DERBA MIDROC CEMENT PLC.

Environmental and Social Management Plan

for Establishment of 5,600 tpd Greenfield Cement Project and Operation of Captive Mines near Derba Village, Oromiya Regional State, Federal Democratic Republic of Ethiopia

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HOLTEC CONSULTING PRIVATE LIMITED

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ABBREVIATIONS

AfDB .....African Development Bank
AIDS .....Acquired Immunodeficiency Syndrome
ANFO.....Ammonium Nitrate Fuel Oil
ARCCH.....Authority for Research & Conservation of Cultural Heritage
BAT.....Best Available Technology
BC .....Before Christ
BOD.....Biological Oxygen Demand
CITES.....Convention on International Trade in Endangered Species
Cl .....Chlorine
cm.....Centimeter
CO .....Carbon Monoxide
CO_2.....Carbon Dioxide
COD.....Chemical Oxygen Demand
CSI.....Cement Sustainability Initiative
DBE .....Development Bank of Ethiopia
DG .....Diesel Generator
DMC .....Derba Midroc Cement
DMP.....Disaster Management Plan
E .....East
EA.....Environmental Assessment
EC.....Electrical Conductivity
EGS .....Ethiopian Geological Survey
EHS .....Environment, Health and Safety
EIB.....European Investment Bank
EMA.....Ethiopian Mapping Association
ENI.....Ethiopian Nutrition Institute
ESDPRP.....Ethiopian Sustainable Development & Poverty Reduction Programme
ESIA .....Environmental and Social Impact Assessment
ESMP .....Environmental and Social Management Plan
EPA .....Environmental Protection Authority
EPE .....Environmental Policy of Ethiopia
ESP .....Electrostatic Precipitator
EU.....European Union
F .....Fluorine
FDRE.....Federal Democratic Republic of Ethiopia
GDP.....Gross Domestic Product
GPS .....Global Positioning System
HAL.....Health Advisory Level

HC .....Hydro Carbons
HFO .....Heavy Fuel Oil
HIV.....Human Immunodeficiency Virus
HVAC.....Heating, Ventilation & Air Conditioning
IFC.....International Finance Corporation
ISC.....Industrial Source Complex
ITCZ.....Inter-Tropical Convergence Zone
IUCN.....International Union for Conservation of Nature
km.....Kilometer
m.....Meter
mio.....million
mm.....Millimeter
MCL .....Maximum Contaminant Level
MDG .....Millennium Development Goal
MIDROC .....Al-Muwakaba For Industrial Development and Overseas Commerce
MoH .....Ministry of Health
MoWR.....Ministry of Water Resources
MPN.....Most Probable Number
MSL .....Mean Sea Level
MW .....Mega Watt
N .....North
NCS .....National Conservation Strategy
NE.....Northeast
NMA.....National Meteorological Agency
NW.....Northwest
OD .....Operational Directive
OPC.....Ordinary Portland Cement
OSHA .....Occupational Safety and Health Administration
pa.....Per annum
PA.....Peasant Association
Pb .....Lead
PM .....Particulate Matter
PM_{10}.....Particulate Matter with diameter less than 10 micron
PPAH.....The Pollution Prevention and Abatement Handbook
PPC .....Portland Pozzolana Cement
PPE .....Personal Protective Equipment
RAP .....Resettlement Action plan
RBP .....Rapid Bioassessment Protocol
S .....South
SAR .....Sodium Adsorption Ratio

SD.....Sustainable Development
SE.....Southeast
STD .....Sexually Transmitted Disease
STP.....Sewage Treatment Plant
SW.....South West
t.....tonnes
TDS .....Total Dissolved Solids
TOR .....Terms of Reference
tpd.....Tonnes per day
TPM .....Total Particulate Matter
TSS.....Total Suspended Solids
UNESCO .....United Nations Educational, Scientific and Cultural Organisation
USEPA .....United States Environment Protection Agency
URTI .....Upper Respiratory Tract Infection
VOC.....Volatile Organic Compound
W .....West
WB.....World Bank
WBCSD .....World Business Council for Sustainable Development
WHO.....World Health Organisation
WWDSE .....Water Works Design & Enterprise Supervision

Chapter 1
Environmental & Social Management Plan

CHAPTER - 1

ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN

MIDROC intends to develop a cement business in Ethiopia and a separate company, **DERBA MIDROC CEMENT PLC. (DMC),** has been established for the purpose. **DMC** is proposing to install a green field cement plant of 5,600 tonnes per day (tpd) clinker capacity based on Derba limestone deposit.

In view of the above, **DMC** has retained **Holtec Consulting Private Limited (HOLTEC)**, India as its consultant for carrying out Environmental and Social Impact Assessment (ESIA), and preparation of Environmental and Social Management Plan (ESMP) and Resettlement Action Plan (RAP) for the proposed integrated cement project.

The proposed project includes:

- Cement plant
- Captive mines
- New road from Derba to plant
- New road from plant to mines
- Upgradation of road from Chancho to Derba
- Belt Conveyor from mines to plant
- Power transmission line
- Water pipeline

This ESMP Report is prepared for submission to Environmental Protection Authority (EPA), FDRE, African Development Bank (AfDB), International Finance Corporation (IFC), European Investment Bank (EIB) and Development Bank of Ethiopia (DBE) for their approval.

Ordinary Portland Cement (OPC) and Portland Pozzolana Cement (PPC) are proposed to be manufactured at the **DMC** Plant. Both the cements shall meet the requirements of Ethiopian National Standard No. EN-197. OPC shall be produced as per CEM-I - 42.5 grade and shall contain 95% clinker and 5% gypsum. PPC shall be produced as per CEM-II - 32.5 grade and shall contain 67% clinker, 28% pumice and 5% gypsum.

1.1 PREAMBLE

Subsequent to the Environmental screening of the project, whereby it was categorized as falling in Category 1 as per AfDB guidelines and in Category A as per IFC guidelines, a detailed Scoping for the ESIA study was carried out. On the basis of the Scoping, a Comprehensive baseline environmental data collection and Public Consultation programme was undertaken during the period Aug-Sept 2007.

The ESIA report has been prepared and on the basis of the impacts of the projects identified, an Environmental and Social Management Plan (ESMP) is prepared.

The objective of this ESMP is to identify project specific environmental actions that will be undertaken to mitigate and manage the impacts associated with the development, operation and closure of the proposed Cement project at Derba.

The ESMP focuses on direct impacts, which are identified as having the potential to cause significant impacts on the environment and identifies:

- Specific measures that will be taken to prevent, reduce or manage the environmental impacts of the development
- Where it is not possible to specify these at this stage, the level of environmental performance that will be expected of the operation
- Proposals for monitoring and audit of the ESIA implementation process.

1.2 MITIGATION MEASURES

The mitigation measures are proposed for the identified impacts as described in **Table 1.1 to 1.3** for the following:

- Construction phase of the cement plant & Development phase of the mines
- Operation phase of the cement plant
- Operation phase of the mines.

Table 1.1: Environment Management Plan During Construction of Proposed Cement Plant and Development of Mines

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Primary Responsibility
			Severity	Likelihood	Potential		
1	Land Use	❑ Mobilization and demobilization of men, materials and machinery ❑ Preparation of access road and clearing and leveling the site ❑ Camp site	Localized	Likely	Medium	❑ Though DMC has implemented all necessary protocols for conversion of land use for the project site from grazing land to industrial use, it will be ensured that all legal requirements are implemented with respect to Ethiopian regulations pertaining to use of land for industrial activities. ❑ Site boundaries will be marked out. It will be ensured that land take during construction of project is restricted to pre-agreed area. ❑ All requisite permits will be obtained prior to mining or blasting activities. ❑ Disturbance to streams present around project area will be minimal. The streams shall be protected and preserved and natural drainage pattern shall not be disturbed.	DMC/ Contractor

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Primary Responsibility
			Severity	Likelihood	Potential		
2	Soil erosion	❑ Mobilization and demobilization of men, materials and machinery ❑ Preparation of access road and site and clearing and leveling the site ❑ Civil and mechanical works ❑ Camp site	Localized	Likely	Medium	❑ Area and extent of site clearance will be minimized, by staying within defined boundaries. ❑ Installation and maintenance of effective run-off controls, including siltation ponds, traps and diffusion methods so as to minimize erosion. ❑ Reducing or preventing erosion by: ○ Scheduling to avoid heavy rainfall periods to the extent practical ○ Contouring and minimizing length and steepness of slopes ○ Mulching to stabilize exposed areas ○ Re-vegetating areas promptly ○ Designing channels and ditches for post-construction flows ❑ Reducing or preventing off-site sediment transport through use of settlement ponds, silt fences, and modifying activities during extreme rainfall and high winds to the extent practical ❑ Limiting access road gradients to reduce run-off induced erosion ❑ Providing adequate road drainage based on road width, surface material, compaction and maintenance.	DMC/ Contractor

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Primary Responsibility
			Severity	Likelihood	Potential		
3	Terrestrial ecology	❑ Mobilization & demobilization of machinery/ equipment ❑ Preparation of access road, clearing and leveling site ❑ Storage of construction materials & fuels ❑ Civil and mechanical work ❑ Camp site	Localized	Likely	Medium	❑ Site boundaries will be marked out and all machine operators involved in site preparation will be trained to observe the defined site boundaries. ❑ Kerosene oil/ LPG will be used for domestic purposes. ❑ Plantation in the plant area and surroundings will start with the commencement of construction activities.	DMC/ Contractor

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Primary Responsibility
			Severity	Likelihood	Potential		
4	Fuels, Lubricants and Chemicals Management with respect to spills (Hazardous Solid Waste)	❑ Storage & handling of chemical, fuel & materials ❑ Camp site	Localized	Likely	Medium	❑ All fuels, lubricants, surface treatment materials, welding rods/ gases, chemicals, etc. will be placed in controlled storage i.e. properly fenced area and in clearly marked vessels and containers ❑ Storage and liquid impoundment areas for fuels, raw and in process materials, solvents, wastes, and finished products will be designed with secondary containment (e.g., dikes and berms) to prevent spills and the contamination of soil, groundwater, and surface waters. ❑ Material Safety Data Sheet (MSDS) of all materials stored will be displayed and proper training will be imparted to the persons involved in handling the same ❑ All used and unused lubricants and chemicals no longer required at construction site, will be transported offsite to a centralized storage facility ❑ Re-fuelling operations will be undertaken over area with impervious flooring and surface drainage with oil traps ❑ Training workers on the correct transfer and handling of fuels and chemicals and also on response to spills	DMC/ Contractor

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Primary Responsibility
			Severity	Likelihood	Potential		
5	Solid Waste	❑ Preparation of access road and clearing and leveling site ❑ Mobilization and demobilization machinery/ equipment ❑ Storage of construction materials, fuels and chemicals ❑ Civil and mechanical work ❑ Camp site	Localized	Likely	Medium	❑ Recycle or reclaim materials where possible. ❑ If recycling or reclamation is not practical, wastes will be disposed of in an environmentally acceptable manner and in compliance with local laws and regulations. ❑ Dust bins will be placed at requisite locations and solid waste so generated will be segregated and disposed off at sites allocated by municipal authorities ❑ Used lubricating oil will be collected separately in drums and will be sold to authorized external agency for further treatment or stored for later use in kiln after obtaining requisite permit. ❑ Adequate sanitary facilities will be provided	DMC/ Contractor

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Primary Responsibility
			Severity	Likelihood	Potential		
6	Soil Contamination	❑ Preparation of access road and site ❑ Mobilization and demobilization machinery/ equipment ❑ Civil and mechanical works ❑ Operation of DG sets ❑ Storage & handling of chemical, fuel and material ❑ Campsite	Localized	Likely	Medium	❑ Impervious liners will be put in place for fuel, lubricants and chemicals storage area ❑ Effective bunds capable of containing 100% of the volume of the containment capacity and enclosing all potentially contaminating materials will be used for fuel lubricants and chemicals storage area ❑ Non-contaminated and potentially contaminated run-off will be kept separate. Non-contaminated run-off will be routed to off-site areas via silt traps. Potentially contaminated surface run-off will be routed through oil traps ❑ Oil drip pans will be used wherever there is significant potential for leakage including, but not limited to; ○ Electric generator engine, DG sets, earth moving machinery/ equipment, etc. ○ Compressors, pumps or other motors ○ Maintenance areas ○ Fuel transfer areas. ○ All spills/ leaks will be contained, reported and cleaned up immediately ❑ Oil absorbent /spill containment material will be deployed to contain large spills ❑ Contaminated soil will be dug up, placed in drums and subsequently removed from site to centralized storage area ❑ MSDS of all materials stored will be displayed and proper training will be imparted to the persons involved in handling the same. ❑ Regular monitoring of site for contamination, if any	DMC/ Contractor

