Status Page

Draft Report of the Environmental Impact Assessment (EIA) for the proposed Sahara Lubricants Plant at Auta-Balefi, Karu Local Government Area, Nasarawa State

Document Control and History

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LIST OF ABBREVIATIONS AND ACRONYMS

AfDB	African Development Bank
ALARP	As Low As Reasonably Practicable
APHA	American Public Health Association
API	American Petroleum Institute
ASTM	American Society for Testing and Materials
BAT	Best Available Technology
BBV	Batch Blending Vessel
BOD	Biochemical Oxygen Demand
BOG	Boil Of Gas
BRV	Bulk Road Vehicles
CDAs	Community Development Agencies
CDC	Community Development Committee
CH4	Methane
CITES	Control of International Trade on Endangered Species
CLO	Community Liaison Officer
CNG	Compressed Natural Gas
CO	Carbon monoxide
CO2	Carbon dioxide
COD	Chemical Oxygen Demand
CSR	Corporate Social Responsibility
Cu	Copper
DCC	Department of Climate Change
DO	Dissolved Oxygen
EGASPIN	Environmental Guidelines and Standards for the Petroleum Industry in Nigeria
EHS	Environmental, Health, and Safety
EIA	Environment Impact Assessment
EMP	Environmental Management Plan
EMR	Environmental Management Report
EPA	Environmental Protection Agency
ESR	Environmental Screening Report
Fe	Iron
FEPA	Federal Environmental Protection Agency
FMEnv	Federal Ministry of Environment
FTO	Freedom to Operate
GHG	Greenhouse gas
GIIP	Good International Industry Practice
GPS	Global Positioning System
H2S	Hydrogen Sulphides
HFO	Heavy fuel Oil y
Hg	Mercury
HSE	Health Safety and Environment
IAPs	Interested and Affected Parties

IFC	International Finance Corporation
ISO	International Organization for Standardization
IUCN	International Union for the Conservation of Nature
NMEnv	Nasarawa State Ministry of Environment
LGA	Local Government Area
LNG	Liquefied Natural Gas
LPG	Liquid Petroleum Gas
MOU	Memorandum of Understanding
NESREA	National Environmental Standards and Regulations Enforcement Agency
NGL	Natural Gas Liquids
NGOs	Non-Governmental Organizations
NMDPRA	Nigerian Midstream and Downstream Petroleum Regulatory Authority
NNPC	Nigeria National Petroleum Corporation
NOSDRA	National Oil Spill Detection and Response Agency
NPC	National Population Census
PIAR	Preliminary Impact Assessment Report
SCoP	Standard Codes of Practice
SMB	Simultaneous Metering Blender
SPM	Suspended Particulate Matter
TDS	Total Dissolved Solid
THC	Total Hydrocarbons Content
ToR	Terms of Reference
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Carbon
WHO	World Health Organization

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EXECUTIVE SUMMARY

ES1: Background Information

A lubricating oil is a type of oil that is introduced to minimize friction between surfaces in contact, hence reducing the heat created when the surfaces move, reducing corrosion, and improving the efficiency of mechanisms where it is applied or employed. As new equipment is produced on a daily basis, so is the demand for high performance lubricant oil.

The Nigerian lubricant industry has evolved from a pre-1991 landscape dominated by international majors into a substantial local blending sector. The modern era of lubricant production in Nigeria began with the deregulation of the downstream petroleum sector in 1991. Before this, the market was largely controlled by major international oil companies. Deregulation opened the door for the first indigenous blending plants. The industry subsequently grew to include over 32 independent blenders alongside six major companies (including Mobil, Total, and Oando). A key milestone was the establishment of the first Castrol-certified blending plant in Sub-Saharan Africa in 1996, with a capacity of 35,000 MT. A persistent challenge has been the lack of local base oil production; the Kaduna refinery, which once produced base oils, has not done so since a fire in 1986, forcing blenders to rely on imports.

Nigeria's lubricant consumption is estimated at over 600 million litres annually. The market was valued at approximately USD 1,083 million in 2025 and is projected to reach USD 1,419 million by 2031. Demand is driven by an active vehicle fleet of about 14.8 million units in 2025, as well as industrial, power-generation, and construction activities.

To this effect, Sahara Lubricants Limited has commissioned Silage Consult Limited to carry out their environmental compliance to National Environmental Laws by carrying out an Environmental Impact Assessment (EIA) study for the proposed plant. Silage Consult Limited is a professional environmental advisory firm that carry out environmental, sustainability, geosciences and climate change advisory services in Nigeria. To ensure good international industry practice, this EIA report is prepared in accordance with the FMEnv EIA Procedural Guidelines, recommendations from the Preliminary Impact Assessment Report (PIAR), Environmental Screening Report (ESR), EIA Terms of Reference (ToR), the 2018 World Bank Environmental and Social Sustainability Standards, and the 2012 International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability (GIIP).

The Proponent

Sahara Lubricants Limited is a duly registered company established under the Laws of the Federal Republic of Nigeria. It is a Nigerian lubricant manufacturing company headquartered at Plot No. 11689, Cadastral Zone A15, Auta Baleifi, Karu LGA, Nasarawa State, Nigeria. The company specialize in the formulation, blending, packaging, and nationwide distribution of premium-grade lubricants including engine oils, and other industrial lubricants. The products are engineered to meet and exceed international quality standards, providing superior protection and performance

for automotive, industrial, agricultural, marine, and construction applications across Nigeria and beyond.

