

**ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT FOR THE
PROPOSED MASHUJAA CEMENT GRINDING PLANT ON PLOT L.R NO. 7885/17, 18,
19, & 20 AT MATHATANI, MAVOKO SUB-COUNTY IN MACHAKOS COUNTY.**

TERMS OF REFERENCE NO:

(NEMA/TOR//5/2/256) GPS COORDINATES:

(1°30'13.0"S 37°04'15.7"E)



Proposed Cement Grinding Plant Construction Site

SUBMITTED TO NEMA IN ACCORDANCE WITH THE ENVIRONMENTAL MANAGEMENT AND COORDINATION ACT, EMCA 1999, THE ENVIRONMENTAL (IMPACT ASSESSMENT / AUDIT) (AMENDED) REGULATIONS, 2019 GAZETTED ON 30TH APRIL 2019 UNDER LEGAL NOTICE NO. 31 AND 32 FOR SUBMISSION TO THE NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY NEMA.

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MAY 2021

EXPERTS AND PROPONENT DETAILS

PROJECT TITLE:

Environmental and Social Impact Assessment Study Report for the Proposed Mashujaa Cement Grinding Plant on Plot L.r.No. 7885/17, 7885/18, 7885/19, 7885/20 at Mathatani, Mavoko Sub-County in Machakos County.

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Disclaimer:

This Environmental and Social Impact Assessment Study Report (ESIA) is based on information made available by the Proponent to the Consultant and findings from field assessment. It is strictly confidential to the Proponent and any materials thereof should strictly be in accordance with the agreement between the Proponent and the environmental consultants. It is, however, subject to conditions in the Environmental (Impact Assessment and Audit) Regulations, 2003 and thereafter subsequent amendment.

ACKNOWLEDGEMENTS

This ESIA report is based on the compilation of the work conducted to develop the proposed Cement Grinding Plant (CGP). The team of experts is grateful to the dedication of the project proponent for having availed the necessary resources, legal documents, goals, objectives, and work plans that are vital in ensuring a comprehensive and sustainable ESIA report is prepared.

The EIA consultants are also grateful to the list of experts, professionals, and technicians that assisted in conducting research, site survey, site investigation, data collection analysis and interpretation, comparisons from past similar work projects, and literature reviews.

The team of experts is also thankful for the input, advice, and recommendations given by the public, especially near the project site. In addition, the dedication of the neighbors during the consultation and public participation processes; filing questioners, interviews, and necessary site meetings as per the COVID-19 health regulation.

Lastly, the final compilation of this ESIA report was conducted by the team of EIA/EA registered experts that coordinated the wholes works of sites visits, data collection, analysis, interpretation, literature review, consultations, public participation, soft copies, and hard copies of the report through printing and binding of the document.

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CRONYMS

C	Degrees Celsius
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
EMCA	Environmental Management and Coordination Act
NEMA	National Environment Management Authority
A.P.	Affected Persons
PM	Particulate Matter
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
EMC	Estate Management Company
EMP	Environmental Management Plan
Ft	Feet
Ha	Hectare
IEA	Initial Environmental Audit
IMCE	Inter-Ministerial Committee on Environment
K.M.	Kilometres
KVA	Kilo Volts Amperes
NEC	National Environment Council ERP Emergency Response Plans
GoK	Government of Kenya
KEBS	Kenya Bureau of Standards
NEAP	National Environment Action Plan
NES	National Environment Secretariat
NPEP	National Poverty Eradication Plan
PEC	Poverty Eradication Commission
PPE	Personal Protective Equipment
S.S	Suspended Solid
T-N	Nitrogen
V	Volt
WRMA	Water Resources Management Authority
WSSD	World Summit for the Social Development
CGP	Cement Grinding Plant

OBJECTIVE

The ultimate objective for the Environmental and Social Impact Assessment (ESIA) Study Report for Mashujaa Cement Grinding Plant in compliance with the Environmental Management and Coordination Act (EMCA) 1999 (amendments), the Environmental (Impact assessment / Audit) (Amended) Regulations, 2019 gazette on 30th April 2019 under Legal Notice No. 31 and 32 is structured to ensure sustainable project development.

The objective of the ESIA is to ensure that environmental concerns are integrated into the development of the project and therefore ensure sustainable development. It has covered and considered all environmental-related features and aspects. Notably, identification of the potential environmental impacts associated with the project, Impact migration measures, and Environmental Management Plans (EMP). Cement is an important material used in the construction industry. It finds its use in building works and most infrastructural development in societies. Besides, an increase in cement production in the country will help achieve the big four agenda most import the construction of affordable housing in Kenya.

EXECUTIVE SUMMARY

Introduction

The Proponent has contracted NEMA registered experts to carry out consultation, referred to as the "consultants." The Proponent, **Mashujaa Cement PLC, address P.O. Box 43170- 00100, Nairobi**, has proposed to develop **Cement Grinding Plant on Plot L.r No. 7885/17, 7885/18, 7885/19, 7885/20 at Mavoko Sub-County in Machakos County**. The Project Proponent submitted The Terms of Reference (**NEMA/TOR/5/2/256**) to NEMA for review and approval. The TOR was approved as per the reference letter (**NEMA/TOR/5/2/256**) on **16th April 2021**. The Proponent contracted the EIA/EA registered experts to conduct an Environmental Impact Assessment Study Report (ESIA) for the Proposed Cement Grinding Plant (CGP). The team of registered EIA/EA experts and other stakeholders conducted the environmental impact assessment for cement grinding plant; site visit, data collection, analysis and interpretation, consultations, and public participation and thereby compiled the ESIA report. The team of experts provided a summary statement of the possible environmental and social effects of the proposed project.

The proposed site is in an area planned and marked for industry development. The area is hosted by similar neighboring characters and factories naming; **National Cement Company Limited, Simba Cement, Golden Africa Kenya Limited, and Muthaiga Gas Point**. By enactment, processing and manufacturing industries, cement manufacturing plants, and lime processing operation is a prescribed activity as per the second schedule in section 58, of the Environment Management and Coordination Act, among other law enactments. Under these laws, any activity out of character with its surrounding and which is likely to cause substantial impact to the environment in areas such as waste disposal, sustainable resource use, ecosystem "s maintenance, social environment, land use, and water extraction; an Environmental and Social Impact Assessment (ESIA) study report is required to assess such impacts and propose mitigation measures.

By law, Environmental Management and Coordination Act, (EMCA) 1999, the project proponent is required to submit an ESIA report to NEMA for approval before commencing

implementation of any project. By this report, the relevant government authorities can monitor impacts within the life span of the project on the immediate environment to enable major stakeholders of the project, including the government agencies, to manage the environment for the community's well-being. This ESIA report has been prepared based on the screening and scoping results, field visits, and information collected from primary and secondary sources in addition to the information provided by the project proponent, Mashujaa Cement PLC. Preparation for this ESIA Study report is based on the General Guidelines for conducting ESIA's in Kenya as per environment (Impact Assessment and Audit) regulations, 2003 (amendments) 2019 gazette on 30th April 2019 under Legal Notice No. 31 and 32, which operationalizes the Environmental Management and Coordination Act, (EMCA) 1999.

Site visits, investigations, and data analysis examined and assessed the project's potential impacts on its environment, concentrating on all the project phases (Design, construction, operation, and closure plans). It examined the physical environment, biological environment, Socio-economic and cultural constraints. The Proponent availed all the relevant legal documents necessary for compilation, submission approval of the ESIA Study report. All the primary and secondary data collected, including the photos and questionnaires, have been attached to the report. Notably, this ESIA Study report has discussed the potential environmental impacts and suggested the necessary mitigation measures to minimize the negative impacts. The consultant also prepared an Environmental Management Plans for the proposed project to ensure environmental sustainability in all phases of the project.

Mashujaa Cement PLC proposed will put up the project for grinding and packaging cement raw materials inputs; clinker, limestone gypsum, and other additives to produce 1 MTPA (1 million ton per annum) Portland cement. Clinker will be outsourced and transported using trucks and stored in the proposed site stored on hardstands on the ground and covered under polyethylene sheets.

The technology to be used **Vertical Rolling Mills (VRM)** for the cement grinding is known to have little or no environmental waste. The system setup is powered by electrical energy, an eco-friendly power source which does emit environmental pollutants.

The mass balance on this process manages potentially no waste. All input raw materials of Clinker, limestone, and gypsum will be completely used, thus excluding waste generated as a result of materials handling (spillages and as a result of dust). It is anticipated that there will be no waste from overall general cement grinding and bagging.

The project proponent for the proposed Mashujaa cement grinding plant has proposed to use the most modern technology developed by the company, Ultimate Technology to Industrial Saving, -UTIS, UC3 -Ultimate Cell Continuous Combustion technology) The technology chemically breaks and injects H₂ and O₂ into the combustion stream intensifying the combustion and thereby increasing its efficiency and lowering the CO₂ emission gases. In summary, the technology is known to reduce the amount of fuel consumption, speed up combustion, reduce exhaust emissions, increase productivity, and ensure safety and reliability and 24-hour control with an emergency control.

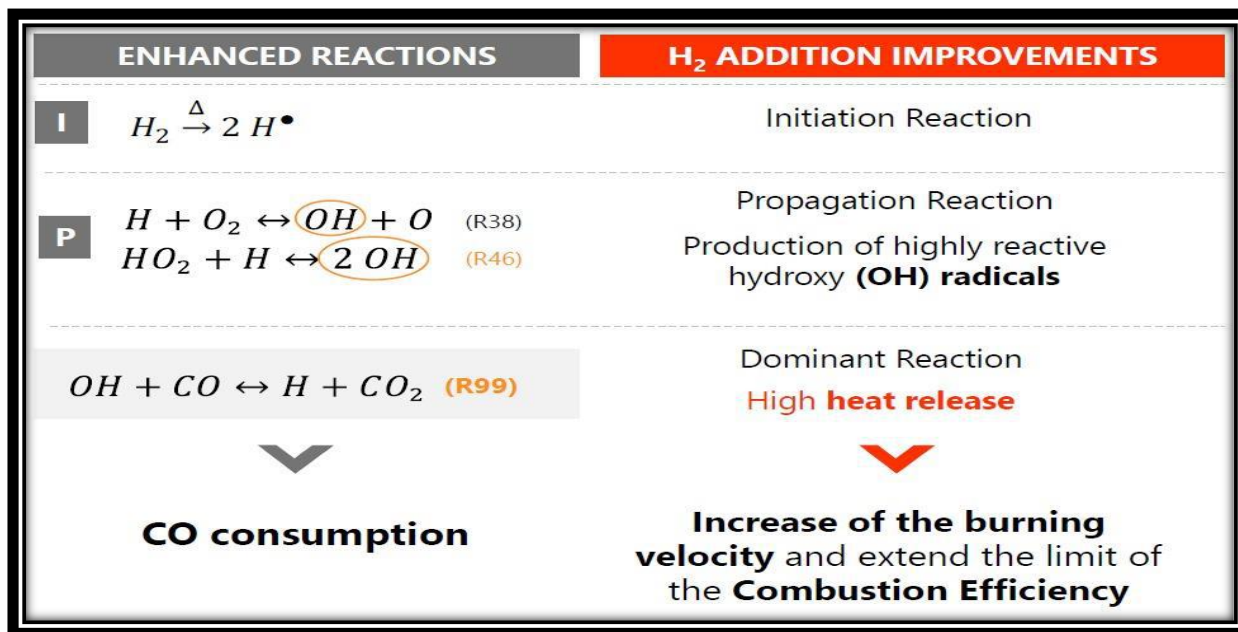


Figure 1: UC3 enhanced chemical reaction.

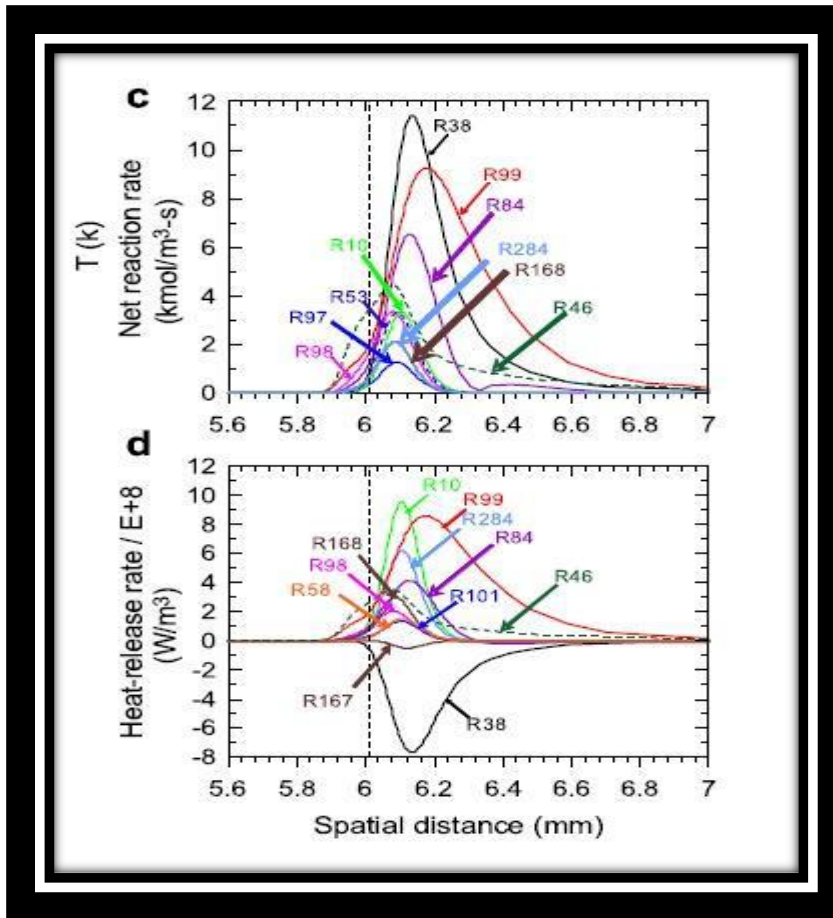


Figure 2: Heat release rate Y-axis and spatial distance X –axis.

Portland cement is an important material used in the construction industry. It is used in building works and most infrastructural development in Kenya. An increase in cement production in the country will create employment and help achieve the Big Four Agenda, especially affordable housing in the country.

Environmental Impacts and Mitigation Measures

The project has both positive and negative impacts .however; the negative impacts can be mitigated and monitored.

Positive environmental impacts

- Employment Opportunities

- Increase in the supply of cement for construction projects
- Increased revenue to government
- vision 2030
- High demand for cement manufacturing raw materials
- Support of the Local Businesses in the area of Mathatani and Mavoko Sub County

Negative environmental impacts

- Air Pollution
- Noise and Vibration
- Dust Generation
- Soil and Water Pollution
- Impacts on Ecology
- Water shortage
- Wastewater management
- Occupational injuries and or accidents

Proposed Technology to be used in the project

- The plant will utilize the latest technology, Verticle Roller mill (VRM) and UTIS-Ultimate Technology to Industrial Saving Technology
- UC3-Ultimate Cell Continuous Combustion technology that is efficient with minimal Co2 emissions
- The plant does not manufacture clinker, and therefore eliminating gaseous emissions associated with clinker production
- The plant does not manufacture clinker, and therefore most of the gaseous emissions are minimal
- The plant is powered by electric energy, therefore, minimizing air pollution associated with fossil fuels

Table 1a: below is a summary of potential negative environmental impacts and mitigation measures of the proposed cement grinding plant projects

ENVIRONMENTAL IMPACT	PROPOSED MITIGATION MEASURES
Noise Pollution	<ul style="list-style-type: none"> • Choosing quieter machinery provided with efficient silencers • Confining noise by isolating the source • Planting trees to create a wide green belt • Using the equipment having low noise emissions • Use equipment which is properly fitted with noise reduction devices • Restrict the operation during the night • Supply appropriate personal noise protection gear to
Dust/ Air Quality	<ul style="list-style-type: none"> • particulate emission in bulk is not encountered in grinding unit • Fabric filters based on the most modern technology are proposed to be installed to ensure that the dust emissions are within the prescribed limits and lower than 25mg/Nm³, which is compatible to the best international standards. • Good housekeeping and maintenance; • Use of air-conditioned, closed cabins; • Dust extraction and recycling systems; • Immediate removal dust and any other material which generate dust will be cleaned up and removed immediately • Particularly in exposed area the construction site will be dampened every 4 – 6 hours to prevent a dust nuisance. • Stored construction materials will be covered

<p>Solid Waste Management and Disposal</p>	<ul style="list-style-type: none"> • Traditionally the proposed operation of the plant is very efficient and does not generate/produce solid waste; • Recycle and reuse where applicable; • Segregate for appropriate disposal; • Process & technological improvement to minimize waste generations; • Material substitution to minimize waste generation; • Waste disposal as provided for in the Environmental Management and Coordination (Waste Management) Regulations, 2006;
<p>Storm Water</p>	<ul style="list-style-type: none"> • Storm water will be separated from process and sanitary wastewater streams; • Runoff will be minimized and the peak discharge rate be reduced (e.g. by using vegetated swales and retention ponds); • Oil water separators and grease traps will be installed and maintained as appropriate at refueling facilities, workshops, parking areas, fuel storage and containment areas
<p>Effluent Treatment and Waste Management</p>	<ul style="list-style-type: none"> • In the absence of any effluent produced in the grinding unit, there is no requirement of installing any effluent treatment plant. • There is no generation of any waste products or by products from the plant.

	<ul style="list-style-type: none"> •
Waste water disposal/water pollution	<ul style="list-style-type: none"> • The unit operation involved in cement grinding unit utilize water only • For external cooling and does not take part in the process in any manner to produce any water pollution.
Vegetation clearance	<ul style="list-style-type: none"> • Areas exposed soil will be replanted with grass as soon as possible after the site preparation and construction to mitigate against flash flooding and soil erosion. • Adequate temporary drainage channels will be constructed to help
Transportation/Traffic	<ul style="list-style-type: none"> • The new project is expected to increase the traffic along the access • Roads for transporting raw materials and finished product. Proper care will be taken to eliminate the dust generation.

<p>Environmental Impact</p>	<p>Proposed Mitigation Measures for gaseous emissions</p>
	<ul style="list-style-type: none"> • The plant will utilize the latest technology, Verticle Roller mill (VRM) and UTIS-Ultimate Technology to Industrial Saving Technology • UC3-Ultimate Cell Continuous Combustion technology that is efficient with minimal Co2 emissions • The plant does not manufacture clinker, and therefore eliminating gaseous emissions associated with clinker production • The plant does not manufacture clinker, and therefore most of the gaseous emissions are minimal • The plant is powered by electric energy, therefore, minimizing air pollution associated with fossil fuels
<p>Sulphur (Sox) gases</p>	<ul style="list-style-type: none"> • Fuel substitution (lower total sulfur), • Flue gas desulphurization (FGD). • Wet systems • targeted emissions reduction • Wet scrubbers • Dry scrubbers • raw material alkali/sulfur balance
<p>Environmental Impact</p>	<p>Proposed Mitigation Measures for gaseous emissions</p>

NOx Emissions	<ul style="list-style-type: none"> • Low NOx burner • Selective Catalytic reduction SRC • Selective Non-Catalytic reduction SRC • Exhaust Gas recirculation • NOx scrubbers • Catalytic converter • oxygen control (decrease), indirect firing
CO Emission	<ul style="list-style-type: none"> • UC3-Ultimate Cell continuous combustion technology • Good combustion practice, excess air (increase), • raw material substitution, • preprocessing system design and mixing air fan
CO2 Emission	<ul style="list-style-type: none"> • UC3-Ultimate Cell continuous combustion technology • suitable green belt development and production of cement • Improved thermal efficiency • Improved electrical efficiency, • Raw material substitution

The following arrangements for the control of pollution are considered:

Air pollution control

1. Installation of bag filters and bag house in the cement grinding section

2. Installation of bag filters in the cement storage section
3. Installation of bag filters in the packing section

All conveyors will be completely covered. Green belt development, Water sprinkling, concrete road, covered storage,

1. the bounded yard will be constructed for maintenance of Air Quality
2. Dust control measure - wetting of roads, dust screens, and equipment that generates low dust emissions
3. Efficient scheduling of deliveries to reduce traffic load
4. Maintaining stockpiles at minimum heights and forming long-term stockpiles into the optimum shape (i.e., stabilization) reduces wind erosion.
5. Establishing and enforcing appropriate speed limits overall unpaved surfaces.

Noise pollution control

1. Select low noise equipment, install mufflers at air inlets and outlets of the fans and air compressors;
2. Install sound insulation cover (room) for equipment with higher noise;
3. Place noisier sources farther away from sensitive receptors in the overall design;
4. Build 2 m high wall around the cement plant premises;
5. Grow high-rise and thick trees around the plant and quarry premises.

6. Proper route planning, traffic planning
7. Install high noise warning boards displayed in areas of noise levels and mandate ear protection in the identified high-risk area.
8. Noise level monitoring should be conducted regularly to ensure that noise levels during all times are within national noise exposure standards.

List of Pollution Control Equipment

- Main Bag House for Cement Mill
- Dedusting Bag Filters for raw material Hoppers
- Dedusting Bag filters for all transfer points
- Dedusting bag filter for all Silos
- Dedusting bag filter for cement extraction
- Packing Plant bag filter
- Enclosed Air Slides for conveying various raw materials and their Blowers
- DCS controls and instrumentation for all above equipments
- Compressed Air/Dryer System for all above equipment

CHAPTER 1: BACKGROUND INFORMATION

1.1 Introduction

The Proponent, **Mashujaa Cement PLC**, address **P.O. Box 43170-00100, Nairobi**, has proposed installing a **Cement Grinding Plant** on **Plot L.r No. 7885/17, 7885/18, 7885/19, 7885/20 at Mavoko Sub-County in Machakos County**. NEMA registered experts have been contracted to carry out consultation and prepare an Environmental and Social Impact Assessment Study Report (S.R.) for the proposed Cement Grinding Plant.

The proposed site will be specialized only for grinding and not manufacture of clinker; the material to ground are; Clinker, limestone Gypsum, and other additives. Clinker will be outsourced and transported using trucks and stored in the proposed site. The other additives, such as Pozzolana, will be sourced from the local area quarries. The proposed cement plant shall be adopting a state- of-art technology, Vertical Rolling Mills (VRM), which ensures minimum emission. Whatever little dust emission occurs, it is almost completely captured by using bag filters employing most modern technology. The Cement Plant will be powered by electrical energy, thereby minimizing the pollutants (heat-trapping gases) associated with nonrenewable sources of energy such as fossil fuel.

The proposed area is located on an area zoned, planned, and marked for industry development. The area is hosted by another similar neighboring character naming; National Cement Company Limited, Simba cement, Golden Africa Kenya Limited, and Muthaiga Gas Point. By enactment, processing and manufacturing industries, cement manufacturing plants, and lime processing operation is a prescribed activity as per the second schedule in section 58, of the Environment Management and Coordination Act, among other law enactments. Under these laws, any activity out of character with its surrounding which is likely to cause substantial impact to the environment in areas such as waste disposal, sustainable resource use, ecosystem's maintenance, social environment, land use, and water extraction; an Environmental and Social Impact Assessment (ESIA) study report is required to assess such impacts and propose mitigation measures.

By law, the project proponent must submit an ESIA report to NEMA for approval before commencing implementation of the project. By this report, the relevant government authorities can monitor impacts within the life span of the project on the immediate environment to enable major stakeholders of the project, including the government agencies, to manage the

environment for the community's well-being.

This ESIA Study report has been prepared based on the screening and scoping results, field visits, and information collected by project-affected persons. Both primary and secondary sources, including information provided by the project proponent, Mashujaa Cement PLC. This report is based on the General Guidelines for conducting ESIA's in Kenya as per environment (Impact Assessment and Audit) regulations, 2003 (amendments) 2019 gazette on 30th April 2019 under Legal Notice No. 31 and 32, which operationalizes the Environmental Management and Coordination Act, (EMCA) 1999.

Cement is a binding material used in the construction industry. It is used in building works and most infrastructural development in Kenya. An increase in cement production in the country will, directly and indirectly, create employment and help achieve the big four plan, especially the construction of affordable housing in the country.

Environmental concerns need to be part of the planning and development process and not an afterthought. The cement industry is a heavy industry with a lot of waste in heat energy, dust, and other product materials. It requires project-affected (P.A.) persons to be consulted through the EIA process. The participation of the project neighbors is critical to avoid any future concerns which could be sorted out during the EIA process. It's having this in mind that the Proponent undertook this EIA Study report and incorporated environmental concerns as advised by the experts. Finally, a comprehensive Environmental Management/Monitoring Plan (EMP) is mandatory for this magnitude and nature project to guide construction, operation, and decommissioning.

1.2 Project Justification

There is evidence to support justification for the proposed Cement Grinding plant project in many aspects. Eco-friendly cement manufacturing technologies have been developed. There is also high demand for Portland cement in the country. Over the past ten years, it is noted that many construction projects are going on around the country and in the eastern Africa region. The project revolves around infrastructural developments, civil and building works notably, the many houses being developed every day.

This follows due to the high demand for decent, affordable housing in the country, as evidenced by the high rent fees charged for housing.

The project also helps to achieve the Kenya Vision 2030 that aims to transform Kenya into a newly industrializing, middle-income country providing a high quality of life to all its citizens by 2030 in a clean and secure environment. This entire project requires readily available construction material inputs. Cement is one of the key raw materials used as a binder in concrete works. The demand for decent, affordable houses cannot be achieved without readily available Portland cement. In this view, the Proponent has the vision to establish the cement grinding plant to produce 1 MTPA (one million ton per Annum) The Proponent plans to increase the cement production to a higher number in the future.

1.3 Scope and Criteria of the Environmental Impact Assessment Study

The scope of the proposed Cement Grinding Plant Project will involve the installation of the Vertical Cement Grinding Mills and its auxiliary machinery and equipment such as materials feed hoppers, transport conveyors, and cement storage. This well indicated in the design layout. Other key installations include water tanks, staff structures, parking area.

