ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT FOR PROPOSED 50MW CAPTIVE POWER PLANT WITHIN DANGOTE CEMENT PLANT AT HIYARI VILLAGE, MAYANGA WARD IN MTWARA DISTRICT, MTWARA REGION, TANZANIA.

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EXECUTIVE SUMMARY

Introduction

Dangote Cement Limited (DCL) Cement Factory is one of the newly Cement Plant in Tanzania started in September 2015. It is located at Hiyari Village of Mtwara District, Mtwara Region, Tanzania. The Plant has installed capacity of 3 million tons per annum of Portland Cement and thereafter will be expanded to 5 million tons per annum. The design of the Plant is to have Captive Power Plant of 50 Megawatts (CPP). This was conceived in the initiation of the Cement Plant due to the fact that the National Grid is not covering the Mtwara Region that would support the electricity need of the Plant. The isolated Min Grid of Mtwara Region has installed maximum generation capacity of only 18 Megawatts and thus would not meet the electricity demands of the Plant. The CPP has delayed and thus currently the Cement Plant is operated temporary by Diesel Generators that produces 42 Megawatts. The Company is thus now in the process of developing the Captive Power Plant of 50 Megawatts that shall depend on Natural Gas available in Mtwara. However, the design of the Power Plant will be of multi-fuel having capability of using either Natural Gas, Coal or Furnace Oil (FO). Should the supply of the Natural Gas be interrupted during operation shall be able to switch to other type of fuel to ensure the supply of power to the Cement Plant is not interrupted. It is expected that the CPP will co-exist with the Cement Plant which is estimated to run for 149 years due to limitation of limestone reserves, which will be depleted after 149 years.

The CPP will be located within the Cement Plant Premises in which the parcel of land of Plot Number 2 Certificate of Tittle Number 3287 has been legally acquired by the Dangote Cement Limited before development of the Cement Plant. As per the title the designated land use of the plot is for General Industrial purpose; Use Group O, Use Class (a) as defined in the Town and Country Planning Regulations, 1960 as amended in 1993. The CPP development in the area is thus in compliance with the applicable local legal requirements.

The development of the project will be financed by Development International Institution that among other things require comprehensive Environmental and Social Impact Assessment (ESIA) study to be undertaken for the project. Under the local environmental requirements, the ESIA was undertaken and the environmental permit had already been granted for the project.

The ESIA study was done both as a desktop study and field work. It involved review of literature/documents and field studies at the project site to gather information and data on various aspects of the project. Thus, the assessment made use of data and information on the physical, biological, cultural and socio-economic environment to predict both negative and positive impacts of the project, to design mitigation measures of the adverse impacts, as well as to plan the monitoring of potential changes that may arise in the course of implementing the project.

Policy and legal guidance

The study has consulted a number of policies and laws relevant to the project for guidance in order to ensure sustainability of the project in the area. The chapter also captures the relevant MEAs, international safeguards and guidelines requirements for such kind of the project in the area. Thus, the project during its entire course of the implementation shall refer to these cited documents.

Project description

The CPP will be Multi-Fuel type with capability of using Coal, Natural Gas and/or FO. Two (all working) Front bunker design AFBC Boilers will be used with steam generation of 110 TPH (gross) at 110 Kg/cm2 (g) pressure and 540 ± 5 °C temperature at main steam stop valve outlet. Two of 25 MW STG Bleed cum condensing Steam Turbine generator set with emergency stop valves will be used. The Plant water system consisting of Boiler make up streams, cooling tower make up system shall be used together with the pre-treatment plant as RCC clarifier which are common for boiler and cooling tower make up as well as full treatment plant for Boiler makeup. Effluent will be generated from the Water treatment plant that shall be collected in neutralization pit and pumped to Holding pond where boiler blowdown and CT blow

downs are collected and the same shall be treated in the effluent treatment plant on site. The resultant effluent shall be used for dust suppression in mines and Cement Plant areas as well as for gardening after meeting the standard limits. The Coal fuel preparation handling shall be Single stage crushing & screen arrangement considering the raw coal as less than 80 mm. Coal shall be stored in a steel dome. Ash handling system shall have mechanical cum Pneumatic dense phase system for conveying of Bed ash into bed ash silo. The generated ash shall be used in the Cement production as one of the additives. Synchronous Generator shall be connected to the proposed 11 KV MV switchgear through phase segregated Aluminum bus-duct. The generated power shall be utilized by the power plant's auxiliaries for catering in-house loads. The surplus power after delivering to power plant shall be then exported to Cement Plant.

The Dangote Cement Limited CPP will use bituminous coal of about 105,000 tonnes per year as raw material fuel for power production from Ruvuma Region specifically Ngaka area, and Natural Gas from TPDC Pipeline as well as Furnace Oil to be imported through Mtwara Port. However, these will not be used concurrently as when the gas will be available Coal shall not be required. Small amount of the FO shall be required to start up the plant, nevertheless it can be used when other fuels are in difficult supply. Coal shall be mixed with lime to reduce emission and in this case there will be lime shed with concrete bind wall for stockpiling it.

The handling and operation of LPFO/HSD and Natural Gas is rather simple process compared to the Coal operations. The LPFO operation it will require HSD to start up the plant to ensure the steam is provided for steam coil tracing for LPFO. Thereafter LPFO firing can be done continuously. In this case there are dedicated three LPFO fuel transfer cum unloading pumps and three LPFO fuel forwarding pumps to the firing chamber through the spuds and also there are dedicated two HSD unloading and two HSD transfer pumps to the firing chamber. Once the firing is done the water in the boiler is steamed to run the turbines and other process continues as noted in coal process below up to production of the power. The usage of LPFO will only attain 60% capacity of the boiler and in this case this will only be used during startup of the power plant. No lime is involved or ash produced in the process. the Liquid oil will be supplied by supplier to the site through specialized trucks.

The Natural Gas is simplest in logistics compared to the rest as there will be no pump required. The Gas comes with high pressure from TPDC Gas Pipeline which will be reduced in stages from 90 bar up to 5 bars that will be injected to the burning chamber/furnace of the boiler. Once the firing is done the usual process of steaming the water containing in the boiler continues that is directed to the steam turbine for production of the power as noted below. Likewise, there is no Lime involved in the process and no ash is produced with the Natural Gas operation.

The power will be generated from the expansion of the steam generated from boiler and expanding in the steam Turbine. The Steam Turbine is coupled with the generator from which the Power will be evacuated through HT Switch Gear. The AFBC (Atmospheric Fluidized Bed Combustion) Technology for the steam generation will be be employed. The Combustion process allows the steam generation to be on lower temperatures which reduces the NOx and gives better combustion efficiency. The Power generation process is also with the steam turbine and regenerative heating which increases the efficiency of the power generation system. To ensure the SOx, NOx and CO_2 levels remains low as per plant design or even lower there shall be lime feeding system for Sulphur reduction in the coal at the source. The inherent design of the power plant is such that the exhaust gases from the boiler are cleaned using cyclones and an electro-static precipitator (ESP) system. This removes most of the fine dust and ash from the exhaust stream, before being released into the atmosphere through a chimney. Furthermore, the stack height for the CPP have been designed in accordance to the Good International Industrial Practice with the height of 76 meters.

Description of the Environment

The EIA provides a summary of available information on the baseline site conditions including the physical and atmospheric conditions, water and biological resources, cultural resources and socioeconomic conditions of the area. In the EIA process, information on the baseline site conditions along with the applicable standards and norms are used to assess the potential environmental and social impacts of the proposed generation facility.

The site for CPP is within the premises of the Cement Plant. At the time of site assessment some construction activities for the CPP had already began. Most of the civil works had already taken place and there are erected structures on site. Based on the state of the site there is no pristine environment that can promote thriving and existence of the species of conservation concern as per IUCN and CITES standards. Furthermore, there are no sensitive ecological receptors in the vicinity of the project area. Also, there were no cultural or archaeological objects that were reported earlier during the excavation of the site and likewise during assessment none of the objects were observed or found at site. The baseline air quality condition of the study area shows that the ambient air condition is not degraded.

Stakeholders Engagement

Stakeholder consultations were carried out, including interviews and meetings with officials from Government departments and Local authorities. Officials from Mtwara District Council; - Mayanga Ward, Hiyari village and the community were consulted in EIA process. Further, EWURA, OSHA, TANROADS, TANESCO, and TPDC were also identified as stakeholders and were consulted in the EIA process. A multidisciplinary team including environmental experts considered all aspects of the project that can cause environmental or socio-economic changes at a public and stakeholders' consultation and meetings. They evaluated the significance of each aspect of the project in terms of defined criteria, which take account of the scale, extent, duration, the potential to implement mitigation measures and controls and the likelihood and timescale of environmental recovery.

Generally, stakeholders view the proposed project as a positive project for supporting full scale production of the Cementto ensure the social economic impacts of the Cement Plant as noted during its initiation are realised. On the other hand, some local stakeholders were worried to some impacts of the proposed power plant to include discomfort condition that could be brought about from air pollution, noise pollution and vibration, water pollution, spread of communicable diseases due to expected increase of people/workers, public to mention some. Employment opportunities and contributions to social economic activities at local level were some of expectations noted by locals.

Environmental and social Impact Assessment

The ESIA study identified a number of environmental and social impacts for the entire life cycle of the project. The potential environmental impacts considered in the ESIA process include impacts to the air quality, water resources, land resources, and socioeconomic/cultural conditions during mobilization, construction and operation of the CPP and associated components/activities. The social/cultural resources evaluated include labor employment, raw material sources, transportation, and local community services.

The ESIA also presents mitigation measures to be employed to help prevent or minimize the environmental and social impacts of the project. These are included in an environmental management plan (EMP), which can be seen in detail in the report. The EMP consists of the set of mitigation, monitoring, and institutional measures to be taken during construction and operation of the planned CPP to eliminate, offset, or reduce adverse environmental and social impacts. The plan also includes the actions needed to implement these measures. Moreover, the ESIA outlines specific environmental management and monitoring plans and identifies any necessary reporting requirements.

Conclusion

The study concludes that a number of environmental impacts have been identified and assessed; none of these are considered to be that severe after mitigation as to prevent the further planning, and

development of the project in the area. Thus, the project development in the area can be considered suitable subject to the implementation of the mitigation measures as indicated in the Environmental and Social Management Plan. Further, in order to further sustainability of the project in the area it is recommended that, the proposed Monitoring Plan should be implemented accordingly for consistence efficacy of mitigation measures or timely corrective measures before significant impacts to the environment and social components.

NAMES OF CONSULTANTS FORMED ESIA TEAM

SN	Name of Consultant	Position/Area of Expertise
1.	Mr. Bashiru Abdul Hassani	Lead Consultant, Environmental Planning and Social Economist
2.	Mr. Abel Sikaona	Water Resources, Environmental Management and Biodiversity Specialist
3	Mr. Julius Elius Daudi	Environmental Management and EIA Specialist
4	Mr. Alfred Pius	Plant System & OHS Specialist
5	Mr. Moses Mfuko	GIS and Mapping Specialist

ACKNOWLEDGEMENT

This Environmental Impact Assessment (EIA) Report for the proposed project was carried out by TRES Consult (T) Limited on behalf of the Dangote Cement Limited. The Consultant acknowledges with thanks the collective and individual contributions from a range of stakeholders involved in the preparation of this EIA report. Special thanks are extended to the Management of Dangote Cement Limited for entrusting TRES Consult (T) Limited for this assignment. The management and staffs of the Dangote CementLimited for their cooperation and valuable inputs during the site visit and for providing relevant information for the study. Other organisations and individuals that are enlisted in the appendices are also acknowledged for their in put and help towards the realization of this report.

LIST OF ACRONYMS AND ABBREVIATIONS

AFBC	Atmospheric Fluidized Bed Combustion
BAT	Best Available Technologies
BH	Borehole
BOD	Biochemical oxygen demand
CBD	Central Business District
CBO	Community Based Organisation
CBOs	Community Based Organisations
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CO	Carbon monoxide
CO_2	Carbon dioxide
CPP	Captive Power Plant
CRB	Contractor Registration Board
CSRs	Corporate Social Responsibilities
dBA	decibels-acoustic
DCL	Dangote CementLimited
DG	Diesel Generator
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EM (AQS)	Environmental Management (Air Quality Standards) Regulations
EM (WQS)	Environmental Management (Water Quality Standards) Regulations
EMA	Environmental Management Act, 2004
EMF	Electromagnetic Fields
EMP	Environmental Monitoring Plan
EPA	Environmental Protection Agency
EPs	Electrostatic Precipitators
ETP	Effluent Treatment Plant
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EWURA	Energy Water Utilities Regulatory Authority
GIS	Geographical Information System
GIIP	Good International Industrial Practices
HFO	Heavy Furnace Oil
FO	Furnace Oil
LPFO	Low Pour Furnace Oil
HSD	High Speed Diesel
HIV/AIDS	Human Immune Deficiency Virus/ Acquired Immune Deficiency Syndrome
IFC	International Financing Institutions
ILO	International Labour Organization
ISO	International Organization for Standardization
IUCN	International Union for Nature Conservation
LPFO	Low Pour Fuel Oil
MDC	Mtwara District Council
MLHSD	Ministry of Lands and Human Settlements Development
NBS	National Bureau of Statistics
NEMC	National Environment Management Council
NEP	National Environmental Policy
NGOs	Non-Governmental Organisations
Nm^3	Normal cubic meters
NO×	Nitrogen oxides

OHS	Occupational Health and Safety
OP	Operation Policy
OSHA	Occupational Safety and Health Authority
PPE	Personal Protective Equipment
PPV	Peak Particle Velocity
PM	Particulate Matter
RO	Reverse Osmosis
S	Standby
SO_2	Sulphur dioxide
STDs	Sexual Transmission Diseases
TANESCO	Tanzania Electric Supply Company
TANROADS	Tanzania Roads Agency
TIC	Tanzania Investment Centre
ToR	Terms of reference
TPH	Tonner Per Hour
TPDC	Tanzania Petroleum Development Corporation
TSP	Total Suspended Particulate
TZS	Tanzania Standards
URT	United Republic of Tanzania
US$	United States Dollar
VFD	Variable Frequency Drive
VEO	Village Executive Officers
W	Working
WB	World Bank
WEO	Ward Executive Officer
WHO	World Health Organisation
MM5	Mesoscale Meteorological Model, Version 5
ICIRP	International Commission On Non-Ionization Radiation Protection

Units

°C	*temperature*	degrees centigrade
Kg	*mass*	kilogram
kJ	*energy*	kilo-Joule
kMT	*mass*	kilo –metric ton
kWh	*electricity Power*	kilo-watt-hour
MW	*Electrical power*	Megawatts
MV	Electric Pot. Diff.	Megavolt
LV		Low Voltage
KV		Kilovolt
MT	*mass*	metric ton
dBA	*Noise*	decibel – Acoustic
HZ	*frequency*	Hertz

1 INTRODUCTION

1.1 BACKGROUND INFORMATION

Dangote Cement Limited (DCL) Cement Factory is one of the newly Cement Plant in Tanzania started in September 2015. It is located at Hiyari Village of Mtwara District, Mtwara Region, Tanzania (See figure 1.1). The Plant has installed capacity of 3 million tons per annum of Portland Cement and thereafter will be expanded to 5 million tons per annum. The design of the Plant is to have Captive Power Plant of 50 Megawatts (CPP). This was conceived in the initiation of the Cement Plant due to the fact that the National Grid is not covering the Mtwara Region that would support the electricity need of the Plant. The isolated Min Grid of Mtwara Region has installed maximum generation capacity of only 18 Megawatts and thus would not meet the electricity demands of the Plant. The CPP has delayed and thus currently the Cement Plant is operated temporary by Diesel Generators that produces 42 Megawatts. The Company is thus now in the process of developing the Captive Power Plant of 50 Megawatts that shall depend on Natural Gas available in Mtwara. However, the design of the Power Plant will be of multi-fuel having capability of using either Natural Gas, Coal or Furnace Oil (FO). Should the supply of the Natural Gas be interrupted during operation shall be able to switch to other type of fuel to ensure the supply of power to the Cement Plant is not interrupted. The CPP is to be located within the Dangote Cement Plant Premises. It is expected that the CPP will co-exist with the Cement Plant which is estimated to run for 149 years due to limitation of limestone reserves, which will be depleted after 149 years.

The development of the project will be financed by Development International Institution that among other things require comprehensive Environmental and Social Impact Assessment (ESIA) study to be undertaken for the project. It is against this background the Company Commissioned TRES Consult (T) Limited of Dar es Salaam (Certified Firm of Environmental Experts) to undertake the ESIA study for the Captive Power Plant in the area in line with World Bank/International Finance Corporation Safeguards Requirement. However, under the local environmental legal requirement the Captive Power Plant of 50 Megawatts would also require an ESIA study. The ESIA for development of the Cement Plant was approved in September 2012 that did not fully cover the CPP component as the specific information of the plant were not available. This necessitate another assessment that lead to review of the ESIA report to incorporate fully the CPP component and its associated environmental and social implications. Since the CPP is regarded as one of the component of the Cement Plant and it is to be located within environmentally licensed area of the Cement Plant the variation of EIA Certificate was thus done and issued in July 2016 (see appendix 4).

As noted above the CPP is to be located within the Cement Plant Premises in which the parcel of land of Plot Number 2 Certificate of Tittle Number 3287 has been legally acquired by the Dangote Cement Limited before development of the Cement Plant. As per the title the designated land use of the plot is for General Industrial purpose; Use Group O, Use Class (a) as defined in the Town and Country Planning Regulations, 1960 as amended in 1993 (Appendix 2). The CPP development in the area is thus in compliance with the applicable local legal requirements.

Figure 1.1: Map of Mtwara Rural District Council Showing the project location area
Source: UDSM, 2014

1.2 THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)

The development of 50 Megawatts Multi-Fuel Captive Power Plant for Dangote Cement Plant and its associate components may cause various both positive and negative impacts. Generally, impacts related to land take for plaCementof the project infrastructures may necessitate disruption of existing land uses and social economic features and/or damage/loss / disturbances to ecological systems and local biodiversity (during the entire cycle of developing the project); vegetation clearance; noise and air emissions from mobilization, construction and operation activities and this may cause nuisance and disturbance to on/offsite receptors; wastes, leakage/spillage of fuel/oils from vehicle/machines may contaminate receiving land and water bodies; extraction of water may deplete ground water resource etc. On the other hand, the project will provide a number of socioeconomic benefits: (i) more reliable and

consistent energy supply to the Cement Plant, furthering economic activity and development through the entire Cement Plant and power plant supply chain; (ii) create a number of jobs during the construction and operation phases; and (iii) an apprentice system or similar approach to raise the skills level of the local workforce. However, the purpose of ESIA is to quantify the extent of these impacts.

Therefore, the main objectives for carrying out this environmental and social impact assessment are as follows: -

(a) to support the goals of environmental protection and sustainable development.
(b) to integrate environmental protection and economic decisions at the earliest stages of planning an activity.
(c) to predict environmental, social, economic, and cultural consequences of the proposed project and to assess plans to mitigate any adverse impacts resulting from the proposed activity, and
(d) to provide for the involvement of the public, the Government of Tanzania and its agencies in the review of the proposed activities.

Specifically, this ESIA intends to achieve the following objectives: -

a) To identify adverse environmental and social impacts associated with the overall project.
b) To develop mitigation measures and their plans {Environmental Management & Monitoring Plans (EM&MPs)} for the adverse environmental impacts
c) The TRES Consult (T) Limited will also ensure that the ESIA report reflects on compliance with the Tanzania governing national laws and regulatory framework on environment and social as well as safeguard's policies given as best practices by international funding agencies. Compliance with World Bank's best practices will satisfy this requirement

Further under the World Bank's environmental review process, thermal generation facilities are considered as Category A project and require a comprehensive ESIA. This ESIA provides an assessment of the potential positive and negative environmental impacts of the project and compares them to feasible alternatives including the "without project alternative". The ESIA also recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse environmental and social impacts and improve environmental performance. In addition, the ESIA outlines specific environmental and social management and monitoring plans and identify reporting requirements and time frames.

1.3 TERMS OF REFERENCE

The Environmental and Social Impact Assessment of the 50 Megawatts CPP at Hiyari Village, Mayanga ward in Mtwara District, Mtwara Region, Tanzania was undertaken in accordance with the Terms of Reference set out by the Dangote CementLimited and are provided as Appendix 1. These were developed and form the basis for this study.

1.4 APPROACH AND METHODOLOGY OF THE STUDY

The ESIA study was done both as a desktop study and field work. It involved review of literature/documents and field studies at the project site to gather information and data on various aspects of the project. Thus, the assessment made use of data and information on the physical, biological, cultural and socio-economic environment to predict both negative and positive impacts of the project, to design mitigation measures of the adverse impacts, as well as to plan the monitoring of potential changes that may arise in the course of implementing the project. The ESIA study adopted the following approach:

1.4.1 General Approach

A multi-disciplinary team of experienced social and environmental professionals (see appendix 1) was assembled to carry out the required resource assessment, generation of baseline data, determination of

potential impacts and recommendation of mitigation measures. An interactive approach among the environmental team members and other project professionals was adopted. The core team was made up of the following persons:

- Bashiru Abdul Hassani, MSc - Principal Consultant; EIA Specialist and Socio-economist
- Julius Elius Daudi, MSc – Environmental Management and EIA Specialist
- Abel Sikaona, MSc – Water Resources and Biodiversity Specialist
- Alfred Pius, MSc/BL – Plant System & OHS Specialist
- Mr. Moses Mfuko, BSc. - GIS and Mapping Specialist

The team utilized the checklist for data gathering, analysis, and presentation whereby team members conducted the reconnaissance investigations together to determine the critical elements for analysis and the issues to be highlighted for the design and planning process. Further modelling of key parameters was conducted to support professional opinions and judgement. Team meetings were held to discuss the progress of investigations and analyses and facilitate integration of data toward an understanding of the systems at work in both the natural and built environment.

1.4.2 Communication with Stakeholders

Identification of stakeholders
The identification was based on the role and relevance of an organization, group or individual to the proposed project. Some of the stakeholders such as national authorities e.g. relevant Ministries/Departments/Agencies, Local Government Authorities (Mtwara District Council), etc. were pre-determined based on the nature of the project, while others and potential affected groups in the vicinity of the proposed project site and area of influence were identified during the field visit. List of stakeholders identified and consulted is found in chapter 5. Further it should be noted that information from previous ESIA reports as part of the review were also used to compliment on this report.

Involvement of stakeholders
The study team visited the proposed area for the proposed project and later on visited neighbouring community. Stakeholders' interviews were conducted in order to inform the stakeholders about the proposed project and to collect baseline data and issues of concerns. The EIA study applied different participatory methods to involve all the relevant stakeholders. Public meeting dominated at the local level i.e. village where the project is located, one-to-one interviews with individual based upon a list of general topics or questions and partly based on an open discussion, were conducted. Focused group discussions were also used to gather information.

In establishing the views of the public concerning the proposed project, the consultants provided introductory letter addressed to each stakeholder briefing the project, need for EIA and asking the stakeholder to freely raise their concerns to the Consultant. During the discussions the consultants introduced the project and elaborated to the stakeholders the project objectives and purpose and envisaged project activities so as to give a good understanding for stakeholders to be able to air their views. Furthermore, Notices were posted on strategic places requesting stakeholders who did not have opportunity to raise their concerns to do so through written or verbal communications. The notices were then advertised in the Newspaper of both languages i.e. English and Swahili to cover wider spectrum of stakeholders at local and national level (see appendix 7).

Identification of stakeholders' concerns
The stakeholders pointed out a number of issues and concerns. An issue raised by one individual or a group of people was cross-checked by discussing it over with other groups (triangulation). Key issues raised by each stakeholder group were summarized and further analysed. Details of stakeholders

consulted, names and signatures of people consulted and record of main issues raised are integrated in Chapter 5 and Appendix 8 of this report.

1.4.3 Physical Environment

Information was gathered on the existing physical environment, particularly as related to topography, soils, drainage, air quality and noise. Further spot measurements were done to compliment on existing data as well as to get most recent baseline condition bearing existence of the new Cementoperations.

Soils and Topography,
Information on the climate, geology, topography, soils, was obtained by compiling data from existing reports, and source agencies. Maps were also examined to obtain some of the data such as topography of the general area. Field work was carried out to augment and verify existing information relating to topography and soils and to obtain first-hand knowledge of the other physical aspects.

Hydrology and Drainage
Surface and ground water characteristics were obtained from secondary sources while the field visits were used to augment the secondary sources of information. Samples of the borehole water were also collected for laboratory analysis to obtain up to date ground water quality baseline condition.

1.4.4 Biological Environment

The status of the flora and fauna of the study area was determined by a review of literature relevant to the area and field investigations.

The vegetative communities were identified and classified into community types. Identification was carried out of dominant tree species. The vegetation was identified and described for their property. Information on fauna was gathered from existing literature on reported species as well as observations in the field. Observations were made particularly to assess the presence of birds in the general area. Information also was obtained from locals in the area about the presence of any significant specie.

1.4.5 Socio-economic Environment

Rapid field appraisal techniques in conjunction with desk research were employed for investigations of the socio economic considerations within the project area, *viz*:

- population and settlement characteristics
- land uses and livelihoods
- developments underway
- infrastructures in place
- water supply and other utilities
- waste management practices
- recreational activities

1.4.6 Policy, Legal and Institutional Arrangement

Policy, legal and regulatory framework were compiled from review of documents: policies, legislation, guidelines and standards as well as international safeguards policy and guidelines.

1.5 IMPACT ASSESSMENT

The impact assessment was done literally by superimposing project elements onto the existing natural and man-made conditions of the project site. Environmental impacts were then identified, their significance assessed and mitigation/enhanCementmeasures proposed. As the proposed activities will be within occupied project land, cumulative effects are likely to occur and have been given consideration in the impact assessment as well as residual impacts that cannot be mitigated against. The assessment has also considered contribution to local and national environmental and socio-economic issues as well as global environmental issues of air quality.

1.6 REPORT STRUCTURE

The report is structured in the following style:

i) Executive Summary
ii) Table of Contents
iii) Acknowledgement
iv) List of Acronyms
1. Introduction
2. Policy, legal and regulatory framework
3. Project description
4. Baseline/ Existing conditions
5. Stakeholders Analysis
6. Assessment of environmental and social Impacts
7. Environmental and Social Mitigation Measures
8. Environmental and Social Management Plan
9. Environmental and Social Monitoring Plan
10. Decommissioning and Closure
11. Summary and Conclusions

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Appendices

2 POLICY, LEGAL AND REGULATORY FRAMEWORK

2.1 INTRODUCTION

In establishing the project in the area, various environmental and social issues may arise at any phase of the project development i.e. from construction to decommissioning phases. These issues needs to be addressed so that the envisaged operations do not impair the integrity of the environment and social components and further ensure that they are in line with policies and legal regime operating in Tanzania as well as International Financing Institutions. This chapter list down relevant policies, legislations and international safeguards requirements pertaining to the planning and implementation of the proposed 50MW Captive Power Plant project in the area. Below are the most relevant policies, legislations and international safeguards policies and guideline requirements for the project; -

2.2 RELEVANT POLICIES

The following are relevant sectoral and cross–sectoral policies which provide directives on how the project should be implemented in relation to concerned environmental and socio-economic settings. The project proponent will consult these policies in the course of designing and implementing the proposed project activities.

2.2.1 The National Environmental Policy (URT, 1997)

The National Environmental Policy (NEP), 1997 appropriately sets broad goals committing Tanzania to sustainable development of its natural resources heritage. The policy promotes the use of EIA as a planning tool that integrates environmental issues into the planning process, the implementation of the "polluter pays" principle and the use of precautionary principle (i.e. it is better to be roughly right in time, than to be precisely right in too late). It also stipulates the use of numerous approaches in environmental management in Tanzania including; use of economic instruments, development of environmental standards, indicators and their use, and that environmental legislation is an essential component of effective environmental management.

Chapter 4, Paragraph 64 of the NEP states that "*It is in the context of an EIA regime that policy guidance on choices to maximise long-term benefits of development and environmental objectives can be revealed and decided upon. EIA as a planning tool shall be used to integrate environmental considerations in the decision making process in order to ensure unnecessary damage to the environment is avoided".*

The policy recognises the importance of promoting use of environmentally sound technologies that protect environment based on careful assessment of the carrying capacity of the environment. Undertaking this EIA study, DCL has observed one of the requirements of the national environmental policy and will continue to observe the requirements of the policy during the whole life cycle of the project.

2.2.2 The Land Policy (URT, 1996)

The National Land Policy advocates the protection of land resources from degradation for sustainable development. Among other things the policy requires that project development should take due consideration the land capability, ensures proper management of the land to prevent erosion, contamination and other forms of degradation. EIA for this project is intended to identify if there is potential for the adverse impact and to propose means for mitigating them. With regard to land compatibility the site earmarked for the project is under Industrial Use as per Certificate of Occupancy document (see appendix 2). Thus, the project is in line with the land use, though the assessment will critically look on

the pertinent environmental and social issues of concern and come up with means to mitigate the possible impacts.

2.2.3 The National Policy on HIV/AIDS (URT, 2001)

The policy provides a framework for leadership and coordination of the National multisectoral response to the HIV/AIDS epidemic. One of the major objectives of the policy is to strengthen the role of all the sectors, public, private, NGOs, faith groups, CBOs and other specific groups to ensure that all stakeholders are actively involved in HIV/AIDS work and to provide a framework for coordination and collaboration. The policy recognizes that HIV infection shall not be grounds for discrimination in relation to education, employment, health and any other social services. The company shall adhere to the policy guidance while implementing the project.

2.2.4 The National Water Policy (URT, 2002)

The National water policy of 2002 was developed to promote among others sustainable development and management of the Nation's water resources. The policy is quite relevant as the project will require significant amount of water for cooling purpose that will be sourced from ground water. Furthermore, its related wastes in one way or the other might pollute the natural water resources around the area. In this respect all the effluent from the project shall be directed to the Effluent Treatment Plant existing on site. The ETP capacity had considered the effluent from the CPP. The resultant ETP effluent shall be used for secondary and tertiary purpose within the Cement Plant mainly for dust suppression in the mines and Cement Plant as well as for gardening. The water abstraction permits have already been acquired from the Ruvuma Water Board as per policy and legal requirements. Furthermore, the EIA study is one of the internationally recommended tool towards sustainable development and thus this study will critically look on these aspects to ensure the measures in place are enough or not to ensure there is no water pollution in the area, while its abstraction is undertaken in sustainable way.

2.2.5 The National Health Policy (URT, 2003)

One of the main objectives of this policy is to ensure that health services are available and accessible to all people wherever they are in the country, whether in urban and rural areas. The policy encourages safe basic hygienic practices in workplaces, promote sound use of water, promotes construction of sanitary facilities and their use, encourage maintenance of clean environment; working environment which are conducive to satisfactory work performance. With regard to this project occupational health and safety during project development and operational phase are more relevant with the policy. The company shall adhere to policy guidance by implementing what is required to the work force of the company in all project phases.

2.2.6 The National Gender Policy (1999)

The key objective of this policy is to provide guidelines that will ensure that gender sensitive plans and strategies are developed in all sectors and institutions. While the policy aims at establishing strategies to eradicate poverty, it puts emphasis on gender equality and equal opportunity of both men and women to participate in development undertakings and to value the role played by each member of society. This project will respond to the policy by ensuring equal opportunities in employment during development phase and operation phases.

2.2.7 The National Employment Policy (1997)

The major aim of this policy is to promote employment mainly of Tanzania Nationals. Relevant sections of this policy are (i) 10, which lays down strategies for promoting employment and section 10.1 is

particularly focusing on industry and trade sectors (ii) 10.6 which deals with employment of special groups i.e. women, youth, persons with disabilities and (iii) 10.8 which deals with the tendencies of private sectors to employ expatriates even where there are equally competent nationals. It is one of the objectives of the DCL to have notable trickle down positive impact to the locals through various means one of which is direct employment in the area. The project will also provide direct employment to the locals in the area without specifying the number as it is not known how many technical workers will be available for the technical positions. Special attention will be to the marginalised groups to include disabled, women, and youth while strictly avoiding employing children as required by the law. Thus, the project shall be in line with the objectives of the policy.

2.2.8 The Construction Industry Policy (URT, 2003)

Since the project will involve construction of the Transmission line and few structures at the plant site this policy has got a stake on the project. The policy promotes among other things, application of cost effective and innovative technologies and practices to support socio-economic development including utilities and ensure application of practices, technologies and products which are not harmful to both the environment and human health. This EIA is undertaken to ensure that the project proponent uses technologies and products not harmful to both the environmental and human health by providing feasible alternatives and appropriate mitigation measures.

2.2.9 The Sustainable Industrial Development Policy (SIDP, 1996 – 2020), (1996)

The Sustainable Industrial Development Policy refers to sound environmental management in order to ensure promotion of environmentally friendly and ecologically sustainable industrial development. The policy underscores the importance of carrying out EIA. Also the government among other things pledges to promote the continuous application of an integrated preventive environmental strategy to industrial processes, products and services. This strategy includes propagating efficient use of raw materials and energy; elimination of toxic or dangerous materials, as well as reduction of emissions and wastes at source. Undertaking the EIA study complies with the policy requirement. Furthermore, the DCL will establish internal system to implement and monitor its operation with a view to minimize its adverse environmental effects throughout the project lifespan (see dedicated standalone ESMP manual for CPP).

2.2.10 The Energy Policy (2003)

The Energy Policy recognizes energy as a critical aspect for the national economic development. The overall policy objective is to provide an input to support the national economic development process. The policy promotes the establishment of efficient energy production, procurement, transportation, distribution and end use, in an environmentally sound manner and with due regard to gender issues. The Energy Policy recognizes the need for synchronizing with other sector policies, plans and strategies. In addition, it recognizes the need to use energy pricing as an important tool in energy conservation and environmental protection. DCL undertaking this EIA study is in line with the policy requirement.

2.3 LEGAL FRAMEWORK

The following legal documents and Acts were reviewed to have an overview of legal requirement of this project:

2.3.1 Environmental Management Act (2004)

The Environmental Management Act No. 20 of 2004 is the principal legislation governing environmental management in the country. The Environmental Management Act (EMA) recognizes "…the right of every

citizen to a clean, safe and healthy environment, and the right of access to environmental resources for recreational, educational, health, spiritual, cultural and economic purposes."
Thus, the EMA "provides a legal framework for coordinating harmonious and conflicting activities by integrating those activities into overall sustainable environmental management systems by providing key technical support to Sector Ministries."
Section 81, subsection 1 in Part VI of the EMA requires a project proponent or developer to undertake an Environmental Impact Assessment (EIA) at his/her own cost prior to commenCementor financing of a project or undertaking. The EMA prohibits any development to be initiated without an Environmental Impact Assessment (EIA) Certificate. The DCL through undertaking this study complies with the requirement of the law.

2.3.2 Water Resource Management Act, No. 11 (2009)

The Water Resource Management Act 2009 is a principal legislation dealing with the protection of water resources and control of water extraction for different uses. The Act requires any person who diverts, dams, stores abstracts or uses water from surface or underground water source to secure a Borehole drilling permit and water use permit from respective water basin office. Also, according to section 39 (1) of the Act, requires owner or occupier of land on which any activity or process is or was performed or undertaken, or any other situation exists which causes/has caused or is likely to cause pollution of a water source, to take all reasonable measures to prevent any such pollution from occurring, continuing or recurring.

As noted above all the effluent from the project shall be directed to the Effluent Treatment Plant existing on site. The ETP capacity had considered the effluent from the CPP. The resultant ETP effluent shall be used for secondary and tertiary purpose within the Cement Plant mainly for dust suppression in the mines and Cement Plant as well as for gardening. Further, for the onsite borehole the Company has secured borehole drilling permit and water use permit for the existing borehole from Ruvuma Basin Water Board hence in line with the legal requirement (see appendix 5). Furthermore, the EIA study is one of the internationally recommended tool towards sustainable development and thus this study will critically look on these aspects to ensure the measures in place are enough or not to ensure there is no water pollution in the area, while its abstraction is undertaken in sustainable way. Thus, undertaking this EIA study the DCL complies with the Act requirements.

2.3.3 The Electricity Act, 2008 (Act No. 10/2008)

This is an Act to provide for the facilitation and regulation of generation, transmission, transformation, distribution, supply and use of electricity energy. It provides for cross-border trade in electricity and the planning and regulation of rural electrification and for related matters. The Act has given powers to Energy and Water Utilities Regulatory Authority (EWURA) to oversee and grant licenses to generate, and sale of electricity. The Act has the following sections: - Operating license; Provisional license and license; Rights and obligations of licensee; Tariffs and charges; Customer rights and protection; Monitoring, inspection; investigation and compliance; Access to land for installation; Rural electrification; Reorganization of the electricity market; and Dispute settlement and miscellaneous.

Since the company will require all relevant permits before operation from EWURA the Act has relevance to the project. Further the company shall apply for all relevant permits and licenses from EWURA before commencement. This study is among of the pre-requite conditions of the license application.

2.3.4 The Land Act, Cap 113, R.E 2002

The basic principles of the Land Act 1999 are adopted from Land Policy 1995. The Act contains provisions of critical environmental importance. One of important fundamental principles of the Land Act is "*to ensure that land is used productively and that any such use complies with the principles of sustainable*

development". The project activities will be conducted in consent with this principle in order to preserve the environmental integrity of the area. This will be ensured by implementing the Environmental Management Plan as outlined in this report.

2.3.5 The Occupational Health and Safety Act (2003)

The Occupational Health and Safety Act No. 5 of 2003, deals with regulation of health, safety and welfare of workers in factories and workplaces. Some of the provisions of this Act could be relevant to the project, in particular to the contractors that will continue to build the proposed power plant and the transmission line. The company shall ensure that the involved contractor is aware of the OHS issues and his obligations regarding the workforce health and safety measures stipulated in this Act. Further the employer shall register its work place after commissioning operation of the project.

2.3.6 The Local Government Act (1982)

The Local Government Act of 1982 forms an important legal basis for rural councils and rural authorities which were reintroduced in the early 1980s. The Act establishes and regulates district councils, township authorities and village authorities. Important provisions are the subdivision of districts into divisions and wards and the establishment of ward development committees along with procedures for implementation of schemes and programmes at Ward level. In the context of development projects which entail compensation the Act thus allows for the active participation of ward authorities and ward development committees in the compensation process.
The Act also provides for the protection and management of the environment. Section 111 of the Act promotes social welfare and economic well-being of all residents within their areas of jurisdiction.

Section 118 deals with protection and management of the environment. The District Councils are required to take necessary measures to control soil erosion and desertification; to regulate the use of poisonous and noxious plants, drugs or poisons, regulate and control the number of livestock; maintain forests, manage wildlife, ensure public health, and provide effective solid and liquid waste management.
The Local Government Act of 1982 empowers the local governments to enact by-laws to protect public health and regulate land pollution problems. The Local Government Act of 1982 contains provisions to protect human health and regulates pollution problems.
In connection with the project the developer shall adhere to the provision of this act on its execution

2.3.7 The Employment and Labour Relation Act No. 6 of 2004

Generally, the Act among other things intends to provide the legal framework for effective and fair employment relations and minimum standards regarding conditions of work. For example, it prohibits employment of children under 18 years of age; stipulated types of contracts that can be entered with employees; the maximum number of ordinary days or hours that an employee may be permitted or required to work; remuneration; leaves; unfair termination of employment; establishment of trade unions branches in workplaces; etc. Both DCL and the Contractor will offer employment, therefore both shall observe these and other relevant provisions in this Act.

2.3.8 The HIV and AIDS (Prevention and Control) Act – 2008

The HIV/AIDS Act (Act No. 28/08) calls for prevention, treatment, care, support and control of HIV and AIDS for promotion of public health in general. It also calls for appropriate treatment, care and support by using available resources to people living with or at risk of HIV and AIDS and to provide for related matters. Apparently, for the Project the risk of population living in or nearby project area contacting HIV/AIDS during construction and operation phases is high and thus, the Act provides legal guidance to the cause.

Of particular importance to this project is found in part II, section 6 (1), titled Roles of Sectors, which states that: 'every ministry, department, agency, local government authority, parastatal organization, institution whether public or private, shall design and implement gender and disability responsive HIV & AIDS plans in its respective area, and such plans will be mainstreamed and implemented within the activities of such sector.' The project shall also adhere to the requirements of the Act.

2.3.9 The Contractors Registration Act No. 17 of 1997

The Act establishes the Contractors Registration Board (CRB). CRB has a mandate to register contractors, regulate the conduct of the contractors and for related matters. Among other things CRB is required to take legal action against unregistered contractors who undertake construction; installation, erection or alteration works; ensure that all construction sites are hoarded; and labour laws, occupational health and safety regulations in the construction industry are adhered to. On executing its construction activities DCL shall therefore appoint a registered contractor and make sure that the provisions of the Act are adhered to.

2.4 INTERNATIONAL FUNDING AGENCIES GUIDELINES

Each financing institution has specific policies and procedures for promoting environmental protection and sustainable development. These procedures include a detailed environmental review process and preparation of an ESIA prior to final approval of financing for the project. This ESIA has been prepared to address the safeguard policies and environmental guidelines of the WBG as they are applied in a private sector context. The International Finance Corporation ("IFC"), which is the private sector lending arm of the WBG, has put in place safeguard policies that apply to the private sector projects that it provides financing for. The International Funding Agencies safeguard policies, which are closely aligned with the safeguard policies of the WBG, are as follows:

***Environmental Assessment (OP 4.01)**:* The policy helps to ensure the environmental and social soundness and sustainability of investment projects. It also supports integration of environmental and social aspects of projects into the decision-making process. The policy promotes environmentally sustainable development by supporting the protection, conservation, maintenance, and rehabilitation of natural habitats and their functions. The World Bank has adopted principles of Environmental Assessment (EA) to examine the environmental and social risks and benefits associated with Bank lending operations. The present ESIA is part of the compliance process as detailed in operational Policy 4.01. The construction of the 50 MW (2 x 25 MW) thermal power plant and associated facilities classified as Category A project that calls for ESIA. An Environmental and Social Management Plan is provided as part of this ESIA Report.

***Involuntary Resettlement (OP 4.12)**:* the project will not affect people with respect to land acquisition and/or access denial, restriction or loss of access to economic resources as the project site is within the already legally acquired and developed land of the Dangote Cement Plant premises. Thus, the OP 4.12 is not triggered in this case. Nevertheless, should there be grievance with respect to the land under the project there is grievance mechanism in place to manage the grievance and complainants (see appendix 11).