Project Location

The proposed plant is located in Auta-Balefi community, Karu Local Government, Nasarawa State. The coordinate of the location is N 08° 56' 00.6" E 007 41' 11.2" The proposed facility was also strategically selected so as to facilitate the ease of production and distribution within the region

Objectives of the Environmental Impact Assessment

The aim of the EIA study is to proactively evaluate the associated/ potential environmental and social (including adverse and beneficial) impacts of the Sahara Lubricants. This is to ensure that the planned activities exert minimal impacts on the environment and the stakeholder communities. The objectives of the EIA therefore are to, amongst other things:

- Determine the baseline (biophysical, social and health) conditions of proposed project environment;
- Assess the potential and associated impacts of the development on biophysical, social and health components of the environment;
- determine and document the sources of impact from the development/project activities and identify the environmental, social and health components of the environment that can be potentially impacted;
- Identify and evaluate the potential socio-economic effects of the project on the communities including impacts on cultural heritages, properties, social infrastructures and natural resources;
- Proffer appropriate mitigation measures for negative impacts and make recommendations aimed at sustaining/ enhancing the beneficial impacts of the projects on the environment;
- Aid early selection of best available techniques (including technology and method of operation) that can help in realizing the project's environmental objectives; develop cost effective Environmental Management Plan (EMP) as well as provide recommendations for monitoring and management activities;
- Produce an acceptable EIA Report to be submitted to FMEnv and any other government or private institutions.

Legal and Regulatory Framework

- EIA Act, CAP E12, LFN 2004
- National Policy on Environment, 2016
- Land Use Act, Cap L5, LFN 2004
- Water Resources Act, Cap W2, LFN 2004
- Labour Act Cap L1, LFN 2004
- Nigeria National Health Act 2014
- Employees Compensation Act, 2010

- Fire Service Act CAP F29, LFN 2004
- Public Health Law Cap 103 LFN 1995
- Natural Resources Conservation Act CAP 349 LFN 1990
- Climate Change Act 2021
-

ES 2: PROJECT JUSTIFICATION

Need for Project

Lubricants are necessary for smooth running of engines and machineries. Once oil is used, it must be managed properly to keep it from contaminating the environment-Refining Plant of the used oil is the most preferred way of handling used oil to protect the environment and conserve limited natural resources. Re-refined Plant lube oil is environmentally friendly and can be re-refined many times over for maximum savings.

Value of the project

When successfully completed the proposed lubricating oil blending plant development project is expected to increase lubricants manufacturing capacity and improve its distribution efficiency in the country. This is anticipated to provide more lubricants for local consumption by domestic, commercial, industrial and transport operating customers.

Benefits of the Project

Over the last decade, there has been an increase in global demand for energy resources for both home and industrial reasons. It is no different in Nigeria, where the energy (oil) industry is virtually exclusively responsible for about 80% of the country's earnings. This has resulted in an all-time high in the exploration for hydrocarbon reserves in Nigeria and throughout the world. The proposed blending plant shall assist to address the lubricants' infrastructure capacity constraints in the country and optimize the use of the products. Job creation and increased economic activity in Nasarawa State are also anticipated as a positive impact of this project.

Envisaged Sustainability of the Proposed Project

Various aspects of sustainability have been considered for the proposed project, including economic, environmental, social, and technological viability, because lubricants will be in constant demand and appropriate supply. This demand is expected to rise further due to expanding population and increased residential and industrial activity need for the product.

Environmental Sustainability

Desktop information of the project area was used to understand the potential environmental receptors of the activities of the proposed project phases. Innovative technologies that are economically viable, with minimal environmental, social and health impacts shall be utilized in the execution of the proposed project. These have been further documented in Chapter Five of this report. As noted, the project may also impact negatively on the environment. However, incorporating the findings of this EIA, and effectively implementing the EMP at the planning,

design, construction, operation and decommissioning stages will ensure these negative impacts are mitigated and managed to extents as low as reasonably practicable (ALARP).

Technical Sustainability

Sahara Lubricants Limited has a build track record of successfully completing several projects in the past. The Company should use Best Available Technology (BAT) in engineering designs and adhere to Standard Codes of Practice (SCoP) in implementation throughout the project's various phases. The project's facilities and buildings will be built to the greatest feasible safety and environmental standards, and they are expected to survive for well over twenty-five (25) years. Furthermore, periodic maintenance, which will be a continuing process, will keep the plant working at peak efficiency. The project shall also be managed by both local and international experienced experts in the Oil and Gas industry. The installation of plants/equipment and the building of facilities shall be done in consonance with internationally approved standards such that the entire project operation will have minimal adverse and maximum beneficial effect on the host community.

Economic Sustainability

The target lubricant products to be manufactured by the proposed lube oil blending plant include gear (transmission) oil, engine oil, and heavy-duty oil. All these commodities are in very high demand in Nigeria and as such the proposed project will guarantee. a very high return on investment. Thus, the project is economically sustainable

Social Sustainability

The project shall offer gainful employment to the host communities in addition to putting in place manpower skill development programme to enterprising members of the host communities. Sahara Lubricants Limited shall from time-to-time relate with neighbouring communities throughout the life of this project and shall implement sustainable community focused projects, in collaboration with the host community, in the discharge of its Corporate Social Responsibility (CSR). The host communities shall also in turn contribute to their own welfare by entering a Memorandum of Understanding (MOU) with Sahara Lubricants Limited. Continuous consultation with stakeholder communities shall further promote social sustainability of the project.

Project Options

For any given project there is usually a series of options that should be considered based on their cost, suitability of the location/site and environmental considerations. For the proposed installation of Sahara Lubricants Limited Plant, the options considered along with the aforementioned were:

- The No Project Option
- The Delay the Project Option
- The Go-Ahead Option.

Alternative Site Options

Several site options within Nasarawa state were considered for the proposed lubricants blending plant however, the proximity to raw materials, available requisite land take, and access to transportation infrastructure for the distribution of the products, environmental sustainability among others were top considered. These are some of the required criteria for establishing a lubricants blending plant. However, most of the alternative site areas considered were found to be deficient in either one or more of the aforementioned criteria.