1.4 The objective of the Environmental Impact Assessment

The proposed project aims to put up an eco-friendly and sustainable Cement Grinding Plant That will involve the grinding and packaging of the overall cement production process to produce 1 MTPA (one million ton per Annum) of Portland cement. The Proponent has also planned to increase production in the future.

1.5 Terms of Reference (TOR) for the EIA Study Process

The scope of the assessment covered implementation works of the proposed Mashujaa Cement Grinding Plant development which included, ground preparation, excavations construction and/or installations as well as associated utilities required by the project. The output of this work was a comprehensive Environmental Impact Assessment Study report for the purposes of applying for an EIA licence. The main objective of the assignment was to assist the project proponent to prepare an EIA Study report for the proposed project and take into consideration appropriate measures to mitigate any adverse impacts to the environment. The assessment identified existing and potential environmental impacts and possible concerns that interested and/or affected parties have with the development, as well as the associated prevention and mitigation measures for the negative impacts as stipulated in the Environmental Management Plan (EMP) proposed.

The consultant on behalf of the project proponent conducted the assessment by incorporating but

not limited to the following terms of reference: -

- Location of the proposed project site;
- A concise description of the national environmental legislative and regulatory framework, baseline information, and any other relevant information related to the project;
- The objectives of the proposed project;
- The technology, procedures and processes to be used, in the implementation of the project;
- The materials to be used in the construction, installations and implementation of the project;
- The products, by-products and waste to be generated by the project;
- A description of the potentially affected environment;
- The environmental effects of the project including the social and cultural effects and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated;
- Provide alternative technologies and processes available and reasons for preferring the chosen technology and processes;
- Analysis of alternatives including project site, design and technologies;
- An environmental management plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment, including the cost, timeframe and responsibility to implement the measures;
- Provide an action plan for the prevention and management of the foreseeable accidents and hazardous activities in the cause of carrying out development activities;
- Propose measures to prevent health hazards and to ensure security in the working environment for the employees, residents and for the management in case of emergencies;
- An identification of gaps in knowledge and uncertainties which were encountered in compiling the information;
- An economic and social analysis of the project;
- Such other matters as the Authority may require.

1.6 Data Collection Procedures

First, the consultant undertook environmental screening and scoping to avoid unnecessary data. The data collection was carried out through consultations with the proponent representatives, administration of questionnaires, observations and photography, site visits, desktop environmental studies, and scientific tests, where necessary in the manner specified in Part V (section 31-41) of the Environmental (Impact Assessment and Audit) Regulations, 2003.

1.7 EIA Organization and Structure

The EIA was carried out to full completion under the guidance of the lead expert who coordinated the day-to-day functions and any related institutional support matters. Otherwise, all requirements by NEMA concerning the assessment were formally communicated to the project proponent.

1.8 Reporting and Documentation

An Environmental and Social Impact Assessment Study report from the findings was compiled under the guidelines issued by NEMA for such works and was prepared and submitted by the project proponent for consideration and approval. The consultant ensured regular briefing of the proponent during the exercise. Drawing plans and relevant documentation are part of the appendices.

Responsibilities and Undertaking

The team undertook to meet all logistical costs relating to the assignment, including those producing the report and any other relevant material. The consultant arranged for their transport and travels during the exercise. On the proposed Cement Grinding Plant site, the Proponent provided a contact person(s) to provide the information required by the team. The Proponent also provided the design layout and the actual sizes of the site, future development plans, operation permits, baseline data, and land-ownership documents, and estimated project cost.

The output from the consultants includes the following: An Environmental and Social Impact Assessment Study Report comprising of an executive summary, study approach, baseline conditions, anticipated impacts, and proposed mitigation measures. An Environmental Management Plan outlines, which also forms part of the report recommendations.

1.9 Methodology Outline

Since the proposed site is located within an industrial zone, with no rich natural resources whose total effect on the surroundings could not be adverse and noting that the intended development and use of the facility will be in line with what exists in the surrounding areas, an environmental Study report is seen to be adequate. The general steps followed during the assessment were as follows:

1.9.1 Environmental Screening

The step was applied to determine whether an Environmental and Social Impact Assessment Study report was required and the necessary level of assessment. This was done about

requirements of the EMCA, 1999, and specifically the second schedule. Issues considered include the physical location, sensitive issues, and nature of anticipated impacts.

1.9.2 Environmental Scoping

The scoping process helped narrow down the most critical issues requiring attention during the assessment. Environmental issues were categorized into physical, biological/natural/ecological and social, economic, and cultural aspects.

1.9.3 Desktop Study

It included a documentary review on the nature of the proposed activities, project documents, design policy, legislative framework, and the environmental setting of the area, among others. It also included discussions with the proponent's representatives and design engineers and interviews with neighboring communities.

1.9.4 Site Assessment

Field visits were meant for physical inspections of the site characteristics and the environmental status of the surrounding areas to determine the anticipated impacts. It also included further interviews with random members of the surrounding.

1.9.6 EIA Public Participation

In ensuring adequate public participation in the EIA process, questionnaires were administered. Face-to-face interviews and focused group meeting at the venue, **Athi River Sub-County in Mathatani Sub-Location Chief's Camp** were carried out to seek public views towards the proposed project and any anticipated effects of the project on the surrounding. The Focused group discussions were held on **18th and 21th of May 2021**.The information gathered was subsequently synthesized and incorporated in the ESIA Study report.

1.9.7 Reporting

In addition to the regular briefing of the client, this environmental impact assessment study report was prepared. The contents were presented for submission to NEMA as required by Kenyan environmental laws and regulations.

CHAPTER 2: PROJECT DESCRIPTION AND DESIGN

2.0 Kenya's Cement Sector

The proponent, Mashujaa Cement PLC, has proposed constructing the **Mashujaa Cement**

Grinding Plant on Plot L.r No.7885/17, 7885/18, 7885/19, 7885/20 at Mathatani, Mavoko Sub-County in Machakos County. The company has contracted registered NEMA EIA/EA experts to carry out an Environmental and Social Impact Assessment Study Report (ESIA) for the proposed cement plant. Mashujaa Cement Plc is a company incorporated in Kenya and having a registered office address, **P.O. Box 43170-00100, Nairobi**. The proposed Cement Grinding Plant has an initial target of grinding and packaging the overall cement production process to produce 1 MTPA (one million ton per Annum) of Portland cement. The proposed project will comprise the construction of the Cement Grinding Plant, raw material storage area, administrative, and other related infrastructure. The proposed site location for the cement plant was realized after conducting an initial feasibility study which culminated on the proposed site as the best on matters economic and environmental sustainability.

The proponent, Mashujaa Cement Plc, has a team of competent and experienced directors with vast knowledge in the extractive industry. The company has also employed qualified and experienced staff in areas of mining and mineral processing industries.

2.1 Physical location and size of the project

The proposed **Mashujaa Cement Grinding Plant** is located at Mathatani, Mavoko Sub-County in Machakos County and on Plot Lr. **7885/17, 18, 19, & 20** and about 800m off Mombasa Road. The land is owned by Mashujaa Cement PLC. The proposed project location site is compatible with the surrounding land use, which has similar industries and factories. It is envisaged that the proposed Plant will alleviate unemployment for the Mathatani and Athi River area people.



Figure 3: A photo image of the proposed site.

The site location is easily accessed by road driving along Mombasa Road. As you drive from Nairobi along Mombasa Road, you go past National Cement Company Limited, Golden Africa Limited. About 1.1km past Golden Africa Ltd, you arrive at murram road next to HU Ming PVC Company Ltd, and then drive along the murram road off Mombasa Road. About 800m drive, you arrive at the proposed site on plot Lr. No. **7885/17, 18, 19, & 20**. The site is on GPS Coordinates **1°30'13.0"S 37°04'15.7"E, (-1.503611, 37.071028.)**

2.2 Google earth map for the proposed site area

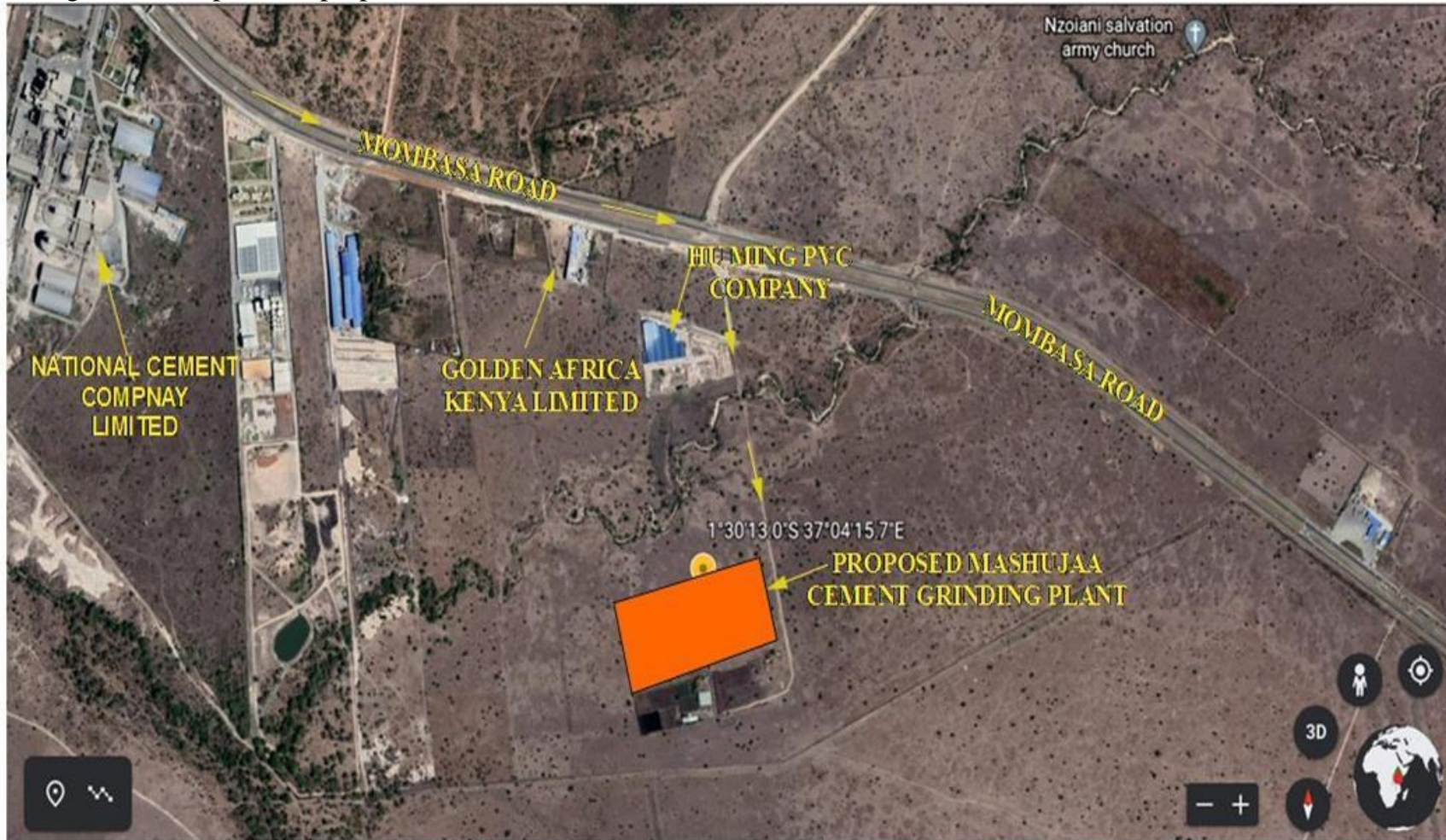


Figure 4: A map depicting the neighboring character

2.3 Sketch map to access the proposed site area

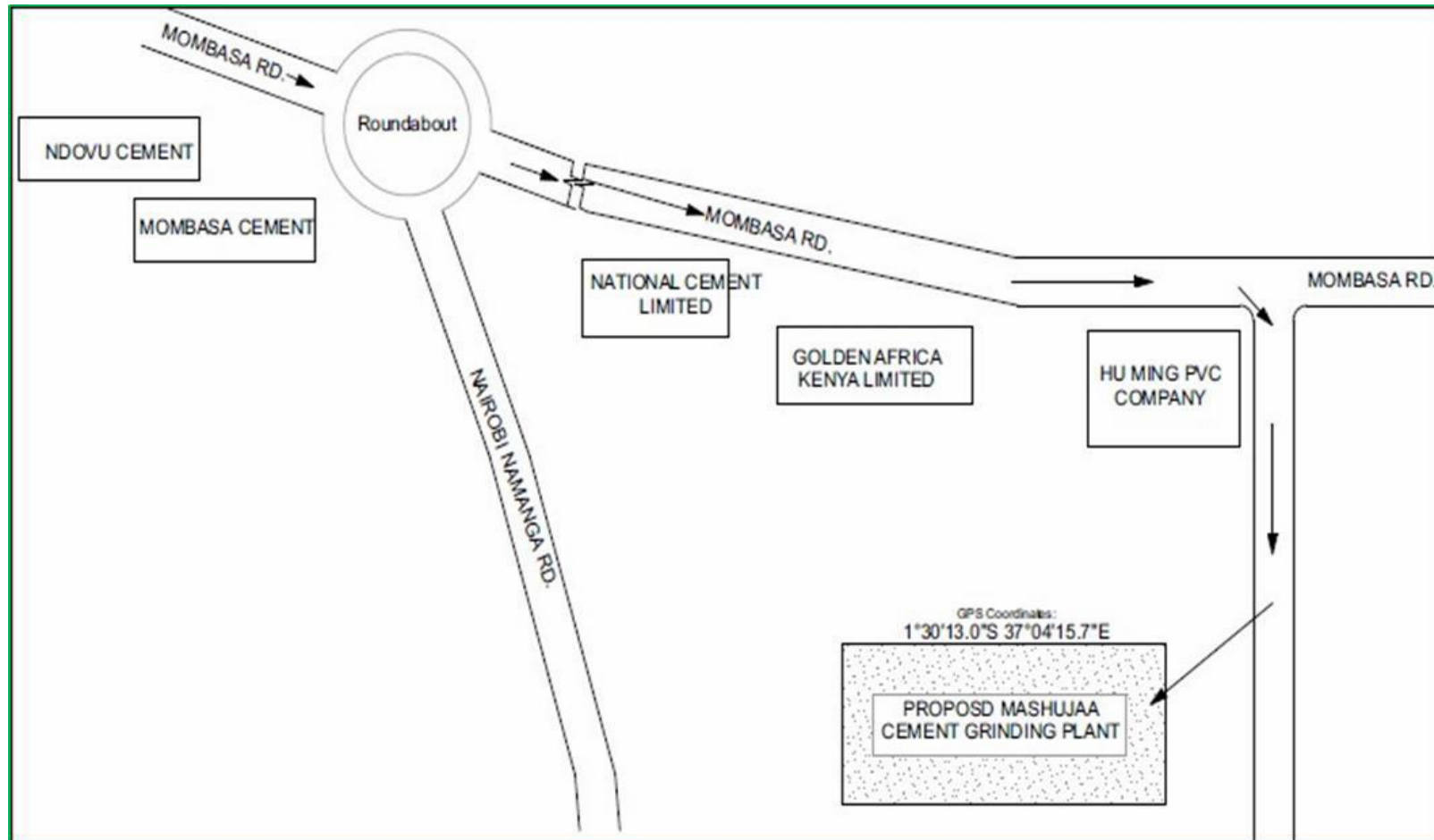


Figure 5: A sketch map for the proposed site.

2.4 Roads

The main access road to the proposed Mashujaa Cement Grinding Plant is the Nairobi-Mombasa highway. The other main river in the Athi river area is the Nairobi-Namanga Road. Most roads are tarmacked and in good condition apart from the proposed site access road. The site is accessed by 12m width murram road access. All the streets have a sound drainage system.

Current Status of the Project Site

There is no development in the proposed site area. The perimeter survey boundary beacon marks the site. Bush grass has dominated most of the land, with someplace having bare soil with no vegetation cover.

2.5 Project Budget

The total budget for the proposed project is estimated to cost KShs 3,787,000,000.00 (Three billion, seven hundred and eighty seven million Kenya Shillings only). This amount will be distributed to various project activities that include; land, builders' work, electrical services installations, mechanical service installations, external works, water reticulation and drainage services, site installations, preliminaries, and contingencies.

2.6 Project activities to be undertaken;

The construction activities shall involve engineering works; civil, mechanical, and electrical as here on:

- Site clearance and preparation
- Normal excavation of soil and filling with hardcore
- Laying of foundation slab and walling
- Putting up the cement grinding plant as per the engineer's design
- Plastering and painting on masonry works
- Landscaping
- Storm water and drainage construction
- Laying of the pavement blocks
- Installation of electrical works
- Government inspection/ relevant permit, licensing, and completion of works
- Commencing of plant operation works

2.7 Objectives of the Project

The ultimate objective for the Environmental and Social Impact Assessment (ESIA) Study Report for Mashujaa Cement Grinding Plant in compliance with the Environmental Management and Coordination Act (EMCA) 1999 (amendments), the Environmental (Impact assessment / Audit) (Amended) Regulations, 2019 gazette on 30th April 2019 under Legal Notice No. 31 and 32 is structured to ensure sustainable project development.

2.8 Environmental and Social Impact Assessment Consultant

The proponent has contracted NEMA registered experts to carry out consultation, referred to as the consultants 'with a team of experts with a proven track record of excellence focusing mainly on environmental management, mining, mineral processing, and manufacturing industries, earth sciences, and, engineering projects. The team of experts has experience preparing quality Environmental Impact Assessment and Audit Reports that go a long way in ensuring sustainable projects development and utilization of natural resources.

2.9 EIA Team of Experts

The team of experts comprised the following professions;

Table 2: Team of specialists

Sr./No.	Name	QUALIFICATION
1.	Purity Muthoni Njeru	Masters of Science in Occupation Safety and Health; Bachelor of Science Environmental Studies Science (science)
2.	Wilson Irungu Kamande;	BSc. Mining and Mineral Processing Engineering Environmental; Impact Assessment and Audit EIA/EA
3	Joseph Githaiga;	BSc. Industrial Chemistry with management.
4	Dennis Masivayi Wekhuyi	Bachelors in Tourism Management, Diploma Wildlife and Conservation Management.
5.	Ngumbao Mwabaya	Bachelor of Arts in Economics and Sociology- Second Class Upper Division
6.	Honorata Muthoni Ngungi	Bachelor of Arts in Peace and Conflict Studies.

3.0 The Scope of Work Undertaken

The Environmental and Social Impact Assessment Report has covered the following:

- Project Objectives
- Complete description of the existing site location proposed for the cement grinding plant.
- Anticipated critical environmental issues of concern by presenting baseline data, which should include social, cultural, and heritage considerations. Assess public views and concerns of the proposed cement grinding plant.
- Relevant Policies, Legislation, and Regulations relevant to the proposed cement grinding plant.
- Potential negative and positive impacts of the project on the described environment, including direct, indirect, and cumulative impacts, and their relative importance to the design of the cement grinding Plant.

- Possible mitigation measures to minimize predicted adverse environmental impacts if necessary and quantify associated costs.
- Environmental and social management plans for the projects.
- The Environmental and Social Monitoring Plan that will ensure that the mitigation plan is adhered to.
- The available alternatives to the project are considerate to the proposed site or any other location, including a no-action alternative.
- Conclusions and recommendations

3.1 Project design

The tentative layout of the proposed cement plant will be as follows;

- The Cement Grinding Plant area
- The raw material area
- Store
- Parking
- Security
- Electrical control room
- Shed for park material
- Office building
- Water tank

3.2 Tentative layout of the proposed project;

Environmental and Social Impact Assessment Study Report for the Proposed Mashujaa Cement Grinding Plant ` Plot L.r No. 7885/17, 7885/18, 7885/19, 7885/20 at Mathatani , Mavoko Sub-County in Machakos County.

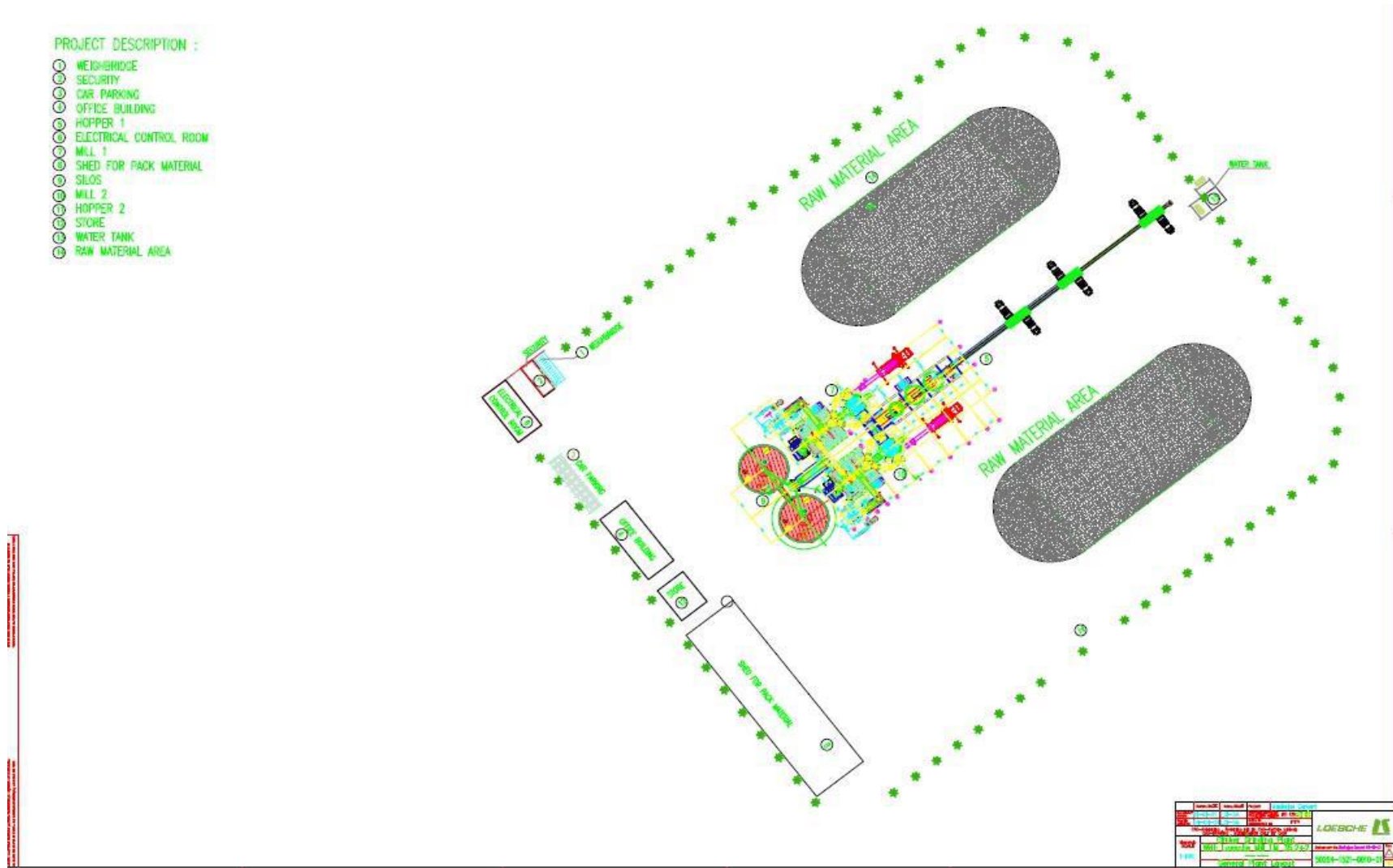


Figure 6: Tentative layout of the proposed project

The project will involve the installation of the Cement Grinding Plant. And other auxiliary equipment such as materials feed hoppers, transport conveyors, and cement storage silo. The cement grinding plant will be grinding and package the overall cement production process to produce 1MTPA of Portland cement. The process will consist of cement grinding (clinker (primary raw material), size reduction, and other additives) and cement packing and dispatch. Clinker will be transported to the proposed plant site by covered trucks. The Clinker will be stored on hardstands on the ground and covered under polyethylene sheets. It will be transferred to silos, where it will be stored before grinding. A small portion of limestone required will be sourced from nearby quarries. Electronic weigh feeders will introduce the Clinker into a grinding mill with other additives to produce cement. Cement grinding will be performed by a vertical roller mill in a close circuit. The mass balance on this process manages potentially no waste. All input raw materials of Clinker, limestone, and gypsum will be wholly used, thus excluding waste which may be generated as a result of materials handling (spillages and as a result of dust). It is anticipated that there will be no waste from the overall general cement grinding and bagging process.

The cement plant will be virtually free of water pollution as no effluents are involved. Even as regards air pollution, which basically can be caused by both particulates and undesirable gases, the plant operation ensures practically no emission of gaseous substances, whereas adequate numbers of dust collectors are installed in order to keep the particulate emission within acceptable limits all the points of dust generation during the process of cement manufacturing.

Keeping the above philosophy in view, the proposed cement plant will be adopting a state-of-art technology, which ensures minimum emission, and whatever negligible dust emission takes place, it is almost completely captured by using bag filters employing most modern technology.

A very substantial part of the Project Cost shall be earmarked for pollution control devices to ensure negligible dust emission to do this project a model unit from environmental protection and pollution control point of view.

3.3 Sources of power

The Proposed Cement Grinding Plant will be powered by an electrical power supply network from Kenya Power. There will be electrical works such as installation of electrical gadgets and appliances including electrical cables, lighting apparatus, sockets, among others. Stand by electrical power generators will also be installed to support the emergency requirement during the power interruptions.

3.4 Selection Criteria of Grinding Equipment

Cement/Slag Grinding can be done by following methods.