Natural Habitats (OP 4.04): All natural habitats have important biological, social, economic, and existence value. World Bank funding cannot be used for investments impacting critical habitats such as wetlands, forest or wildlife reserves etc. Since this project will not carry activities in/near such habitats this safeguard is not triggered.

Cultural Property (OP 11.03): cultural assets may either be close to or within potential project sites. The proximity of the investments to these cultural properties triggers the Cultural Property OMS. The project

will not trigger OP 4.11 on Physical Cultural Resources as such resources have not been clearly found onsite, near or close to the proposed project site.

The WBG also has established sector–specific environmental performance guidelines as set out in the Pollution Prevention and Abatement Handbook (World Bank Group, 1998). This document sets out specific guidelines for: occupational health and safety; emissions to air, water and land; and maximum concentrations of pollutants in the receiving environments.

2.5 INTERNATIONAL CONVENTIONS

The United Republic of Tanzania Government has signed and ratified several international conventions, including those on biodiversity, climate change, desertification, protection of the ozone layer, and the Convention on Wetlands of International Importance, Especially as Waterfowl Habitat (RAMSAR). The conventions and their relevance to the proposed CPP project are listed in Table 2.1 below.

Table 2.1: International Conventions and Treaties with Relevance to the DCL CPP Project

Name of Convention	Description of the Convention	Relevance
Convention concerning the Protection of Workers Against Occupational Hazards in the Working Environment due to Air Pollution, Noise and Vibration, adopted in 1977.	To ensure safe working environment for workers.	DCL to implement a Occupational Health and Safety program in accordance with Tanzania laws and World Bank guidelines.
The Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and Disposal. The Bamako Convention on Ban of the import into Africa and the Control of Trans-boundary Movement and Management of Hazardous Wastes within Africa, adopted in 1991.	The control of the import and movement of hazardous wastes by either introducing permits or legislation.	DCL to verify that all waste disposal contractors have the appropriate licenses. DCL to ensure that all imported materials or equipment from abroad do not have elements of hazardous wastes
The Vienna Convention for the Protection of Ozone Layer, adapted in 1987. 1987 Montreal Protocol on Substances that Deplete the Ozone Layer adopted in 1987.	Agreements designed to protect the stratospheric ozone layer.	Cooling systems for the power plant will utilize non-ozone depleting substances. Technology to be deployed will results into less emission of the greenhouse gases in compliance with IFC Guidelines and GIIP.
The United Nations Convention on Conversation of Biological Diversity signed in 1992.	This convention was agreement on developing national strategies for the conservation and sustainable use of biological diversity.	The CPP facilities have been sited, and the construction practices designed, to minimize disruption of high-biodiversity systems

2.6 ENVIRONMENTAL PERFORMANCE STANDARDS

This section summarizes the environmental performance standards and guidelines applicable to the project. The Project has been planned to meet the more stringent of the applicable local standards and WBG guidelines.

2.6.1 Air Emission Standards

The WBG guidelines that are applicable to the air emissions from the Power Plant are listed in Table 2.2 below. The WBG guidelines for stack emissions are those applicable to new power projects that are less than 50 MW.

Table 2.2: Power Plant Stack Emission Guidelines Applicable to the DCL CPP Project

S/N	Description	Units	IFC Guideline	DCL CPP Design Performance for Coal	DCL CPP Design Performance for Natural Gas
1	SPM	mg/Nm3	50	30	0
2	Sox	mg/Nm3 at 6% O_2	1500	1144	0
3	NOx	mg/Nm3 at 6% O_2	510	450	150
		mg/Nm3 at 3% O_2	510		$\leq$ 240

Source: Thermax, 2016

2.6.2 Ambient Air Quality Standards

The WBG guidelines that are applicable to ambient air quality are listed in Table 2.3.

Table 2.3: Ambient Air Quality Guidelines Applicable to the DCL CPP Project

Pollutant	Averaging Time	WBG
NO_2	1-hour	not specified
	24-hour	150 µg/m^3
	Annual	100 µg/m^3
SO_2	24-hour	150 µg/m^3
	Annual	80 µg/m^3
PM_{10}	24-hour	150 µg/m^3
	Annual	50 µg/m^3
Total Suspended Particulates (“TSP”)	24-hour	230 µg/m^3
	Annual	80 µg/m^3
CO	8-hour	
	24-hour	

World Bank 1998 “Pollution Prevention and Abatement Handbook, Part III, Thermal Power - Guidelines for New Plants”

2.6.3 Environmental Noise Standards

The Local standards for environmental noise applicable to the project are similar to those for WBG guidelines indicate that noise abatement measures should achieve the levels set out in Table 2.4 or a

maximum increase from background levels of 3 dB(A). Measurements are to be taken at noise receptors located outside of the project's property boundary.

Table 2.4: Environmental Noise Guidelines Applicable to the DCL CPP Project

Land-Use	Sound Level Limits [dB(A)] at Receptor (hourly Leq)	
	Daytime (07:00 - 22:00)	Night-time (22:00 - 07:00)
Residential, institutional, and educational	55	45
Commercial and Industrial	70	70

World Bank 1998 "Pollution Prevention and Abatement Handbook, Part III, Thermal Power - Guidelines for New Plants"

2.4.4 Water Effluent Standards

The WBG has developed water effluent standards and guidelines for power stations (Table 2.5). Nevertheless, the Company is not intending to have effluents outside the plant premises as the effluent from ETP shall be use for dust suppression in mines and Cement Plant areas as well as for gardening. Should there be required for disposing the effluent from the ETP the WB Group limits below as well as local standard limits whichever stringent shall be adopted and complied accordingly.

Table 2.5: Selected Maximum Water Effluent Requirements for Power Stations

Parameter	Unit	WBG
Alkyl benzyl sulphonate (ABS)	mg/L	Not listed
Aluminium	mg/L	Not listed
Ammonia	mg/L	10
Arsenic ("Ar")	mg/L	0.1
Aromatic Amines	mg/L	Not listed
Aromatic hydrocarbons	mg/L	Not listed
Biological Oxygen Demand ("BOD")	mg/L	50
Barium	mg/L	Not listed
Bromine	mg/L	0.2
Cadmium (Cd")	mg/L	0.1
Chemical Oxygen Demand ("COD")	mg/L	250
Chromium hexavalent	mg/L	0.1
Chromium (3+)	mg/L	Not listed
Chromium (total)	mg/L	0.5
Chloride (CL-)	mg/L	Not listed
Chlorine, total residual ("Cl")	mg/L	0.2
Chloroform Extract	mg/L	5.0
Cobalt (Co)	mg/L	Not listed
Coliform (total)	MPN/100 ml	400
Copper ("Cu")	mg/L	0.5
Fluorine ("F")	mg/L	0.2
Formaldehyde	mg/L	Not listed
Heavy metals, total	mg/L	10
Iron ("Fe")	mg/L	1.0
Lead ("Pb")	mg/L	0.1
Mercury (Hg")	mg/L	0.01
Nickel ("Ni")	mg/L	0.5
pH	mg/L	6-9
Phenol	mg/L	0.5

Phosphorous (“P”)	mg/L	2.0
Phosphate (PO4)	mg/L	Not listed
Oil and grease	mg/L	10
Sulphide (S)	mg/L	1.0
Total suspended solids (“TSS”)	mg/L	50
Zinc (“Zn”)	mg/L	1.0
Temperature	°C	Change of ≤3°

World Bank 1998 “Pollution Prevention and Abatement Handbook, Part III, Thermal Power – Guidelines for New Plants and General Environmental Guidelines

3 PROJECT DESCRIPTION

3.1 PROJECT LOCATION

The Captive Power Plant (CPP) is located within the Concrete fenced Premises of the Cement Plant on the further eastern side. The Cement Plant is located at Hiyari Village of Mayanga Ward in Mtwara District, Mtwara Region, Tanzania (see map of Figure 3.2 below). The specific coordinates of the site are 10°15'24.48" South, and 40° 2'48.54" East while figure 3.1 is the Google map showing the location of the CPP within the CementFactory premises.

Figure 3.1: The Google Map showing the location of CPP within Dangote Cement Plant
Source: Google, 2016

3.2 PROJECT ACCESSIBILITY

The Cement Plant site is located along the Mtwara - Lindi Road, it is about 23 kilometers from Mtwara Town CBD. Mtwara – Lindi Highway is the main road of Mtwara Region that connects with Lindi Region and it is a gateway road to other parts of the Country. The Cement Plant is on Northern side of the Road just opposite the Hiyari Village settlement. The Mtwara can also be reached via water way and air way as it has Harbour facility and Airport.

3.3 LAND OWNERSHIP

As noted earlier the CPP is being developed within the acquired Cement Plant area within its fenced premises. The Dangote CementLimited acquired the Plot Number 2 with title Number 3287 in collaboration with relevant government institutions to include local authority (i.e. Mtwara District Council), Tanzania Investment Centre and Ministry of Lands, Housing and Human Settlement Developments. All the legal procedures in the acquisition of the parcel of land were followed accordingly (see appendix 3). As per the title the designated land use of the plot is for General Industrial purpose; Use Group O, Use Class (a) as defined in the Town and Country Planning Regulations, 1960 as amended in 1993. Thus the CPP is in compliance with the title stated land use. The title is attached as appendix 2 to this document.

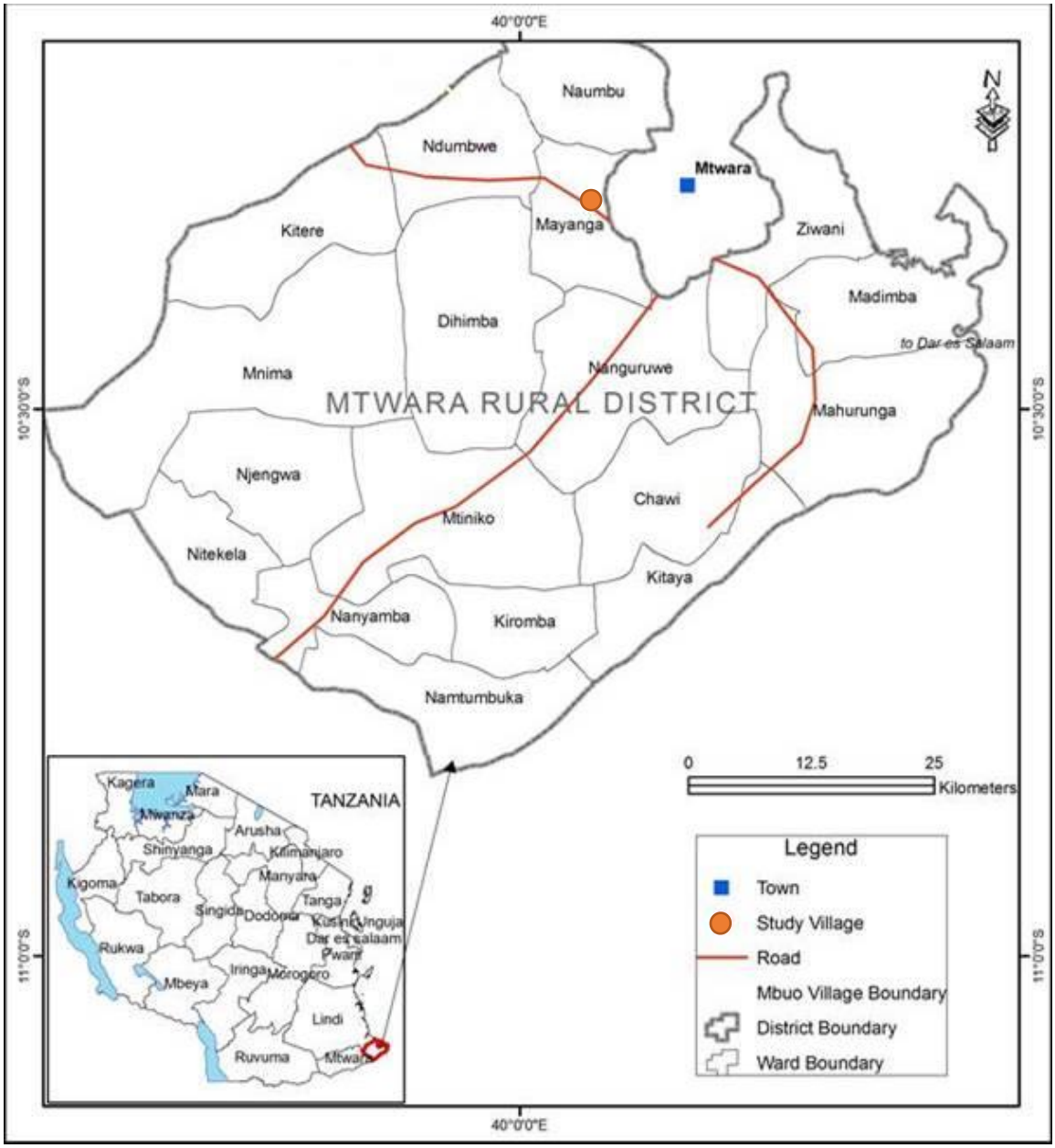

Figure 3.2: The Map of Mtwara District showing the location of study area

DCL, 2014

3.4 SITE CONDITION

As noted earlier the specific site for CPP is within the premises of the Cement Plant. At the time of site assessment some construction activities of the CPP had already began. Most of the civil works had already taken place and thus the ESIA team found some erected structures on site (see figure 3.3 below). Thus, the area had already been cleared up and currently there are only few sprouting grasses due to ongoing seasonal rains. The clearance of the site was also done in the course of construction of the main Cement Plant as part of it was used for storage of construction materials/equipment. The site was also levelled and thus the current terrain is almost flat however the nearby areas shows the general overland flow towards the west northern side. The nearby water body is the Ocean which is about 10 kilometers from the site. The estuary is about 3 kilometers on the North western side. The soils of the area are deep and loose clay brownish/reddish in color. Based on the state of the site during assessment and at the present there is no pristine environment that can promote thriving and existence of the species of conservation concern as per IUCN and CITES standards. Furthermore, there were no cultural or

archaeological objects that were reported earlier during the excavation of the site and likewise during assessment none of the objects were observed or found at site.

Figure 3.3: Existing CPP structures on site

3.5 ADJACENT FEATURES/LAND USE

Adjacent features of the CPP other than the Cement Plant on western side, it is natural vegetation that extend from the plant boundary up to the Ocean. Likewise, to the northern side it extends further to more than 3 kilometers. However, immediate to the east southern side there is Chinese construction camp that was used during the construction of the Cement Plant. The mines site (pit) is about a kilometer on northern side of the site. Hiyari settlement which is nearby settlement is at about 1.7 kilometers on south western side of the CPP. Figure 3.4 below shows the immediate adjacent features of the CPP site.

Figure 3.4: The Google Map showing the CPP in relation to adjacent features
Source: Google, 2016

3.6 CAPTIVE POWER PLANT COMPONENTS AND DESCRIPTION

More than half of the electricity generated in the world is by using coal as the primary fuel. The function of the coal fired thermal power plant is to convert the energy available in the coal to Electricity. Coal power plants work by using several steps to convert stored energy in coal to usable electricity

The conversion from coal to electricity takes place in three stages. The first conversion of energy takes place in the boiler. Coal is burnt in the boiler furnace to produce heat. Carbon in the coal and Oxygen in the air combine to produce Carbon Dioxide and heat.

The second stage is the thermodynamic process in which the heat from combustion of the coal boils water in the boiler to produce steam. The boiler produces the steam at a high pressure and temperature. The steam is then piped to a turbine. The high pressure steam impinges and expands across a number of sets of blades in the turbine. The impulse and the thrust created rotates the turbine. The steam is then condensed and pumped back into the boiler to repeat the cycle.

In the third stage, rotation of the turbine rotates the generator rotor to produce electricity.

In practice to effect these three stages of conversion, many systems and sub systems have to be in service. Also involved are different technologies, like combustion, aerodynamics, heat transfer, thermodynamics, pollution control, and logistics.

These specifications are typical for coal fired power plant of 25 MW capacity which is for the CPP.

- Around 105,000 tons of coal will be required each year to produce the continuous power.
- Coal combustion in the boiler requires air. Around 84,000 cubic meter of air in an hour is delivered by air fans into the furnace.
- The ash produced from this combustion is around 638 tons per year.
- Electrostatic precipitators capture almost all of this ash without dispersing this to the atmosphere. Pollutants from coal power plants like carbon dioxide, sulphur dioxide, and nitrogen oxide can also affect the environment. Lime addition is done in coal to reduce these parameters at root itself.

- The boiler units produce around 110 tons per hour of steam at a temperature of 540 to 550 degrees Centigrade. The steam pressure is in the range of 110 bar. The boiler materials are designed to withstand these conditions with special consideration for operational safety.
- Heat transfer from the hot combustion gases to the water in the boiler takes place due to Radiation and convection.
- The steam leaving the turbine is condensed and the water is pumped back for reuse in the boiler. To condense all the steam, it will require around 1.25 cubic meter per hour per MW of cooling water (Air cooled condenser) that is to be generated from onsite boreholes. The water is directed to the onsite effluent treatment plant for further treatment eventual usage for gardening and dust suppression in the Cementand mines areas.

3.7 KEY COMPONENTS

3.7.1 Boiler & Auxiliaries

The CPP will have two boilers, Front bunker design AFBC Boilers Top Supported, Natural circulation, Balanced draft, Semi-outdoor type, Water tube, Single drum type Boiler for the proposed CPP. The proposed boiler will generate 110 TPH (gross) at 110 Kg/cm2 (g) pressure and 540 ± 5 °C temperature at main steam stop valve outlet. Common Deaerator, boiler feed pumps, fuel oil transfer pumps. Individual chimney is offered for each boiler with guniting lining. Salient design features of proposed AFBC boiler are; -

- Conservatively designed furnace with large free board height to provide adequate residence time for efficient combustion of fuel with minimum unburnt carbon loss.
- Under-bed fuel feeding system is provided for efficient fuel combustion.
- Boiler designed with sectionalized bed to provide maximum flexibility in operation under varying load conditions.
- Optimum selection of bed temperature eliminating ash slagging / Clinkering and ease in ash handling and disposal.
    - Optimum flue gas velocities across heating surfaces to reduced erosion potential especially with respect to high ash in solid fuels.
    - Fuel piping layout with minimum bends to prevent fuel pipe choking and to ensure uniform distribution of fuel to each bed section.
- Complete furnace made of water cooled membrane wall construction with bottom refractory lining in the fluidizing zone to minimize tube erosion.
    - Provision of adequate access doors for easy access to boiler pressure parts for maintenance.
- Provision of Cross below fuel feed points and removable plugs/spool pieces near mixing nozzles.
- Optimum air nozzle pressure drop to ensure uniform air distribution.
    - Bed coil evaporator tubes are provided with Stainless steel studs in the bottom straight portion and bends to minimize tube erosion.
    - Optimum fluidization velocity to prevent escape of fine particles of fuel.
    - Under bed fuel feeding system with six nos. Drag chain feeders placed below bunker outlet with variable frequency drives. Each bed compartment is fed by one drag chain feeder with four fuel feeding points to ensure uniform fuel distribution.
    - Surge hoppers are provided at the inlet of each feeder to ensure proper fuel feed even in adverse conditions.
    - Water cooled membrane wall construction to ensure maximum heat absorption and structural rigidity.

- Conservatively designed Steam drum to keep drum steam loading rate low and to enable boiler operation with rapid load swings and fast response to load changes

- Efficient drum internals consisting of cyclone separators and demisters to ensure high steam purity at all loads. Drum internals of bolted construction for easy removal / replacement.
  - Two stage super heater with inter stage attemperator between super heaters to control the super heater temperature within ± 5 deg. C in the control range of 60-100% MGR. Stainless Steel liner is provided for the de-super heater header / pipe at spray point to withstand erosion and thermal shock.
  - Plain tube economizer with in-line arrangement ensures ease of cleaning and inspection.
  - Air heater air side bypass arrangement with motor operated damper. Carten steel tubes will be provided for first 12 rows (air side) to prevent corrosion during low load operation and startup of the boiler.
  - The boiler will be provided with bed ash coolers (One no. cooler for each compartment) to cool the bed ash temperature to around 250-300 deg. C
- Pressure parts tubes made of hot finished seamless steel construction to ensure high tube life and hence higher boiler availability.
- Electrically operated long retractable soot blowers are provided in super heater zone and electrically operated rotary soot blowers in economizer zone for effective on load cleaning of heating surfaces.

3.7.2 Steam Turbine & Generator Set

2 x 25 MW Bleed cum condensing Steam Turbine generator set with emergency stop valves, gland sealing system, bleed steam systems, all control & protection & monitoring devices, Turbine Lubricating & Control oil system equipment complete with oil storage tank, main oil pump, auxiliary, emergency oil pump, oil purification unit and oil coolers. Air cooled Condenser with steam jet air evacuation system,

3.7.3 Power Cycle Piping

Complete power cycle piping, fittings & valves as required for the boiler and steam turbine islands and connected systems up to Balance of Plants.

3.7.4 Plant Water System

Plant water system consisting of Boiler make up streams, cooling tower make up system. Pre-treatment plant as RCC clarifier which are common for boiler and cooling tower make up. Treatment plant for Boiler makeup: Multi grade filer +Ultra Filter +Reverse osmosis +Strong acid cation + Degasser with DGWST + Strong base anion +Mixed bed. Treatment plant for cooling tower makeup: Multi grade filer + Softener Side stream filter for cooling water flow. Cooling tower anti corrosion dosing chemical skid. Cooling tower corrosion coupon. Liquid chlorination system for cooling tower.

3.7.5 Effluent Treatment Plant

Effluent are regeneration waste generated from the Water treatment plant shall be collected in neutralization pit and pumped to Holding pond where boiler blowdown and CT blow downs are collected and the same shall be treated in the effluent treatment plant scheme as mentioned below

- ETP as follows - Holding Pond=- Alum dosing --- Polymer dosing-• --RCC Clarifier --- Clarified water tank--- MGF--- UF --'" Acid dosing--- Antiscalant dosing--- SMBS dosing --- Micron Cartridge Filter--- High pressure pumps ---- RO module=- Permeate transfer pumps.

- The ETP outlet will be back to Soft water storage tank for cooling tower makeup.
- The effluent from ETP shall be utilised for dust suppression system & gardening purpose (100 m Pipe length considered). However, before being used for dust suppression and gardening water quality shall be analyzed to comply with minimum standard for discharge into open environment as per table 8.2 below.

3.7.6 Auxiliary Cooling Tower

One (1) No. Induced draft, counter flow, Pultruded FRP cooling tower two working cells with one standby cell with PVC film type fill arrangement

3.7.7 Fuel Preparation & Handling System

Coal System

Ten thousand (10,000) tons of covered shed (Dome type) on both sides from ground shall be provided. Coal crushing & secondary screening plant and primary crusher house will be housed in RCC building consisting of up to crusher & screen operating floors. And steel structural with roof and side cladding, handrails above operating floor and side cladding up to bottom of RCC houses. CHP Control cum MCC building will be situated near the screen house.

The boilers will adopt Atmospheric Fluidised bed combustion system. The two boilers will be operated on 100% (Coal 1) as the design and Performance fuel. The fuel shall be received at (-) 80 mm with the specified sieve analysis as mentioned in the Specifications. The limitations on the fines shall be restricted to 10%. Customer to ensure the input fines to 10-14%.

The coal handling plant is of 135 TPH with covered gallery/gantry (with side cladding as noted above) and with walkway of 800 mm on both sides. This walkway will have 750 mm gratings with 1" clearance on both sides. The covered gallery shall have natural ventilation. The coal will be fed to CCP-BC-1 conveyor from the Cement Plant conveyor at the tap off point. (refer Plot Plan). Coal is offloaded through truck tipler in Cement Plant which has got dust extraction system.

BC-1 will feed coal to BC-2. BC-2 conveyor will then feed the coal either to BC-3 (stacker) conveyor which will stack the coal in the coal shed or feed to BC-4 which will feed to BC-5. The Recalimer installed on BC-5 will reclaim the coal and feed to BC- 5 which in turn feed to the Primary flip-flop screen (2 x 100%). The screened – 6 mm size coal from primary screen is fed to the final product belt BC- 7. The oversize is then fed to the Crusher (2 x 100%) which is housed in crusher and primary screen house, RCC (up to operating floor) & structural (above operating & complete house side cladding including stair case, hand rails etc).

Crushed material will be taken to secondary screen by BC-6 which is housed in secondary screen house RCC (up to operating floor) & structural (above operating & complete house side cladding including stair case, hand rails etc). The -6 mm from secondary flip flop screen shall be fed to BC-7 and oversized will be recycled back through BC-5. BC-5 belt design capacity shall take care of the recycled coal from secondary screen.

Belt width will be calculated based on maximum belt speed of 1.5 m/sec and troughing angle of 35 deg. The length of inclined portion of conveyor will be calculated based on max. height of lift and max. conveyor angle of 14 deg as per contract.

The crusher house is RCC building and shall have steel structural above operating floor & complete building side cladding including stair case with hand rails. Belt width for all belts will not be less than

800mm. The bunker feeding arrangement shall be by means of travelling tipper. Suitable dust extraction system shall be provided for the crusher houses, Screen house, TT's & the bunker to avoid dust pollution in the plant.

Limestone and Bed Material Handling System

Limestone of (–50) mm will be made available at lime shed. The lime shed shall have a concrete surface with bund wall to avoid material spill over outside the shed area. The lime shall be fed from lime shed to ground hopper (5m^3) by means of pay loader (3m^3) capacity. From hopper lime will be fed to BC-9 will feed to crusher (2x100%). Crushed lime then will be fed to vibrating screen (2x100%). Screened < 3mm lime will be conveyed pneumatically to Lime Bunker. Suitable dust extraction system shall be provided for the crusher house to avoid dust pollution in the plant.

Bed material will also be fed by means of bags through the same ground hopper, BC-9 (by passing crusher & screen) into surge hopper and then pneumatically conveyed to bed material bunker.

The limestone shall constitute 96% of calcium carbonate, 2.5% of Magnesium carbonate and 0.5 – 2% of moisture.

LPFO System

Bulk storage tank of capacity 1500 m^3 & day storage tank of 500 m^3 for storing LPFO (to be used in the two boilers) and One-day oil storage tank for HSD of 150 m^3 (to be used for Boiler start-up and Black-start DG sets) and respective pumps will be provided for unloading/ transferring LPFO/ HSD from the storage tank to the two AFBC boilers and Black-start DG's. Suitable unloading pumps for HSD and LPFO shall be provided. Steam coil tracing for LPFO shall be provided considering the low pour point of LPFO. Steam tapping if required will be from boiler and will be routed up to LPFO storage tank.

3x100% LPFO fuel transfer cum unloading pump. - 3x100% LPFO fuel forwarding pumps and 2X100% HSD unloading & 2x100%HSD transfer pumps are considered.

Note: Kindly note that while starting the oil firing, it shall be with HSD. Once the steam is provided for steam coil tracing for LPFO, LPFO firing can be done.

GAS System

The Power plant will have dual fuel fired burners for both oil and gas. There will be separate spuds for each fuel and thus Oil and gas separately or together can be fired in the same burner. Oil shall be fired in the centre and gas shall be fired in the periphery. For coal feeding there will be coal nozzles situated in the furnace.

Thus, there will be dedicated gas pipe from the TPDC Pipeline on the Mtwara - Lindi Road Reserve to the DCL premises that will be connected to the power plant. There will be three pressure reduction stations from 90bar to 30 bar to 22 bar then to 5 bar which is the requirement for boiler firing, all of which will be within DCL Premises. The gas pipeline within DCL premises will be overhead through pipe rack up to the Power Plant. From TPDC pipeline to DCL Premises the pipe will be underground up to the point where the overhead rack which will be constructed. Seven thousand (7000) kilogram of the gas will be required to run each boiler at full capacity into order to produce the 25 MW power. Thus in total 14,000 kg of gas will be required to run the two boilers.

3.7.8 Ash Handling System

The Power plant shall have three Ash silos of concrete structure, one of which will be for Bed Ash storage and two will be for Fly Ash storage. The Bed Ash silo will be of 80 m^3 storage capacity while the two fly ash silos will be having a storage capacity of 220 m^3 each. The location of silos has been selected in such a way that it is away from coal and water area to avoid dust nuisance and by considering wind direction.

The ash handling system for the AFBC boiler, fed by both 100% Coal 1 (Performance Fuel) and other (Coal-2) and shall be designed considering continuous operation of the two boilers at MCR. The boilers will be operated with 100% Coal 1 (Performance Fuel)

The ash handling system basically consists of two schemes:

- Bed ash-handling system, which consists of bed ash removal from the bed ash coolers of the two boilers'. Bed ash will be pneumatically fed to common bed ash silo (CS silo of 80 m^3).

- Fly ash handling system consists of fly ash removal from the boiler economizer bank, air heater and four (4) fields of ESP of the two boilers and will be routed to two fly ash silos (CS silo each of capacity 220 m^3). Silo design temperature shall be less than 100 Deg. Celsius

- Both silos shall be provided with pressure relief valves.

Note: The ash handling plant will be designed considering two boilers in operation. Bag filter for all the silos will be provided with automatic reverse pulse jet cleaning facility.

Ash from the respective silos will be discharged into trucks for subsequent usage in the Cement Plant as one of the additives. The ash conditioner capacity for fly ash shall be of suitable capacity. Water supply from ACW and Effluent reject shall be provided to the above conditioners to suppress dust nuisance. One spare connection with a knife gate valve will be provided on each ash silo for emergency unloading of ash.

Two (2) of fluidising air blowers of adequate capacity (1W/1S) to provide fluidization in ESP hoppers and in the fly ash silo will be provided. Requirement of compressed air for dense phase ash handling system shall be met by two (3x100%) (2W+1S) dedicated Single stage, lubricated type screw type air cooled compressor. There shall be two air receiver of 10m^3 capacity for the ash handling system one near compressor and one near distant boilers to cater to conveying air requirement.

Details of each Ash Handling System are described below.

Bed Ash Conveying System

Bed ash from the boiler will be discharged at about 200 ^oC to 400°C. Each boiler will have a five bed ash coolers. Ash from the bed ash cooler outlet will be collected in MS water cooled hoppers. These hoppers will discharge ash into ash vessels and ash will then convey pneumatically into the Bed ash silo. The bed ash silo of 80 m^3 CS construction has been considered, for 2 boilers running at MCR.

Fly Ash Conveying System

Dense phase pneumatic handling system shall be used for conveying the fly ash from the economizer, air preheater and 4 fields of ESP to fly ash silo.

Below each hopper outlet at connection bank, economizer and air preheater, suitable MS surge chutes with each 1 no. expansion joint shall be provided. Wherever required water cooled surge hoppers will be provided along with level probes. The ash vessel (transporters) will be placed below each surge hopper. The level probe in the hopper senses the pressure of material to initiate the conveying cycle, fluidising

pads with compressed air in ESP hoppers shall be provided. Dome valve will open and allow the material to gravitate in to the vessel till it is closed automatically by the timer present as per process parameters. On closure of dome valve, butterfly valve seal gets inflated and signals the conveying air injection into the transporters. Material will be conveyed through conveying pipelines pneumatically up to the fly ash silo.

3.7.9 Conveying, Instrument & Service Air Compressor & Its Auxiliaries

2 Nos (all Working) Lubricated screw type air compressor for conveying air requirement & lime stone conveying air requirement.
2 Nos (2 Working) Non -Lubricated Screw type air compressor for instrument & service air requirement.
2 Nos (1 Working +1 Standby) Heatless Type air drier type.
2 Nos for Air receiver for conveying air requirement.
2 Nos for Air receiver for service air requirement.
2 Nos for Air receiver for instrument air requirement.

3.7.10 Oil System

One no. Bulk storage tank with steam coil heating & 2x100% (1W+1S) Unloading cum transfer pumps for each unit.
One Day oil tank with steam coil heating at inside the tank & suction header steam heating, electric heaters for each unit.
One HSD start up day oil tank One Day oil tank with steam coil heating at inside the tank & suction header steam heating, electric heaters.

3.7.11 Crane & Hoist

- EOT crane for STG Maintenance (Generator Stator)
- Monorail & Hoist
    - FD fans
    - ID fans
    - PA fans
    - Crusher cum screen house
    - Raw water pump House
    - Cooling water pump house
    - Bunker house for conveyors
    - Transfer tower
    - Air compressor

3.7.12 Ventilation System

- Turbine bay hall ventilation
- Cable cellar Room
- Pump house
- Water & Feed water pump house
- Storage area WTP
- Exchanger area
- Battery room
- plant room
- Toilet & store house

3.7.13 Air Conditioning System

- DCS / CCR - Control building
- Electronic cubicle room
- UPS room
- Office area
- Conference room
- Shift in charge room
- SWAS room- in control room
- Physical and chemical lab -WTP area
- WTP plant laboratory
- ESP, Ash handling, fuel handling
- control room
- Instrument lab
- Switchgear room inside STG Building
- WTP, Aux cooling water, Raw Water, water MCC
- ESP, Compressor, Fuel handling & Ash handling MCC
- Workshop /Main shop office

3.7.14 Fire Fighting System

There shall be a Fire Hydrant System for power plant with the following; -

- HVWS for LPFO Oil storage
- MVWS spray system for conveyor area
- MVWS for cable cellar room

- Addressable fire detection & alarm for the following locations.
    i. Control room in TG building
    ii. MCC /Switchgear room in TG building
    iii. Cable cellar room in TG building iv. Local MCC room /Control room

3.7.15 Electrical System

Synchronous Generator shall be connected to the proposed 11 KV MV switchgear through phase segregated Aluminum bus-duct. The generated power shall be utilized by the power plant's auxiliaries for catering in-house loads. The surplus power after delivering to power plant shall be then exported to Cement Plant. Two no's of 4000A, 11 KV VCBs shall be considered at proposed MV panel for Power evacuation to Cement Plant. Further power distribution from CPP MV Panel to Cement Plant (Including cables, cables trays, support structure, termination kits and other associated items) shall be done.

Separate CTs for cable differential protection and one no of 4 stages under frequency relay for load shedding shall be provided for the use. Further cabling to Cement Plant is layed. There shall be two nos. of auxiliary distribution Transformers 2 x 50%, (11/0.420kV) to feed the power plant LV loads that are connected to the 400V LT system. These transformers shall receive power from 11 KV MV switchgear. There shall be two nos. of converter duty Transformers 2x100%, (11/0.420/0.420kV) to feed the power plant LV loads that are connected to the 400V 12 pulse VFD LT system. These transformers shall receive power from 11 KV MV switchgear.

Each LV Switchgear / Motor Control Centre (MCC) / Main Distribution Board (DB) shall have 2x100% incomer without bus coupler and Sub Distribution Boards shall have 1x100% incoming feeder.

One no. 11 OV DC system has been considered for plant TG and electrical DC auxiliaries' power purpose. Two nos. of 400/400V, lighting transformer has been considered for internal lighting purpose. Two nos. of 11 KV, 50Hz, 2000kVA, 0.8pf lag, black start DG sets has been considered for plant start up power and One no of 0.400KV, 500KVA, 0.8 p.f emergency DG set has been considered for plant safe shutdown. Two nos. of Redundant UPS with two separate battery bank shall be provided for Power plant DCS, field instruments and electrical switch gear panels.

3.7.16 Control & Instrumentation (C&I)

C&I including DCS comprising data acquisition sub-system, closed loop and open loop controls, data highways, gateways, Operator stations & Control device, Printers & Engineering work station. Boiler, STG & BOP instruments, AHS, SWAS, all junction's boxes, Cubicles, enclosures, local panels, Marshalling panels & etc. Maintenance and calibration equipment. Complete control, monitoring and protections system of auxiliary system of FHS including stacker & reclaimed, WTP & ETP shall be done by remote I/o station.

3.7.17 Steel Building

The CPP shall have three steel buildings at site which are; -

- Power House building
- Fuel storage shed.
- Workshop & store

3.7.18 Electrostatic Precipitator

For the purpose of ensuring that the dust concentrations are within the limits, two (2) Electrostatic Precipitators (ESP) have been provided for the two boilers in the plant. The ESP shall remove dust concentrations (Fly ash) from the Flue gas & ensure a maximum dust load of 30-mg/Nm^3 of flue gas. The ESP shall consist of four fields. All fields shall be on line during normal operation. In the event of one field out condition the outlet dust concentration shall not exceed 50 mg/Nm^3. See the design basis of the ESP on table 3.1 below.

Table 3.1: Design Basis

Sr. No.	Description	Unit	Other Coal -1 (PG Fuel)
1	Gas flow per boiler	m^3/Sec	50.6
2	ESP Design Gas temperature at the outlet of APH	℃	140
3	Gas Analysis		
	CO_2	% by volume	13.336
	SO_2	% by volume	0.030
	N_2	% by volume	72.028
	H_2O	% by volume	11.14
	O_2	% by volume	3.465
	Total	% by volume	100
4	Gas density (wet basis)	Kg/Nm^3	1.3019
6	Clean gas burden at outlet (with all field in service)	Mg/Nm^3	30

Source: Themax Limited, 2017

3.8 PROJECT ACTIVITIES

3.8.1 Development Phase

As noted earlier most of the civil works have already been done at site in which there are concrete structures erected on site that will host the machinery. Other structures remaining includes the steel type dome shaped fuel storage shed for coal, three Ash Silos of concrete structures, Limestone shed, two storage tanks for LPFO of steel type, One storage tank for HSD, Gas pipping and its associated pressure reduction stations, and workshop & store. Other remaining part of the development phase is the installation of the key plant components and machinery as well as internal cabling. The entire electrical distribution network for the Cement Plant and its associated components have already been covered.

The remaining construction activities will involve preparation of the site that will involve clearance of the few sprouting vegetation cover of the site to pave way for the structures. This will be followed by some further levelling and grading the site as well as creation of trenches for foundations. Once the foundations are set erection of the structures will be followed either by steel for steel type structures or by concrete for concrete type structures. The specific structures and components to be elected are covered under

section 3.7 above. Once concrete and steel structures have been erected installation of machinery and cabling and piping will follow. Landscaping of the site including creation of road networks to link with the other part of the Cement Plant shall be done. The roads will be concrete type just like the other parts of the Cement Plant. Landscaping will also involve demarcating the areas for gardens and paved areas as well as controlling the areas prone to erosion (inclined areas) by putting perforated paving blocks just like other part of the Cement Plant.

3.8.1.1 Construction Materials and equipment's

The construction materials that will be needed for the project include: - Gravel, and Sand which will be locally sourced from licensed suppliers or from the legalised quarry sites; Cement for concrete base and structures erection that will be sourced from within the Cement Plant; Water for concrete also that will be sourced from the onsite existing water sources (boreholes), while other materials of industrial nature shall be imported through Mtwara Port to the site.

Other associated important materials for the project includes; Diesel Fuel, Lubricants and engine fluids. The main equipment to be involved with the project activities are Excavator, Wheel loader, Trucks, Motor grader, Compactor, Concrete Mixers.

3.8.1.2 Demobilization Sub-Phase

After the construction work is done demobilisation will be required and especially to the cleared and excavated areas. The demobilization will entail: - Reinstatement of the excavated area(s); Removal of any remaining construction materials; Use of spoils to reinstate the excavated areas; Removal of spoiled material from the sloppy areas to avoid the movement of soil and sediment; Clearing of stock yard; Transportation of construction equipment and machineries offsite which will no longer be needed at site; and Security and safety measures

3.8.2 Operation Phase

Operating the automated machines i.e. controlling and monitoring its performance from the control room at site shall be done; Periodic inspection and servicing the machines shall be done accordingly.

3.8.2.1 Plant operations materials

The CPP will use bituminous coal as raw material fuel for power production from Ruvuma Region specifically Ngaka area, and Natural Gas from TPDC Pipeline as well as Heavy Furnace Oil to be imported through Mtwara Port. However, these will not be used concurrently as when the gas will be available Coal shall not be required. Small amount of the HFO shall be required to start up the plant, nevertheless it can be used when other fuels are in difficult supply.

<u>Coal Handling</u>
Coal will be sourced from Ngaka Ruvuma by trucks which is about 660 kilometres by road to the site. Around 292 tons per day will be required which is equivalent to 105,000 tons per annum. In average around 10 trucks of 30 tons will be required to deliver the coal to the site per day. Coal is offloaded through truck tipler in Cement Plant which has got dust extraction system. The coal will then be transported through hoppers and conveyer systems to the storage steel dome dedicated for the CPP. Coal from the storage dome will be conveyed to the single stage crushing and screening machine to achieve 80mm required. In this case there will be two pre-flip-flop screens, two crushers and two post-flip-flop screens.

<u>Limestone</u>

Limestone will be required for reduction of sulphur oxides emission. The required limestone will be sourced from the available resources within the project area. Limestone preparation shall have single stage crushing and screening in which there will be two crushers and two post vibratory screen. The materials shall be transported by a conveyor belt to and from the crusher.

Water supply

The water for the plant operation will be needed to produce steam to the turbines as well as for cooling (Air cooled condenser). Water at the site is available from ground water source and about 1000 m^3 per day will be required. Three additional boreholes shall be drilled at site to cater for the CPP water needs while the existing four boreholes will remain for the mines and Cement Plant. There will be dedicated raw water treatment plant for the CPP. The water will be pumped and stored into a water reservoir and distribution will be done through circulating pumps.

Return hot water in cooling water circulation system shall be collected into a pit and shall flow to the return hot water tank by gravity. Further cooling may be done in cooling tower and goes back to its tank for further distribution.

LPFO/HSD and Natural Gas operations

The handling and operation of LPFO/HSD and Natural Gas is rather simple process compared to the Coal operations. As noted above for the LPFO operation it will require HSD to start up the plant to ensure the steam is provided for steam coil tracing for LPFO. Thereafter LPFO firing can be done continuously. In this case there are dedicated three LPFO fuel transfer cum unloading pumps and three LPFO fuel forwarding pumps to the firing chamber through the spuds and also there are dedicated two HSD unloading and two HSD transfer pumps to the firing chamber. Once the firing is done the water in the boiler is steamed to run the turbines and other process continues as noted in coal process below up to production of the power. The usage of LPFO will only attain 60% capacity of the boiler and in this case this will only be used during startup of the power plant. No lime is involved or ash produced in the process. the Liquid oil will be supplied by supplier to the site through specialized trucks.

The Natural Gas is simplest in logistics compared to the rest as there will be no pump required. The Gas comes with high pressure from TPDC Gas Pipeline which will be reduced in stages from 90 bar up to 5 bars that will be injected to the burning chamber/furnace of the boiler. Once the firing is done the usual process of steaming the water containing in the boiler continues that is directed to the steam turbine for production of the power as noted below. Likewise, there is no Lime involved in the process and no ash is produced with the Natural Gas operation.

