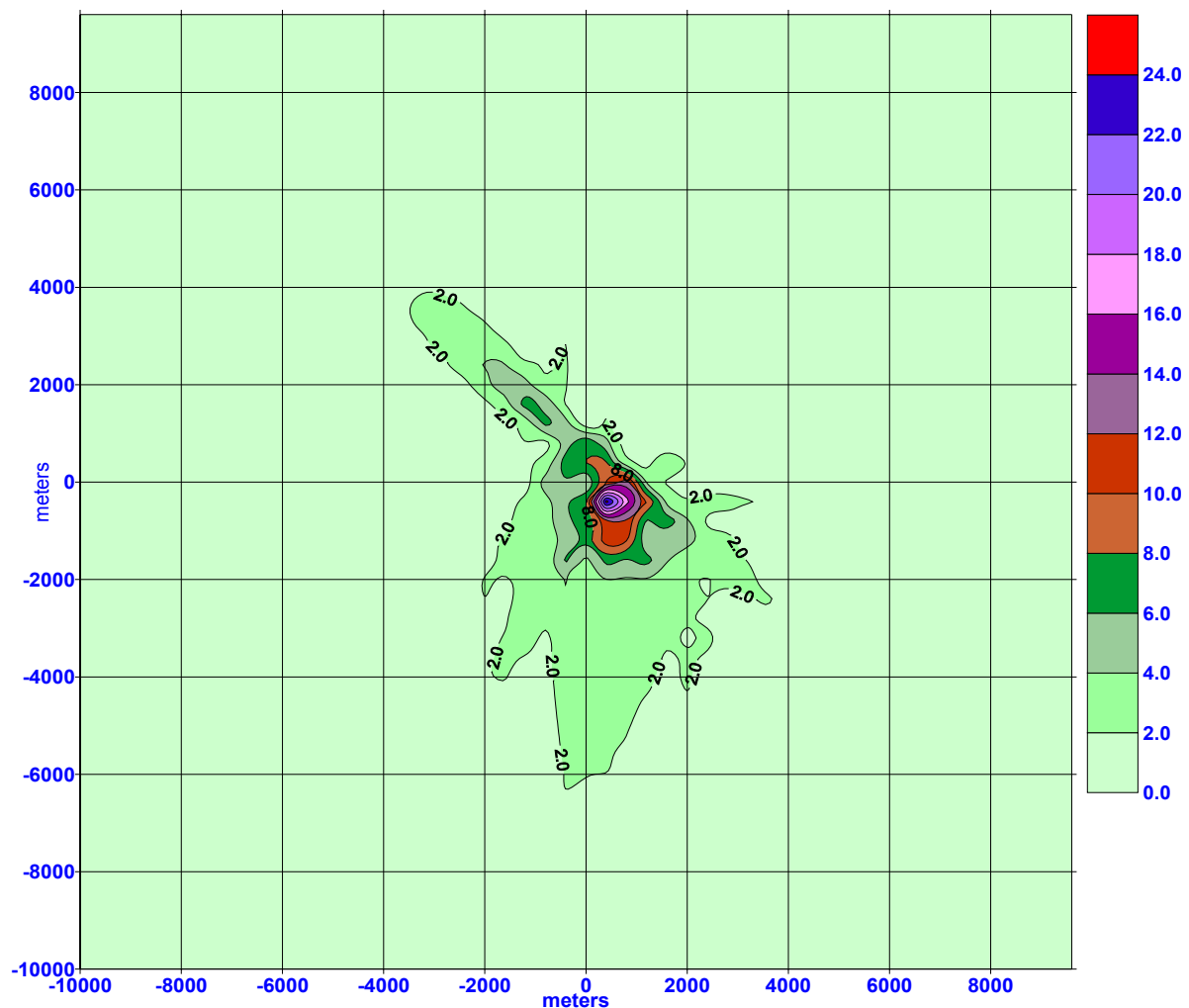


Fig. 6.2 : 24 hourly Incremental GLCs of SPM ($\mu\text{g}/\text{m}^3$) resulting from the proposed project



Sulphur Dioxide (SO₂): The Maximum 50, 24-Hr Average Concentration Values for source group are predicted and are given in Table 6.6.