3.4.1 Ball Mill System

The ball mill system consists of a cylindrical shell with liners and grinding media in terms of steel balls of sizes ranging from 20 mm to 90 mm are filled in the shell. The shell rotates; the balls will be lifted as per the trajectory of liners and will fall. The impact of fall will crush the material and generates fine powder. These fine powder are further classified in air separator, and acceptable fines are taken out as cement, and coarse material is recirculated back to the mill as reject. Because of impact actions, the power consumption of the ball mill system is very high, and also the sound pollution is increased to the tune of 110-115 dB at 1 M distance.

3.4.2 VRM System

Vertical Roller mill (VRM) is the latest technology grinding equipment compact, and the principle of grinding is by crushing through attrition. The material will be crushed between the rotating roller and table, thereby considerably reducing power consumption and noise. The mill has an inbuilt separator so that the material is redirected to the table inside the mill itself. Hence, conveying equipment and transfer points are eliminated, thereby reducing air pollution to a great extent. Also, the mill building is tiny (1/3rd of the ball mill), thus reducing the steel and cement consumption compared to the ball mill.

3.6.1 Environmental Advantages of Vertical Roller Mill:

Vertical Roller mill has the following unique advantages over ball mill

- a) Lesser power consumption (1/3rd reduction in power)
- b) Lower noise pollution, i.e < 85 dB compared 115 dB of ball mill
- c) Lesser consumption of steel and cement in the construction of the building

d) Few types of equipment, thereby avoiding many conveying and transfer points, thereby reducing fugitive dust.

Lower power consumption and lesser footprint will result in lower carbon footprint and thus become more environments friendly. Similarly, lower noise pollution will ensure compliance with the noise pollution standard limits. Adequate high capacity bag filters are used to provide dust emission below 25mgm/Nm³, and also, dust generation source points are reduced in the VRM circuit due to lesser transport and transfer points.

In general, project design will essentially optimize using the best available technology to prevent or minimize potentially significant environmental impacts associated with the project and incorporate efficient operational controls and trained staff to ensure high-level business and ecological performances.

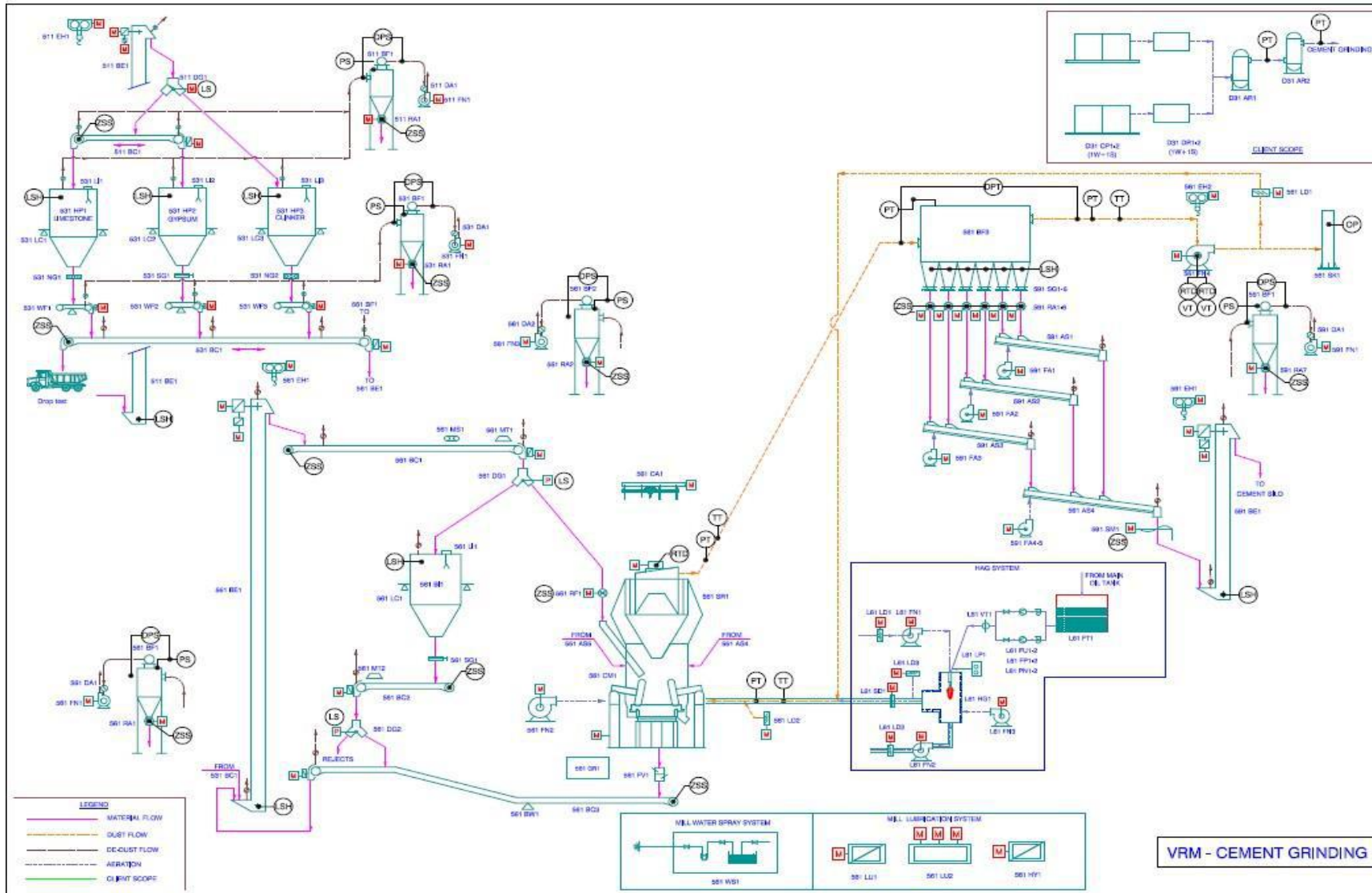


Figure 7: Vertical Roller Mill Cement Grinding Process

3.7 UC3-Ultimate Cell Continuous Combustion Technology

The project proponent for the proposed Mashujaa cement grinding plant has proposed to use the most modern technology developed by the company, Ultimate Technology to Industrial Saving,-UTIS, UC3 -Ultimate Cell Continuous Combustion technology) The technology chemically breaks and injects H₂ and O₂ into the combustion stream intensifying the combustion and thereby increasing its efficiency and lowering the co₂ emission gases. In summary, the technology is known to reduce the amount of fuel consumption, speed up combustion, reduce exhaust emissions, increase productivity, and ensure safety and reliability and 24-hour control with an emergency control`

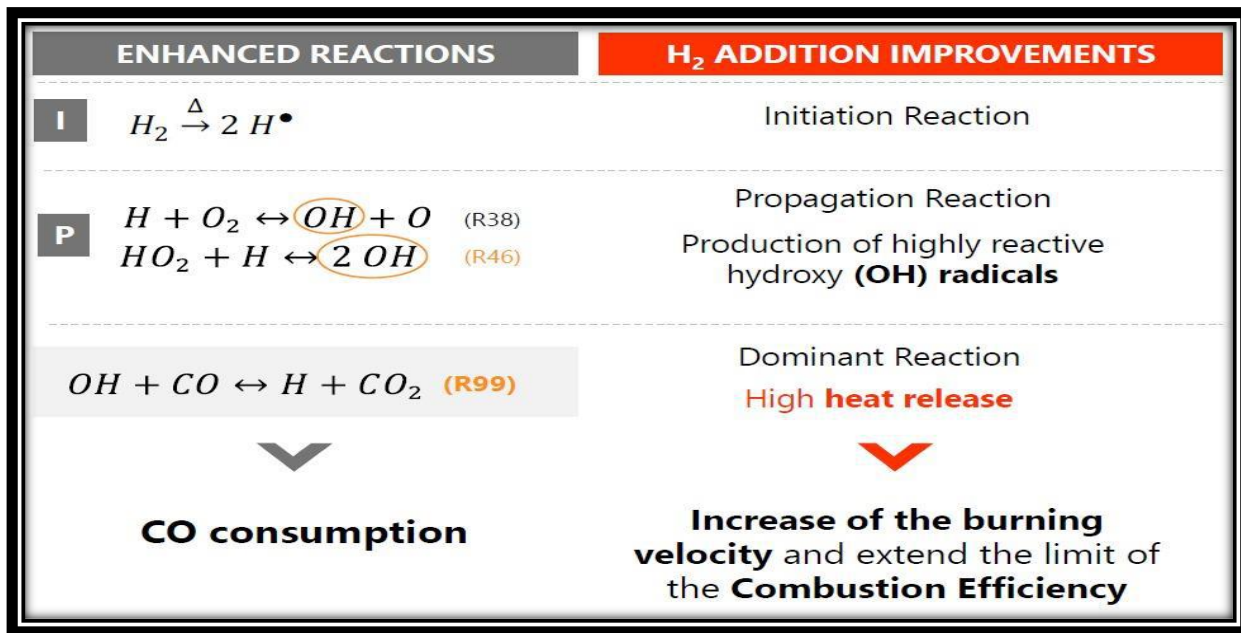


Figure 8: UC3 enhanced chemical reaction: Source UTIS Co.

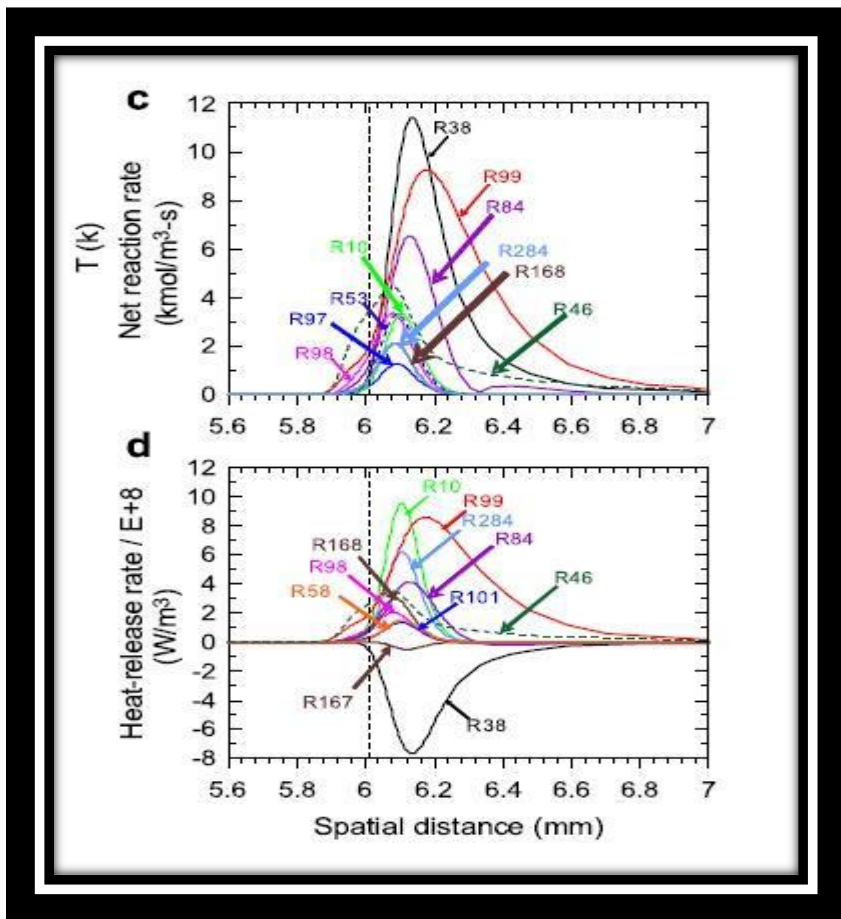


Figure 9: Heat release rate Y-axis and spatial distance X-axis: Source UTIS Co.

Table 3 - Technical Specifications of UC3: Source UTIS Co.

Designation:	ULTIMATE CELL® CONTINUOUS COMBUSTION
Manufacturer:	ULTIMATE CELL, LDA Rua Marciano Tomaz da Costa 24, Arm. 5 2739-510 Cacém – Sintra PORTUGAL
Product Version:	UC3 - 1, UC3 - 2.6, UC3 - 3.7, UC3 - 5 e UC3 - 10
Usage:	Continuous Combustion
H₂ Supply flow:	Up to 10 Nm ³ /h
O₂ Supply flow:	Up to 5 Nm ³ /h
Purity:	99.5%
Pressure:	Up to 10bar
Power Supply:	380 to 480 VAC, 3-phase, 50 or 60 Hz
Maximum Power Consumption:	Up to 80kW
Cooling:	Cooled Liquid with Chiller
Sizes (C x L x H):	Container with 6,20x3,00x2,90m
Weight:	Aprox. 3 ton
Public water system consumption:	Up to 20L/h
Source:	Drinking water
Conductivity (µS/cm to 20°C)	< 1400
Maximum FI	< 10
Free Chlorine (ppm)	< 0,5
Heavy metals (ppm)	< 0.05

Silica (ppm)	< 30
Temperature (°C)	1 a 35
Pressure (bar at 5 lpm)	> 2

3.7.1 UC3 System

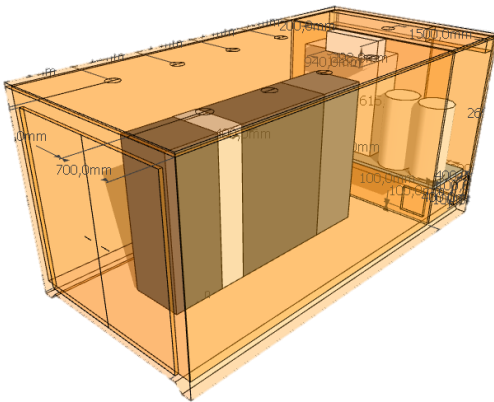


Figure 10 – 3d view of the UC3 System: Source UTIS Co.

The Ultimate Cell Continuous Combustion system is designed to optimize combustion in Continuous Combustion Industrial applications such as cement, glass, paper pulp, steel, large energy plants, etc. The system is based on an internationally patented technology, of exclusive production, unique in the market. The UC3 systems (UCCC - Ultimate Cell Continuous Combustion) were developed, using a PEM (Proton Exchange Membrane) electrolysis system, exclusively designed for application in industrial environments and to be installed as an easy connection to existing industrial processes.

The system integrates an automatic electrolyte production unit, which is fed from tap water source. The electrolyte, once produced, is fed to a PEM (Proton Exchange Membrane) system to produce in a controlled and safe way, hydrogen and oxygen in independent stainless pipes. These gases will be introduced in the air transport pipes, in order to be transported to the fuel injection points, ending in the continuous combustion burners.

The entire system is supplied fully automated with cutting edge technology, with a local command via an HMI console or remote control via TCP/IP Mod Bus or Internet, equipped with an automatic system for fault detection, an alarm for H2 leak detection and protected by an emergency stop, complying with all the international standard regulations for this type of equipment.

It has a production capacity up to 10 Nm³/h of H₂ and up to 5 Nm³/h of O₂ with a purity of 99,5% at a pressure of up to 10 bars. The water feed system works with a minimum pressure of 2 bar and with consumptions of up to 20 L/h. It is also electrically powered (380 to 480 VAC, 3-phase, 50 to 60 Hz), with a consumption that can vary up to a maximum of 80 kW. The whole system is internally cooled, with liquid coolant from a chiller

The system adopts the “plug and play” form of a container, whose dimensions are (W x L x H) 6,20mx3, 00mx2, 90m, having an approximate weight of 3.000 kg.

The entire installation requires only the electrical connections, communication, tap water supply and exhaust to ensure its normal operation to optimize any continuous combustion system resulting in significant fuel consumption reductions, and suppression of harmful gas emissions from combustion. Case by case, additional other benefits can be achieved, as the reduction or almost total elimination, of ammonia consumption in the case of the cement industry

3.8 Description of the project’s Construction and Installation activities

3.8.1 Pre-construction investigations

The implementation of the project’s design and construction phase will start with a thorough site investigation, soil, chemical, and physical properties, and water table level determination.

3.8.2 Construction Materials and Equipment

Greater emphasis will be laid on the procurement of construction materials and equipment from within the local area, which will make both economic and environmental sense as it will reduce negative impacts of transportation of the materials and equipment to the project site through a reduced distance of travel by the materials transport vehicles. These materials and equipment will be transported to the project site from their extraction, manufacture, and storage sites using trucks. The construction materials to be used in the construction of the project will be sourced from Nairobi and the surrounding areas. Some of the specialized equipment will be imported from outside Kenya.

3.8.3 Storage of Materials

Provision for storage of construction materials and equipment will be provided on-site. Bulky materials such as rough stones, ballast, sand, and steel will be carefully piled on site. To avoid

piling large quantities of materials on-site, the project proponent will order bulky materials such as sand, gravel, and stones in quotas. Materials such as cement, paints, and glasses; and equipment will be stored in storage structures that are already within the project site for this purpose.

3.8.4 Excavation and Foundation Works

At the proposed project site, excavation works will be carried out to set up a foundation for the Plant and other equipment. This will involve the use of heavy earth-moving machineries such as tractors and bulldozers.

3.8.5 Masonry, Concrete works, and related activities

The construction of the foundations, structural frames, pavements, drainage systems, perimeter fence, among other components of the project, will involve a lot of masonry work and related activities. General masonry and associated activities will include concrete mixing, plastering, slab construction, construction of foundations, and erection of structural frames, and curing of new concrete surfaces. These activities are known to be labour intensive and will be supplemented by machinery such as concrete mixers.

3.8.6 Electrical work

During construction of the proposed development, electrical work will include installing electrical gadgets and appliances, including electrical cables, lighting apparatuses, and sockets; in addition, there will be other activities involving the use of electricity such as welding and metal cutting.

3.8.7 Landscaping

The proponent will carry out landscaping to improve the site's aesthetic value or visual quality once construction ceases. This will include the establishment of flower gardens and flourishing grass lawns and will involve replenishing the topsoil. It is noteworthy that the proponent will use plant species available locally, preferably indigenous ones, for landscaping.

3.9 Description of the Project's Operational Activities

3.9.1 Mashujaa Cement Grinding Plant

The operations phase of the Proposed Cement Grinding Plant will involve grinding and bagging of

Portland cement. The cement production process is targeted to produce 1MTPA of Portland cement. The process will consist of the cement grinding Clinker as the basic raw material, size reduction, and other additives; Gypsum, Pozzolana and cement packing, and dispatch. Clinker will be transported to the proposed plant site by covered trucks. There will be storage of Clinker on hardstands on the ground and covered under polyethylene sheets. It will be transferred to silos, where it will be stored prior to grinding. A small portion of limestone required will be outsourced from nearby quarries. Electronic weigh feeders will introduce the Clinker into a grinding mill with other additives to produce cement. Cement grinding will be performed by a vertical roller mill in a close circuit. The mass balance on this process manages potentially no waste. All input raw materials of Clinker, limestone, and gypsum will be completely used, thus excluding waste which may be generated as a result of materials handling (spillages and as a result of dust). It is anticipated that there will be no waste from the overall general cement grinding and bagging process.

3.9.2 Sustainability Technologies to be used

As discussed above, the technology to be used for the proposed cement grinding plant is that of Vertical Rolling Mill (VRM)

3.9.2.1 VRM System

Vertical Roller mill (VRM) is the latest technology grinding equipment compact, and the principle of grinding is by crushing through attrition. The material will be crushed between the rotating roller and table, reducing power consumption and noise. The mill has an inbuilt separator so that the material is redirected to the table inside the mill itself. Hence, conveying equipment and transfer points are eliminated, thereby reducing air pollution to a great extent. Also, the mill building is tiny (1/3rd of the ball mill), thus reducing the steel and cement consumption compared to the ball mill.

Vertical Roller mill has following unique environmental advantages over ball mill

- a) Lesser power consumption (1/3rd reduction in power)
- b) Lower noise pollution i.e. < 85 dB compared 115 dB of ball mill
- c) Lesser consumption of steel and cement in the construction of the building
- d) Few types of equipment thereby avoiding many conveying and transfer points, thereby reducing fugitive dust

Lower power consumption and lesser footprint will result in lower carbon footprint and thus become more environments friendly. Similarly, lower noise pollution will ensure compliance with the noise pollution standard limits. Adequate high capacity bag filters are used to provide dust emission below 25mgm/Nm³, and also, dust generation source points are reduced in the VRM circuit due to lesser transport and transfer points.

3.9.3 Emissions and Controls

Particulate matter, consisting primarily of cement, Clinker, Pozzolana, Limestone, and Gypsum dust but including some aggregate and sand dust emissions, is the primary pollutant of concern. In addition, there are emissions of metals that are associated with this particulate matter. All but one of the emission points is fugitive. The only point sources are the transfer of cement and pozzolan material to the mill, and these are usually vented to a fabric filter or sock. Fugitive sources include the transfer of raw materials, truck loading, vehicle traffic, and wind erosion from sand and aggregate storage piles. The number of fugitive emissions generated during the transfer of sand and aggregate depends primarily on the surface moisture content of these materials.

Types of controls used may include water sprays, enclosures, hoods, curtains, shrouds, movable and telescoping chutes, central duct collection systems, and the like. A significant source of potential emissions, the movement of heavy trucks over unpaved or dusty surfaces in and around the Plant, can be controlled by good maintenance and wetting of the road surface. The project proponent will provide facilities for handling solid waste generated within the Plant. A licensed garbage collector will be contracted by either the proponent or the County Government. There will be dust bins/skips/receptors for temporarily holding waste within the premises before final disposal at the city's designated dumping site. Wastewater from the offices will be directed into the sewer system.

3.9.4 Cleaning

The proponent will be responsible for the cleaning of the Plant, the parking areas, and the compound, among other areas. Cleaning operations will involve the use of water, disinfectants, and detergents.

3.9.5 General repairs and maintenance

The proposed Nairobi Grinding Plant (NGP) Capacity Increase project and associated facilities will be repaired and maintained regularly during the project operation phase. Such activities will include repairs of silos and

machinery, repairs and maintenance of electrical gadgets, and equipment repairs.

3.10. Description of the project's decommissioning activities

3.10.1 Demolition works

Upon decommissioning, the project components, including equipment, grinding mill, pavements, drainage systems, staff and parking areas, and perimeter fence, will be demolished. This will produce a lot of solid waste, which will be reused for other construction works, and those not reusable will be disposed of appropriately by a licensed waste disposal company.

3.10.2 Dismantling of equipment and fixtures

All equipment, including electrical installations, furniture, finishing fixtures partitions, pipe-work, and sinks, among others, will be dismantled and removed from the site on decommissioning of the project. Priority will be given to the reuse of this equipment in other projects. This will be achieved through the resale of the equipment to other contractors.

3.10.3 Site restoration

Once all the waste resulting from demolition and dismantling works is cleared from the site, the site will be restored by replenishing the topsoil and re-vegetation using indigenous plant species.

3.11 Factors, Components, and Activities of the Proposed Cement Grinding Plant

The study's objective was to provide a comprehensive description of the proposed project and the surrounding environment, specifying any information necessary to identify and assess the environmental impacts of the cement grinding plant. This includes project objectives and information on the rationale for the project and background, nature, location/existing setting, timing, duration, frequency, general layout, and other impacts on the surrounding communities, pre-construction activities, construction methods, works, and time, and post-construction plans. An accurate and detailed description of raw material inputs. The technology and processes to be used, as well as products and by-products. In addition, areas to be reserved for construction and areas to be preserved in their existing state as well as activities and features which introduce risks or generate impact (negative and positive) on the environment. The report has undertaken the assessment of all the factors and activities related to the projects.

Such factors and activities include:

4.3.1 Factors:

A description and assessment of the location of the land, the land use characteristics, including the planned use of the land and description of the existing land use and their patterns within 3-km radius from the boundary of the Project area and project characteristic

4.3.2 Activities:

Description and assessment of the specific phases and activities; including timing and location, for:

- i)** Pre-construction (planning) phase (Design Plan preparation and seeking of the appropriate approvals from the relevant authorities, baseline condition appraisal),
- ii)** Construction phase (establishment of the project camp, site clearance, acquisition and transportation of building materials, construction of the colony/apartment);
- iii)** Occupation phase (Plant operation and managing the grinding facility as per the laid down rules and procedures; and
- iv)** Closure and decommissioning phase (demolition of the facility).

CHAPTER 3: BASELINE INFORMATION

This chapter describes the biotic and abiotic elements of the ecosystem present in the project area. In addition, it discusses the environmental conditions current in the project area, including physical environment, social-economic aspects, demography, and historical facts.

3.1 Physical Environment

3.1.1 Data information gathering procedure

The study information was gathered through discussions with the proponent. Site visits were also undertaken to get information on the project site and environmental status in the immediate neighborhood.

The physical observation was the geological status, drainage systems, water supply, and waste disposal in, settlement patterns, and typical socio-economic activities.

3.1.2 Machakos County

Machakos is the capital city for **Machakos County**, which had about 1,421,932 as of 2019. It borders other counties, **Nairobi** and **Kiambu** counties to the west, Embu to the north, Kitui to the east, **Makueni** to the south, **Kajiado** to the southwest, and **Muranga** and **Kirinyaga** to the North West.