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Primary Responsibility
			Severity	Likelihood	Potential		
7	Waste and Effluent Management	❑ Preparation of access road and site ❑ Mobilization and demobilization of machinery/equipment ❑ Civil and mechanical works ❑ Operation of DG sets ❑ Storage & handling of chemical, fuel and material ❑ Campsite ❑ Traffic movement	Localized	Likely	Medium	❑ Provision of portable STP unit at camp site capable of treating wastewater will be made ❑ Proper drainage system or collection pits will be provided for transportation/ collection of waste water to the portable STP ❑ All the debris resulting from the site will be isolated from the waste water and disposed off separately ❑ An oil trap will be provided in the drainage line to prevent contamination by accidental spillage ❑ Wash down area for cleaning of vehicles wheels will be provided and wheel wash waste will be treated and drained properly ❑ To prevent contamination from accidental spillage of oil, the storage areas will be bunded and will be inspected and cleaned at regular intervals. ❑ No untreated discharge will be made to land ❑ Suspended solids loads to water courses will be minimized by installing appropriate surface run-off drainage systems (e.g. silt traps) ❑ All spills/ leaks will be contained, reported and cleaned up immediately. ❑ Regular monitoring of the treated wastewater to be discharged will be carried out to conform to the standard. ❑ Adequate sanitary facilities will be provided	DMC/ Contractor

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Primary Responsibility
			Severity	Likelihood	Potential		
8	Noise and Vibration	❑ Preparation of access road and site ❑ Mobilization and demobilization of machinery/equipment ❑ Civil & mechanical works ❑ Operation of DG sets ❑ Storage & handling of chemical, fuel and material ❑ Traffic movement ❑ Campsite	Localized	Likely	Medium	❑ Planning activities in consultation with local communities so that activities with the greatest potential to generate noise are planned during periods of the day resulting in minimum disturbance ❑ Provision of rubber padding/ noise isolators ❑ Provision of silencers to modulate the noise generated by machines, wherever possible ❑ Provision of protective devices like ear muff/ plugs to the workers ❑ All equipment will be operated within specified design parameters (site preparation and construction phases) ❑ Preventive maintenance of vehicles and machinery ❑ Minimal use of roads at any particular time by planning vehicles movements ❑ Advise traffic police about the activities. Traffic will be controlled by deploying local people at sensitive accident prone locations who will also oversee the movement of livestock on these roads ❑ Road crossings to be used will be well marked ❑ Regular monitoring of noise level and vibration level due to construction activities at site and in the local areas to conform to the standard as prescribed by IFC.	DMC/ Contractor

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Primary Responsibility
			Severity	Likelihood	Potential		
9	Air Emissions	❑ Preparation of access road and site ❑ Mobilization and demobilization of machinery/equipment ❑ Civil and mechanical works ❑ Operation of DG sets and other fuel driven machinery to be used for civil and mechanical works ❑ Movement of traffic ❑ Campsite	Localized	Likely	Medium	❑ All equipment operated within specified design parameters (site preparation and construction phases). ❑ Emission from DG sets and other machinery will conform to the standard as prescribed for DG sets by IFC. ❑ Any dry, dusty materials (chemicals, construction materials etc) will be stored in sealed containers ❑ Wash down area at site for cleaning of vehicles wheels will be provided ❑ Wetting of roads and arrangements of wheel washing of trucks and other vehicles, reaching on site ❑ Preventive maintenance of vehicles and machinery ❑ Regular testing of the combustion efficiency of the vehicles ❑ Periodic third party audit and regular monitoring of ambient air quality will be carried out.	DMC/Contractor
10	Ground water Resources	❑ Usage in Construction activities ❑ Domestic usages	Localized	Likely	Medium	❑ A detailed Hydrological Study carried out has indicated adequate available ground water in the area ❑ Regular monitoring of water table in the area	DMC/ Contractor

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Primary Responsibility
			Severity	Likelihood	Potential		
11	Structural Safety of Project Infrastructure	❑ Physical trauma associated with failure of building structures ❑ Injuries suffered as a consequence of falls or contact with heavy equipment	Localized	Likely	Medium	❑ Inclusion of buffer strips or other methods of physical separation around the site to protect the public from major hazards associated with hazardous materials incidents or process failure ❑ Incorporation of siting and safety engineering criteria to prevent failures due to natural risks posed by flooding, landslides, fire, earthquakes, etc. All project structures will be designed in accordance with engineering and design criteria mandated by site specific risks, including, slope stability, wind loading, other dynamic loads, etc. ❑ All buildings will be designed, constructed and operated in full compliance with local building codes, local fire department regulations, local legal requirements and in accordance with internationally accepted standards.	DMC/ Contractor

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Primary Responsibility
			Severity	Likelihood	Potential		
12	Traffic Safety	❑ Increased traffic due to movement of project personnel to and from workplace and movement of equipment on public roads	Localized	Likely	Medium	❑ Emphasis on safety aspects among drivers ❑ Adopting limits for trip duration and arranging driver rosters to avoid overtiredness ❑ Avoiding dangerous routes and times of day to reduce risk of accidents ❑ Use of speed governors on trucks ❑ Regular maintenance of vehicles to prevent accidents due to equipment malfunction and premature failure ❑ Collaborating with local community on education about traffic and pedestrian safety ❑ Employing safe traffic control measures, including road signs ❑ Deployment of locals at sensitive accident prone sites on the main roads to control movement of heavy trucks and also livestock	DMC/ Contractor
13	Socio-economic	❑ Preparation of access road and working strip ❑ Mobilization and demobilization machinery/ equipment ❑ Civil & mechanical works ❑ Campsite ❑ Utilization of local available resources	Localized	Likely	Medium	❑ Close monitoring on the type of loss to local habitats. In case of loss to locals, adequate compensation shall be provided as per law ❑ Preference will be given to locals in temporary direct and indirect employment ❑ Local suppliers for machineries and construction materials will be given preference ❑ Local transporters will be preferred for transportation of machineries/ materials ❑ Help will be extended to locals to establish small business ventures catering to the cement plant.	DMC

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Primary Responsibility
			Severity	Likelihood	Potential		
14	Community Health and safety	❑ Inadvertent or intentional trespassing, including potential contact with hazardous material, contaminated soil, buildings that are under construction, or excavations & structures which may pose falling and entrapment hazards	Localized	Likely	Medium	❑ Removing hazardous conditions on construction sites that cannot be controlled affectively with site access restrictions, such as covering openings to small confined spaces, ensuring means of escape for larger openings such as trenches or excavations, or locked storage of hazardous materials ❑ Restricting access to the site, with a focus on high risk structures or areas depending on site specific situations, including fencing, signage, and communication of risks to the local communities	DMC/ Contractor

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Primary Responsibility
			Severity	Likelihood	Potential		
15	Occupational Health & Safety	❑ Existence of confined spaces like, silos, hoppers, tanks, sewers, pipes, access shafts, etc. and excavations	Localized	Likely	Medium	❑ Controlling factors which may contribute to excavation slope instability including, use of excavation dewatering, potential instability due to steep slopes and elevation differences, side-walls support, and slope gradient adjustments that eliminate or minimize the risk of collapse or entrapment ❑ Providing safe means of access and egress from excavations, such as graded slopes, graded access routes, stairs and ladders ❑ Planning and segregating the location of vehicle traffic, machine operation, walking areas, and controlling vehicle traffic through the use of one-way traffic routes, establishment of speed limits and on site people wearing high visibility clothing to direct traffic ❑ Ensuring moving equipment is outfitted with audible back-up alarms ❑ Using inspected and well maintained lifting devices that are appropriate for the load, such as cranes, and securing loads when lifting them to higher elevations ❑ Use of PPE, including respirators, clothing/ protective suits, gloves, helmets, face shields, eye protection, safety shoes, etc. ❑ Use of temporary fall protection measures in scaffolds and out edges of elevated work surfaces, such as hand rails and toe boards to prevent materials from being dislodged	DMC/ Contractor

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Primary Responsibility
			Severity	Likelihood	Potential		
						❑ Conducting sawing, cutting, sanding, chipping or chiseling with proper guards and anchoring as applicable ❑ Training and use of personal fall arrest systems, such as full body harnesses as well as fall rescue procedures to deal with workers whose fall has been successfully arrested ❑ Use of control zones and safety monitoring systems to warn workers of their proximity to fall hazard zones, as well as securing, marking, and labeling covers for openings in floors, roofs, or walking surfaces. ❑ Implementing administrative controls into work processes, such as job rotations and rest or stretch breaks	

Table 1.2: Environment Management Plan During Operation of Cement Plant

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Prime Responsibility
			Severity	Likelihood	Potential		
1	Natural Resources	Depletion of Limestone reserves and other corrective materials and additives	Localized	Likely	Medium	❑ Availability of raw materials will be estimated properly ❑ Regular review of raw mix to get consistent quality of products ❑ Smooth operation of the plant to achieve consistent efficiency ❑ Continuous attempt will be made to control wastages during transportation, storage and handling of raw materials ❑ Regular monitoring of availability of stocks and consumption of raw materials, dispatch of products and loss of material as waste	DMC

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Prime Responsibility
			Severity	Likelihood	Potential		
2	Air Emissions						
	Air Emissions from stacks	❑ Air Emissions ○ Crusher ○ Raw Mill ○ Coal Mill ○ Kiln ○ Clinker Cooler ○ Cement Mill ○ Packing Plant ○ DG sets ❑ Traffic movement	Localized	Likely	Medium	❑ Ensure maximum efficiency of combustion in kiln and emergency DG sets ❑ Suitably designed ESPs/ Bag filters will be placed downstream of the stacks which will separate out the incoming dust in flue gas and limit the dust concentration at its designed outlet concentration of 25 mg/ Nm^3 in all emissions. ❑ In the event of failure of pollution control equipment, automatic tripping in the control system will be provided ❑ For ESP operations, interlocking will be provided with supply to electrode, which means that any disturbance in the power supply to electrode will switch the whole unit off ❑ Efficiency of each air pollution control equipment will be ensured to more than 99% ❑ Attempt will be made to use low sulphur fuel subjected to availability and economics for reduction of SO_2 emission from the process. ❑ SO_2 and NOx emissions will be within the norms of 400 mg/ Nm^3 and 600 mg/ Nm^3 respectively as specified by IFC. ❑ A well-designed burner system, will limit the core flame temperature to ensure a low value of NO_x	DMC

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Prime Responsibility
			Severity	Likelihood	Potential		
						❑ Impact of CO emission is negligible in view of the firing technique of keeping a positive oxygen balance. However, regular monitoring and continuous auto regulation of fuel and air by automatic combustion control system will be installed in Kiln ❑ Regular preventive maintenance of pollution control equipments ❑ All vehicles and their exhausts will be well maintained and regularly tested for emission concentration. ❑ Continuous dust monitor will be installed on all point emissions ❑ Continuous SO_2 & NOx monitor will be installed on main stack ❑ Stack emissions will be regularly monitored as per Monitoring Plan.	DMC

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Prime Responsibility
			Severity	Likelihood	Potential		
	Fugitive Emissions	❑ Storage and Conveying/ transportation of raw materials and products ❑ Leakages from machinery and pipes	Localized	Likely	Medium	❑ Jet Pulse bag filters will be provided at all dry material conveying and transfer points ❑ Efficiency of each air pollution control equipment will be ensured to more than 99% ❑ Drop distances will be minimized by the use of adjustable conveyors ❑ Dust suppression system by water sprinkler at dump hopper of raw materials ❑ Regular dust suppression with water sprinkler on the haul roads ❑ Level sensor to have a suitable gap between stacking boom and top of pile ❑ Plant roads & approach roads will be made of bitumen/ concrete ❑ Areas between various sections and truck parking areas will be made of concrete/ bitumen/ brickwork ❑ Mechanical vacuum cleaner will be used for cleaning of dust on roads within plant premises ❑ Open areas within the plant premises and along with boundaries of the plant premises will be covered under green belt ❑ Raw Materials/ products will be fully covered during transportation to/ from the site by road.	