3.8.2.2 Power generation technology

As noted above the power will be generated from the expansion of the steam generated from boiler and expanding in the steam Turbine. The Steam Turbine is coupled with the generator from which the Power will be evacuated through HT Switch Gear. The AFBC (Atmospheric Fluidized Bed Combustion) Technology for the steam generation is one of the latest technologies adapted by all power plants of this capacity. The Combustion process allows the steam generation to be on lower temperatures which reduces the NOx and gives better combustion efficiency. The Power generation process is also with the steam turbine and regenerative heating which increases the efficiency of the power generation system.

Boiler

The boiler design will be based on proven high pressure fluidized bed combustion technology. A high pressure Fluidized bed combustion boiler of 110 TPH is envisaged for supplying steam for the power generation process. The benefits of using this technology is that higher significantly power supply

reliability, stabilization power generation costs, ash utilization in Cementproduction with substitution of other Cementadditives and power generation.

Steam Turbine
Two Steams Turbines of 25 MW each will deliver the 50 MW power for Cement Plant as well as its auxiliary consumption.

Firing system and steam generation
The Firing system is Fluidized Bed Combustion which is the new technology giving higher combustion efficiency. The boiler will generate 110 TPH (gross) steam at 110 Kg/cm2 (g) pressure and 540 ± 5 °C temperature at main steam stop valve outlet. During the combustion process, due to the high gas velocity the more part of the fine particles leaves the combustion chamber and then being separated in the re-circulation cyclone. The fuel gases leaving the boiler are routed to a combustion air heated and cooled down to approximately 130^{o}C. For the removal of fly ash from the fuel gas a bag house filter is employed. Following the fly ash collector, the fuel gases are conveyed by means of an ID fan directly to the stack. The steam generation capacity of the boiler shall be sufficient for the minimum required net electricity power generation of about 2 x 25MW. The generated high pressure steam of each boiler will be fed to common steam header.

Condensing system
The Steam after having being expanded in the Turbine has to be condensed. The plant has been designed for the Air Cooled Condenser thereby minimizing the water consumption. The Steam will be condensed by Air cooled condenser and condensate will return back to boiler again for generation into high pressure steam.

Ash handling and Disposal
All the Ash generated by the power Plant will be consumed in-house by the Cement Plant and no ash disposal outside the plant boundary is envisaged. The utilised ashes will substitute the use of additives and again reduce the cost for additives in the Cement production. Due to this concept there are no environmental concerns with regard to ash disposal.

Flue Gas Handling System
As noted above to ensure the SOx, NOx and CO_2 levels remains low as per plant design or even lower there shall be lime feeding system for Sulphur reduction in the coal at the source. The inherent design of the power plant is such that the exhaust gases from the boiler are cleaned using cyclones and an electro-static precipitator (ESP) system. This removes most of the fine dust and ash from the exhaust stream, before being released into the atmosphere through a chimney. Furthermore, the stack height for the CPP have been designed in accordance to the Good International Industrial Practice with the height of 76 meters. For more details on the calculated stack height see appendix 9).

3.8.2.3 Power Plant Lifespan

Since the power requirement for the Cement Plant is there to stay to support the Cement Plant it is reasonably to indicate the lifespan of the power plant to be 149 years which is the time required to finish the limestone reserves for Cement production. Despite the fact that the design life of Power Plant is 25 years, it is a standard procedure to extend the life of the power plant by refurbishing the Boiler parts, upgrading the turbines. Life extension is possible due to the conservative nature of the original plant design and the fact that only a relatively small number of the components are life limited.

3.9 WASTE AND WASTE MANAGEMENT

3.9.1 Solid waste management

Construction wastes will include solid waste i.e., spoils and remains of construction materials e.g. sand, stone and gravel. Packaging wastes will include Cardboard boxes, wooden drums and Cement empty bags. Remains of the conductors will also be among of the wastes generated. Packaging material will be collected and sorted according to their nature ready for final disposal to the approved Dumpsite located at Magamba area in Mtwara Municipality. Table 2.2 below shows the specific method to be used in handling different types of the wastes at the site. However, the waste shall be managed as per the Company Waste Management Plan (WMP) attached as appendix 10.

During operation phase there will be few wastes generated from the activities and these include; - remains of domestic wastes due to the presence of people at site. People at site will be supplied with food and water and thus wastes like food remains, used water bottles and paper wastes are inevitable. These will require proper management and disposal. There will be dedicated waste containers of 50 litres volume for biodegradables and plastic wastes in strategic locations. Hydrocarbons waste will come from servicing the power plant units and these may include oil filters and used oils. As per waste management plan the used oil shall be used in the Cement kiln as source of fuel and the filters shall be incinerated in the kiln and the resultants elements from high temperature combustion shall be part and parcel of Cement constituents. Further details see the WMP of appendix 10.

3.9.2 Liquid waste management

All the generated wastes to include plant wastes and sanitary wastes will be directed to the onsite existing Effluent Treatment Plant. The resultant effluent shall be used for secondary and tertiary usage at the Cement Plant and mines for gardening and dust suppression. However, before being used for dust suppression and gardening water quality shall be analyzed to comply with minimum standard for discharge into open environment as per table 8.2 below.

3.10 SECURITY, HEALTH AND SAFETY ASPECTS

The site to large extent has taken care of security aspect as it is within the concrete fenced area of the Cement Plant premises. Nevertheless, additional security measures shall be deployed to include more guards to the specific construction area. The site will be guarded 24 hours a day seven days a week to supplement on the fence structures. Under health and safety aspects, always there are occupational health hazards when human ware and machinery ware are involved in work. In this case appropriate defined safety procedure shall be established at site during development phase that shall also involve provision and usage of appropriate safety gears. Also safety signs shall be provided to the areas where required. Likewise, during operation, the same will be done and appropriate personal protective gears will be provided to workers at site as well as to the visiting people. Qualified people will be employed to run the power plant. Emergency preparedness and response measures shall be implemented on site. The existing Company safeguards shall also be extended to cover and integrate the CPP operations.

4 PROJECT ENVIRONMENT AND BASELINE STUDIES

4.1 DEFINITION OF THE STUDY AREA

Hiyari Village is a traditional village, officially recognized as far back as 1945. The settlement has been progressively growing with main increase in 1974 during Ujamaa Villagization policy. Administratively the village is within Mayanga Ward, Mtwara Rural District, Mtwara Region, Tanzania (See Figure 4.1 below). The Mtwara rural District is one of 6 districts of Mtwara Region, bordered by the Indian Ocean to the East, Lindi Region to the North, Tandahimba District to the west and the Ruvuma River on the border between Tanzania and Mozambique to the south. The district also engulfs the Mtwara-Mikindani Municipality on the eastern side. It lies between longitudes 39°0" and 40°27" east of Greenwich. It is also situated between latitudes 10°0" and 10°07" south of the Equator.

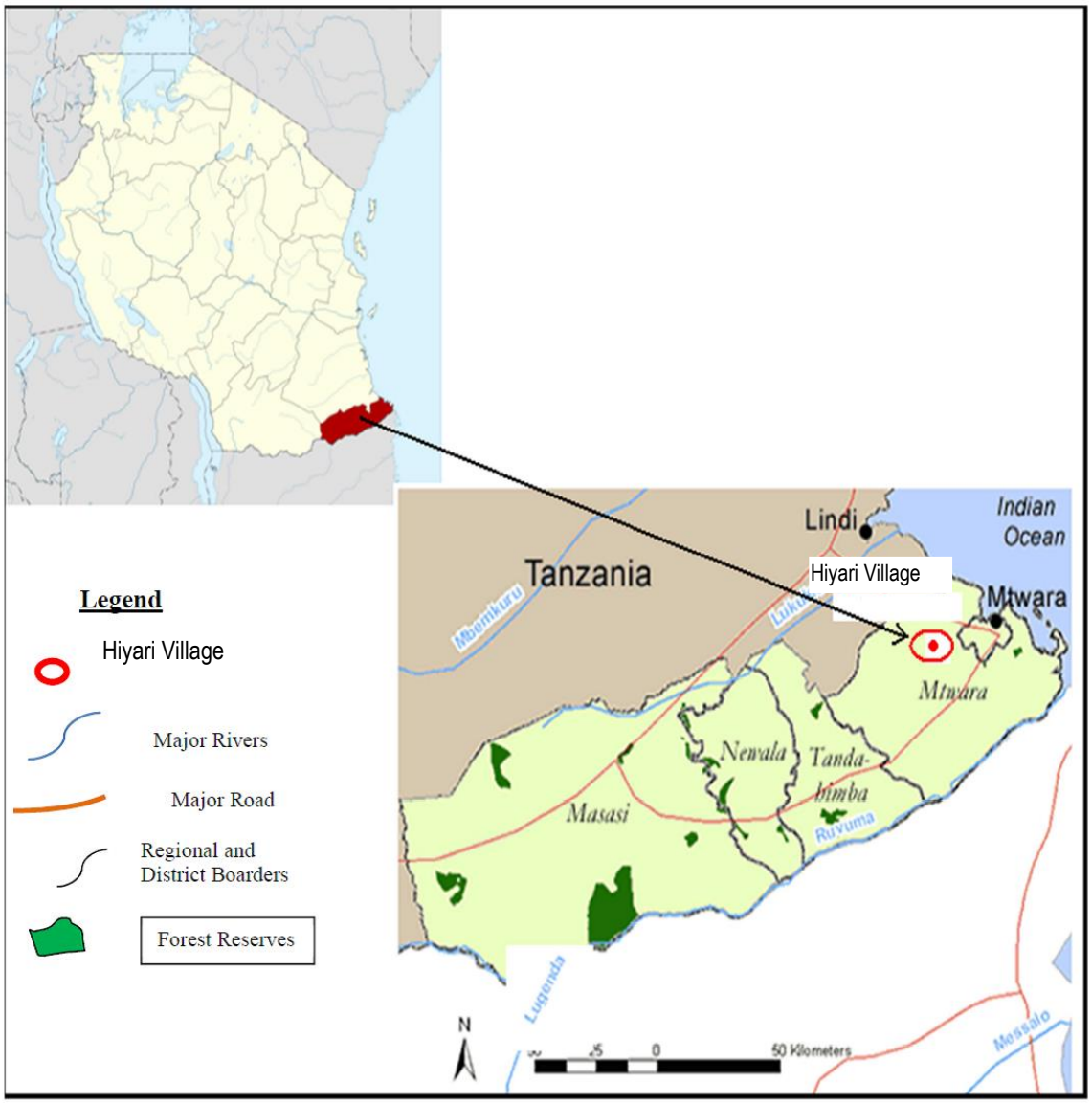

Figure 4.1: Location of Project Site Hiyari Village, Mtwara Region

4.2 SCOPE AND METHODOLOGY

The survey team consisted of experts in the fields of biodiversity and water resources, socio-economic and environment. The survey program incorporated a walk-over survey through the abovementioned sites. The environmental baseline description was based on two inter-dependant activities:

An extensive desk review of existing data records consisting of the analysis of satellite imagery, review of previous studies and publications on the area, interviews with local inhabitants and public officials; and Field investigation of the study area consisting of a series of site visits, visual documentation and field measurements. The field survey confirmed findings from the desk review based studies and allowed the team to visually identify areas of a sensitive nature and investigate the soils and surface geology, hydrological features, groundwater resources, general terrain, flora and fauna, geomorphology, archaeology, habitat types and any evidence of human activity (e.g. land use and agriculture), as well as overall socio-economic conditions in the general project area.
Spot measurements were done in February 2017 to obtain current baseline condition for the proposed CPP while the other Cement operations as well as mines operation were ongoing. The measurements involved ambient air quality that included particulate matter and noxious gases, ambient noise condition, and vibration levels. Likewise, water samples were collected mainly for the onsite boreholes for laboratory analysis, as there was no surface water within or in the vicinity of the project site.

The scope and methodology for each of the performed technical studies as well as full findings are covered in more details in the Baseline Survey report of February, 2017 attached as appendix 12.

4.3 AIR QUALITY (MONITORING) STATIONS

In order to document the baseline data for the proposed CPP, air quality, noise and vibration parameters were measured at six (6) re-established sampling stations. The sampling stations were selected to be across the area that the generated dust, noise, vibrations and gaseous products from existing DCL operations and the proposed CPP project are likely to disperse to (i.e., nearest settlements and/or receptors). Other selective factors were based on the norms prescribed by local standards (Environmental Management (Air Quality Standards) Regulations, 2007) and International (WB/IFC) guidelines together with predominant wind direction in the area. The selected monitoring stations and their description are tabulated in Table 4.1 while figure 4.2 below is the extract of Google Map showing respective locations.

Table 4.1: Coordinates for onsite and offsite air quality monitoring stations

Code	GPS Readings	Location
AQMS1	37L 063310; UTM 8868831	Reject damp area; Represent the onsite stations at the damp area located about 4,170 meters from the proposed CPP on northern border of the DCL project area
AQMS2	37L 0614043; UTM 8867377	Crusher area; Represent the onsite stations also at the crusher area located about 1,586 meters from the proposed CPP on the northern side
AQMS3	37L 0613665; UTM 8866926	Near mining pit (block I); onsite station nearby the main and active limestone mine pit located at about 1,450 meters on northern side from the CPP site.
AQMS4	37L 0614729; UTM 8865980	Captive Power plant; onsite station where the proposed CPP will be located
AQMS5	37L 0613164; UTM 8865243	Hiyari village (Near Lindi- Mtwara road); Off-site station at the village center, representing the sensitive receptor located at about 1,727 meters on western side of the CPP

AQMS6	37L 0614446; UTM 8664987	CRDB Plot at Msijute village; offsite station located at Msijute village (near Gopex-Oil filling station), on southern side at about 1,005 meters from the proposed CPP site
CP	37L 0613600; UTM 8872342	Control point; Offsite and control station located at Namgogoli village, about 2 km on northern side of the DCL site

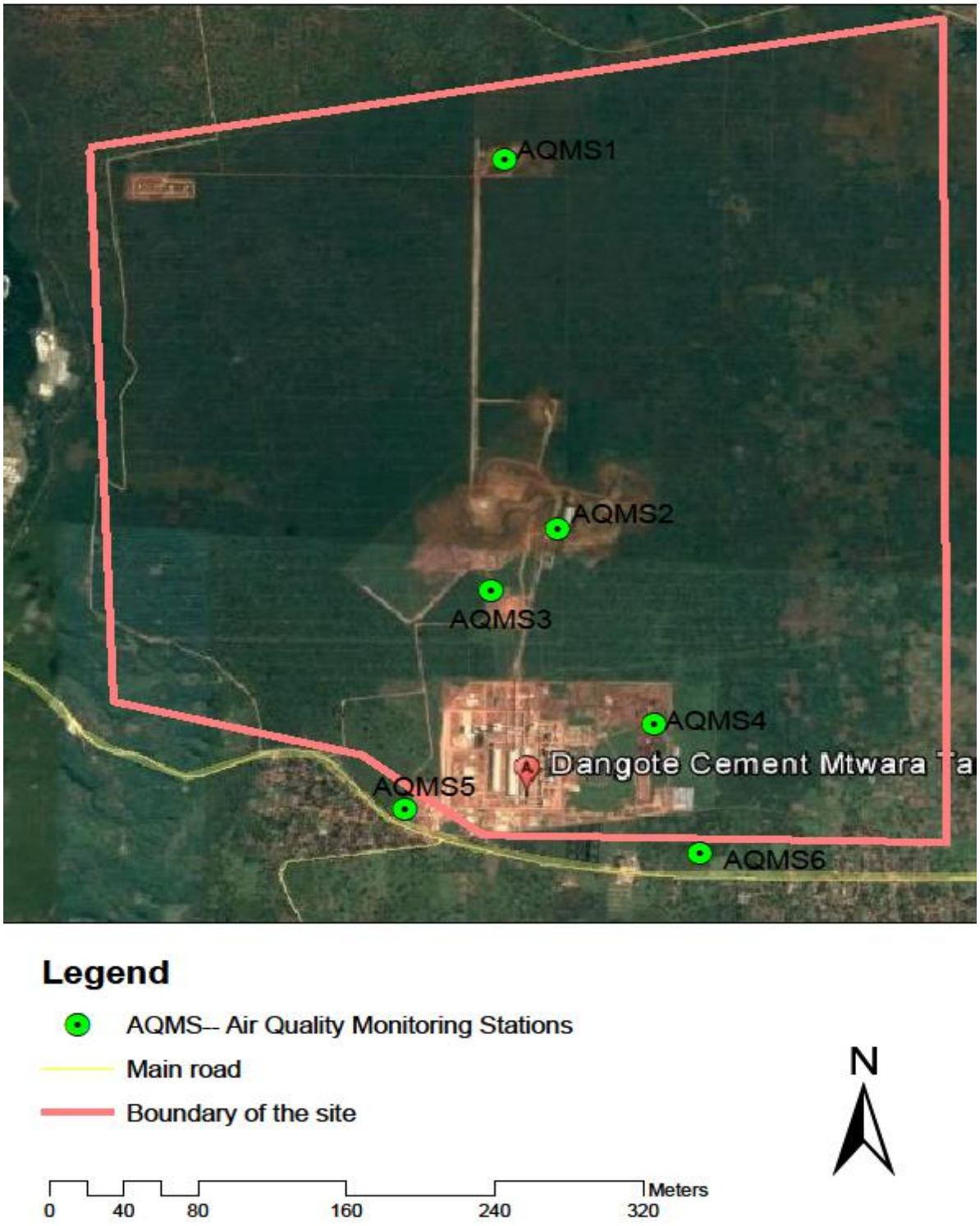

Figure 4.2: Map showing onsite and offsite Air Quality Monitoring Station (AQMS)

4.4 PHYSICAL ENVIRONMENT

4.4.1 The Climatic Condition

Rainfall

Project site experiences climatic conditions which are typical of Mtwara Rural District. The climate is characteristically coastal Tanzania. Mtwara Rural District site has a unimodal rain season where dry season begins from June to December and wet season from January to May. The amount of total annual precipitation tends to vary with altitude - lowest levels are about 800mm in lower altitude like Hiyari village.

Temperature

Temperatures vary from 27^{o}C as the highest monthly mean at the coast in December to 23^{o}C in July. Relative humidity ranges from 87% in March to 79% in October. The project site has wind characteristics typically of village off the coast blowing North-east to South-west direction and influenced by the monsoons. More details on wind is covered below.

Wind condition of the project area

As wind being the main factor in determining dispersion (Mannan, 2005). A wind rose was created using WRPLOT View, by Lakes Environmental Software. The plots below summarized the information on wind direction and speed for the direction where the wind was blowing from NE to SW for a total of 8784 hours. Therefore, parameters useful in describing the dispersion and dilution potential of the site i.e. wind speed, wind direction, temperature and atmospheric stability, are presented in this section as Figures 4.3, 4.4, 4.5 and 4.6a-b.

A). Surface Wind Field

(a). 24-hour period

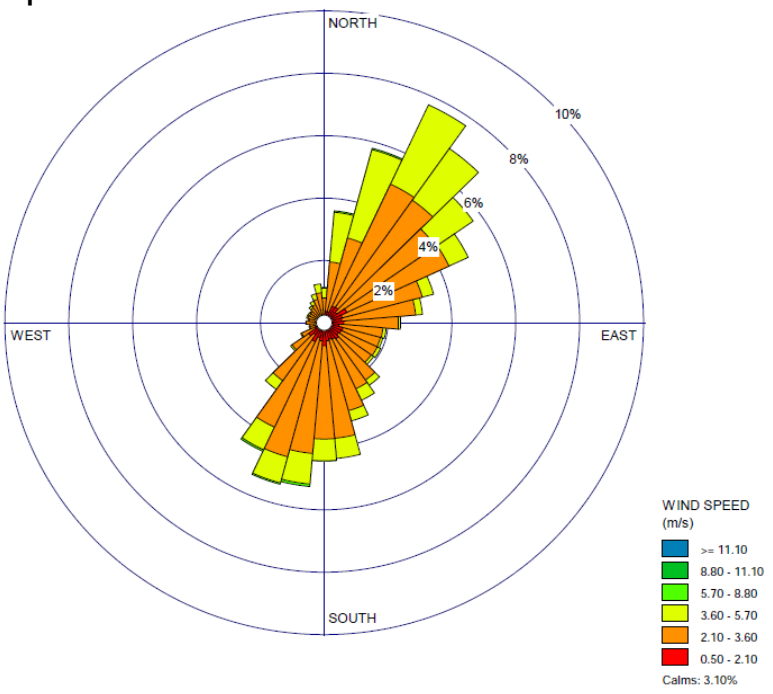

Figure 4.3: Wind rose plot showing 24-hours wind direction and wind speed
Data Source: MM5, 2016/17

(b). Day-time

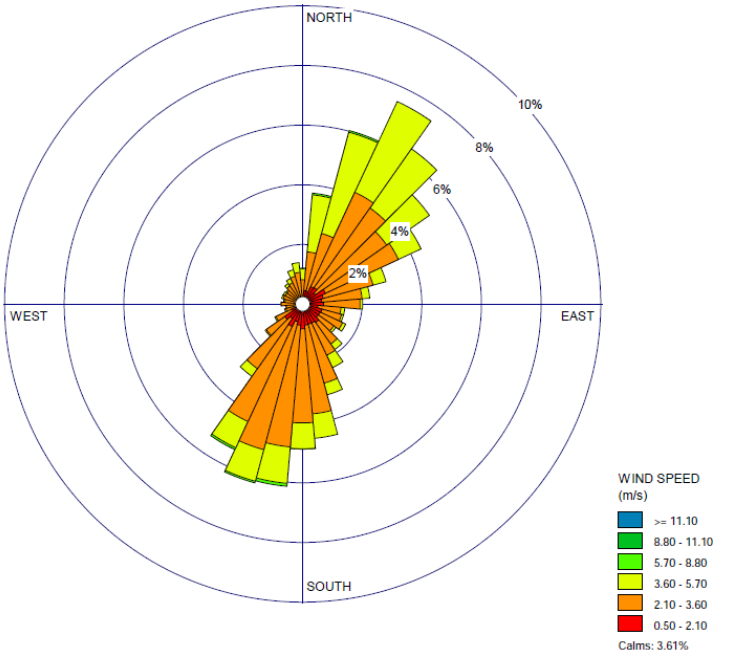

Figure 4.4: Wind rose plot showing wind direction and wind speed during the daytime
Data Source: MM5, 2016/17

(c). Night-time

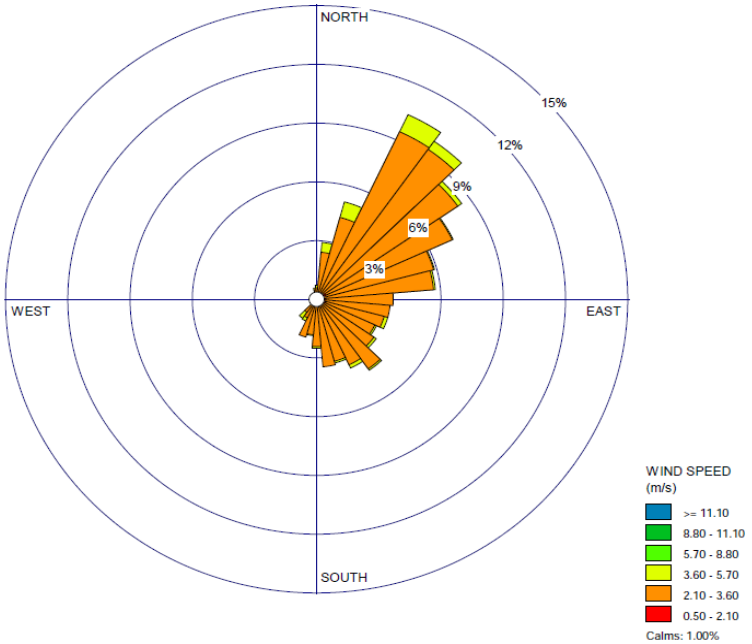

Figure 4.5: Wind rose plot showing wind direction and wind speed during the night-time
Data Source: MM5, 2016/17

B). Atmospheric Stability

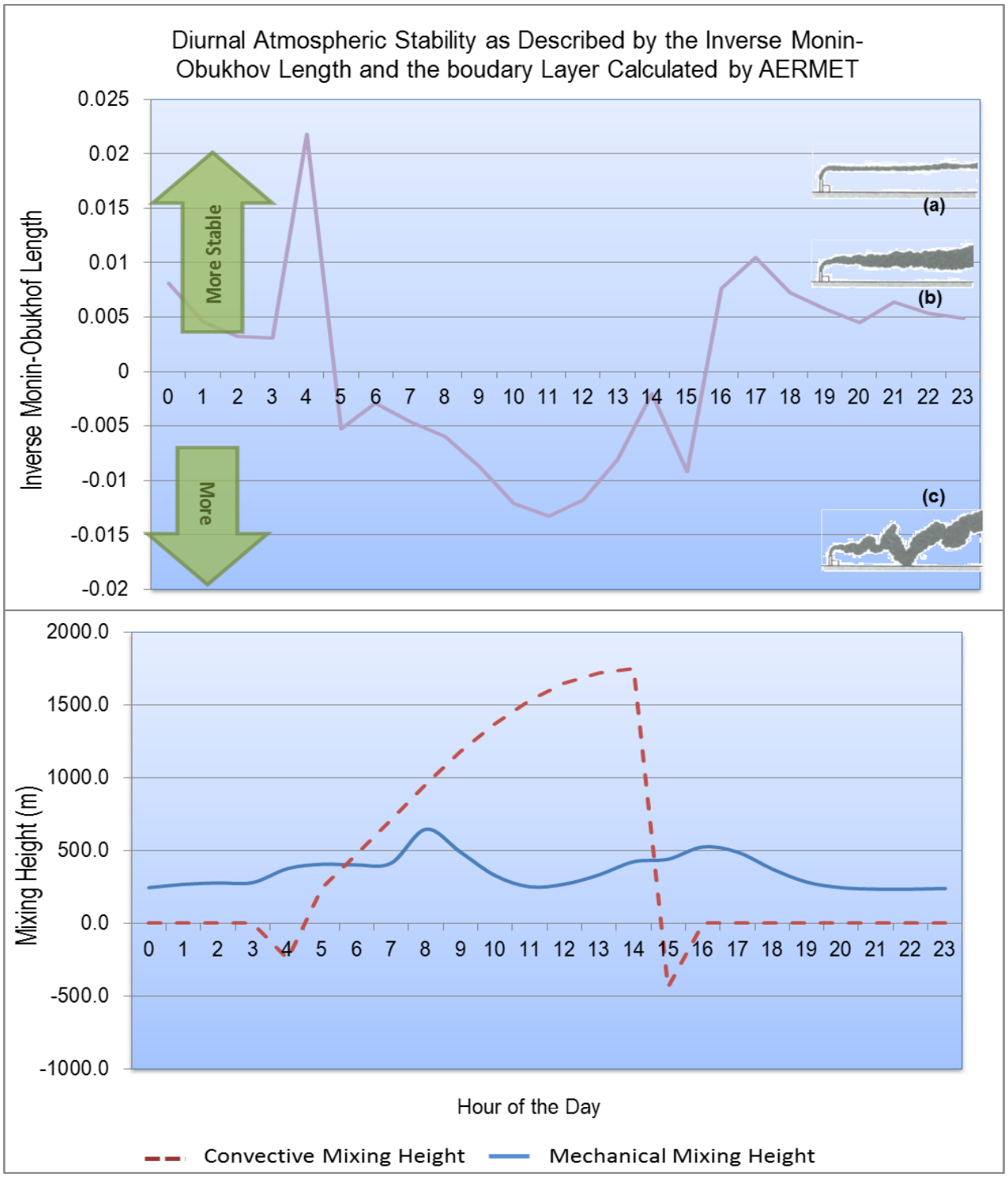

Figure 4.6a: Diurnal atmospheric stability
Data Source: MM5, 2016/17

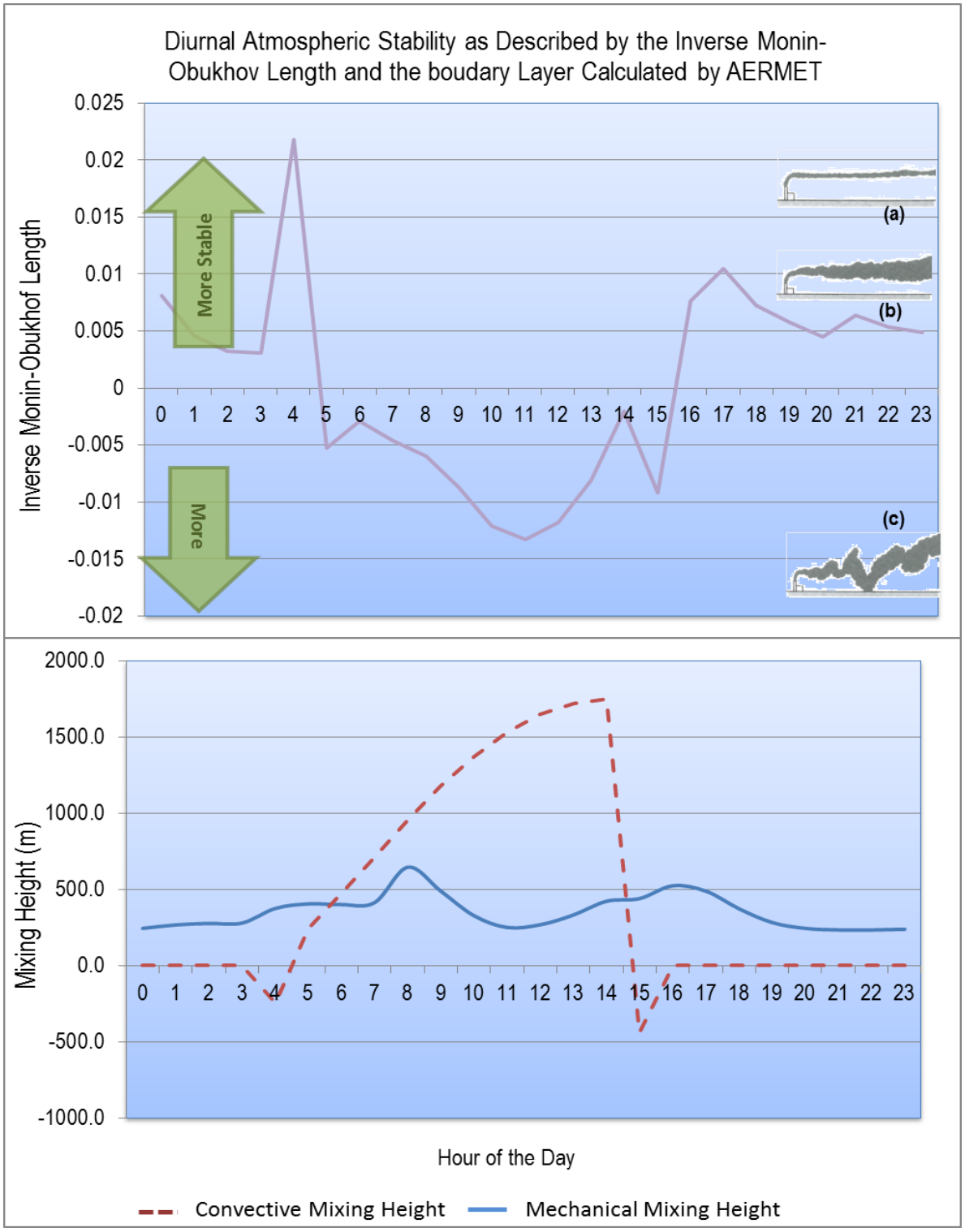

Figure 4.6b: Diurnal atmospheric stability
Data Source: MM5, 2016/17

Spot Meteorological Conditions

Analysis of hourly average meteorological data was taken as necessary to facilitate a comprehensive understanding of the dispersion potential of a site. The existing meteorological conditions were measured (at outdoor locations to document their representative mean values) along with the other spot measurements for ambient baseline condition. The general outdoor meteorological conditions include clear to partly cloudy skies, daytime temperatures of approximately 26.2 to 36 ºC and relative humidity ranging from 61.9 to 88.3%. The wind speed varied from calm conditions to maximum of about 7.3 m/s, mostly from the NE to SW during the day and SW to NE during the night, with occasional higher gusts

noted at certain stations. Higher wind speed of 5.5 and 7.3 m/s were noted during the morning and evening hours, respectively.

4.4.2 Topography and Drainage

The general topographical features of the Mtwara Region is characterised with the altitude that ranges between 0 metres along Indian Ocean and 350m above Sea level. Topography wise the region is divided into two halves; the coastal plain with its complexity of landforms and the basement plain dominated by the Makonde Plateau at 300 mm to 400mm. It is generally low level with isolated rocky and hills and steep river sides. The western half lying beyond the Makonde Plateau drains to the south through tributaries of the Ruvuma River. The Maombi and Hiyari rivers drain most of the Makonde Plateau. The topographical features of the specific project site fall within the coastal plain. It is characterised with almost even terrain with very gentle slope towards the estuary side on north western. The overland flow towards the sea through an estuary. The estuary is located at about three kilometres from the DCL Plant site and in between the area is characterised with thick vegetation cover. Figure 4.7 below is the extract of google map showing the features of the surrounding project site.

Figure 4.7: Google Map showing features of the project area

4.4.3 Soil

Geology determines soils since the Mtwara Region has two geological zones so the two geologically determines soils types. The first zone is geologically the coastal sedimentary formation extending some 12 km from the Indian Ocean to the edge of the Makonde Plateau of Newala, of which the project site falls within. This zone produces deep, well drained, sandy soil of low fertility and low moisture holding capacity. They are produced from sandstones. Some areas give rise to marine heavy clay soils or virtuosi's. Further, coastal limestone produces red, well drained and heavy textured soils.

The second zone geologically extends west of the coastal sediments. It is a zone of pre-cambrian basement rocks consisting of gneisses and granulites. Soils from this basement are variable. They are deep, well drained, red clay to the north of Masasi Town. These are the best soils in the Region since they suit best the upland crops in the Region.

4.4.4 Hydrology

4.4.4.1 Well survey

A survey for the existing wells in the area of investigation was conducted and revealed the presence of about 20 wells mostly tapping the Neogene and Paleogene aquifers. The depth of the wells varies between 15 m and 100 m below ground (B.G.). Discharge rates vary between 10 and 150 m^3/day. The wells are mostly used for domestic and agricultural purposes. Depth to water level in most of the Neogene wells vary between 10 m and 90 m B.G., which corresponds to an absolute static water level of about 130 to 150 m a.s.l. Wells drilled in the outcrops of the Neogenegroup are found north to the study area.

In wells tapping the Paleogene formations, seldom down to depths of 130 - 160m B.G., static water level varies between 10 m and 110 m below ground level, which is equivalent to an absolute level of 130 m to 150 m a.s.l. Water starts to appear at about 110 m-120 m BG in wells drilled in the Paleogene unit. Based on generated water level contour maps for each of the tapped aquifers, namely the Neogene, Paleogene, and Cretaceous aquifers, the groundwater flow direction in the Paleogene and Neogene aquifers is in an eastern to western direction.

4.4.4.2 Groundwater Quality

The sampling results help to assess the existing quality of the groundwater and serve as a basis for comparative assessment to evaluate potential repercussions to the water quality that might arise from the various construction and/or operation activities of the proposed project.

The sampling results were evaluated for three onsite boreholes (within Dangote plant premises) based on the Environmental Management (Water Quality Standards) Regulations, 2007. Table 4.2 below shows the results based on laboratory analysis (see also appendix 6). For all the parameters and samples analysed, results revealed most parameters to be well within the allowable limits of the local and international of standards. Exceptional is only for Total alkalinity and Calcium where their levels to all three boreholes were well above the standard limits hence non conformity to the standards, while the electro-conductivity were above the limits to only borehole number 4. Non conformity to the standard limits for these parameters is obvious due to inherent mineral contents of the ground water.

Table 4.2: Ground water analytical results

S/N	PARAMETER	UNITS	DANGOTE BOREHOLES			(WHO) Standards
			BH1	BH2	BH4	
1	pH		6.91	7.05	6.86	6.5-8.5
2	Turbidity	NTU	0	0	0	25
3	Colour	Hazen°	0	0	0	50
4	Salinity	‰ (ppt)	0.40	0.30	0.60	na
5	Electric conductivity	µS/cm	792	743	1150	1000
6	Total Dissolved solids	mg/l	387	362	567	1000
7	Phosphate	mg/l	0.57	0.19	0.39	na
8	Nitrate –Nitrogen	mg/l	0.40	0.140	0.10	6.7
9	Ammonia –Nitrogen	mg/l	0.548	0.336	0.490	1.0
10	Chloride	mg/l	201	168	252	600
11	Sulphate	mg/l	91.60	61.50	61.60	400
12	Bicarbonate Alkalinity	mg/l	258	289	305	na
13	Iron	mg/l	0.042	0.025	0.018	1.0
14	Carbonate Alkalinity	mg/l	0	0	0	na
15	Total Alkalinity	mg/l	258	289	305	250
16	Magnesium	mg/l	3.939	7.40	9.96	150
17	Calcium	mg/l	187.0	201	206	75
18	Sodium	mg/l	32.95	24.2	39.34	150
19	Potassium	mg/l	4.712	1.68	8.301	150
20	Lead	mg/l	<0.01	<0.01	0.088	0.1
21	Manganese	mg/l	<0.01	<0.01	<0.01	0.5
22	Copper	mg/l	<0.01	<0.01	<0.01	0.05
23	Zinc	mg/l	<0.01	<0.01	<0.01	5
24	Cadmium	mg/l	<0.01	<0.01	<0.01	0.05
25	Chromium	mg/l	<0.01	<0.01	<0.01	0.05
26	Alluminium	mg/l	<0.01	<0.01	<0.01	N/A
27	Nickel	mg/l	<0.01	<0.01	<0.01	N/A
28	Mercury	mg/l	<0.01	<0.01	<0.01	0.001

4.4.4.3 Surface water

No permanent surface water resource flows within the project premises or in near vicinity of the study area. the nearby water body as noted in previous sections is more than 3 kilometres on the west northern side which is the estuary to the sea (Indian Ocean) while the sea is about 10 kilometres from the project site.

4.4.5 Noise Levels

4.4.5.1 Ambient Noise Level

It is evident that at any setting, both the frequency and magnitude of environmental noise may vary considerably over the course of the day. In the case of the proposed CPP, the project would occur primarily on already industrial established area i.e. Cement Plant. This implies that noise sources are predominantly from the operation of the ongoing operations of Cement Plant, mining and movement of vehicles along the Mtwara - Lindi highway. Findings show that baseline noise levels within the Dangote premises were within recommended limits of both local and international standards (see table 4.3 below).

Table 4.3: Onsite ambient noise levels (in dBA) recorded at Dangote CementLimited

Code	Location	Average Daytime Noise	Average Nighttime Noise
AQMS1	Rejected material dumpsite	56.7	39.7
AQMS2	Crusher Area	59.0	46.4
AQMS3	Near mining pit - block I	61.1	45.3
AQMS4	Captive Power plant	50.7	40.1
EM(NVS) Limits		**<70**	**<60**
WB/IFC Guideline		**<70**	**<70**

Sampling date: February, 2017 Source: Field measurements

4.4.5.2 Noise-Sensitive Receptors

Noise sensitive receptors near the proposed project site include mainly the population clusters and dwellings located at the front gate of the Cement Plant about 1700m while few houses of Msijute Village are at about 1005 meters from the CPP. The background noise levels were also established in these areas and the results as presented in Table 4.4 below shows that, the noise levels for both areas and both night and day time to be within the limits of both local and international standards. Furthermore, it is noted that the noise in these areas are mainly influenced by the moving vehicles along the highway of Mtwara – Lindi other than per se influence from the operation of Cement Plant or mines, as the latter are located relatively far to have noise influence to the area.

Table 4.4: Offsite daytime noise levels (in dBA) recorded at nearby local communities

Code	Location	Average Daytime Noise	Average Nighttime Noise
AQNMS5	Near Lindi- Mtwara road at Hiyari village	53.1	43.9
AQNMS6	CRDB Plot at Msijute village, near Gopex-oil filling station	51.1	42.2
Average noise at offsite		**52.2**	**43.1**
EM(NVS) Limits		**<55**	**<45**
WB/IFC Guideline		**<55**	**<45**
% of Stations > EM(NVS) Limits		**0.00%**	**0.00%**
% of Stations > WHO/IFC Limits		**0.00%**	**0.00%**

Sampling date: February, 2017 Source: Field measurements

4.4.6 Ambient air quality (Particulate Matter)

Given the presence of the Cement Plant and its associated mines operation one would expect the levels of ambient dust would be in elevated levels in the area. However, this was recorded to be in contrary with the expectations as all on site as well as offsite recorded stations were well within the limits of the international standards (see table 4.5 below). However, it is noted further the study was done in wet season when the ground was generally wet with very minimal influence of fugitive dust from the mentioned earth operations.

Table 4.5: Average ambient particulate matter measured at onsite and offsite stations

Code	Location	TSP	PM_{10}	$PM_{2.5}$
		mg/m^3	mg/m^3	mg/m^3
AQMS1	Rejected materials dumpsite	0.0165	0.0106	0.0054
AQMS2	Crasher area	0.0221	0.0142	0.0063
AQMS3	Near major mining pit-block I	0.0214	0.0192	0.0081
AQMS4	Proposed Captive Power plant area	0.0162	0.0104	0.0054
AQMS5	Near Lindi- Mtwara road at Hiyari village	0.0173	0.0116	0.0060
AQMS6	CRDB Plot (near Gopex oil) at Msijute village	0.0171	0.0110	0.0056
***CP**	Control point at Namgogoli village	0.0020	0.0010	0.0010
Environmental Management (Air Quality Standards), 2007		**-**	***0.0002**	**-**
WB Group and IFC (2008)		**0.23**	**0.05**	**0.025**

Sampling date: February, 2017 Source: Field measurements

4.4.7 Ambient air quality (Noxious Gases)

Likewise, the results of measured noxious gases were not exception to the particulate matter results as all stations for all measured parameters were well within the local and international standard limits as shown in table 4.6 below.