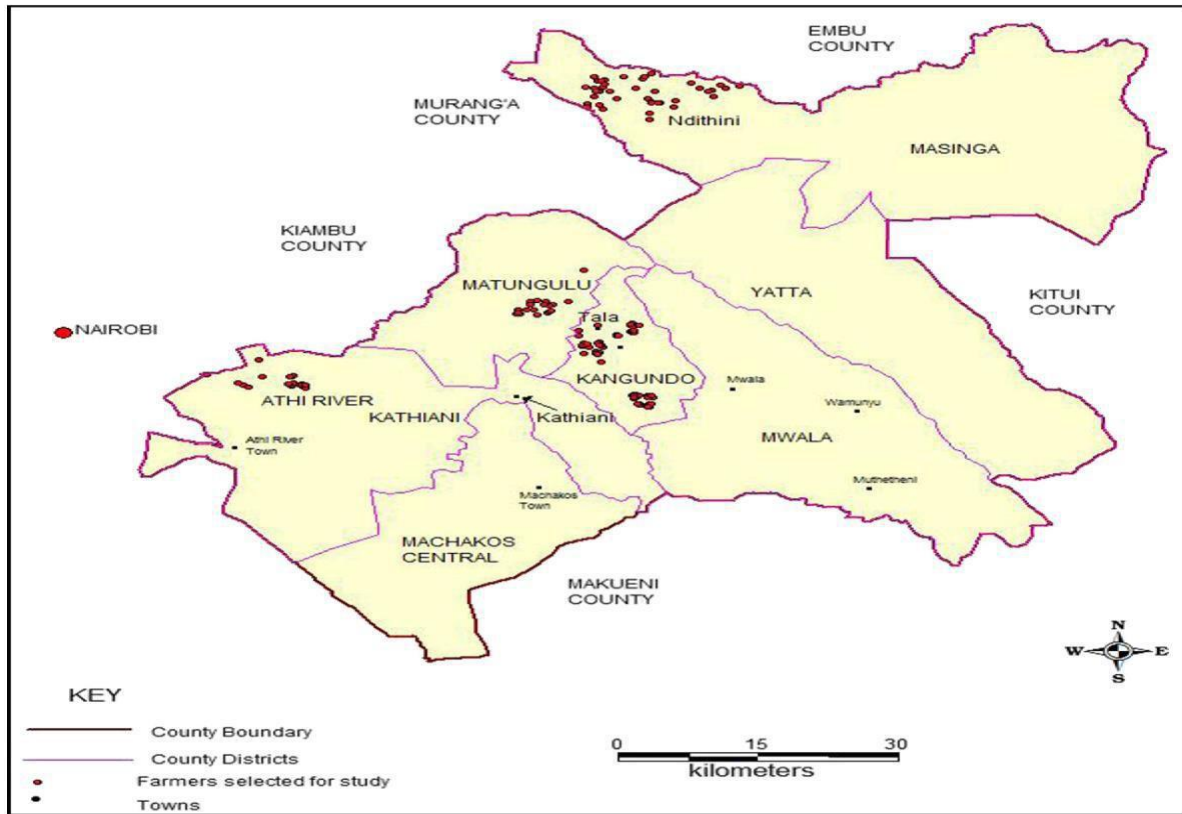


Figure 11: Map of the County’s Political and Administrative boundaries Source: Machakos County Government website.

3.1.3 Climate

The local climate is semi-arid with hilly terrain and an altitude of 990 to 2130m above sea level. It has tourist-related activities include camping, hiking safaris, ecotourism, and cultural tourism, dance, and music festivals.

3.1.4 Economy

Subsistence agriculture is mostly practiced with maize and drought-resistant crops such as sorghum and millet being grown due to the area's semi-arid state. The county also plays host to the open-air market concept with major market days where large amounts of produce are traded. Fruits, vegetables, and other foodstuffs like maize and beans are sold in these markets.

The county is banking on projects such as the Konza Technology City, a new Machakos City, and its proximity to Nairobi County to boost output in the economy.

3.1.5 Location of the Study Area

The project is located in private land located at Mathatani, Mavoko Sub-County, Athi River in Machakos County and on Plot Lr. 7885/17, 18, 19, & 20. The site is about 20km from Kitengela town and about 50km from Nairobi CBD. Athi River Town is named after the Athi River, which passes through the area. The outskirts of the area are sparsely populated with scattered factories, commercial and social structures. The area has a few productive areas where agriculture is practiced.

3.1.6 Topography and geology of the site area

The area has a relatively flat terrain, as is the norm in the semi-arid regions. The site is on an area with an approximate altitude (1520m). The land terrain slopes towards the south-western side while the general attitude on the globe lowers southwards. These altitudes are believed to affect the amounts of rainfall received in the area.

3.1.7 Altitude and climate of Athi River area

The altitude for the Athi River area is approximately 1540m above sea level. The climate of the site is mild and generally warm, and temperate. The region has a significant amount of rainfall during the 12 months of the year. This is the case even for the driest month. Precipitation is the lowest in September, with an average of 15 mm. Most precipitation falls in April average 143mm. The difference in precipitation between the driest and wettest months is 128 mm. During the year, the average temperatures vary by 3.5 °C.

Opportunities exist in agriculture, particularly livestock and crop farming, thanks to fertile soils and a good weather pattern. However, most areas are dry, with some regions being semi-arid.

As with other semi-arid regions, the proposed cement grinding plant site is characterized by low primary vegetation productivity and high geographical and seasonal variability in water availability (both surface and accessible groundwater). This is witnessed by the availability of some dry seasonal

rivers. This also explains the scant vegetation in the area.

Soil erosion has taken place first in the areas where vegetation has been cleared either through clearing or overgrazing. Finally, decay occurs along the sloppy paths used by the indigenous communities as there are no paved footpaths and tarmacked roads in the interior regions.

The site is at an approximate altitude (1520m), from where the land rises northwards and lowers southwards. These altitudes are known to affect the amounts of rainfall received in a given locality.

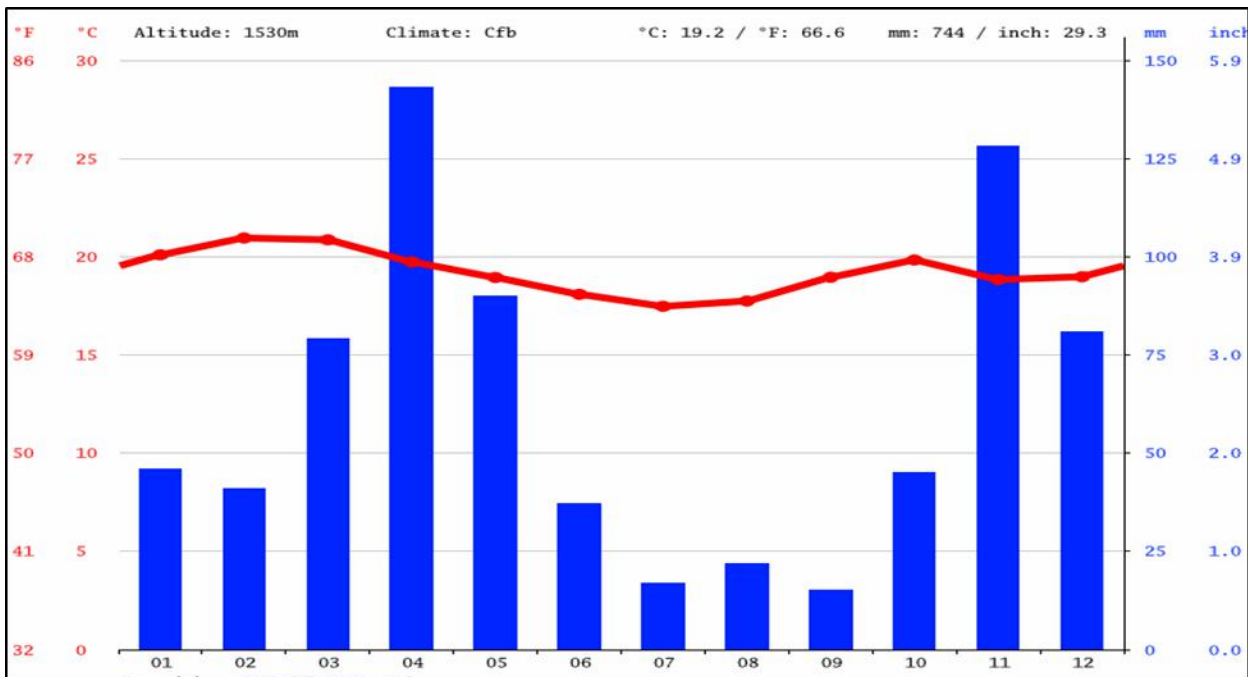


Figure 12: Athi River Climate Graph // Weather by Month **Source:** Climate-Data.Org. Records.

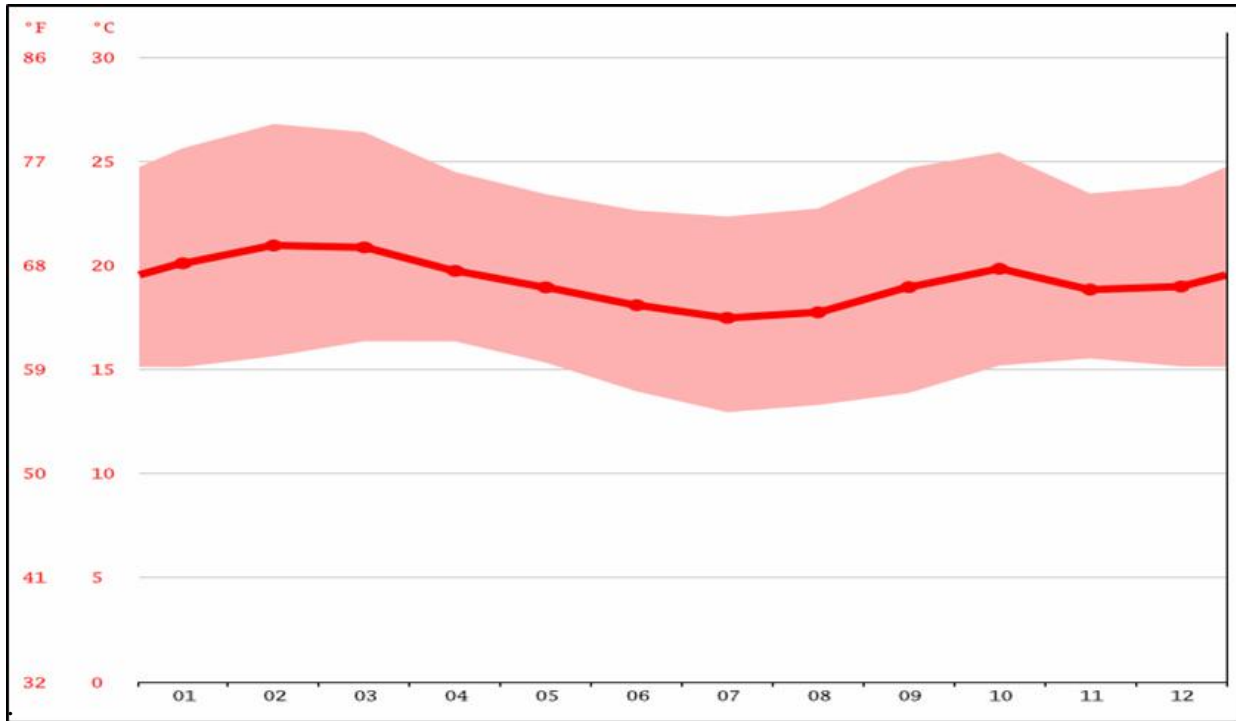


Figure 13: Athi River Average Temperature. **Source:** Climate-Data.Org. Records

3.2 Biological Environment

3.2.1 Flora

The site is located within a less agriculturally productive area where conditions are not much favorable for vegetation. Hence, the proponent has proposed to utilize the land maximally by putting up a cement grinding plant. The vegetation on the site is that of grassland with scattered shrubs and a number scatter of acacia trees.

3.2.2 Fauna

There is no fauna/wildlife threatened by the development. There is the presence of some insects such as ants, butterflies, and mosquitoes.

3.3.0 Social Economic Environment

3.3.1 Roads and Accessibility

The proposed site area is easily accessed by road driving along Mombasa Road. As you drive from Nairobi along Mombasa Road, you go past National Cement Company Limited, Golden Africa Limited. About 1.1km past

Golden Africa Ltd you arrive at murrum road next to HU Ming PVC Company ltd, then drive along the murrum road off Mombasa Road. About 800m drive, you arrive at the proposed site on plot Lr. No.7885/17, 18, 19, & 20

CHAPTER 4: POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

4.1 General Overview

This chapter highlights the policies, legislation, guidelines, standards, and regulations used in advising the EIA process. Environmental Impact Assessment (EIA) as a tool for environmental conservation has been identified as a critical component in new project implementation. At the national level, Kenya has put into place necessary legislation that requires EIA to be carried out on every new project, activity, or program (EMCA, 1999.), and a report submitted to the National Environmental Management Authority (NEMA) for approval and issuance of relevant certificates and licenses.

The National Environment Management Authority (NEMA), is established under the Environmental Management and Co-ordination Act No. 8 of 1999 (EMCA) to exercise general supervision and coordination over all matters relating to the environment and to be the principal instrument of the Government of Kenya in the implementation of all policies relating to the environment. NEMA uses Environmental Impact Assessment (EIA) as a tool for ensuring sustainable development for the future by mainstreaming environmental and social safeguards in all projects, plans, and programs.

In ensuring facilitation and implementation of this process, there has been the establishment of the EIA regulations amendments, the Environmental (Impact Assessment / Audit) (Amended) Regulations, 2019 gazetted on 30 April 2019 Under Legal Notice No. 31 and 32 for submission of the Summary Project Report (SR), Comprehensive project Report (CPR), and ESIA Reports (SR).

Besides, several other national policies and legal statutes have been reviewed to enhance environmental sustainability in national development projects across all sectors.

4.2. Policies and Framework Law

4.2.1 Environment Policy (Sessional Paper No.6 of 1999 on Environment and Development)

Most of the current Kenya environment policy is embodied in the **Sessional draft paper No. 6 of 1999 (Environment and Development)**. Nevertheless, this draft policy was not presented into the

parliament for approval. The Cabinet later approved it.

The range of environmental issues and challenges discussed in the draft Environment and Development Policy formed the basis for the EMCA enacted 1999.

Chapter 5, part 5 of the sessional Paper No. 6 Of 1999 on Environment and Development dealt with the EIA. It defined ESIA and underscored its importance in environmental protection, It also emphasized monitoring at all stages of the project and the need to carry out period environment audits to determine if the developers are fully mitigating identifies in the assessment.

The Environment Policy called on the Government to:

- Formulate comprehensive EIA guidelines, procedures, and legislation
- Strengthen and develop environmental standards
- Establish a system for EIA audits, monitoring, evaluation, and appeal
- Subject new and existing projects and programs to ecological monitoring and auditing;
- Strengthen capacities in institutions and local communities with regards to EIA; and
- Incorporate social and cultural values in the EIA.

Most of what the policy called for was later incorporated in the amended EMCA, 2015 and the Environmental Impact Assessment Regulations, 2003. Among the key objectives of the Policy Paper on Environment and Development (Sessional Paper No. 6 of 1999) are: -

- (i) To ensure that from the onset, all development policies, programs, and projects take environmental considerations into account,
- (ii) To ensure that an independent environmental impact assessment (EIA) report is prepared for any industrial venture or other development before implementation,
- (iii) To come up with effluent treatment standards that will conform to acceptable health guidelines.

Under this paper, broad categories of development issues have been covered that require a sustainable approach. These issues include the waste management and human settlement sectors. The policy recommends the need for enhanced re-use/recycling of residues, including wastewater, low non-waste technologies, increased public awareness-raising, and appreciation of a clean environment. It also encourages the participation of stakeholders in the management of wastes within their localities. Regarding human settlement, the paper encourages better planning in both

rural and urban areas and provision of basic needs such as water, drainage, and waste disposal facilities.

4.2.1 The National Environment Policy, 2013

This policy builds on the Sessional Paper No. 6 of 1999 on environment and development and has emerging issues such as;

- Climate change Invasive species Disaster management
- Gender and Youth Mainstreaming in the environment management
- Partnership and stakeholder involvement

4.2.2 National Environmental Action Plan (NEAP)

According to the Kenya National Environment Action Plan (NEAP, 1994), the Government recognized the negative impacts on ecosystems emanating from industrial, economic, and social development programs that disregarded environmental sustainability. Following this, the establishment of appropriate policies and legal guidelines, and harmonization of the existing ones, have been accomplished and/or are in the process of development. Under the NEAP process, EIA was introduced, and among the key participants identified were the industrialists, communities, and local authorities.

4.2.3 National Policy on Water Resources Management and Development

While the National Policy on Water Resources Management and Development (1999) enhances a systematic development of water facilities in all sectors for promotion of the Country's socio-economic progress also recognizes the by-products of this process as wastewater. It, therefore, calls for the development of appropriate sanitation systems to protect people's health and water resources from institutional pollution.

Development projects, therefore, should be accompanied by corresponding waste management systems to handle the wastewater and other waste emanating therefrom. The same policy requires that such projects should also undergo comprehensive EIAs that will provide suitable measures to be taken to ensure environmental resources and peoples' health in the immediate neighborhood and further downstream are not negatively impacted by the emissions.

In addition, the policy provides for charging levies on wastewater on quantity and quality (similar to polluter-pays-principle) in which those contaminating water are required to meet the appropriate cost on remediation, though the necessary mechanisms for the implementation of this principle have not been fully established under the relevant Acts. However, the policy provides for the establishment of standards to protect water bodies receiving wastewater, an ongoing process.

4.2.4 Provisions in the Environmental Management and coordination (amendments) Act 2015 Relating to EIA

Part VI of EMCA provides for the Environment Impact Assessment (EIA) Project proponents are imposed to conduct EIA at their own cost by expert registered and by the NEMA. The second schedule of the Act list all the projects that must undergo EIA.EMCA requires that the EIA be conducted under the environmental impact assessment regulations, guidelines, and procedures issued under the Act. NEMA is empowered to set up a technical advisory committee to advise on the EIA reports. Lead agencies are also invited by NEMA to give their comments regarding the EIA report.

4.3 Institutional Framework

Kenya has several institutions that are mandated with the responsibility of participating and managing the review process of the EIA. These are;

- The national environment management authority
- Lead agencies
- Technical Advisory Committee (TAC)
- Standards and Enforcement Review Committee
- National Environmental Tribunal
- County Environment Committees

Interested and Affected Stakeholders (**IAS**) also should participate in the EIA process and give their comments regarding the proposed projects

4.4 Environmental Legal Aspects

Relevant Sectoral laws govern different sectors of the environment. Applications of national statutes and regulations on environmental conservation suggest that the owner of any project has a legal

duty and responsibility to discharge wastes of acceptable quality to the receiving environment without compromising public health and safety. This position enhances the importance of an EIA for the proposed extension project to provide a benchmark for its sustainable operation when it is finally commissioned. The key national laws that govern the management of environmental resources in the country have been briefly discussed in this chapter. Notably, wherever any of the laws contradict each other, the Environmental Management and Coordination Act 1999 prevails. The key sectoral laws that touch on EIA include the following;

4.4.1 The Environment Management and Coordination Act, 1999 (Amendments)

Established in 1999 and is the most comprehensive on matters of the environment in Kenya. The Act has amendments. Notably, there is the **Environmental Management and coordination (amendments) Act 2015**.

Part II of the Environment Management & Coordination Act, 1999 states that every person in Kenya is entitled to a clean and healthy environment and has to safeguard and enhance the environment. To ensure this is achieved, part VI of the same Act directs that any proponent of a new project should undertake an EIA study and prepare an appropriate report for submission to the National Environmental Management Authority (NEMA), who in turn may issue a license as appropriate. The second schedule of the same Act lists the proposed project among the key urban developments that must undergo EIA before implementation.

Part VIII section 72 of the Act prohibits discharging or applying poisonous, toxic, noxious, or obstructing matter, radioactive, or any other pollutants into the aquatic environment. Section 73 requires that operators of projects which discharge effluent or other pollutants submit to NEMA accurate information about the quantity and quality of the effluent. Section 74 demands that all effluent generated from point sources are discharged only into the existing sewerage system upon issuance of a prescribed permit from the local authorities.

4.4.2 Mining Act 2016

This Act was assented by the President on 6 May 2016. The purpose of the Act is to give effect to Articles 60, 62 (1)(f), 66 (2), 69, and 71 of the Constitution in so far as they apply to minerals; provide for prospecting, mining, processing, refining, treatment, transport and any dealings in minerals. This Act however does not apply to petroleum and hydrocarbons processing.

Mining regulations also require an applicant to obtain License from NEMA offices, prepare a feasibility report and mine closure plans before issuance of a mining license.

Every mineral in its natural state in, under or upon the land in Kenya; in or under a lake, river, stream, or watercourses in Kenya; in the exclusive economic zone and an area covered by the territorial sea or continental shelf is the property of the Republic and is vested in the National Government in trust for the people of Kenya.

In addition to this, the State has a right of pre-emption of all strategic minerals raised, won, or obtained within the territory of Kenya before they are sold.

The Cabinet Secretary (CS) in charge of mining is responsible for the administration of the Mining Act and has powers to develop regulations to provide for activities in the mining life cycle. Further, the law provides for a Mineral Rights Board that will support the CS on administration aspects such as granting and revoking licenses, designating areas for certain mining operations such as small scale and artisanal mining operations, excluding areas from mining activity.

The CS can declare certain minerals or deposits to be strategic by advising and seeking approval of the Cabinet. The Act also establishes two directorates to assist with the administration – the Directorate of Mines and the Directorate of Geological Survey. Together, they will manage the activities and information related to mining operations in the country including establishing operational linkages between the national and county governments.

4.4.3 The Physical and Land Use Planning Act, 2019

Physical and Land Use Planning Act, 2019 (the 2019 Planning Act) came into force on 5 August 2019, repealing the Physical Planning Act of 1996 (the 1996 Act). The 2019 Planning Act shall now govern matters relating to the planning, use, regulation, and development of land in Kenya.

4.4.3.1 Similarities of the 2019 Planning Act to the 1996 Act

The government, at both the national and county level, is tasked with the preparation of physical and land use plans. The national, county, inter-county, and local plans are required to be integrated, and these plans shall collectively form the basis of how land is to be used in Kenya.

County governments have retained their role of development control in their respective counties. All applications for development permission shall therefore continue to be made in the relevant county.

Development permission must be sought before undertaking any development. A developer who does not obtain such prior permission risks criminal sanctions and demolition of the unapproved works.

4.4.3.2 Changes introduced by the 2019 Planning Act.

Increased public participation: Members of the public will now be allowed to give their views and raise objections to various matters e.g. the suitability of the national and county plans.

Classification of developments: Developments are no longer classified as either Class "A" or Class "B" but rather the 2019 Planning Act lists developments that require development permission. In this regard, developments such as subdivision, amalgamation, change of user, an extension of the user, extension of the lease, and approval of building plans will still require development permission to be issued by the relevant county government.

Additional developments requiring approvals: Processing of easements and wayleaves will now require express development permission, as will siting of educational institutions, base transmission stations, petrol stations, eco-lodges, campsites, power generation plants, and factories.

Definition of commercial and industrial use: There is also more clarity as to what constitutes a commercial use versus an industrial use. This will guide applicants in selecting the correct land use, depending on the nature of the project they wish to undertake.

Pre-requisite for other licenses: Development permission in respect of commercial and industrial use is a pre-requisite for other licensing authorities granting a license for commercial or industrial use, or occupation of land.

4.4.4 Occupational safety and health act, 2007. (Rev 2010)

The Act makes provision for the health, safety, and welfare of persons employed in factories and other places of work. The provisions require that all practicable measures be taken to protect persons employed in a factory from dust, fumes, or impurities originating from any process within the facility. The provisions of the Act are also relevant to the management of hazardous and non-hazardous wastes, which may arise at a project site.

For developments such as construction projects, the Act is important as it requires project

proponents to have adequate management procedures of occupational safety and health at the workplaces. For safe construction works, the contractor and project managers should ensure the following:

- Provision of personal protective equipment (PPE), fire safety, electrical safety, and other precautions essential for safe construction work.
- Provision of physical barriers and solid separators (dust barriers, hazard barriers, temporary walkways, among others, as explained in the extract of the Act.)
- Inspection of construction equipment to ensure that they are in good working condition before beginning a job. In addition, the proponent will ensure that regular inspections and maintenance of the equipment are conducted accordingly.

4.4.5 The Public Health Act (Cap. 242) (Rev 2012)

Part IX section 115 of the Act states that no person/institution shall cause nuisance or condition liable to be injurious or dangerous to human health. Section 116 requires Local Authorities to take all lawful, necessary, and reasonably practicable measures to maintain their jurisdiction clean and sanitary to prevent the occurrence of nuisance or condition liable for injurious or dangerous to human health.

Such nuisance or conditions are defined under section 118 waste pipes, sewers drains, or refuse pits in such a state, situated or constructed as in the opinion of the medical officers of health to be offensive or injurious to health. Any noxious matter or wastewater flowing or discharged from any premises into a public street or the gutter or side channel or watercourse, irrigation channel, or bed not approved for discharge is also deemed as a nuisance. Other nuisances are an accumulation of materials or refuse which in the opinion of the medical officer of health is likely to harbor rats or other vermin.

On the responsibility of local authorities, Part XI section 129 of the Act states in part “It shall be the duty of every local authority to take all lawful, necessary and reasonably practicable measures for preventing any pollution dangerous to the health of any supply of water which the public within its district has a right to use and does use for drinking or domestic purposes”.

Section 130 provides for making and imposing regulations by the local authorities and others the duty of enforcing rules in respect of prohibiting the use of water supply or erection of structures draining filth or noxious matter into the water supply as mentioned in section 129. This provision is supplemented by Section 126A that requires local authorities to develop by-laws for controlling and regulating among others private sewers, communication between drains and sewers and between sewers as well as regulating sanitary conveniences in connection to buildings, drainage, cesspools, etc. for reception or disposal of the foul matter.

Part XII Section 136 states that all collections of water, sewage, rubbish, refuse and other fluids which permits or facilitate the breeding or multiplication of pests shall be deemed nuisances and are liable to be dealt with in the manner provided by this Act

4.4.6 The County Government Act, 2012

The Act empowers County Governments to make by-laws in respect of suppression of nuisances, imposing fees for any license or permit issued in respect of trade or charges for any services. Local authorities are given the power to control or prohibit all developments which, because of smoke, fumes, chemicals, gases, dust, smell, noise, vibration, or other cause, may be or become a source of danger, discomfort, or annoyance to the neighborhood, and to prescribe the conditions subject to which such developments shall be carried on. In compliance, the EIA project report has proposed potential mitigation measures (in the EMP and monitoring plan; and the environmental management Framework in the report.