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Prime Responsibility
			Severity	Likelihood	Potential		
	Fugitive Emissions	❑ Storage and Conveying/ transportation of raw materials and products ❑ Leakages from machinery and pipes	Localized	Likely	Medium	❑ Jet Pulse bag filters will be provided at all dry material conveying and transfer points ❑ Efficiency of each air pollution control equipment will be ensured to more than 99% ❑ Drop distances will be minimized by the use of adjustable conveyors ❑ Dust suppression system by water sprinkler at dump hopper of raw materials ❑ Regular dust suppression with water sprinkler on the haul roads ❑ Level sensor to have a suitable gap between stacking boom and top of pile ❑ Plant roads & approach roads will be made of bitumen/ concrete ❑ Areas between various sections and truck parking areas will be made of concrete/ bitumen/ brickwork ❑ Mechanical vacuum cleaner will be used for cleaning of dust on roads within plant premises ❑ Open areas within the plant premises and along with boundaries of the plant premises will be covered under green belt ❑ Raw Materials/ products will be fully covered during transportation to/ from the site by road.	DMC

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Prime Responsibility
			Severity	Likelihood	Potential		
						❑ Greenbelt/ plantation will be developed within and all along the plant boundary ❑ Training on regular basis to all workers and staff about the importance of cleanliness ❑ Air quality inside premises of plant and working floors will be regularly monitored.	
	Greenhouse Gas Emissions	❑ Emissions ○ Crusher ○ Raw Mill ○ Coal Mill ○ Kiln ○ Clinker Cooler ○ Cement Mill ○ Packing Plant ○ DG sets ○ Traffic movement	Regional	Likely	Medium	❑ The proposal to manufacture blended cement will reduce clinker requirement in cement, thereby reducing GHG emissions. ❑ The state-of-the-art-technology of 5 stage preheater will lead to increased energy efficiency thereby reducing GHG emissions. ❑ An attempt will be made to use alternative fuel/ carbon neutral fuel, after trials are held for the same.	DMC

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Prime Responsibility
			Severity	Likelihood	Potential		
3	Noise Emissions	❑ Operation of noise generating equipment like compressors, pumps, DG sets, etc. ❑ Maintenance ❑ Traffic movement	Localized	Likely	Medium	❑ Cumulative noise level at walkways and work areas will be <85 dB (A) and no worker shall be exposed to a noise level >85 dB(A) without hearing protection ❑ Noise level at the boundary of plant will be <70 dB(A) ❑ Acoustic mufflers in large engines (where practicable) will be provided ❑ Regular maintenance of noise generating equipment ❑ All rotating items will be well lubricated and provided with enclosures as far as possible to reduce noise transmission. ❑ Extensive vibration monitoring system will be provided to check and reduce vibrations. Vibration isolators will be provided to reduce vibration and noise wherever possible ❑ In general, noise generating items such as fans, blowers, compressors, pumps, motors etc. will be so specified as to limit their speeds for reduction of noise levels. Static and dynamic balancing of equipment will be insisted upon and will be verified during inspection and installation. ❑ Provision of silencers will be made wherever possible.	DMC

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Prime Responsibility
			Severity	Likelihood	Potential		
						❑ The insulation provided for prevention of loss of heat and personnel safety will also act as noise reducers. ❑ Layouts of equipment foundations and structures will be designed keeping in view the requirement of noise abatement. ❑ Central control room(s) provided for operation and supervision of plant and equipment will be air-conditioned, insulated and free from plant noise. ❑ Necessary enclosures will also be provided on the working platforms/areas for local protection in high noise level areas ❑ Proper lubrication and housekeeping to avoid excessive noise generation. ❑ In case, where the operation of the equipments warrants the presence of operators in close proximity to equipment, the operators will be provided with necessary safety and protection equipment such as ear plugs, ear muffs etc. ❑ By provision of plantation in and around the plant premises. ❑ Occupational Health and Safety Administration System (OHSAS) for evaluation of exposure of noise pollution on the associated staff and comparing it with permissible exposure and subsequently taking corrective actions will be developed ❑ Earth mounds and plantations in the zone between plant and township would further attenuate noise in the residential area. ❑ Regular monitoring of noise level at individual	
06121						noise generating equipment and at boundary of plant.	1.24

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Prime Responsibility
			Severity	Likelihood	Potential		
4	Ground Water Resources	❑ Make up water for cooling ❑ Dust suppression ❑ Domestic usages	Localized	Likely	Medium	❑ Continuous attempt will be made to optimize/reduce the use of water ❑ Continuous attempt will be made to avoid wastage and leakage of water ❑ Water harvesting will be carried out to the maximum extent possible ❑ Regular monitoring of ground water table will be carried out.	DMC
5	Waste Water	❑ Domestic ❑ RO Rejects	Localized	Likely	Medium	❑ STP with tertiary treatment will be provided and no waste water shall be discharged from the plant premises ❑ Treated effluent will be used for dust suppression and plantation/ greenbelt development ❑ Rejects from RO of STP will be sprayed on raw material stockpiles and coal stored in yard. ❑ Construction of suitably designed drains all along the roads and boundary of the plant premises ❑ Appropriate storm water and runoff control systems will be provided to minimize the quantities of suspended material carried off site ❑ Periodic monitoring of performance of STP and water quality of the nearby ground water source will be carried out as per Monitoring plan.	DMC

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Prime Responsibility
			Severity	Likelihood	Potential		
6	Solid waste (hazardous & non-hazardous)	❑ Maintenance and Operation of integrated plant ❑ Storage and handling of fuel ❑ Accidental spillage	Localized	Likely	Medium	❑ Whenever possible, use of non-hazardous instead of hazardous materials. ❑ All hazardous (ignitable, reactive, flammable, corrosive, and toxic) materials will be stored in clearly labeled containers or vessels ❑ Storage and handling of hazardous materials will be in accordance with local regulations or international standards and appropriate to their hazard characteristics. ❑ All hazardous wastes, process residues, solvents, oils, and sludges will be properly disposed of ❑ Recycle or reclaim materials where possible ❑ If recycling or reclamation is not practical, wastes will be disposed of in an environmentally acceptable manner and in compliance with local laws and regulations. ❑ Careful garbage transportation to dumping site and disinfections of transport vehicles body ❑ Fire prevention systems and secondary containment shall be provided for storage facilities, where necessary or required by regulations, to prevent fires or the release of hazardous materials to the environment ❑ Training on regular basis to all workers and staff about the importance of cleanliness ❑ Periodic monitoring and third party audit will be carried out to assess the impacts and accordingly remedial measures shall be implemented, if any	DMC

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Prime Responsibility
			Severity	Likelihood	Potential		
7	Spill Management	❑ Maintenance and Operation ❑ Storage and handling of fuel ❑ Accidental spillage				❑ Impervious liners in place for fuel, lubricants and chemicals storage area. ❑ Effective bunds capable of containing 110% of the volume of the container and enclosing all potentially contaminating materials will be used for fuel and lubricants storage area ❑ Oil drip pans will be used wherever there is significant potential for leakage including, but not limited to; ○ Electric generator engine ○ Compressors, pumps or other motors ○ Maintenance areas ○ Fuel transfer areas	DMC

Table 1.3: Environment Management Plan During Operation of Captive Mines

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Prime Responsibility
			Severity	Likelihood	Potential		
1	Natural Resources	Depletion of Limestone reserves and other corrective materials and additives	Localized	Likely	Medium	❑ Progressive Mining plan and Reclamation Plan will be prepared to optimize the mining methodology and to replant in areas where limestone has been removed. ❑ Regular review of raw mix to get consistent quality of products ❑ Continuous attempt will be made to control wastages during transportation, storage and handling of raw materials ❑ Regular monitoring of availability of stocks and consumption of raw materials, dispatch of products and loss of material as waste	DMC

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Prime Responsibility
			Severity	Likelihood	Potential		
2	Air Emissions	❑ Drilling ❑ Blasting ❑ Loading and unloading ❑ Crusher ❑ Transportation ❑ Wind erosion ❑ Traffic movement	Localized	Likely	Medium	❑ Land clearing, topsoil removal & stacking, haul roads and blasting will be planned with due consideration to meteorological factors like rainfall, wind direction, etc. ❑ Dust emissions from crusher will be controlled by bag filter. ❑ All dumps will be suitably vegetated. ❑ A speed limit will be defined for the trucks/ dumpers moving within the mining area. ❑ Dust suppression systems (water spraying) will be adopted at: o Faces/ sites before and after blasting, o Faces/ sites while loading, ❑ Dust generated due to blast hole drilling will be suppressed by using water injecting system of dust collectors in the drills. ❑ Use of sharp drill bits for drilling holes and drills with water flushing systems (wet drilling) to reduce dust generation, ❑ Use of sharp teeth for shovels to reduce dust generation	DMC

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Prime Responsibility
			Severity	Likelihood	Potential		
						❑ Mist sprays will be provided at appropriate places for preventing dust pollution during handling and stockpiling of limestone & other materials. ❑ Regular water spraying will be carried out on haulage roads by water sprinklers during transportation of raw materials. ❑ All vehicles and their exhausts would be well maintained and regularly tested for emission concentration. ❑ Dust masks will be provided to workers engaged at dust generation points like drills, loading, unloading points, etc. ❑ Regular monitoring will be carried out in and around the mines and standards prescribed for ambient air will be complied with. ❑ Extensive plantation will be carried out in and around the mining area ❑ Use of good quality explosives having proper oxygen balance with regular monitoring. ❑ Regular updating of the date of manufacture/ expiry of explosives ❑ A procedure will be formulated to check all explosives, and if disintegrated ingredients are spotted, the explosives will not be used, even if the date has not expired.	

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Prime Responsibility
			Severity	Likelihood	Potential		
3	Noise Emissions	❑ Drilling ❑ Blasting ❑ Loading and unloading ❑ Transportation ❑ Traffic movement	Localized	Likely	Medium	❑ Cumulative noise level in work zone will be <85 dB(A) ❑ Noise level at the boundary of mine will be <70 dB(A) ❑ Provision of silencers will be made wherever possible. ❑ Procurement of drill, loaders and dumpers and other equipment with noise proof system in operator's cabin ❑ Confining the equipment with heavy noise emissions in soundproof cabins, so that noise is not transmitted to other areas. ❑ Regular and proper maintenance of noise generating machinery including the transport vehicles and belt conveyors, to maintain the noise levels. ❑ Blasting operations will be carried out only during the day time using milliseconds detonators and cord relay so as to avoid high noise intensity in night time. ❑ Siting of buildings and other infrastructure will be away from the noise sources with the probability of sound waves being directed towards them being least. ❑ Provisions will be made for noise absorbing pads at foundations of vibrating equipment to reduce noise emissions.	DMC

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Prime Responsibility
			Severity	Likelihood	Potential		
						❑ Plantation will be developed at the mine periphery, within the mine lease area along the haul roads and all around the working areas, to screen the noise levels. ❑ Proper lubrication and housekeeping to avoid excessive noise generation. ❑ In case, where the operation of the equipments warrants the presence of operators in close proximity to equipment, the operators will be provided with necessary safety and protection equipment such as ear plugs, ear muffs, etc. ❑ All vehicles will be well maintained and regularly tested for noise level. ❑ Regular monitoring of noise level at individual noise generating equipment and in and around the mining area.	

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Prime Responsibility
			Severity	Likelihood	Potential		
4	Ground Vibration	❑ Drilling ❑ Blasting	Localized	Likely	Medium	❑ Exact details will be worked out during the preparation of mining plan ❑ Careful planning, checking, execution and monitoring of each blast ❑ Blast holes will always be initiated by short delay detonators rather than adopting instantaneous detonation. Short delay in blasting of successive blast holes effectively reduces the vibration problem. ❑ Free faces will be sufficiently cleared of any loose material before blasting and burden. ❑ Multi row blasting will be followed. ❑ Use of ANFO, which has low velocity of detonation, will also reduce the vibration problem.	DMC
5	Fly Rocks	❑ Drilling ❑ Blasting	Localized	Likely	Medium	❑ Exact details will be worked out during the preparation of mining plan ❑ Stemming length will not be kept less than the burden. ❑ Adequate stemming column from 0.75 to 1.0 times the burden depending upon the rock being blasted shall be maintained. ❑ The burden shall not be excessive. ❑ Inter-row delay will be selected in a manner so that each row pushes its burden in a forward rather than in an upward direction.	DMC

Sn	Potential Impact	Main Source of Risk	Impacts			Mitigation Measures	Prime Responsibility
			Severity	Likelihood	Potential		
6	Land Management/ Soil conservation	❑ Excavation of raw materials	Localized	Likely	Medium	❑ Exact details of land reclamation and of arresting the silt/ soil, if any during rainy season will be worked out during preparation of mining plan. The Progressive Mining Plan will be prepared before commencement of mining operations.	DMC
7	Waste Water	❑ Domestic ❑ Workshop	Localized	Likely	Medium	❑ Treatment plant will be provided ❑ Treated effluent will be used for dust suppression and plantation/ greenbelt development ❑ Periodic monitoring of wastewater to be discharged	DMC
8	Risk and Occupational Health Management	❑ Storage of explosives ❑ Handling of Explosives	Localized	Likely	Medium	❑ Safe procedure for storage and handling the explosives will be developed ❑ Adequate training will be provided to the staff ❑ Details will be worked out during the preparation of mining plan considering the best practices being used for the same ❑ Regular health check-up of workers will be carried out ❑ Personal Protective Equipment (PPE) like mask, goggles, boots etc. will be provided ❑ Third party audit will be carried out	DMC
9	Visual Intrusion	❑ Mine Operation	Localized	Likely	Medium	❑ Thick tree belts will be planted along the roads on the periphery of the excavation to the maximum extent possible. ❑ The virgin areas around the excavation will be afforested to improve the scenic value to the maximum possible extent.	DMC

The other aspects of the ESMP are detailed below:

1.3 OCCUPATIONAL HEALTH & SAFETY

DMC is making attempts to ensure that the contractors comply with the commitments being made by **DMC** with regard to OHS during construction phase. A copy of the OHS measures committed by **DMC** is being made available to the contractors with instructions to enforce strict implementation. Compliance of the contractor with these commitments will be monitored by **DMC** regularly.