Sn	Receptor		Conc. µg/m ³	Sn	Receptor		Conc. µg/m ³
	X	Y			X	Y	
1	-200	-3400	5.37393	26	200	-3200	5.02925
2	-200	-3200	5.36121	27	0	-4000	5.02728
3	-200	-3600	5.33325	28	0	-2600	5.02715
4	0	-3200	5.30134	29	200	-3000	5.02577
5	0	-3400	5.29491	30	0	-3400	5.02268
6	-200	-3000	5.28332	31	-1000	-1800	5.00268
7	-200	-3800	5.25043	32	-200	-4200	4.99723
8	0	-3000	5.24879	33	0	-2600	4.99545
9	-1000	-2000	5.24761	34	200	-3400	4.97944
10	0	-3600	5.24038	35	-1400	-2600	4.97684
11	-1000	-2200	5.23782	36	200	-2400	4.96385
12	-1200	-2400	5.23316	37	200	-2200	4.95652
13	0	-2200	5.22326	38	200	-2800	4.95525
14	-1200	-2200	5.2061	39	-400	-3600	4.94767
15	0	-2400	5.15803	40	-1200	-2000	4.94397
16	0	-3800	5.1481	41	-400	-3400	4.93669
17	0	-2000	5.14311	42	0	-2600	4.92641
18	0	-3000	5.13825	43	-400	-3800	4.91272
19	-200	-4000	5.13554	44	0	-3600	4.90905
20	-200	-2800	5.12895	45	-1400	-2400	4.90159
21	0	-2800	5.12675	46	-1400	-2800	4.89808
22	0	-2800	5.11743	47	-200	-2600	4.8889
23	0	-3200	5.10265	48	200	-3600	4.88873
24	-1200	-2600	5.09511	49	0	-4200	4.88584
25	-1000	-2400	5.06214	50	-400	-3200	4.86978

Note: All receptors are grid card type and distances are in meter

Table 6.6: 24 Hourly Average Incremental GLCs of SO₂

Contours for incremental GLC of SO₂ are drawn and corresponding isopleths are shown in **Fig. 6.3**.

Maximum 24 hourly average incremental GLC value for SO₂ has been found to be 5.37 µg/m³ at a distance of 3.4 km.



ISCST3 -BREEZE MODEL FOR SO₂
(PLOT FILE OF 1ST HIGH 24 HR. VALUES FOR A TOTAL OF 10000 RECEPTORS)