ES3. PROJECT DESCRIPTION

Project Overview

The project is the construction and operation of a Lube Blending Plant. The proposed plant is located in Auta-Balefi community, Karu Local Government Rea, Nasarawa State and geographical reference is N 08° 56' 00.6" E 007 41' 11.2" The land size of the proposed plants t is 0.355Hactare (3,555.35sqm) The planned facility is expected to have a life duration of 25 years. The project is intended to comply with all Nigerian legislation and requirements. Consultations and meetings with regulatory bodies, project affected community, and contractors must be held on a regular basis to ensure that land acquisition, labor-related, and community relations structures are well taken care of, as well as to address any concerns that may arise as a result of project development activities. The goal is to generate community support and social permission to complete the project in the shortest amount of time feasible. The plant is designed as a "Grass-Root-Plant" with major processes modularized and housed in buildings. The main plant building, the filling unit, tank farms (raw material and finished product), the utility rooms, modules, and skidded packages are connected by structural steel pipe bridges / racks. The blending plant will comply with all European standards for equipment. Layout planning is being done according to the FMEnv guidelines.

Components of a Lube Blending Plant

The lube blended oil (base oil) will be received at the Sahara Lubricant Ltd to be stored and distributed via bowsers or tanker trucks. The facility shall consist of the following:

- Storage Tanks
- Fire Fighting Facility Equipment
- Control and Power System
- Administrative Building
- Loading gantry
- Laboratory
- Filtration and Metering System
- Oil Water Separator
- Krebs
- Transformer
- Surveillance Room

- Wash Room
- Security Post/Convince
- Store Servicing Facility
- Driver's Lounge
- A Generator house

Project Design Basis

The design objective of the blending plant is to develop environmentally sustainable plant that satisfy applicable regulations, industry standards and codes. The project design objectives can be summarized as follows:

- Safety and security - nobody gets hurt during project planning and execution. These are the project's highest priorities and everyone's responsibility;
- Quality - quality is the foundation of safe, operable and reliable facilities;
- Business Conduct and Controls – maintain integrity in the conduct of business;
- Environment / Regulatory / Permitting - project design and work are performed in a manner that meets high performance expectations of Nigeria;
- Community Relations - foster an effective, productive relationship with communities;
- Operability & Reliability ensure facilities meet business objectives to ensure safe, environmentally sound, and cost-effective operations;
- Nigerian Content - foster continued development of Nigerian-based industry with a view to meet FMEnv requirements;
- Stakeholder - continuous engagement is necessary for project success;
- Commercial Agreements - execute commercial agreements and secure fiscal terms to achieve the project schedule.

Raw Material Input and Supply

Mainly, there are two main raw materials for the production of lubricants. These are: Lube base stock and Additives

Lube Base Stock

Lube base stocks are raw materials which when mixed in the right components form base oil required for the production of lubricants. Base stocks are highly refined crude oil or in some cases a synthetic composition and account for about 1% of the total output of petroleum products from crude refining. Depending on the engine in which the lubricants is to be used, the ratio of base oil to additives varies from 85:15 to 90:10 and it shall be adopted in this project. Lubricant base oils are complicated mixtures of paraffinic, aromatic and naphthenic hydrocarbons with molecular weights ranging from medium to high values, which produce oils with appropriate viscosities, densities and ideal distillation curves. Base oil classes are characterized by the American Petroleum Institute (API) as shown below in three groups. The first three groups are refined from petroleum crude oil. Group IV base oils are full synthetic (polyalphaolefin) oils. Group V is for all

other base oils not included in Groups I through IV. Before all the additives are added to the mixture, lubricating oils begin as one or more of these five API groups.

Additives

Additives are substances formulated for improvement of the antifriction, chemical and physical properties of base oils. Typical Additives are listed below as follows:

- Friction modifiers;
- Anti-wear (AW) additives;
- Extreme pressure (EP) additives;
- Antioxidants;
- Chemical corrosion inhibitors;
- Detergents;
- Dispersants;
- Pour point depressants;
- Viscosity index improvers (viscosity modifiers); and Anti-foaming agents

Energy/Power Requirement

The proposed project will source power from the national grid. This will involve the acquisition of transformer by the proponent and contact appropriate authority for installation and commissioning. Proponent shall also acquire power generating set(s) of about 500KVA in the case of power outage from the national grid.

Water Requirement

The water supply for the lubricating oil blending plant shall include the in-plant water supply, drainage pipe network, fresh water distribution, circulating water yard, waste water treatment facility, mini fire-fighting station, etc. Ground water (via boreholes) shall be used as the major water supply source both at construction and operation. During operation, water use will include; process water, fire-fighting water, domestic water and drinking water within the oil blending plant area. Water supply shall include the in-plant fresh water system and cold circulating water system. The water drainage system includes the implant hot circulating-water system, oily waste water system, domestic sewage system, salt-containing waste water system, other production waste water system and rainwater oil free system, etc. The generated wastewater from the plant operation process shall be treated in the Water Treatment Plant (WTP) and recycled as much as possible.

Waste Generation and Management Plan

Effective and responsible handling and disposal of wastes are key elements in environmental management system. Wastes refer to any material (solid, liquid, gaseous or mixture) that is surplus to requirements. Waste management for the project shall be carried out in consultation and in line with the waste management guidelines of Sahara Lubricants Limited. The company shall take all practical and cost effective measures to minimize the generation of wastes, by employing the four

R's (Reduce, Reuse, Recycle, and Recovery) through process of optimization or redesign, efficient procedures and good housekeeping.