All places of work within the plant shall be designed and equipped to protect OHS:

- Surfaces, structures and installations will be made easy to clean and maintain, and not to allow for accumulation of hazardous compounds
- Buildings will be structurally safe, provide appropriate protection against the climate, and have acceptable light and noise conditions
- Fire resistant, noise absorbing materials shall, to the extent feasible, be used for cladding on ceilings and walls
- Floors will be level, clean and non-skid.
- Heavy oscillating and rotating equipment will be located in structurally isolated sections
- Passages to emergency exits will be unobstructed at all times. Exits will be clearly marked to be visible in total darkness. The number and capacity of emergency exits will be sufficient, and there will be minimum two exits from any work area.

1.3.1 OHS TRAINING

- Provisions will be made to provide OHS orientation training to all new employees to apprise them of the basic site rules of work at site and of personal protection and preventing injury to fellow employees
- Training will consist of basic hazard awareness, safe work practices, and emergency procedures for fire, evacuation, etc.
- All workers and contractors prior to commencement of new assignments will receive adequate training and information covering:
    - Knowledge of materials, equipment, and tools
    - Potential risks to health
    - Precautions to prevent exposure
    - Hygiene requirements
    - Use of protective equipment and clothing
    - Appropriate response to operational incidents and accidents

1.3.2 WORK ENVIRONMENT

- Adequate toilets and washing areas will be provided for the number of people expected to work in the plant and allowances made for segregated facilities.

- Water supplied for drinking, to canteen, etc., will meet the WHO drinking water quality standards.
- Workplace will, to the degree feasible, receive natural light and be supplemented with sufficient illumination to promote worker's safety and health, and enable safe equipment operations. Supplemental "task lighting" may be required where specific visual acuity requirements shall be met
- Emergency lighting of adequate intensity will be installed and automatically activated upon failure of the principal artificial light source to ensure safe shutdown, evacuation, etc.
- First aid facilities will be provided and shall be easily accessible throughout the work place.

1.3.3 SAFE ACCESS

- Passageways for pedestrians and vehicles within and outside buildings will be segregated and provided for easy, safe, and appropriate access.
- Equipment and installations requiring servicing, inspection and / or cleaning will have unobstructed, unrestricted and ready access
- Hand, knee and foot railings shall be installed on stairs, fixed ladders, platforms, permanent and interim floor openings, loading bays, ramps etc.
- Measures to prevent unauthorized access to dangerous areas will be put in place

1.3.4 AIR SUPPLY

- Sufficient fresh air will be supplied for indoor and confined work spaces.
- Mechanical ventilation systems will be maintained in good working condition.
- Air inlet filters will be kept clean and free of dust and microorganisms.
- Heating, ventilation and air conditioning (HVAC) and industrial cooling systems will be equipped, maintained and operated so as to prevent growth and spreading of diseases and breeding of vectors of public health concern.

1.3.5 ERGONOMICS

Injuries due to ergonomic factors, such as repetitive motion, over-exertion, and manual handling, take prolonged and repeated exposures to develop, and typically require long periods for recovery. These OHS problems will be minimized and efforts made to completely eliminate them to maintain a productive workplace. Controls proposed shall include:

- Selecting and designing tools that reduce force requirements and improve postures
- Providing user adjustable work stations
- Incorporating rest and stretch breaks into work processes, and conducting job rotation

1.4 CUMULATIVE TRAFFIC PLAN

There will be a significant increase in traffic movement on the road leading to Derba. During the construction phase, there shall be movement of men, construction materials,

heavy equipment and machinery to the plant using trucks, trailers, etc. During operation phase of the plant, there will be increased traffic due to movement of men, raw materials like coal, pumice, transport of cement, etc. The operation of the plant will lead to a general influx of people due to potential employment / business opportunities, thereby creating traffic congestion as also illegal and haphazard development along the arterial roads.

DMC, being aware of the enormity of the problem, has requested the Government to formulate an Area Development Plan for Derba area and survey work for the same has already been initiated by the Government. **DMC** plans to technically assist in the planning of the area around the plant site by the Government. To this effect, **DMC** would like to extend its assistance in the form of covering the cost of the experts doing the planning work.

Adequate parking space for trucks bringing material into the plant is allocated in the plant premises. In addition the following measures are proposed to be implemented to address the increased traffic.

- Emphasis on safety aspects among drivers
- Adopting limits for trip duration and arranging driver rosters to avoid overtiredness
- Avoiding dangerous routes and times of day to reduce risk of accidents
- Use of speed governors on trucks
- Regular maintenance of vehicles to prevent accidents due to equipment malfunction and premature failure
- Collaborating with local community on education about traffic and pedestrian safety
- Employing safe traffic control measures, including road signs
- Deployment of locals as traffic marshals at sensitive accident prone sites on the main roads to control movement of heavy trucks and also livestock

1.5 GENERAL HEALTH MEASURES

- Sanitary facilities will be well equipped with supplies (e.g., protective creams) and employees will be encouraged to wash frequently, particularly those exposed to dust or chemicals.
- Ventilation systems will be provided to control work area temperatures and humidity.
- Personnel required to work in areas of high temperature and/ or high humidity will be allowed to take frequent breaks away from these areas.
- Pre-employment and periodic medical examinations will be conducted for all personnel, and specific surveillance programs instituted for personnel potentially exposed to health hazards.

1.6 GENERAL SAFETY MEASURES

- Conveyors and similar machinery will be provided with a means for stopping them at any point.
- Shield guards or guard railings will be installed at all belts, pulleys, gears and other moving parts.

- Elevated platforms and walkways, and stairways and ramps will be equipped with handrails, toeboards and non-slip surfaces.
- Electrical equipment shall be grounded, well insulated and shall conform to applicable codes.
- Employees will be provided with hard hats, safety boots, eye and ear protection, and snug fitting gloves as appropriate.
- Masks and dust-proof clothing shall be provided to personnel working in areas with high dust levels.
- Procedures will be strictly enforced for the storage, handling, and transport of explosives, flammable and hazardous materials.
- All blasting operations will be carried out only by qualified and certified personnel.

1.6.1 TRAINING

- Employees will be trained on the hazards, precautions and procedures for the safe storage, handling and use of all potentially harmful materials relevant to each employee's task and work area.
- Training shall incorporate information from the MSDSs for potentially harmful materials.
- Personnel will be trained in environmental, health and safety matters including accident prevention, safe lifting practices, the use of MSDSs, safe chemical handling practices, and proper control and maintenance of equipment and facilities.
- Training also will also include emergency response, including the location and proper use of emergency equipment, use of personal protective equipment, procedures for raising the alarm and notifying emergency response teams, and proper response actions for each foreseeable emergency situation.

1.7 SECURITY REQUIREMENTS

- Currently, limited security services have been taken from the Local Wereda Administration. Forty six (46) armed security personnel have been employed at site at present. These services will, however, be strengthened as the construction of the plant progresses. The security personnel are mostly former members of police force, army, etc. and hold valid licensed arms provided by the Wereda authorities.
- Though all the security personnel are armed, **DMC** has communicated to them that it will not sanction any use of force except when used for preventive and defensive purposes in proportion to the nature and extent of the threat. A grievance mechanism will also be established later on, which will allow the affected community to express concerns about the security arrangements and acts of security personnel.
- **DMC** will investigate any credible allegations of unlawful or abusive acts of security personnel, take action or urge Wereda authorities to take action, to prevent recurrence, and report unlawful and abusive acts to public authorities when appropriate.

1.8 DISEASE PREVENTION

1.8.1 COMMUNICABLE DISEASES

Communicable diseases pose a significant public health hazard. Health hazards typically associated with large development projects are those relating to poor sanitation and living conditions, sexual transmission and vector borne infections. Communicable diseases of most concern during the construction phase due to labour mobility are sexually transmitted diseases (STDs) such as HIV/ AIDS. Since no single measure is likely to be effective in the long run, successful initiatives shall combine a series of behavioral and environmental modifications.

Proposed measures at the project level shall include:

- Preventing illness among workers in local communities by:
  - Undertaking health awareness and education initiatives, by implementing an information strategy to reinforce person-to-person counseling which shall aim to influence individual behaviour as well as promote individual protection, and protect others from infection.
  - Training health workers in disease treatment
  - Providing health services
- Providing treatment through standard case management in on-site and/ or community health care facilities. Ensuring ready access to medical treatment, confidentiality and appropriate care, particularly with respect to migrant workers
- Promoting collaboration with local authorities to enhance access of workers, their families and the community as a whole to public health services and promote immunization

1.8.2 VECTOR-BORNE DISEASES

A number of diverse measures are proposed to reduce the impact of vector-borne diseases like malaria in the workers and the local communities. An integrated control strategy in collaboration with community health authorities for mosquito and other arthropod-borne diseases will involve:

- Prevention of larval propagation through sanitary improvements and elimination of breeding habitats close to human settlements
- Elimination of unusable impounded water
- Application of residual insecticide to interiors of buildings
- Promoting use of repellants, clothing, netting, and other barriers to prevent insect bites
- Use of appropriate drugs by workers and collaborating with public health officials to help eradicate disease reservoirs
- Monitoring and treatment of circulating and migrating populations to prevent disease reservoir spread
- Educating project personnel and area residents on risks, prevention, and available treatment

- Monitoring communities during high-risk seasons to detect and treat cases
- Distributing appropriate education materials

1.9 SOCIO-ECONOMIC DEVELOPMENT PLAN

DMC shall actively contribute to improve the socio-economic conditions of the area and also actively participate in implementing Government schemes for the welfare of the area.

As an outcome of the Public Consultation process, a number of issues, which have been raised by the local inhabitants, have emerged. The expectations and requirements of the local project affected people have been identified and **DMC** is proposing to implement an appropriate Social Management Plan as a part of their Corporate Social Responsibility.