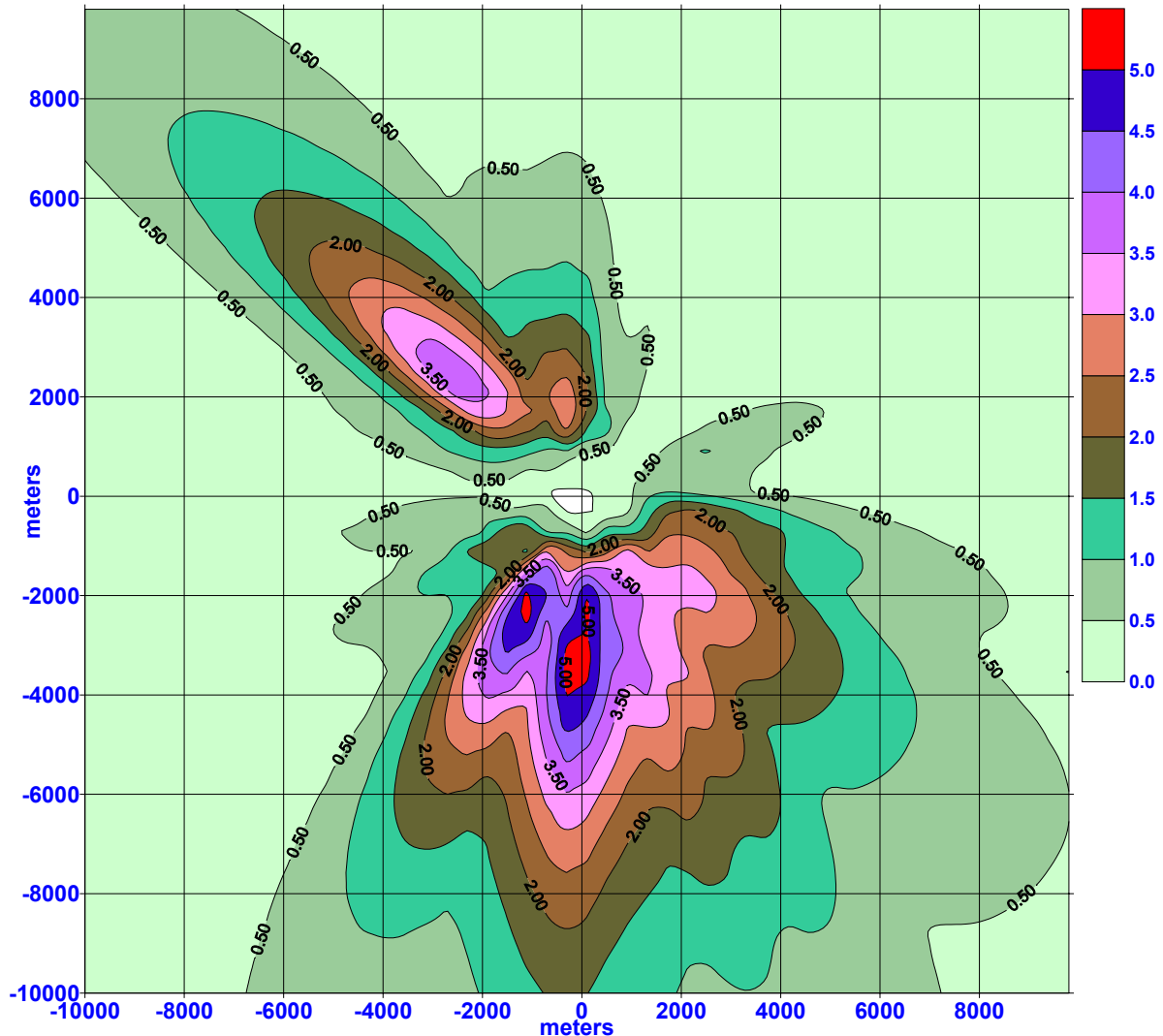


Fig. 6.3 : 24 hourly Incremental GLCs of SO₂ (µg/m³) resulting from the proposed project

Oxides of Nitrogen (NO_x) : The first maximum 50 values of incremental GLCs of NO_x resulting from operation of proposed plant are given in **Table 6.7**.

Sn	Receptor		Conc. µg/m ³	Sn	Receptor		Conc. µg/m ³
	X	Y			X	Y	
1	-200	-3400	21.4973	26	200	-3200	20.1185
2	-200	-3200	21.44645	27	0	-4000	20.11063
3	-200	-3600	21.33458	28	0	-2600	20.1101
4	0	-3200	21.20693	29	200	-3000	20.10458
5	0	-3400	21.1812	30	0	-3400	20.09221
6	-200	-3000	21.13484	31	-1000	-1800	20.01219
7	-200	-3800	21.00327	32	-200	-4200	19.99041
8	0	-3000	20.99674	33	0	-2600	19.98328



Sn	Receptor		Conc. $\mu\text{g}/\text{m}^3$	Sn	Receptor		Conc. $\mu\text{g}/\text{m}^3$
	X	Y			X	Y	
9	-1000	-2000	20.99199	34	200	-3400	19.91926
10	0	-3600	20.96309	35	-1400	-2600	19.90884
11	-1000	-2200	20.95282	36	200	-2400	19.85687
12	-1200	-2400	20.93418	37	200	-2200	19.82755
13	0	-2200	20.89459	38	200	-2800	19.82249
14	-1200	-2200	20.82593	39	-400	-3600	19.79215
15	0	-2400	20.63367	40	-1200	-2000	19.77736
16	0	-3800	20.59394	41	-400	-3400	19.74823
17	0	-2000	20.57398	42	0	-2600	19.70709
18	0	-3000	20.55453	43	-400	-3800	19.65234
19	-200	-4000	20.54368	44	0	-3600	19.63765
20	-200	-2800	20.51732	45	-1400	-2400	19.60781
21	0	-2800	20.50853	46	-1400	-2800	19.59376
22	0	-2800	20.47122	47	-200	-2600	19.55705
23	0	-3200	20.41212	48	200	-3600	19.55636
24	-1200	-2600	20.38196	49	0	-4200	19.5448
25	-1000	-2400	20.25006	50	-400	-3200	19.48057

Note: All receptors are grid card type and distances are in meter

Table 6.7: 24 Hourly Average Incremental GLCs of NO_x

Contours for incremental GLC of NO_x are drawn and the corresponding isopleths are shown in **Fig 6.4**.

Maximum 24 hourly average incremental GLC value for NO_x has been found to be 21.5 $\mu\text{g}/\text{m}^3$ at a distance of 3.4 km.