Project Activities

The project development phases are summarized below:

Pre-construction Phase

- Preliminary surveys and site investigation work (geotechnical, topographical, and geophysical environmental studies).
- Site preparation activities shall include; fencing, levelling, and grading of soil to prepare it for foundation and earthworks as well as backfilling.
- Mobilization shall include; supply of building materials, personnel, and equipment.

Construction Phase

- Earth work, excavation, concrete mixing, pilling, welding and metal works
- Construction / Installation of mounded tanks
- Piping construction and laying, Painting and coating
- Construction of plant facilities / utilities
- Non-destructive testing
- Commissioning

Operations Phase

- Storage and distribution of Lubricants
- Power generation
- Testing and laboratory analysis of product
- Product fiscalization
- Routine plants facilities maintenance
- Waste Management

Decommissioning Phase

- Personnel, equipment and material demobilization
- Containment of wastes of equipment
- Site restoration

ES4 DESCRIPTION OF PROJECT ENVIRONMENT

Baseline Data Collection Methodology

The baseline condition of the proposed project location was established through literature review, previous studies around the area and a two season data gathering exercise which was on 8th September, 2026

Both literature study and field sampling were carried out in accordance with FMEnv and international standards and best practices.

- Developing an EIA Terms of Reference (ToR);
- Designing a field sampling strategy and rationale to meet regulatory requirements;
- Pre-mobilization activities including calibration checks and job hazard analysis;
- Field samples collection, handling and storage;
- Regulators (FMEnv) onsite supervision;
- Demobilization and transfer of samples to FMEnv accredited laboratory for analysis

Desktop Research

The systematic data acquisition involved obtaining the project site's regional environmental and meteorological characteristics, geology, ecological profile as well as some elements of the socio-economic profile of the project area and similar environment through consultation of relevant textbooks, research materials, articles, journals, etc.

Description of sampling location

The sampling environmental and social parameters was generally designed with an intent to collect representative samples within the project boundary and AOI so as to represent the range of environmental conditions.

Sampling therefore involved the following components:

• Soil samples – Ten (10) stations and two (2) control;

• Ground water – two (2) and one control points;

• Air Quality and Noise - ten (10) stations and two (2) control.

• Flora; and Fauna.

Climate and Meteorology

Major elements of climate according to Thompson (1975) fluctuate with varying degrees of impacts on natural and human activities. This is not going to be different in the project area. At the microclimate level of rainfall, temperature, relative humidity and wind speed, direction and patterns are expected to influence project activities.

Wind Speed, Pattern and Direction

The 16year period wind characteristics of the project area were extracted form NIMET data who has responsibility of maintaining primary microclimate data for the nation. The data was secured from NIMET office in Lafia which is the closest to the project areas.

Rainfall

The years 2024 had the highest rainfall followed closely by 2017, 2014, 2012 and 2011. The years 2009 and 2019 had the least rainfalls. In all the years the months of September, August, June, July, May and October had high rainfall. with the months of December and January having the least. The fall follows a pattern of the normal wet and dry season periods.

Relative Humidity

The year 2020 had the highest high relative humidity whereas the year 2012 had the lowest high relative humidity in the 16year period. The month of November for the 16year period had the highest high relative humidity where the lowest high relative humidity amongst the months occurred in December and January of each year. The lowest low relative humidity within the 16year period occurred in 2012 whereas the year 2016 had the highest low relative humidity.

Temperature

The yearly overall maximum temperatures as recorded were higher in 2022 followed by 2010 and 2016. The lowest temperatures were recorded in 2012 and 2006. The months February and March had the highest maximum temperatures within the 16year period in the area. The highest minimum temperatures were recorded in the years 2017, 2016 and 2019 whereas the other months had relatively uniform minimum temperatures though March and April had slightly higher minimum temperatures. The years with least minimum temperatures were 2012 and 2014 whereas January and February had the least minimum temperatures within the period.

Air Quality and Noise Levels

The air quality baseline was assessed to determine the level of atmospheric pollution over the spatial coverage of the project area. This is important for establishing the potential impacts of the proposed project on the ambient air as well as providing baseline data to benchmark the compliance of operations to national air quality standards to ensure emission reduction and control during compliance audit. The ambient air quality and noise level were measured with the use of calibrated digital hand-held monitoring equipment described in Table 4.1 using standard procedures recommended for surveillance and monitoring of air pollutants by World Health Organization (WHO) and the Nigerian Ambient Air Quality Standards (NAAQS) FMEnv.

Approach and Methods

To evaluate the prevailing air quality and noise level in the project area, in-situ measurements from every direction round the project site. The measurements were taken during the rainy season from ten (10) selected points within the project area of influence and two others away from it to serve as control making a total of twelve (12). Based on the National Environmental Air Quality Control Regulations (2014), parameters such as suspended particulate matter (SPM) concentrations and gaseous pollutants concentrations including carbon monoxide (CO), carbon dioxide (CO2), nitrogen dioxide (NO2), sulphur dioxide (SO2), hydrogen sulphide (H2S), Ammonia (NH3) and lower explosive limit (LEL) were measured

Results of Air Quality and Noise Level Measurement

The air quality of an area is largely determined by the ambient concentration of the various atmospheric gases, which are otherwise referred to as pollutants. Although, atmospheric gases occur naturally to ensure ecosystem stabilization, however, human activities could also increase the amount of these gases in the atmospheric boundary layer above tolerable limits, which signifies

air pollution. The effect of air pollution is directly proportional to the toxicity of the gases, level of exposure and susceptibility of individuals exposed.