4.4.7 Wildlife (Conservation and Management) Act

The Wildlife Conservation and Management Act, 2013 is the main statute governing all Wildlife resources, and its main aim is to improve the protection, conservation, sustainable use, and management of wildlife resources. The Act revises the Wildlife (Conservation and Management) Act of 1976 and brings wildlife legislation into compliance with the Constitution. Principles of the Act: devolution, effective public participation, ecosystem approach, recognition of wildlife conservation and management as a form of land use on public, community, and private land, self-sustainability (benefits from wildlife offset costs), sustainable utilization, and equitable benefit sharing.

4.4.7.1 Provisions of the Act relevant to forestry

The mandate of Kenya Wildlife Service (KWS) The main implementing body for the Act is the Kenya Wildlife Service (KWS), which is charged with managing and conserving wildlife resources within National parks, wildlife conservation areas, and sanctuaries in Kenya. The institution is also responsible for protecting forests within its jurisdiction and supporting the conservation, rehabilitation, and protection of forests and water catchments that are significant wildlife habitats. The KWS gets funding from national budgetary allocations, investments by the service, loans, donations, and revenue from joint partnerships on bioprospecting

4.4.7.2 Role of County governments in Wildlife management

The Wildlife Act provides restructured governance of wildlife resources per the Constitution of Kenya, 2010. Specifically, County governments have a role through the management of national reserves (Section 35) and the County Wildlife Conservation and Compensation Committees (Section 18). These committees are required under the law to establish wildlife user rights, oversee implementation of management plans on community and private lands, oversee equitable benefit sharing of wildlife resources and review compensation claims.

4.4.7.3 Establishment of a Wildlife Endowment Fund

The Wildlife Act establishes a Wildlife Endowment Fund (Section 23). The Fund is expected to facilitate wildlife conservation initiatives, manage and restore protected areas, and protect endangered species, habitats, and ecosystems.

4.4.7.4 Establishment of a Wildlife Compensation Scheme

The Act also establishes a Wildlife Compensation Scheme for financing compensation claims for human death or injury or crop and property damage caused by wildlife (Section 25). Such cases are verified by the County Wildlife Conservation and Compensation Committee. The committee then gives recommendations to the Cabinet Secretary (in the case of bodily injury or death) and the KWS (in case of crop damage or loss of property) for the payment of compensation.

4.4.7.5 National wildlife conservation and management strategy

The Wildlife Act has provisions for the formulation of a national wildlife conservation and management strategy for the protection, conservation, and management of wildlife resources and their habitats. KWS is therefore charged with the protection of forests within National parks, wildlife conservation areas, and sanctuaries. These areas are strictly under the jurisdiction of KWS.

The officials regulate entry and user rights of wildlife resources (Section 7) but restrict extraction of forest resources to only medicinal herbs and other non-wood products.

1. Conformity with Environmental Management and Coordination (Amendment Act (EMCA), 2015 regulations

The Wildlife Act conforms to the EMCA on conservation, protection, and management of the environment (Section 26, 1) as well as the hearing of disputes by the National Environment Tribunal and the Environment and Land Court. The Act also conforms with the provision of EMCA, 1999 concerning strategic environmental, cultural, economic, and social impact assessment licenses, where required.

4.4.7.6 Alignment with the Water and Land Act

The Wildlife Act aligns with the Water Act about the right to the use of water from any water source, reservoir, or point. The Wildlife Act also provides for sustainable use of land, where a permit is granted (Section 29). It prohibits any activity that is likely to have adverse effects on the environment, including seepage of toxic waste into streams, rivers, lakes, and wetlands (Section 30).

4.4.7.7 Protection of habitats and ecosystems for wildlife conservation

The Wildlife Act provides for the protection of wetlands and marine areas that are important habitats or ecosystems for wildlife conservation (Section 33 and 36). These include mangrove forests in the coastal region of Kenya. It also provides restrictions for the pollution of wildlife habitats and ecosystems (Section 89). The law sets out stiffer fines and punishments for offenders. In addition to any sentence imposed, a polluter may also be required to pay the full cost of cleaning up the polluted wildlife habitat and ecosystem (Section 89, 2).

4.4.7.8 Mining regulations in wildlife protected areas

The Wildlife Act regulates mining and quarrying within wildlife-protected areas through EIAs per the provisions of EMCA (Section 45, 2d). A bond is also required, equivalent to the cost of environmental restoration of the site (Section 45, 2f).

4.4.7.9 Protection of endangered and threatened ecosystems and habitats

The Wildlife Act provides for the protection of endangered and threatened ecosystems and habitats (Section 46). It also restricts any activities involving a specimen of wildlife species that negatively impact their survival (Section 48, 2a). Conservation and Management Act, 2013 is the main statute governing all wildlife

4.4.8 The Water Act 2002

The aim of the Water Act 2002 is to make better provisions for the conservation, apportionment, and use of water resources of Kenya.

Part II section 18 of this Act provides for national monitoring and information systems on water resources. Following this, sub-section 3 allows the Water Resources Management Authority to demand from any person or institution, specified information, documents, samples, or materials on water resources. Under these rules, specific records may require to be kept by an owner of the project and the information thereof furnished to the authority.

Section 73 the Act of the Act allows a person with a license (licensee) to supply water to make regulations for purposes of protecting against degradation of water sources. Section 75 and sub-section 1 allow the licensee to construct and maintain drains, sewers, and other works for intercepting, treating, or disposing of any foul water arising or flowing upon the land for preventing pollution of water sources within his/her jurisdiction.

Section 76 states that no person shall discharge any trade effluent from any trade premises into sewers of a licensee without the consent of the licensee upon application indicating the nature and composition of the effluent, maximum quantity anticipated, the flow rate of the effluent and any other information deemed necessary. The consent shall be issued on conditions including payment of rates for the discharge as may be provided under section 77 of the same Act.

4.4.9. The Building Code 2000

Section 194 requires that where a sewer exists, the occupants of the nearby premises shall apply to the local authority for a permit to connect to the sewer line and that all wastewater must be discharged into the sewers. The code also prohibits the construction of structures or buildings on sewer lines.

4.5.0 The Penal Code (Cap. 63)

Section 191 of the Penal Code states that any person or institution that voluntarily corrupts or foils water for public springs or reservoirs, rendering it less fit for its ordinary use is guilty of an offense. Section 192 of the same Act says a person who makes or vitiates the atmosphere in any place to make it noxious to the health of persons/institution in dwellings or business premises in the

neighborhood or those passing along a public way, commits an offense.

4.5.1 Wastewater guidelines

Part of the study involves a review of the environmental standards that provides a basis for monitoring and future audits. The table below presents recommended guidelines on wastewater quality for discharge into the public sewers and open water bodies.

Tale 4: Kenya discharge Guidelines for Waste water,

Parameter	Discharge in public	Discharge into water bodies (mg/l) –
PH	6.0 – 9.0	6.0 – 9.0
BOD ₅ (20°C)	500	20
✓	1000	5
Suspended Solids	500	30
Detergents	30	Nil
Heavy metals (combined)	1	0.1
Oils/Grease	50	Nil
Nitrates (TN)	20	10
Phosphates (TP)	30	5
Conductivity	-	1500 uS/cm
4hr PV Value	No limits	20
Faecal Coliforms	No limits	1000/100ml for large water bodies,
Sulphates	-	500
Dissolved Oxygen	No limits	2
Phenols	-	2
Cyanides	-	0.1

Parameter	Discharge in public	Parameter
Parameter	Discharge in public	Discharge into water bodies (mg/l) –
Chlorides	-	1000
PCB	-	0.003
Colour	No limits	5 Hazen Units
Odour	No limits	Not objectionable

Sources: Department of Water Development

Chemicals should not be discharged into sewers: Calcium Carbide, Chloroform, condensing water, Degreasing solvents, radioactive residues, Inflammable solvents, and substances likely to interfere with sewers.

4.5.2 EIA Guidelines

The EIA guidelines require that EIA be conducted per the issues and general guidelines spelled out in the second and third schedules of the regulations. These include coverage of the issues on schedule 2 (ecological, social, landscape, land use, and water considerations) and general guidelines on schedule 3 (impacts and their sources, project details, national legislation, mitigation measures, a management plan, and environmental auditing schedules and procedures).

4.5.3 Energy Act 2016

The Energy (Solar Water Heating) Regulations, 2012 require among other things that:-

1. All premises within the jurisdiction of local authorities with hot water requirements of a capacity exceeding one hundred liters per day shall install and use solar heating systems;
- 2 Within five years from the effective date of the Regulations, all existing premises with hot water requirements of a capacity exceeding one hundred liters per day shall install and use solar heating systems.

4.5.4 National Construction Authority Act No. 41 of 2011

This is an Act of Parliament to provide for the establishment, powers, and functions of the National Construction Authority and connected purposes.

The Act defines —construction works as the construction, extension, installation, repair, maintenance, renewal, removal, renovation, alteration, dismantling, or demolition of:-

1. Any building, erection, edifice, structure, wall, fence, or chimney, whether constructed wholly or partly above or below ground level;
2. Any road, harbor works, railway, cableway, canal, or aerodrome;
3. Any drainage, irrigation, or river control works;
4. Any electrical, mechanical, water, gas, petrochemical, or telecommunication works; or
5. Any bridge, via-duct, dam, reservoir, earthworks, pipeline, sewer, aqueduct, culvert, drive, shaft, tunnel, or reclamation works, and includes any works which form an integral part of or are preparatory to or temporary for the works described in paragraphs (a) to (e), including site clearance, soil investigation, and improvement, earth-moving, excavation, laying of the foundation, site restoration, and landscaping.

The Act establishes the National Construction Authority which among its functions includes overseeing the construction industry and coordinating its development. The National Construction Authority (N.C.A) is mandated to streamline, overhaul and regulate the construction industry in Kenya and establish a code of conduct for the industry.

Among the powers of the Authority include; with the approval of the Minister, to facilitate, or promote the establishment or expansion of, companies, corporations or other bodies to carry on any activities related to construction either under the control or partial control of the Authority or independently.

The Act states the conditions required for one to be registered to trade as a contractor in the country, whether a local or a foreigner. It defines a contractor as;

A person who carries on business as a contractor where such person, for reward or other valuable consideration, undertakes the construction, installation or erection, for any other person, of any structure situated below, on or above the ground, or other work connected therewith, or Execution, for any other person, of any alteration or otherwise to any structure or other work connected therewith, and undertakes to supply: -

1. The materials necessary for the work, or is authorized to exercise control over the type, quality, or use of the materials supplied by any other person;
2. The labor necessary for the work, or is authorized on behalf of the person for whom the work is undertaken or any other person, to employ or select workmen for employment for the execution of the work, whether under a contract of service or otherwise.

4.5.5 Way leaves Act Cap 292

According to the Way leaves Act cap 292 Section 2, Private land does not include any land sold or leased under any Act dealing with Government lands.

Section 3 of the Act states that the Government may carry any sewer, drain or pipeline into, though, over or under any lands whatsoever, but may not in so doing interfere with any existing building. Section 8 further states that any person who, without the consent of the Permanent Secretary to the Ministry responsible for works (which consent shall not be unreasonably withheld), causes any building to be newly erected over any sewer, drain or pipeline the property of the Government shall be guilty of an offense and liable to a fine of one hundred and fifty shillings, and a further fine of sixty shillings for every day during which the offense is continued.

4.5.6 Registration of Titles Act Cap 281

Section 34 of this Act states that when land is intended to be transferred or any right of way or other easement is intended to be created or transferred, the registered proprietor or, if the proprietor is of unsound mind, the guardian or other person appointed by the court to act on his/her behalf in the matter, shall execute, in original only, a transfer in form F in the First Schedule, which transfers shall, for the description of the land intended to be dealt with, refer to the grant or certificate of title of the land.

4.6 Regulatory Framework

4.6.1 The Environment (Impact Assessment and Audit) Regulations, 2003

Environmental (Impact Assessment / Audit) (Amended) Regulations, 2019 gazetted on 30 April 2019 Under **Legal Notice No. 31** and **32** for submission of the Summery Project Report (SR), Comprehensive project Report (CPR), and ESIAS Reports.

These are entrenched under sections 58 and 69 of the EMCA. The regulations provide the framework for carrying out EIAs in Kenya on any commencing project and EAs for undergoing projects.

4.6.2 The Environmental Management and (Water Quality) Regulations, 2006

These regulations set the standards for domestic water and wastewater. The regulations are meant for pollution control and prevention and provide for the protection of water sources. The proposed project has no chance of significantly affecting this since the project will connect to the conservancy tank provided in the area.

4.6.3 Environmental Management and Co-ordination (Waste management) Regulations 2006

These regulations define the responsibilities of waste generators and define the duties and requirements for the transportation and disposal of waste. It provides for the mitigation of pollution and provides for hazardous and toxic wastes. The regulations require a waste generator to dispose of waste only to a designated waste receptacle. The proponent shall adhere to the regulations and proposes to contract a NEMA registered waste collector.

4.6.4 The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations 2009

Part II of the general prohibition of this regulation state that except as otherwise provided for in this regulations, no person shall make or cause to be made any loud, unreasonable, unnecessary, or unusual noise which annoys, disturbs, injures, or endangers the comfort, repose, health or safety of others and the environment. Part (2) of the general prohibitions stated that in determining whether noise is loud, unreasonable, unnecessary, or unusual the following factors may be considered: -

- Time of the day;
- Proximity to residential area;
- Whether the noise is recurrent, intermitted, or constant;

- The level and intensity of the noise;
- Whether the noise has been enhanced in level or range by any type of electronic or mechanical means;
- and Whether the noise can be controlled without much effort or expense to the person making the noise.

Part 2 of section III states that any person wishing to operate or repair any machinery, motor vehicle, construction equipment or other equipment, pump, fan, air-conditioning apparatus, or similar mechanical device or engage in any industrial activity which is likely to emit noise or excessive vibrations shall carry out the activity or activities within relevant levels prescribed in the first schedule to these regulations. Part III section 13 (1) states that except for the purpose specified in sub-Regulation (2)... no person shall operate construction equipment (including but not limited to any pile driver, steam shovel, pneumatic hammer, derrick, or electric hoist) or perform any outside construction or repair work to emit noise above the permissible levels as set out in the second schedule of the regulations.

4.5.5 Environmental Management and Co-ordination (Air Quality) Regulations, 2013

This Regulation provides for prevention, control and abatement of air pollution to ensure clean and healthy ambient air. It provides for the establishment of emission standards for various sources such as mobile sources (e.g. motor vehicles) and stationary sources (e.g. industries) as outlined in the EMCA 1999. It also covers any other air pollution source as may be determined by the Cabinet Secretary in consultation with the Authority. Emission limits for various equipment and facilities have been set. The regulations also establish the procedures for the issuance of emissions licenses, measurement of emissions, inspection and monitoring programs, and reporting requirements.

First Schedule of the regulation gives the Ambient Air Quality Tolerance Limits as shown in the table below;

Table 5: Ambient Air Quality Tolerance Limits

	Pollutant	Time weighted Average			
			Industrial area	Residential, Rural & Other area	Controlled areas***
1.	Sulphur oxides (SO _x);	Annual Average*	80 µg/m ³	60 µg/m ³	15 µg/m ³
		24 hours**	125 g/m ³	80 g/m ³	30 g/m ³
		Annual Average		0.019 ppm/50 g/m ³	
		Month Average			
		24 Hours		0.048ppm /125 g/m ³	
		One Hour			
		Instant Peak		500 g/m ³	
		Instant Peak (10 min)		0.191 ppm	
2.	Oxides of Nitrogen (NO _x);	Annual Average*	80 g/m ³	60 g/m ³	15 g/m ³
		24 hours**	150 g/m ³	80 g/m ³	30 g/m ³
		8 hours			
		Annual Average		0.2 ppm	
		Month Average		0.3 ppm	
		24 Hours		0.4 ppm	
		One Hour		0.8 ppm	
		Instant Peak		1.4 ppm	
3.	Nitrogen Dioxide	Annual Average	150 g/m ³	0.05 ppm	
		Month Average		0.08 ppm	
		24 Hours	100 g/m ³	0.1 ppm	
		One Hour		0.2 ppm	
		Instant Peak		0.5 ppm	
4.	Suspended Particulate matter (SPM)	Annual Average*	360 g/m ³	140 g/m ³	70 g/m ³
		24 hours**	500 g/m ³	200 g/m ³	100 g/m ³

	Pollutant	Time weightedAverage	Pollutant		
			Industrial area¹	Residential, Rural & Other area	Controlled areas^{***}
		mg/Kg			
		Annual Average ^{****}		100 g/m ³	
		24 hours ^{***}		180 g/m ³	
5.	Respirable Particulate Matter (<10 m) (RPM)	Annual Average*	70 g/m ³	50 g/m ³	50 g/m ³
		24 hours**	150 g/Nm ³	100 g/Nm ³	75 g/Nm ³
6.	PM _{2.5}	Annual Average	35 g/m ³		
		24 hours	75 g/m ³		
7.	Lead (Pb)	Annual Average*	1.0 g/Nm ³	0.75 g/Nm ³	0.50 g/m ³
		24 hours**	1.5 g/m ³	1.00 g/m ³	0.75 g/m ³
		Month Average		2.5	
8.	Carbon monoxide (CO)/ carbon dioxide (CO ₂)	8 hours**	5.0 mg/m ³	2.0 mg/m ³	1.0 mg/m ³
		1 hour	10.0 mg/m ³	4.0 mg/m ³	2.0 mg/m ³
		mg/Kg			
		24 hours**			
9.	Hydrogen Sulphide	24 hours**	150 g/m ³		
10.	Non-methane hydrocarbons				
		instant Peak	700ppb		
11.	Total VOC	24 hours**	600 g/m ³		
12.	Ozone	1-Hour	200 g/m ³	0.12 ppm	
		8 hour (instant Peak)	120 g/m ³	1.25 ppm	

Table 6: Ambient Air Quality at Property Boundary for General Pollutants

	Pollutant	Time weighted Average	Property Boundary
1	Particulate matter (PM)	Annual Average*	50 $\frac{\mu\text{g}}{\text{m}^3}$
		24 hours**	70 $\frac{\text{g}}{\text{m}^3}$
2.	Oxides of Nitrogen (NO _x);	Annual Average*	80 $\frac{\mu\text{g}}{\text{m}^3}$
		24 hours**	150 $\frac{\text{g}}{\text{m}^3}$
3.	Sulphur oxides (SO _x);	Annual Average*	50 $\frac{\text{g}}{\text{m}^3}$
		24 hours**	125 $\frac{\text{g}}{\text{m}^3}$
4.	Hydrogen Sulphide	24 hours**	50 $\frac{\text{g}}{\text{m}^3}$
5.	Lead(Pb)	Annual/24 hours	0.5-2.0 $\frac{\text{g}}{\text{m}^3}$
6.	Ammonia	24 hours**	100 $\frac{\text{g}}{\text{m}^3}$

Note.

- a) For residential premises in designated industrial areas, the above standards do not apply.
- b) For industries in designated residential areas, standards for residential areas shall apply.

4.5.6 Climate Change Act, 2016

On 6 May, Kenya’s Climate Change Act, 2016 became law. President Uhuru Kenyatta assented to Kenya’s Climate Change Bill, 2014 after it was approved by both houses of Parliament (the National Assembly and the Senate). This Act provides a framework for action that promotes low carbon, climate resilient development in Kenya, and is an important milestone on the country’s path towards developing its economy while simultaneously reducing greenhouse gas emissions.

The outcomes will include:

- mainstreaming climate change responses into development planning, decision making and implementation
- formulating programs and plans to enhance the resilience and adaptive capacity of human and ecological systems to the impacts of climate change
- reinforcing climate change disaster risk reduction in strategies and actions of public and private

entities

- mainstreaming intergenerational gender equity in all aspects of climate change responses
- providing incentives and obligations for private sector contributions to achieving low carbon climate resilient development
- promoting low carbon technologies to improve efficiency and reduce emissions intensity
- mobilizing and transparently managing public and other financial resources for climate change responses
- providing mechanisms to facilitate climate change research and development, training, and capacity building
- mainstreaming the principle of sustainable development into planning and decision making on climate change responses
- integrating climate change into the exercise of power and functions of all levels of governance, and enhancing cooperative climate change governance between national and county governments

CHAPTER 5: CONSULTATION AND PUBLIC PARTICIPATION

5.1 Objectives of Consultation and public Consultation

The objectives of public consultations in conforming to the environmental legislation in Kenya is to ensure that:

- All stakeholders and interested parties are fully informed of the proposed project and have the opportunity to raise their concerns;
- Any issues resulting from this process are addressed in the EIA and incorporated into the design and implementation of the project.
- Consultation is done on sensitive issues and that baseline information is established for the management of any impacts that may arise during the implementation and operation phase of the project.

5.2 Legal Requirements

5.2.1 EIA and Audit Regulations

Section 17 of the Environmental (Impact Assessment and Audit) Regulations 2003 (Amendments) states that an EIA process should "seek the views of persons who may be affected by the project."

5.2.2 Consultation with interested and affected parties

Public participation was conducted through key informant interviews, meetings, and discussions mainly with neighboring residents, Key stakeholders and the proponent. Each respondent filled in the questionnaire on issues relating to awareness about the proposed project, benefits of the project, and whether the project will cause any negative impacts on the following, residents, natural ecology of the area, recreational and leisure facilities, public health, and safety, effect on water resources and quality,

effect on the soils and effect on infrastructure. The copies of those who participated are attached to the annexed page. Moreover, some environmental issues were raised as issues or concerns. These include;

The analysis of the consultation and interviews led to the following conclusions.

(i) The proposed Cement Grinding Plant is located in an industrial zone area that has a similar neighboring character; National Cement Limited, Simba Cement Limited, HU Ming PVC Limited, and other factories. Putting up a Cement Grinding Plant therefore will fully maximize the potential of the site and was accepted by interested and affected parties (i.e. all the respondents).

(ii) The proposed Cement Grinding Plant will offer employment to area residents and quality cement for the construction industry; building and civil works.

(iii) No significant negative impacts were envisaged from the proposed project activities which cannot be mitigated through proposed mitigation.

From consultations with the proponent, he is willing to comply with recommendations and guidelines of the EIA report about mitigation of significant environmental impacts

5.2.3 Questionnaire survey

The detailed questionnaire survey targeted reaching out to the key stakeholders at the grass root. This included political leaders, local administration, community-based organizations, local learning institutions, local faith-based institutions, local medical institutions, opinion leaders, and the business community. The questionnaire is attached at the back of the report appendices. The summary of all the responses from the diverse stakeholders was then analyzed and all the impacts assessed scientifically.

5.2.3 Focused Group Meeting at chief's camp

Two different public participation meetings were held. All the stake holders gave their views regarding the proposed Cement grinding Plant.



Figure 6: The community of Mathatani Sub-location in Athi River Sub County during the t Public Participation focused group meetings.



Figure 17: The community of Mathatani Sub-location in Athi River Sub County during the Public Participation meetings.



Figure 18: The community of Mathatani Sub-location in Athi River Sub County during the focused group meetings.

5.3 Major Environmental Concerns Raised and their Analyses

5.3.1 Dust Generation

The people expressed concern over the possibility of the generation of a large amount of dust within the project site and surrounding areas as a result of cement grinding, construction works, and transportation of packaged cement bags. The proponent will ensure that dust levels at the site are minimized through the installation of dust collectors, bag filters, and traps, sprinkling water in areas being excavated, and along the tracks used by the transport trucks within the site.

5.3.2 Soil and Water Pollution

There was concern over the pollution of topsoil and groundwater. The cement plant is virtually free of water pollution as no effluents are involved.

5.3.3 Noise and Vibration

There was concern over the possibility of high noise and vibration levels in the project site as a result of construction works. The sources of noise pollution will include transport vehicles, plant machinery, and metal grinding and cutting equipment. However, the proponent will take appropriate steps to minimize noise impacts including the provision of appropriate protective equipment to

construction workers, planning and minimizing the frequency of materials transport, and ensuring that all equipment is well maintained.

5.3.3 Impacts on Ecology

There was a concern over the proposed CGP and its impact on the Flora and fauna, wildlife in the area. There was concern on clearing of vegetation and loss displacement of biodiversity. The Proponent has planned to establish plans and mechanism to combat any harmful impact to the ecosystem around. Other concern raised was the proximity of the area to wildlife migratory paths. However, after further discussion on the issue, the stakeholders were informed that the proposed project is set off the migratory corridor and its location is within the area zoned by Machakos County Government for industrial development. Therefore, poses no major significant impact to the wildlife and fauna in the area.

5.3.4 Water shortage

There was concern over the prevailing water condition within the area. The proponent was requested to ensure that there is an alternative source of water by the installation of enough water storage tanks as a backup system due to water shortage problems. The proponent has proposed to drill two numbers of boreholes in the site area after approval by WARMA.

5.3.5 Wastewater management

There was concern about how the CGP will ensure wastewater management in the area. The proponent has planned to install a wastewater treatment plant and ensure treated water is recycled for reuse.

5.3.6 Positive Impacts Raised Employment Opportunities

The persons interviewed were positive that during its development and operations, the CGP project will create numerous employment opportunities for the residents most of them being jobless youth.

5.3.6.1 Increase in the supply of cement for construction projects

The proposed Cement grinding Plant project involves the grinding and packaging of the overall cement production process to produce 1MTPA (one million ton per annum) of Portland cement. The respondents were positive about the eventual increase in the quantity of cement production

in the county.

Building contractors will have competitive prices for cement purchases. The cement will also find its way into the construction of affordable houses in Kenya. One of the Big four activities of cement importation will also reduce and therefore improve the gross domestic product, GDP for the country.

5.3.6.2 Increased revenue to the government

The proposed cement grinding plant will grind and package the cement for commercial purposes. This will create profit for the company and also revenue for the government via taxes, cess fee, and royalties.