Table 4.6: Average 24hours pollutant gases values compared with their respective limits

Measured Average 24hours Ambient Pollutant Gases								
	CO_2	CO	NO_X	SO_2	O_3	H_2S	Methane	HCs
Locations	**ppm**	mg/m^3	mg/m^3	mg/m^3	mg/m^3	mg/m^3	mg/m^3	mg/m^3
AQMS1	0.10	0.40	0.05	0.01	0.00	0.00	0.00	0.00
AQMS2	0.02	0.01	0.03	0.02	0.00	0.00	0.00	0.00
AQMS3	0.50	0.62	0.16	0.01	0.01	0.01	0.01	0.01
AQMS4	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00
AQMS5	1.35	0.84	0.21	0.02	0.00	0.00	0.00	0.00
AQMS6	0.24	0.02	0.13	0.01	0.00	0.00	0.00	0.00
***CP**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WB/IFC Guidelines	**500**	**30**	**0.2**	**0.5**	**0.1**	**-**	**-**	**-**
EM (AQS)	**-**	**15**	**0.15**	**0.5**	**0.12**	**-**	**-**	**-**

Sampling date: February, 2017 Source: Field measurements

4.4.8 Land Uses in the Project Area

The project site earmarked for CPP is within the concrete fenced premises of Dangote Cement Plant of which this is treated as one of the component of the Cement Plant. The area has been largely influenced by Cement Plant construction activities as well as construction activities of the same CPP, as some civil work has already started as noted above. In the vicinity of the Dangote Premises there are various land uses to include mining activities of the Limestone which is on western side adjacent to fenced Dangote Cement Plant premises and beyond is the thick vegetation cover of natural vegetation which extend beyond three kilometres, to the northern side is also natural vegetation cover upto the Sea which is more than 10 kilometres. To the southern side is the Hiyari settlement which stretch up to around four kilometers and beyond after TPDC Natural Gas pipeline is the industrial designated area though currently it's a mixture of farmlands and some natural vegetation cover. To the western side more than 2 kilometers

is another settlement of Msijute Village. Within the village there are also some farms mainly grown cashew nut tree as cash crop and some seasonal crops to include maize, cassava, sorghum, paddy, pineapples, legumes etc. mainly for subsistence and limited sale. The uncultivated areas are covered with patches of bush at varying levels of maturity.

Currently the District Council has 366 surveyed plots. In this planning period, council aims at demarcating primary and secondary school, health centre and village boundaries. The council also aims at increasing number of surveyed and allocated plots. Land under cultivation is 184,385 this is 73% of the total arable land or 51% of the total land. Land under people's settlement is 5,000 hectors, under water is 1,800 hectors and under forest reserve is 55,465 hectors. Potential land for livestock is 16,651 hectors. 160,000 people out of the district population are provided as farm labour.

4.4.9 Cultural and Archaeological Features

The study noted that there were no cultural or archaeological objects that were reported earlier during the excavation of the site while the Cement Plant was under construction and likewise during site assessment for the CPP none of the objects were observed or found at site.

4.5 BIOLOGICAL CHARACTERISTICS

4.4.1 Flora

As noted earlier the CPP has already started being constructed and most civil work has been done and concrete structures have been elected. In this case one would not expect to find pristine vegetation cover in the area. Further, the area was also influenced by the construction of the main Cement Plant in which the area was cleared along with Cement Plant area for storage of some construction materials. The photo of figure 4.8 below shows the current features of the main part of the project area. The sprouting vegetation in the area due to some rains are mainly grasses.

However, the vegetation survey of the area before construction of the Cement Plant as obtained from the EIA report of the Cement Plant and its associated components (DIL, 2011) which represents the vegetation of the surrounding area are covered hereunder.

Main vegetation cover in the vicinity of the project site can be categorized as coastal bushland. The dominant vegetations are bushes *Maclura African, Dichrostachys cinerea, Combretum* spp*., Acacia* spp*., Cassia* sp*., Markhamia lutea* with shrubs of *Comiphora Africana* and *Albizia vescholor* and exotic species of *Anacardium occidentalis.*

There are no rare or endangered species in this vegetation type. It is possible that more endemic plant species formally occurred on the project site are now disappeared due to human activities like bush fires, tree clearance for subsistence farming, etc. The important tree species which were reported to have medicinal value in the area include (in local names) *Mmalala, Mtoro, Mnumukamongo* and *Lidingili*. Further the study indicates that there has been no reported invasive species in the area as most vegetation are either native or naturalised such as *Anacardium occidentalis and Azadirachta indica.*

Figure 4.8: CPP current site features

4.4.2 Fauna

As noted above one would not expect to have large fauna in the area as the land use of the project site cannot provide conducive environment for wild fauna to thrive in the area. However, in the nearby areas where there is good vegetation cover some wild animals would be present. Main fauna reported by locals includes large animals which are wild pigs, duiker, bushbuck/deer, hyenas, black monkeys, foxes, baboons and small animals of field rats and hares; reptiles: lizards (in local names) *Liwalawehe and Kijusi*, Snakes (in local names) *Nachungo, Julidochromis regain (Kipili), Yahamitela, Namayamba, Naliyohi, Nnalu* and *Kukutu*; Arthropods: butterflies, grasshoppers, beetles, ants of various kinds and other insects commonly found in bushy areas. Birds seen and reported in vicinity of the site were mainly owl, white-browed coucal, falcons and others (in local names) *Machende, Kachwele, Kapungu, Madea, Vituku* and *Tipitila.* The presence of snakes, cashew nuts, wild fruits, insects, sorghum, maize and other cultivated cereals generate food for birds. As far as the study has determined there were no species of conservation concern as per IUCN and CITES standards noted in the area (i.e. rare, threatened, endangered or vulnerable species). Furthermore, there are no sensitive ecological receptors in the vicinity of the project area.

4.6 SOCIO-ECONOMIC AND CULTURAL ENVIRONMENT

4.6.1 Population and Demographic Aspects

Villages and District population data are very important for fair allocation of the project available employment opportunities and in planning of sustainable initiative support programme. Information about the population and demographics of Mtwara Region, Mtwara District, Mayanga Ward and Hiyari Village are presented in Table 4.7 below. Main occupation is farming employing more than 80% of the village population: male engaged are 40% and 60% are female. Much of the populations of Mtwara are Muslim, but a few other faiths are also represented and ethnic origins are diverse. For example, considerable heterogeneity exists with respect to places of origin of the population, largely due to historical connections with traders, maritime activities. The dominant ethnic group in the district is the Makonde. The area is not endowed with many significant natural resources, except land and sea products.

Table 4.7: Population of the Project Area by Sex Average Household Size and Sex Ratio

Name	Population (Number)			Sex Ratio	Av. Household Size
	Total	Male	Female		
Mtwara Region	1,270,854	599,648	671,206	90	3.9
Mtwara District	228,003	107,922	120,081	95	3.9
Mayanga Ward	9,528	4,571	4,957	92	4.0
Hiyari Village	812			92	4.0

Source: NSB, 2013

Most of the people in Mtwara District live in rural areas and depend on the land for their subsistence. The district like other Mtwara Regional Districts faces migration of new generation who move out in search of greener pastures elsewhere in Tanzania. Development of project similar to this of DCL have a potential to make the area attractive to young generations so that they do not need to go beyond its borders to seek a secure economic future.

4.6.2 Land use

The main land use activities within the project area are settlements, subsistence agriculture, grazing, and forestry. Cropland is generally located adjacent to or near the homestead. At the village centers there are petty business (small shops, kiosks cafe etc) as well as local institution. All people have permanent homes in the villages and most dwellings are mud houses with grass /makuti roofs. There are a considerable number of tin-roofed brick houses. The village governments are responsible for the management of the land and planning for land use within their jurisdiction.

4.6.3 Land rights and tenure

Under existing land laws, (Land Act, 1999 and Village Land Act, 1999) there are no restrictions on access to land. Any person, citizen or foreigner can apply and be allocated land for any type of use. In practice, however, it is a lengthy procedure to acquire land especially for a foreigner. In respect of public land, Tanzania mainland has a dual system of land tenure. The system recognizes both customary and statutory rights of occupancy.

Tenure rights to land can be held by individuals and by communities. Holdings of individuals can be (i) by leasehold right of occupancy for varying periods e.g. 33, 66, or 99 years which must be confirmed by a certificate of occupancy; (ii) by customary right of occupancy that is supposed to be confirmed by certificate (Hati ya Ardhi ya Mila) and has no term limit. Communities (Villages) are allowed to hold land and to manage it, although they do not formally own the land. In the project rural areas, holdings of individuals are in conformity to the law i.e. by customary right of occupancy.

4.6.4 Economic Activities

Agriculture

About 75 - 98% of people in the villages within the project area are farmers and their livelihoods depend on those farm. Quite a sizable amount of agricultural production in Hiyari village is carried out on small scale farms characterized by small yields per size and no access to agricultural credit. Also farming in this area is seasonal and limited by generally poor soil conditions and insufficient rains. Also traditional small hand hoe is the major implement used by farmers. The main food crops are maize, cassava, sorghum and pigeon pea. Cashew is the most important cash crop. Other economic crops include simsim, mangoes, groundnuts and coconut. This type of crops provides indications of types of crops that will need to be compensated.

Livestock keeping

Livestock keeping in project area is very minimal as the customs and practices of the communities living in the area are not of animal husbandry. The main livestock most people in the area keep are goat, sheep and indigenous chicken for subsistence and income generation.

Fishing

Fishing is a traditional activity and the main source of livelihood of the majority of people living within the project area particularly for sea bordering villagers. Fishermen found in the community are characterized as artisan fishermen, and net fishing fishermen. The majority of fishers about 70% are using traditional dug-out canoes, outrigger canoes and small boats propelled by sails and few propelled by engines. A large proportion of the traditional fishers in the area fish mainly for subsistence and the majority own neither fishing crafts nor fishing gears. Fishing gears includes; beach seine, hand line (mishap), gill nets, Tandilo, basket traps (madema), hooks (zulumati), spear and weir (wando). Type of fishing ground is rocky mud and pump and the common fish species that feature are mainly snappers, emperors, groupers, mackerel and other reef species. Other types include rabbit fish, goatfish, parrots and milkfish caught from sea grass beds, mangrove and estuary.

Trading activities

Much of Mtwara's population is engaged in either agricultural or fishing, or related activities such as processing or trading and similar to most of the coastal zone of Mtwara. Small-scale trade and handicraft activities are seasonal undertakings to supplement household's incomes. This includes women selling produce such as coconuts, vegetables, fried fish and palm wine and producing crafts such as mats, rags, pottery, batiks, and some weaving. Coastal forests are an important source of raw materials for carpentry, carving, and weaving.

Men are involved in small-scale trades such as drying fish, tailoring and carpentry. The transport of people, goods, food, processed fish, handcraft products and raw materials is also conducted by men, usually using traditional small vessels.

Coastal forestry

Natural forests within the coastal zone, including mangroves, provide various livelihoods, i.e. for construction, fuel wood, and charcoal as well as beekeeping. Many households rely on mangrove trees to meet a variety of residential, production energy and commercial needs i.e. cooking and heating, fuel for salt and lime production, and drying and frying fish. Mangrove trees are also a valuable source of timber used for construction poles for local housing needs and for beekeeping activities (honey production).

4.6.5 Economic Infrastructure

Roads

Mtwara District has a total of 846km of roads, out of these, only 36 km are tarmac 25 km gravel, 561 km are earth roads. The project site can be accessed by tarmacked road from from Lindi road to Mtwara Municipality. Other roads in the project area are earth surfaced with the implication that they are generally impassable during the rainy season. Even during the dry season, they are used with difficulty. According to responsibility, maintenance of the roads (feeder roads) in the project area is the responsibility of the district authority. However, the District Council has showed little aptitude in maintaining roads they are responsible for. These feeders' roads should be taken care of to easy transportation of the drilling rig, and supporting equipment during mobilization.

Energy

Firewood and charcoal is the major source of energy for cooking in the project area where it stands at 95% of the total energy required for cooking and other domestic energy uses. Other sources of energy include electricity (Hydro and thermal electric power), solar energy and fossil fuels (Kerosene, diesel and petrol). Electricity is mainly produced/supplied by Tanzania Electricity Supply Company (TANESCO)

which has isolated mini grid. The National Grid is yet to connect Mtwara Region. The generation capacity of TANESCO within the Region is about 18 Megawatts from the Natural Gas. This electricity supports relatively large scale production activities in the extraction, manufacturing and processing industries and also home supplies especially in urban and to small extent in rural areas.

Air services
The airport near to the project area is located in Mtwara Municipality and is able to accommodate big jets. Daily flights are operated by the Air Tanzania (ATCL) and Precession Air. Services available include a control tower, VHF radio and Navigation aids all powered by either solar energy or electricity. A Regional fire-fighting department is in place with one vehicle and trained fire tendering personnel. Fuel service are available – JETA 1 and AVIGAS gasoline and meteorological station.

Harbour
The project equipment's and other resources such as coal will be mobilized to the area via the near-by Mtwara port. The port is so strategically well placed in that area so that it could serve as an outlet for cargo to and from the Southern regions of Mtwara, Ruvuma and Lindi. The harbour can accommodate two ships (175 m) and one Coaster at a time at its deep-water berth as well as another six ships within the harbour and its entrance channel. It has covered storage capacity of 15,000 tonnes and a 15,000 square meters of open yard could be used for container storage. The port can handle 400,000 tonnes of cargo a year. This can be extended to 750,000 tons if containerisation is opted for.

Telecommunications
Within the project area, there are no landline telephone lines. Vodacom, Tigo and Airtel cellular phone are accessible from all area. To strengthen communications for the project DCL is proposing to put its own communication system within the area.

4.4.6 Social Infrastructure and Services

Water supply
The Hiyari village and other 13 villages within four wards depends on two borehole located at Mbuo village which is the adjacent village to the Cement Plant. The water source is equipped with pumps and buster pumps to enable pumping to the rest of villages. The water scheme is managed/administered by the Mtwara District Council. Other than this scheme generally most of people of the Mtwara District get water from unprotected sources such as seasonal streams, shallow wells, boreholes and hand dug ponds, and thus suspected to water borne diseases. Use of traditional water sources is unsafe due to prone to contamination. Consultations at Village levels indicate that water availability is among the most priority need of the community.

Health Services
The project area has no hospital or the health centre. There is a nearby government owned dispensaries which serve the village. Most of health workers in the area have primary school education and one-year professional training in Nursing. It was reported that the health services available including medicine are not sufficient for the growing number of people and emerging diseases such as HIV/AIDS. The most common diseases mentioned in the area include malaria, cholera, STDs/STIs, HIV/AIDS, intestinal worms, tuberculoses, leprosy, and skin infections/scabies.

Education
Within the project area the literacy levels are low (one quarter of adults have no education and 29% are illiterate), and twice the number of women compared to men have no or little education. Mtwara District also has eight Vocational Training Institutes (VTI), namely Mtwara Teachers Training College, Mtwara Technical Teachers Training College, Social Welfare, Institute of Public Health, Vocational Training Center, Agricultural Training Institute, Medical Assistant Training College and School of Accountancy)

and two research institutes: for agricultural research and for livestock research. Mafia Island has a single VTI (under construction).

Sanitation
Most people in the project area use traditional pit latrine as main type of toilet facility. The poorest inhabitants and a certain proportion of small children use haphazardly open areas for defecation.

Solid waste management
There is no formal system for collecting or managing solid waste, or hazardous waste in the villages within the project area. Littering is common in most villages and combustible wastes are disposed of by burning. At the workers camp solid waste generated are collected through dust bins and there are separate collection bins which are for non-cooked waste, cooked waste, cans and tins, plastics and glass.

Police, security and fire services
In the project area there is no Police Post. Security measures available within the village include local militia (Mgambo) and village security and safety committees which has a role of containing the crime. Currently, DCL use the Police's Field Force Unit (FFU) to guard the project site and the workers camp and has hired a private security company to guard its working camps. There are strict procedures for entry.

Fire Fighting
The District has a small fire-fighting unit (with vehicle but limited capabilities) and Mtwara Municipal Council has a fire-fighting station, however, lacking a fire-fighting vehicle. The Mtwara Port and Mtwara Airport have their own fire-fighting services which are used by the Council in case of fire breaks.

5 STAKEHOLDERS ENGAGEMENT

5.1 STAKEHOLDERS

The stakeholders for this project are considered to be any organization, group or individual who is potentially affected by the proposed project, or who has an interest in the proposed project and its potential impacts. The stakeholder is defined as It is therefore important to establish which organizations, groups and individuals may be directly or indirectly affected (positively and negatively) by the proposed Project and which might have an interest in the proposed Project. The employees of the company associated with the project are the internal stakeholders of the project. Other parties are the external stakeholders. It should be noted that stakeholder identification is an ongoing process, requiring regular review and updates.

5.2 STAKEHOLDER IDENTIFICATION AND ANALYSIS

Identification of stakeholders is a first and essential step in effective engagement. It is necessary to determine exactly who the stakeholders are and understand their priorities and objectives in relation to the proposed project. By classifying and analyzing the stance, influence, capacity and interests of stakeholders it will be possible to develop a plan that is tailored to the needs of different stakeholder groups. This information is then used to tailor engagement to each type of stakeholder. As part of this, it is important to identify individuals and groups who may find it more difficult to participate and those who may be differentially or disproportionately affected by the Project because of their marginalized or vulnerable status.

It is also important to understand how each stakeholder may be affected - or perceives they may be affected – so that engagement can be tailored to inform them and understand their views and concerns in an appropriate manner.

For the DCL Captive Power Plant Project stakeholders have been, and will continue to be, identified on an ongoing basis by:

1) Identifying the different categories of parties who may be affected by or interested in the project; these groups are presented in table 5.1 below; and
2) Identifying specific individuals or organizations within each of these categories taking into account:

    i) the expected area of influence of the Project, that is the geographical area over which it may cause impacts (both positive and negative) over its lifetime, and therefore the localities within which people and businesses could be affected; and
    ii) the nature of the impacts that could arise and therefore the types of government bodies, non-governmental organisations, academic and research institutions and other bodies who may have an interest in these issues.

Stakeholder identification is a particular priority at the beginning of the ESIA process, however additional stakeholders were identified as the ESIA proceeded. The process of identifying the individuals and organizations within each group is a continuing one. To date a large number of potentially affected and interested parties have been identified from:

- contacts that the project has already made with communities, government departments and other organizations as part of its public consultation, disclosure and government relations activities to date;

- consideration of the area of influence of the project as it has currently been defined during the initial stages of the ESIA;
- contacts made through a ESIA done for the Cement factory and limestone mining within the project area and a round of stakeholder engagement conferences held within the project area and dissemination of information about the project and the ESIA on the web, in brochures and through correspondence and
- unsolicited contacts with the project made by outside organizations expressing an interest in the project.

Details of individual stakeholders are compiled in a stakeholder register which is periodically updated throughout the engagement process. Such information is kept on a database for ease of use and cannot be shared with any third party. The stakeholder records are 'living documents' that can be updated as engagement progresses. Table 5.1 below sets out the stakeholder groups that were identified. Stakeholders were pre-determined based on the nature of the project, while others and affected groups at the proposed project site and area of influence unfolded as consultations went along.

Table 5.1: Stakeholder Groups

Category	Institution/Group	Role and Responsibility
National level	Vice President's Office (Division of Environment)	• Coordinate various environment management activities in Tanzania • Advise the Government on legislative and other measures for the management of the environment • Advise the Government on international environmental agreements • Monitor and assess activities, being carried out by relevant agencies in order to ensure that the environment is not degraded • Prepare and issue a report on the state of the environment in Tanzania; • Coordinate the implementation of the National Environmental Policy
	National Environnent Management Council (NEMC)	• Carry on environmental audit and environmental monitoring • Carry out surveys which will assist in the proper management and conservation of the environment • Undertake and co-ordinate research, investigation and surveys in conservation and management • Review and recommend for approval of environment impact statements • Enforce and ensure compliance of the national environmental quality standards • Initiate and evolve procedures and safeguards for the prevention of accidents which may cause environmental degradation and evolve remedial measures where accidents occur; • Undertake in co-operation with relevant key stakeholder's environmental education and public awareness; • Render advice and technical support, where possible to different stakeholders
	Prime Minister's Office (Regional Administration and Local Government)	• Responsible for matters relating to Regional Administration and Local Government, including giving policy guidelines necessary for the promotion, protection and sustainable management of the environment.
	Ministry of Lands, Housing and Human Settlements Development	• Land use planning • Issuing of Right of Occupancy • Valuation and compensation (if any)

Category	Institution/Group	Role and Responsibility
	Ministry of Lands, Housing and Human Settlements Development	• Land use planning • Issuing of Right of Occupancy • Valuation and compensation
	Ministry of Industry, Trade and Marketing	• Issuing policy guidance • Providing legal frameworks • Issuing licenses, provisions of certificates of compliances • Enforcement of laws and regulations • Setting operation standards for energy generation projects • Project monitoring.
	Occupational Safety and Health Authority (OSHA)	• Registration of the workplace • Issuance of OSHA Compliance certificate • Inspection on OSH related aspects • Enforcement of Occupational Health and Safety Act, 2003 (Act No. 5/2003)
	Tanzania Petroleum Development Corporation (TPDC)	• Provisional of Natural Gas for the power plant
	Energy and Water Utilities Regulatory Authority (EWURA)	• Mandated with electricity generation, transmission, distribution, supply, system operation, import and export of electricity and electrical installation. • Ensuring the operating conditions for power plant
	Dangote Cement Limited	• Project concept, carrying out ESIA study for the proposed project • Project implementation including mitigation measures • Ensure environmental compliance by the sector Ministry; • Liaise with the DoE and the NEMC on matters involving the environment and all matters with respect to which cooperation or shared responsibility is desirable or required;
Regional level	Mtwara Regional Secretariat Office	• Responsible for environmental coordination of all advice on environmental management in the region and liaises with the Director and the Director General on implementation and enforcement of the Environment Act. • A Regional Environment Management Expert appointed by the Minister responsible for Regional Administration heads the secretariat. • The Regional Environment Management Expert is responsible for advising the local authorities on matters relating to the implementation and enforcement of the Environment Act. The Expert links the region with the Director of Environment and Director General. • Advice on implementation of development projects and activities at Regional level
District level	Mtwara District Executive Director Office	• Chief Executive Officer for all development activities in the District level • Baseline data on social and economic conditions • Extension services • Plan and coordinate activities on community-based natural resource and environment management • Enforcement of laws & regulations • Coordinate environmental matters at the District level

Category	Institution/Group	Role and Responsibility
District level	Mtwara District Commissioner office	• Oversee and advice on implementation of national policies at District level • Proper management of the environment in their areas of jurisdiction • Carrying out directives given to promote and enhance sustainable management of the environment and as provided under the Local Government; • Performing any functions as provided by the Local Government (District) Authorities Act, 1982. • Advice on implementation of development projects and activities at District level
	District Planning/ Natural Resource/ Health/Community Development Departments etc.	• Plan and coordinate activities on community-based natural resource and environment management • Enforcement of laws and regulations • Issue license for forest/mangrove utilization • Provides guidelines for forest/mangrove use and management within project area and area of influence Baseline data on social and economic conditions • Extension services
	District Environmental Committee	• Coordinate environmental matters at the District level
Ward Level	Ward Development Committees – (Ward Councilor, WEO, Ward Environment Committee	• Oversee general development plans for the Ward. • Provide information on local situation and Extension services • Technical support & advice • Project Monitoring
Community level	Village Council (Chairman/ VEO, Environment Committee); Other leaders - Religious, Teachers, Elders, Vulnerable Groups etc), Communities groups (farmers, women, youth, etc)	• Information on local social, economic, environmental situation • View on socio-economic and cultural value of the sites and on proposed project operations. • Rendering assistance and advice on the implementation of the project • Project Monitoring (watchdog for the environment, ensure well-being of residents and participate in project activities
	Local NGO/CBO and academic institutions	• With direct interest in the proposed Project, and its social and environmental aspects and that are able to influence the Project directly or through public opinion. • Monitoring and management of the project area • Forest/environment conservation • Socioeconomic development in the area
	Commerce and Industry	• Local businesses • Businesses from elsewhere Tanzania who may benefit by providing goods and services to the project • Potential suppliers and contractors

Category	Institution/Group	Role and Responsibility
Bilateral and Multilateral Organisations	Development Agencies Financial Institutions	A range of different international organisations may have an interest in the proposed Project and may have useful data or insight into local and national issues of relevance to the proposed Project.

5.3 STAKEHOLDER ENGAGEMENT ACTIVITIES UNDERTAKEN

This area outlines the engagement activities that have been undertaken to date. The ESIA engagement activities provide an opportunity for all interested and affected parties to air their opinions and concerns about impacts and mitigation measures associated with the proposed project and allow the project to consider and respond to these in undertaking the ESIA. Also input from engagement activities provide the authorities and DCL an opportunity to ensure that concerns and comments raised by other stakeholders are included in developing a Social and Environmental Management Plan and Environmental Monitoring Plan for the project.

Dangote Cement Limited was first registered in Tanzania in 26th October 2007 and the land ownership processes started in 2011. The land title of occupancy was issued on 07th March 2012. Since then the Interaction with local authorities and the government permitting and regulating bodies has been carried out through a series of meetings and discussions. Starting October 2011 the ESIA process started and a series of consultations was done. The consultation plan was organized in such a way that the consultation meetings were carried out in parallel to the corresponding stages of the EIA during their preparation. Accordingly, consultations were carried out in two separate rounds of meetings: the first phase, related to the scoping report and development of terms of reference, baseline studies stage (social-economic and environmental characterization of the project area and area of influence) and the second phase was related to the environmental and social assessment stage and the preparation of the environmental management plan.

5.3.1 Stakeholder Identification in the Project Area of Influence

The stakeholders were identified based on their roles, relevance, and potential to be impacted or to impact the project. Most of the stakeholders likely to be impacted by the project were pre-determined based on the previous knowledge of the project area of influence, while others were identified by different stakeholders including the client. Some of the stakeholders unfolded as consultations went along, e.g. groups and individuals on and in the vicinity of the project area.

5.3.2 Advertising/Public Notices

Newspaper advertisements – daily news dated 28th November 2011 and Habari Leo of 28th November 2011 (see appendix 7) were used to provide official notification at key stages in the project as required by the EIA and Audit Regulations, 2005. Posters at the Hiyari/Mbuo Village and Mayanga Ward office notice boards, were used to inform potentially interested parties with information about the project and invite attendance at public meetings. Advertisements and notices were provided in both English and Swahili.

5.3.3 Formal Public Meetings

Formal public meetings were held to provide information to potentially affected persons, and to collect their comments and questions; and formal Public Meetings consisted of a presentation followed by a question and answer period.

5.3.4 Informal Meetings with Selected Officials

Informal meetings with selected official's representatives were used to provide information on the status of the project, to collect relevant existing information, and to identify issues of concern; Informal meetings were typically held at Government Offices during normal working hours; and DCL has been particularly active with respect to consulting with staff and management of NEMC, Mtwara Region Secretariat Office, Mtwara District Council (DC office) and EWURA. Staffs have been given detailed briefings about and consulted on, the project design throughout the planning process. These activities included a joint visit to the project area to identify the preferred sites for the project equipment's.

5.3.5 Formal Agency Meetings

Formal meetings with elected officials and government functionaries were held to provide information about the project to agency representatives, and to solicit their comments and questions. The meetings consisted of a short formal presentation followed by a question and answer period as well as discussion.

5.3.6 Disclosure

DCL will provide public access to the produced ESIA report as well as other relevant project documentation. The full documentation will be made available in hard copy at local libraries in Mtwara, project offices, and selected government offices particularly Mtwara District Council. Electronic copies will be available on the Company's internet site; and summary information will be made available in Hiyari Village and Mayanga Ward office.

5.3.7 Consultation Activities Scoping Consultations for the EIA Terms of Reference

The scoping report was prepared from 12th October, 2011 to December 05th 2011. Names of consulted persons, and their contact are attached as Appendix 8. The initial consultation strategy for the project was to proactively contact governments at national, regional and district levels, as well as Ward and Village level in the project area, to request meetings for the purpose of scoping issues for the EIA. The meetings were held to obtain background information and to seek views on potential impacts of the project and to develop the draft Terms of Reference for the EIA. Their comments were primarily concerned with the impacts of the project on the local community and on gathering background information. Their comments were used in the development of the final Terms of Reference (TOR) and development of effective methods of approaching the EIA study with respect to impact identification, prediction and evaluation

Following completion of the scoping report and approval of the same by NEMC, DCL issued a public notification of EIA commencement that included ways interested parties could obtain more information.

5.3.8 Consultations on Results of the EIA

The second phase of consultations was held from 17th January 2012 to 22nd April 2012. Objectives of consultations on the results of the EIA were to inform stakeholders about the project and its likely effects; to demonstrate how the information and views of stakeholders were taken into account in the EIA and in project decision making; and to discuss mitigation and benefit enhancement measures. As for scoping consultations, the EIA results consultation strategy was to proactively contact governments at regional and district levels, as well as village in the project area, to request meetings. Village level meeting was organized with the assistance of Village Chairman. Meeting content was slightly adjusted to respond to interests of different stakeholders. In total about 30 local people, representing Hiyari Village attended the meeting. The public meeting was conducted in Swahili, and the EIA team was available to answer

questions. Maps and diagrams were used to illustrate key aspects of the project, including the proposed locations of the project infrastructure. Further in the meetings, the EIA Team explained the scope of the project and after the presentation the consultants solicited views from the audience.

Key issues considered during consultations include land use of the project site, potential conflicts, envisaged negative environmental impacts, negative social impacts, positive impacts of the project, management aspects of the identified negative impacts, enhancement mechanism of positive impacts and aspects to be considered for sustainable project operations. In all cases Stakeholders' views were sought on their acceptance of the project.

To ensure that the consultations included as many stakeholders as possible, during scheduling the meetings, an EIA Consultant went to local government offices personally, using written letters and messages to schedule village meetings through the Village Executive Officers. Stakeholder consulted during phase one and two included:

- The Mtwara Region Commissioner Office
- Mtwara District Council (the District Executive Director (DED), District Planning Officer (DPO), Ag. District Water Engineer (DWE), Ag. District Agriculture and Livestock Officer (DALDO), Ag. District Natural Resources Officer (DNRO), District Land Officer, District Community Development Officer (DCDO), Ag. District Education Officer (DEO) (P) and District HIV/AIDS Coordinator (CHACO).
- TANESCO (Mtwara office)
- The National Environmental Management Council;
- Mayanga Ward office and
- Village Governments of Hiyari, Msijute, Imekuwa, Mangogori, Mnyundo and Mbuo.
- Village Environmental Committee and other Venerable Group representative
- The District Lands Officers, and District Engineer)
- NGO's & CBO's (MFAWOPA, MUKEMBA GROUP, MSOAPO, MEDI & Mtwara Sports Academy).

5.3.9 NEMC Review and Consultations on Draft EIA

Section 88 (1) of the Environmental Management Act Cap 191, provides that *"the council may, during the review process, visit for purposes of inspecting or verification any site or place associated with the proposed project or undertaking at the proponents' Cost.* To fulfill this legal and procedural requirement, two officers on behalf of the Technical Advisory Committee visited the project site from 6th to 11th, July 2012. The team comprised three NEMC staff (Team Leader), one member from Ministry of Energy and Minerals; Land officer from Mtwara District Council. During that visit, NEMC requested that DCL and ESIA Consultant to organize a series of meetings for verification purpose which took place in the project area. The meetings included public meeting in the Hiyari/Mbuo Village area and meetings with Government Officials and representatives of local government and TANESCO.

Following completion of the field activities, NEMC convened a meeting of the Technical Advisory Committee ("TAC") on 20th July, 2012 to deliberate their findings. The TAC is an inter-ministerial committee that is convened by NEMC to provide comments on draft EIA Reports that have been submitted for review. Representatives from DCL and ESIA consultants were invited to attend to make a brief presentation and to clarify as well as answer member's questions. The meeting was positive about the project and concluded that the project is supported by the Regional, District Authorities and communities due to the expectations that it will boost economic development in the Region.

5.3.10 Updating the ESIA Report for the Power Plant

The Environmental Impact Assessment certificate number 1844 was issued to DCL on 24th September 2012. Since the issuance of the EIA Certificate there was minor changes of some project aspects to

include change of firing system of the power plant from natural gas only to Natural Gas, Coal and Heavy Furnace Oil and slight increase of plant capacity from 5million ton/annum to 6million ton/annum of Cement production. Due to that a new Environmental Assessment was conducted and the updated Environmental Impact Assessment Report was produced. During updating the ESIA report, a series of formal and informal meetings with entities of the government at regional and local level were held directly by Environmental and Social Safeguards Consultant appointed by DCL as a complimentary of the public consultation process described above. The formal consultative meetings were held from on 21st May 2015. More than 25 participants attended who represented the DCL, District Council, the consultants who were due to undertake the study, local community representatives, NGOs and government agencies. One of the objectives of the meeting was to inform interested parties about the changes of the power plant project, and to receive views on the potential impacts and the scope of the Updated ESIA report. This therefore formed a part of the public consultation exercise.

Name and signatures of stakeholders consulted for the updating ESIA report are attached as Appendix 8. In general, there was strong support for the project expressed by consulted officials, agency staff, and the general public. For the most part, the support appears to be related to the acceptance amongst stakeholders that the project will improve the reliability and accessibility of electrical power at DCL.

5.3.11 Mine Closure Plan

Stakeholder engagement is particularly important in the lead up to mine closure, detailing the ways in which impacts on the stakeholders will be managed. The process of consulting with and providing information to workers and community groups/members throughout the life of the mine plays a crucial role in mitigating impacts of mine closure. Engagement is inclusive and regular with monitoring of impacts during pre-closure, decommissioning and post closure. This process ensures that impacts on the well-being of individuals and communities are minimised, and also contribute to the reputation of the company.

A series of meetings with stakeholders were held during the preparation of the Mine Closure Plan (MCP) at regional and local level. Formal meetings were held on 11th July 2016, and 12th July 2016. Name and signatures of stakeholders consulted for this development project are attached as appendix 8. The objectives of DCL's MCP stakeholder engagement were to develop strong relationships with stakeholders based on open communication and mutual respect, Identify and respond to community concerns to manage potential risks to DCL's reputation and/or ongoing operations and be an active member of the local community and collaborate with stakeholders.

5.3.12 Additional Consultation with Authorities

More consultation for the power plant project was done in the month of November 2016 and February 2017. Stakeholder consulted includes Energy and water Utilities Regulatory Authority (EWURA), Occupational and Health and Safety Authority, Tanzania Roads Agency (TANROADS), Tanzania Petroleum Development Corporation (TPDC), Tanzania Electrical Supply Company (TANESCO), Local Government Authorities: (Mtwara District Council i.e. District Executive Director Offices (staffs and key personnel to include District Environmental Management Officer, Land officers, Mayanga Ward Executive Officer, Hiyari Village Executive Officer) and Local community as immediate neighbour of the project area(s). Name and signatures of stakeholders consulted in November 2016 are attached as appendix 8.

The Consultant ensured that the concerned parties were given adequate opportunity to participate in the ESIA study for the power plant. Different participatory methods were used to involve the stakeholders and these included, one to one discussions with individual stakeholder or representative of an organization, focus group discussions and public meetings with group of people and community respectively. Public notices were also employed to cover wide spectrum of stakeholders at local level. In

establishing the views of the public concerning the project, notices were sent to the local authorities of the area mainly District Council, Ward Office, and the involved village office (Hiyari Village).

5.3.13 Extent of Stakeholder Engagement

It is evident that stakeholder engagement activities have been undertaken as part of the previous studies. The activities undertaken to date for DCL project and this project in general are in compliance with Tanzanian legislation as well as with international standards and best practice guidelines as described in the World Bank documentation. The stakeholder engagement process was planned and developed during the ESIA for the Establishment of the DCL Clinker and Cement Production Facility at Hiyari, updating the ESIA report and in preparation of the Mine Closure Plan for the project. These process allowed the creation of a channel of communication between the project and the public from the local and regional project areas of influence. Consultation with the stakeholders was aimed at positively conveying information about the project, clear up misunderstandings, allow a better understanding of relevant issues and how they will be dealt with, and identify and deal with areas which are controversial while the project is still in its early stage.

National and regional authorities and the population living in the area of influence of the project have been involved in the development of the ESIA and MCP. The public meetings were conducted in Swahili language, and the ESIA team was available to answer questions. The process afforded opportunity to the stakeholders to express their views and concerns to be included in the ESIA study and the MCP. All views and concerns were documented and considered during the evaluation of potential impacts and risks associated with the project.

Generally, the consultation process for the DCL project and its components including the power plant had a positive perception by all the stakeholder groups. In each of the meetings held, the public expressed the wish that future projects be carried out in the same way, with a transparent information dissemination with respect to the project to be developed. The stakeholders also showed special interest since they could verify that their concerns and recommendations were taken into account and were reflected on the identification of the potential impacts and on the management plans. The consultation process has already started, and it will continue in future at relevant stages.

5.4 Grievance Mechanism Procedure

Stakeholder engagement is a two-way process. It is therefore important to ensure that there is a feedback mechanism to ensure stakeholders affected by or interested in the proposed Project can present their input (e.g. opinions, requests, suggestions and grievances) for consideration and, if required, seek redress. It should be noted that, even where not all feedback or grievances are deemed ‘valid’ or applicable to the context of the proposed Project, the feedback mechanism needs to function in a non-judgmental manner and record all feedback received.

A Grievance Mechanism was developed in 2017 which ensures that grievances are recorded and considered fairly and appropriately. DCL work to continually improve this process. Affected parties were notified of the Grievance Mechanism during the public consultation meetings held in this March of 2017. The DCL’s designated Grievance Officer (GO) is responsible for maintaining the Grievance Register. Grievances are received in writing or verbally by the GO directly from the complainant or via DCL employees, consultants and/or contractors.

5.5 Issues Raised by stakeholders

The key issues raised during various stakeholder meetings as part of previous studies include:

- Loss/disturbance of biodiversity and threatened species
- Depletion /degradation at points of source of construction materials
- Air pollution (dust, ash and fumes)
- Potential for fire hazards from stockpile of coals
- Occupational health and safety hazards due to inadequacies in provisions for working conditions
- Nuisance and disturbance on/offsite receptors from noise pollution and vibration from the power plant
- Contamination of land and water resources from mismanagement of solid wastes
- Potential impacts related to transitory population increase
- Increased sexually transmitted disease such as HIV/AIDS
- Contribute to the economic development of the country
- Employment opportunities
- Benefit to local producers and suppliers

5.6 Addressing The Stakeholders' Concerns

The study has provided a variety of views and opinions on what are considered to be the main concerns and issues of different stakeholders. Based on the raised issues/concerns, an analysis was carried out and recommendations were given for those issues that required attention in the study. The recommendations are covered in the mitigation chapter of this document as indicated in chapter 7. Other chapters also provide some good clarifications on the issues raised. Table 5.2 below shows the response table with specific sections where the issue is addressed.

Table 5.2: EIA recommendations for issues raised by the stakeholders

Issues	Section addressed
Loss/disturbance of biodiversity and threatened species	7.3.1, 7.2.1,
Depletion /degradation at points of source of construction materials	6.3.11, 7.2.11,
Air pollution (dust, ash and fumes)	6.3.3, 6.3.4, 6.4.1, 6.4.2, 6.6.1, 6.6.2, 7.2.3, 7.2.4, 7.3.1, 7.3.2, 7.5.1, 7.5.2,
Potential for fire hazards from stockpile of coals	6.4.7, 7.3.7,
Occupational health and safety hazards due to inadequacies in provisions for working conditions	6.3.9, 6.4.9, 6.6.8, 7.2.9, 7.3.9, 7.5.8
Nuisance and disturbance on/offsite receptors from noise pollution and vibration from the power plant	6.3.5, 6.4.3, 6.4.10, 6.6.3, 7.2.5, 7.3.3, 7.5.3,
Contamination of land and water resources from mismanagement of solid wastes	6.3.6, 6.3.7, 6.4.4, 6.4.5, 6.6.4, 6.6.5, 6.6.6, 7.2.6, 7.2.7, 7.3.4, 7.3.5, 7.5.4, 7.5.5,
Potential impacts related to transitory population increase	Residual impact
Increased sexually transmitted disease such as HIV/AIDS	6.3.10, 7.2.10,
Contribute to the economic development of the country	6.5.4, 6.5.3, 7.4.3, 7.4.4, 7.4.2
Employment opportunities	6.5.2, 7.4.2,
Benefit to local producers and suppliers	6.5.2, 7.4.2,

5.7 Acceptance of Proposed Project

Consultation with local stakeholders indicated that they generally view the proposed project as a positive venture that might stimulate new economic and social activities and enhance development in the area.

Most of stakeholders were aware of the project's activities, as similar activities have been previously conducted in the area.

5.8 ESIA Documentation and Disclosure

During the ESIA consultation process, documentation dissemination was a key engagement tool. In this context, non-technical summary documentation played an important role and all disseminated information was clear, concise and accessible. In addition, non-technical summaries were translated into Swahili language and widely disseminated. Effective consultation should allow stakeholders *to contribute to the design, operation and closure of a project*. Early consultation during baseline studies has enabled meaningful stakeholder inputs into project planning and design.

6 ASSESSMENT OF ENVIRONMENTAL AND SOCIAL IMPACTS

6.1 INTRODUCTION

In previous chapters' description of both the project and the environment where the project will have footprint have been covered. Based on the areas covered the impacts of the project on the environment and social components as well as on human health are identified. Thus, this chapter presents the identification of potential impacts and their analysis to determine significance level. Treatment of the impacts is covered in the subsequent chapters of the report.

6.2 ASSESSMENT METHODOLOGY

The team members conducted literature reviews of available information related to the site conditions and with respect to similar Thermal power plant operations prior to visiting the site. Most of the members of the team visited the project site in several occasions for the study accordingly. The team spent the time on site gathering information through field studies to include taking measurements of various parameters to understand the baseline condition. The combined site visits by all specialists assisted in integration of ideas and findings between the specialists.

The role of each specialist was to collect sufficient data to assess the environmental impacts. In order to achieve this, the EIA team assessed the environment as it existed at project area and secondary data from published and unpublished sources.

6.2.1 Environmental Impact Rating Scale

To ensure a direct comparison between various EIA team studies, a standard assessment methodology was used to assess the significance (the importance of the impact in the overall context of the affected system) of the identified impacts. The criteria that were considered in the determination of the impact significance are:

- **Severity/Benefit**: the importance of the impact from a purely technical perspective;
- **Spatial scale**: extent or magnitude of the impact (the area that will be affected by the impact);
- **Temporal scale**: how long the impact will be felt:
- **Degree of certainty**: the degree of confidence in the prediction of the impact;
- **Likelihood**: an indication of the risk or chance of an impact taking place;

To ensure integration of social and ecological impacts, to facilitate specialist assessment of impact significance, and to reduce reliance on value judgments, the severity of the impact within the scientific field in which it takes place (e.g. vegetation, fauna) is assessed first. Thereafter, each impact is assessed within the context of time and space, and the degree of certainty in the prediction is indicated.