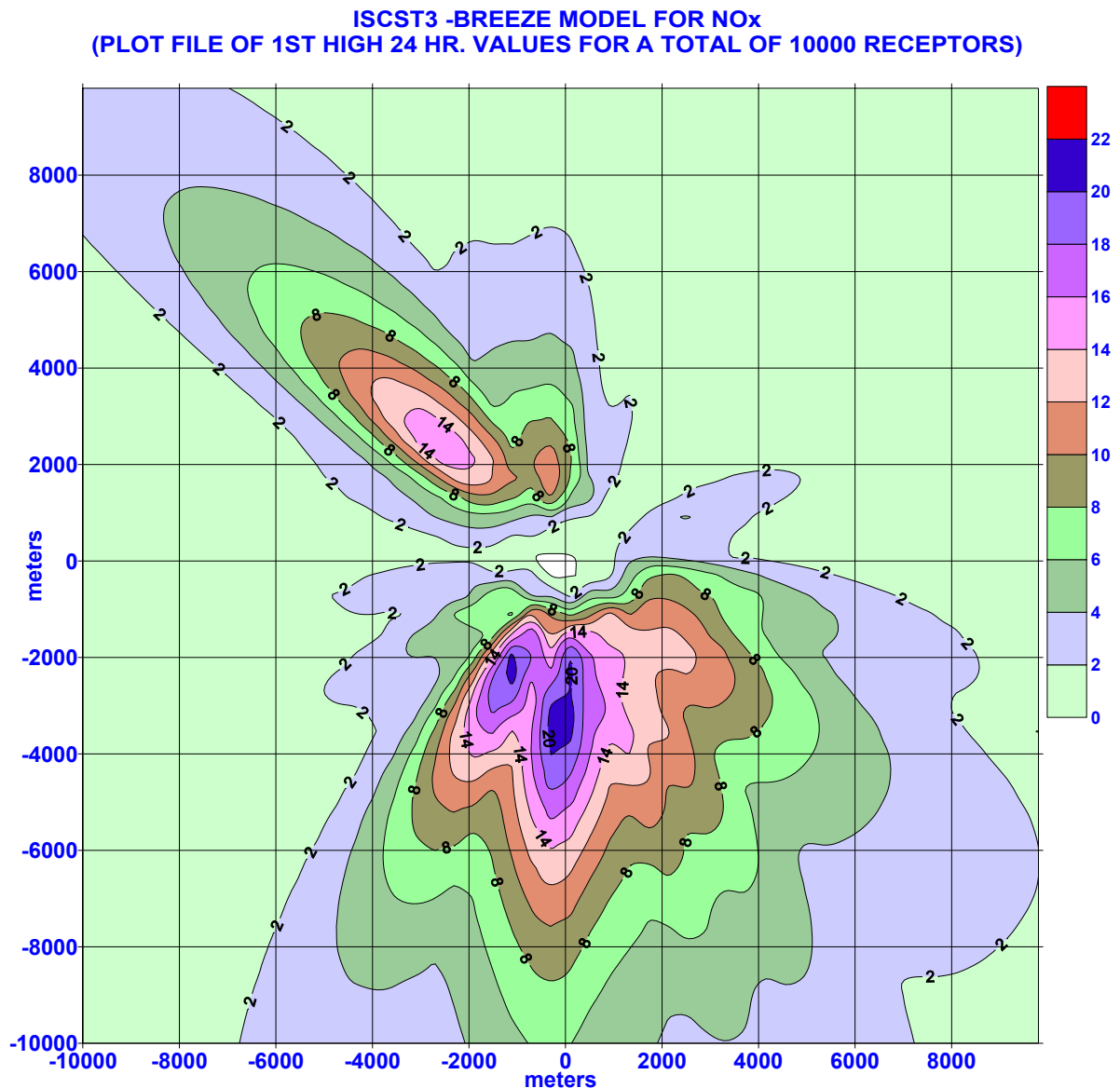


Fig. 6.4 : 24 hourly Incremental GLCs of NO_x (µg/m³) resulting from the proposed project

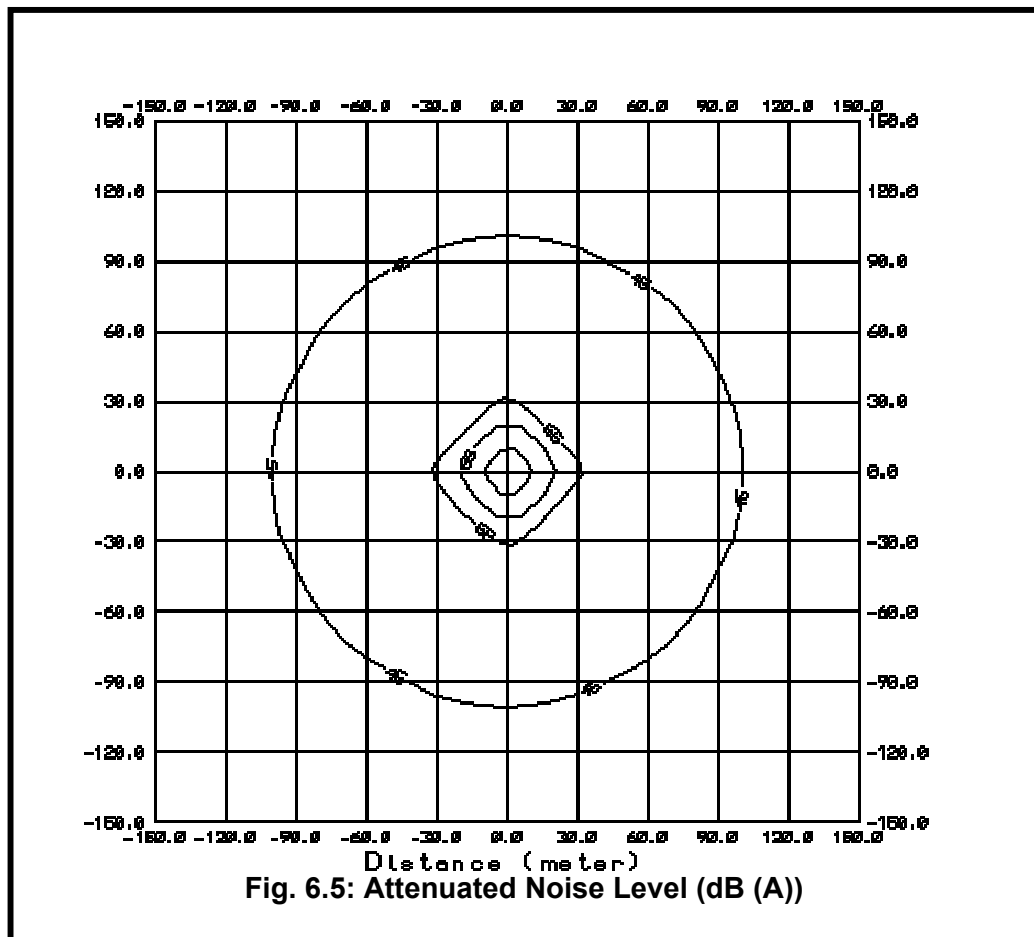
Thus, it is predicted that the contribution of the proposed cement project to the Ground Level Concentrations of SPM, SO_x and NO_x levels is very low. The ambient levels of SPM, SO_x and NO_x being low in the area, the resultant levels of these parameters are expected to remain within the norms.