The salient features of the Socio-economic Development Plan are presented in **Table 1.4.**

Sn	Issues	Action Plan
1	**Employment and business opportunities**	❑ Preference is being/ will be given in employment to able-bodied locals whose land has been permanently acquired for the project. Currently the following types of local labour is employed at the plant site: Skilled : 10 Unskilled : 60 **Total : 70** The local labour strength proposed during later construction stage will be as follows: Skilled : 50 Semi-skilled : 50 Unskilled : 300 **Total : 400** The employment of locals will be regularly monitored and a Local Employment Policy and Procedure will be established**.** ❑ The Community Development Fund to be established by **DMC** (details given ahead) will help the interested locals in setting up small businesses like transportation, auto workshops, small eateries, and other small shops which shall come up to cater to the cement plant ❑ Preference shall be given to engage locals for: o Transportation of raw materials/product o Distribution of product in region o Transportation and supply of other essential items to plant o Supply of food items and other items to the township
2	**Road Development**	❑ Major road building and upgradation is being carried out by **DMC** for the project. o Road from the Plant to mine will for the first time link the

Sn	Issues	Action Plan
		valley to the town of Derba and further. Villages hitherto inaccessible or accessible through difficult, long mountainous foot trails will gain access to the highlands and the capital city of Addis Ababa. ○ The proposed bridge over Mugher river will provide an access to the villages in the vicinity of the quarry and beyond. ○ The road from Chancho to Derba, which is presently a gravel road, will be converted to a tarred black-topped road in stages, which shall provide a better connectivity. ○ There are presently four old, narrow bridges over small streams on the way from Chancho to plant site. New bridges will be constructed alongside these bridges thereby providing much improved infrastructure in the area. ❑ With improved roads, connectivity to towns like Addis Ababa, Chancho, etc. shall improve. Bus/ truck services shall increase in the area.
3	**Health Facilities**	**Health facilities at Plant** ❑ A Health Centre staffed by a Doctor, a Nurse, Laboratory technician, pharmacist and other supporting staff will be upgraded from the existing Health Post up within the plant which will serve the employees of **DMC**. ❑ **DMC** plans to extend health facilities for the local community by establishing a Clinic at the plant site. The ownership and administration of the Clinic shall be with the Regional Government. ❑ The estimated cost of the Clinic which shall be allocated by **DMC** in its budget is: Establishment Cost : 300,000 Birr Health facility Cost : 200,000 Birr **Total : 500,000 Birr** ❑ **DMC** is willing to support the upgradation and upkeep of the established Centre by providing the Centre up to 10,000 Birr 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. ❑ Diseases of high concern during the construction phase due to labour mobility are sexually transmitted diseases (STDs) such as HIV/ AIDS. **DMC** propose the following measures at the project level: ○ Undertaking health awareness and education initiatives

Sn	Issues	Action Plan
		by imparting information and counseling to influence individual behaviour as well as promote individual protection, and protect others from infection. o Training health workers in disease treatment o **DMC** shall ensure ready access to medical treatment, confidentiality and appropriate care, particularly with respect to migrant workers ❑ **DMC** is proposing a number of measures to reduce the impact of vector-borne diseases like malaria in the workers and the local communities. o Sanitation in and around the project area will be improved to eliminate breeding habitats o Use of repellants, clothing, netting, etc. will be promoted o **DMC** will make efforts to provide appropriate drugs to workers and collaborate with public health officials to help eradicate disease reservoirs o It is proposed to monitor and treat the migrating population to prevent disease spread o Educating project personnel and area residents on risks, prevention, and available treatment Distribution of appropriate education materials **Health facilities at Mines** ❑ 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 supplementing 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.
4	**Education Facilities**	❑ **DMC** commits 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 in its budget for expanding and upgrading the educational facilities at plant and quarry.

Sn	Issues	Action Plan
		Cost of additional class rooms at plant and quarry: 500,000 Birr Cost of facilities like desks, laboratory equipment, etc.: 250,000 Birr **Total: 750,000 Birr**
5	**Vocational Training Centre**	❑ A Regional Vocational Training Center is being 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.
6	**Water Supply**	**DMC** will help in improving the water supply in the area. As seen during the socio-economic baseline survey, almost all villages rely on dirty, non-potable stream water for their water requirement. This has lead to prevalence of water borne diseases. ❑ 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 form the sale of water, so as to cover at least the maintenance cost of the system.
7	**Community Development Fund**	❑ **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. **DMC** shall continue the contribution till the cumulative contribution reaches Birr 2.5 million. A Committee comprising of Wereda officials, affected PAs and **DMC** will oversee the implementation of this fund.
8	**Communication**	❑ With the establishment of the plant, **DMC** shall set up modern communication facilities like telephones, internet, etc. in the area, which will also be available to the local population.
9	**Electricity Power Line**	❑ **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. However, the cost of individual connections and bills based on the consumption will have to be borne by the individuals.
10	**Periodic Public Consultation**	❑ Periodic public consultation shall be made to assess the impact of ongoing welfare and development schemes at that particular time and to identify the local issues to be

Sn	Issues	Action Plan
		addressed ❑ Based on the findings of periodic public consultation, SMP shall be modified in consultation with local Weredas, Kebeles and PAs.

Table 1.4 : Socio-economic Development Plan

1.10 HABITAT CONSERVATION & GREEN BELT DEVELOPMENT PLAN

As detailed in the Baseline terrestrial and aquatic ecology study, the study area is rich in flora diversity. And as elsewhere, biodiversity is being lost in the project area also due to human pressures. **DMC** is keen to devise and plan for biodiversity conservation in the area. A simple way to maintain a population of a particular species is to guarantee the existence of a sufficient area of suitable habitat that can be kept free of alien competitors, predators, and diseases. Several measures can be taken at different levels to preserve the native species like in situ conservation efforts, documenting of indigenous knowledge, and the application of science and technology.

The landscape in the buffer zone has several habitat types sheltering plants and animals. This includes small patches of scrub, agricultural lands and water bodies such as streams and rivers. A number of medicinal species are found in the area.

The African subcontinent is one of the greatest repositories of ethnobotanical knowledge. This knowledge, which may have been acquired by local communities over time, is passed down from generation to generation. **DMC** will extend assistance to local communities in protecting the flora especially the medicinal plants recorded in the study. Local communities shall be involved in the planning, management and monitoring of conservation programme, and to ensure that they are the beneficiaries of economic and other returns. Efforts shall be channelised by **DMC** to make people take charge of or participate in the management of their local biodiversity – some initiated by themselves, others by government and NGOs.

In addition, faunal census would be organized to collect the population data with special reference to threatened species. Different types of trees will be planted for roosting and nesting. In addition existing roosting & nesting sites will be identified & protected.

1.10.1 AFFORESTATION AND GREEN BELT DEVELOPMENT

DMC proposes to develop a thick green belt in and around the plant and mining areas and also take up afforestation programme in the buffer zone. The afforestation programme will be supervised by a qualified Horticulturist who shall develop the plantation in consultation with the Wereda forest officials.

A full fledged Nursery will be established in the Plant premises to provide saplings for the afforestation programme. Due importance will be given to cultivation and propagation of medicinal plants.

The selection of suitable species for plantation shall be based on the following criteria:

- ❑ The plant should be fast growing;
- ❑ The plant should have a thick canopy cover;
- ❑ Preferably perennial and ever green;

- Resistant to specific air pollutants;
- Should maintain ecological land and hydrological balance of the region.

1.11 CLOSURE OF PLANT SITE

The decision to close a site, quarry or cement plant is shaped by factors including the availability and quality of raw materials, production costs, market demand for cement, etc.

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 will be conducted to identify possible impacts on the community and employees due to closure of the plant/ quarry at the time of closure.

As the **DMC** plant shall operate for a very long period, communities shall grow up around the site. 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.

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. However, it will be worthwhile for **DMC** to 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.

1.12 CLOSURE OF MINE

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.

1.13 AUDITS AND MONITORING

Environmental monitoring and audits will be undertaken during & after the construction and development phase and during operation phase to check that the environmental management measures are being satisfactorily implemented and that they are delivering the appropriate level of environmental performance.

The Federal EPA, the Regional EPA and the Wereda level offices do not have the capacity to undertake any monitoring or audits. Therefore, **DMC** will establish the Environmental Management Cell to address the issues of environmental management.

1.13.1 AUDIT

The audit programme will include pre-commissioning audits of the facilities focusing on the compliance of equipment and procedures to deliver the specified level of performance to ensure that all environmental requirements are met.

Subsequent to commencement of production, regular operational audits will be carried out to check:

- The integrity and function of physical systems
- Compliance with operating procedures
- Testing and review of emergency procedures
- Compliance with maintenance procedures and records
- Competence and training of operatives and field management staff

Audit results will be reported to the management and field staff responsible for the process or equipment in question. Where audits reveal non-compliance with requirements, corrective actions will be implemented. These will be prioritized according to the significance of the environmental risks arising.

Audits may also need to be carried out by the Federal and Regional EPA to check compliance with the Ethiopian regulations. Since the EPA does not adequate facilities to carry out audits and monitoring, it is recommended that an external environment consulting organization, as a third party should be engaged for audits. The selection of this third party shall be made in consultation with and after approval by the EPA.

1.13.2 MONITORING

DMC will implement a comprehensive impact and compliance monitoring plan. The main objectives of the monitoring plan include:

- Assessing the performance and effectiveness of monitoring activities by comparing monitoring results with the baseline data and/ or environmental standards.
- Identifying the extent of environmental impacts as predicted in the ESIA
- Determining project compliance with regulatory requirements
- Adopting remedial action and further mitigation measures if found necessary.

Monitoring of air quality, noise levels, surface and ground water quality, soil quality, solid waste generation, biodiversity, traffic, health and safety, socio-economics as well as operations is proposed. In the case of non-compliance, efforts will be made to:

- Identify the most probable source
- Check on the proper implementation of the specified mitigation measures
- Review the effectiveness of the ESMP and propose alternative actions as appropriate
- Increase the monitoring frequency to assess the effectiveness of remedial measures

Quarterly monitoring progress reports will be prepared, while yearly comprehensive reports will be generated to present results of the monitoring activities and assess the adequacy of environmental control measures. All monitoring records will be kept in an acceptable format and reported regularly to the responsible EPA authorities and concerned stakeholders.

A summary of the proposed monitoring plan is given in **Table 1.5**.

Impact	Monitoring method	Parameters	Location	Frequency
Air quality	Measurement/ sampling	PM/ PM_{10}, NOx, SOx	Pyro-processing stacks	Continuous
		PM/ PM_{10}	Cement grinding and clinker cooler stacks	Continuous
		PM/ PM_{10}, Temperature, Oxygen level, combustion efficiency	Combustion sources	Biannually
		Ambient PM/ PM_{10}, NOx and SOx	Selected receptor villages, colony, plant premises	Quarterly
Noise	Measurement	Leq (dB(A))	Mines, Crusher, Raw mill, Cement Mill	Biannually
			4 sites around Plant site	Biannually and upon complaints
Surface and ground water	Sampling	Temperature, pH, Oil content, Suspended solids, COD	Ground water wells, installed grease traps, oil/ water separators, sedimentation tanks	Quarterly
Soil	Sampling	Moisture content, pH, salinity, Nitrogen, Phosphate, Chloride, Potassium, Sodium	Agricultural plots near project site	Annual
		Heavy metal content (mercury, lead, chromium, copper, nickel, zinc and cadmium)		Every three years
Solid Waste	Audits, photographic documentation, and interviews	Generation, storage, recycling, transport and disposal	Plant premises	Quarterly
Biodiversity	Visual inspection and photographic documentation	General condition of the floral cover	Plant, mines and landscaped areas	Annual
Resource use	Metering	Water and energy consumption	Plant and mines	Continuously
	Audit	Raw material consumption	Plant and mines	Continuously
Health and Safety	Health and safety surveys	Proper use of PPE, presence of safety signs, first aid kit, fire fighting devices, Injury/ illness records. Accident statistics recording in accordance with ILO standards, including recording of Lost-Day-	Plant, road linking DMC with the main road network	Continuously

Impact	Monitoring method	Parameters	Location	Frequency
		Accidents per Million-Man-Hours (LDA/ MMH).		
Socio-economic	Field questionnaire	Local population	Plant and surrounding areas	Annually
	Interviews	Employment records	Plant	Continuously
Operations monitoring	Visual inspection and documentation	Production rate, gas flow rates, counter readings, pressure valves, temperatures, abnormal readings, overloads, stoppages	All facilities and major equipment at Plant and Mines	Daily

Table 1.5 : Proposed Environmental Monitoring Plan

The above said monitoring shall be carried out by either creating in-house facilities or by hiring an external environmental laboratory.

1.13.3 MANAGEMENT CONTROL

DMC will ensure that environmentally critical actions are undertaken as per various requirements of AfDB, IFC and applicable Ethiopian legislations. There will be an assigned high level Management Committee for overseeing all environment and safety responses to ensure the implementation of ESMP.

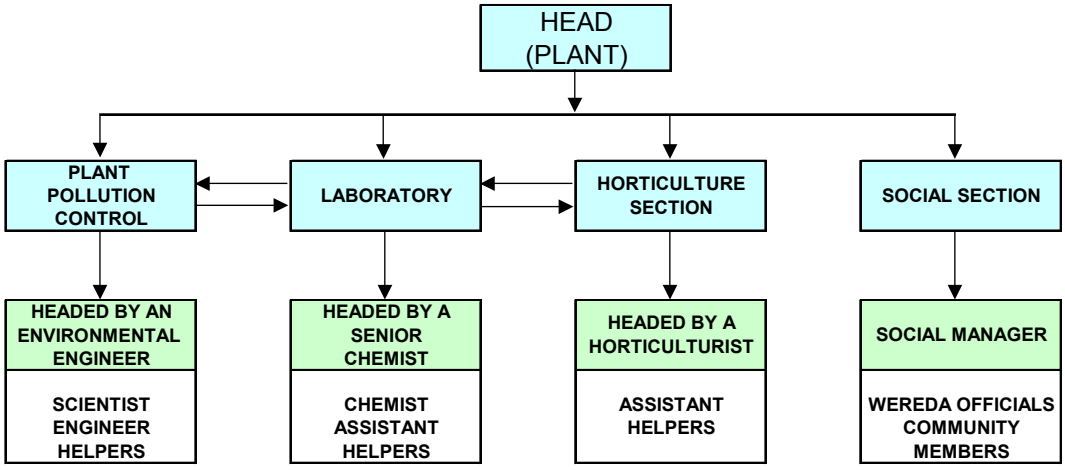
An organizational Environmental Management Cell will be instituted with defined roles, responsibilities, and authority to implement the ESMP. The Cell will focus on assessing current environmental practices, developing an internal audit system, reviewing environmental monitoring reports, identifying required control measures, initiating public relations campaigns to report, maintaining a clear environmental policy, and establishing a transparent communication with governmental and non-governmental agencies concerned in environmental management.