5.3.6.3 Vision 2030

Vision 2030 was launched in 2008 as Kenya's development blueprint by the year 2030. Its goal is to Make Kenya a newly industrializing, "middle-income country providing a high-quality life for all its citizens by the year 2030". Different stakeholders agreed that the establishment of industries is key for the country to achieve the vision 2030. The industries create job opportunities and therefore upgrading the living standards of the citizens.

5.3.6.4 Support of the Local Businesses in Mathatani

Services of local businesses Mathatani such as transporters will be required to cater for day-to-day activities and operation of the cement plant. This will contribute to the growth and development of such businesses. There will also be investments in housing to cater for the increased workforce, hospitals, schools, shops among others.

5.3.6.4 High demand for cement manufacturing raw materials

Cement manufacturing depends on various raw material inputs that are mostly mined from the quarries. The proposed cement plant will increase the demand for the input material from mine quarries. This is an opportunity for the existing and new mining companies.

CHAPTER 6: POTENTIAL ENVIRONMENTAL IMPACTS

6.1. Introduction

This chapter outlines the potential negative and positive impacts that will be associated with the proposed Mashujaa Cement Grinding Plant. The impacts will be related to activities to be carried out during construction/installation phase of the project; the operational phase impacts of the project will be associated with the cement grinding activities carried out by the proponent. In addition, closure and decommissioning phase impacts of the project are also highlighted. The impacts of the project during each of its life cycle phases (construction/installation, operation and decommissioning) can be categorized into: impacts on the biophysical environment; health and safety impacts; and socio-economic impacts.

6.2. Quantification of the Magnitude of Impacts

The magnitude and significance of impacts was assessed based on the following factors:

- Location or extent: The area/volume covered
- Timing: Whether immediate or delayed
- Duration: Short term, long term, intermittent or continuous
- Reversibility or irreversibility
- Likelihood: Probability of the impact taking place
- Significance: Whether it is local, regional or global

From the observation made, expert knowledge based on the magnitude of the predicted impacts was relied upon. The scale that was applied in the analysis of impacts is shown in the table below.

6.3 Impact identification

The International Finance Corporation Performance Standard 1 paragraph 7 emphasizes on the process of identifying environmental risks and impacts. The type, scale and location of the project guided the scope of the impact identification. The direct and indirect project-related impacts on biodiversity and ecosystem services and residual impacts were considered during the assessment of impacts in accordance to the IFC Performance Standard 6 paragraph 6. Project components potentially have impact on environment by altering terrestrial coastal habitats. The ESIA study was confined within the scope that was affected by the project.

An ecological Risk Assessment Matrix developed by Kurrent Technologies Ltd 2012 was used to assess impacts of the project on biodiversity. The **extent** of impact can be limited to the project site and to specific activity at particular period, or affect areas beyond the project site. **Duration** in which the impact

takes place is also considered in the evaluation of the impact. The period can be specific to the period of certain activities or could be related to the occupancy period of the project development. Thus, in terms of duration an impact can be viewed as a short, medium, long term impact or permanent. Impact can affect biodiversity partially or completely. For instance only small part of habitat, ecological processes or small population of species can be destroyed by the impact. Thus, **magnitude** of an impact was evaluated as proportion of the environmental entity affected. The probability of the impact to happen was derived from the frequency of the activity and frequency of impacts. The four characteristics described above were used to synthesize significance of the impact. See below the scale of risk assessment matrix.

Figure 13: an ecological Risk Assessment Matrix

EXTENT

Localized (At localized scale and a few hectares in extent)	1
Study area (The proposed site and its immediate environs)	2

Regional (District and provincial level)	3
National (Country)	4
International (Beyond Kenya)	5

MAGNITUDE

Small and will have no effect on the environment	0
Minor and will not result in an impact on the processes	2

Low and will cause a slight impact on the processes	4
Moderate and will result in process continuing but in a modified way	6
High (processes are altered to the extent that they temporarily cease)	8
Very high and results in complete destruction of patterns and permanent cessation of the processes	10

DURATION		PROBABILITY	
Very short (0 – 1 Years)	1	Highly improbable (<20% chance of occurring)	1
Short (1 – 5 Years)	2	Improbable (20 – 40% chance of occurring)	2
Medium term (5 – 15 years)	3	Probable (40% - 70% chance of occurring)	3
Long term (>15 years)	4	Highly probable (>70% - 90% chance of occurring)	4
Permanent	5	Definite (>90% chance of occurring)	5

		CONSEQUENCE (Extent+Duration+Magnitude)																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
PROBABILITY	1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	2	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
	3	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60
	4	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80
	5	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100

Figure 15: Method used to determine the environmental risk: Risk = (Extent + Duration + Magnitude) x Probability

Low	<30	Where this impact would not have a direct influence on the decision to develop in the area
Medium	30-60	Where the impact could influence the decision to develop in the area unless it is effectively mitigated
High	>60	Where the impact must have an influence on the decision process to develop in the area

Figure 16: Confidence of assessment table

The degree of confidence in predictions as per the available information, Kurrent Technologies Ltd. judgment and/or specialist knowledge	Low
	Medium
	High

Table 15; Levels of Scale used in the Analysis of Impacts

Value	Description	Scale Description
0	No impact	This means that to the best knowledge of the expert, the particular activity/action will not have any known impact on the environment. Such an impact will not in any way affect the normal functioning of either the human or the natural systems and does not therefore warrant any mitigation.
1	Minimal impact	Any activity with little impact on the environment calls for preventive measures, which are usually inexpensive and manageable. Such activities have minimum impacts on either natural or human environment or both.

2	Moderate impact	A moderate impact will have localized effect on the environment. If the effect is negative and cumulative, action in form of mitigation measures needs to be put in place to ensure that it doesn't become permanent and /or irreversible.
3	High impact	An impact is high if it affects a relatively high area (spatial), several biological resources (severity) and/or the effect is felt for a relatively long period (temporal) e.g. more than one year. In case the effect is negative, such an impact needs to be given timely consideration and proper mitigation measures put in place to prevent further direct, indirect or cumulative adverse effects.
Value	Description	Scale Description
4	Very high impacts	Such an activity rates highly in all aspects used in the scale i.e., temporal, spatial and severity. If negative, it is expected to affect a huge population of plants and animals, biodiversity in general and a large area of the geophysical environment, usually having trans-boundary consequences. Urgent and specialized mitigation measures are needed. It is the experts' opinion that any project with very high negative impacts MUST be suspended until sufficient effective mitigation measures are put in place.

5	Not known	There are activities for which impacts are not yet known e.g. some chemicals are suspected to produce carcinogenic effects but this has not yet been confirmed.
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6.4 Potential Negative Impacts of the Project

Potential negative impacts that may result from the implementation of the proposed Mashujaa Cement Grinding Plant: -

- Increased gaseous emissions
- Increased dust emissions
- Increased noise disturbance
- Occupational injuries and or accidents
- Waste (liquid and solid) related pollution
- Negative impacts on local flora and fauna
- Negative impacts on avifauna

6.4.1 Gaseous Emissions

There are three main sources of gaseous emissions from a cement production system namely raw materials, the fuel, and the process itself. Gases produced from cement production process include carbon dioxide, carbon monoxide, nitrogen oxides, sulfur dioxide, and ammonia.

In the case of a cement-grinding unit, unlike clinker production, there is no burning process involved. Hence, there are no gaseous emissions. Even as regards air pollution, which basically can be caused by both particulates and undesirable gases, the plant operation ensures practically no emission of gaseous substances.

6.4.2 Carbon dioxide- CO₂

Carbon dioxide results from the combustion of fuel and the calcination of the limestone component of the raw material mix, an essentially unavoidable and fixed consequence of clinker manufacture. Of the total amount of CO₂ emitted from a cement kiln, about half of the CO₂ originates from the raw material

while the other half originates from the combustion process.

The environmental impact is minimal since there is little or no CO₂ emission since the grinding plant does not produce clinker associated with carbon emission.

Potential negative impacts of CO₂

- CO₂ contributes to the formation of smog, ground-level ozone, which can trigger serious respiratory problems;
 - Greenhouse gas hence contribution to global warming;
 - Formation of acid rain potentially damaging to plants, animals and property;
 - Harmful health effects by reducing oxygen delivery to the body's organs (like the heart and brain) and tissues;
- Central Nervous System Effects

6.4.3 Nitrogen oxide- NO_x

There are four mechanisms of NO_x formation in cement kilns of which thermal and fuel NO_x formation is the most important. Thermal NO_x results from the oxidation of molecular nitrogen in air at high temperature. This phenomenon occurs in and around the flame in the burning zone of a cement kiln at a temperature greater than 1200°C. Fuel NO_x results from the oxidation of nitrogen in the fuel at any combustion temperature found in the cement process. Because of the lower combustion temperature in the calciner and some sites of supplemental fuel combustion, the formation of fuel NO_x often exceeds that of thermal NO_x at these locations. The environmental impact is minimal since there is little or no CO₂ emission since the grinding plant does not produce clinker associated with carbon emission.

Potential negative impacts of NO_x

- Formation acid rain which may negatively affect plant and animal life;
- Visibility impairment through formation of brown cities;
- Eutrophication that is, explosive algae growth which can deplete oxygen in water bodies;
- It contributes to global warming;
- Respiratory illness in young children and harm lung function in adults

6.4.4 Sulfur dioxide - SO_x

Sulfur dioxide results from the oxidation of sulfide or elemental sulfur contained in the fuel during combustion. In addition, sulfide or elemental sulfur contained in raw materials may be roasted or oxidized to SO₂ in areas of the pyroprocessing system where sufficient oxygen is present and the material temperature is in the range of 300-600°C. In addition, sulfates in the raw mix can be converted to SO₂ through localized reducing conditions in the kiln system. The environmental impact is minimal since there is little or no CO emission since the grinding plant does not produce clinker associated with carbon emission.

Potential negative impacts of SO_x

- Pollution of upper atmosphere that result in the formation of smog,
- Acid rain effect on plant, wildlife and property;
- Precursor of fine particulate soot, which poses a significant health threat;
- Respiratory illness

6.4.5 Dust Emissions

Dust is made of fine particles of solid matter on earth; it generally consists of particles in the atmosphere that come from various sources such as soil lifted by wind, an aeolian process, volcanic eruptions, and pollution

Dust is a significant consideration from the point of its nuisance effect to the surrounding atmosphere. Dust can be produced by almost all production processes in Portland cement factory. Negative health Impact of dust pollution can be controlled with equipment having high efficiency dust collection systems. In case of grinding unit both raw material crushing and Pyro processing operation for the production of clinker are not required and hence the particulate emission in bulk is not encountered in grinding unit. Separate particles and particle aggregates—from ultra-microscopic particles to those visible with the naked eye—have various shapes and compositions. In most cases, dust is formed as a result of the dispersion of solid bodies. It consists of particles that range in size from 10⁻⁷ to 10⁻⁴ m and that carry an electrical charge or are electrically neutral. Dust concentration, or dust content, is expressed by the number of particles or their total weight per unit volume of gas (air). Dust is unstable; its particles adhere during Brownian motion or during sedimentation. Dust from cement or more appropriately cement particulate matter, at a cement plant

is typically caused by physical attrition, combustion particle burnout, or nucleation. Physical attrition occurs as particles abrade against each other. Particles generated by physical attrition range from less than 10 micrometers in size to more than 1,000 micrometers. Combustion particle burnout refers to the residues remaining from the pyro process. These particles are typically in the 1 to 100 micrometer range. Nucleation particles are generated when materials that are in a vapor form condense. These particles are truly very small, usually between 0.1 and 1.0 micrometers.

6.4.5.1 Potential sources of dust generation

As mentioned above, dust in cement Manufacturing plant, is generated from a number sources and sections. They include;

- Material transportation,
- Crushing unit
- Grinding unit
- Material mixing,
- Conveying raw material and;
- Cement bagging and packaging.

In case of grinding unit both raw material crushing and Pyro processing operation for the production of clinker are not required and hence the particulate emission in bulk is not encountered in grinding unit.

However, regarding the dust generation from the other sections viz. cement mill, Material storages, packing and various material transfer points, fabric filters based on the most modern technology are proposed to be installed to ensure that the dust emissions are within the prescribed limits and lower than 25mg/Nm³, which is compatible to the best international standards.

6.4.5.2 Health Effects of Exposure to Cement Dust

Environmental and occupational pollution has always been a major cause of morbidity and mortality. The incidence of the occupational disease is constantly increasing throughout the world, especially in developing countries due to the lack of proper quality control documentation and the practical approach towards this mammoth problem. The smoke and dust produced by some industries cause various types of pathogenesis. The unhygienic exposure of the smoke and dust are

linked with an increased risk of chronic obstructive pulmonary diseases. In this vista, cement workers may also be exposed to numerous types of occupational hazards, and these materials are the major culprits in mortality and morbidity.

Respiratory diseases associated with inhalation of airborne dust are the most vital group of occupational diseases. Previous study subjects with chronic obstructive pulmonary disease advocate that workplace exposures are powerfully linked with an increased risk of chronic obstructive pulmonary disease. Chronic respiratory diseases account for a public health challenge in both industrialized as well as developing countries because of their health and economic impacts.

Cement is one of the most important building materials in the world. Moreover, cement dust constitutes numerous materials including calcium oxide, silicon oxide, aluminium trioxide, ferric oxide, magnesium oxide, sand and other impurities. The cement dust or constituents of cement causes pathogenesis of various lung diseases including chronic bronchitis, asthma, lung cancer, pneumonia and tuberculosis. The study based on workers have reported that condition of the oral mucosa in cement plant workers, where clinical examination established features of mechanical trauma and oral mucosal inflammation in all workers exposed to cement dust. Research finding based on Iran of 200 workers, increased prevalence of respiratory symptoms and reduced lung function indices were noticed post-shift. There are also other types of health complication caused by prolonged exposure to cement dust are; cough complications of asthma, lung infections, skin allergy, back pain, and chest tightness

In conclusion, cement particle exposure or inhalation causes respiratory complications and its accumulation in the lung causes epithelial damage and causes inflammation.

6.4.3 Potential negative impacts of cement dust

Potential negative impacts of exposure to cement dust would include:

-
- Epithelial damage and body inflammation
- Respiratory complications including lung infections
- Skin allergy
- Coughing

- Eye damage
- Asthma attacks
- Eye damage
- irritation of the eyes

6.4 Increased Noise disturbance

Noise pollution is the unwanted or excessive sound that can have deleterious effects on human health, wildlife, and environmental quality. Noise pollution is commonly generated inside many industrial facilities and some other workplaces, but it also comes from highway, railway, and airplane traffic and from outdoor construction activities.

6.4.1 Measuring and Perceiving Loudness

Sound waves are vibrations of air molecules carried from a noise source to the ear. Sound is typically described in terms of the loudness (amplitude) and the pitch (frequency) of the wave. Loudness (also called sound pressure level, or SPL) is measured in logarithmic units called decibels (dB). The normal human ear can detect sounds that range between 0 dB (hearing threshold) and about 140 dB, with sounds between 120dB and 140 dB causing pain (pain threshold). The ambient SPL in a library is about 35 dB, while that inside a moving bus or subway train is roughly 85 dB; building construction activities can generate SPLs as high as 105 dB at the source. SPLs decrease with distance from the source.

The rate, at which sound energy is transmitted, called sound intensity, is proportional to the square of the SPL. Because of the logarithmic nature of the decibel scale, an increase of 10 dB represents a 10-fold increase in sound intensity, an increase of 20 dB represents a 100-fold increase in intensity, and a 30-dB increase represents a 1,000-fold increase in intensity, and so on. When sound intensity is doubled, on the other hand, the SPL increases by only 3 dB. For example, if a construction drill causes a noise level of about 90 dB, then two identical drills operating side by side will cause a noise level of 93 dB. On the other hand, when two sounds that differ by more than 15 dB in SPL are combined, the weaker sound is masked (or drowned out) by the louder sound. For example, if an 80-dB drill is operating next to a 95-dB dozer at a construction site, the combined SPL of those two sources will be measured as 95 dB; the less intense sound from the compressor will not be noticeable.

Frequency of a sound wave is expressed in cycles per second (cps), but hertz (Hz) is more commonly used (1 cps = 1 Hz). The human eardrum is a very sensitive organ with a large dynamic range, being able to detect sounds at frequencies as low as 20 Hz (a very low pitch) up to about 20,000 Hz (a very high pitch). The pitch of a human voice in normal conversation occurs at frequencies between 250 Hz and 2,000 Hz.

Precise measurement and scientific description of sound levels differ from most subjective human perceptions and opinions about sound. Subjective human responses to noise depend on both pitch and loudness. People with normal hearing generally perceive high-frequency sounds to be louder than low-frequency sounds of the same amplitude. For this reason, electronic sound-level meters used to measure noise levels take into account the variations of perceived loudness with pitch. Frequency filters in the meters serve to match meter readings with the sensitivity of the human ear and the relative loudness of various sounds. The so-called A-weighted filter, for example, is commonly used for measuring ambient community noise. SPL measurements made with this filter are expressed as A-weighted decibels, or dBA. Most people perceive and describe a 6- to 10-dBA increase in an SPL reading to be a doubling of “loudness.” Another system, the C-weighted (dBC) scale, is sometimes used for impact noise levels, such as gunfire, and tends to be more accurate than dBA for the perceived loudness of sounds with low frequency components.

Noise levels generally vary with time, so noise measurement data are reported as time-averaged values to express overall noise levels. There are several ways to do this. For example, the results of a set of repeated sound-level measurements may be reported as $L_{90} = 75$ dBA, meaning that the levels were equal to or higher than 75 dBA for 90 percent of the time. Another unit, called equivalent sound levels (L_{eq}), can be used to express an average SPL over any period of interest, such as an eight-hour workday. (L_{eq} is a logarithmic average rather than arithmetic average, so loud events prevail in the overall result.) A unit called day-night sound level (DNL or L_{dn}) accounts for the fact that people are more sensitive to noise during the night, so a 10-dBA penalty is added to SPL values that are measured between 10 PM and 7 AM. DNL measurements are very useful for describing overall community exposure to aircraft noise, for example.

6.4.2 Sources of Noise Generation

Industrial machinery and processes are composed of various noise sources such as rotors, stators,

gears, fans, vibrating panels, turbulent fluid flow, impact processes, electrical machines, internal combustion engines etc. The mechanisms of noise generation depend on the particularly noisy operations and equipment including crushing, riveting, blasting (quarries and mines), shake-out(foundries), punch presses, drop forges, drilling, lathes, pneumatic equipment (e.g. jack hammers, chipping hammers, etc.), tumbling barrels, plasma jets, cutting torches, sandblasting, electric furnaces, boiler making, machine tools for forming, dividing and metal cutting, such as punching, pressing and shearing, lathes, milling machines and grinders, as well as textile machines, beverage filling machines and print machines, pumps and compressors, drive units, hand-guided machines, self-propelled working machines, in-plant conveying systems and transport vehicles.to add, there are the information technology devices which are being encountered more and more in all areas.

Noise is therefore a common occupational hazard in a large number of workplaces such as the iron and steel industry, foundries, saw mills, textile mills, airports and aircraft maintenance shops, crushing mills, among many others.

Noise is more than a mere nuisance. At certain levels and durations of exposure, it can cause physical damage to the eardrum and the sensitive hair cells of the inner ear and result in temporary or permanent hearing loss, known as noise-induced hearing loss. Hearing loss does not usually occur at SPLs below 80 dBA (eight-hour exposure levels are best kept below 85 dBA), but most people repeatedly exposed to more than 105 dBA will have permanent hearing loss to some extent. In addition to causing hearing loss, excessive noise exposure can raise blood pressure and pulse rates, cause irritability, anxiety, and mental fatigue, and interfere with sleep, recreation, and personal communication. Children living in areas with high levels of noise pollution may suffer from stress and other problems, such as impairments in memory and attention span. Noise pollution control is therefore important in the workplace and in the community.

Noise pollution also impacts wildlife. A wide range of animals, including insects, frogs, birds, and bats, rely on sound for a variety of reasons. Noise pollution can interfere with an animal's ability to attract a mate, communicate, navigate, find food, or avoid predators and thus can even be an existential threat to vulnerable organisms.

6.4.3 Potential negative impacts of noise

- Hearing loss
- High blood pressure
- High pulse rate
- Irritability
- Anxiety
- Mental fatigue
- Interfere with sleep and personal communication
- Fatigue, headache, nervousness

6.5 Occupational injuries and or accidents

The most significant occupational health and safety impacts occurring during the construction and operational phase of cement manufacturing plant include, dust, heat, noise and vibrations, physical hazards, radiation, chemical hazards and other industrial hygiene issues.

6.5.1 Dust

Exposure to fine particulates is associated with work in most of the dust-generating stages of cement manufacturing, in this case cement grinding. Exposure to active (crystalline) silica dust (SiO₂), when present in the raw materials, is a relevant potential hazard in the cement manufacturing.

6.5.2 Heat

The principal exposures to heat in cement manufacturing occur during operation and maintenance of kilns, grinding mill or other hot equipment, and through exothermic reactions.

6.5.3 Noise and Vibrations

Exhaust fans and grinding mills are the main sources of noise and vibrations in cement manufacturing plants.

6.5.4 Physical hazards

Injuries during cement manufacturing operations are typically related to slips, trips, and falls; contact with falling / moving objects; and lifting / over-exertion. Other injuries may occur due to contact with, or capture in, moving machinery (e.g. dump trucks, front loaders, forklifts). Activities related to maintenance of equipment, including crushers, mills, mill separators, fans, coolers, and

belt conveyors, represent a significant source of exposure to physical hazards.

6.5.6 Radiation

An X-ray station is sometimes used to continuously monitor the, raw material mix on the belt conveyer or feeding the raw mill. Operators of this equipment should be protected through the implementation of ionizing radiation protection measures.

6.5.7 Chemical Hazards and other Industrial Hygiene Issues

Chromium may contribute to allergic contact dermatitis among workers handling cement. Prevention and control of this potential hazard includes a reduction in the proportion of soluble chromium in cement mixes and the use of proper personal protective equipment (PPE) to prevent ingestion, inhalation and skin burns.

Precautionary measures against noise pollution are proposed to be taken as follows:

- Choosing quieter machinery provided with efficient silencers
- Confining noise by isolating the source
- Planting trees to create a wide green belt

6.6 Waste related pollution Solid waste

The project has the potential of solid waste generated from the manufacturing process. Traditionally the proposed operation of the plant is very efficient and does not generate produce solid waste. As a result, waste from the actual grinding plant is expected to have negligible waste

However, sources of solid waste in cement manufacturing can be of three categories namely material process waste, office waste and domestic waste.

The latter, domestic waste include waste from canteen and other eating places within the plant and waste from dwelling houses of staff such waste include food left offers, wastepaper. Office waste includes wastepaper, electronic waste and sweepings.

Process waste in cement production waste is composed of spoil rocks, which are removed from the raw materials during the raw meal preparation. Another potential waste collected during the operation phase is generated from plant maintenance (e.g. used oil and scrap metal).

Potential negative impacts of solid waste include:

- Production loss;

- Odor from decomposing food leftovers from the canteen;
- Blockage of drainage system by scrap and other non-decomposing solid wastes;
- Some electronic office waste such as used toner cartridges and absolute office electronic equipment contain hazardous substances.

6.7 Liquid waste

The unit operation involved in cement grinding unit utilize water only for external cooling and does not take part in the process in any manner to produce any water pollution

Liquid waste generated from the proposed cement plant manufacturing process includes, sanitary wastewater, storm water and waste oil. Wastewater is also generated from sanitary facilities from the plant, from cleaning of floors and other surfaces and from tools and equipment cleaning such as motor vehicles.

Waste oil is generated from servicing of machines and equipment. Handling of the waste oil includes water separation for reuse, selling to recyclers and burning in incinerators.

Potential negative impacts of wastewater generation include:

- Odor from untreated contaminated wastewater;
- Water scarcity due to high use;
- Water contamination due to high dissolved solids and other contaminants;
- Contamination of ground water if untreated contaminated wastewater is discharged into the environment;
- Degradation of the quality of water of the receiving water body if contaminated wastewater is discharged into aquatic environment prior to treatment;
- Contamination of soils if contaminated wastewater is discharged into the ground

6.7.1 Effluent Treatment and Waste Management

In the absence of any effluent produced in the grinding unit, there is no requirement of installing any effluent treatment plant. There is no generation of any waste products or by products from the plant.

Potential negative impacts of wastewater generation include:

- Water shortage due to high use;
- Water contamination due to high dissolved solids and other contaminants;

- Contamination of ground water if untreated contaminated wastewater is discharged into the environment;
- Odor from untreated contaminated wastewater;
- Degradation of the quality of water of the receiving water body if contaminated wastewater is discharged into aquatic environment prior to treatment;
- Contamination of soils if contaminated wastewater is discharged into the ground prior to treatment.

6.8 Negative impacts on local flora

The proposed Mashujaa Cement Grinding Plant will have a direct negative impact on local vegetation. This is because the vegetation on site will have to be cleared to pave way for the construction of the cement plant, other associated components and opening up more areas for quarrying to obtain raw material.

The potential negative impact of vegetation clearance will include the following:

- Reduction in local greenery.
- Diminishing of local carbon sink resulting in reduced area capacity of carbon sequestration;
- Overall reduction of flora in the area and overall loss and/or reduction of ecological and economic services derived from the lost vegetation;

Potential Negative impacts on local fauna

Based on the knowledge on hazards, ecological hazards in terrestrial ecosystem can be coined to be any biological, chemical, mechanical, environmental or physical agent that is likely to cause harm to other organisms and damage to habitats and ecological processes in the environment in the absence of their control. Potential risks that would likely occur when project is implemented include destruction of;

- Foraging areas for insect pollinators
- Ecological life cycles of insects and butterflies

Notably, observation from site investigation revealed presence of small insects, butterfly and birds in the site area. However, Fauna diversity and population in the area is low. Due to low population of

this group in the area, chances of interference would also be low.