6.2.1.5 Noise Levels

General cumulative noise levels generated from equipment of the operation of proposed cement plant and mines (except blasting) shall be less than 85 dB(A).

For an approximate estimation of dispersion of noise in the ambient from the source points, a standard mathematical model for sound wave propagation is used assuming total cumulative noise level of 85 dB(A). For the modelling purposes, flat terrain is considered and environmental attenuation factors are not considered. Based on the model,

calculations are made and the estimated attenuated noise levels from the proposed activities at different distance are given in **Fig. 6.5**.



The above results show that the elevated noise levels will be limited to a short distance from the source. Further the resultant noise level will be mingled with the background noise levels of 70 dB(A) within 20 m from the center point of the plant site as shown in **Fig. 6.6**, which is well within the plant premises.

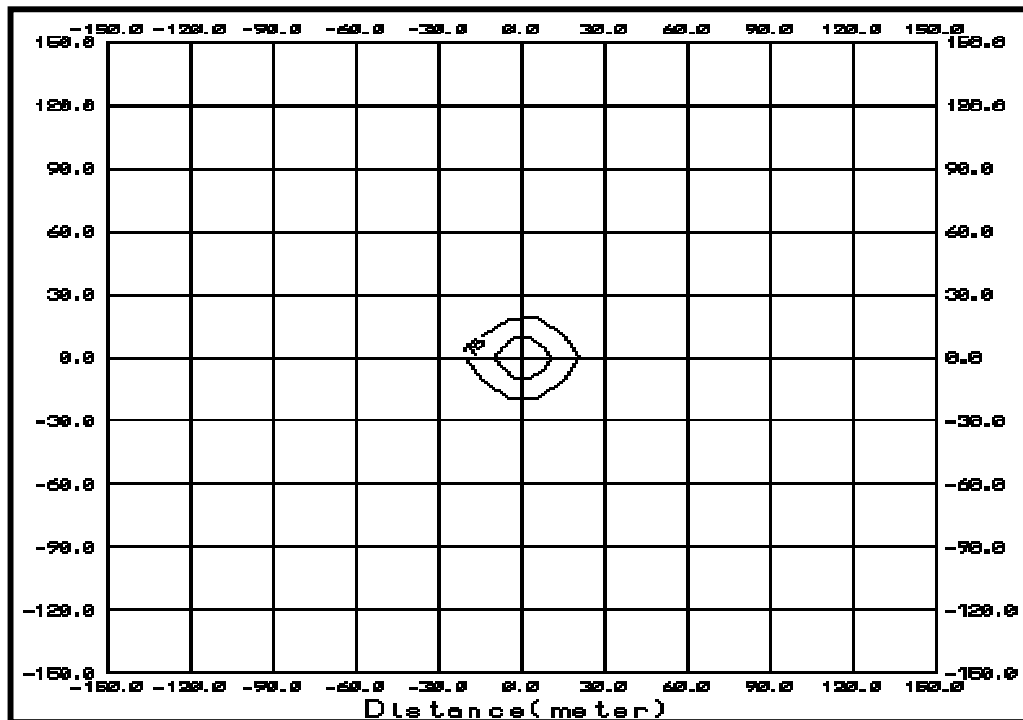


Fig. 6.6: Resultant Noise Level (dB (A))

The above noise levels worked out are without mitigative measures. With the mitigative measures in place, the noise levels will be further restricted within very short distance from the source. Hence impact may be rated as adverse, long term and localized with medium potential impact level.

6.2.1.6 Traffic Movement

Road Traffic to and from the plant during operation will be more intensive and much heavier than at present in normal operating conditions due to transportation of raw materials and cement. In turn, it will contribute to noise as well as ambient air quality in terms of dust and other gaseous pollutants. The regular maintenance of vehicles shall limit the pollution within limit.