Traces of harmful gaseous pollutants were not detected within and around the proposed project area as at the time of assessment during the rainy season, except for CO2 in which few sampling points recorded values close to 1000ppm (USEPA Permissible standard limit). This indicates that there are no such activities that could emits significant level of gaseous pollutants into the immediate environs of the proposed project area. The activities of Sahara Lubricants Limited operation within the proposed project area involve the use of any mechanical device which are frequently used and thus will lead to significant emission of gaseous pollutant. Considering the presence of harmful gas pollutants such as NO2, SO2, CO and H2S, the current state of the project environment is suitable for human habitation and outdoor activities if maintained.

Relief and Geology

As in Geology of Nigeria, Geology of Nasarawa State also comprises of Basement and sedimentary rocks. The Basement rocks cover about 60% of the superficial area of the state while the remaining 40% is made up of sedimentary rocks of the Middle Benue Trough. The Basement complex is comprised essentially of rocks of Precambrian to Cambrian age. The rocks include Older and Younger Granite of different description, and some Meta sediments and some minor intrusive. (Obaje, et al., 2006). The general succession in the Basement Complex rocks of Nigeria starts with the Older meta-sediments generally thought to be Precambrian in age. The sequence was followed by the Older Granites which comprises migmatite and gneisses quartzite and silicified rocks. This is followed by Younger meta sediments and the Younger Granite of Jurassic age. The Basement Complex rocks occupy nearly half of Nasarawa State, being confined to the northern part of the state (Map 4.1) and covering areas of Nasarawa, Keffi, and Akwanga Local Government areas. Isolated outcrops of the meta-sediments are found in Keffi, Kudaru-Aquaa and Isawa areas (Offodile, 2002; Obaje et al., 2006) The Basement Complex rocks at the southern part of the state are overlain by marine and terrestrial and transitional marine terrestrial sedimentary formations. These formations include the Asu River Group (Middle Albian), Early Cenomanian Awe formation, Keana formation and Ezeaku formations, the Turanian and Maastrictian Agwu and Lafia formations respectively. (Offodile, 1976, 2002). There are some volcanic intrusives dotting the area

Soil Quality

The major soil units of Nasarawa State belong to the category of oxisols or tropical ferruginous soils (Nyagba, 1995). The soils are derived mainly from the basement complex and old sedimentary rocks. Lateritic crust occurs in extensive areas on the plains, while hydromorphic soils (humic inceptisols) occur along the flood plains of major rivers. Loamy soils of volcanic origin are found around the volcanic cones of Awe. The hilly areas carry shallow skeletal soils. Many parts of the state are ravaged by both sheet and gully erosion, the major urban centres particularly Lafia and Keffi, are heavily gulled. Since most of the inhabitants of the state are farmers, extensive areas in the countryside are also cleared for farming, thus exposing wide areas of land to sheet erosion.

A total of ten (10) and two control composite soil samples were collected from 0 – 15cm (topsoil) and 15 – 30cm (sub soil) depths respectively using a stainless-steel hand auger. Samples from each depth range were homogenized (with removal of non-matrix particles) to form composite soil samples. Soil samples were collected into clean decontaminated containers, preserved in ice chest and transported to the laboratory for physical, chemical and microbial analyses. Sub samples for microbial analysis were wrapped up using aluminium foil. Table 4.7a for the locations for soil sampling in the project area.

Groundwater Occurrence

Karu area comprises metasedimentary rocks (mainly mica schists and sericitized/chloritized phyllonites) intruded by a Pan-African granodiorite/ granite batholith (ca. 600Ma), fracture controlled elongate Late Pan-African granite and pegmatites. The Precambrian rocks have been subjected to many tectonic movements and pressure through geologic history such that they often have several fracture lines. Within the project area, groundwater occurs within the weathered rock or in the joint and fracture systems of the unweathered or partly weathered rocks (MacDonald et al., 1986). Du Preez and Barber, (1965) proposed that aquifer is in the weathered mantle and fractured rock where permeability and porosity are sufficient to allow appreciable amount of water to accumulate in storage. The high groundwater yield in the area is found where thick overburden overlays fractured zones. The aquifer types described by Olorunfemi and Fasuyi (1993) from the study area include: Weathered layer aquifer and Weathered/ fractured or partly weathered aquifer and fractured aquifer.

Groundwater Quality

A total of three (3) groundwater samples (including one control sample) were collected from existing boreholes one from the project site and two from community in order to assess potable water quality. The water samples were collected into 1-litre polyethylene bottles for general physico-chemical analysis. Samples for heavy metals analysis were collected separately in plastic containers and fixed with diluted nitric acid (10ml HNO3 in 100ml of Distilled Water). Presterilized 50ml McCartney bottles were used for samples meant for microbial analysis. In-situ measurements of fast degrading parameters including pH, Conductivity, Total Dissolved Solids (TDS), Temperature, and Dissolved Oxygen (DO) were taken at each location using calibrated Extech Digital DO700 metre and EC, etc meter. All samples collected were preserved on ice chest and transported to the laboratory for further analysis. The analysis results were compared with the prescribed limits in the FMEnv Nigeria Standard for Drinking Water Quality (NSDWQ) in Nigeria, 1999

Physical and Chemical Property of Groundwater

The groundwater samples analysed are not saline but are entirely slightly alkaline with an average pH of 8.35 which falls within the FMEnv permissible limit in the NSDWQ. Total dissolved Solids (TDS) and Total Solids (TD) for open wells are above the permissible limits (500mg) and well below the permissible limit for boreholes (15-26ppm). Total Suspended Solids (TSS) is entirely low for boreholes and high for open wells, well above the permissible limit of (500mg) and well

below the permissible limit for boreholes (15-26ppm). The hardness of the groundwater is caused by compounds of Mg and Ca and variety of other metals. Groundwater samples S3 and S4 are moderately hard, and this can reduce the life of industrial and domestic equipment. Nitrate (NO3) and Ammonia (NH3) concentration in the groundwater is low and falls below the permitted limit by NSDWQ