Clearance of vegetation for construction of the cement plant has the potential to reducing the area of foraging for the insect pollinators such as the butterflies and bees. Insect pollinators rely on the vegetation for food nectars and fruit juice. Development activities normally take up more areas from the natural habitats that serve these taxa on various ecological services including foraging. When these areas are continuously reduced, the insect pollinators are left with small areas hence their population is affected with the little resource. However, most of the insect pollinator has the tendency of local movements for foraging and breeding. This ecological behavior provides them with the capacity for resilience.

6.9 Negative Impacts on Avifauna

The implementation of the proposed project will lead to negative impacts to avifauna in the area. The project has the potential to affect the avifauna of the project area from the associated activities. This is mainly through ecological disturbance leading to displacement or exclusion of birds. For some of the species, there will be complete annihilation of their habitats. This is because the project activities are likely to cause site-specific negative impacts on the biophysical environment of the project area which will affect avifauna in various ways including increased pressure and/or loss of habitat and essential resources for food and nesting for birds.

The following are the potential impacts on avifauna at the proposed site

- The impacts of direct habitat loss due to annihilation of the species habitats.
- The impacts of habitat modification due to changes in land management.
- The impacts of indirect habitat loss due to the displacement of birds as a result of construction, and maintenance activities,

As a wintering/feeding ground for some of the migrants, it is also possible that the species will have to find alternative sites. The effects of the proposed project on birds are highly variable and will depend on a wide range of factors including:

- Specification of the development – how expanse and level of the transformation,
- Topography of the surrounding land,
- Habitats affected
- Number and species of birds present.

- Land uses within the surrounding matrix and availability of alternative sites for these species

6.9.1 Loss of avifauna habitats

Potential negative impacts on avifauna population were quantitatively assessed against the set criteria. Activities associated with the project during construction will involve; movement of works of project components. Bird habitats are expected to be affected through various processes and activities including: -

- Construction activities will result in destruction of bird habitats at the construction sites;
- Equipment activity at the proposed project site may result in trampling on habitats of ground dwelling birds, including bird nests;
- Project implementation may result in bird habitat fragmentation making the habitat less attractive to bird;
- Disturbance of birds may occur during all phases of the project as a result of increased on-site human activities during site preparation, and plant operation activities.

Table 10 **Impact analysis for avifauna habitat loss**

Unmitigated impacts on Avifauna habitat loss	
Extent of impact	1
Magnitude of impact	1
Duration of impact	5
Probability of impact	5
Risk = (Extent + Duration + Magnitude) x Probability	35
Confidence of Assessment	High (70)

6.9.2 Habitat Modification from associated project activities

Implementation of the proposed project may result in modification of habitats for avifauna at the proposed project site and its environs. Vegetation clearance to pave way for project implementation

will destroy bird feeding grounds, bird nesting ground and complete interfere with the daily routine of the birds. The results of habitat modification to local avifauna will include:

Disruption on breeding patterns which will results on diminished bird population;

- Migration and relocation of the affected bird species from the area which will affect the local food chain;
- Loss of ecological services associated with birds such as pollination;
- Destruction of migration route for migrant bird species;
- Destruction of foraging grounds of local resident species.

7.0 Environmental Mitigation Measures

7.1 Proposed mitigation measure of exposure to cement dust Dust removal

Modern equipment is equipped with high efficiency dust collection systems.

In case of grinding unit both raw material crushing and Pyro processing operation for the production of clinker are not required and hence the particulate emission in bulk is not encountered in grinding unit. Exposure to cement dust can be mitigated by removing the cement dust being generated. However, regarding the dust generation from the other sections viz. cement mill, Material storages, packing and various material transfer points, **fabric filters** based on the most modern technology will be installed to ensure that the dust emissions are within the prescribed li

The following technologies have successfully been used to mitigate generated dust water sprinkling, bag filters and electrostatic precipitators. Water sprinkling to remove dust will be used in belt conveyor system. The, fabric filters /bag filter technology will be used in the plant to suck out dust generated. The system will be used in cement mill and cement packaging and dispatch.

7.2 Dust removal by use of bag/ fabric filter technology

High efficiency fabric filters are used for controlling dust emissions from cement production material handling and product bagging systems. The bag filters system range in number depending on the size and production capacity of the cement plant. Separate fabric filter control systems ranging in size from 30 actual cubic meters per minute capacity to more than 100,000 actual cubic meters per minute capacity. Fabric filter operation can be described in three sequential steps:

- Filtration of particles from the gas stream
- Gravity settling of the dust cake
- Removal from the hopper

7.3 Cement dust management

Keeping in view the hazards of cement dust it is advisable therefore, the cement industry management, their workers and health officials should work together to adopt technical preventive measures, such as well-ventilated work areas and workers should wear appropriate personal protective equipment (PPEs). It is also suggested that cement mill workers must undergo pre-employment and periodic medical surveillance tests. These measures would help to identify susceptible workers in due time and improve the technical preventive measures that will decrease

the risk of occupational hazards in the cement industrial workers.

Potential negatively impacts likely to a result from exposure to cement dust can be mitigated in the following ways among others:

- Proper maintenance of the de-dusting systems i.e. water sprinkling, bag filters to ensure efficiency in dust collection;
- Workers to undergo pre-employment and periodic medical surveillance tests by a designated medical practitioner;
- Workers working in dusty area should wear appropriate Personal Protective Equipment, (PPEs) all the time;
- Management to ensure strict enforcement on the use of personal protective equipment by all workers;
- Management to ensure that the workplace is always well ventilated;
- Workers to be trained on the importance of making proper use of personal protective equipment provided.

7.4 Proposed mitigation measures of increased noise

Management of the noise risks can be done in six steps namely: -

- Assessing the risks;
- Protecting employees;
- Maintaining and equipment use;
- Training and sensitizing of workers;
- Health surveillance;
- Work reviews

Assessing of noise risks involves identification of noise hazards at the work place and developing the appropriate action plans. Employee protection involves elimination or controlling noise risks to acceptable legal limits by use good practice, appropriate engineering controls and employee protection. Equipment use and maintenance involves appropriate use of all noise control equipment and appropriate use of hearing protection. Training and sensitization of workers involves employee accessing information and training on noise risks, control measures and hearing protection. Health surveillance involves hearing checks for exposed workers and using result to improve on protection

of the workers. Work reviews involve constant review of work practice, changes in noise exposure and new ways to reduce risks.

7.5 Proposed measures to mitigate against gaseous emissions

7.5.1 Proposed measures to mitigate against SO_x

Fuel substitution (lower total sulfur),

- Flue gas desulphurization (FGD).
- Wet systems
- targeted emissions reduction
- Wet scrubbers
- Dry scrubbers
- Raw material alkali/sulfur balance

7.5.2 Proposed measures to mitigate against- CO₂

- Low NO_x burner
- Selective Catalytic reduction SRC
- Selective Non-Catalytic reduction SRC
- Exhaust Gas recirculation
- NO_x scrubbers
- Catalytic converter
- oxygen control (decrease), indirect firing

7.5.3 Proposed measures to mitigate against Carbon monoxide- CO

- UC3-Ultimate Cell continuous combustion technology
- Good combustion practice, excess air (increase),
- Raw material substitution, preprocessing system design and mixing air fan.
- Thermal oxidation

7.6 Proposed measures to mitigate against solid waste generation

7.6.1 Management practices

Some of the management practices that can be put in place to mitigate waste generation include: -
Establishing waste management priorities at the outset of activities based on an understanding of potential Environmental, Health, and Safety (EHS) risks and impacts and considering waste generation and its consequences;

- Establishing a waste management hierarchy that considers prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes;
- Avoiding or minimizing the generation waste materials, as far as practicable;

- Where waste generation cannot be avoided but has been minimized, recovering and reusing waste;
- Where waste cannot be recovered or reused, treating, destroying, and disposing of it in an environmentally sound manner;
- Collection of data and information about the process and waste streams in existing facilities, including characterization of waste streams by type, quantities, and potential use/disposition;
- Establishment of priorities based on a risk analysis that takes into account the potential EHS risks during the waste cycle and the availability of infrastructure to manage the waste in an environmentally sound manner;
- Definition of opportunities for source reduction, as well as reuse and recycling;
- Definition of procedures and operational controls for onsite storage;
- Definition of options / procedures / operational controls for treatment and final disposal.

7.6.2 Solid Waste Generation Prevention

The cement production processes should be designed and operated to prevent, or minimize, the quantities of wastes generated and hazards associated with the wastes generated. The proposed Mashujaa Cement Plant Project has the potential of solid waste generated from the manufacturing process. Traditionally the proposed operation of the plant is very efficient and does not generate solid waste. As a result, waste from the actual grinding plant is expected to have negligent waste. The following strategy will be used to prevent quantities and hazards associated with wastes generated

- Substituting raw materials or inputs with less hazardous or toxic materials, or with those where processing generates lower waste volumes;
- Applying manufacturing process that convert materials efficiently, providing higher product output yields, including modification of design of the production process, operating conditions, and process controls;
- Instituting good housekeeping and operating practices, including inventory control to reduce the amount of waste resulting from materials that are out-of-date, off specification, contaminated, damaged, or excess to plant needs.

7.7 Proposed measures to mitigate wastewater generation Sanitary Wastewater management

Sanitary wastewater includes effluents from domestic sewage, food service, and laundry facilities serving site employees. Miscellaneous wastewater from laboratories, medical infirmaries, water softening plant. Recommended sanitary wastewater management strategies include:

- Segregation of wastewater streams to ensure compatibility with selected treatment option(e.g. septic system which can only accept domestic sewage);
- Segregation and pretreatment of oil and grease containing effluents (e.g. use of a grease trap) prior to discharge into the environment;
- Treatment to meet national standards for sanitary wastewater discharges;
- Sewage from the industrial facility is to be discharged to either a septic system, or where land is used as part of the treatment system, treatment to meet Environmental Management and Coordination (Water Quality) Regulations, 2006, standards for sanitary wastewater discharges;
- Sludge from sanitary wastewater treatment systems should be disposed in compliance with Environmental Management and Coordination (Water Quality) Regulations, 2006

7.8 Utilities operations wastewater management

The unit operation involved in cement grinding unit utilize water only for external cooling and does not take part in the process in any manner to produce any water pollution.

7.9 Effluent Treatment and Waste Management

In the absence of any effluent produced in the grinding unit, there is no requirement of installing any effluent treatment plant. There is no generation of any waste products or by products from the plant.

7.10 Storm water management

Storm water includes any surface runoff and flows resulting from precipitation, drainage or other sources. Typically storm water runoff contains suspended sediments, metals, petroleum hydrocarbons, Polycyclic Aromatic Hydrocarbons (PAHs), coliform, etc. Rapid runoff, even of uncontaminated storm water, also degrades the quality of the receiving water by eroding stream beds and banks. In order to reduce the need for storm water treatment, the following principles

should be applied:

- Storm water should be separated from process and sanitary wastewater streams in order to reduce the volume of wastewater to be treated prior to discharge;
- Surface runoff from process areas or potential sources of contamination should be prevented;
- Where this approach is not practical, runoff from process and storage areas should be segregated from potentially less contaminated runoff;
- Runoff from areas without potential sources of contamination should be minimized (e.g. by minimizing the area of impermeable surfaces), and the peak discharge rate should be reduced (e.g. by using vegetated swales and retention ponds);
- Where stormwater treatment is deemed necessary to protect the quality of receiving water bodies, priority should be given to managing and treating the first flush of storm water runoff where the majority of potential contaminants tend to be present;
- When water quality criteria allow, stormwater should be managed as a resource, either for groundwater recharge or for meeting water needs at the facility;
- Oil-water separators and grease traps should be installed and maintained as appropriate at refueling facilities, workshops, parking areas, fuel storage, and containment areas;
- Sludge from stormwater catchments or collection and treatment systems may contain elevated levels of pollutants and should be disposed in compliance with the Environmental Management and Coordination (Water Quality) Regulations, 2006.

Proposed mitigation measures of occupational injuries and accidents

Methods to prevent and control exposure to dust include the following: -

- Control of dust through implementation of good housekeeping and maintenance;
- Use of air-conditioned, closed cabins;
- Use of dust extraction and recycling systems to remove dust from work areas, especially in grinding mills;
- Use of air ventilation (suction) in cement-bagging areas;
- Use of PPE, as appropriate (e.g. masks and respirators) to address residual exposures following

the adoption of the above-referenced process and engineering controls;

- Use of mobile vacuum cleaning systems to prevent dust buildup on paved areas.
- Recommended prevention and control techniques against exposure to heat include the following:
 - Shielding surfaces where workers' proximity and close contact with hot equipment is expected;
 - Using personal protective equipment (PPE), as needed (e.g., insulated gloves and shoes);
 - Minimizing the work time required in high-temperature environments by implementing shorter shifts at these locations;
 - Making available and using, as needed, air- or oxygen supplied respirators;
 - They are implementing specific personal protection safety procedures in the process to avoid potential exposure to exothermic reactions.

Control of noise emissions may include the following:

- Use of silencers for fans.
- Room enclosures for mill operators.
- Noise barriers and attenuators.
- Personal hearing protection.

CHAPTER 7: PROJECT ALTERNATIVES AND UNCERTAINTIES

In terms of the EIA Regulations, feasible alternatives are required to be considered as part of the environmental investigations. An alternative concerning a proposed activity refers to the different means of meeting the general purpose and requirements of the activity which may include alternatives to:

- The property on which or location where it is proposed to undertake the activity;
- The type of activity to be undertaken;
- The design or layout of the activity;
- The technology to be used in the activity; and
- The operational aspects of the activity.

All identified feasible alternatives are required to be evaluated in terms of social, biophysical, economic, and technical factors.

7.1 Zero Option, No Project or Do-Nothing Alternative

The do-nothing option would entail not using the site and maintaining the site as-is. From certain perspectives, this is not a viable option as the site is situated within an industrial zone area surrounded by either upcoming or already existing factories or other industries. In that case, both the positive and negative impacts of the project would not occur. The major impact of not proceeding would be the loss of expected benefits. By not developing the site, the site will be anomalous in the context of the surrounding factories' land uses, and some of the direct and indirect socio-economic benefits (i.e. job creation to the youth, revenue to the government, availability of construction cement, etc.) will not materialize.

From an ecological perspective, the site is located in an industrial zone area whose neighborhood characters are factories and other commercial facilities. The ecological linkages between the site and surrounding natural areas will be better maintained by increased project development around the site. Not developing the site will leave the site lying idle and unutilized and resulting in the underdevelopment of the area.

7.2 Layout Alternatives

The layout alternatives have been investigated and assessed within the Environmental and Social

Impact Assessment Phase. These are detailed in the report as the Preferred Layout with the Alternative Layout being the second option. Both options were investigated in terms of the layout for the proposed cement grinding plant establishment to accommodate the proposed project. Due to the surrounding access roads, accessibility, and convenience of the proposed site, the alternative (non- preferred) layout was not deemed a feasible option for the proposed site.

The preferred layout was deemed feasible. It has good support from the persons who would be most affected by its implementation. This alternative will provide positive benefits to Mashujaa Cement Company, the immediate community residents of Mavoko Sub County, and the government of Kenya (Tax revenue, job creation availability of cement as construction material to building contractors, engineers, and architects).

7.3 The Proposed Project with Technological Modifications

Every technology can be improved or enhanced to improve its environmental sustainability. The proponent confirms that in case of any emerging issues regarding the current technology used to put the plant, and then any sound technological modification will be implemented. Nevertheless, the cement plant shall be adopting a state-of-art technology, which ensures minimum emission, and whatever little dust emission takes place, it is almost completely captured by using bag filters employing most modern technology. A very substantial part of the Project Cost shall be earmarked for pollution control devices to not only ensure negligible dust emission but also to make this project a model unit from environmental protection and pollution control point of view.

CHAPTER 8: ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN

8.1 Introduction

This chapter presents the Environmental and Social Management Plan (ESMP) that will need to be implemented by the proponent to prevent or reduce significant negative impacts to acceptable levels. The purpose for Environmental and Social Management Plan is to address the impacts of the proposed project. All the project components and support infrastructure were considered when this ESMP was developed. Environmental management plans for all project phases has been outlined to cover: -

- Design and construction Phase
- Operation Phase
- Decommissioning Phase

The following ESMP tables forms the core of this ESMP for the construction, operational and decommissioning phases of the proposed cement grinding project. The following tables details all necessary mitigation measures as well as the person responsible for implementing and monitoring such measures. The tables should be used as checklist on site. Due to the magnitude of the project, compliance with the ESMP must be monitored periodically and reports prepared and provided at monthly site meetings during the construction phase and quarterly during the operations and maintenance period as required in EMCA 1999. Annual audits will be conducted during the construction, operation and maintenance phases.

8.2 Cost of Implementation the ESMPs

For effective implementation of the ESMPs, the project must establish an environment, health and safety (EHS) unit that will be responsible for Project Environmental Monitoring and Evaluation to ensure compliance to NEMA and international standards and practices. The project proponent will be responsible for all costs of implementing the project's EIA license conditions, including the ESMPs and the actual costs of

public involvement in the ESIAS process. Hence all costs proposed in the ESMPs below will be incurred by the project proponent. The costs outlined are current costs mainly for project environmental monitoring and evaluation to ensure compliance to NEMA and international standards and practices. To estimate future costs, an increase to cover annual inflation should be applied. The costs for actual activities should be included in the main bill of quantities of the project.

The proponent will incorporate mitigation measures into the activities of the proposed Mashujaa Cement Grinding Plant and will ensure that mitigation measures highlighted in this report are implemented. Once the project becomes operational, the Health and Safety issues as well as environmental considerations will be handled by the proponent. The proposed project should be implemented in such a way that will include issues of environmental considerations and issues affecting the project, implementation of environmental management plan, project management, health risks and their prevention. Others include the following:

- Organizational practices.
- Project management.
- Socio-economic issues relating to access and use of road and natural resource.
- Financial management.

TABLE 8: PRE-CONSTRUCTION, CONSTRUCTION & OPERATION PHASES

Activity	Potential Environmental & Health Impact	Proposed Mitigation Measures	Monitoring	Responsible Party	Time Frame	Cost (Ksh)
<ul style="list-style-type: none"> • The plant will utilize the latest technology, Verticle Roller mill (VRM) and UTIS-Ultimate Technology to Industrial Saving Technology UC3-Ultimate Cell Continuous Combustion technology that is efficient with minimal Co₂ emissions <ul style="list-style-type: none"> • The plant does not manufacture clinker, and therefore eliminating gaseous emissions associated with clinker production <ul style="list-style-type: none"> • The plant is powered by electric energy, therefore, minimizing air pollution associated with fossil fuels 						

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Activity	Potential <ul style="list-style-type: none"> • Environmental & Health Impact 	Proposed <ul style="list-style-type: none"> • Mitigation Measures 	<ul style="list-style-type: none"> • Monitoring 	Responsible <ul style="list-style-type: none"> • Party 	<ul style="list-style-type: none"> • Time Frame 	<ul style="list-style-type: none"> • Cost (Ksh)

<p>Cement Dust pollution</p>	<ul style="list-style-type: none"> • Occupation illness (lung infection, itching skin, eye irritation, coughing, to workers and other people exposed to the cement dust; • Reduced visibility; • Chocking of plants 	<ul style="list-style-type: none"> • Ensure de-dusting system is always efficient • Fabric filters /bag filter technology; • Particulate scrubbers • Workers to use appropriate PPE; • Strict enforcement on PPE use; • Ventilation at workplace to be sufficient; 	<ul style="list-style-type: none"> • Dust surveys Results of periodic dust surveys within the production line, packaging line and the neighbourhood of the facility to determine dust levels from time to time; • Medical surveillance • Results of medical tests of workers likely to be exposed to cement dust 	<ul style="list-style-type: none"> • Proponent; • Mashujaa Cement PLC • County Occupational Safety and Health Officer; • District Environmental Officer; 	<ul style="list-style-type: none"> • Dust surveys should be carried preferable every six months; • Medical severance should be carried out every twelve months 	<ul style="list-style-type: none"> • 600,000
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<p>High noise level at the workplace</p>	<p>Noise induced hearing loss Poor concentration at the workplace Reduced productivity</p>	<ul style="list-style-type: none"> • Developing and implementing an effective noise control and hearing conservation programme • Carrying out periodic noise measurements • Fitting noise machines with noise reduction devices; • Providing suitable hearing protection to all workers exposed to noise levels above 85dB(A); • Posting notices and signs in noisy areas; • Carrying out audiometric test by a designated medical practitioner to all workers exposed to noise levels above 85dB(A); • Educating all workers on 	<p>Reduction of noise levels at the workplace to the stipulated legal limits</p>	<p>Proponent; Mashujaa Cement PLC</p>	<p>The proposed mitigation measures to be implemented from the beginning of the end of the project</p>	<p>500,000</p>
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					implementation of the proposed project, be sustained throughout the project cycle ensuring continuous improvement	
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		protect them against high noise levels.				
Process solid waste management and disposal	<ul style="list-style-type: none"> • Air pollution especially from mill dust; • Skin irritation when in contact; • Water pollution; • Production loss; • Irritation of eyes; • Chocking of plants 	<ul style="list-style-type: none"> • Recycle and reuse where applicable; • Segregate for appropriate disposal; • Process improvement to minimize waste generations; • Material substitution to minimize waste generation; • Technological 	<ul style="list-style-type: none"> • Monitoring quantity of process waste generated 	Proponent; Mashujaa Cement PLC	From the onset of the production process and then throughout the operational life of the plant	600,000 per year

		improvement to minimize waste generation				
Domestic waste management and disposal	<ul style="list-style-type: none"> • Odor from decomposing food leftovers; • Blockage of drainage system 	<ul style="list-style-type: none"> • Sorting of waste at source; • Waste disposal as provided for in the Environmental Management and Coordination (Waste Management) Regulations, 2006; 	<ul style="list-style-type: none"> • Regular checking of handling areas; • Waste disposal records. 	<ul style="list-style-type: none"> • Mashujaa Cement PLC 	From the onset of the production process and then throughout the operational life of the plant	300,000 per year
		<ul style="list-style-type: none"> • Provide appropriate waste handling receptacles. 				