The present road conditions upto Chanco are satisfactory for proposed movement of traffic and the existing traffic density is almost insignificant. From Chanco to Derba, the road is a gravel road, which shall be strengthened and converted to a black-topped road in stages. In addition four bridges on the way from Chanco to the Plant site shall be strengthened to be able to take the load of increased heavier traffic. Additional trucks for transportation of raw materials and cement will increase the traffic tremendously.

A new road connecting Derba to the Plant site will also be constructed. The impacts of traffic movement due to proposed project will be adverse, long term, high but localized in extent.

6.2.1.7 Water Resources

During the operation of proposed plant, the water requirement is estimated at around 2,000 m³/ day, which shall be made available through ground water resources at village Muluseya. The detailed hydrological studies carried out in the area during the course of EA



studies have revealed the availability of balance 19.9 mio m³ per year of ground water after considering the exploitation of water by the existing cement plants and the local villages.

The exploitation of water resources during the operation will not affect the water availability in the area for other competing users and the overall impact may be rated as adverse, long term and medium.

6.2.1.8 Soil Erosion

During construction and operation phases, soil erosion could result from cutting of soil. To prevent this from happening, run off control measures shall be implemented, which include installation from siltation ponds and traps. Thus the impact shall be adverse and low in potential.

6.2.1.9 Waste Water

The wastewater generated from the operation of proposed plant shall be about 100 m³/ day, which shall be mainly contributed by waste water from domestic activities and rejects from RO plant.

The wastewater so generated shall be treated in STP of 300 m³/ day capacity, which shall consist of primary to tertiary treatment. Treated water shall be reused for dust suppression, green belt development and in the process to the extent possible. Nothing shall be discharged outside the plant premises. Thus there shall be no adverse impact.

6.2.1.10 Solid Waste

A detailed Quarry Reclamation Plan will be prepared before commencement of mining operations. The reclamation shall be simultaneous with excavation. Once the mining has reached the ultimate pit depth, the pit shall be backfilled, soil be spread on it and plantation shall be developed.

Waste oil shall be generated as and when lubricating oil is changed from various gearboxes. Waste oil shall be collected through the drain ports and stored in leak proof steel drums and sent to the "Spent Oil Storage Site" of the plant. The waste oil drums shall be properly identified with label of what is contained both in Amahrik/ Oromiya and English. Lubricant so generated shall be disposed off as per approved methods or stored for future use in kiln after the requisite permissions have been obtained.

Domestic solid waste generated shall be segregated and will be sent to waste disposal site allocated by the local administrative authorities.

6.2.2 COMPONENTS CREATING IMPACTS ON SOCIO-ECONOMIC ENVIRONMENT

The components of the operation phase that could result in effects on the socio-economic environment include the following:

6.2.2.1 Loss of Agricultural/ Grazing Land

The details of the land acquired from local farmers and the compensation paid are given in the Resettlement Action Plan. Loss in agricultural/ grazing land will result in shift from traditional occupations like farming and livestock rearing to other industry based occupations resulting in a long term adverse impact.



6.2.2.2 Terrestrial Ecology

Vegetation would be disturbed due to clearing of the area. The overall impact on the terrestrial ecology can be considered positive as a green belt/ plantation of appropriate width shall be developed and maintained in the area by **DMC**.

6.2.2.3 Ground Vibrations

There shall be a risk of ground vibrations during mining activities at the quarry site, which will be controlled by using appropriate blasting techniques. The blast holes shall be initiated by short delay detonators. Multi row blasting shall be undertaken. Use of ANFO as explosive, which has a low velocity of detonation, shall restrict the vibrations to a large extent.

In addition, a detailed vibration study will be carried out after commencement of mining to arrive at an optimized blasting programme.

6.2.2.4 Fly Rocks

Fly rocks are generated during blasting activity in mining operations. The burden shall not be excessive. Keeping an adequate stemming column and keeping the stemming length less than the burden shall control the fly rock generation. This shall result in an adverse, long term impact of medium potential.

6.2.2.5 Occupational Health and Safety

Storage and handling of explosives, exposure to high dust and noise levels are some of the occupational hazards associated with cement plant and mining operations.

Safe storage and handling practices for explosives shall be insisted upon. Specially trained and qualified staff only will be allowed to handle explosives.

Workers shall be provided with Personal Protective Equipment (PPE) like dust masks, ear muffs, helmets, boots, etc. All workers will undergo periodic and regular health check ups and detailed records will be maintained for the same. They shall be trained in safe work practices and frequent third party audits will be carried out.

6.2.2.6 Employment and Economic Growth

Increased quantity of cement produced and provided to local market at a fair price will in general result in the industrial growth, which in turn would generate direct and indirect opportunities of employment and business in the region. The setting up of a cement project would result in payment of various types of taxes to the Government that will have positive regional impacts.