Vegetation (Flora)

The major floral formation of Nasarawa State is the dry woodland savannah. This broad zone can further be divided into forest savannah and southern guinea savannah. Within each formation, there exist pockets of thickets, tree savannah, open grass savannah, fringing forest in the river valleys and gallery forest at the foot of mountains and their valleys. Dense forests are few though can be continuous in some locations. Such forests are found in lowland areas, particularly where population pressure is less on the land. Gallery forests are common along major streams and pronounced depressions. Forest reserves are being developed mostly near major urban centers like Lafia, Nasarawa, Keffi, Akwanga and Wamba. The vegetation on the hilly parts of the state is composed mainly of grasses and isolated trees. Trees of economic value, including locust bean, Shea butter, mango, citrus and banana are scattered across the state, particularly the lowland areas and southern parts of the state.

A greater percentage of this vegetation cover has however been influenced through fuel-wood extraction and land clearance for cultivation. This has affected the indigenous woody plant species. The result is that most places close to human settlement are now covered with exotic species such as locust bean, Shear butter, cashew and other economic trees. Forest reserves are scattered all over the state. Deforestation which is the deliberate destruction of vegetation because of human activities and domesticated animals has altered the vegetation of the study area so much that the natural vegetation or climatic climax vegetation is rare. Instead, what one finds includes plagio-climax vegetation, secondary forest, derived vegetation, plantations of tree crops and cultivated lands (Abaje, 2007; Abaje, 2016). Clearance of vegetation for farming, fuel wood extraction for domestic and cottage industrial uses and saw milling has led to the development of regrowth vegetation at various levels of development.

Animals (Fauna Domestica)

In the middle belt region, Nasarawa State is one of the states that is blessed with a relatively high concentration of fauna population. Their spread as observed in the state is a function of vegetation, water and cultural factors. Wildlife resources are also abundant and mostly concentrated in the southern part of the state where gallery forests are many. Generally, the state can be divided into two pastural blocks. The Northern pastural block comprises the local governments North of Nasarawa. Doma. Keana and Awe. It is largely made up or guinea savannah grassland with relatively dry condition in the dry season.

Socioeconomic

The heads of the community invited their members for interaction with the company, consultants and representatives of inter-governmental ministries at State and Federal levels in charge of the environment and mining. A total of 30 questionnaires were administered face-to face to respondents using random sampling techniques. Illiterate respondents were assisted in filing out the questionnaire. In addition to the structured questionnaire, the consultant also adopted oral interview and Focus group discussion (FGD) to obtain information from the respondents.

Auta Balefi Community

The meeting was attended by the community heads and combined team of representatives of the company, consultants and ministries (appendix A). It was an interactive session. The community is in full support of the proposed project. It would bring rapid growth and development to the community. The community leaders gave assurance of a peaceful atmosphere for the business to flourish. Questionnaires were administered to 30 participants. The questions cut across demographic parameters, socioeconomics, and likely impacts of the proposed projects on the community.

Demographic and Socio-Economic Data

Male respondents (> 60%) were more than females, and dominated by age group 18-65 years, and the married populations. Respondents are basically farmers, civil servants, and traders. They are permanent residents in the area. The level of education of the respondents 90% of the responding population had formal education; 50% attained higher level while the remaining attended 50% attained primary and secondary education. The informal section education had 10% of the responding population. Many of the respondents disposed of their waste at community dumpsite which are mostly at the backyards. The community water is the majorly sourced from boreholes. Monthly income is relatively low. This is an indication of a high poverty level. About 70% of residents earn more than N70,000 at while 30% earn less than N70,000 per month in the community.

ES4. ASSOCIATED AND POTENTIAL IMPACT

Impacts Identification and Evaluation

The main effects of the project activities are identified using the Screening Matrix. The Screening Matrix has distinguished between positive and negative impacts, direct/indirect, local or widespread, short or long term impacts, as well as the level of importance attached to each impact. These impacts in the form of residues and emissions include but are not limited to:

- Discharges to land.
- Emissions to air.
- Noise and vibrations.
- Effects on Ecosystems.
- Effects on Socio-economics
- Effects on People‘s Health

The ISO 14001 requires identification, evaluation and registration of environmental aspects associated with company‘s activities. The company‘s HSE MS is the tool for achieving ISO 14001

requirement, and this EIA report is a component of the HSE-MS. We identified impacts associated with activities of the project through many sources of documentation including:

- Regulator-approved Environmental Impact Assessment for similar projects, e.g. Synod
- EIA 2015; NMDPRA EGASPIN 2O18.

Impacts Assessment Methodology

Several methods of impacts assessment are available. The methodology adopted for the impact study of the proposed project was in phases as follows:

i. Evaluation of major Project Activities.

ii. Identification of environment sensitivities: E.g. Air Quality, Ecology, Unrest, traffic situation using baseline data from fieldwork and previous studies in the project area.

iii. Relating environmental sensitivities to project activities using an interaction matrix:

iv. Prediction the magnitude of impacts using the modified ISO 14001 method (Vesilind et al., 1994), i.e. the consequences of the proposed impact on the environment.

v. Evaluation of the importance (or significance) of impacts. Development of mitigation measures to avoid, reduce or manage the impacts.

vi. Assessment of residual significant impacts after the application of mitigation measures.

Where significant residual impacts remain, other options for mitigation may be considered and impacts re-assesses until they are as low as reasonably practicable for the project.

Anticipated Impacts

Impacts can be positive or negative, direct or indirect. The magnitude of each impact is described in terms of being significant, minor or negligible, temporary or permanent, long term or short-term, specific (localized) or widespread, reversible or irreversible. Some impact mitigation has already been addressed in the proactive design and other mitigations can only be guaranteed through active, responsible management, helped by following the guidelines in the project Environmental Management Plan.