This department will undertake monitoring of the environmental pollution levels by measuring stack emissions, ambient air quality, water and effluent quality, noise level etc., either departmentally or by appointing external agencies wherever necessary. In case, the monitored results of environmental pollution are found to exceed the allowable values, the Environmental Management Cell will suggest remedial action and gets these suggestions implemented through the concerned plant authorities.

The social set up within the Cell will form an important part of the Environmental management. There is no institutional capacity at the Wereda and PA levels for implementation of social development schemes in the project area. Thus this set up in the Plant will implement these programmes.

The Social Officer will coordinate with the Municipality of Derba town, the Wereda officials and the local community to address the social issues in the area surrounding the project area. Community liaison and implementation of various education, health, employment, and infrastructure schemes proposed will be its important function.

A permanent organizational set up charged with the task of ensuring effective implementation of the Environmental Management Plan is proposed to be established. **DMC** will have a department consisting of officers from various disciplines to co-ordinate the activities concerned with the management and implementation of the environmental control measures of the proposed plant operation. The organization and responsibility of the Environmental Management Cell is presented here.



For maintenance & repair of Pollution Control Devices, maintenance crew shall be taken from respective plant section

The Environmental Management Cell will also co-ordinate all the related activities such as collection of statistics w.r.t health of workers and population of the region, afforestation and green belt development.

To achieve the objective of pollution control, it is essential not only to provide best pollution control system but also to provide trained manpower resources to operate the same. The training will cover the items listed below:

- Awareness of pollution control and environmental protection;
- Operation and maintenance of pollution control equipment;
- Knowledge of norms, regulations and procedures; and
- Occupational health and safety.

1.13.4 RECORD KEEPING AND REPORTING

- Records of significant environmental matters, including monitoring data, accidents and occupational illnesses, and spills, fires and other emergencies will be maintained.
- Recorded information will be reviewed and evaluated to improve the effectiveness of the environmental, health and safety program.
- An annual summary of the above information will be provided to statutory authorities, if required.

1.14 STAKEHOLDER CONSULTATION

Stakeholder consultation will be an ongoing process at **DMC**. The purpose of community engagement will be to build and maintain a constructive relationship with the local communities.

Disclosure

DMC has disclosed relevant project related information as a part of the Public Consultation process, which has helped the neighbouring communities understand the impacts and opportunities of the cement project. **DMC** will provide this information as a part of the

Environmental and Social Impact Assessment early and before the commencement of the construction of the project and on an ongoing basis.

Grievance Mechanism

DMC is already responding and shall continue to respond to the communities' concerns related to the Cement project. A grievance mechanism will be established to receive and facilitate resolution of the affected communities' concerns. The grievances will be addressed promptly, using an understandable and transparent process, which will be readily accessible to all segments of the neighbouring communities.

1.14.1 LABOUR & WORKING CONDITIONS

IFC's Performance Standard 2 recognizes the fact that the objective of economic growth through employment creation and income generation should be balanced with protection of basic rights of workers. The workforce is a valuable asset, and a sound worker-management relationship leads to a sustainable business.

Human Resources Policy

DMC will adopt a sound Human Resources Policy under which **DMC** will provide its employees with information regarding their rights under Ethiopian national labour and employment law, including rights related to wages and benefits. This policy will be clear and will be made accessible to each employee at the time of his or her employment.

Working Conditions

DMC will provide reasonable working conditions and detail the terms of employment such as wages and benefits, hours of work, overtime arrangements, leave for illness, maternity, holiday, etc. which shall comply with the national Ethiopian law.

Non-Discrimination and Equal Opportunity

DMC will base the employment relationship on the principle of equal opportunity and fair treatment, and will not discriminate with aspects of compensation, working conditions and terms of employment, access to training, promotion, retirement and discipline. **DMC** will abide by the national law for non-discrimination in employment.

Grievance Mechanism

DMC shall develop a grievance mechanism for workers and their organizations to raise reasonable workplace concerns. The mechanism will involve an appropriate level of management and address concerns promptly, using a transparent process. The mechanism shall not impede access to other judicial or administrative remedies that are available through law.

Child Labour

DMC will not employ children below 18 years at the proposed Cement plant or mines.

Forced Labour

DMC will not employ forced labour, which covers any form of involuntary or compulsory labour, bonded labour or similar labour contracting arrangements.

1.15 CAPACITY BUILDING, INSTITUTIONAL STRENGTHENING AND PUBLIC RELATIONS CAMPAIGNS

Capacity building in environment management shall cover all aspects including air quality, water quality, noise levels, soil quality, traffic, solid waste, occupational health and safety, etc. Proper environmental management envisages that construction and operation procedures be implemented in accordance with the current state-of-the-art technology. This can be accomplished by hiring competent personnel with an appropriate educational and professional background and instituting periodic training programmes and site specific plans that area adequate for protecting the general public and the environment as well as contributing to the mitigation of potential impacts. For this purpose, **DMC** employees as well as the employees of the contractors and consultants involved in various activities shall be required to attend environmental training awareness seminars and workshops. In an effort to strengthen institutional capacity and environmental awareness, such seminars-workshops shall also be open for individuals from concerned ministries and agencies such as Federal EPA, Oromiya Regional EPA, Wereda level Environment Departments, etc. The objective of the seminars-workshops is to ensure environmental awareness, knowledge and skills for the implementation of ESMP.

It is also proposed that the permanent staff at **DMC** who is in charge of coordinating the implementation of the ESMP be given an opportunity to attend relevant international workshops coupled with study tours of well operated cement plants elsewhere to have a first hand idea of the best practices in the industry.

The proposed plan for capacity building, institutional strengthening and public relations campaign is given in **Table 1.6.**

Activity	Target Audience	Content/ Task	Responsibility	Time frame
Training and awareness	**DMC** employees as well as employees of contractors and consultants involved	Environmental awareness, knowledge and skills for implementation of EMP	**DMC** management & environmental consultant	Monthly for a period of 1 to 2 days during the first year and at least twice in a year for period of 1 to 2 days thereafter
Training the Trainers	Permanent staff of **DMC** who are in charge of coordinating the implementation of EMP	Relevant international workshops coupled with study tours at well run cement plants	**DMC** management	1 to 2 weeks every year for the first 3-4 years
Formation of a high level Environmental Committee	Comprising the Plant Head and the heads of all departments	Assessing current environmental practices, developing an internal audit system, reviewing environmental monitoring reports, identifying required control measures, initiating public relations campaigns	**DMC** management	Formation at commissioning. Extensive meetings for the first months followed by monthly meetings thereafter
Compliance with international standards, international accreditation such as ISO 14001		Obtaining quality and environmental accreditation such as ISO 14001	Environmental Committee	Within 5 years. Environmental Committee to monitor progress biannually
Public relations campaigns	General public, Oromiya Regional Government, Ministries and authorities, NGOs	Field Questionnaires and interviews	Environmental Cell	Continuous engagement
Advertisement	General public	Television, billboards, print media, seminars	Environmental Cell and management	Commencement of operations, major landmarks

Table 1.6 : Proposed Plan for Capacity Building and Institutional Strengthening

Chapter 2
Disaster Management Plan

CHAPTER – 2

DISASTER MANAGEMENT PLAN

2.0 PREAMBLE

The objective of this Disaster Management Plan (DMP), for the cement project is to be in a state of perceptual readiness through training, development and mock drills, to immediately control and arrest any emergency situation so as to avert a full fledged disaster and the consequence of human and property damage and in the event of a disaster still occurring, to manage the same so that the risk of the damage consequences to life and property are minimized. Thereafter, proper rehabilitation, review and revisions of the DMP to overcome the shortcomings noticed shall be undertaken.

2.1 DEFINITIONS

2.1.1 DISASTER

Disaster is a sudden calamitous event, bringing great damage, loss or destruction.

2.1.2 DISASTER MANAGEMENT

It is the most comprehensive plan which states who does what, when and how before, during and after a disaster.

2.1.3 INCIDENT

Incident may be defined as an emergency situation of any critical deviation in the process control or otherwise that may lead to a major accident /potential emergency and disaster.

2.1.4 EMERGENCY

Emergency may be defined as any situation of process deviation that if uncontrolled may lead to a major accident /disaster with potential short term and/or long term risk damage consequence to life and property in and /or around the factory where the situation has arisen and the control of which requires external help and controls.

2.1.5 HAZARD

Hazard may be defined as “the potential of an accident ”. Hazard exists in man and the system of materials and machines.

2.1.6 ACCIDENT

An accident may be defined as “an undesirable and unplanned event with or without or major damage consequence of life and /or property”.

2.1.7 RISK

Risk of an accident may be defined as the chance or probability or likelihood of an accident being caused in a given man-material-machine system.

This DMP does not cover natural disasters and sabotage activities. However, the duties and responsibilities given in this DMP may be followed to deal with emergencies, arising out of natural disasters and sabotage activities.

2.2 DISASTER MANAGEMENT PLAN - PLANT

- Emergency Organization and Roles of Incident Controller, Site Main Controller, Other Key Personnel, Essential Workmen and others.
- Emergency Control Center, Assembly Points, Transport and Evacuation arrangements, Medical Arrangements, Pollution Control arrangements
- Declaration of major emergency, Communication system, Telephone Messages and Communication of major emergency.

2.3 EMERGENCY RESPONSE ORGANIZATION

The following officers of the plant will be responsible for coordinating in case of emergency situation in any section of the cement plant or mine.

Person	Responsibility
President/ Jt. President	Site Controller
HOD/ Section-in-charge of affected department	Incident Controller
Employee who gives the first information about the incident/ accident	Primary Controller
HOD (Administration)	Liaison Officer
Section-in-charge	Communication Officer

2.4 KEY PERSONNEL AND THEIR RESPONSIBILITY

2.4.1 SITE CONTROLLER

The President shall have the overall responsibility for the plant and its personnel. In the absence of President, Jt. President (Operations) shall assume the responsibility of Site Controller. Duties of the Site Controller during emergency shall be:

- To assess the magnitude of the situation and decide if employees need to be evacuated from assembly points.
- To maintain a continuous review of possible development and assess in consultation with Incident Controller as to whether the shutting down the plant or part of plant and evacuation of person is required.
- To give necessary instructions to Liaison officer/ HOD (Administration) regarding the help to be obtained from outside agencies like the Fire brigade, police and medical.
- To advise Liaison Officer to pass necessary information about the incident to news media and ensure that the evidences are preserved for inquiries to be conducted by statutory authorities.

2.4.2 INCIDENT CONTROLLER

The HOD of affected department shall have overall responsibility for controlling the incident and directing the personnel. Section-in-charge of the affected department shall assume the

responsibility of Incident Controller in the absence of HOD of affected department. His duties during emergencies shall be:

- To inform Communication Officer about the emergency, Control Center and assembly point.
- To direct all operators within the affected areas with priorities for safety of personnel, to minimize damage to the plant and environment and to minimize loss of material.
- To act as Site Controller till the latter arrives
- To provide advice and information to fire squad, security officer and local fire services when they arrive
- To ensure that all non-essential persons are sent to the assembly point.

2.4.3 PRIMARY CONTROLLER

The Primary Controller is the employee who gives the first information about the incident/ accident. He will be responsible:

- To inform the Security Office (Main Gate) & Sr. Engineers/ Shift-in-Charges / HOD of Section of the aforesaid Department/ Section from the nearest available telephone about the location and the nature of incident.
- To assist Fire Brigade in their operation, and would assist in clearing any obstruction coming in way of fire extinguishers.
- To carry out all instructions from Incident Controller.

2.4.4 LIAISON OFFICERS

HOD (Administration) shall be the Liaison Officer. He shall be responsible for:

- To contact Fire Brigade, Police and Medical facilities on intimation from Site Controller and arrange for the rescue operation.
- To ensure that the casualties receive attention.
- To inform relatives of affected employees at the earliest.
- To arrange for additional transport if required
- To arrange for relief of personnel and organize refreshment /catering facility, in case the duration of emergency is prolonged.
- To issue authorized statements to news media and ensure that evidence is preserved for enquires to be conducted.