The impact is then assessed in the context of the whole environment to establish the "significance" of the impact. This assessment incorporates all social, cultural, historical, economic, political and ecological aspects of the impact. Thus, the severity or benefit of an impact within a specialist discipline is first assessed before the significance of the impact is evaluated in a broader context. Consequently, two rating scales are required, one to determine the severity or benefit, and one to determine environmental significance.

6.2.2 Severity / Benefit

Severity is based on the professional judgement of the various specialists to evaluate the extent to which negative impacts would change current conditions, or how beneficial positive impacts would be on a particular affected system (for ecological impacts) or a particular affected party (for social impacts). The severity of impacts can be evaluated with and without mitigation order to demonstrate how serious the impact is when nothing is done about it. The word mitigation means not just "compensation", but also ideas of containment and remedy. For beneficial impacts, optimisation means anything that can enhance the benefits. Mitigation or optimisation must be practical, technically feasible and economically viable.

6.2.3 Spatial Scale

The spatial scale defines the extent or area over which the impact will take place.

Table 6.1: Spatial scale

Localised	A few hectares in extent. The specific area to which this scale refers is defined for the impact to which it refers.
Study Area	Includes the entire Hiyari and Mayanga Area.
District	Includes area within Mtwara District Council
Regional	The impacts will be of such a nature that it may affect the Mtwara Region and nearby Regions.
National	The impacts will be of such a nature that it may affect the entire Tanzania.
International	The impact would affect resources and processes up to outside the border of Tanzania

6.2.4 Temporal Scale

The temporal scale defines the times over which the impacts would continue to occur.

Table 6.2: Temporal scale

Temporal scale	Explanation
Short term	Less than a year.
Medium term	Between 1 and 5 years
Long term	Between 5 and 20 years, and from a human perspective essentially permanent
Permanent	More than 20 years, and resulting in a permanent and lasting change.

6.2.5 Significance Ratings

Significance ratings based on synthesis of the above criteria above (only for negative impacts) are:

- Not significant/Negligible: Impact not of significance hence no mitigation action, should not influence the decision to approve the proposed development.
- Low: No mitigation action required. Impact should not influence the authorisation decision. However, monitoring of such impacts may be necessary to make sure they remain low over the lifetime of the project.
- Moderate: Mitigation action is required. Impact should influence the decision to authorise the development.
- High: Mitigation action is required. Impact should influence the decision for authorisation. Authorisation granted only when effectively mitigated.

6.3 CONSTRUCTION PHASE

6.3.1 Loss of Biodiversity

It should be noted that at the time of undertaking the specific EIA study for the Captive Power Plant some construction activities on side were already done. Most of concrete work were already done on site and on this case the land clearance had already taken place also. Further, the proposed site for the CPP is located within the Cement Plant premises and thus the site was also influenced/affected by the development of the Cement Plant. In this respect the current flora condition at site is only remains of grasses and other sprouting after clearance (see figure 6.1 below). Based on the site condition there is no pristine vegetation condition that would also support fauna in the area. Furthermore, the area has been designated and has become industrial area. ***The impact is considered negative, permanent term and of negligible significance.***

6.3.2 Accelerated Soil Erosion

The removed vegetation has caused the land to be bare in the areas where there no constructed structures and hence prone to agent of soil erosion such as wind and moving water and hence accelerated soil erosion. Based on the site condition the proposed CPP is located on lower ground and there is possibility of increased flow of storm water from higher ground and this might further exacerbate the soil erosion tendency. However, it is a plan of the DCL for all the areas that have been cleared or excavated and not covered by structures (buildings) to be covered by hard-cored and landscaped to reduce the risk of long-term erosion of the area. ***The impact is negative, short term and of low significance.***

6.3.3 Air Pollution due to Dust Emission

As noted in previous section the construction will further involve earth work at site. These activities inevitable will cause generation of dust into atmosphere. Likewise, dust will emanate from moving vehicles with construction material such as sands and gravel for structures to be added at site, if the moving vehicles are not covered will lead to dust along the route. Dust generated will impair local atmospheric condition. The impact receptors are likely to include site workers and nearby community as well as people/community centres along the route. However, the level of remaining construction activities will be limited to the few supporting facilities. This implies that there will be relatively small amount of materials required for construction with resultant few trucks to be involved. The likelihood for public health concerns for onsite activities is minimal due to distance to the nearby settlement. ***The impact is considered negative, short term and of low to moderate significance***

6.3.4 Air Pollution due to Exhaust Emission

As a rule of thumb whatever uses fuel oil generates exhaust emission into the atmosphere and thus contributing to the local air pollution as well as to the global air pollution. Thus, the trucks and earth moving equipment to be used will emit exhaust fumes which are unwanted atmospheric pollutants. Atmospheric pollutants from engines of vehicles/machinery include SO_2, NOx, CO_2 and particulate matters. Main impact is impairment of local air quality, the extent of which will depend on quantities emitted, duration and prevailing atmospheric conditions. However, based on the scale of the remaining activities to be involved only few machinery and vehicles will be involved with the work and thus small amount of fuel oil will be used eventually with small amount of exhaust gas emitted. Thus, the exhausts emissions from the few machineries/vehicles will neither have significance impacts to the local air quality nor to the global pollution. ***The impact of air pollution due to exhaust emission is considered negative, cumulative, short term and of low significance.***

6.3.5 Noise Pollution

Noise is considered as an interference to and imposition upon comfort, health and the quality of life. Given the conditions like exposure limit, time and noise levels, noise may have both physiological as well as psychological effects on human health. During construction phase noise is expected from machinery working on site, trucks transporting materials to and from the site and other tool to be involved. Due to distance to the nearby settlement the key receptors (which is more than a kilometer) for the noise impact could be limited to the site workers, which is covered under occupational health and safety hazards. ***The impact is considered negative, short term and low significance.***

6.3.6 Water Pollution

The machinery and vehicles operating at site will required fossil fuels i.e. gasoline and engine oil for their operation. This if not handled properly during refuelling and servicing might leak and result into soil and water resource contamination of hydrocarbons. Likewise, since landscaping has not been done and some civil/earth work will still be required on site, this will generate spoils. Unmanaged spoils might be accumulated on land or on slope areas which eventually might end up to the lower gradient areas where water course and water resources are found and hence polluting the resource. Spoils might increase turbidity level in the water course, or might cause pooling which could be conducive site for some vectors like mosquito. ***The impact is considered negative, short -term and of moderate significance.***

6.3.7 Public Health Hazards due to Wastes

Workers working on site during development phase definitely will generate some wastes in solid and liquid form including human wastes. Unmanaged site wastes might end up to the nearby water bodies

and thus polluting the water that is flowing downstream where it could be used. This might result into sanitary related diseases such as cholera, dysentery and alike. Depending on the number of construction workers and the season when work will be done the impact might become significance. Likewise, mismanaged solid wastes such as plastic bottles, food remains, used packaging material i.e. Cement bags and alike might end up into drainage system and interfere the usual flow of storm water. This might also create untidy condition in the area while also creating favorable condition for the germs. ***The impact is considered negative, short term and of moderate significance.***

6.3.8 Traffic Accidents along the route when Sourcing Construction Materials

The construction activities as indicated in previous sections will involve transportation of construction materials to the site as well as equipment for installation at site. Traffic aaccidents involving both the construction workers and the general public can be expected to occur during the transportation of the materials/equipment if precautions are not taken. Drivers might cause accident to children in the residential areas along the route. ***The impact is indirect (offsite), negative, short term and of high significance.***

6.3.9 Occupational Health and Safety Hazards

When human ware and machinery ware are involved at work always there are potential occupational health hazards. Some of the hazards are obvious which require some management; issues like excessive noise levels from the machinery, excessive dust emission from earth works. Injuries to construction workers may result from moving equipment. According to the National OHS Act of 2003 causes of accidents in construction sites includes but not limited to poor site layout; poor erection and improper use of scaffolds; falling objects from high level such as poles; improper method of lifting; sharp edges; improper use of Personal Protective Equipment (PPE); inadequate provisions of PPE; falling through uncovered openings especially at upper floor levels and carelessness of workers. ***The impacts are considered negative, short term and of high significance.***

6.3.10 Public Health Hazards (HIV/AIDs and STDs Spread)

During construction a number of workers about 200 will be involved at site. Some workers will come from other places. This will result into social interactions and intermingling. In this case social interactions cannot be avoided which can result into spread of HIV/AIDs and STDs. Bearing the fact that the workers become financial stronger compared to the locals if care is not taken spread of HIV/AIDs and STDs might become real. ***The impact is considered negative, short term and of high significance.***

6.3.11 Degradation of Land at point source of Construction Materials

The project will require various standard construction materials including gravel, aggregates, and sand. It is expected that the contractor will obtain materials for construction purposes such as aggregates, stones, sand, timber etc. from licensed suppliers or from authorized areas. Extractions of construction materials from un-authorized borrow pits and quarries on government land, communal land and on private-owned land are associated with rampant degradation at points of source with no efforts of restoration/re-vegetation. Most exploited borrow pits are found on private owned /communal land of natural vegetation or planted with crops which have been cleared/disturbed and boulders left exposed. Pollution risks include sediment overload into the river systems during rains and contamination by oils from excavators/loaders. However**,** based on the remaining construction works to be involved the materials required will be relatively in small scale. Thus, impacts associated with resource extraction from off-site locations are considered as: ***Secondary or indirect, negative impacts, cumulative, long-term and of moderate significance.***

6.3.12 Land Related Potential Conflict(S)

Dangote Cement Limited owns the land part of which the proposed CPP is to be located. The Company has title deed since 2012 through Tanzania Investment Centre (see appendix 1). At the time of doing this specific ESIA for CPP the land issues were all sorted out and DCL possessed the Certificate of Occupancy of the land Title Number 3287 Plot No. 2 situated at Mbuo, Hiyari and Mnyundo in Mtwara District measuring 140.757 hectares. It was further confirmed from the Mtwara District Council and Hiyari Village that all legal procedures were followed in the process of acquiring the parcels of land. ***The impact is considered negative and of negligible significance.***

6.3.13 Introduction of alien/invasive species

Construction materials are required to be sourced outside of the project area, likewise some food is sourced far from the project area. During bringing of the materials in the park there is possibility of bringing substrates and vectors with some species which might become invasive in the project area. If care is not taken this hypothesis might become real. Invasive tree species might over shed other native tree species in the area which are dependent upon by wild species in the area. However, the possibility of occurrence is minimal as all brought up construction materials are kept within plant premises that is concrete fenced to allow escape of any brought up material outside of the compound. ***The impact is considered to be negative, long term and of low to moderate significance***

6.4 OPERATION PHASE

6.4.1 Air Pollution due to Emission of Particulate Matter (dust & ash)

All coal power plants in the world pump out into the atmosphere combustion gases to include dust in terms of Particulate Matter. The dusts produced are of PM_{10} and $PM_{2.5}$ which constitute mainly of coal dust. The emission of such particulate matter if unmanaged from the point source may cause health impacts to workers and the community surrounding the factory/power plant. Health impacts depending on level of it in the atmosphere may include difficulty in breathing or perhaps tightness across the chest, soreness, and ulceration of the eye and inflammation of the mucous membranes. Deposition of the dust on the vegetation and crops inhibit the stomata poles that are used for plant respiration.

However, the amounts of the dust emission depend on the type of boiler technology used. The Atmospheric Fluidized Bed Combustion (AFBC) Technology for the steam generation is one of the latest technologies. The inherent design of the power plant is such that the exhaust gases from the boiler are cleaned using cyclones and an electro-static precipitator (ESP) system. This removes most of the fine dust and ash from the exhaust stream, before being released into the atmosphere through a chimney. The plant designed to have a chimney emission of 30mg/m3 of suspended particulate matter while the WB/IFC guideline standard limit is of 50mg/m3 (Thermax, 2016). Furthermore, the stack height for the CPP have been designed in accordance to the Good International Industrial Practice with the height of 76 meters (see appendix 9).

Furthermore, the air quality assessment through modelling of the CPP with the prevailing condition of mines and Cementongoing operations has shown that the CPP will not exert an excessive increase of particulate matter into the atmosphere. The results showed that the predicted particulate matter increase due to CPP will be well within allowable limits of the international standard (WB/IFC, 2008) within the project boundaries and beyond (see appendix 13). This is partly due to un-degraded atmospheric condition of the project area. ***The impact is considered negative, cumulative, long term and of moderate significance.***

6.4.2 Air Pollution due to Emission of Noxious Gases

As a rule of thumb whatever uses fossil fuel as source of energy generates exhaust emission into the atmosphere and thus contributing to the local air pollution as well as to the global pollution. Thus, the Coal, Gas and HFO fired power plant is not exceptional to this as it will also emit exhaust fumes which are unwanted atmospheric pollutants. Atmospheric pollutants from the power plant include Sulphur dioxides (SO_2), Nitrogen oxides (NOx), Carbon monoxide (CO), and Carbon dioxide (CO2). Carbon dioxide is one of the greenhouse gas contributing to climate change impact while SO_2 and NOx are implicated in long range and trans-boundary acid deposition.

The CPP will make use of Rankine cycle of thermodynamics where the regenerative feed water heating cycle has been considered to improve the efficiency. The sub-critical pressure and temperature parameters that the proposed CPP of 2 x25 MW will use are 108 bar and 540 ^{0}C respectively. The pressure cycle selected for this plant is without reheat cycle due to small size of the power plant compared with large power plant of 500 MW and more. Thus the pressure cycle selected is based on Steam Turbine and Boiler OEM's one of the best available technology for this range of equipment. The gross plant efficiency of the proposed CPP is around 32% on the LHV basis. (Thermax, 2016). Based on this technology as per type and size of the thermal power plant the emission values for the proposed CPP are indicated in table 6.1 below.

Table 6.1: Emission Values for Dangote CPP.

S/N	Description	Units	IFC Guideline	Performance Coal
1	SPM	mg/Nm3	50	30
2	Sox	mg/Nm3 at 6% O_2	1500	1144
3	NOx	mg/Nm3 at 6% O_2	510	450

Source: Thermax, 2016

Further to ensure the SOx, NOx and CO_2 levels remains low as per plant design or even lower there shall be lime feeding system for Sulphur reduction in the coal at the source.

Similarly, to noxious gas, the air quality assessment through modelling of the CPP with the prevailing condition of mines and Cement ongoing operations has shown that the CPP will not exert an excessive increase of noxious gas (CO_2, NOx, SOx) into the atmosphere. The results showed that the predicted CO_2, NOx, and SOx increase due to CPP will be well within allowable limits of the international standard (WB/IFC, 2008) within the project boundaries and beyond (see appendix 13). ***The impact is considered negative, cumulative, long term and of moderate significance***

6.4.3 Noise Pollution for Public Health Hazards

Noise is considered as an interference to and imposition upon comfort, health and the quality of life. Given the conditions like exposure limit and time, noise may have both physiological as well as psychological effects on human health. Physiological effects include dizziness, nausea, unusual blood pressure variation, physical fatigue, loss of hearing, etc. Noise will be generated from the generator, pump, compressor, plate vibrators, piping and valves, motors, transformer as component of the power plant. However, noise as a public health concern it will not be an issue as the potential receptors (settlements) are located far (more than 1000 meters) from the power plant. This is enough buffer for the power plant for the receptors to experience excessive noise levels above the recommended standards. Furthermore, between the power plant and the settlement there are physical structures to include material storage dome that attenuate further the noise from reaching the sensitive receptors (settlement). This is further justified by the noise assessment through modelling of the proposed CPP that also considered the noise from mines and Cement ongoing operations. The results showed that the contribution of noise due to CPP will not cause excessive noise to the nearby sensitive receptors (community) above the

recommended standard limits (see appendix 14). ***Thus, the noise pollution impact is considered negative, long-term and of low significance.***

6.4.4 Water Pollution from Plant Effluent

The water is used in cooling of the power plant. However, the water is sourced from the onsite boreholes which requires treatment before being used for cooling of the power plant machines. Thus, the effluents first originate from the treatment plant and thereafter from cooling process. The residual water from raw water treatment plant may contain elevated levels of salts (dissolved salts/particles) and pH while the resultant water from cooling is normally with high temperature. If these sourced are discharged into open environment may change the chemistry and temperature of the receiving water body bearing the voluminous amount of water (1000m^3/day) required for cooling. This may further impact the living component in it. However, the CPP design is to re-use the cooling water as much as possible and hence reducing voluminous amount to be discharged as waste stream while also reducing the needed raw water. The resultant water will be directed to the effluent treatment plant before being reused in secondary and tertiary usage specifically for dust suppression in gardening. ***Thus, water pollution impact is considered negative, long-term and of moderate significance.***

6.4.5 Water and Land Pollution from Hydrocarbons

Just like any machine the Power plant will be serviced and maintained after specified run as per manufacturers recommendations. Servicing will involve some greasing and changing of oils. These will result into used oil and condensate that will require proper handling and disposal as it is classified as hazardous material. Without due care on these they might end up on the open environment hence polluting land and water in the area. Likewise, the liquid fuel storage tank might accidentally leak and cause pollution to the surrounding environment hence polluting soil/land and water resources of surface water and ground water. Spill might happen also during loading on the storage tanks of case is not taken during offloading from the trucks and loading on the storage tanks. ***This impact is considered negative - irreversible, short to long term, and of moderate significance.***

6.4.6 Water Resource Use Conflict

As noted in the above section significant amount of water (1000m^3/day) is required for the power plant specifically for steam generation and for cooling. This will be drawn from the ground water sources through the established boreholes on site. Abstraction of significant amount of water over a long period of time might lead to depression of the aquifers which might also be shared by the nearby community boreholes. On the western side of the project site at about 4 kilometers there are two community boreholes which are depended by 14 Villages of four Wards of Mayanga, Naumbu, Ndumbwi and Mkunwa. If the same water source (aquifer) is shared by both the DCL and the community and if the aquifer is depleted communities within the 14 villages of the four mentioned wards will be impacted. However, the ground water assessment done on site indicated that there is no correlation between the two sources. The surface (horizontal) distance between the two sources (3.2 kilometers apart) and the difference in vertical distance between the DCL and community boreholes of 180 meters and 45 meters respectively and the analyzed samples from both sources does not indicate the shared water source. Furthermore, the modeling was conducted in the area based on available data from drilled boreholes and combined demand of the CPP, Cement Plant and proposed house colon, assuming the source is shared at the pumping rate to fulfill the demands for all cement, house colon and CPP, the source will not be depleted (see appendix 15). ***Thus, the impact is considered negative, cumulative, long-term and of low significance.***

6.4.7 Fire Hazards

Under hot climatic condition like of Mtwara and without proper storage mechanism coal can spontaneously catch fire and bring about fire hazards where it is stored. Under favorable condition of the coal stockpile to include moisture content, temperature, poor ventilation spontaneous fire can occur on the coal stockpile.
Natural Gas like HFO is one of the inflammable materials and when exposed to the right conditions it may explode and cause fire. Just like many thermal power plants, this power plant will use large quantities of natural gas upon switching from coal to the gas and thus if care is not taken to mitigate fire risks, these might become real. Fires generally have the potential for adverse effects on air quality and could pose risks to human health and safety as well as infrastructures to include the power plant itself and the Cement Plant. ***The impact is considered negative, short -term and of high significance.***

6.4.8 Traffic Accidents

The CPP will require significant amount of coal per time (105,000 tons/year equivalent to 292 tons/day) and this will be sourced from Ruvuma Region and brought at site through road. In this regards the additional of traffics apart from Cement operations (bringing Cement materials and distribution of Cement to intended market centers) will be highly significant. Around 10 trucks of 30 tons will be required to bring coal for the power plant while for Cement Plant 750 tons/day are required which implies 25 trucks per day. Thus in total 1042 tons/day will be required for both Cement and CPP that will require a total of 35 trucks of 30 tons per day. Accidents along the highway and internal roads while sourcing the coal as well as on site while delivering coal cannot be guaranteed in this case. The general public, workers and drivers will be exposed to the accidents. ***The impact is indirect (offsite), negative, cumulative, long term and of high significance.***

6.4.9 Occupational Health and Safety Hazards

Safe working environment is normally assured when code of practices in the working place are instituted. Failure during early planning/design to provide for and integrate health and safety aspect and ensure there is a distribution of responsibility and accountability for health and safety to all employees at all levels may lead to accidents, injuries to workers, loss of lives and/or of property. Occupational health hazards may also be promoted by lack of procedures that mitigate negligence at work, fatigue due to understaffing and long working hours, employing wrong people on particular jobs and low morale etc. The hazards for the thermal power plant may include exposure to non-ionizing radiation, thermal/heat, noise, and electrical hazards. ***This impact is considered negative, long term, and of high significance.***

6.4.10 Vibration and Related Impacts

The operating power plant generates vibration on its own due to movements/running of its parts. Depending on the level of vibration this might be transmitted onto mounting surface. This might propagate further than the core power plant mounted area to nearby areas. If the vibration on the nearby residential area will be felt at 0.15 mm/s PPV (Peak Particle Velocity) or above, this will create stress to those experiencing it. Bearing the fact that the settlement is located far (more than 500m) from the proposed power plant site the likelihood for an individual to experience Peak Particle Velocity of 0.15mm/s is minimal. ***This impact is considered negative, long term and of low significance.***

6.4.11 Groundwater and Soil/Land Pollution from material stockpiles (coal, ash & lime)

As noted earlier the power plant will require substantial amount of coal (292 tons/day) that will require stockpiling to have enough reserve for uninterrupted production. Stockpiling of coal if care is not taken might happen in an open area that could be washed by rain water with potential impact to the soil and water resources (both ground water and surface water). Likewise, after usage of coal for power production there will be resultant residuals i.e. ash that will also be produced in large amount and if care is not taken

might end up to the open environment through either rain water or physical disposal with potential impacts to the soil/land and water resources. Limestone will also be required to mix with coal to reduce emission and thus stockpiling of the same before usage will be required and if care is not taken might also impact the receiving environment to include soil/land, surface water and ground water. All these materials if left in the open environment will change the chemical composition of the receiving environment and making unsuitable for usage. ***This impact is considered negative, medium term, and of high significance.***

6.4.12 Introduction of alien/invasive species

The raw materials to run the power plant to include coal will be sourced far from the project area specifically Ngaka area of Ruvuma region. Since this area has not been studied to establish the vegetation status there could be possibility of the existence of the invasive species. Likewise, the species of the project area could be different from the Ngaka one hence could be introduction of alien species in the area. During bringing of the coal there is possibility of bringing some seed or vegetative materials of the species and vectors which might become invasive in the area. If care is not taken this hypothesis might become real. Invasive species might over shed other native species in the area and hence cause ecological imbalance at the area. However, the possibility of occurrence is minimal as all brought up coal is kept within plant premises that is concrete fenced to allow escape of any brought up material outside of the compound. Further, Coal is to be stored in concrete covered dome and thereafter is to be injected in the processing without possibility for escape from the its handling system. ***The impact is considered to be negative, long term and of low significance***

6.4.13 Public health hazards from the transportation of the liquid oil

Transportation of the liquid oil for the power plant from the port to the project site if not done appropriate may bring about hazards in the route where they are transported. As noted earlier the liquid oil are hydrocarbons by nature (HSD and LPFO) considered hazards due to their inherent properties of flammability. The material upon accident can easily catch fire and can cause serious injuries to death depending with the human exposure to these. Furthermore, it can be drained to sloppy area towards the nearby water sources and hence having far reaching effect. *The impact is considered negative, irreversible and of high significance.*

6.5 SOCIAL-ECONOMIC IMPACTS

6.5.1 Availability of Power

The Dangote Cement Plant in Mtwara is one of the multi-millionaire dollar project in Tanzania. Since its commencement, power supply has been a challenge as it is running under diesel generator at higher costs. This is the main reason why the Cement Plant has not achieved full production capacity. This in turn is translated into low operations than its intended capacity and hence its full operation capacity can only be realised with supply of adequate and of affordable power. In addressing this challenge will result also into increased economic activities in Mtwara and far beyond due to its entire supply chain. ***This Impact is considered to be positive, long-term and of high significance.***

6.5.2 Employment Opportunities

Labour force comprising skilled and unskilled labours will be needed for development purpose of the power plant. Recruitment of skilled labour is mostly of Contractor's choice. Main potential impact is employment opportunities. Employment opportunities during development work will increase the income, skills and knowledge to local labour force. Mostly men will benefit in this respect. Employment opportunities will become more significance during operation where there will be direct and indirect employment through the entire project supply chain at full operation of the Cement Plant. Even though

few people will be directly employed during operation their income will support their families and thus having far reaching impact in the area. ***This Impact is considered to be positive, cumulative, long-term and of moderate significance.***

6.5.3 Increased Government Revenue

As noted in previous chapters the project will enhance full swing production of the Cement Plant which in turn will increase the revenue collection to the government at both local level (District Authority) and National level. The project and its operations will be subjected to statutory fees and charges with eventual increase in revenue. The project will also create economic activities in the area and areas of influence through its supply chain and this will result into increment to overall government revenue. ***The impact is considered positive, cumulative, long-term and of moderate significance***

6.5.4 Increased Social Benefits

As part of the community member of Hiyari the company shall also be involved with community activities in one way or the other when and where appropriate to contribute addressing social needs together with other community members. As part of corporate social responsibility of the company when the project has become stable a dedicated budget shall be established to deal with social needs at local level. This in turn will enhance company social capital and public image while improving social services to the locals i.e. win-win situation. ***The impact is considered positive, cumulative, long-term and of moderate significance.***

6.6 DECOMMISSIONING PHASE

Decommissioning of the proposed project will become necessary when the project completes its life cycle or when there is change of use. In a situation where the buildings complete their lifecycle, decommissioning process will typically involve dismantling of the CPP, demolition of the buildings, clearing of the site and reclaiming or restoring the affected land close to a natural condition. In a situation where there is a change of use, decommissioning process may entail building alterations and relocation of the CPP. Upon transfer of the plant to an alternative site and demolition of some buildings, the affected land will need to be reclaimed or restored close to a natural condition through landscaping and planting of vegetation. In this case the following impacts are inevitable; -

6.6.1 Air Pollution due to Dust Emission

As noted above the demolition process will entail breaking of walling and reinforced slabs using sledge hammers and/or jack hammers, which utilize compressed air and lowering of materials from high to low levels. The exercise will inevitably generate dust into the atmosphere. Furthermore, the land levelling and grading while reinstating the area close to its nature condition will also generate dust to the atmosphere as well as transportation of debris and other unwanted materials from the site. Dust generated will impair local atmospheric condition. The impact receptors are likely to include site workers and nearby community as well as people/community centres along the route where the spoil will be disposed. The likelihood for public health concerns for onsite activities is minimal due to distance to the nearby settlement. ***The impact is considered negative, short term and of low to moderate significance***

6.6.2 Air Pollution due to Exhaust Emission

The trucks and earth moving equipment will be used for demolition works that will emit exhaust fumes which are unwanted atmospheric pollutants. Atmospheric pollutants from engines of vehicles/machinery include SO_2, NOx, CO_2 and particulate matters. Main impact is impairment of local air quality, the extent

of which will depend on quantities emitted, duration and prevailing atmospheric conditions. However, for demolition works to be involved the equipment to be involved will be fewer compared during construction. Thus, the exhausts emissions from the machineries/vehicles will neither have significance impacts to the local air quality nor to the global pollution. ***The impact of air pollution due to exhaust emission is considered negative, cumulative, short term and of low significance.***

6.6.3 Noise Pollution from Demolishing Works

The demolition process will entail removal of roofing materials using crowbars and hammers, breaking of walling and reinforced slabs using sledge hammers and/or jack hammers, which utilize compressed air and lowering of materials from high to low levels. The exercise will inevitably result into generation of noise the aspect of which might create hazard condition to the receptors. However, the sensitive receptors which is nearby community of Hiyari Village is located far from the project site (more than 100 meters) and thus the possibility of public health hazards due to generated noise from demolition work will be insignificant. Nevertheless, the workers within the plant site will be exposed to the excessive noise levels generated, the aspect of which is covered under occupational health and safety hazards below. ***This is considered to be negative, short-term and of negligible significance.***

6.6.4 Water Pollution from Salvaging and Stockpiling

The debris resulting from the demolition will be required to be transported for disposal at an approved site or used as base material for new construction work. Haphazard disposal of demolished wastes may cause contamination/impaired quality of receiving body – especially land, and water resources. Further the material may be carried out by rain water and thus increasing turbidity and sediments loads on the receiving water body. ***This impact is considered to be negative, short term and moderate significance.***

6.6.5 Waste Pollution from Hydrocarbons (oil, fuel, lubricants, transformer oil)

If the refueling, servicing and maintenance of large vehicles and machines will take place at the demolition site there will be fuel and lubricants to be involved. This will create the opportunity for accidental spills of hydrocarbons and contaminants could be washed into the environment. Furthermore, the transformer oil remains in the transformer as well as hydrocarbons that might remain at site if not handled properly might leak or spill on site and thus contaminating the site and eventually could be washed by rain water to the nearby water bodies. ***The impact is considered to be negative irreversible, short-term duration and of moderate significance.***

6.6.6 Increased Sediments Load due to Erosion and Spoils

Decommissioning will entail removing of some structures with resultants generation of spoil materials as well as leaving the land bare. If the bare land is not covered by vegetation the agents of erosion might act on it and lead to soil erosion. Likewise, the generated spoil stockpile from demolition work if not attended the loose material might be washed by rain water into nearby receiving water bodies. These events will generally increase sediments into the receiving water body. Unnatural condition of excessive increase of sediments in the receiving water body will affect the hydrological pattern of the same and hence affecting the usual ecological functioning within the aquatic environment. ***The impact is considered to be negative, short-term duration and of moderate significance.***

6.6.7 Traffic Accidents

The demolition activities as indicated in previous sections will involve transportation of demolition materials from the site to the disposal sites away from the source. Traffic aaccidents involving both the

workers and the general public can be expected to occur if precautions are not taken. Drivers might cause accident to children in the residential areas along the route. ***The impact is indirect (offsite), negative, short term and of high significance.***

6.6.8 Occupational Health and Safety Hazards

The demolition works and reinstating the site close to its natural condition will definitely results into various occupational health and safety hazards which is care is not taken might result into long-term health effects, injuries, fatal and loss of life as well as damage to properties. Some of the hazards are obvious which require some management; issues like excessive noise levels from the machinery, excessive dust emission from earth works. Injuries to construction workers may result from moving equipment. According to the OHS Act of 2003 causes of accidents in construction sites includes but not limited to poor site layout; poor erection and improper use of scaffolds; falling objects from high level such as poles; improper method of lifting; sharp edges; improper use of Personal Protective Equipment (PPE); inadequate provisions of PPE; falling through uncovered openings especially at upper floor levels and carelessness of workers. ***The impacts are considered negative, short term and of high significance.***

Table 6.6: Summary of Potential Impacts

Phase	Potential Impacts	Significance Value
Construction Phase	Loss of biodiversity	*The impact is considered negative, permanent and of negligible significance.*
	Accelerated soil erosion	*This impact is considered negative, short term and of low significant.*
	Air pollution due to dust emission	*The impact is considered negative, short term and of moderate significance.*
	Air pollution due to exhaust emission	*The is considered negative, cumulative, short term and of low significance.*
	Noise pollution	*The impact is considered negative, short term and low significance.*
	Water pollution	*The impact is considered negative, short-term and of moderate significance.*
	Public health hazards due to wastes	*The impact is considered negative, short term and of moderate significance.*
	Traffic accidents along the route when sourcing construction materials	*The impact is indirect (offsite), negative, short term and of high significance.*
	Occupational Health hazards	*The impact is considered negative, short term and of high significance.*
	Public health hazards (HIV/AIDs and STDs spread)	*The impact is negative, short term and of high significance.*
	Degradation of land at point source of construction materials	*Secondary or indirect negative impacts, cumulative, short to medium-term and of moderate significance.*
	Land related potential conflict(s)	*The impact is considered negative, and of negligible significance.*
	Introduction of alien/invasive species	*The impact is considered to be negative, long term and of low to moderate significance*
Operation Phase	Air pollution due to emission of particulate matter (dust & ash)	*The impact is considered negative, cumulative, long term and of moderate significance.*
	Air pollution due to emission of noxious gases	*The impact is considered negative, cumulative, long term and of moderate significance*

Phase	Potential Impacts	Significance Value
	Noise pollution for public health hazards	*The noise pollution impact is considered negative, long-term and of low significance.*
	Water pollution from plant effluent	*The impact is considered negative, long-term and of moderate significance.*
	Water and land pollution from hydrocarbons	*The impact is considered negative-irreversible, medium-term and of moderate significance.*
	Water resources use conflict	*The impact is considered negative, cumulative, long-term and of low significance.*
	Fire hazards	*This impact is considered negative, short term, and of high significance.*
	Traffic accident	*The impact is indirect (offsite), negative, cumulative, long term and of high significance.*
	Occupational health and safety hazards	*This impact is considered negative, long term, and of high significance.*
	Vibration related impacts	*The impact is considered negative, long-term and of low significance.*
	Groundwater and soil/land pollution from materials (Coal, Ash & Limestone)	*The impact is considered negative, medium-term and of high significance.*
	Introduction of alien/invasive species	*The impact is considered to be negative, long term and of low significance*
	Public health hazards from transportation of liquid oil	*The impact is considered negative, irreversible and of high significance.*
	Socio – Economic Impacts	
	Availability of power to support Dangote Cement Plant	*This Impact is considered to be positive, long-term and of high significance.*
	Employment opportunities	*This Impact is considered positive, cumulative, long-term and of moderate significance.*
	Increased Government Revenue	*The impact is considered positive, cumulative, long-term and of moderate significance*
	Increased social benefits	*The impact is considered positive, cumulative, long-term and of moderate significance.*
Decommissioning Phase	Air pollution due to dust emission	*The impact is considered negative, short term and of low to moderate significance*
	Air pollution due to exhaust emission	*The impact of air pollution due to exhaust emission is considered negative, cumulative, short term and of low significance.*
	Noise pollution from demolishing works	*This is considered to be negative, short-term and of negligible significance.*
	Water pollution from salvaging and stockpiling	*This impact is considered to be negative, short term and moderate significance.*
	Water pollution from hydrocarbons (oil, fuel, lubricants, transformer oil)	*The impact is considered to be negative irreversible, short-term duration and of moderate significance.*
	Increased sediments load due to erosion and spoils	*The impact is considered to be negative, short-term duration and of moderate significance.*
	Traffic accidents	*The impact is indirect (offsite), negative, short term and of high significance.*

Phase	Potential Impacts	Significance Value
	Occupational Health and Safety hazards	*The impacts are considered negative, short term and of high significance.*

7 MITIGATION MEASURES

7.1 INTRODUCTION

The impacts which are most likely to affect the environment and human health in the execution of the proposed project have been identified and analyzed in Chapter 6. Based on the analysis and hence classification of the most significant environmental impacts, this chapter proposes the mitigation measures for the negative impacts and enhancement measures of those positive ones. The standards upon which the mitigation measures are targeted, the responsible entity and the associated mitigation costs are presented as part of the Environmental and Social Management Plan in Chapter 8.

7.2 CONSTRUCTION PHASE

7.2.1 Loss of Biodiversity

Despite the impact has been rated negligible significance, the following shall be done to ensure the impact remains negligible throughout the project life span and also for continuous environmental improvement of the plant site; -

- Avoidance of haphazard clearance and clearance will be restricted to areas with physical structures only
- Tree planting around the power plant area shall be done that will also act as noise attenuation measure for the power plant
- The concrete batching plants shall be ensured are not located in close proximity to ecologically sensitive areas
- Avoidance of direct light shall be done in construction areas and from permanent road lighting to reduce illumination of surrounding areas and minimise disturbance to nocturnal fauna, where security and health and safety factors allow.
- Avoidance of burning shall be done at construction site
- Ecological surveys shall be undertaken prior the development of new/extension of existing quarries/ sand pits / soil pits. Creation of buffer zones to protect any significant habitat/ fauna identified shall be done among others.
- Induction cause on ecological awareness shall be done to all new workers prior to engagement on site.

7.2.2 Accelerated Soil Erosion

- Deliberately re-cover exposed soils/land with fast growing grass and other appropriate species (such as Napier grass) as soon as possible to enable vegetation growth.
- backfilling shall be done adequately, compacted, and the site restored. The earth used for backfilling shall be free from all roots, grass, shrubs, vegetation, trees, and rubbish. The backfilling operation will be performed in such a manner so as to prevent washing away of soil. Support structures shall be used in locations where soil can be washed away.
- Monitoring areas of exposed soil during periods of heavy rainfall throughout the remaining construction phase shall also be done accordingly and where there are erosion tendencies corrective measures shall be taken timely.
- All other areas that have been cleared or excavated and not covered by structures (buildings) shall be covered by hard-cored and landscaped to reduce the risk of long-term erosion of the area, while other areas shall be covered by the vegetation as noted in previous points.

7.2.3 Air Pollution due to Dust Emission

The following measures shall be applied; -

- All trucks carrying the fine earth materials will be enclosed during transportation to the construction site to prevent dust generation along the route. Trucks used for that purpose will be fitted with tailgates that close properly and with tarpaulins to cover the materials.
- Measures to suppress dust shall be applied to include watering the area vulnerable for dust including routes/earth roads (3 times a day)
- Trucks will be washed each morning to remove mud on mudguard and tires to reduce dust on routes
- Watering shall be done also on dry excavated areas and mixing of dry earth materials to reduce fugitive dust
- Speed limits will be instituted to drivers and especially in routes passing in community centers areas.
- Covering stockpile that have potential to generate fugitive dust at site

7.2.4 Air Pollution due to Exhaust Emission

The following measures shall be applied; -

- Equipment maintenance to be undertaken in accordance with manufacturer's instructions and at the specified maintenance interval to reduce exhaust emission;
- Equipment operators will be trained in and will follow equipment operational procedure.
- Load limit shall be specified to type of vehicle to avoiding overloading that causes excessive exhaust emission.
- Timely maintenance of the trucks through regular inspection on the need for maintenance.

7.2.5 Noise Pollution

The following shall be done; -

- Activities that will generate excessive/disturbing noise conditions will be restricted to daytime hours only.
- All vehicles and noise emitting machines shall have properly functioning exhaust mufflers
- Installation of portable barriers to shield compressors and other small stationary equipment where necessary
- Speed limits will be instituted to drivers and especially in routes passing in community centers areas.
- Training to drivers on safe drive

7.2.6 Water Pollution

To mitigate this impact the following shall be done; -

- All excavated unwanted materials will be stockpiled away from drainage features.
- Prior instructions to contractor on handling of hazardous waste such as oils, lubricants and gasoline during construction process will be provided.
- All Re-fuelling of big machines on site shall be done on concrete paved area with small channel towards oil scooping chamber
- Vehicles shall be refuelled at dedicated dispersing area within the Cement premises
- All services for vehicles & machinery shall be done at workshop area that has a proper system of oil/spill management
- Emergency response measures will be put on site in case of major accidental oil spill that will include having absorbent materials and sand kits.
- Hydrocarbons to include oil, grease and Fuel is stored at designated area that will have concrete surface with the containment bund.

7.2.7 Public Health Hazards due to Wastes

- Temporary pit latrines will be established for the workers at the construction sites to include for both male and female latrines.
- An efficient collection and disposal system based on the principles of reduction, re-use and recycling of materials, shall be instituted at the site as per DCL-WMP
- The contractor will put in place different waste bins for segregation on site and to discourage uncontrolled waste disposal.
- The wastes will thereafter be collected dumped on a pit to be established (only for biodegradable).
- Some wastes which are difficult to dispose will be minimized and where practicable avoided such as plastic wastes i.e. container/bottles and bags at the site.
- While re-usable and recyclable materials will be accumulated and once enough will collected by certified Waster handlers.
- The DCL WMP shall be followed accordingly

7.2.8 Traffic Accidents along the Route when sourcing Construction Materials

The following shall be done; -

- Only qualified drivers with appropriate driving license shall be engage.
- Induction course shall be done to all drivers prior starting driving
- Drivers shall be sensitized on maintaining speed limits for main roads and on access roads.
- Promoting safe drive with specified hours for long drive to avoid fatigue
- Provision of road and safety signs shall be done on site and surrounding areas that are to be followed by drivers and public in collaboration with local authority.

7.2.9 Occupational Health and Safety Hazards

To mitigate this impact, DCL and contractor shall comply with relevant Tanzania (OSHA, 2003) and International Finance Cooperation's Performance Standards and regulations on health and safety requirements including the provision of Personal Protective Equipment's (PPE), reasonable working hours and good working conditions and facilities. Specifically; -

- Accidents will be minimized through proper maintenance of the machines, protecting or guarding the cutting edges, and awareness of the people including workers on the dangers and make them understand how to protect themselves and others.
- The supervisors shall ensure that safety procedure and measures are in place and are enforced (implemented) including appropriate safety gears (PPEs) e.g. eye glasses and dust masks will be ensured in order to reduce risks associated with dust.
- The contractor shall provide adequate training to workers on the OHS of the construction
- Approved working hours (i.e. eight hours per day) shall be observed in order to avoid careless mishandling due to fatigue.
- Undertake site specific risk assessment and development mechanism to avoid or reduce the risks. This shall be done per each new work to be undertaken and a safety procedure shall be developed and implemented.

7.2.10 Public Health Hazards (HIV/AIDs and STDs spread)

The following are suggested to be undertaken to minimize cases of both HIV/AIDs and STDs; Workers will be sensitized on the issue of HIV/AIDs and STDs and on the usage of appropriate tools like condoms etc.

7.2.11 Degradation of Land at point source of Construction Materials

The contractor shall only source the construction materials including gravel, aggregates and sand from licensed suppliers or from authorized areas where environmental issues are being considered.

7.2.12 Introduction of alien/invasive species

The following shall be done; -

- Green procurement shall be instituted to include stating in the specifications of materials to be brought at site for construction from suppliers that they are free from seeds and vegetative materials.
- The system of monitoring all incoming construction materials that are free from vegetative materials and seeds that might germinate or grow in the area shall be instituted. This will involve physical inspection of the materials while in the trucks and where found to contain seeds and/or vegetative materials shall be rejected as not to qualify from the provided specifications.
- All food remains shall be handled as per attached waste management plan (see appendix 10) that do not allow food wastes to be disposed to the open environment instead food wastes are contained in container and transferred to the concrete and bonded transfer station that is hauled to the Municipal dumpsite for decomposition.
- It shall be ensured that there is no encroachment of soil from storage mounds onto vegetated areas adjacent to works areas.