Impact Quantification

Using Risk Assessment Matrix and the ISO 14001

The identified associated and potential impacts of the proposed Project where quantified using the Risk Assessment Matrix and the ISO 14001 (1996) criteria for identifying significant/adverse environmental impact.

Criteria and Rating Used:

- **Legal/Regulatory Standard (S**) – is there a legal/regulatory requirement or a permit requirement?
  1 = Low requirements
  2 = Medium/Intermediate breach 50% of the time
  3 = High risk, breach 100% of the time

- **Importance of Affected Environmental Components and Impact (I)** – What is rating of importance based on consensus of opinions?
  1 = Low requirements
  3 = Medium/Intermediate Importance

5 = High Importance

- **Public Perception (P)** – What is the rating of public perception and interest in proposed project and impacts based on consultation with stakeholders?
  1 = Low perception and interest
  3 = Medium/Intermediate perception and interest
  5 = High perception and interest

- **Environmental Impact Frequency (F)** – What is frequency rating of impact based on Risk Assessment Model, the probability of impact occurring?
  1 = Low Frequency
  3 = Medium/Intermediate Frequency
  5 = High Frequency

Determination of Significant Potential Impacts

The factors used to weigh the significant of the impact quantified are listed below:

- L+ R + F + I + P ≥ 15: Significant
- F + I ≥ = 6.0: Significant
- P = 5.0: Significant

Risk and Hazard Assessment

Risk assessment is the determination of quantitative or qualitative estimate of risk related to a concrete situation and a recognized threat (also called hazard). The assessment of the risks and hazards associated with the proposed project involves the following steps:

- Identification of hazards/risks
- Likelihood of occurrence
- Consequence/severity of the hazards

Project Specific Risks and Hazards

The potential risks and hazards associated with the construction and operation of the proposed lubricant production plant are described below

❖ **Fire and Explosion**

One major risk associated with lubricant oil production is fire and explosion. Petrol and diesel required to run lubricant oil generating sets as well as trucks and vehicles required for the haulage and transportation of finished products, are highly inflammable. These petroleum products if wrongly handled or a mishap occurs around its storage area, could result in serious conflagration. Any outbreak of uncontrolled fire in the plant area can escalate to dangerous dimensions which could lead to multiple fatalities and catastrophic loss of business. The overall significance is high. Careful handling is necessary to mitigate fire and explosion risks.

❖ **Security Threat and Attack**

Security systems are essential for a suitable operation of a lubricant production plant in order to avoid damage and possibly plant own time from theft and vandalism. The plant may be subject to sabotage or attack and thus result in less than optimal production capacity as a result of uprising.

Although, the likelihood of such invasion by an attack at the project site is considered to be of faraway possibility. The severity of such attack if happens would be a major injury and critical loss of process and damage to property. The risk significance is rated minor.

- **Occupational Hazards**

Workers may be exposed to occupational hazards when working at elevation during construction. The use of elevated platforms during plant installation pose a physical hazard to workers. Also, there could be electrical hazards to workers. Common electrical accidents result in shocks and/or burns, muscle contractions, and traumatic injuries associated with falls after a shock. The likelihood of the hazards occurring is considered to be possible while its severity may lead to reportable injury and limited damage to property. The overall significance is rated moderate.

ES6 MITIGATION MEASURES

The principal objective of the EIA is the development and establishment of suitable procedures (mitigation measures) for identified, significant and adverse impacts of a proposed project. This chapter presents the mitigation measures for the identified associated and potential environmental impacts for the proposed Power Plant project. The mitigation measures have been proffered to prevent, eliminate or minimize the impacts and their effects to levels that are considered as low as reasonably practicable (ALARP).

In proffering mitigation measures, the primary objectives were:

- Prevention – ensuring that significant and adverse potential impacts and risks do not occur.
- Reduction – ensuring that the effects or consequences of those significant associated and potential impacts that cannot be prevented are reduced to as low as reasonably practicable. Reasonable practicability was determined in reference to best industry practice and to economic, environmental, technical, health and safety considerations.
- Control – ensuring that residual associated impacts are reduced to a level as low as reasonably practicable.

Management Procedure for Mitigation Measures

Mitigation measures have been proffered for adverse significant potential impacts. These measures (prevention, reduction, control strategies) were developed for the adverse impacts through review of industry experience (past project experience), consultations and expert discussions with multi-disciplinary team of engineers and scientists

Mitigation Measures for the Identified Project Risks and Hazards

The mitigation measures for the identified project risks and hazards are highlighted below:

Fire and Explosion

- Considering the nature of the facility, working area shall be properly insulator as specified in the project design to prevent any likely fire outbreak.
- Fuel storage facilities which comply with international and local standards for performance and safety shall be used.
- Only suitable electrical cables shall be used.

- An internal firefighting department equipped with the requisite equipment shall be set up.
- The local fire department shall be informed of and familiarized with the project facility.
- Project equipment and facilities shall only be installed by qualified contractors.
- Facility shall be inspected regularly by qualified professionals.
- Periodic checks shall be regularly carried out to look out for damages from rodents and other pests, which could compromise electrical wiring or insulation.
- Emergency response plan shall be developed and implemented.
- Fire suppression system and equipment (such as fire extinguishers, fire notices, and warning signs) shall be installed at different locations within the facility.