2.4.5 SECTION-IN-CHARGE (MEDICAL)

On receiving the information, the Section-in-charge will reach the hospital immediately and take the following actions:

- He will keep the necessary first aid medicines and artificial respiration equipment ready.
- Inform doctors at other places to be ready, for attending serious injury and burns cases.

2.4.6 COMMUNICATION OFFICER

The Section-in-charge (Safety) shall act as Communication Officer. He shall work from Control Center and maintain communication between relevant personnel. He shall be responsible:

- To apprise the Site Controller of the situation, based on the information received, suggest the evacuation of personnel from assembly points, if needed.
- To arrange for suitable persons to act as runners/ messengers in case of failure of communication system.
- To carry out any other works as assigned by the Site Controller/ Incident Controller.

2.4.7 SECTION-IN-CHARGE (SECURITY)

The Section-in-charge (Security) shall be responsible to:

- Guide the fire crew in fire fighting. He shall give instructions to Security Guards to cordon off area as required by Incident Controller. He shall render all help to Incident Controller to handle the emergency and carry out the work as assigned to him.
- He shall be responsible for unauthorized persons inside the affected are as well as inside the factory during emergency.

2.4.8 SHIFT-IN-CHARGE (SECURITY)

The Shift-in-charge (Security) shall be responsible:

- To arrange the necessary help as requested by Primary Controller.
- To inform Section-in-charge (Security).
- To blow emergency Siren, if instructed by Primary Controller.
- To send Ambulance to the accident site with fire brigade along with available trained security persons.

2.5 COMMUNICATION SYSTEM

Any person noticing an emergency should be able to raise or cause to be raised the first Floor Level Emergency Alarm (FLEA). All employees shall be trained to operate such emergency alarms. There shall be an adequate number of points from which the alarm can be raised either directly, by activating an audible warning of individual signal or message to a preliminary manned location. This has the advantage of permitting the earliest possible action to be taken to control the situation, which in turn may avoid the development of a major emergency. All such points shall be distinctively marked and known to all employees.

The alarm shall be audible in every part of the factory. In areas of high noise level, it may be advantageous to provide an alternative to an audible alarm e.g. flashing lights. On DMC site a staged warning system may be more appropriate. The person discovering the incident shall warn all those in the vicinity who should either evacuate or take other immediate action according to the predetermined plan. Automatic alarms may be appropriate at some places. To communicate disaster, hooter will be useful.

The alarm system recommended for the plant is only to meet the local site requirement of the factory. The alarm would reach all those working within the cement plant. The warning need not reach outside as no off-site effect is expected under any major emergency.

The alarm should alert the Site Controller who should assess the situation and implement appropriate emergency procedures.

Separate alarms may be necessary to warn of different types of emergency such as fire and the beginning of the emergency as different procedures may be required. Care shall be taken, however, to avoid a multiplicity of alarms, which would cause confusion. In case of total electricity failure and the alarms, telephones and intercom system not working, help of runners/messengers shall be taken. One (or more) big bell (independent power) and magnetic telephones with fire and emergency services may also be useful. Public address system (PAS) or Internal telephones throughout the factory will be use full for quick communication. The alarm system shall be checked periodically to test efficiency.

2.5.1 DECLARING THE MAJOR EMERGENCY

The declaration of major emergency puts many agencies on action and the running system may be disturbed which may be very costly at times or the consequences may be serious, therefore such declaration should not be decided on whims or immature judgment or without proper thought because of the scale of activity which will be activated after the declaration of major emergency. It is advisable to restrict the authority to declare it. However, it is not necessary, to limit this authority to the Incident Controller and his appointed deputy. The need is to have as early a declaration as is possible. On large plants such as the proposed DMC plant, some other persons may be closer to the incident when it occurs and capable of making the necessary judgment. It may be advisable, therefore, to invert the authority to declare a major emergency in a number of nominated people. They should be selected on the basis that their knowledge and experience equips them to recognize the fact of a major emergency or the potential for it. There need be no limit to the number authorized, provided each has the required competence and understands the significance of the declaration of emergency. Such nominated will advise the Incident Controller or the site Main Controller, with consultation with him to declare the emergency and it will be declared accordingly through him.

A joint decision to declare major emergency may be taken but it shall be as early as possible and without wasting any time.

2.5.2 TELEPHONE MESSAGE

After hearing the emergency alarm and emergency declaration or even while fast receiving the emergency message on phone, a telephone operator (or Communication Officer) has to play an important role. He shall be precise, sharp, attentive and quick in receiving and noting the message and then for immediate subsequent action of further communication.

2.5.3 COMMUNICATION OF EMERGENCY

There shall be an effective system to communicate emergency (a) inside the factory i.e. to the workers including key personnel and essential workers, on duty and inside during normal working hours (b) to the key personnel and essential workers not on duty and outside during normal working hours. (c) to the outside emergency services and the government authorities. And (d) to the neighboring areas and the general public in the vicinity. The key points are suggested below:

2.5.4 COMMUNICATION TO THE OUTSIDE EMERGENCY SERVICES AND AUTHORITIES

Once the declaration is made it is essential that the outside emergency services if they have not already been called in, be informed in the shortest possible time. Liaison at local level will help to determine the best means of achieving this, for example, direct line or automatic alarm to the fire brigade or by any emergency system. Predetermined code words to indicate the scale and type of the emergency may be useful.

The emergency shall be immediately communicated to the Government Authorities such as local Oromiya Regional Authorities, Police and District Emergency Authority.

The statutory information to above authorities shall be supplied beforehand so that they can be well prepared to operate their off-site emergency control (contingency) plan. As per their advice the onsite plan should be modified and updated.

Internal telephone numbers should be listed as per format given in **Table 2.1**.

Department	Designation	Telephone Number	
		Office	Residence
Plant	President		
	Head (Operations)		
Process	HOD (Process & Quality Control)		
	In-charge (Production)		
	In-charge (Quality Control)		
Packing Plant	HOD (Packing)		
	In-charge (Sales)		
	Section In-charge (Sales accounting)		
Stores	HOD (Materials)		
	In-charge (Stores)		
Electrical	HOD (Electrical)		
	In-charge (Electrical)		
Mechanical	HOD (Mech.)		
	In-charge (Mech.)		
Infrastructure	HOD (Inst.)		
	In-charge (Inst.)		
Administration	HOD (Administration)		
	In-charge (Administration)		
	Section In-charge (Security)		
	Section In-charge (Safety)		
Fire Service/ Ambulance	Main gate/ Security office		
	Section In-charge (Medical)/ Doctor		

Table 2.1: Emergency Internal Telephone Numbers

2.6 ACTION ON THE SITE

2.6.1 CO-RELATED ACTIVITIES

Though the scope of the on site plan is to prepare for and activate the emergency time activities so that the emergency, arising as a result of the failure of the pre-emergency control measure, can be controlled and contained within the shortest time, the following three stage activities are suggested as they are co-related and provide better points for emergency preparedness, emergency actions and subsequent actions and subsequent follow up.

2.6.2 PRE EMERGENCY ACTIVITIES

The following are the details of pre-emergency activities.

2.6.3 INTERNAL SAFETY SURVEY

It shall be conducted to identify various hazards in plant area.

- To check protective equipment for workability
- To check various safety installation / facility available at site for workability.
- To check fire system, fire water pumps, sprinklers from ejectors, spray system, etc.
- To suggest extra requirement / modification to make the system more reliable.

2.6.4 THIRD PARTY SURVEY

The survey to be conducted by a 'Third Party" *i.e* experts /consultants from outside:

- To study and identify various hazards
- To conduct survey on available safety equipment/ appliances
- To check in built safety system for its adequacy
- To suggest modifications/ additions in the system, if necessary.

2.6.5 TESTING EQUIPMENT

To prepare a list of pressure vessels for their testing along with testing procedures.

- To plan for testing various equipment under statutory obligations
- To prepare and maintain record for reference.

2.6.6 NON- DESTRUCTIVE TESTING (NDT)

- To prepare a list of equipment / piping for NDT testing.
- To draw an action plan for replacements/ repairs.
- To maintain plan/section-wise record to compare with the past period.

2.6.7 MUTUAL AID SCHEME

To prepare "Mutual Aid Scheme and into adjustments with the neighboring organizations for getting/ extending help to each other in emergency.

- To name the coordinator under "Mutual Aid Scheme"
- To have complete Co-ordination & understanding

2.6.8 MOCK DRILL

Minor mock drills shall be conducted for training the persons internally. Major mock drills shall be conducted after informing the Oromiya Regional Authorities, press, and police for handing the situation effectively.

- To conduct periodic drills as to check the performance of man and equipment.
- To know the draw-backs in the system for its corrective action.

2.6.9 TRAINING

- To organize regular training to the employee on the handing various safety equipment in emergency.
- To train fire staff for handling situation arising out of disaster.

2.6.10 PERSONAL PROTECTIVE EQUIPMENT

- To store adequate number of personnel protective equipment in each plant control room.

The proposed list of Personal Protective Equipments (PPEs) for the proposed DMC plant is given in **Table 2.2.**

Sn	Personal Protective Equipment	Numbers
1	Self Containing Breathing Apparatus	6
2	Gas Mask	10
3	Fire Suits	2

Table 2.2: Recommended List of Personal Protective Equipment (PPEs)

2.6.11 COMMUNICATIONS

- To maintain internal / external communication system in good working order.
- To maintain telephone system between fire station and off sites in working conditions.
- To install 5 km range system, which can be operated in case of disaster.
- To modify the siren sound for emergency
- To install wind cocks/wind recorders inside the plant areas at prominent locations to record wind direction and velocity.

2.6.12 EMERGENCY LIGHTS

- To check and maintain the emergency light in control rooms and selected plant areas.

- To keep sufficient number of torches/ batteries available in control rooms.
- To keep mobile diesel operated power generating set standby in case of failure of normal power supply during emergency

2.6.13 EMERGENCY CONTROL ROOM

- To identify the place for emergency Control Room.
- To identify the place for alternative emergency control room to be operative in case of unfavorable wind direction.
- To keep adequate number of personnel protective equipment in both the emergency control rooms.
- To provide proper telecommunication system in emergency control rooms.

2.6.14 LIAISON WITH STATE AUTHORITIES

- To keep liaison with civil authorities, nearest hospital, Police, Fire Station and keep them informed.
- To inform about the requirement about “Mock Drills”.

2.6.15 HOSPITAL FACILITIES

- Equip the hospital/health center with necessary equipment/medicines for fire effects.
- To train the Doctors for handling emergency situation/ casualties.
- To keep liaison with nearby city hospitals and other hospitals in the area.

2.6.16 STATUTORY INFORMATION

- To workers
- To the Government Authorities

2.6.17 STATUTORY INFORMATION TO EMERGENCY TIME ACTIVITIES

Under these activities, the staff in the plant at various levels with pre assigned duties is expected to work in a coordinated manner to meet the emergency situation, remove the emergency conditions and bring the plant to normalcy with the help of resources available within and outside the plant.

Availability and correct use of different means of communications control are important emergency time activities.

2.6.18 POST-EMERGENCY ACTIVITIES

Post emergency activities comprise of steps taken after the emergency is over so as to establish the reasons of the causation of the emergency and preventive measures. The steps involved are:

- Collection of records
- Conducting inquiry and concluding preventive measures
- Making insurance claims

- Preparation of inquiry reports recommendations
- Rehabilitate the affected persons within the plant and outside the plant
- To restart the plant.

2.6.19 CONTROLLING EMERGENCY

The successful handling of the emergency depends on correct decision and action on site. Some hazardous elements and their control procedures are explained below in brief.

2.6.20 EVACUATION & TRANSPORTATION

Non-personnel will usually be evacuated from the incident area and also from adjacent areas. Evacuation shall be to predetermined assembly points in a safe part of the works. Assembly points shall be clearly marked. The plan shall designate someone to record all personnel arriving at assembly point so that the information can be passed to the emergency control center.

Personnel required to be transported for the purpose of medical care or for better shelter shall be transported with care and facilities.

2.6.21 SAFE PLANT SHUT DOWN

If necessary, full or partial shut down of the plant shall be followed under the judgment of the Incident Controller or the Site Main Controller with the help of trained essential workers.

2.6.22 ACCOUNTING FOR PERSONNEL

It is necessary to know that everyone on site has been accounted for and that the relatives of casualties have been informed. The problem of accounting can be particularly difficult, especially on large works and hinges on being able to know, with any certainly, who is on site at any one time. It can be exacerbated if an accident occurs, as it frequently does, at a shift change or at a time when a large number of contractor's personnel are present at the plant.