7.3 OPERATION PHASE

7.3.1 Air Pollution due to Emission of Particulate Matter (dust & ash)

The following shall be done; -

- The stack of the CPP shall be of enough heights of 76 meters as per GIIP to avoid excessive ground level concentrations to minimize impacts (see appendix 9).
- The exhaust gases from the project shall be cleaned using cyclones and an electro-static precipitator (ESP) system that will be covered in the design of the power plant. This shall remove most of the fine dust and ash from the exhaust stream, before being released into the atmosphere through a stack.
- Bag filters and ESP shall be replaced when worn out to ensure the emission remains within the standard limits throughout the plant life
- The company shall choose the most latest technology that have minimum dust emission capacity in the market which is the Atmospheric Fluidized Bed Combustion (AFBC) Technology for the steam generation
- Frequent monitoring to ensure the initial design emissions remain the same throughout and if not immediate corrective actions can be taken

7.3.2 Air Pollution due to Emission of Noxious Gases

- The stack of the power plant units shall be of enough heights (76 m) to avoid excessive ground level concentrations to minimize impacts including acid deposition (see appendix 9)
- The plant shall have lime feeding system in the coal for the CPP to reduce the emissions especially those related to Sulphur
- Likewise, the company shall choose Steam Turbine and Boiler OEM's one of the best available technology for this range of equipment for pressure cycle
- Periodic maintenance shall be done as per machinery specifications

7.3.3 Noise Pollution for Public Health Hazards

The following shall be done to ensure the noise levels remains as low as possible outside the boundaries of the power plant; -

- Efficient design fans shall be used and overall efficiency enhancing variable-frequency drives (VFDs) in the generator engine that will minimize the parasitic load as well as the noise from these sources, as the noise of the generator is mainly due to the fuel handling system and the combustion air fans.
- Likewise, for the turbine, the noise and vibration from the steam turbine shall be minimized through proper sealing of pipelines of both the entry and exhaust.
- The use of noise control techniques shall be done such as: using acoustic machine enclosures, selecting structures according to their noise isolation effect to envelop the building; using mufflers or silencers in intake and exhaust channels; using sound absorptive materials in walls and ceilings; using vibration isolators and flexible connections (e.g. helical steel springs and rubber elements); applying a careful detailed design to prevent possible noise leakage through openings or to minimize pressure variations in piping;
- Use of noise barriers such as berms
- Tree planting around the power plant site to further attenuate the noise levels outside the plant site

7.3.4 Water Pollution from Plant Effluent

- Effluent from raw water treatment plant shall be neutralised to normal pH levels and thereafter directed to on site waste water treatment plant.
- Effluent from waste water treatment plant shall be used in secondary and tertiary usage at the plant to include dust suppression in the mines and Cement Plant and irrigating the gardens. However, before being used for dust suppression and gardening water quality shall be analyzed to comply with minimum standard for discharge into open environment as per table 8.2 below.
- In case effluent has become more than the usage it shall also meet the standard limits

7.3.5 Water and Land Pollution from Hydrocarbons

The hydrocarbons mainly from servicing and maintenance works shall be handled in the following matter; -

- used oil shall have dedicated storage area with concrete surface, bund wall and a roof to contain only used oil in case of leaks or spills from the containers used to keep it.
- Used oil shall eventually be pumped into the kiln of Cement Plant for firing as source of energy
- Maintenance team shall be equipped with absorbent materials in case of spill to contain and scooped the contaminated oil on surface for incineration in the kiln
- All fuel storage tanks shall be placed on the strong concrete base that shall not allow percolation of any fluid from the tank.
- All the fuel storage tanks shall be surrounded by a strong concrete bund wall of 110% capacity of the stored material.
- The offloading from the trucks and loading to the storage tanks section shall have containment structures to contain all possible spills directed to the scooping chamber. The scooped oil shall be used together with used oil in the kiln of the Cement Plant

7.3.6 Water Resource Use Conflict

The pumping from the boreholes for all seven on site boreholes shall not exceed 10 hours of the day at a pumping rate of 0.417m^3/sec. Further, monitoring of drawdown effect of the community borehole and

onsite boreholes shall be done periodically to ensure detection of the draw effect at earlier stage if it's happening.

7.3.7 Fire Hazards

The following shall be done; -

- Long storage of coal shall be avoided by ordering only what can be consumed over a short period of time.
- Coal shall be stockpiled in an area with enough ventilation to remove build up hot air condition in the stored area
- Temperature and carbon dioxide of the stockpile in the stored area shall be monitored by installed censors to ensure the condition for fire are avoided and/or initial fire is controlled
- Sprinklers shall be installed in and around the stockpile area in case of signs of fire
- Restriction zones of no fire including no smoking shall be implemented with clearly marked warning signs
- The plant shall install firefighting system to include portable fire extinguishers, fire hydrants and fire horse for emergency
- Staffs will be trained on how to operate the firefighting equipment and drills shall be conducted periodically to ensure the system response is as required, just to curb fire in case of incidences.
- Regular cleaning shall be done to prevent accumulation of coal dust in the facility
- Start up and shut down procedure shall be instituted for the to minimize the risks of suspended hot coal particles in the pulverizer, mill and/or cyclone during start up.

7.3.8 Traffic Accidents

The following shall be done; -

- The trucks sourcing coal from Ruvuma Region will also carry Cement product from plant for distribution in Ruvuma and the entire southern highland Regions. Main hub/warehouse will be at Songea in Ruvuma. Trucks from other southern highlands regions will thus be sourcing from the Songea Hub instead of coming to Cement Plant site. This at large will reduce traffics and hence reduction of likelihood of high number of accidents.
- Only qualified drivers with appropriate driving license shall be engage.
- Induction course shall be done to all drivers prior starting driving
- Drivers shall be sensitized on maintaining speed limits for main roads and on access roads.
- Promoting safe drive with specified hours for long drive to avoid fatigue
- Provision of road and safety signs shall be done on site and surrounding areas that are to be followed by drivers and public in collaboration with local authority.
- Ensure Traffic Management Plan is implemented accordingly

7.3.9 Occupational Health and Safety Hazards

As noted in previous chapter the key safety and health hazards for thermal power plants include exposure to non-ionizing radiation, heat (thermal stress), noise and electrical hazards. However, there are general OHS aspects which need to be considered for the project which are covered hereunder while the specific power plant hazards are also covered in the following bullets; -

General OHS measures

- Qualified staffs will be hired to run the equipment
- Safety operating procedures shall be established and further trained to intended workers
- Appropriate protective gears shall be provided and require the workers to use them.

- At work place there shall be provided and maintained first-aid kits, so as to be easily accessible during working hours in case of injury
- regular medical examination for the workers will be instituted
- The safety management system shall be established
- Occupational hazards risks shall be monitored frequently

Non -ionizing radiation hazard

Combustion workers may have higher exposure to electric and magnetic field (EMF) than general public due to working in proximity to electric power generators, equipment, and connecting high voltage transmission lines. This shall be prevented or minimized through; -

i. Identification of potential exposure levels in the workplace, including surveys of exposure levels in new projects and use of personal monitors during working activities. Personal monitors should warn one on exposure levels that are below the reference level.
ii. Training of workers in the identification of occupational EMF levels and hazards
iii. Establishment and identification of safety zones to differentiate between working areas with expected elevated EMF levels compared to those acceptable for public exposure, limiting access to properly trained workers;
iv. Implementation of action plans to address potential or confirmed exposure levels that exceed reference occupational exposure levels developed international organisation such as the International Commission On Non-Ionization Radiation Protection (ICIRP). The plan may include limiting exposure time through work rotation, increasing the distance between the source and the worker, when feasible and/or the use of shielding materials.

Thermal hazard

Workers might experience thermal stress during operation and maintenance of combustion units, pipes, and related hot equipment. The following should be done to minimize the stress; -

i. Regular inspection and maintenance of pressure vessels and piping
ii. Provision of adequate ventilation in work areas to reduce heat and humidity
iii. Reducing exposure of workers in elevated temperatures and ensure access to drinking water
iv. Shielding surfaces where workers come in close contact with hot equipment, including generating equipment and pipes

Acoustic hazard

To minimize the noise hazards for the workers the following shall be done; -

i. Provision of sound -insulated control rooms with noise levels less than 60dBA
ii. Design of generators should meet applicable occupational noise levels
iii. Undertake a survey to mark high noise areas and require protective gears to workers working in these high noise areas (typically areas with noise levels >85 dBA)

Electrical hazards

Energized equipment and power lines can pose electrical hazard for the workers at thermal power plants. The following shall be to prevent, minimize and control the hazard; -

i. Consider installation of hazard warning lights inside electrical equipment enclosures to warn of inadvertent energization
ii. Use of voltage sensors prior to and during workers` entrance into enclosures containing electrical components
iii. Deactivation and proper grounding of live power equipment and distribution lines according to applicable legislation and guidelines whenever possible before work is performed on or proximity to them
iv. Provision of specialised electrical safety training to those workers working with or around exposed components of electrical circuit. For instance, basic electrical theory, proper safe work procedure,

hazard awareness and identification, proper use of PPE, proper lock-out/tag-out procedures, first aid including CPR and proper retraining as necessary.

7.3.10 Groundwater and Soil/Land Pollution from material stockpiles (coal, ash & lime)

The following shall be done; -

- As noted earlier in section 3.7 coal shall be stored in a covered coal shed of dome structure with concrete surface and with storage capacity of 10,000 tons. Thus neither wind nor rain water shall act on the stored coal.
- Coal within the plant shall be conveyed through well covered conveyor belt from one point to the other.
- The resultant ash from coal combustion shall be stored in three dedicated covered silos (bed ash silo of 80m^3 capacity and two fly ash silos each with 220m^3 capacity).
- Ash from the silos shall not be disposed off but shall be collected and transported by covered trucks to the Cement Plant where it shall be used as one of the additives in the Cement production.
- Limestone shall have dedicated storage shed with bund wall to contain the same material within the shed area before usage in the process.

7.3.11 Introduction of alien/invasive species

The following shall be done; -

- Green procurement shall be instituted to include stating in the specifications of Coal materials to be brought at site from suppliers that they are free from seeds and vegetative materials.
- The system of monitoring incoming coal that are free from vegetative materials and seeds that might germinate or grow in the area shall be instituted. This will involve physical inspection of the materials while in the trucks and where found to contain seeds and/or vegetative materials shall be rejected as not to qualify from the provided specifications.
- Coal at site shall only be stockpiled in the dedicated concrete and covered dome within the concrete fenced plant premises.
- Substandard coal that has been received at site shall not be disposed off and instead shall be mixed with high standard coal in required proportional to avoid disposal to the open environment that can cause germination of seeds or vegetative material that could not be spotted during delivery.
- All food remains shall be handled as per attached waste management plan (see appendix 10) that do not allow food wastes to be disposed to the open environment instead food wastes are contained in container and transferred to the concrete and bonded transfer station that is hauled to the Municipal dumpsite for decomposition.
- It shall be ensured that there is no encroachment of soil from storage mounds onto vegetated areas adjacent to works areas.

7.3.12 Public health hazards from the transportation of the liquid oil

The following shall be done; -

- Only qualified drivers with appropriate driving license shall be engage.
- Induction course shall be done to all drivers prior starting driving
- The vehicles shall have a spill kit on board
- The oil shall be carried by specialized tankers fully labelled with hazards signs to notify the public
- Drivers shall be sensitized on maintaining speed limits for main roads and on access roads.
- Promoting safe drive with specified hours for long drive to avoid fatigue

- Provision of road and safety signs shall be done on site and surrounding areas that are to be followed by drivers and public in collaboration with local authority.
- Ensure Traffic Management Plan is implemented accordingly

7.4 SOCIAL-ECONOMIC IMPACTS / ENHANCEMENTMEASURES

7.4.1 Availability of Power

All stakeholders involved with this power plant and its transmission line project should support and hasten the process towards realization of the project.

7.4.2 Employment Opportunities

This impact could be turned into enhanced positive impact if the contractor to be involved with the project development is both encouraged to and committed to hiring local labour (especially marginalized groups such as youth), particularly when only semi-skilled or unskilled labourers are required. This could be made clear during the tendering process for the contractor who will be involved with the development phase (i.e. green procurement). Likewise, during operation local people shall be given priority provided that they do have required qualification and technical skills for the intended work.

7.4.3 Increased Government Revenue

To enhance this impact, it is recommended for the company to timely settle the revenue to the respective government authority. Furthermore, the company should institute fiscalized system of tax payment to all its suppliers to ensure the revenue from the DCL is maximized throughout their suppliers.

7.4.4 Increased Social Benefits

As part of social corporate responsibility it is expected for the company to establish a separate budget to implement its social commitment in the area. Its priority should focus on the pressing needs in the villages such as supporting the community on the ongoing social projects including supporting building dispensaries, classrooms, and water related projects to mention some.

7.5 DECOMMISSIONING PHASE

7.5.1 Air Pollution due to Dust Emission

The following measures shall be applied; -

- All fine earth materials will be enclosed during transportation to the construction site to prevent dust generation along the route. Trucks used for that purpose will be fitted with tailgates that close properly and with tarpaulins to cover the materials.
- Protection and well-being of the employees shall be ensured by minimising their vulnerabilities to dust generated by the machinery on-site. The contractor shall use an appropriate shift system and take care that his workers wear necessary protection gears like masks, safety glasses, and ensure that the necessary and standard precautions are rigorously followed to prevent human health impacts.
- Measures to suppress dust shall be applied to include watering the area vulnerable for dust in the specific potential dust area within the project area

7.5.2 Air Pollution due to Exhaust Emission

The following measures shall be applied; -

- Equipment maintenance shall be undertaken in accordance with manufacturer's instructions and at the specified maintenance interval to reduce exhaust emission;
- Equipment operators will be trained in and will follow equipment operational guidelines and standards.

7.5.3 Noise Pollution

The following shall be done; -

- Activities that will generate disturbing noise conditions will be restricted to normal working hours (day time only).
- Proponent will also ensure all vehicles have properly functioning mufflers,
- Workers operating equipment that generates noise will be equipped with the appropriate noise protection gears.

7.5.4 Water Pollution from Salvaging and Stockpiling

To mitigate the impact, the following shall be done; -

- All excavated unwanted materials will be stockpiled away from drainage features.
- Prior instructions to contractor on handling of hazardous waste such as oils, lubricants and gasoline during construction process will be provided.
- A site waste management plan shall be prepared by the contractor prior to commencement of the works. This will include designation of appropriate waste storage areas, collection and removal schedule, and a system for supervision and monitoring.
- All refuelling for vehicles will be done on dedicated area that has been provided with concrete structure to retain any leaks
- All services will also be done away from the construction site
- Emergency response measures will be put on site in case of accidental oil spill that will include having absorbent materials and sand kits.

7.5.5 Waste Pollution from Hydrocarbons (oil, fuel, lubricants, transformer oil)

The following shall be done; -

- Re-fuelling of big machines shall be done on concrete paved area with small channel towards oil scooping chamber
- Vehicles shall be refuelled at dedicated dispersing area
- All services for vehicles & machinery shall be done at workshop area with proper system of oil/spill management
- Emergency response measures will be put on site in case of accidental oil spill that will include having absorbent materials and sand kits.
- Hydrocarbons to include oil, grease and Fuel is stored at designated area that will have concrete surface with the containment bund.

7.5.6 Increased Sediments Load in Water Bodies due to Erosion & Spoils

- Progressive rehabilitation and re-vegetation of disturbed land surfaces will be ensured. All water draining from cleared areas will be directed through a sedimentation pond ensuring enough retention time for trapping sediments.
- Sediment traps will be constructed along drains and all water from the disturbed area will be directed through a sedimentation pond.

- All unwanted materials will be stockpiled in a dedicated area away from drainage features.
- A site waste management plan (WMP) shall be prepared by the contractor prior to commencement of the works. This will include designation of appropriate waste storage areas, collection and removal schedule, and a system for supervision and monitoring.

7.5.7 Traffic Accidents

The contractor shall only engage qualified drivers with appropriate driving license marching with the intended vehicle to be used. Induction course shall be done to all drivers prior starting the demolition works, and new coming drivers shall be subjected to induction course prior giving the vehicles. Further drivers shall be sensitized among others to maintaining speed limits for main roads and on constructed access road(s). Provision of road and safety signs to the public as well as drivers shall be given to the site that are to be followed/used by project drivers.

7.5.8 Occupational Health and Safety Hazards

Accidents will be minimized through proper maintenance of the machines, protecting or guarding the cutting edges, and awareness of the people including workers on the dangers and make them understand how to protect themselves and others. On the other hand, the supervisors shall ensure that safety measures are in place and are enforced (implemented) including wearing safety gears. Also the contractor shall provide adequate training to construction workers on the health and safety impacts of the construction and shall provide protective gear to construction workers. Approved working hours (i.e eight hours per day) shall be observed in order to avoid careless, mishandling due to fatigue.

8 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

8.1 INTRODUCTION

Environmental and Social Management Plan (ESMP) is a plan for implementation of the mitigation measures that aims at managing the impacts during construction, operation and decommissioning phases of the project. The ESMP is a document which encompasses all major environmental and social impacts associated with the Captive Power Plant development and operation. The ESMP addresses specific issues to be managed at the construction site and ensures that commitments made during the planning phase are incorporated into design. The ESMP also presents implementation responsibilities of main actors during all phases of project cycle. The broad objective of the EMP is to ensure that various environmental protection measures identified during the planning phase are implemented during all phases of the project, so that environmental and social impacts are avoided and/or minimised to the lowest level possible.

8.2 PERSONNEL RESPONSIBLE FOR THE IMPLEMENTATION OF THE ESMP

DCL shall be responsible for overall implementation of the ESMP. The designated Environmental Management Officer/Environmental Manager will do a day to day follows. The Environmental Manager will also ensure that all employees at the project site have their environmental responsibilities and accountabilities clearly outlined. These descriptions will form part of the contractual obligations upon which individual employees are engaged. Specific accountabilities and responsibilities outlined in the specific ESMP will be communicated to responsible staffs.

The HSE Departmental staffs are appropriately qualified for discharging their assigned responsibilities effectively. In order to fulfil the requirement, the DCL shall put in place a training program. Typical duties and responsibilities for the HSE staffs including the Contractor Environmentalist will include, *inter alia to:*

- ensure that environmental monitoring programs are carried out on schedule and correctly;
- review environmental data and recommend appropriate actions;
- monitor environmental compliance of all CPP operations;
- train others in the team and general personnel on CPP environmental issues;
- train and ensure readiness of the emergency response teams;
- report on environmental data and incidents of significance as per regulations;
- liaise with the appropriate regulatory authorities on incidences with environmental risks;
- provide technical and environmental support to Contractors engaged at site; and,
- ensure commitments listed in the project specific ESMP are met.
- review (periodically) the existing ESMP and monitoring system and design updated system.

The summary of the key issues of the proposed CPP project and their management are shown in Table 8.1 below (ESMP).

Table 8.1: Environmental and Social Management Plan

Phase	Potential Impacts/ Environmental Aspects	Management/Mitigation Measures	Target Level/ Performance Indicator	Implementation Timeline	Responsibility	Est Costs in TZS/ year
Construction Phase	Loss of biodiversity	• Avoidance of haphazard clearance and clearance will be restricted to areas with physical structures only • Tree planting around the power plant area that will also act as noise attenuation measure for the power plant • The concrete batching plants shall be ensured are not located in close proximity to ecologically sensitive areas. • Avoid direct light in construction areas and from permanent road lighting to reduce illumination of surrounding areas and minimise disturbance to nocturnal fauna, where security and health and safety factors allow. • Avoidance of burning shall be done at construction site • Ecological surveys shall be undertaken prior the development of new/extension of existing quarries/ sand pits / soil pits. Creation of buffer zones to protect any significant habitat/ fauna identified shall be done among others. • Induction cause on ecological awareness shall be done to all new workers prior to engagement on site.	Permit to clear in place. No cleared areas other than defined area. All affected areas are replanted.		DCL	6,000,000
	Accelerated soil erosion	• Deliberately re-cover exposed soils/land with fast growing grass and other appropriate species (such as Napier grass) as soon as possible to enable vegetation growth. • backfilling shall be done adequately, compacted, and the site restored. The earth used for backfilling shall be free from all roots, grass, shrubs, vegetation, trees, and rubbish. The backfilling operation will be performed in such a manner so as to prevent washing away of soil. Support structures shall be used in locations where soil can be washed away. • Monitoring areas of exposed soil during periods of heavy rainfall throughout the remaining construction phase shall also be done	No eroded area / the disturbed areas reinstated		Dangote Cement Limited, Contractor	5,000,000

Phase	Potential Impacts/ Environmental Aspects	Management/Mitigation Measures	Target Level/ Performance Indicator	Implement ation Timeline	Responsi bility	Est Costs in TZS/ year
		accordingly and where there are erosion tendencies corrective measures shall be taken timely. • All other areas that have been cleared or excavated and not covered by structures (buildings) shall be covered by hard-cored and landscaped to reduce the risk of long-term erosion of the area, while other areas shall be covered by the vegetation as noted in previous points.				
	Air pollution due to dust emission from transportation activities and earth works	• All trucks carrying the fine earth materials will be enclosed during transportation to the construction site to prevent dust generation along the route. Trucks used for that purpose will be fitted with tailgates that close properly and with tarpaulins to cover the materials. • Measures to suppress dust shall be applied to include watering the area vulnerable for dust including routes/earth roads (3 times a day) • Trucks will be washed each morning to remove mud on mudguard and tires to reduce dust on routes • Watering shall be done also on dry excavated areas and mixing of dry earth materials to reduce fugitive dust • Speed limits will be instituted to drivers and especially in routes passing in community centers areas. • Covering stockpile that have potential to generate fugitive dust at site	TSP < 0.23, PM_{10} < 0.05 & $PM_{2.5}$ < 0.025	during construction	DCL, Contractor	25,000,000
	Air pollution from exhaust emission during transportation and machinery operating on site	• Equipment maintenance to be undertaken in accordance with manufacturer's instructions and at the specified maintenance interval to reduce exhaust emission; • Equipment operators will be trained in and will follow equipment operational procedure. • Load limit shall be specified to type of vehicle to avoiding overloading that causes excessive exhaust emission	Units mg/m^3 SO_2<0.5, NOx < 0.2, CO_2 < 500, CO <30,	During construction	DCL, Contractor	6,000,000

Phase	Potential Impacts/ Environmental Aspects	Management/Mitigation Measures	Target Level/ Performance Indicator	Implementation Timeline	Responsibility	Est Costs in TZS/ year
		• Timely maintenance of the trucks through regular inspection on the need for maintenance.				
	Noise pollution from construction activities	• Activities that will generate excessive/disturbing noise conditions will be restricted to daytime hours only. • All vehicles and noise emitting machines shall have properly functioning exhaust mufflers • Installation of portable barriers to shield compressors and other small stationary equipment where necessary • Speed limits will be instituted to drivers and especially in routes passing in community centers areas. • Training to drivers on safe drive	Offsite stations Day < 55 dBA, Night < 45 dBA Onsite stations Day <70 dBA, Night < 60 dBA	During construction	DCL, Contractor	6,000,000
	Waste pollution due to accidental spill of oil, fuel, lubricants on site	• Re-fuelling of big machines on site shall be done on concrete paved area with small channel towards oil scooping chamber • Vehicles shall be refuelled at dedicated dispersing area within the Cement premises • All services for vehicles & machinery shall be done at workshop area that has a proper system of oil/spill management • Emergency response measures will be put on site in case of accidental oil spill that will include having absorbent materials and sand kits. • Hydrocarbons to include oil, grease and Fuel is stored at designated area that will have concrete surface with the containment bund.	Oil & Grease <10mg/l, Zero oil spilled area	Concrete refuelling area in place before construction / Construction period	DCL, Contractor	4,000,000
	Water pollution due to domestic wastes	• Temporary pit latrines will be established for the workers at the construction sites to include for both male and female latrines.	BOD<30 mg/l Coliform<100 counts	In place before construction	DCL, Contractor	3,000,000

Phase	Potential Impacts/ Environmental Aspects	Management/Mitigation Measures	Target Level/ Performance Indicator	Implementation Timeline	Responsibility	Est Costs in TZS/ year
	Public health hazards due to poor management of Solid waste	• An efficient collection and disposal system based on the principles of reduction, re-use and recycling of materials, shall be instituted at the site as per DCL -WMP • The contractor will put in place different waste bins for segregation on site and to discourage uncontrolled waste disposal. • The wastes will thereafter be collected dumped on a pit to be established (only for biodegradable). • Some wastes which are difficult to dispose will be minimized and where practicable avoided such as plastic wastes i.e. container/bottles and bags at the site. • While re-usable and recyclable materials will be accumulated and once enough will collected by certified Waster handlers. • The DCL WMP shall be followed accordingly	Zero litter/No observed wastes on open environment	Different type of waste bins in place during construction	DCL, Contractor	5,000,000
	Traffic accidents along the route during transportation of construction materials	• Only qualified drivers with appropriate driving license shall be engage. • Induction course shall be done to all drivers prior starting driving • Drivers shall be sensitized on maintaining speed limits for main roads and on access roads. • Promoting safe drive with specified hours for long drive to avoid fatigue • Provision of road and safety signs shall be done on site and surrounding areas that are to be followed by drivers and public in collaboration with local authority.	Zero accident	During construction	DCL, Contractor	6,000,000
	Occupational Health and safety hazards associated with construction work	To mitigate this impact, DCL and contractor shall comply with relevant Tanzania (OSHA, 2003) and International Finance Cooperation's Performance Standards and regulations on health and safety requirements including the provision of Personal	<0.05mg/m^3 (>0.05=PPE), <85, (>85dBA=PPE)	During construction	DCL, Contractor	40,000,000

Phase	Potential Impacts/ Environmental Aspects	Management/Mitigation Measures	Target Level/ Performance Indicator	Implementation Timeline	Responsibility	Est Costs in TZS/ year
		Protective Equipment's (PPE), reasonable working hours and good working conditions and facilities. Specifically; - • Accidents will be minimized through proper maintenance of the machines, protecting or guarding the cutting edges, and awareness of the people including workers on the dangers and make them understand how to protect themselves and others. • The supervisors shall ensure that safety procedure and measures are in place and are enforced (implemented) including appropriate safety gears (PPEs) e.g. eye glasses and dust masks will be ensured in order to reduce risks associated with dust. • The contractor shall provide adequate training to workers on the OHS of the construction • Approved working hours (i.e. eight hours per day) shall be observed in order to avoid careless mishandling due to fatigue. • Undertake site specific risk assessment and development mechanism to avoid or reduce the risks. This shall be done per each new work to be undertaken and a safety procedure shall be developed and implemented.	Zero accident			
	Introduction of alien/invasive species	The following shall be done; - • Green procurement shall be instituted to include stating in the specifications of materials to be brought at site for construction from suppliers that they are free from seeds and vegetative materials. • The system of monitoring all incoming construction materials that are free from vegetative materials and seeds shall be instituted. This will involve physical inspection of the materials while in the trucks and where found to contain seeds and/or vegetative materials shall be rejected. • All food remains shall be handled as per attached waste management plan (see appendix 10) that do not allow food	Zero incidence	During construction	DCL, Contractor	

Phase	Potential Impacts/ Environmental Aspects	Management/Mitigation Measures	Target Level/ Performance Indicator	Implementation Timeline	Responsibility	Est Costs in TZS/ year
		wastes to be disposed to the open environment instead food wastes are contained in container and transferred to the concrete and bonded transfer station that is hauled to the Municipal dumpsite for decomposition. • It shall be ensured that there is no encroachment of soil from storage mounds onto vegetated areas adjacent to works areas.				
Operation Phase	Air pollution due to emission of particulate matter (dust & ash)	• The stack of the CPP shall be of enough heights of 76 meters as per GIIP to avoid excessive ground level concentrations to minimize impacts (see appendix 9) • The exhaust gases from the project shall be cleaned using cyclones and an electro-static precipitator (ESP) system that will be covered in the design of the power plant. This shall remove most of the fine dust and ash from the exhaust stream, before being released into the atmosphere through a stack. • Bag filters and ESP shall be replaced when worn out to ensure the emission remains within the standard limits throughout the plant life • Frequent monitoring to ensure the initial design emissions remain the same throughout and if not immediate corrective actions can be taken	Ambient, TSP < 0.23, PM_{10} < 0.05 & $PM_{2.5}$ < 0.025 Stack PM_{10} < 50 mg/m^3		DCL	300,000,000
	Air pollution due to emission of noxious gases	• The stack of the power plant units shall be of enough heights (76 m) to avoid excessive ground level concentrations to minimize impacts including acid deposition (see appendix 9) • Periodic maintenance shall be done as per machinery specifications	Ambient SO_2< 0.5, NOx < 0.2, CO_2 < 500, CO <30, Stack SO_2 <1500, NO_x<600 CO_2 < 500, CO<175		DCL	40,000,000

Phase	Potential Impacts/ Environmental Aspects	Management/Mitigation Measures	Target Level/ Performance Indicator	Implementation Timeline	Responsibility	Est Costs in TZS/ year
	Noise pollution and vibration	• Efficient design fans shall be used and overall efficiency enhancing variable-frequency drives (VFDs) in the generator engine that will minimize the parasitic load as well as the noise from these sources, as the noise of the generator is mainly due to the fuel handling system and the combustion air fans. • Likewise, for the turbine, the noise and vibration from the steam turbine shall be minimized through proper sealing of pipelines of both the entry and exhaust. • The use of noise control techniques shall be done such as: using acoustic machine enclosures, selecting structures according to their noise isolation effect to envelop the building; using mufflers or silencers in intake and exhaust channels; using sound absorptive materials in walls and ceilings; using vibration isolators and flexible connections (e.g. helical steel springs and rubber elements); applying a careful detailed design to prevent possible noise leakage through openings or to minimize pressure variations in piping; • Use of noise barriers such as berms • Tree planting around the power plant site to further attenuate the noise levels outside the plant site	<u>Offsite stations</u> Day < 55, Night < 45 <u>Onsite stations</u> Day <70, Night < 60		Dangote Cement Limited	40,000,000
	Water pollution from Raw Water Treatment plant effluent	• Effluent from raw water treatment plant shall be neutralised to normal pH levels and thereafter directed to on site waste water treatment plant. • Effluent from waste water treatment plant shall be used in secondary and tertiary usage at the plant to include dust suppression in the mines and Cement Plant and irrigating the gardens. However, before being used for dust suppression and gardening water quality shall be analyzed to comply with minimum standard for discharge into open environment as per table 8.2 below.	Applicable standard limits (see table 8.2 below)	Effluent treatment plant in place	Dangote Cement Limited	N/A

Phase	Potential Impacts/ Environmental Aspects	Management/Mitigation Measures	Target Level/ Performance Indicator	Implementation Timeline	Responsibility	Est Costs in TZS/ year
		• In case effluent has become more than the usage it shall also meet the standard limits				
	Water and land pollution from hydrocarbons	The hydrocarbons mainly from servicing and maintenance works shall be handled in the following matter; - • used oil shall have dedicated storage area with concrete surface, bund wall and a roof to contain only used oil in case of leaks or spills from the containers used to keep it. • Used oil shall eventually be pumped into the kiln of Cement Plant for firing as source of energy • Maintenance team shall be equipped with absorbent materials in case of spill to contain and scooped the contaminated oil on surface for incineration in the kiln • All fuel storage tanks shall be placed on the strong concrete base that shall not allow percolation of any fluid from the tank. • All the fuel storage tanks shall be surrounded by a strong concrete bund wall of 110% capacity of the stored material. • The offloading from the trucks and loading to the storage tanks section shall have containment structures to contain all possible spills directed to the scooping chamber. The scooped oil shall be used together with used oil in the kiln of the Cement Plant	Oil & Grease <10mg/l, Zero oil spilled area/zero leakage	Used oil storage structure in place / surrounding bund wall in place	DCL, Contractor	24,000,000
	Water resource use conflict with nearby community boreholes	• The pumping from the boreholes for all seven on site boreholes shall not exceed 10 hours of the day at a pumping rate of 0.417m^3/sec. • Monitoring of drawdown effect of the community boreholes and DCL boreholes shall be done periodically.	No significant change of the baseline discharge rate for both the community & DCL BHs (Community BH - 35m^3/hr)	Procedure in place	Dangote Cement Limited	N/A

Phase	Potential Impacts/ Environmental Aspects	Management/Mitigation Measures	Target Level/ Performance Indicator	Implementation Timeline	Responsibility	Est Costs in TZS/ year
	Potential for fire hazards	• Long storage of coal shall be avoided by ordering only what can be consumed over a short period of time. • Coal shall be stockpiled in an area with enough ventilation to remove build up hot air condition in the stored area • Temperature and carbon dioxide of the stockpile in the stored area shall be monitored by installed censors to ensure the condition for fire are avoided and/or initial fire is controlled • Sprinklers shall be installed in and around the stockpile area in case of signs of fire • Restriction zones of no fire including no smoking shall be implemented with clearly marked warning signs • The plant shall install firefighting system to include portable fire extinguishers, fire hydrants and fire horse for emergency • Staffs will be trained on how to operate the firefighting equipment and drills shall be conducted periodically to ensure the system response is as required, just to curb fire in case of incidences. • Regular cleaning shall be done to prevent accumulation of coal dust in the facility • Start up and shut down procedure shall be instituted for the to minimize the risks of suspended hot coal particles in the pulverizer, mill and/or cyclone during start up.	Zero incident/accident		Dangote Cement Limited	25,000,000
	Traffic accidents	• The trucks sourcing coal from Ruvuma Region will also carry Cementproduct from plant for distribution in Ruvuma and the entire southern highland Regions. Main hub/warehouse will be at Songea in Ruvuma. Trucks from other southern highlands regions will thus be sourcing from the Songea Hub instead of coming to Cement Plant site. This at large will reduce traffics and hence reduction of likelihood of high number of accidents.	Zero incident/accident		Dangote Cement Limited	15,000,000

Phase	Potential Impacts/ Environmental Aspects	Management/Mitigation Measures	Target Level/ Performance Indicator	Implementation Timeline	Responsibility	Est Costs in TZS/ year
		• Only qualified drivers with appropriate driving license shall be engage. • Induction course shall be done to all drivers prior starting driving • Drivers shall be sensitized on maintaining speed limits for main roads and on access roads. • Promoting safe drive with specified hours for long drive to avoid fatigue • Provision of road and safety signs shall be done on site and surrounding areas that are to be followed by drivers and public in collaboration with local authority. • Ensure Traffic Management Plan is implemented accordingly (see Appendix 16).				
	Occupational health and safety hazards	**General OHS measures** • Qualified staffs will be hired to run the equipment • Safety operating procedures shall be established and further trained to intended workers • Appropriate protective gears shall be provided and require the workers to use them. • At work place there shall be provided and maintained first-aid kits, so as to be easily accessible during working hours in case of injury • regular medical examination for the workers will be instituted • The safety management system shall be established • Occupational hazards risks shall be monitored frequently	Zero injuries		Dangote Cement Limited	45,000,000
		Non -ionizing radiation hazard Combustion workers may have higher exposure to electric and magnetic field (EMF) than general public due to working in proximity to electric power generators, equipment, and connecting high	EMF: –			

Phase	Potential Impacts/ Environmental Aspects	Management/Mitigation Measures	Target Level/ Performance Indicator	Implementation Timeline	Responsibility	Est Costs in TZS/ year
		voltage transmission lines. This shall be prevented or minimized through; - i. Identification of potential exposure levels in the workplace, including surveys of exposure levels in new projects and use of personal monitors during working activities. Personal monitors should warn one on exposure levels that are below the reference level. ii. Training of workers in the identification of occupational EMF levels and hazards iii. Establishment and identification of safety zones to differentiate between working areas with expected elevated EMF levels compared to those acceptable for public exposure, limiting access to properly trained workers; iv. Implementation of action plans to address potential or confirmed exposure levels that exceed reference occupational exposure levels developed international organisation such as the International Commission On Non-Ionization Radiation Protection (ICIRP). The plan may include limiting exposure time through work rotation, increasing the distance between the source and the worker, when feasible and/or the use of shielding materials.	At 50Hz Electric 10,000v/m, Magnetic 500 uT, At 60Hz Electric 10,000v/m, Magnetic 500 uT			
		Thermal hazard Workers might experience thermal stress during operation and maintenance of combustion units, pipes, and related hot equipment. The following should be done to minimize the stress; - i. Regular inspection and maintenance of pressure vessels and piping ii. Provision of adequate ventilation in work areas to reduce heat and humidity iii. Reducing exposure of workers in elevated temperatures and ensure access to drinking water	< 27 ^{o}C or equivalent to ambient			

Phase	Potential Impacts/ Environmental Aspects	Management/Mitigation Measures	Target Level/ Performance Indicator	Implementation Timeline	Responsibility	Est Costs in TZS/ year
		iv. Shielding surfaces where workers come in close contact with hot equipment, including generating equipment and pipes				
		Noise hazard To minimize the noise hazards for the workers the following shall be done; - i. Provision of sound -insulated control rooms with noise levels less than 60dBA ii. Design of generators should meet applicable occupational noise levels iii. Undertake a survey to mark high noise areas and require protective gears to workers working in these high noise areas (typically areas with noise levels >85 dBA)	<85 dBA (> 85 dBA= PPE Must)			
		Electrical hazards Energized equipment and power lines can pose electrical hazard for the workers at thermal power plants. The following shall be to prevent, minimize and control the hazard; - i. Consider installation of hazard warning lights inside electrical equipment enclosures to warn of inadvertent energization ii. Use of voltage sensors prior to and during workers` entrance into enclosures containing electrical components iii. Deactivation and proper grounding of live power equipment and distribution lines according to applicable legislation and guidelines whenever possible before work is performed on or proximity to them iv. Provision of specialised electrical safety training to those workers working with or around exposed components of electrical circuit. For instance, basic electrical theory, proper safe work procedure, hazard awareness and identification, proper use of PPE, proper lock-out/tag-out procedures, first aid including CPR and proper retraining as necessary.	Zero accident			

Phase	Potential Impacts/ Environmental Aspects	Management/Mitigation Measures	Target Level/ Performance Indicator	Implementation Timeline	Responsibility	Est Costs in TZS/ year
	Groundwater and soil/land pollution from material stockpiles (Coal, ash & lime)	The following shall be done; - • As noted earlier in section 3.7 coal shall be stored in a covered coal shed of dome structure with concrete surface and with storage capacity of 10,000 tons. Thus neither wind nor rain water shall act on the stored coal. • Coal within the plant shall be conveyed through well covered conveyor belt from one point to the other. • The resultant ash from coal combustion shall be stored in three dedicated covered silos (bed ash silo of 80m^3 capacity and two fly ash silos each with 220m^3 capacity). • Ash from the silos shall not be disposed off but shall be collected and transported by covered trucks to the Cement Plant where it shall be used as one of the additives in the Cementproduction. • Limestone shall have dedicated storage shed with bund wall to contain the same material within the shed area before usage in the process.	All storage/containing structures in place/ within the applicable standard limits (see table 8.2 below)	Structures in place before staring operation/ Monthly measurements from onsite boreholes	DCL	
	Introduction of alien/invasive species	The following shall be done; - • Green procurement shall be instituted to include stating in the specifications of Coal materials to be brought at site from suppliers that they are free from seeds and vegetative materials. • The system of monitoring incoming coal that are free from vegetative materials and seeds shall be instituted. This will involve physical inspection of the materials while in the trucks and where found to contain seeds and/or vegetative materials shall be rejected. • Coal at site shall only be stockpiled in the dedicated concrete and covered dome within the concrete fenced plant premises.	Zero incidence	Throughout operation	DCL, Suppliers	

Phase	Potential Impacts/ Environmental Aspects	Management/Mitigation Measures	Target Level/ Performance Indicator	Implementation Timeline	Responsibility	Est Costs in TZS/ year
		• Substandard coal that has been received at site shall not be disposed and instead shall be mixed with high standard coal in required proportional. • All food remains shall be handled as per attached waste management plan (see appendix 10) that do not allow food wastes to be disposed to the open environment instead food wastes are contained in container and transferred to the concrete and bonded transfer station that is hauled to the Municipal dumpsite for decomposition. • It shall be ensured that there is no encroachment of soil from storage mounds onto vegetated areas adjacent to works areas.				
	Public health hazards from the transportation of the liquid oil	The following shall be done; - • Only qualified drivers with appropriate driving license shall be engage. • Induction course shall be done to all drivers prior starting driving • The vehicles shall have a spill kit on board • The oil shall be carried by specialized tankers fully labelled with hazards signs to notify the public • Drivers shall be sensitized on maintaining speed limits for main roads and on access roads. • Promoting safe drive with specified hours for long drive to avoid fatigue • Provision of road and safety signs shall be done on site and surrounding areas that are to be followed by drivers and public in collaboration with local authority. • Ensure Traffic Management Plan is implemented accordingly	Zero incident/accident		Dangote CementLimited	5,000,000
Decommissioning	Air pollution due to dust emission from demolition works	• All trucks carrying the fine earth materials will be enclosed during transportation to the construction site to prevent dust generation along the route. Trucks used for that purpose will be	TSP < 0.23, PM_{10} < 0.05 & $PM_{2.5}$ < 0.025	During decommissioning	DCL/Contractor	20,000,000

Phase	Potential Impacts/ Environmental Aspects	Management/Mitigation Measures	Target Level/ Performance Indicator	Implementation Timeline	Responsibility	Est Costs in TZS/ year
		fitted with tailgates that close properly and with tarpaulins to cover the materials. • Measures to suppress dust shall be applied to include watering the area vulnerable for dust including routes (3 times a day)/earth roads • Trucks will be washed each morning to remove mud on mudguard and tires to reduce dust on routes • Watering shall be done also on dry excavated areas to reduce fugitive dust • Speed limits will be instituted to drivers and especially in routes passing in community centers areas. • Covering stockpile that have potential to generate fugitive dust at site				
	Air pollution due to exhaust emission	• Equipment maintenance to be undertaken in accordance with manufacturer's instructions and at the specified maintenance interval to reduce exhaust emission; • Equipment operators will be trained in and will follow equipment operational procedure. • Load limit shall be specified to type of vehicle to avoiding overloading that causes excessive exhaust emission • Timely maintenance of the trucks through regular inspection on the need for maintenance.	Units mg/m^3 SO_2<0.5, NOx < 0.2, CO_2 < 500, CO <30,	During decommissioning	DCL, Contractor	6,000,000
	Noise pollution from demolishing works	• Activities that will generate excessive/disturbing noise conditions will be restricted to daytime hours only. • All vehicles and noise emitting machines shall have properly functioning exhaust mufflers • Speed limits will be instituted to drivers and especially in routes passing in community centers areas. • Training to drivers on safe drive	Offsite stations Day < 55, Night < 45 Onsite stations Day <70, Night < 60	During decommissioning	DCL/Contractor	4,000,000

Phase	Potential Impacts/ Environmental Aspects	Management/Mitigation Measures	Target Level/ Performance Indicator	Implementation Timeline	Responsibility	Est Costs in TZS/ year
	Water pollution from salvaging and stockpiling	• An efficient collection and disposal system based on the principles of reduction, re-use and recycling of materials, shall be instituted at the site • Re-usable and recyclable materials will be accumulated and will collected by certified Waster handlers. • Special materials will be handled with care to include hydrocarbons, transformer oils and grease	Applicable standard limits (see Table 8.2 below)	During decommissioning	DCL/Contractor	6,000,000
	Waste pollution from hydrocarbons (oil, fuel, lubricants, transformer oil)	• Re-fuelling of big machines shall be done on concrete paved area with small channel towards oil scooping chamber • Vehicles shall be refuelled at dedicated dispersing area • All services for vehicles & machinery shall be done at workshop area with proper system of oil/spill management • Emergency response measures will be put on site in case of accidental oil spill that will include having absorbent materials and sand kits. • Hydrocarbons to include oil, grease and Fuel is stored at designated area that will have concrete surface with the containment bund.	<10 mg/l, Zero oil spilled area	During decommissioning	DCL/Contractor	4,000,000
	Increased sediments load due to erosion & spoils	• Progressive rehabilitation and re-vegetation of disturbed land surfaces will be ensured. All water draining from cleared areas will be directed through a sedimentation pond ensuring enough retention time for trapping sediments. Sediment traps will be constructed along drains and all water from the disturbed area will be directed through a sedimentation pond. • All unwanted materials will be stockpiled in a dedicated area away from drainage features. • A site waste management plan (WMP) shall be prepared by the contractor prior to commenCementof the works. This will include designation of appropriate waste storage areas,	No erosion tendencies	During decommissioning	DCL/Contractor	20,000,000

Phase	Potential Impacts/ Environmental Aspects	Management/Mitigation Measures	Target Level/ Performance Indicator	Implementation Timeline	Responsibility	Est Costs in TZS/ year
		collection and removal schedule, and a system for supervision and monitoring.				
	Traffic accidents	• Only qualified drivers with appropriate driving license shall be engage. • Induction course shall be done to all drivers prior starting driving • Drivers shall be sensitized on maintaining speed limits for main roads and on access roads. • Promoting safe drive • Haulage of the materials shall be done during the day time • Provision of road and safety signs shall be done on site and surrounding areas that are to be followed by drivers and public in collaboration with local authority.	Zero incident/accident		Dangote Cement Limited	15,000,000
	Occupational health and Safety hazards	• Accidents will be minimized through proper maintenance of the machines, protecting or guarding the cutting edges, and awareness of the people including workers on the dangers and make them understand how to protect themselves and others. • The supervisors shall ensure that safety procedure and measures are in place and are enforced (implemented) including appropriate safety gears (PPEs) e.g. eye glasses and dust masks will be ensured in order to reduce risks associated with dust. • The contractor shall provide adequate training to workers on the OHS of the construction • Approved working hours (i.e. eight hours per day) shall be observed in order to avoid careless mishandling due to fatigue. • Undertake site specific risk assessment and development mechanism to avoid or reduce the risks. This shall be done per each new work to be undertaken and a safety procedure shall be developed and implemented.	<0.05mg/m^3 (>0.05=PPE), <85, (>85dBA=PPE) Zero accident	During decommissioning	DCL/ Contractor	15,000,000

Table 8.2: Performance indicator for effluent

S/N	Parameter	Mg/l except pH
1	pH	6 – 9
2	TSS	50
3	Oil and Grease	10
4	Total Residual chlorine	0.2
5	Chromium-Total (cr)	0.5
6	Copper (Cu)	0.5
7	Irone (fe)	1.0
8	Zinc (Zn)	1.0
9	Lead (Pb)	0.5
10	Cadmium (Cd)	0.1
11	Mercury (Hg)	0.005
12	Arsenic (As)	0.5

Source: WB/IFC, 2008

9 ENVIRONMENTAL AND SOCIAL MONITORING PLAN (EMP)

9.1 INTRODUCTION

Based on the environmental and social impacts identified, the Environmental and Social Management Plan (ESMP) presented in chapter 8 describes technical details of each mitigation measure. This Environmental Monitoring Plan (EMP) includes monitoring objectives that specify the type of monitoring activities that will be linked to the mitigation measures. Specifically, the monitoring section provides:

- A specific description and technical details of monitoring measures that include the parameters to be measured, the methods to be used, measurement/sampling locations, frequency of measurements, detection limits (where appropriate), and definition of thresholds that will signal the need for corrective actions.