Though there would be a loss of cultivable land, the overall indirect impact on the land use is considered as positive due to adoption of latest methods of seeding and irrigation as there is likelihood of increase in purchasing power of local habitats, which could be attributed to the improvement in income.

The area currently lacks any industry or any avenue for large scale employment. The establishment of the cement plant will lead to direct and indirect employment opportunities.



Preference is being/ will be given in employment to able bodied locals whose land has been permanently acquired for the project. Currently around 70 local labour have been employed at the plant site. This figure will go up to 400 as the construction progresses. Currently around 63% of the labour employed is Chinese because of the Chinese contractor implementing the project. However, this figure shall reduce to 33% as construction progresses. The details of labour employment are as follows:

Sn	Labour source	Labour type	Currently employed	Proposed to be employed
1	Local labour	Skilled	10	50
		Semiskilled	-	50
		Unskilled	60	300
Sub-total			70	400
2	Chinese labour	Skilled	111	1200
		Semiskilled	-	-
		Unskilled	-	-
Sub-total			111	1200
Total			181	1600

The project will generate direct employment for about 475 persons. The indirect employment generated by way of transportation, workshops, petty contractors, shopkeepers and other casual employment is expected to be above 1,500.

The company may need to have a network of retailers (cement stockists) throughout the country and in its marketing regions. Each stockist will have at least 3 employees. This will mean employment to several thousand persons. Thus the project will have positive impact on the employment pattern of the region.

A shift in household industry is likely towards carpentry, blacksmiths and cobblers (the essential services required for any plant and /or its township) from traditional vocations like livestock rearing, etc.

The livestock-rearing pattern is likely to change in the vicinity of the plant to an increase in cows rearing. A moderate increase in poultry farming is also likely, to meet the increased demand for eggs and poultry items.

6.2.2.7 Socio-Economic

DMC shall actively contribute to improve the socio-economic conditions of the area. Infrastructure like roads, facilities for transportation, health and education, which shall be developed as a result of the operation of proposed project, shall also add to socio-economic development of the area.

DMC is committing an annual contribution of Birr 250,000 per year to the project area for establishing a revolving fund to support/ supplement the efforts to help finance small scale businesses for the local communities. A Committee comprising of Wereda officials, affected PAs, DMC will oversee the implementation of the Community Development Fund. **DMC** shall continue the contribution till the cumulative contribution reaches Birr 2.5 million.



A Health Post is already operational at the plant site. This will be upgraded to Health Centre for catering to the **DMC** employees. **DMC** plans to extend health facilities for the local community by establishing a Clinic for inhabitants around the plant site. The ownership and administration of the Clinic shall be with the Regional Government. The estimated cost of the Clinic, which will be allocated by **DMC** in its budget, is estimated as Birr 500,000.

DMC is willing to support the upgradation and upkeep of the established Centre by providing up to Birr 10,000 per month aimed at supplementing the running expenses like manpower. In addition to the above, professional assistance to organize and run the Centre will be provided by **DMC** health professionals.

The health facility at quarry site will also be established to the same standards as the plant facility. The cost of health facility, which will be borne by **DMC**, is estimated as Birr 200,000. However, the administration and management of the health facilities will remain with the concerned office of the Regional Government. A financial assistance of Birr 10,000 per month will be given for meeting the running expenses of the Health Centre. **DMC** health professionals will extend close cooperation in periodic health surveys and during occurrence of any accidents, calamities, etc.

DMC proposes to build new or expand the existing elementary school at the plant and quarry sites and hand over the same to the concerned Government office for managing them. **DMC** is allocating 750,000 Birr in its budget for expanding and upgrading the educational facilities at plant site and quarry. A Regional Vocational Training Centre is planned to be established by Sululta Wereda at Chancho. **DMC** will contribute about Birr 224,000 for the establishment of Vocational (Health Extension Workers and Farmers Training Centre).

Water supply access will be extended to a total of seven villages around the plant and mining sites. These villages are Adero, Abale, Becho Kidanemehrat, Debedebe, Muger, Anda Wezero and Anda Botero. The amount of water, which shall be made available, is estimated to be 83,560 litres per day (assuming consumption of 20 l/ day) in the form of one water point per village. The water points shall be run by a Water Committee, which shall be established comprising of members of the community. The community will be expected to generate a small amount of revenue from the sale of water, so as to cover at least the maintenance cost of the system.

DMC will extend up to 2MW electric power line for the community along the Derba-plant road and around the plant site to facilitate personal connections for the community.

Development of infrastructure like roads, bridges shall improve connectivity in the area. A bridge is proposed to be constructed over Mughher River, which shall provide the only link from the valley to Derba village. Currently people have to walk a distance of 10 km on foot to reach from the quarry area to Derba wading and swimming through Mughher river. The area has until now remained undeveloped due to its poor accessibility.

The overall impact of the proposed project will be high, beneficial and long term.