It may be impracticable in many situations, to have an updated list of names of peoples on site at any one time. Holiday and sickness absence will mean that relief personnel are present and some others may be off site at the time engaged in other jobs in areas of control. A nominal roll is maintained of the employees normally present at the time of emergency.

Contractors shall be asked to maintain a similar list of personnel on site. If a record is maintained of the arrival and departure of visitors, together with the names of those they have called to see, it will prove useful in establishing their whereabouts in the emergency. Visitors shall wherever practicable, be accompanied on site by a responsible member of the work staff. The procedures so far recommended have included certain actions, which will assist in establishing the whereabouts of personnel.

In the immediately affected area, the Incident Controller shall arrange for a search to be made. The Fire Brigade will want to know if this has been done and will, if necessary, arrange for a further search to be made.

Nominated work personnel shall record the names, where known, of casualties taken to respective reception areas and the location, e.g. hospital to which they are subsequently sent. The police will want to know the names of fatal casualties and will arrange for normal identification.

Nominated work personnel should record the names and departments of people reporting at assembly points.

At the Emergency Control Center, a responsible person shall be appointed to collate the lists, check them against the nominal role of these believed to be missing. Where missing people could have had cause to be at the affected area, the Incident Controller shall be informed and arrangement made for further search.

2.6.23 PUBLIC RELATIONS

Inevitably, a major incident will attract the attention of the press, television and radio services. It is essential to make arrangements for authoritative release of information to them, preferably at a place remote from the workers to avoid any possible harm to the people concerned. The police have experience in arranging press conferences and will be willing to assist. A senior manager shall be approached to be appointed as the sole authoritative source of information of the news media. All other employees shall be instructed not to divulge information themselves, which may, in the event, be misleading or inaccurate. They shall, instead, refer all enquires to the appointed manager.

2.6.24 REHABILITATION

The senior fire brigade officer will not signal the end of emergency until he is satisfied that all fires are extinguished and there is no risk.

Even when the all clear has given, great care is needed when re-entering the affected areas. And no work in connection with collection of evidence shall be put in hand until a through examination of area has been carried out.

2.7 SERVICES AND CONTROL

2.7.1 PUBLIC ADDRESS SYSTEM

The Public Address System proposed to be installed at selected points in the plant shall be used for announcement/ information to be given.

2.7.2 TELEPHONES

Adequate facility for internal telephones already installed in the different offices in the plant shall be used to communicate any emergency to senior officers.

Telephone numbers of all Incident Controllers and Site Controller shall be maintained with each department and emergency control centers.

A list of all external authorities, their address and telephone nos. shall be maintained with Liaison Officers.

2.7.3 IN CASE OF FAILURE OF TELEPHONE

Security guards shall work as runners/ messengers. A vehicle which shall be detained round the clock at the main gate will be used for sending message, in case of emergency and to bring people to work for additional help to deal with emergency.

2.7.4 FIRE FIGHTING EQUIPMENT

Fire Tender will be used for the fire fighting. Periodic Check/ preventive maintenance of fire Tender shall be carried out. To maintain it healthy, weekly test drives will be undertaken.

Fire extinguishers shall be used depending upon the type of fire. List of location & type of fire extinguisher will be maintained with each department. A quarterly check for extinguishers shall be done and recorded.

A list showing location of the fire hydrant points, and its type will be available at all departments. A monthly check of each fire hydrant point shall be done and recorded. The following shall also be provided:

- A suitable high-pressure system of fire hydrants consisting of a suitable number of fire hydrants.
- A complete separate fire fighting water piping network for feeding the hydrants.
- Heavy-duty ABC powder type fire extinguishers shall be hung at particularly important electrical equipment areas.
- Portable CO_2 extinguishers shall be provided throughout the plant.
- Automatic fire extinguishing system using water shall be considered for empty bags store in the packing plant.

2.7.5 MOCK DRILL

For reviewing and assessing the level of preparedness, the Section-in-charge (Safety) will be conducting mock trials periodically (Once in six months), simulating the covered emergencies and will maintain records of the trials.

The team of prime and deputy responsible persons will review the records and events of the emergency preparedness trials and the report will be put forward to the Site Controller. Corrective and preventive measures, if suggested / directed will be initiated and relevant records of the same will be maintained.

2.7.6 TRAINING

Yearly basis classroom training for fire fighting and mitigating measures to be adopted to reduce occupational health and safety risks will be imparted to at least 20 % employees by the Section-in-charge (Safety) and Section-in-charge (Security). The records of the same will be maintained.

2.7.7 FIRE DRILLS

Fire drills will be exercised once in every six months under the leadership of Section-in-charge (Security). The records of fire drill will be maintained.

2.7.8 REVIEW & REVISION

All accidents /emergency situations shall be recorded in accident report. This shall be produced in the Safety Committee meeting in order to review & revise the emergency preparedness and response.

2.8 DISASTER MANAGEMENT PLAN - MINES

The complete mining operation will be carried out under the management control and direction of a qualified Mines Manager. The mining staff will be sent to refresher courses from time to time to keep them alert. However, the following natural/ industrial hazards may occur during normal operation.

- Accident due to explosives;
- Accident due to heavy mining equipment; and
- Sabotage in case of magazine.

In order to take care of above hazards/ disasters the following control measures will be adopted:

- All safety precautions and provisions of Proclamation on Mining Regulations, 1994 will be strictly followed during all mining operations
- Entry of unauthorized persons into the mines area will be prohibited
- Provision of fire fighting and first-aid services in the mines office complex and mining area
- Safety appliances such as safety boots, helmets, goggles etc. will be provided to the employees and regularly checked for their use
- Training and refresher courses for all the employees working in hazardous premises
- Working of mine, as per approved plans and regularly updating of the mine plans
- Cleaning of mine faces will be done regularly
- Handling of explosives, charging and blasting will be carried out by competent persons only
- Provision of magazine at a safe place with fencing and necessary security arrangement
- Regular maintenance and testing of all mining equipment as per manufacturer's guidelines
- Suppression of dust on the haulage roads
- Adequate safety equipment will be provided at explosive magazine
- Increasing the awareness of safety and disaster through competitions, posters and other similar drives.

For any type of above disaster, a rescue team will be formed by training the mining staff with specialized training.

2.9 TRAINING AND HUMAN RESOURCES DEVELOPMENT

Though stress shall be given on appointing qualified and experienced personnel in various disciplines, it shall also be ensured that they are adequately trained for the jobs expected

of them. For this basic training shall be given to new appointees, whereas refresher training shall be given to others.

Personnel who will be operating and/or maintain heavy earth moving equipment will be trained under the guidance of the manufacturers either at the site or in the works of the manufacturers.

The training of mine personnel will be conducted regularly with respect to environmental protection. Specialized courses may be arranged for afforestation, re-vegetation, reclamation etc.

Training and human resource development is not a single time function but a continuous requirement to up-date and improve the skills of employees. Hence, in addition to whatever statutory training is required, the company shall continue the process by way of participative training of the personnel in various courses, workshops, seminars training courses organized by manufacturers/ professional agencies.

2.10 SAFETY MEASURES AT LIMESTONE MINES

The company shall ensure implementation of all the possible safety measures in the course of its endeavor to mine limestone from the area. This is in line with the company's motto that all the efforts made towards enhancement of safety pays rich dividends in terms of higher productivity and reduction of losses.

The mining activity has several disaster prone areas. The identification of various hazards at the proposed limestone mines is depicted in **Figure 2.1**.

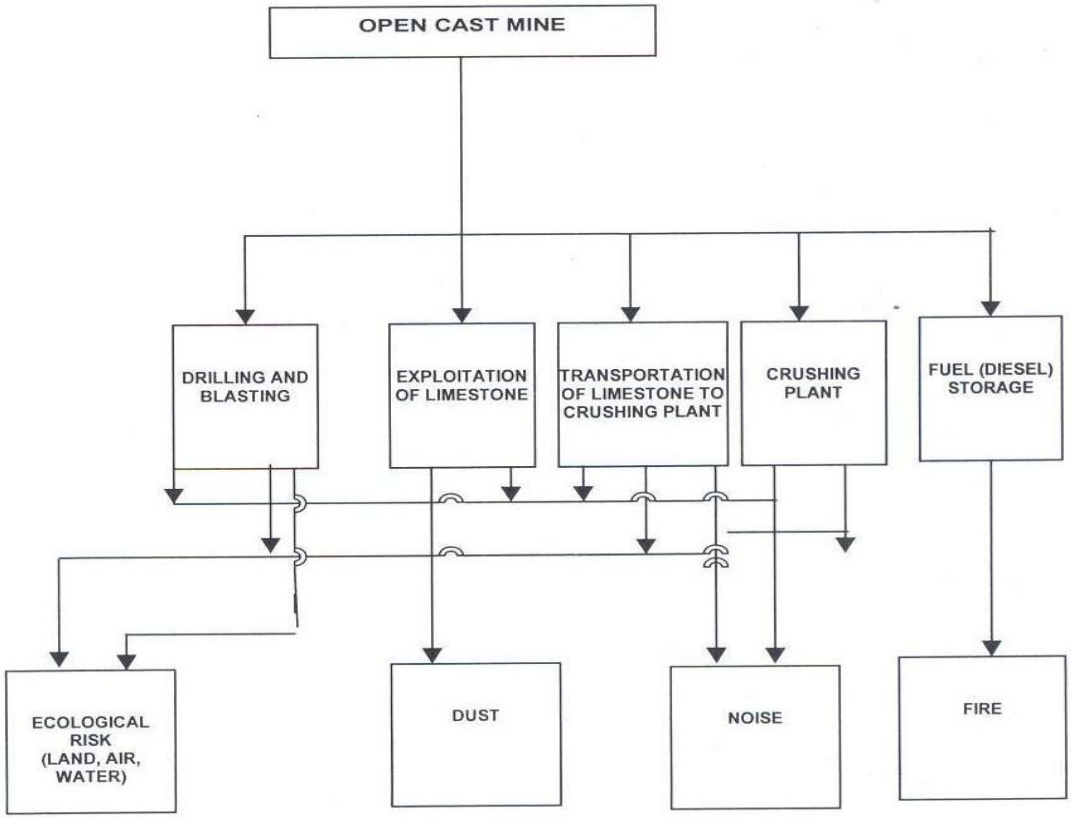


Figure 2.1: Various Hazards at the Proposed Limestone Mines

A brief description of some of the measures to be taken by the company during the process of quarrying is mentioned below.

2.10.1 BLASTING

To ensure safe blasting following are some of the measures to be adopted:

- The use of Non Electric System of Initiation of the blast holes shall be investigated. It ensures bottom hole initiation of the explosive charge, thereby reducing the ground vibration and fly rock problem.
- Use of ground vibration and air blast monitoring instrument to monitor the blasts. The instrument reveals efficiency of the blasting activity.
- Complete evacuation of the area falling within 300 m of the blast site by sounding siren and by sending guards to avoid any exposure of human beings and other animals to the danger associated with blasting.
- All the blasts will be carefully planned and executed under proper supervision to ensure effective utilization of the explosive material towards breaking of the rock only.
- The explosive material will be stored properly in an approved magazine, which shall be guarded round the clock.

2.10.2 STORAGE AND TRANSPORTATION OF EXPLOSIVES

The main hazard associated with the storage, transport and handling of explosives is fire and explosion. The rules as per relevant Ethiopian laws will be followed for handling of explosives.

2.10.3 RIPPING AND DOZING

The company will procure Dozer, especially to excavate mineral from the areas having close proximity to structures, likely to be affected by blasting. This machine completely minimizes the blasting activity, thereby ensuring safety at the critical locations.

2.10.4 TRANSPORT OF MINERAL

To ensure safe working of the rear dump trucks, which transport the mineral from the quarry to the crusher:

- The haul roads will be sufficiently wide to ensure free and easy movement;
- The curves on the roads will be given proper super elevation;
- Drains all along the roads will be provided to carry away rainwater without causing damage to the road;
- The valley side of the road will be clearly demarcated either by erecting stonewalls or by fixation of drums;
- Proper illumination of the roads will be made to facilitate work in the dark hours;

2.10.5 OTHER FEATURES

The company will provide automatic Fire Fighting Systems on critical equipment like Excavators, Loaders etc. All the Heavy Earth Moving Equipment will be maintained in

efficient working condition by a team of well-experienced and qualified personnel at mines. Personal checking of the following features will be done on daily basis.

- Brakes
- Horns and auto reverse horns
- Lights

All the staff will be provided with essential personal protective equipment like safety shoes, Helmets, Hand Gloves, Goggles, Apron, Guards, Ear muffs etc. Regular training will be imparted to the related staff of the mines for safe and proper operation and maintenance of the machines.

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