- Monitoring and reporting procedures to ensure early detection of conditions that necessitate particular mitigation measures and to furnish information on the progress and results of mitigation, e.g. by annual audits and surveys to monitor overall effectiveness of the ESMP.

The ESMP also provides a specific description of institutional arrangements, i.e. who is responsible for carrying out the mitigating and monitoring measures. Additionally, the EMP includes an estimate of the costs of the measures and activities recommended so that the project proponent (DCL) can budget the necessary funds. Subsequent sections covered the methods to be employed in the course of monitoring for the key parameters while table 9.1 below summarizes key environmental and social monitoring issues/aspects of the proposed CPP project.

9.2 MEASUREMENT METHODS AND PROCEDURES

9.2.1 Monitoring Stations

The established ambient air quality, noise and vibration monitoring stations as well as water sampling stations during the baseline study as noted in section 4.3 of chapter 4 will be used in subsequent monitoring during construction, operation and decommissioning of the captive power Plant (CPP). Measurement methods of some key parameters are covered hereunder, while more details are covered under the Baseline Survey report of February, 2017 which shall also be used in the subsequent monitoring exercise (see appendix 12).

9.2.2 Ambient Pollutant Gases Measurement

Ambient pollutant gases will be measured using portable gas analyzers with lowest detection limits of 0.01mg/m^3 as per manufacturers' procedure. The parameters to be tested will include: CO_2, CO, NO, NO_X, O_3, SO_2, H_2S and Methane. The data will be acquired hour for 24 hours during the normal operation condition of CPP, Cement Plant and mines operation.

9.2.3 Ambient Dust Concentration Measurement

Dust levels will be measured using DustTrack Aerosol Particulate Monitor that allow automatic and continuous data recordings in accordance to manufacturer procedure and applicable local standards and/or international environmental guidelines. The device is capable of testing dust particles of different dimensions (microns of 10 and 2.5 and >10) simultaneously. On taking measurements, the device will be placed at breath height of about 1.5 meter from the ground to monitor dust concentrations at each

identified station. This position is assumed to be a relatively the breathing zone of the people at their respective locality or working environment. as references for comparison in future monitoring studies.

9.2.4 Noise Levels Measurement

Daytime (Lday) and night-time (Lnight) noise levels will be measured in accordance to ISO 1996 -1:2003 using a digital sound level meter, with measurement range of 30 to 130dB (A). On taking measurements, the device-meter scale will be set to the "A" weighed measurement scale to enable it to respond in the same manner as the human ear. Moreover, the device will be fixed and/or held approximately 1.5m above the ground and at least 3m away from hard reflecting surfaces or objects. A total of 120 readings will be periodically recorded for 24 hours (with five runs being recorded after every 1 hour) to grasp the mean diurnal (morning, afternoon, evening and night hours) noise values for each station. The averaged Lday and Lnight values will be calculated thereafter.

9.2.5 Vibration Measurement

The vibrations measurement will be done using vibration meter model SDL 800 manufactured by Extech Instruments. On taking measurements, the accelerometer transducer will be mounted on the ground to record ground vibrations. To produce accurate results, the transducer will be secured in direct contact with the ground. The levels of vibrations will be recorded in terms of Peak Particle Velocity (PPV) in millimeters per second in the vertical direction. At each station, continuous 1-hour vibration readings covering morning, afternoon, evening and night hours will be measured while storing continuous values after every 5 seconds. The mean value of all recorded data at each station will be calculated and used to represent that particular station.

9.2.6 Stack Emitted Particulate Matter (TSP, PM_{10} and $PM_{2.5}$)

The hot stack particulate matter (PM) concentration will be determined using gravimetric method by a Vayubodhan stack sampler. This will be as per EPA method 17 where the particulate matter (PM) will be withdrawn iso-kinetically from the process sources and collected on a high temperature glass fiber dry-filter of known pre-weight. Pre-weighted glass membrane filter paper will be placed in a holder and then connected to gas sampler. A large known volume of air will be pumped through the pre-weighed glass membrane filter paper and the increased weight of the filter due to collected particles. The weight of particulate matter per unit volume of air will then be obtained by calculating the differences between post dry-weight and pre dry-weight of each filter, which is the dust level value for the particular environment. Besides the PM, this stack measuring kit will also monitor stack gas temperature, pressure, stack velocity, volumetric flow and pollutant gases under Isokinetic condition. The recorded parameters at each kiln stack will then be used to calculate the PM concentration in mg/m^3, as a stack representative value.

9.2.7 Stack Emitted Pollutant Gases

Stack emitted pollutant gases from the stack(s) will be measured using Flue Gas analyzer based on equipments manufacturers' procedures and reference made by ISO 9096:2003(E). Small hole of about 12-20mm diameter will be made along each stack (as a sampling point) for inserting the probe of measuring device. Multiple measurements (5 runs) will be recorded after the equipment providing stable readings (after every 3 minutes) and their average values will be used as a stack representative value.

Table 9.1 Environmental and Social Monitoring Plan

Phase	Potential Impacts/ Environmental aspects	Parameter to be monitored	Monitoring Frequency	Monitoring Area	Measurement Units	Measuring method/ Equipment	Target Level/ Performance indicator	Responsibility	Est. Costs in TZS/ year
Construction Phase	Loss of biodiversity	Cleared area	Monthly	CPP area	m	Inspection / metering the affected area	No cleared areas other than defined area. All affected areas are replanted.	DCL, Contractor	2,000,000
	Soil erosion	Eroded area	Monthly	CPP area	m	Inspection / metering the affected area	No eroded area / the disturbed areas reinstated	DCL, Contractor	2,000,000
	Air pollution due to dust emission from transportation activities and earth works	Particulate matter (TSP, PM_{10}, $PM_{2.5}$)	Monthly	Established Monitoring stations	mg/m^3	DustTrack Aerosol Particulate Monitor	TSP < 0.23, PM_{10} < 0.05 & $PM_{2.5}$ < 0.025	DCL, Contractor	4,000,000
	Air pollution from exhaust emission during transportation and machinery operating on site	SO_2, NOx, CO_2, CO,	Monthly	Established Monitoring stations	mg/m^3	portable Gas Analyzer	SO_2< 0.5, NOx < 0.2, CO_2 < 500, CO <30,	DCL, Contractor	4,000,000
	Noise pollution from constriction activities	Noise level	Monthly	Established Monitoring stations	dBA	Sound meter	Offsite stations Day < 55, Night < 45 Onsite stations Day <70, Night < 60	DCL, Contractor	3,000,000
	Water pollution due to accidental spill of oil, fuel, lubricants on site	Hydrocarbons/ Oil & Grease / area affected	Quarterly	Project area / nearby water body	mg/l, m^2	Laboratory analysis / visual	<10 / Zero oil spilled area	DCL, Contractor	3,000,000

Phase	Potential Impacts/ Environmental aspects	Parameter to be monitored	Monitoring Frequency	Monitoring Area	Measurement Units	Measuring method/ Equipment	Target Level/ Performance indicator	Responsibility	Est. Costs in TZS/ year
	Water pollution due to domestic wastes	BOD, Total coliform (TC)	Quarterly	nearby water body	Mg/l, Counts	Laboratory analysis	BOD<30, TC<100 counts	DCL, Contractor	3,000,000
	Public health hazards due to poor management of Solid waste	Solid wastes/litter	Weekly inspection	Project area & in vicinity	None	Site inspection, Observation,	Zero litter/No observed wastes on open environment	DCL, Contractor	3,000,000
	Traffic accidents along the route during transportation of construction materials	Measures in place; Licensed & trained drivers, Awareness of safe drive, safety signs, road humps, awareness to community & pupils along the routes.	Quarterly	Project site	N/A	Inspection/observation, document review	Done/ in place	DCL, Contractor	2,000,000
		Accident/incident	Monthly	Project site	Number	Reviewing accident /incident records	Zero accident	Contractor, /DCL	2,000,000
	Occupational Health and safety hazards associated with construction work	Particulate matter PM_{10},	Monthly	construction site/Working area	mg/m^3	DustTrack Aerosol Particulate Monitor	< 0.05 (>0.05 = PPE)	DCL/ Contractor	3,000,000
		Noise levels	Monthly	construction site/Working area	dBA	Sound meter	<85, (>85=PPE)	DCL/ Contractor	2,000,000
		Accident/incident	Monthly	construction site	Number	Reviewing accident/incident records	Zero accident	Contractor, Transporter /DCL	2,000,000

Phase	Potential Impacts/ Environmental aspects	Parameter to be monitored	Monitoring Frequency	Monitoring Area	Measurement Units	Measuring method/ Equipment	Target Level/ Performance indicator	Responsibility	Est. Costs in TZS/ year
		PPEs, Safety signs, safety procedures, safety training done, periodic medical checks, safety inspection	Weekly	construction site/Working area	N/A	Documents review, visual, interview	Done / in place	DCL/ Contractor	2,000,000
	Introduction of alien/invasive species	Growth of any foreign flora species	Twice annually	Project area	Number of foreign species	Physical inspection/visual	Zero foreign species	KHHL	500,000.00
Operation – Phase	Air pollution due to emission of particulate matter (dust & ash)	<u>Ambient Air</u> TSP, PM_{10}, $PM_{2.5}$,	Fortnightly	Established Monitoring stations	mg/m^3	DustTrack Aerosol Particulate Monitor	TSP < 0.23, PM_{10} < 0.05 & $PM_{2.5}$ < 0.025	DCL	12,000,000
		<u>Stack Emission</u> TSP, PM_{10}, $PM_{2.5}$,	Fortnightly	Stack(s)	mg/m^3	gravimetric method by a Vayubodhan stack sampler	PM_{10} < 50	DCL	12,000,000
	Air pollution due to emission of noxious gases	<u>Ambient Air</u> CO_2, CO, NO_2, NO_x, SO_2,	Fortnightly	Established Monitoring stations	mg/m^3	portable Gas Analyzer	SO_2< 0.5, NOx < 0.2, CO_2 < 500, CO <30,	DCL	12,000,000
		<u>Stack Emission</u> CO_2, CO, NO_2, NO_x, SO_2,	Fortnightly	Stack(s)	mg/m^3	Flue Gas analyzer	SO_2 <1500, NO_x<600 CO_2 < 500, CO<175	DCL	12,000,000
	Noise pollution and vibration	Noise level / vibration	Quarterly	Established Monitoring stations	dBA & mm/s PPV	Sound meter & Vibration meter	<u>Offsite stations</u> Day < 55, Night < 45 <u>Onsite stations</u> Day <70, Night < 60	DCL	3,000,000

Phase	Potential Impacts/ Environmental aspects	Parameter to be monitored	Monitoring Frequency	Monitoring Area	Measurement Units	Measuring method/ Equipment	Target Level/ Performance indicator	Responsibility	Est. Costs in TZS/ year
	Water pollution from Raw Water Treatment plant effluent	Physical & chemical parameters	Weekly (Before being re-used)	Effluent of treatment plant	mg/l	Laboratory Analysis	Applicable standard limits (see Table 8.2 above)	DCL	18,000,000
	Water and land pollution from hydrocarbons	Hydrocarbons/ Oil & Grease / area affected	Quarterly	Project area / nearby water body /onsite boreholes	mg/l, m^2	Laboratory analysis / visual	<10 / Zero oil spilled area	DCL	3,000,000
	Water resource use conflict with nearby community boreholes	Water availability	Every six months	Nearby Community borehole at Mbuo Village	m^3/hr	Pumping Test	No decrease change from baseline condition ($35m^3$/hr)	DCL	4,000,000
	Potential for fire hazards	Moisture content of stored coal, temperature of stored coal,	Continuous (temp. detectors)	Coal storage Dome	^{0}C, %	Thermometer,	Temp. <35, Moisture <3	DCL	2,000,000
		Measures in place e.g. fire alarms, fire detectors, firefighting equipment, equipment inspection, fire training, emergency alarm,	Monthly	Project site	N/A	Inspection/observation, document review	Done/ in place	DCL	2,000,000
		Accident/incident	Monthly	Project area	Number of cases	Incidence/accident records	No exposure	DCL	2,000,000

Phase	Potential Impacts/ Environmental aspects	Parameter to be monitored	Monitoring Frequency	Monitoring Area	Measurement Units	Measuring method/ Equipment	Target Level/ Performance indicator	Responsibility	Est. Costs in TZS/ year
	Traffic accidents	Accident/incident	Quarterly	Project site	Number	Reviewing accident/incident records	Zero accident	Transporter /DCL	2,000,000
		Measures in place; Licensed & trained drivers, Awareness of safe drive, safety signs, road humps, awareness to community & pupils along the routes.	Quarterly	Project site	N/A	Inspection/observation, document review	Done/ in place	DCL	2,000,000
	Occupational health and safety hazards	Noise levels	Monthly	Working area	dBA	Sound metring	<85 (>85=PPE)	DCL	2,000,000
		EMF	Monthly	Working area	v/m & uT	EMF metering	At 50Hz Electric 10,000v/m, Magnetic 500 uT	DCL	3,000,000
		Temperature	Monthly	Working area	^{0}C	Thermometer measurement	<27^{0}C,	DCL	2,000,000
		Light	Monthly	Working rooms	lux	Lux metering	500 lux	DCL	2,000,000
		PPEs, Safety signs, safety procedures, safety training done, periodic medical checks, safety inspection	Monthly	construction site/Working area	N/A	Documents review, visual, interview	Done / in place	DCL, Contractor	2,000,000
		Incident/accident	Monthly	Project site	Number	Reviewing accident/incident records	Zero accident	Transporter /DCL	2,000,000

Phase	Potential Impacts/ Environmental aspects	Parameter to be monitored	Monitoring Frequency	Monitoring Area	Measurement Units	Measuring method/ Equipment	Target Level/ Performance indicator	Responsibility	Est. Costs in TZS/ year
	Groundwater and soil/land pollution from material stockpiles (Coal, ash & lime)	Physical & chemical parameters	Monthly	Onsite boreholes	mg/l, pH level	Laboratory Analysis	Within applicable standard limits (see Table 8.2 above)	DCL	3,000,000
	Introduction of alien/invasive species	Growth of any foreign flora species	Twice annually	Project area	Number of foreign species	Physical inspection/visual	Zero foreign species	KHHL	500,000.00
Decommissioning	Air pollution due to dust emission from demolition works	TSP, PM_{10}, $PM_{2.5}$,	Monthly	Established Monitoring stations	mg/m^3	DustTrack Aerosol Particulate Monitor	TSP < 0.23, PM_{10} < 0.05 & $PM_{2.5}$ < 0.025	DCL, Contractor	4,000,000
	Air pollution from exhaust emission during transportation and machinery operating on site	SO_2, NOx, CO_2, CO,	Monthly	Established Monitoring stations	mg/m^3	portable Gas Analyzer	SO_2< 0.5, NOx < 0.2, CO_2 < 500, CO <30,	DCL, Contractor	4,000,000
	Noise pollution from demolishing works	Noise level	Monthly	Established Monitoring stations	dBA	Sound meter	Offsite stations Day < 55, Night < 45 Onsite stations Day <70, Night < 60	DCL, Contractor	3,000,000
	Water pollution from salvaging and stockpiling	Physical & chemical parameters	Quarterly	Nearby water body	mg/l	Laboratory Analysis	Applicable standard limits (see Table 8.2 above)	DCL, Contractor	3,000,000
	Water pollution from hydrocarbons (oil, fuel, lubricants)	Hydrocarbons/ Oil & Grease / area affected	Quarterly	Project area / nearby water body	mg/l, m^2	Laboratory analysis / visual	<10 / Zero oil spilled area	DCL, Contractor	3,000,000

Phase	Potential Impacts/ Environmental aspects	Parameter to be monitored	Monitoring Frequency	Monitoring Area	Measurement Units	Measuring method/ Equipment	Target Level/ Performance indicator	Responsibility	Est. Costs in TZS/ year
	Soil erosion from earth works and eventually sediment increase in nearby water bodies	Eroded area, turbidity/sediments	Monthly	Project area, nearby water body	m^2, NTU	Visual, laboratory analysis, sediment measuring	No eroded area, < 300 NTU	DCL, Contractor	3,000,000
	Traffic accidents	Accident/incident	Monthly	Project site	Number	Reviewing accident/incident records	Zero accident	DCL, Contractor	2,000,000
		Measures in place; Licensed & trained drivers, Awareness of safe drive, safety signs, road humps, awareness to community & pupils along the routes.	Monthly	Project site	N/A	Inspection/observation, document review	Done/ in place	DCL, Contractor	2,000,000
	Occupational health and Safety hazards	Particulate matter PM_{10},	Monthly	construction site/Working area	mg/m^3	DustTrack Aerosol Particulate Monitor	< 0.05 (>0.05 = PPE)	DCL, Contractor	2,000,000
		Noise levels	Monthly	construction site/Working area	dBA	Sound meter	<85, (>85=PPE)	DCL, Contractor	2,000,000
		Accident/incident	Monthly	construction site	Number	Reviewing accident/incident records	Zero accident	Contractor, /DCL	2,000,000
		PPEs, Safety signs, safety procedures, safety training done,	Monthly	construction site/Working area	N/A	Documents review, visual, interview	Done / in place	DCL, Contractor	2,000,000

Phase	Potential Impacts/ Environmental aspects	Parameter to be monitored	Monitoring Frequency	Monitoring Area	Measurement Units	Measuring method/ Equipment	Target Level/ Performance indicator	Responsibility	Est. Costs in TZS/ year
		periodic medical checks, safety inspection							

10 PRELIMINARY DECOMMISSIONING PLAN

10.1 INTRODUCTION

The preliminary decommissioning plan serves to establish decommissioning as an important consideration from the inception of the project, during design and throughout the operation of the project. The plan has the following purposes:

a) The primary purpose of the preliminary plan is to ensure that the project designers are cognizant of decommissioning during the initial design of the plant in general. Thus, where design choices that would enhance decommissioning are available for types of materials and system components, and location of components, these choices should be made.
b) Another purpose of the plan is to identity the ultimate decommissioning options and final project status. These options would be evaluated and narrowed to the decommissioning method of choice as the end of project life is approached.
c) The final purpose of the plan is to demonstrate to regulatory agencies and financial institutions that important aspects of decommissioning are considered as early as possible during the initial design of the power plant. The plan serves as the starting point to demonstrate that areas such as decommissioning methods, costs, schedules, and operating impact on decommissioning will be reviewed and refined throughout the operating life of the project.

10.2 PLAN CONTENT

The plan will provide a general description of decommissioning options and methods considered feasible for the project. The description should demonstrate that the option and methods considered are practical and that they protect the environment, health and safety of the public as well as decommissioning personnel. Design personnel should study the proposed decommissioning methods and take steps to ensure that the design incorporates features that will facilitate smooth decommissioning.

Considerations include:

a) Options of decommissioning
b) Provisions for adequate material-handling equipment.
c) An estimate of manpower, materials, and costs anticipated to support the decommissioning.
d) A description of the anticipated final disposition and status of the facilities and site.
e) A discussion demonstrating that adequate financing will be programmed for decommissioning.
f) Identification of records that should be maintained during development and operation which might facilitate smooth decommissioning, including a set of “as built” drawings.

10.3 DECOMISSIONING OPTIONS

Based on this understanding Among of the options considered for decommissioning the project include; -

i. Total removal of the constructed and installed infrastructures to restore the area close to the original status. This might entail also incur some efforts to restore the area such as planting the vegetation of the area, removing properly all structures that might pose hazards to the public after decommissioning.

ii. The second option looked at is to retain the major infrastructures for other potential operator such as TANESCO bearing the fact that the TPDC Pipeline is there to stay and thus the gas supply will still

be there. Or converting the infrastructures for educational purpose and especially for practical and demonstration of the typical thermal power plant and its operation for mechanical and electrical engineering students at various levels could be high institutions for degree students or for vocational training students.

Considering the two options described above the most viable option is to retain most of the infrastructures for TANESCO for socio-economic use. This will further have a multiple benefit to both parties, as the process of restoring the site close to its original state has got costs implication to the proponent and thus savings, while infrastructures will address the socio-economic need of the nation. Currently the Government is struggling to electrify most parts of the Country while only about 24% of the Country population is connected to the electricity. At the same time 88% of the energy is from biomass and only about 3% is from electricity. (J.F. Kitonga et al, 2015). Furthermore, currently TANESCO electricity supply cannot offset full electrical needs of the Country, a typical example is Dangote Cement Plant needs. This implies that the need for electrical infrastructures for electricity supply to the national grid by TANESCO is there to stay especially with continued increasing electricity demand growth rate current of 10 – 15% (*Ditto, pp.7*). Donating this infrastructure to the Parastatal organization (i.e. TANESCO) for generation of the 50MW electricity into the National Grid is something recommendable at any point in time.

In this case decommissioning will entail handing over the infrastructures and all related structures to the government through TANESCO. Should this be a decision then impacts related to decommissioning of the project will be negligible as only few activities will be involved. Furthermore, this is a wise decision taking into account the socio-economic needs of such kind of the project at the present and hopefully in the future.

10.4 PROJECT CLOSSURE METHODOLOGY AND SCHEDULE

Despite that major infrastructures (i.e. the CPP and its associated structures, workshop, fuel storage shed, internal roads, electrical network, and water supply pipes) will be retained there are some activities need to be performed by the closure part to ensure smooth decommissioning. These will include undertaking closure environmental assessment and permitting. The Company shall monitor environmental impacts during and after Project closure on defined time to respond to defined events during the monitoring phase. The Company shall ensure the closure is undertaken in safer and in a manner that:

- minimizes environmental impacts;
- satisfies the Proponent's obligations under the EMA (2004); and
- restores the site to a condition suitable for use.

The decommission activities will begin one year after closure when environmental assessment is also concluded and this will last for about another three months considering that there will be no major civil activities for decommissioning. The Proponent will undertake inventory of all components that need to be removed and those to be handled over to the second part as well as for those to be disposed (if any). Such components to be removed will include connection components to the Cement Plant of which will be redundant. This information will also assist in the preparation of the environmental assessment decommissioning for approval by the National Environment Management Council (NEMC).

After the approval of the closure assessment report then those elements that will require physical removal can start to be removed and after defined time the formal handing over shall be done accordingly. The second part shall take full environmental responsibility and liability of the Plant thereof.

10.5 CLOSURE COST ESTIMATES

Due to chooses closure option the following are deduced to be the costs estimates based on activities to be undertaken. However, this are just present costs that shall be factored in the future based on fiscal changes between the two elapsed time.

Table 10.1: CPP Closure Cost Estimates

S/N	PARTICULARS	ESTIMATED COSTS (USD)
1	Undertaking environmental assessment for the closure	25,000.00
2	Approval & permitting by the government entity	8,000.00
3	Removal of some structures ()	70,000.00
4	Landscaping of the area	15,000.00
5	Monitoring of the key aspects (One year)	50,000.00
	Sub-total	**168,000.00**
	Miscellaneous (10%)	16,800.00
10	**Total amount**	**174,800.00**

11 SUMMARY AND CONCLUSION

The study has scrutinized the environmental and social implications of the proposed 50 MW Multi Fuel Captive Power Plant within Dangote Cement Plant at Hiyari Village, Mayanga ward of Mtwara District, Mtwara Region, Tanzania. It is evident that development of the CPP project will result in overall economic growth and development in the area as a result of supporting full scale Cement Production. The Environmental and Social Impact Assessment (EIA) study for the project indicates that, the potential negative impacts can be mitigated without any major effect to the siting and surrounding environment. However, some important resources may be affected negatively such as flora, fauna, the land and water resources as well as air. The impacts associated with these mostly vary from low to moderate significance and can be mitigated as shown in the Environmental and Social Management plan of chapter eight to this document.

The project will be implemented on the already developed and modified environment within the Cement Plant premises where there are no pristine environment conditions to be significantly affected by the project. Further, the site earmarked for the CPP is with enough buffer to the nearby sensitive receptors (settlement of Hiyari village) to ensure minimal impact to the social aspects. Likewise, at site and in the vicinity of the project site there is no ecological sensitive receptors such as national park, forest reserve, game reserve etc. that the project could pose serious threat to these sensitive components.

The study concludes that a number of environmental impacts have been identified and assessed; none of these are considered to be that severe after mitigation as to prevent the further planning, and development of the project in the area. Thus, the project development in the area can be considered suitable subject to the implementation of the mitigation measures as indicated in the Environmental and Social Management Plan. Further, in order to further sustainability of the project in the area it is recommended that, the proposed Monitoring Plan should be implemented accordingly for consistence efficacy of mitigation measures or timely corrective measures before significant impacts to the environment and social components.

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APPENDICIES

APPENDIX 1: TERMS OF REFERENCE

TERMS OF REFERENCE FOR UNDERTAKING ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) STUDY FOR THE PROPOSED 50MW MULTI-FUEL CAPTIVE POWER PLANT WITHIN DANGOTE CEMENT PLANT AT HIYARI VILLAGE, MAYANGA WARD, MTWARA DISTRICT, MTWARA REGION, TANZANIA.

1. INTRODUCTION

1.1 Project Background

Dangote Cement is Africa's leading Cement producer with existing and planned operations in 16 African countries, revenues in excess of US$2 billion and nearly 17,000 employees. It is a fully integrated quarry-to-customer producer with production capacity of up to 43.3 million tonnes per annum (Mta) across Africa at the end of 2015. The Company is investing several billion dollars to build manufacturing plants and import/grinding terminals across Africa and by 2020 the plan is to have more than 70Mta capacity across Africa and beyond. The operational facilities are in Nigeria, Senegal, South Africa, Cameroon and Ghana (importation), Ethiopia, Zambia, Tanzania and are committed to building integrated production factories in Rep. Congo, Kenya, Zimbabwe and outside of Africa, Nepal. Dangote Cement is the largest company on the Nigerian Stock Exchange, having listed its shares in October 2010.

The 3.0Mta plant in Mtwara – about 400km from Dar es Salaam – was commissioned in December 2015 and is the largest Cement factory in Tanzania. With about 500 million tonnes of limestone reserves, enough for 149 years, the plant is capable of producing large amounts of high-quality 32.5 and 42.5 grade cements to meet local market needs at competitive prices, as well as surrounding export markets by sea. With an estimated population of about 42 million, Tanzania's per-capita Cement consumption of around 50kg per annum is well below the global average and low even for Africa. Tanzania's economy is expected to grow at an estimated 7.0% over the next five years, supported by the manufacturing, mining and tourism sectors. The improving performance of the economy has fueled strong growth in Cement demand and the prospects remain favourable, given the linear relationship between economic growth and Cement consumption. The plant is being run by costly diesel powered generators while plans for 50 MW Multi fuel Captive Power Plant are underway. Towards this realization environmental and social impact assessment has to be undertaken in line with World Band and IFC Guidelines requirements.

1.2 Objectives of EIA

The objectives of the EIA are:

- To establish baseline information on both natural and built environment including socio-economic conditions of the project area of Hiyari Village, Mayanga ward of Mtwara District, Mtwara Region, Tanzania.
- To identify, predict and evaluate foreseeable impacts, both beneficial and adverse, of the proposed project; and
- To develop mitigation measures that aim at eliminating or minimising the potential negative impacts and promote positive ones.
- To develop management clauses and monitoring aspects to be observed during project implementation.

1.3 Environmental Assessment Requirements

The World Bank's environmental review process, thermal power plant generation facilities are considered as Category A project and require a comprehensive ESIA study.

1.4 Study Area

The Captive Power Plant (CPP) is to be located within the Concrete fenced Premises of the Cement Plant on the further eastern side. The Cement Plant is located at Hiyari Village of Mayanga Ward in Mtwara District, Mtwara Region, Tanzania. The specific coordinates of the CPP site are 10°15'24.48"S, and 40° 2'48.54"E.

1.5 Environmental Impact Assessment Scope of Work

Task 1: Description of the Proposed Project
The Consultant shall give details of:

- Location of all project-related development and operation sites
- General layout of facilities - diagrams of facilities, design basis, size, sources of utilities;
- pre-construction activities and construction activities;
- Organizational relationships, mandates and interactions among the different parties to be involved in the project

Task 2: Description of the Environment
The Consultant shall:

i. Provide general description of the project environment and sources of information for anyone requiring a more extensive description (especially the EIA reviewers).
ii. Identify those features that are particularly important in the project area – Hiyari area and other areas related to the project in Mtwara District i.e. maps at appropriate scales to illustrate the surrounding areas likely to be environmentally and socially affected.
iii. Identify areas that require special attention in the project implementation.

Environmental Impact Assessment shall specifically focus on these ecological components in the environment to ensure that the proposed development does not harm the well-being or these characteristics.

Task 3: Legislative and Regulatory Considerations
The Consultant shall:
Describe pertinent local, national and international regulations and standards governing environmental quality, health and safety, land use control etc. which the project developer required to observe during the implementation of the project activities.

Task 4: Determination of Potential Impacts of the new Proposed Project Component
Under this activity the consultant shall:

i. identify issues and concerns in order to find suitable remedies;
ii. identify linkages among project components and the issues;
iii. identify where project activities or elements interact with social and biophysical environment (direct impacts):
iv. identify indirect impacts of the project on the environment;
v. identify cumulative impacts that may be anticipated;
vi. identify residual impacts if any;
vii. predict probability, magnitude, distribution and timing of expected impacts:
viii. for certain project components it might be necessary to carry out assessment at two or more sites (alternatives) in order to come out with the best option; and
ix. Forecast what will happen to the affected environmental components if the project is implemented as is or if the alternatives (e.g. sites and routes) are chosen.

Task 5: Estimation of the significance of the impacts
The consultant shall:

i. determine which environmental components are mostly affected by the project or its alternatives;
ii. list issues raised by the public and classify them according the level and frequency of concern whenever possible;
iii. list regulatory standards, guidelines etc. that need to be met; and
iv. Rank predicted impacts in order of priority for avoidance, mitigation, compensation and monitoring.

Task 6: Development of Management Plan to Mitigate Negative Impacts and develop a monitoring plan
The consultant shall: -

i. determine appropriate measures to avoid or mitigate undesirable impacts;

ii. assess and describe the anticipated effectiveness of proposed measures;
iii. ascertain regulatory requirements and expected performance standards;
iv. determine and assess methods to monitor impacts for prediction accuracy remedial measures for effectiveness;
v. determine and assess methods to monitor for early warning of unexpected effects;
vi. re-assess project plans, design and project management structure;
vii. describe follow-up scheme and post-project action plan for achieving EIA objectives; and
viii. Assess the level of financial commitment by the project proponent for the management and monitoring plan, and follow up activities.

The consultant shall be guided by the cost-effectiveness principles in proposing amelioration measures. Estimation of costs of those measures shall be made. The assessment will provide a detailed plan to monitor the implementation of the mitigation measures and impacts of the project during construction and operation.

Task 7: Drawing Recommendations
The consultant shall:
i. highlight key concerns and considerations associated with the acceptance and implementation of recommended actions;
ii. determine resources requirements for implementing recommendations;
iii. determine capacity and resourcefulness of the client to meeting such commitment;
iv. explain rationale for proposed development and benefits and costs vis-à-vis the no-project option;
v. Ascertain degree of public acceptance of or reaction to recommendations.

Task 8: Environmental Impact Statement (EIS)
The assessment shall result into an EIS focusing on findings of the assessment, conclusions and recommended actions, supported by summaries of data collected etc. This shall be a concise document limited to significant environmental issues.

Task 9: Review
The review report from reviewers may require further input (data collection, consultation inputs etc.). The consultant shall undertake to provide extra information and inputs until the project review is satisfactorily concluded.

Task 10: Public involvement
The assessment shall establish the level of consultation of the affected stakeholders before designing the project, level of involvement in the running and maintenance of the project facilities as this is an important aspect for both environmental and project sustainability.

The assessment will provide a framework:
- For co-ordinating the environmental impact assessment with other government agencies, and
- For obtaining the views of affected groups, and in keeping records of meeting and other activities, communications, and comments and their disposition.

Consultations with various stakeholders have been conducted during the initial studies and further consultation will be conducted during the EIA study to complement on the existing information (where necessary).

1.6 Time Scale

It is expected that the study would be completed within a period of three months.

1.7 Personnel Requirement

The consultants shall deploy consultants/experts with the demonstrable practical experience in conducing EIA studies. Specific experience/competence in GIS, environmental management & planning and socio-economic will be deployed.

1.8 Reporting and Report Presentation

The draft of the EIA document submitted to Dangote CementLimited should be concise, and well written for simplifying the review process.

1.9 Record of Meetings

The consultants shall provide record of the names of organizations, government and departments and individuals whose views will be obtained. The record will also provide description of views and information that will be obtained.

1.10 Outputs

The consultant shall submit to the Client, 2 original bound hard copies and electronic copies of the final ESIA Report.

1.11 Reference

The consultant shall provide a list of all information sources used, including unpublished documents and sources.

APPENDIX 2: CERTIFICATE OF OCCUPANCY

TANGANYIKA

The Land Registration Ordinance (Cap. 334 of the Laws)

CERTIFICATE OF TITLE TO RIGHT OF OCCUPANCY

(SUB TITLE)

copy of

This is to certify that the annexed Certificate of Occupancy dated

the 7th day of March 20..2012

is registered in the Land Registry under Title No. 3287

Copies of the subsisting entries in the register are within

Dated the 07th day of March 20..12

JUMA LEGHEIA

Asst. *Registrar of Title*

Title No. 3287/1 Description of registered land.

All that land known as Plot No.2 situated at Mbuo; Hiyari and Mnyundo in Mwara District containing One Hundred Forty Decimal Point Seven Five Seven (140.757) Hectares shown for identification only edged black on the plan attached to this lease agreement registered

Land Form No. 56

TANZANIA INVESTMENT CENTRE

THE LAND ACT
(No. 4 of 1999)

DERIVATIVE RIGHT
(Under Section 20)

C.T. No. 3287
L.O. No. 456138
REF. No. 303951

Made and entered into this 27th **day of** February **2012**

BETWEEN

TANZANIA INVESTMENT CENTRE

A body corporate established under THE INVESTMENT ACT, 1997 (ACT No. 26 of 1997) by order published in the Official Gazette as Government Notice No. 291 of 1997, (Hereinafter referred to as "the Lessor") on the one part

AND

M/S DANGOTE INDUSTRIES LIMITED of P.O Box 12038, DAR ES SALAAM AND HAVING CERTIFICATE OF INCENTIVES No. 041385
(Hereinafter referred to as "the Lessee") on the other part.

THIS LEASE WITNESSES as follows:

WHEREAS the Lessor is the holder of a Right of Occupancy registered in the Land Registry at Mtwara, under Title No. **3287** in respect of land within Plot No. **2**, measuring **one hundred forty decimal point seven five seven (140.757) hectares**, situated at Mbuo, Hiyari and Mnyundo in **Mtwara District**; and in the terms thereof is authorized to grant leases, the Lessor hereby demises unto the Lessee the Land being more fully described in the schedule hereto for a term of **98 years** commencing on the **first** day of **January, two thousand** and **twelve,** and expiring on the **thirty first** day of **December, two thousand one hundred** and **ten** subject to the provisions of the Land Act No. 4 of 1999 and regulations made thereunder and subject to the following conditions:-

The Land shall be used for **General Industrial** purposes only; Use Group **'O'** use classes **(a)** as defined in the Town and Country Planning (Use Classes) Regulations, 1960 as amended in 1993.

1

FILED DOCUMENTS ON 27th
REG'D 2-3-2012
AT 1.00 P M

Stamp Duty Shs 500/= Paid
and Revenue Receipt No 46340663
of 2-3-2012 Issued

Registrar of Titles

SCHEDULE

ALL that land known as Plot No. **2**, situating at Mbuo, Hiyari and Mnyundo in **Mtwara District**; containing **one hundred forty decimal point seven five seven (140.757) hectares**, and shown for identification only edged **black** on the plan attached to this Certificate and defined on the Registered Survey Plan Numbered **67876** deposited at the Office of the Director for Surveys and Mapping at Dar es salaam.

SEALED with the **COMMON SEAL** of the said **M/S DANGOTE INDUSTRIES LIMITED** and DELIVERED in the presence

of us this 27 day of February 2012)

Signature .....)
Postal Address P.O. Box 1241, MTWARA)
Qualification Group Executive Director)

Signature .....)
Postal Address P.O. Box 1241, MTWARA)
Qualification Project Head of country Representative)

SEALED with the **COMMON SEAL** of the said **TANZANIA INVESTMENT CENTRE** and DELIVERED in our presence

of us this 8th day of February 2012)

Signature .....)
Postal Address 938 DAR ES SALAAM)
Qualification ACTING EXECUTIVE DIRECTOR)

Signature .....)
Postal Address 938 DAR ES SALAAM)
Qualification LEGAL AFFAIRS MANAGER)

TANGANYIKA STAMP DUTY
Stamp Duty Shs 500/=
Or original Receipt No 46340663
2-3-2012

APPENDIX 3: DESIGNATION OF LAND FOR INVESTMENT PURPOSES

Namba ya Kiwanja: TKM/TMK/MGG15/47.
Mwombaji: OMARI MSHAMU.

TAARIFA IMETOLEWA kwamba leseni ya makazi iliyotajwa hapo juu imepotea na ninakusudia kutoa Leseni ya Makazi mpya badala yake iwapo hakuna pingamizi kwa muda wa mwezi mmoja tokea tarehe ya taarifa hii itakapotangazwa katika Gazeti la Serikali.

LESENI YA MAKAZI YA ASILI ikionekana irudishwe kwa Msajili wa Nyaraka Msaidizi, S. L. P. 46343 Temeke, Dar es Salaam.

MWASIJA R. A,
Msajili Msaidizi Leseni za Makazi
Temeke Manispaa

TAARIFA YA KAWAIDA NA. 1062

KUFUTWA KWA LESENI YA MAKAZI
Sheria ya Uandikishaji wa Ardhi
(Sura 117)

Namba ya Leseni: KND06223.
Mmiliki: CYLIACUS CYRIDION RWEYAMAMU.
Namba ya Kiwanja: KND/MBB/JTG1/199.
Mwombaji: KINONDONI MUNICIPAL.

TAARIFA IMETOLEWA kwamba Leseni ya Makazi iliyotajwa hapo juu ina mgogoro na ninakusudia kuifuta iwapo hakutakuwa na pingamizi kwa muda wa siku thelathini (30) tokea tarehe ya taarifa hii itakapotangazwa katika Gazeti la Serikali.