6.3 IMPACTS DURING CLOSURE PHASE

6.3.1 COMPONENTS CREATING IMPACTS ON SOCIO-ECONOMIC ENVIRONMENT

The components of the closure phase that could result in effects on the socio-economic environment include the following:



6.3.1.1 Plant

Since the land has been given to **DMC** on a long-term lease for establishment of the Cement plant, the options for the final use of the site will depend on the Government.

For the proposed plant of **DMC**, a socio-economic assessment shall be conducted to identify possible impacts on the community and employees due to closure of the plant/quarry at the time of closure.

It is proposed that **DMC** also prepare a Future Site Use Plan with the close involvement of the Government and the local community, prior to the decommissioning of the Plant. The Future Site Use Plan shall take into account the amount of remediation and rehabilitation that will be required, and any development of the site that can provide the stakeholders with a sustainable source of employment and income and be sustainable in the long run.

An effort shall be made to develop alternate skills in the local people employed at the Plant so that they may be gainfully employed in other ventures when the Plant closes down.

6.3.1.2 Mine

Addressing the communities' and stakeholders' needs in relation to the option of site closure is essential. For the proposed plant of **DMC**, a socio-economic assessment shall be conducted to identify possible impacts on the community and employees due to closure of the quarry ahead of the closure.

The closure of a quarry can present safety issues. Prior to closure, a hazard assessment study shall be conducted to identify possible areas of concern, which may impact on the safety of the community and employees, giving particular consideration to preventing uncontrolled access as well as potential exposure to any hazardous materials on site.

A detailed progressive Mine Reclamation and Closure Plan will be prepared before start of mining activities. Progressively, as the extraction takes place and areas are exhausted according to the Mining Plan, the stacked reject material will be backfilled into the pit and a layer of topsoil spread over it and plantation done. The remaining part of the pit, if any, shall be converted to a water reservoir. The reservoir shall be properly fenced.

6.4 IMPACT EVALUATION

Based on the qualitative impact assessment, the evaluation of the impacts of the proposed project on the environment both in terms of quantity has been made. The environmental impact evaluation of possible impacts as a result of proposed project activities on various environmental parameters is primarily based on careful study of plant operations, surrounding environment etc. The aspects such as air, water, land, noise and related issues of environment have been assessed on the basis of plant operations for similar plants and baseline of the study area.

For quantification of impacts, matrix system as modified to some extent has been used. For quantifying impacts on the environment, the policies of FDRE, guidelines and standards prescribed by AfDB and the World Bank are being considered. Weightage to each environmental parameter based on its importance has been assigned.

The severity has been divided in impact scores from 0-5 for calculating the severity of impacts on the environmental parameters due to various project activities as given below.



Severity criteria	Impact score
No impact	0
No appreciable impact	1
Significant impact-slight or short term effect	2
Major impact-occasional irreversible effect	3
High impact-irreversible or long term impact	4
Permanent impact	5

The impact score can be -ve or +ve depending on whether the impact is adverse or beneficial.

Based on the above importance values and impact scores, the impact value (impact score x importance value) for the environmental parameters is calculated. The impact value for individual parameter is added to arrive at the total impacts value. The criteria, which shall be used to make conclusive statement based on the total impacts value without control measures, are given below.

Total impact value	Conclusions
Upto (-) 1000	No appreciable impact on environment
(-) 1000 to (-) 2000	Appreciable but reversible impact. Mitigation measures important.
(-) 2000 to (-) 3000	Significant impact mostly reversible after short period. Mitigation measures crucial.
(-) 3000 to (-) 4000	Major impact which is mostly Irreversible. Site selection to be considered.
Above (-) 4000	Permanent irreversible impact, alternative sites to be considered.

The environmental impact matrix based on the above principles has been attempted for the proposed project and is given in **Table 6.8**. The total impact value for the project works out to:

□ During construction stage (-) 250

□ During operation stage (+) 250

Environmental parameters	Importance value	Construction Phase	Operation Phase		Impact Value	
			Without EMP	With EMP	Construction	Operation with EMP
Air Quality	100	(-)1	(-)2	(-)1	-100	-100
Waste Water	50	(-)1	(-)2	(-)1	-50	-50
Water resources	100	(-)1	(-)2	(-)1	-100	-100
Noise & vibration	50	(-)1	(-)2	(-)1	-50	-50
Solid waste	50	(-)1	(-)2	(-)1	-50	-50
Land use	100	(-)1	0	(-)1	-100	-100
Ecology	100	(-)1	(-)1	(-)1	-100	-100
Infrastructure & support services	200	(+)1	0	(+)2	+200	+400
Employment & economic growth	200	(+)1	(+)1	(+)2	+100	+400
Total					-250	+250

Table 6.8 : Quantitative Impact Evaluation During Construction and Operation Phase



The results indicate a definite positive impact of setting up of the proposed project. To summarize, most of the plant activities are not likely to adversely affect the environmental quality of the area surrounding the plant.