<p>Office waste management and disposal</p>	<p>Some electronic office waste such as used toner cartridges and absolute office electronic equipment contains hazardous substances</p>	<p>Absolute electronic equipment and other electronic waste to be returned to manufacturers for safe disposal</p>	<p>Records of disposal</p>	<ul style="list-style-type: none"> • Mashujaa Cement PLC , 	<p>From starting of operation of the plant and then be sustained throughout the operational life of the plant</p>	<p>100,000 per year</p>
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<p>Utilities operations wastewater</p>	<ul style="list-style-type: none"> • Water shortage due to high use; • Water contamination due to high dissolved solids and other contaminants 	<ul style="list-style-type: none"> • Adoption of water conservation opportunities; • Minimizing use of antifouling and corrosion inhibiting chemicals; • Testing for residual biocides and other pollutants of concern; • pH adjustment; • Sedimentation for suspended solids 	<p>Sampling and testing for conformity with water quality standards before discharge</p>	<p>Proponent;</p> <ul style="list-style-type: none"> • Mashujaa Cement PLC , 	<p>The proposed mitigation measures to be implemented from the beginning of the implementation of the proposed project, be sustained throughout the project cycle ensuring</p>	<p>1,000,000 per year</p>
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		<p>reduction using settling basins or clarifiers;</p> <ul style="list-style-type: none"> • Multimedia filtration for reduction in non settleable suspended solids. 				
<p>Sanitary Wastewater</p>	<ul style="list-style-type: none"> • Contamination of ground water; • Odor 	<ul style="list-style-type: none"> • Segregation of wastewater streams; • Treatment to meet national standards for sanitary wastewater discharge 	<p>Sampling and testing for conformity with Water quality standards before discharge</p>	<ul style="list-style-type: none"> • Mashujaa Cement PLC • NEMA, 	<p>The proposed mitigation measures to be implemented from the beginning of the implementation of the proposed project, be sustained throughout the project cycle ensuring continuous</p>	<p>1,000,000 per year</p>

					improvement	
Storm Water	<ul style="list-style-type: none"> • Degradation of the quality of water of the receiving water body; • Contamination of soils; 	<ul style="list-style-type: none"> • Storm water should be separated from process and sanitary wastewater streams in order to reduce the 	<p>Sampling and testing for conformity with Water quality standards before discharge</p>	<ul style="list-style-type: none"> • Mashujaa Cement PLC , 	<p>The proposed mitigation measures to be implemented from the beginning</p>	<p>2,000,000 per year</p>

	<ul style="list-style-type: none"> • Erosion 	<ul style="list-style-type: none"> • volume of wastewater to be treated prior to discharge; • Runoff from areas without potential sources of contamination should be minimized (e.g. by minimizing the area of impermeable surfaces) and the peak discharge rate should be reduced (e.g. by using vegetated swales and retention ponds); • Oil water separators and grease traps should be installed and maintained as appropriate at refueling facilities, workshops, parking 		<p>NEMA, WRMA,</p>	<p>of the Implementation of the proposed project is sustained throughout the project cycle ensuring continuous improvement.</p>	
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		areas, fuel storage and containment areas.				
Dust	<ul style="list-style-type: none"> • Lung infection; • Itching skin; • Eye irritation; • Coughing, to workers and other people exposed to the cement dust. 	<ul style="list-style-type: none"> • Good housekeeping and maintenance; • Use of air-conditioned, closed cabins; • Dust extraction and recycling systems; • Air ventilation (suction) 	<ul style="list-style-type: none"> • Dust survey every six months; • Visual observations; • Medical examination of workers exposed to dust 	<ul style="list-style-type: none"> • Mashujaa Cement PLC 	Proposed mitigation measures to employed before start of plant operations and be sustained and improved on throughout the functional life of the plant	5,200,000 per year

<p>Heat</p>	<ul style="list-style-type: none"> • Physical burns of workers exposed to heat; • Burning and damage to process equipment. 	<ul style="list-style-type: none"> • Shielding surfaces; • Using personal protective equipment; • Minimizing the work time required in high temperature environments by implementing shorter shifts; • Use of air- or oxygen supplied respirators. 	<ul style="list-style-type: none"> • Periodic • Heat Measurement 	<ul style="list-style-type: none"> • Mashujaa Cement PLC 	<p>Proposed mitigation measures to be employed before start of plant operations and be sustained and improved on throughout the functional life of the plant</p>	<p>500,000 per year</p>
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<p>Noise and vibrations</p>	<ul style="list-style-type: none"> • Noise induced hearing loss; • Poor concentration at workplace; • Reduced productivity 	<ul style="list-style-type: none"> • Use of silencers for fans; • Room enclosures for mill operators; • Noise barriers; • Personal hearing protection 	<ul style="list-style-type: none"> • Noise survey at the workplace every twelve months; • Audiometric test for workers exposed to high noise levels 	<ul style="list-style-type: none"> • Mashujaa Cement PLC 	<p>Proposed mitigation measures to employed before start of plant operations and be sustained and improved on throughout the functional life of the plant</p>	<p>1,100,000 per year</p>
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<p>Physical Hazards</p>	<ul style="list-style-type: none"> • Slip; • Trips; • Falls; • Contact with falling/moving parts 	<ul style="list-style-type: none"> • Good housekeeping; • Ensure surfaces are not slippery; • Clearly mark all uneven surfaces; • Guarding of machine moving parts; • Provide and mark safe passages and exits; 	<ul style="list-style-type: none"> • Physical checking/inspection of all workplaces at short intervals 	<ul style="list-style-type: none"> • Mashujaa Cement PLC 	<p>Proposed mitigation measures to employed before start of plant operations and be sustained and improved on throughout the functional life of the</p>	<p>600,000 per year</p>
		<ul style="list-style-type: none"> • Spills to be Promptly cleaned. 			<p>plant</p>	

<p>Occupational Health and Safety</p>	<ul style="list-style-type: none"> • Physical burns; • Sickness; • Disease/ill health 	<ul style="list-style-type: none"> • PPE use; • Appropriate handling as per material safety data sheets; • Training and sensitizations; • Medical examination of exposed workers 	<p>Spot checks at workplace on appropriate handling of equipment</p>	<ul style="list-style-type: none"> • Mashujaa • Cement PLC • DOSH , NEM A, 	<p>Propose mitigation measures to be employed before start of plant operations and be sustained and improved on throughout the functional life of the plant</p>	<p>600,000 per year</p>
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<p>Increased vehicular traffic along Nairobi-Mombasa Roads</p>	<ul style="list-style-type: none"> • Potential delays at the junction as traffic enters and exits the highway; • More traffic on the said road may translate to increased use of the road and hence increased wear and tear; • Likelihood of accidents, incidents and mere misses at the said turnoff from the highway 	<ul style="list-style-type: none"> • Liaise with the Kenya National Highway Authority for permission to construct an acceleration/deceleration lane for safe entry and exit of the highway; • Liaise with Kenya National Highway Authority to ensure that appropriate road signs before the exit/entry junction area erected; • Drivers to strictly observe the Highway Code; • Speed limits to be strictly observed 	<ul style="list-style-type: none"> • Records of traffic number in and out of the project site; • Flow of traffic in and out of the plant during construction phase; • Record of vehicular accidents and incidents 	<p>• Mashujaa Cement PLC</p>	<p>Implementation of the proposed mitigation measures to be put in place during the proposed project implementation phase and to be sustained and improved on throughout the lifecycle of the project</p>	<p>5,000,000 for construction of an acceleration / decoration lane</p>
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Parking of lorries outside Mashujaa Cement Grinding plant	Inconvenience to other motorists and other road users	Provide sufficient space for internal parking of lorries awaiting to deliver material or to collect material	Checking of available space provided for parking of lorries within the plant premises	Mashujaa Cement PLC	Provision of internal parking of lorries should be implemented within the first six months of project implementation	800,000 for construction and paving of lorry parking yard internally
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Activity	Potential Environmental & Health Impact	Proposed Mitigation Measures	Monitoring	Responsible Party	Time Frame	Cost (Ksh)
		<ul style="list-style-type: none"> The plant will utilize the latest technology, Verticle Roller mill (VRM) and UTIS-Ultimate Technology to Industrial Saving Technology UC3-Ultimate Cell Continuous Combustion technology that is efficient with minimal Co₂ emissions The plant does not manufacture clinker, and therefore eliminating gaseous emissions associated with clinker production <ul style="list-style-type: none"> The plant is powered by electric energy, therefore, minimizing air pollution associated with fossil fuels 				

<p>Release of Sulphur gases SOx</p>	<ul style="list-style-type: none"> • Pollution of upper atmosphere that result in the formation of smog, Acid rain effect on plant, wildlife and property; • Precursor of fine particulate soot, which poses a significant health threat; • Respiratory illness, 	<ul style="list-style-type: none"> • fuel substitution (lower total sulfur), • Flue gas desulphurization (FGD). • Wet systems • targeted emissions reduction • Wet scrubbers • Dry scrubbers • raw material alkali/sulfur balance 	<ul style="list-style-type: none"> • Monitoring of atmospheric SO2 using UV fluorescence or other sensors; • Measurement of emission standards; 	<p>Proponent; Mashujaa Cement PLC</p>	<p>(Construction, operation and decommissioning phase) The proposed mitigation measures to be implemented from the beginning and other implementation of the proposed project, be</p>	<p>300,000</p>
	<p>alterations in the lungs' defences and aggravation of existing cardiovascular disease.</p>				<p>sustained throughout the project cycle ensuring continuous improvement</p>	

<p>NOx Emissions</p>	<ul style="list-style-type: none"> • Formation acid rain which may negatively affect plant and animal life; • visibility impairment through formation of brown cities; • eutrophication that is, explosive algae growth 	<ul style="list-style-type: none"> • Low NOx burner • Selective Catalytic reduction SRC • Selective Non-Catalytic reduction SRC • Exhaust Gas recirculation <ul style="list-style-type: none"> • NOx scrubbers • Catalytic converter • oxygen control (decrease), indirect firing 	<p>Compliance with international national and ambient air quality, emission standards and meeting of NOx air quality index</p>	<p>Projects Proponent; Mashujaa Cement PLC</p>	<p>The proposed mitigation measures to be implemented from the beginning of the implementation of the proposed project, be sustained throughout the project cycle ensuring</p>	<p>200,000</p>
	<ul style="list-style-type: none"> • It contributes to <ul style="list-style-type: none"> • global warming; • respiratory 				<p>improvement</p>	

O emission	<ul style="list-style-type: none"> • CO contributes to the formation of smog, ground-level ozone, which can trigger serious respiratory problems; • Greenhouse gas hence contribution to global warming; • Formation of acid rain potentially damaging to plants, animals and property; • Harmful health effects by reducing oxygen delivery to the body's organs (like the heart and brain) and tissues; • Central Nervous System Effects 	<ul style="list-style-type: none"> • UC3-Ultimate Cell continuous combustion technology <ul style="list-style-type: none"> • Good combustion practice, excess air (increase), • Raw material substitution, preprocessing system design and mixing air fan. • Thermal oxidation 	<ul style="list-style-type: none"> • Adopting Direct control Carbon monoxide (CO) monitor; • Using NEMA accredited laboratories to measure emission standards; • Continuous checking of coal production technology and related processes 	Proponent; Mashujaa Cement PLC	The proposed mitigation measures to be implemented from the beginning of the implementation n of the proposed project, be sustained throughout the project cycle ensuring continuous improvement	200,000
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<p>CO2 Emission</p>	<ul style="list-style-type: none"> • Formation of acid rain, weak carbonic acid; • Major source of greenhouse gas; • Causes 	<ul style="list-style-type: none"> • UC3-Ultimate Cell continuous combustion technology • suitable green belt development and production of cement • Improved electrical efficiency, raw material substitution 	<p>Continuous checking of production technology and related processes</p>	<p>Proponent; Mashujaa Cement PLC</p>	<p>The proposed mitigation measures to be implemented from the beginning of the implementation of the proposed</p>	<p>200,000</p>
					<p>project, be sustained throughout the project cycle ensuring continuous improvement</p>	

8.3 Community basic grievance and redress mechanism

Community grievances that may arise from implementation of the proposed project can be addressed through existing community leadership structures in place from the grassroots level of Nyumba Kumi through to the Deputy County Commissioner and or from the grassroots (Ward) political leadership representation (Member of County Assembly) through to the County Assembly.

8.4 Combined Administrative and political leadership route

The aggrieved community member can register the grievances to the Chair Person of his or her NyumbaKumi who will intern notify the MzeeWaMtaa for that cluster of NyumbaKumi on the matter the two of them together with the aggrieved person can hold joint discussion to address the issues and concerns raised. These issues can be resolved at this level. However if the issues is not resolved at this level then the matter moves to the next level where it is reported by the MzeeWaMtaa to the area Assistant Chief who will in turn inform the area chief and the local Ward Representative (Member of County Assembly). All these parties can have a joint seating and discuss the matter with the aim of resolving the matter. The Area Chief can call a Chief ‘s Baraza to include more members of the community to discuss the matter. The matter can be resolved at this level. However, if no solution is reached then the Area Chief can report the matter to the Assistant County Commissioner who will in turn report the matter to the Deputy County Commissioner and the County Executive Member Water, Forestry, Environment and Natural Resources all these parties together with the aggrieved person can have joint seating to address the complaint with the

aim of reaching an amicable solution. If the matter is not resolved at this level then the Deputy County Commissioner and the County Executive Member Water, Forestry, Environment and Natural Resources can report the report the matter to the County Commissioner and the Chair Person County Environmental Committee respectively for redress.

8.5 Grievance Redress Mechanism

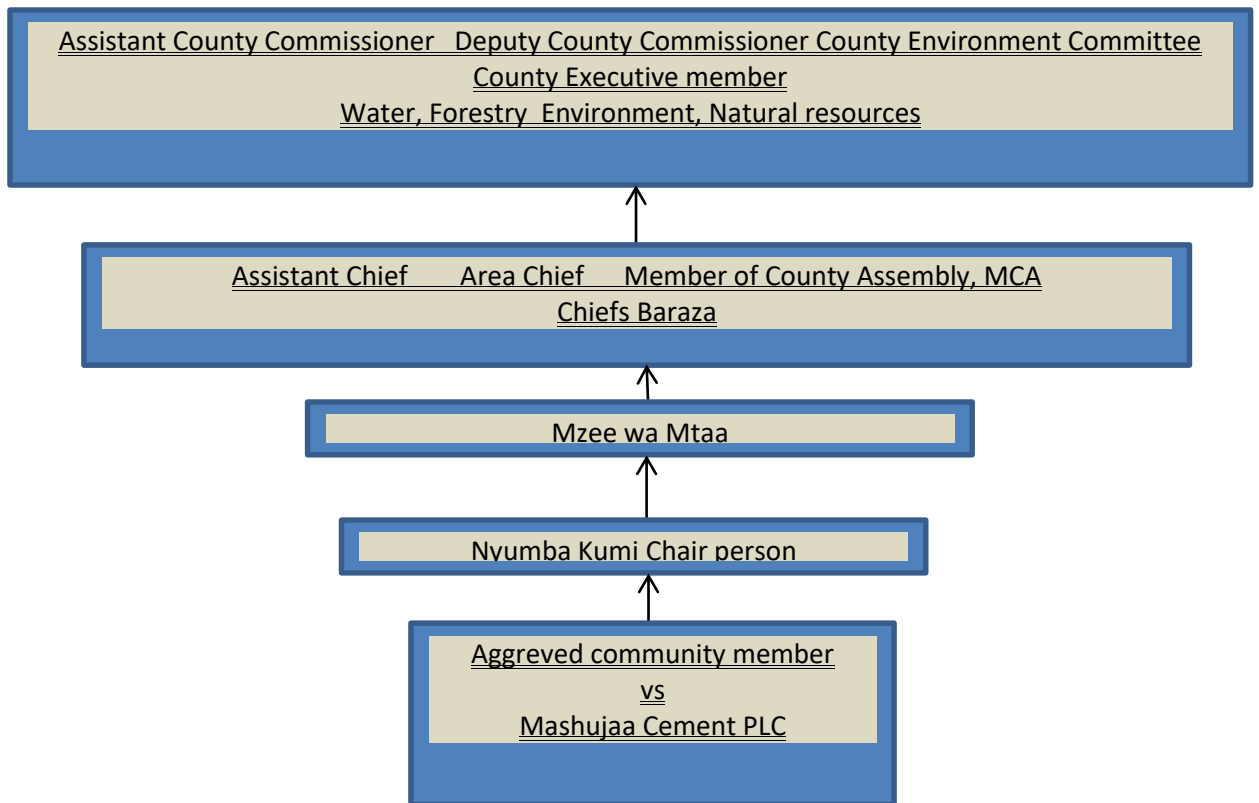


Figure 14: Flow chart of proposed community basic grievance redress mechanism

8.6 Decommissioning Phase

- In addition to the mitigation measures provided in the above tables, it is necessary to outline some basic mitigation measures that will be required to be undertaken once all operational activities of the proposed development have ceased. Appropriate vegetation and crops re-planted on open spaces (landscaping).
- All solid waste to be collected and disposed of appropriately by licensed garbage handlers.
- All efforts should be made to ensure that all excavated sites are restored to as near as possible to the state in which they were before the project was undertaken. This is according to EMCA's section 108.

The necessary objectives, mitigation measures, allocation of responsibilities, time frames, and costs about prevention, minimization, and monitoring of all potential impacts associated with the decommissioning and closure phase of the Mashujaa Cement Grinding Plant project are outlined in Table below.

Table 9: Environmental Management/Monitoring Plan for the decommissioning phase of the

Expected Negative impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost

1. Demolition waste management				
Demolition waste	1. All plant structures, buildings, machinery, equipment, and partitions that will not be used for other purposes must be removed and recycled/reused as far as possible	Contractor, Proponent	One-off	500,000

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost
Demolition waste	2. All foundations must be removed and recycled, reused or disposed of at a licensed disposal site			200,000
	Where recycling/reuse of the machinery, equipment, implements, structures, partitions and other demolition waste is not possible, the materials should be collected by a	Contractor, Proponent	One-off	150,000
	4. Donate reusable demolition waste to charitable	Contractor, Proponent	One-off	0
Site degradation	2. Rehabilitation of project site			
	1. Implement an appropriate re-vegetation programmed to restore the site to its original status	Contractor, Proponent	One-off	400,000
	2. Consider use of indigenous plant species in re-vegetation	Proponent Contractor,	One-off	
Trees should be planted at suitable locations so as to interrupt sight lines (screen planting), between other industrial structures and	Contractor, Proponent	Once-off		

CHAPTER 9: CONCLUSION AND RECOMMENDATION

This industrial development is compatible with the current land-use trends in the Athi River region. The project is timely and is supported by the local and broader community.

There is high demand for Portland cement in the building and civil works projects that go a long way in achieving infrastructural developments in the country. This project is one of the critical projects in line with the pillars of vision 2030 and the Kenyan Government Big Four Agenda, more so the affordable housing. Looking at other factories, industries, cement manufacturing plants, the investors have shown that they can develop sustainable industrial processing plants with reduced environmental impacts.

During the preparation of this report, it was observed and established that most of the negative impacts on the environment are rated low and short term with no significant effect as the plant is only set up for cement grinding and packaging. In contrast, clinker is outsourced externally from other mine areas. The positive impacts are highly rated and will benefit all stakeholders and the area residents at large. The proponent will adhere to the prudent implementation of the environmental management plan. They have qualified and adequate personnel to establish the project as proposed and have sufficient safety and health mitigation measures as part of the relevant statutory requirements.

9.1 Recommendations

The proposed project is recommended for implementation. The cement grinding plant should be licensed subject to annual environmental audits once it has been commissioned. Notably, this is to ensure it complies with the Environmental Management and Coordination Act of 1999 and the Environmental Impact Assessment and Audit regulations 2003 (amendments), the Environmental (Impact assessment / Audit) (Amended) Regulations, 2019 Gazetted on 30th April 2019 under Legal Notice No. 31 and 32

Following on the above conclusions, the following recommendations have been listed to ensure the prevention and mitigation of adverse impacts that may emanate from the proposed project;

- Open spaces with loose soils will require to be well compacted to prevent any erosion by wind and water,

- Excavated earth and other constructed debris will require to be removed safely and dumped in approved sites or reused elsewhere as road graveling landfills materials,
- Workers will require to be provided with appropriate personal protective gear and the application enforced at all times while at the place of work,
- Dry construction materials and excavated earth will be kept moist to prevent excessive dust and particulate matter emissions into the air, during the construction phase, and site clean-up on completion.
- All equipment will be properly maintained and in good operating condition,
- . Ensure compliance with all relevant laws and regulations throughout the project cycle,
- File completion report to NEMA.
- Give the proponent a copy of the report.
- Undertake regular audits during the occupational phase.
- Any other relevant legal document

CHAPTER 11: AUXILIARY INFORMATION

10.1 Project cost

The project is estimated to cost Ksh. 3,787,000,000.00 (Three Billion, seven hundred and eighty-seven million Kenya Shillings only).

10.2 Photo Inventory



Proposed site area



Neighbourhood Character



Proposed site area



Neighbourhood Character



Neighbourhood Character



Figure 1h: The community of Mathatani Sub-location in Athi River Sub County during the Public Participation and focused meetings at the chiefs' compound.

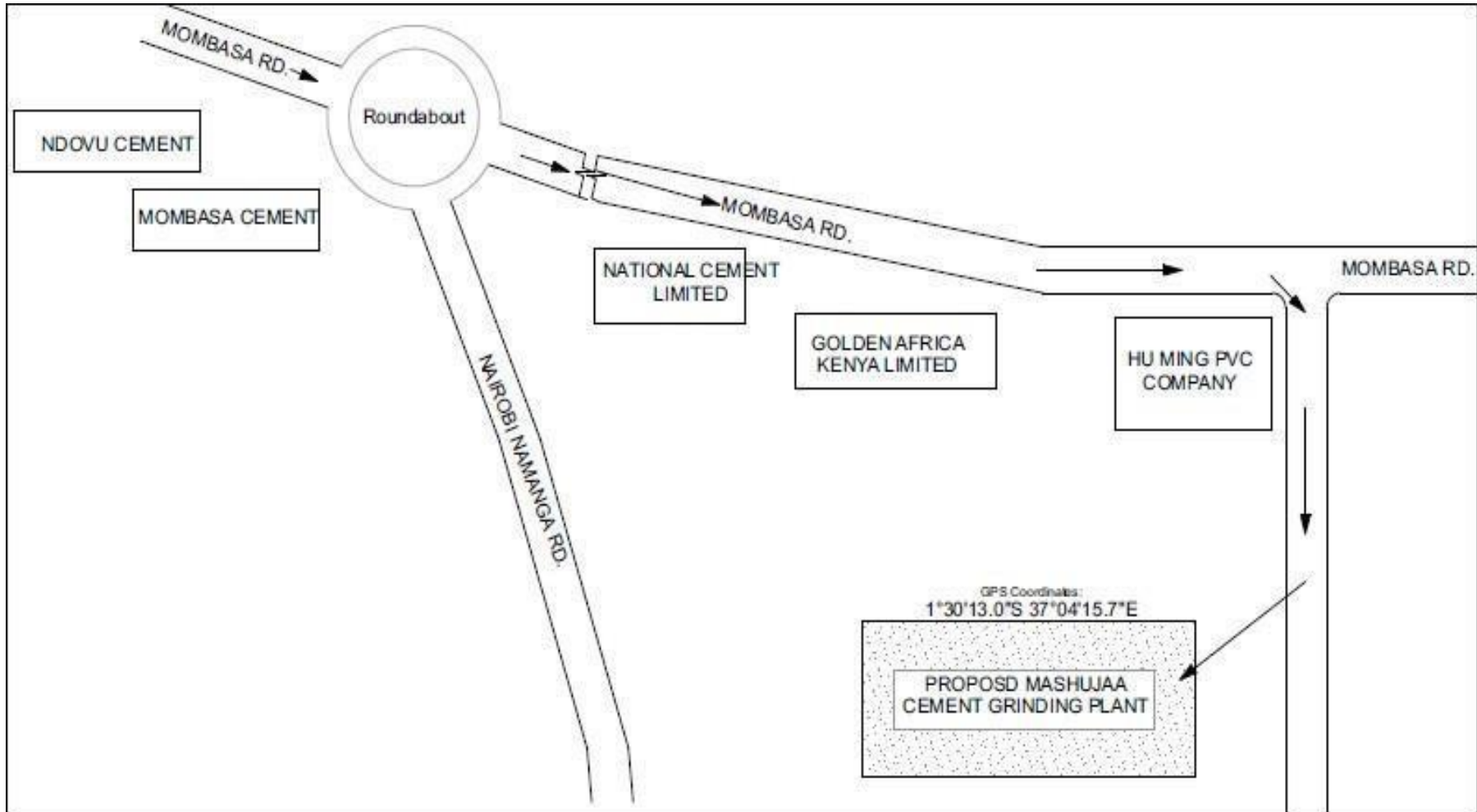


Figure 15: The community of Mathatani Sub-location in Athi River Sub County during the Public Participation and focused group meetings at the chiefs' compound.



Figure 16: The community of Mathatani Sub-location in Athi River Sub County during the focused group meetings at the chiefs' compound

10.3 Figure 17: A Sketch Map to the Proposed Site.



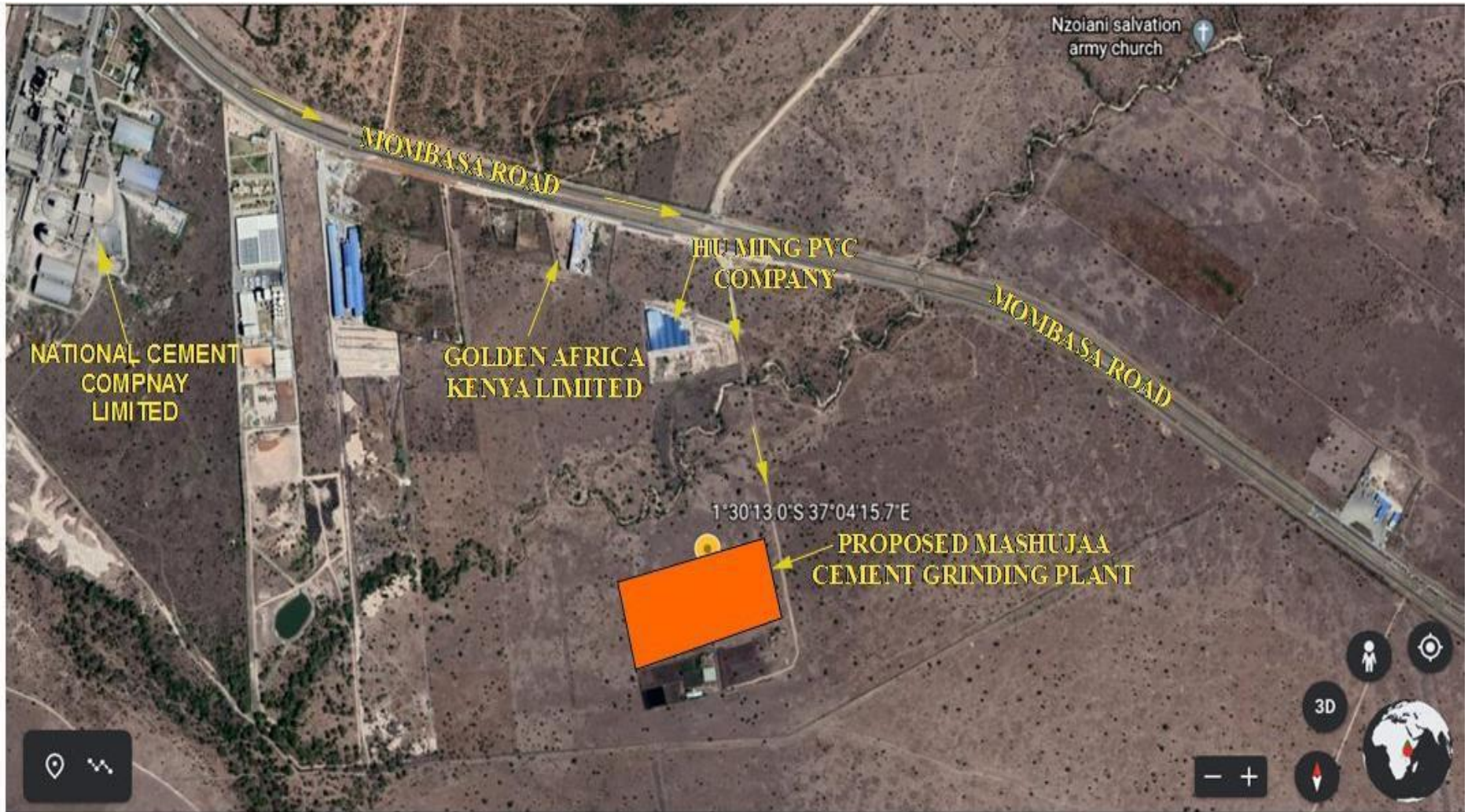


Figure 18: Map depicting neighboring character

10.3 REFERENCES

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10.4 APPENDICES

- Public Participation Forms
- Copy minutes for the meetings and attendance list
- Copy of Design layout for the proposed Cement Grinding Plant
- Copy of the UTIS, UC3-Ultimate Cell Continuous Combustion technology
- Certificate of Incorporation
- KRA Pin Certificate for the Company
- Copy of CR12
- NEMA Approval Letter to Undertake the full ESIAS report
- Terms of Reference
- Copy of land ownership documents.
- Copy of National Identification Card
- Kenya Revenue Authority pin certificate