.....
Afisa Mteule - Leseni za Makazi
Halmashauri ya Manispaa ya Kinondoni

TAARIFA YA KAWAIDA NA. 1063

KUPOTEA KWA BARUA YA TOLEO YA KUMILIKI ARDHI
Sheria ya Ardhi ya Mwaka 1999

Barua ya Toleo yenye Kumb. No.: LD/137371/1/CFK.
Mmiliki aliyeandikishwa: MVUNILWA AVUNILWA MSANGATI.
Ardhi: Shamba Namba 125 Kitalu 'G' Tegeta, Manispaa ya Kinondoni, Dar es Salaam.
Muombaji: DICKENS JACOB OGONG JUNIOR.

TAARIFA INATOLEWA kwamba BARUA YA TOLEO YA KUMILIKI ARDHI iliyotajwa hapo juu imepotea na ninakusudia kutoa NAKALA HALISI YA BARUA YA TOLEO YA KUMILIKI ARDHI iwapo hakuna pingamizi litakalotolewa kwa muda wa mwezi mmoja tangu tarehe ya taarifa hii itakapotangazwa katika Gazeti la Serikali.

BARUA HALISI YA TOLEO ikipatikana, irudishwe kwa KAMISHNA WA ARDHI, Wizara ya Ardhi Nyumba na Maendeleo ya Makazi S. L. P. 9230, Dar es Salaam.

C. BINALI,
Kny; Kamishna wa Ardhi

TAARIFA YA KAWAIDA NA. 1064

DESIGNATION OF LAND FOR INVESTMENT PURPOSES
(Under section 20)

THE LAND ACT, 1999
(No. 4 OF 1999)

I BRAMSIDEN LAIMOS SICHONE Assistant Commissioner for Lands of P. O. Box 9230, Dar es Salaam HEREBY DESIGNATE the following land(s) for investment purposes under the **Tanzania Investment Act** No. 26 of 1997:-

(a) Area known as **Plot No. 1 Mbuo, Hiyari and Mnyundo in Mtwara District.**

(b) Measuring **95.340 Hectares** bound with beacons **KZQ 721, KZQ 722, KZQ 723, KZQ 724, KZQ 725, KZQ 726, KZQ 727, KZQ 728, KZQ 729, KZQ 783, KZQ 730, KZQ 751, KZQ 750 KZQ 749, KZQ 748, KZQ 758, KZQ 746, KZQ 745, KZQ 744, KZQ 743, KZQ 742, KZQ 741, KZQ 740, KZQ 731, KZQ 732, KZQ 733, KZQ 734, KZQ 735, KZQ 736, KZQ 737, KZQ 738,** on Registered Plan No. **67876.**

(c) Situated in **Mtwara District.**

(d) The Land is designated for **Industrial and Mining** purposes only.

Dated at Dar es Salaam this 7th day of December, 2011.

.....
Assistant Commissioner for Lands

Copies served upon us:

.....
Ag. Executive Director, Tanzania Investment Centre

Date: 14th December, 2011

.....
Authorised Land Officer in charge of the District

Date: .....

TAARIFA YA KAWAIDA NA. 1065

DESIGNATION OF LAND FOR INVESTMENT PURPOSES

(Under section 20)

THE LAND ACT, 1999
(No. 4 OF 1999)

I BRAMSIDEN LAIMOS SICHONE Assistant Commissioner for Lands of P. O. Box 9230, Dar es Salaam HEREBY DESIGNATE the following land(s) for investment purposes under the **Tanzania Investment Act** No. 26 of 1997:-

(a) Area known as **Plot No. 2 Mbuo, Hiyari and Mnyundo in Mtwara District.**

(b) Measuring **140.757 Hectares** bound with beacons **KZQ 700, KZQ 701, KZQ 702, KZQ 703, KZQ 704, KZQ 705, KZQ 706, KZQ 707, KZQ 708, KZQ 709, KZQ 710, KZQ 739, KZQ 712 KZQ 713, KZQ 714, KZQ 715, KZQ 716, KZQ 717, KZQ 718, KZQ 719** and **KZQ 720,** on Registered Plan No. **67876.**

(c) Situated in **Mtwara District.**

(d) The Land is designated for **Housing Estate** purposes only.

Dated at Dar es Salaam this 7th day of December, 2011.

.....
Assistant Commissioner for Lands

Copies served upon us:

.....
Ag. Executive Director, Tanzania Investment Centre

Date: 14th December, 2011

.....
Authorised Land Officer in charge of the District

Date: .....

TAARIFA YA KAWAIDA NA. 1066

BUSINESS REGISTRATIONS AND LICENSING AGENCY

ADVERTISEMENT OF WINDING - UP PETITION

Pursuant to section 281 of the Companies Act 2002

In the Matter of: 2000 Industries Limited.

A Petition to wind up the above named Company, of:

Address:	2000 Industries Limited, Plot No. 42 Light Industry, Mikocheni Area
	P. O. Box 40120, Dar es Salaam, Tanzania
presented on:	21st July, 2010
by: (name and address of petitioner)	MODERN FLEXIBLE PACKAGING LTD, PLOT NO. 109A MBOZI ROAD, CHANG'OMBE AREA, P. O. BOX 9958, DAR ES SALAAM, TANZANIA

claiming to be a [creditor] of the Company,

will be heard at: (Name of Court)	HIGH COURT OF TANZANIA AT DAR ES SALAAM (DISTRICT REGISTRY)
on (date):	6th February, 2012
at (time):	9:00 AM

(or as soon thereafter as the petition can be heard)

Any person intending to appear on the hearing of the Petition (whether to support it or to oppose it) must give notice of his intention to do so to the petitioner or his/its Advocate in accordance with Rule 3.16 of the Companies (Insolvency Rules) 2003 by 16:00 hours on the business day before the date of the hearing given above.

The Petitioner's Advocate is:	Jonathan Mbuga, Jurisconsults Law Chambers, Jamhuri/Simu Street, Panayotou Building 2nd Floor, P. O. Box 3750, Dar es Salaam, Tanzania

Dated 19th December, 2011.

TAARIFA YA KAWAIDA NA. 1067

SPECIAL RESOLUTION

EXTRA ORDINARY GENERAL MEETING OF MEMBERS OF VENTURE COMMUNICATIONS TANZANIA LIMITED

HELD ON 7TH DECEMBER, 2011 AT LEO ATTORNEYS OFFICES, P. O. BOX 78572, DAR ES SALAAM

Company No. 45457

IT WAS RESOLVED THAT:

1. The shareholders do not intend to continue with operations of the company, therefore it is hereby resolved that the company should be wound up voluntarily subject to complying with necessary procedures provided under the law.

2. It is hereby resolved that Dr. Wilbert Kapinga of Mkono and Company of P. O. Box 4369, Dar es Salaam be and is hereby appointed to be the Liquidator of this company.....

That the resolution should be filed with Registrar of Companies

Shareholder
VENTURE COMMUNICATIONS MAURITIUS LIMITED

Shareholder
AMI MPUNGWE

APPENDIX 4: EIA CERTIFICATES FOR CEMENT PLANT AND ASSOCIATED COMPONENTS (CAPTIVE POWER PLANT INCLUSIVE)

GN. No. 349

THE UNITED REPUBLIC OF TANZANIA

ENVIRONMENTAL IMPACT ASSESSMENT

Certificate

[Section 92(1) of the Environmental Management Act No. 20 of 2004]

Application Reference No. 1844
Registration No. EC/EIS/694
This is to Certify that

M/S. DANGOTE INDUSTRIES TANZANIA LTD

of P. O. BOX 1241, MTWARA

has this day been granted an Enviromental Impact Assessment Certificate for the proposed project/Activity titled. ESTABLISHMENT OF CEMENT PRODUCTION FACILITY

to be implemented/carried out at. MBUO VILLAGE IN MTWARA RURAL, MTWARA REGION

This certificate shall remain in force during the whole lifecycle of this specific project unless henceforth revoked or suspended.

General conditions and terms attached to this certificate are set out herein behind and specific conditions are annexed.

Dated this 24TH day of SEPTEMBAR 2012

Dr. Terezya Luoga Huvisa (MP)
Minister of State, Vice-President's Office - Environment

Form No. 6

Regulation 35 (2)

THE UNITED REPUBLIC OF TANZANIA

THE ENVIRONMENTAL MANAGEMENT ACT, 2004
CERTIFICATE OF VARIATION OF ENVIRONMENTAL IMPACT ASSESSMENT CERTIFICATE

Application Reference No. **1403**

Certificate No. **EC/EIS/694**

This is to certify that

The Environmental Impact Assessment Certificate **No. EC/EIS/694** issued on **24th September 2012 to Dangote Industries Tanzania Limited** of **P. O. Box 1241, Mtwara** regarding **the establishment of cement production facility at Mbuo village in Mtwara Rural district, Mtwara region** whose objective was cement production has been varied to **establishment of cement production facility** at **Hiyari village, Mayanga ward in Mtwara Rural district, Mtwara region** in accordance with the provisions of the Act.

Dated this 11th day of July 2016

Signature .....

January Y. Makamba (MP)

Minister of State, Vice President's Office - Union and Environment

APPENDIX 5: BOREHOLE DRILLING PERMITS & WATER USE PERMITS

UNITED REPUBLIC OF TANZANIA
MINISTRY OF WATER

RUVUMA RIVER AND SOUTHERN COAST BASIN

PROVISIONAL FOR A WATER USE PERMIT

The Water Utilization (Control and Regulation) Act, 2009 (Section 11)

Provisional Water Use Permit No.: **RSCBWB / PWUP 04/17** District: MTWARA RURAL
Zone/Catchment: Region: MTWARA

1. Name of Holder: DANGOTE INDUSTRIAL LTD
2. Address: P.O.Box 1241 Mtwara.
3. Particulars of Provisional Water Use Permit: To Abstract **10,000 L/ Hr** From Bore Hole No.1 at Hiyari for Cement Plant Use.
4. This Provisional Water Use Permit is not appurtenant to: LAND
5. Works: Constructed
6. Whether Provisional is subject to construction of works specified in paragraph 5 and date by which works to be completed:
7. This Provisional Water Use Permit is granted subject to the provision of the Water Utilization (Control and Regulation) Act No. 11 of 2009 and the Special Terms and Conditions specified overleaf.

Msaru L. Msengi
BASIN WATER OFFICER

BASIN WATER OFFICER
RUVUMA RIVER AND
SOUTHERN COAST BASIN

24 FEBRUARY, 2017

UNITED REPUBLIC OF TANZANIA
MINISTRY OF WATER

RUVUMA RIVER AND SOUTHERN COAST BASIN

PROVISIONAL FOR A WATER USE PERMIT

The Water Utilization (Control and Regulation) Act, 2009 (Section 11)

Provisional Water Use Permit No.: **RSCBWB / PWUP 03/17** District: MTWARA RURAL
Zone/Catchment: Region: MTWARA

1. Name of Holder: DANGOTE INDUSTRIAL LTD
2. Address: P.O.Box 1241 Mtwara.
3. Particulars of Provisional Water Use Permit: To Abstract **10,000 L/ Hr** From Bore Hole No.1 at Hiyari for Cement Plant Use.
4. This Provisional Water Use Permit is not appurtenant to: LAND
5. Works: Constructed
6. Whether Provisional is subject to construction of works specified in paragraph 5 and date by which works to be completed:
7. This Provisional Water Use Permit is granted subject to the provision of the Water Utilization (Control and Regulation) Act No. 11 of 2009 and the Special Terms and Conditions specified overleaf.

Msaru L. Msengi
BASIN WATER OFFICER

BASIN WATER OFFICER
RUVUMA RIVER AND
SOUTHERN COAST BASIN

24 FEBRUARY, 2017

UNITED REPUBLIC OF TANZANIA
MINISTRY OF WATER

RUVUMA RIVER AND SOUTHERN COAST BASIN

PROVISIONAL FOR A WATER USE PERMIT

The Water Utilization (Control and Regulation) Act, 2009 (Section 11)

Provisional Water Use Permit No.: **RSCBWB / PWUP 02/17** District: MTWARA RURAL
Zone/Catchment: Region: MTWARA

1. Name of Holder: DANGOTE INDUSTRIAL LTD
2. Address: P.O.Box 1241 Mtwara.
3. Particulars of Provisional Water Use Permit: To Abstract **10,000 L/ Hr** From Bore Hole No.1 at Hiyari for Cement Plant Use.
4. This Provisional Water Use Permit is not appurtenant to: LAND
5. Works: Constructed
6. Whether Provisional is subject to construction of works specified in paragraph 5 and date by which works to be completed:
7. This Provisional Water Use Permit is granted subject to the provision of the Water Utilization (Control and Regulation) Act No. 11 of 2009 and the Special Terms and Conditions specified overleaf.

Msaru L. Msengi
BASIN WATER OFFICER

BASIN WATER OFFICER
RUVUMA RIVER AND
SOUTHERN COAST BASIN

24 FEBRUARY, 2017

UNITED REPUBLIC OF TANZANIA
MINISTRY OF WATER

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4. This Provisional Water Use Permit is not appurtenant to: LAND
5. Works: Constructed
6. Whether Provisional is subject to construction of works specified in paragraph 5 and date by which works to be completed:
7. This Provisional Water Use Permit is granted subject to the provision of the Water Utilization (Control and Regulation) Act No. 11 of 2009 and the Special Terms and Conditions specified overleaf.

Msaru L. Msengi
BASIN WATER OFFICER

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RUVUMA RIVER AND
SOUTHERN COAST BASIN

24 FEBRUARY, 2017

UNITED REPUBLIC OF TANZANIA
MINISTRY OF WATER

RUVUMA RIVER AND SOUTHERN COAST BASIN

DRILLING PERMIT

The Water Utilization (Control and Regulation) Act, 2009

Drilling Permit No.: **RSCBWB / DRP 03/17**
Zone/Catchment:

District: MTWARA
Region: MTWARA

This is to certify that, Dangote Industrial L.t.d Is granted to drill the bore hole in the named area of **Hiyari Village** with the following conditions.

1. Before drilling any bore hole, GEOPHYSICAL SURVEY must be done in the respective area and must have the report of surveyed area .
2. Drilling of the bore hole must be supervised by the HYDROGEOLOGIST from the Basin water Office or recognized institute
3. All the information concerning the bore hole (i.e Bore hole design, water level etc) must sent to the Basin Water office after drilling.
4. For successful bore hole, you must apply for the water use permit from the Basin Water Office

Msaru L. Msengi
BASIN WATER OFFICER

BASIN WATER OFFICER
RUVUMA RIVER AND
SOUTHERN COAST BASIN

24 FEBRUARY , 2017

UNITED REPUBLIC OF TANZANIA
MINISTRY OF WATER

RUVUMA RIVER AND SOUTHERN COAST BASIN

DRILLING PERMIT

The Water Utilization (Control and Regulation) Act, 2009

Drilling Permit No.: **RSCBWB / DRP 02/17**
Zone/Catchment:

District: MTWARA
Region: MTWARA

This is to certify that, Dangote Industrial L.t.d Is granted to drill the bore hole in the named area of **Hiyari Village** with the following conditions.

1. Before drilling any bore hole, GEOPHYSICAL SURVEY must be done in the respective area and must have the report of surveyed area .
2. Drilling of the bore hole must be supervised by the HYDROGEOLOGIST from the Basin water Office or recognized institute
3. All the information concerning the bore hole (i.e Bore hole design, water level etc) must sent to the Basin Water office after drilling.
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RUVUMA RIVER AND
SOUTHERN COAST BASIN

24 FEBRUARY, 2017

UNITED REPUBLIC OF TANZANIA

MINISTRY OF WATER

RUVUMA RIVER AND SOUTHERN COAST BASIN

DRILLING PERMIT

The Water Utilization (Control and Regulation) Act, 2009

Drilling Permit No.: **RSCBWB / DRP 01/17**
Zone/Catchment:

District: MTWARA
Region: MTWARA

This is to certify that, Dangote Industrial L.t.d Is granted to drill the bore hole in the named area of **Hiyari Village** with the following conditions

1. Before drilling any bore hole, GEOPHYSICAL SURVEY must be done in the respective area and must have the report of surveyed area .
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3. All the information concerning the bore hole (i.e Bore hole design, water level etc) must sent to the Basin Water office after drilling.
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Msaru E. Msengi
BASIN WATER OFFICER

BASIN WATER OFFICER
RUVUMA RIVER AND
SOUTHERN COAST BASIN

24 FEBRUARY, 2017

APPENDIX 6: BOREHOLE WATER ANALYSIS RESULTS

ARDHI UNIVERSITY
School of Environmental Science and Technology

Telephone: (255-022) - 2771272,
2775004, 2772291/2
Fax: (255-022) - 2775391, 2775479
Telegrams: ARDHICHUO

P. O. Box 35176
Dar es Salaam
e-mail: aru@aru.ac.tz
website: http://www.aru.ac.tz

ENVIRONMENTAL ENGINEERING LABORATORY

Water Analysis Results

Client: TRES CONSULT (T) LTD
Date Received: 15 February 2017
Source: Borehole water from Dangote Cement Plant, & Mbuo Village, Mtwara.

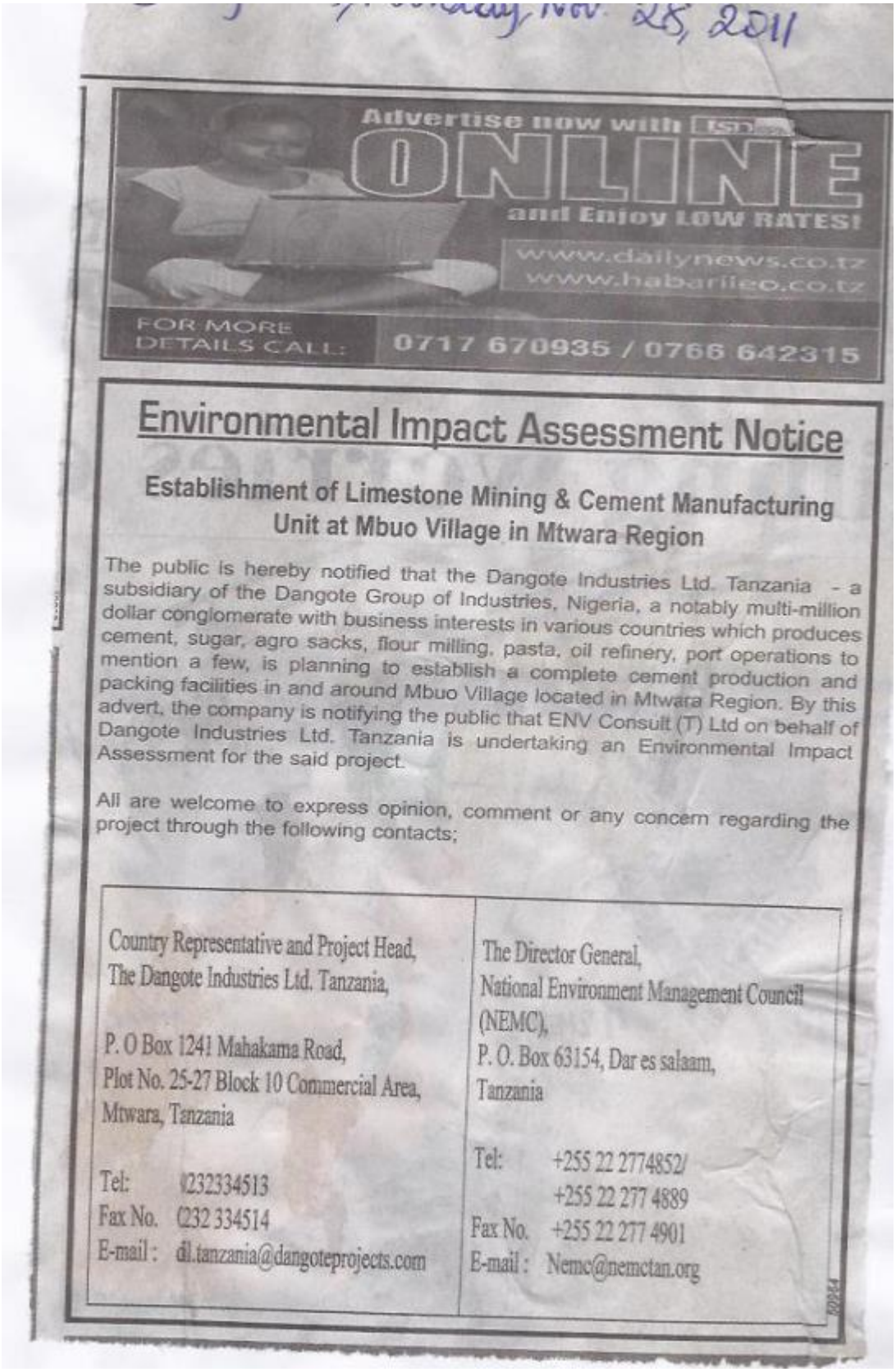
S/N	PARAMETER	Units	Dangote Cement Plant Boreholes			Mbuo Village/ Community Borehole
			D/ BH1	D /BH2	D /BH4	D /BHV
1	pH		6.91	7.05	6.86	7.21
2	Turbidity	NTU	0	0	0	0
3	Colour	Hazen°	0	0	0	10
4	Salinity	‰ (ppt)	0.40	0.30	0.60	0.40
5	Electric conductivity	µS/cm	792	743	1150	828
6	Total Dissolved solids	mg/l	387	362	567	405
7	Phosphate	mg/l	0.57	0.19	0.39	0.86
8	Nitrate –Nitrogen	mg/l	0.40	0.40	1.10	0.40
9	Ammonia-Nitrogen	mg/l	0.548	0.336	0.490	0.418
10	Chloride	mg/l	201	168	252	203
11	Sulphate	mg/l	91.60	61.50	61.60	25.20
12	Bicarbonate Alkalinity	mg/l	258	289	305	243
13	Iron	mg/l	0.042	0.025	0.018	0.108
15	Carbonate Alkalinity	mg/l	0	0	0	0
16	Total Alkalinity	mg/l	258	289	305	243
17	Magnesium	mg/l	3.939	7.40	9.96	5.82
18	Calcium	mg/l	187.0	201	206	182
19	Sodium	mg/l	32.95	24.2	39.34	34.23
20	Potassium	mg/l	4.712	1.68	8.301	3.44
21	Lead	mg/l	<0.01	<0.01	0.088	<0.01
22	Manganese	mg/l	<0.01	<0.01	<0.01	0.011
23	Copper	mg/l	<0.01	<0.01	<0.01	<0.01
24	Zinc	mg/l	<0.01	<0.01	<0.01	<0.01
25	Cadmium	mg/l	<0.01	<0.01	<0.01	<0.01
26	Chromium	mg/l	<0.01	<0.01	<0.01	<0.01
27	Aluminium	mg/l	<0.01	<0.01	<0.01	<0.01
28	Nickel	mg/l	<0.01	<0.01	<0.01	<0.01
29	Mercury	mg/l	<0.01	<0.01	<0.01	<0.01

na= Not available/applicable *Sampling done by Client*

Reporting officer

Ndimbo A.M

APPENDIX 7: PUBLIC NOTICES AND NEWSPAPERS ADVERTS



Monday, Nov. 28, 2011

Environmental Impact Assessment Notice

Establishment of Limestone Mining & Cement Manufacturing Unit at Mbuo Village in Mtwara Region

The public is hereby notified that the Dangote Industries Ltd. Tanzania - a subsidiary of the Dangote Group of Industries, Nigeria, a notably multi-million dollar conglomerate with business interests in various countries which produces cement, sugar, agro sacks, flour milling, pasta, oil refinery, port operations to mention a few, is planning to establish a complete cement production and packing facilities in and around Mbuo Village located in Mtwara Region. By this advert, the company is notifying the public that ENV Consult (T) Ltd on behalf of Dangote Industries Ltd. Tanzania is undertaking an Environmental Impact Assessment for the said project.

All are welcome to express opinion, comment or any concern regarding the project through the following contacts;

Country Representative and Project Head, The Dangote Industries Ltd. Tanzania, P. O Box 1241 Mahakama Road, Plot No. 25-27 Block 10 Commercial Area, Mtwara, Tanzania Tel: (232334513 Fax No. (232 334514 E-mail : dl.tanzania@dangoteprojects.com	The Director General, National Environment Management Council (NEMC), P. O. Box 63154, Dar es salaam, Tanzania Tel: +255 22 2774852/ +255 22 277 4889 Fax No. +255 22 277 4901 E-mail : Nemc@nemctan.org

Habari Leo Novemba 28, 2011

TANGAZO KWA UMMA

TATHMINI YA ATHARI KWA MAZINGIRA NA JAMII YA MRADI WA UJENZI WA KIWANDA CHA KUZALISHA SEMENTI KATIKA KIJIJI CHA MBUO, KATA YA NDUMBWE, WILAYA YA MTWARA VIJIJINI, MKOA WA MTWARA, TANZANIA

Tunapenda kuujulisha umma kuwa Kampuni ya Dangote Industries Limited ambayo ni Tawi la muunganiko wa Viwanda la Dangote la Nigeria (Dangote Group of Industries) inakusudia kujenga na kuendesha kiwanda cha kuzalisha sementi katika kijiji cha Mbuo, Kata ya Ndumbwe, Wilaya ya Mtwara Vijijini, Mkoa wa Mtwara.

Hapa Tanzania miradi yote ambayo inaweza kuwa na athari mbaya kwa mazingira inasimamiwa na Kanuni za Tathimini ya Athari ya Mazingira na Ukaguzi za mwaka 2005 chini ya kifungu cha 82(1) na 230(2)(h) na (q) cha Sheria ya Usimamizi na uendelezaji wa Mazingira ya mwaka 2004. Ili kuendana na Kanuni za Tathmini ya Mazingira na Ukaguzi, na kudumisha uwajibikaji wake mzuri kwa jamii na mazingira, Kampuni ya Dangote Industries Limited liliamua kuingia Mkataba na Kampuni ya ushauri wa maswala ya Mazingira ya ENV Consult (T) Limited ya Dar es Salaam kufanya ukaguzi wa athari za mazingira ya mradi wake.

Kwa Tangazo hili Kampuni ya ENV Consult (T) Limited kwa niaba ya Kampuni ya Dangote Industries Limited, inapenda kuujulisha umma kuwa inafanya tathmini ya athari ya mazingira ya mradi huu kama ilivyoagizwa na serikali (Sheria ya Mazingira Na. 20 ya 2004). Kama una maoni kuhusu huu mradi unaweza kuyatoa / kuyatuma katika ofisi zifuatazo:

Mwedelezaji wa Mradi:	DANGOTE INDUSTRIES LIMITED, kitalu 25, Mahakama Road, Block 10, Commercial Area, S.L.P 1241, Mtwara, Tanzania, Simu: +25523 2334513/ 514, Simu ya mkononi: +255774053246, +255719296042, Baruapepe: estherkroll@hotmail.com, musaleds@yahoo.com
Washauri wa Mazingira wa Mradi:	ENV Consult (T) Limited, Suite 16 Regent Street, S.L.P 3131 Dar es Salaam, Tanzania, Simu (+255) 22 2772209, Nukushi: +255 22 2773609,
Mkurugenzi Mkuu,	Mkurugenzi Mkuu, Baraza la Hifadhi la Taifa na Usimamizi wa Mazingira, Regent Estate, Kitalu Na. 29/30, S.L.P 63154, Dar es Salaam, Tanzania; Simu: +255 (022)2134603 Nukushi: +255 (022)2111579; Barua pepe: dg@nemc.or.tz.

APPENDIX 8: NAMES AND SIGNATURES OF CONSULTED STAKEHOLDERS

Environmental and Social Impact Assessment for the Establishment of CementProduction Facility at Hiyari Village, Mayanga Ward, Mtwara Rural District, Mtwara Region, Tanzania

Name and Signature of Consulted Stakeholders

DATE/TAREHE	NAME/JINA	INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/SAHIHI
21.05.2015	KAONDO JULIUS M	DED MTWARA DC	0784860638	[illegible]
21.05.2015	LAWRENCE H. VEGULLA	TPA MTWARA	065211000	[illegible]
21.05.2015	NORBERT J. KALEMBWE	TPA - MTWARA	0713 501162	[illegible]
21.05.2015	M. K. MUTAJOBA	TPA - MTWARA	0689 243232	[illegible]
21/05/2015	WILBERT NGOWI	OSHA - S. ZONE	0758263505	[illegible]
21/05/2015	BARAKA NDELWA	Division officer Mtwara DC office	0787042227	[illegible]

DATE/TAREHE	NAME/JINA	INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/SAHIHI
21/05/2015	MOHAMED A KIAMCOPA	MUKITI [illegible]	0785290636	[illegible]
"	ISMAIL R SADIKI	VEO HIYARI	0784533356	[illegible]
"	UWESU - A - SALUMU	MJUMBE	0653808227	[illegible]
"	HARUNA M. NINGA	MJUMBE		Haruna
"	ALLY I. KULUMBO	MJUMBE	0774 635958	[illegible]
"	ISSA . B . BUBA	MJUMBE	0783-676091	[illegible]
"	HASANI M. NJOPA	MJUMBE	0779836960	[illegible]
"	Saidi Salum	mjumbe	0789089781	[illegible]

DATE/TAREHE	NAME/JINA	INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/SAHIHI
21/05/2015	[illegible]	MJUMBE	0776866280	
〃	AHMADI M. NJOPA	MJUMBE	0682921013	
〃	LUIS U. MLAPONI	MJUMBE	0684330455	
〃	SESILIA V. [illegible]	MJUMBE	0784057253	
〃	RABIA SAMLI	MJUMBE	0779692431	
〃	FATUMA S. KILINDI	MJUMBE		
〃	SOMOE RASHIDI	MJUMBE		
〃	[illegible]	MJUMBE		

DATE/TAREHE	NAME/JINA	INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/SAHIHI
21/05/2015	Tuzo Mapunda	DANGOTE	0654460479	
21/05/2015	ALLY A. NALINGA	MW/KITI WA KITONGOJI	0653 853756	

DANGOTE INDUSTRIES LIMITED
MBUO/HIYARI VILLAGES IN MAYANGA WARD, MTWARA DISTRICT, MTWARA REGION, TANZANIA.

Name and Signature of Consulted Stakeholders

DATE/TAREHE	NAME/JINA	INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/SAHIHI
11/07/2016	DENIS E. KITALI	MTWARA DC	0712 920 705 dkitali@yahoo.co.uk	
〃	FUNDIKIRA D MASANGO	MTWARA DC	0688745459 masamabofundika @yahoo.com	
〃	ENG JOHN MSENGI	MTWARA DC	0784509598 john_msengi @yahoo.com	
〃	NYAMAYAO SAID	MTWARA DC	nyamayaoSaid @yahoo.com	
〃	MSARU L. MSERAS	RUVUMA BASIN	0754620011 lamsaru59@gmail.com	
〃	Eng. BENJAMIN MGWANDAKEJOO	MADINI MTWARA	0754-366768 mgwandakejoo@gmail.com	

DATE/TAREHE	NAME/JINA	POSITION & INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/SAHIHI
11/07/2016	WILLIAM -H. MAMMA	GEOLOGIST	0688040282	
12/07/2016	KULYOTHI S. SALUMU	MAYANGA DIWANI	0685 209710	
12/07/2016	DIMARY NDUNGURU	WEO-MAYANGA	0785-160166	
12/07/2016	ABDALA M. CHALO	VEO LIKONDE	0689208615	
12/07/2016	KIDAWA M. MAIGALA	VEO - MAYANGA	0717134040	K. Mafala.
〃	HAMISI M. HAMISI	MEK - MAYANGA	0785968066	
12/07/2016	MUKIDADI SAIDI	WEO-MAYANGA	0715497033	
12/07/2016	HAMZA A FUJO	HEADMASTER-MAYANGA SEC-SCHOOL	0784572850	

DATE/TAREHE	NAME/JINA	POSITION & INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/SAHIHI
12/07/2016	MOHAMED ALLY NJAMKOPA	MWENYEKITI HIYARI	0653224036	
12/07/2016	ALI H. KUMBO	MWENYEKITI HIYARI	0688620466	
12/07/2016	AHMADI A LIWOWA	VEO-MJUMBE	0786-840080	
12/07/2016	ISMAIL R. SADIKI	VEO HIYARI	0784533856	
12/07/2016	JAMAL A SAIDI	MJUMBE/KIJIJI	0788062065	
12/07/2016	SAIDI M. CHALO	MWENYEKITI KIJIJI	0715117278	
11	SELEMAN. S. DUNGWA	MWENYEKITI KIJIJI	0788952986	
12/07/2016	SOPHIA B. MALONGOLA	MWENYEKITI/KITONGOJI	0689593003	

DATE/TAREHE	NAME/JINA	INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/SAHIHI
12/07/2016	MOHAMED A NJAMKOPA	MWENYEKITI KIJIJI	0785290686	
11	Ismail Sadiki	Mjumbe	0784533356	
11	UMESH - A - SALUMU	MJUMBE	065380827	
11	HERUNIA M NINGA	MJUMBE		
11	ALLY I. KULUMBA	MJUMBE	0774 635958	
11	ISSA. B. BUBA	Mjumbe	0783-676091	
11	HASANI M. NJUPA	MJUMBE	0779836466	
11	Said. Salum	mjumbe	0789089781	

DATE/TAREHE	NAME/JINA	INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/SAHIHI
12/07/2016	[illegible]	MJUMBE	0776866280	
11	AHMADI M. NJOPA	MJUMBE	0682921013	
11	LUIS U. MLAPONI	MJUMBE	0634330455	
11	[illegible]	MJUMBE	0784057253	
11	RABIA SAMLI	MJUMBE	0779692431	
11	FATUMA S. KILINDI	MJUMBE		F.S. KILINDI
11	SOMOE RASHIDI	MJUMBE		S. RASHIDI
11	[illegible]	MJUMBE		

DATE/TAREHE	NAME/JINA	POSITION & INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/SAHIHI
12/07/2016	SALUMU M. ABDERAHMAN	MW/KITANGOJI	0686539506	
12/07/2016	ISSA ALY LUSAKA	MW/KITANGOJI	0686101843	

Name and Signature of Consulted Stakeholders

DATE/TAREHE	NAME/JINA	INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/SAHIHI
14/11/16	Hemendra.G. Raithatha	Dangote Industries	Village HIYARI, Mtwara	[signature]
14/11/16	Chimanlal H. Jasani	Dangote Industries	Village Hiyari MTWARA	[signature]
14/11/2016	SHAKIRU B ABDALLAH	Dangote Industries	Mtwara Tanzania	[signature]
14/11/2016	Balagiya Ramesh Kumar.	Dangote INDUSTRIES	Mtwara Tanzania	[signature]
	OMARI KIPANGA	DED MTWARA DC	omaryhipanga@yahoo.co.uk 0713595345	[signature]
	Rahati S. Mayoms	DEMO MTWARA DC	0717011121 bsosthenes@...	[signature]

DATE/TAREHE	NAME/JINA	INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/SAHIHI
14/11/2016	KITALI, D.E	MTWARA DC	0712 920705	[signature]
-11-	MKONO WEREMA	-11-	0713768788	[signature]
-11-	Eng Dotto John	TANROADS -MTW	0784 755210	[signature]
14/11/2016	SIM S. SICHONE	OSHA - MTWARA	0713 978870	[signature]
14/11/2016	FABIAN RUHUMBIKA	TANESCO	0782559784	[signature]
14/11/2016	DITMARY.C NDUNGURU	WEO-MAYANGA	0785 160146	[signature]
-11-	Mikidadi Saidi	Afya-Kata Mayanga	0715457633	[signature]
14/11/2016	BAKARI M SURA	CDO-MAYANGA	0715927437	[signature]

Name and Signature of Consulted Stakeholders

DATE/TAREHE	NAME/JINA	INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/SAHIHI
29/11/2016	BALTAZARI THOMAS	TPDC/GASCO	0754590486	
29/11/2016	Eng. Mwanaidi Rashid	TPDC/GASCO	0754640716	
30/11/2016	Eng. Victor S. Labaa	EWURA	0754268641	

DATE/TAREHE	NAME/JINA	INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/SAHIHI
14/11/2016	MOHAMED A. NAMKOPA	MWENYEKITI KIJIJI	0653224036	
"	AHMAD M. NJOPA	K. AFISA MTENDAJI	0682921013	
14-11-2016	HASSANI M. NJOPA	MJUMBE	0718197274	
14-11-2016	DAUDI BIABABU CHIPEDI	MJUMBE	0653313980	
"	ALLY AHAMADI NALIENDA	MJUMBE	0653 993756	
	UNESU AHAMADI SALUMA	MJUMBE	0657 180131	
16-11-2016	SHARIFA MOHAMEDI MAMPILIKANO	MJUMBE	0655568383	
"	JUMA OMARI NANGAMETA	MJUMBE	0782831160	

DATE/TAREHE	NAME/JINA	INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/SAHIHI
14/11/2016	FATUMA SALUMO KILINDI	MJUMBE		F. KILINDI
14/11/2016	LUIS USALE MLAPONI	MJUMBE	0655 389272	
14/11/2016	SESILIA V. MILLANZI			S. millanzi

APPENDIX 9: STACK HEIGHT CALCULATIONS FOR CPP

Annex 1.1.3 - Good International Industry Practice (GIIP)

Stack Height

(Based on United States 40 CFR, part 51.100 (ii)).

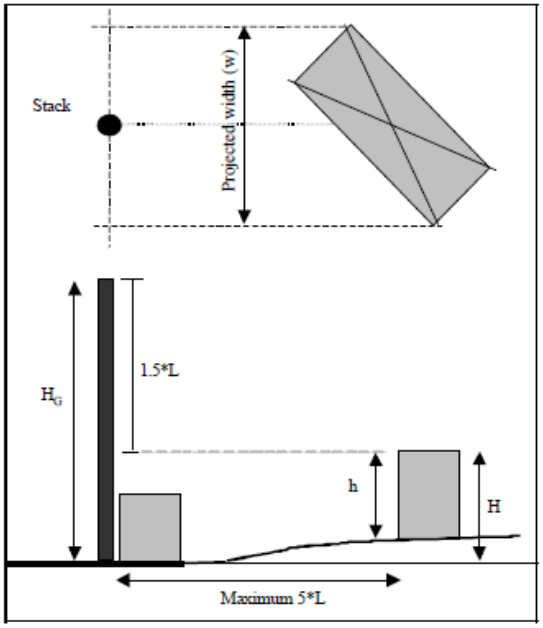
$H_G = H + 1.5L$; where

H_G = GEP stack height measured from the ground level elevation at the base of the stack

H = Height of nearby structure(s) above the base of the stack.

L = Lesser dimension, height (h) or width (w), of nearby structures

"Nearby structures" = Structures within/touching a radius of 5L but less than 800 m.



S.No	Description	Length in Meter	Width in Meter	Height in Meter	PP Chimney center to Equipment center in meter
1	Raw Mill Proposnal Station	47.5	10	36.4	743
2	Cooling Tower-612 , 613 & 614	Dia- 2, 2 & 2		42,42 & 58	661,676 & 694
3	Raw mill Bag House	72.25	70	80	669
4	Raw Mill Silo	Dia - 22.5		88.35	671
5	Preheater & Chimney	37.5	18.5	121	708
6	Cooler Building And Chimney	43	28.2	40	710
7	Klinker Silo	Dia - 40		62	710
8	Klinker Bulk Loading	46	22	39	808
9	CoalMill & raw mill Structure Building	42.5	14	42	747

Stack Height calculation as per IFC Guideline

Project Dangote Industries Ltd Tanzania
Date 06-Feb-17

Nearby structure	Length of nearby structure	Width of nearby wquipment	Height of nearby structure	PP Chimney center to Equipment center in meter	Finished Ground level of stack	Finished Ground Level of nearby structure	Height of nearby structure above base of stack	L (min of h and w)	NearBy Structure Criteria	NearBy structure criteria match Yes/No	Height of Stack Calculated	Height of Stack Selected	Stack Height OK /Not
		(w)	(h)		(El_s)	(El)	(H)=h+(El_s-El)	L=Min(h,w)	min(5L or 800)		H_a	H_a	
Unit	m	m	m	m	m	m	m	m	m		m	m	
Power Plant Structures													
Pipe Rack Number 1		110	11	18.116	-0.3	-0.3	11	11	55	Nearby Structure	27.5	76	Height OK
Boiler 1		25.7	35.5	60.8	-0.3	-0.3	35.5	25.7	128.5	Nearby Structure	74.05	76	Height OK
ESP structure		28	24	30.117	-0.3	-0.3	24	24	120	Nearby Structure	60	76	Height OK
STG Building		104	23.286	121.225	-0.3	-0.3	23.286	23.286	116.43	Not a Nearby structre	58.215	76	NA
ESP MCC room		76	24	41.013	-0.3	-0.3	24	24	120	Nearby Structure	60	76	Height OK
Cement Plant Structures													
Raw Mill Proposnal Station	47.5	10	36.4	743	-0.3	0	36.7	10	50	Not a Nearby structre	51.7	76	NA
Cooling Tower-612 , 613 & 614	2	2	58	696	-0.3	0	58.3	2	10	Not a Nearby structre	61.3	76	NA
Raw mill Bag House	72.25	70	80	669	-0.3	0	80.3	70	350	Not a Nearby structre	185.3	76	NA
Raw Mill Silo	22.5	22.5	88.35	671	-0.3	0	88.65	22.5	112.5	Not a Nearby structre	122.4	76	NA
Preheater & Chimney	37.5	18.5	121	708	-0.3	0	121.3	18.5	92.5	Not a Nearby structre	149.05	76	NA
Cooler Building And Chimney	43	28.2	40	710	-0.3	0	40.3	28.2	141	Not a Nearby structre	82.6	76	NA
Klinker Silo	40	40	62	710	-0.3	0	62.3	40	200	Not a Nearby structre	122.3	76	NA
Klinker Bulk Loading	46	22	39	808	-0.3	0	39.3	22	110	Not a Nearby structre	72.3	76	NA
CoalMill & raw mill Structure Building	42.5	14	42	747	-0.3	0	42.3	14	70	Not a Nearby structre	63.3	76	NA

APPENDIX 10: WASTE MANAGEMENT PLAN

APPENDIX 11: GRIEVANCE MECHANISM

APPENDIX 12: AMBIENT AIR QUALITY, NOISE AND VIBRATION SURVEY REPORT

APPENDIX 13: AIR QUALITY ASSESSMENT/MODELLING REPORT

APPENDIX 14: NOISE ASSESSMENT/MODELLING REPORT

APPENDIX 15: GROUND WASTE ASSESSMENT/MODELLING REPORT

APPENDIX 16: TRAFFIC MANAGEMENT PLAN