Security Threat and Attack

- No authorized person(s) shall be allowed into the facility without adequate check.
- A 24-hour site security shall be put in place.
- The proponent shall maintain regular communication with the Nigerian Police/Army and other relevant local security

Occupational Hazards

- Installation of fixtures on tower components to facilitate the use of fall protection systems.
- Provision of an adequate work-positioning device system or workers.
- Hoisting and lifting equipment shall be rated and maintained and operators trained in their use.
- Appropriate Personal Protective Equipment (PPEs) shall be worn.
- Electrical installation shall be carried out by trained personnel in line with the approved procedures.

ES7. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

The Environmental Management Plan (EMP) for the proposed Lube Blending plant Project incorporates various mitigation measures to ensure that adverse impacts associated with the project are reduced to As Low As Reasonably Practicable (ALARP) levels. The long-term objectives of the programme of environmental management for the proposed project shall be achieved by:

- Ensuring compliance with existing legislation and FGEL‘s HSE policy;
- Enhancing and demonstrating excellent environmental performance built around the principle of continuous improvement;
- Integrating environmental issues fully into the field development;
- Enabling management to establish environmental priorities for the proposed project;
- Ensuring that appropriate recovery preparedness is in place in the event that control is lost during the implementation and operation of the proposed project;
- providing the basis and standards to be used in overall planning, monitoring, auditing and reviewing of socio-economic and environmental performance throughout the project life cycle;
- Assigning roles and responsibilities to appropriate personnel to ensure effective EMP implementation.
- The EMP addresses waste management, environmental audit and environmental monitoring programmes of the proposed project. Wastes generated during the proposed project shall be handled, stored, treated, recycled, and disposed based on the nature of each waste stream. The

project-specific waste management guidelines shall take into consideration the nature of each waste stream to be generated during the lifetime of the proposed project.

- Environmental audit will be conducted on a regular basis for all operations facilities throughout the life span of the proposed project. The EMP audit programme shall be conducted bi-annually during construction and start-up, and during operations in accordance with the company policy and regulatory requirements. The Environmental Monitoring Programme for the proposed project, which shall cover environmental components and discharge types, shall comply with /FMEnv/NMDPRA regulatory requirements. Generally the monitoring shall check alterations in the interactions between project activities and environmental sensitivities, and interactions between the sensitivities.

ES 8. DECOMMISSIONING

The FMEnv/NMDPRA Guidelines for decommissioning of oil and gas facilities shall be employed to decommission the proposed project. All assets which have reached the end of their useful life, will be decommissioned and either abandoned, dismantled and removed, or will be left in a state compatible with the next expected use in accordance with prevailing statutory requirements and standards. Management of wastes during this process will be in accordance with applicable Nigerian requirements and the company Waste Management Plan.

ES 9. CONCLUSION

The Environmental Impact Assessment of the Lube blending plant Project showed that the project shall have significant profits as well as some short-term negative impacts particularly on the soil and air quality. The potential impact on the components will be largely short-term, occurring mostly during the drilling activities. The economic advantages of the proposed project to the government and people of Nigeria cannot be exaggerated. The EIA of the proposed project shows that the project can be executed and operated within insignificant negative impacts on the surrounding environment and personnel by stern implementation of the recommended mitigation measures. The EIA has also established an Environmental Management Plan (EMP), which integrates various mitigation measures that will remove or reduce the potential impacts of the proposed project implementation on the environment. The EMP shall be implemented and upheld throughout the period of the project with the adverse impacts mitigated to as low as practically realistic levels. Impact mitigation monitoring shall also be carried out with the involvement of regulators to check compliance with the EMP.

CHAPTER ONE
INTRODUCTION

1.1 Background Information

A lubricating oil is a type of oil that is introduced to minimize friction between surfaces in contact, hence reducing the heat created when the surfaces move, reducing corrosion, and improving the efficiency of mechanisms where it is applied or employed. As new equipment is produced on a daily basis, so is the demand for high performance lubricant oil.

The Nigerian lubricant industry has evolved from a pre-1991 landscape dominated by international majors into a substantial local blending sector. The modern era of lubricant production in Nigeria began with the deregulation of the downstream petroleum sector in 1991. Before this, the market was largely controlled by major international oil companies. Deregulation opened the door for the first indigenous blending plants. The industry subsequently grew to include over 32 independent blenders alongside six major companies (including Mobil, Total, and Oando). A key milestone was the establishment of the first Castrol-certified blending plant in Sub-Saharan Africa in 1996, with a capacity of 35,000 MT. A persistent challenge has been the lack of local base oil production; the Kaduna refinery, which once produced base oils, has not done so since a fire in 1986, forcing blenders to rely on imports.

Nigeria's lubricant consumption is estimated at over 600 million litres annually. The market was valued at approximately USD 1,083 million in 2025 and is projected to reach USD 1,419 million by 2031. Demand is driven by an active vehicle fleet of about 14.8 million units in 2025, as well as industrial, power-generation, and construction activities. Industry estimates put the total installed blending capacity at more than 965,000 metric tons per year. Key local producers include Ardova Plc (150 million litres annual capacity) and Oilden Energies, which produces over 40,000 metric tonnes annually at full capacity. Despite local capacity, Nigeria continues to import finished lubricants, often of questionable quality, which dominates the market. The Lubricant Producers Association of Nigeria (LUPAN) has stated that local producers have "sufficient capacity to meet local demand and even export". However, the industry is currently producing at less than 30% of its installed capacity due to the unchecked influx of imported finished lubricants. This influx of imports, including substandard products, has been identified as a major threat that is "strangling" the local industry and discouraging investment. The Recovery and Growth Plan (ERGP) will prioritize infrastructure investment. With the recent 7.5 percent VAT on finished lubricants in the country and the recent 30 percent increase in import duties on finished lubricants, the sectors have become more open to investment, and the proposed project considered in this study is well positioned to capitalize on the new opportunity. Despite the fact that the country already has 34 lubricant blending facilities, only the planned facility is located in Nigeria's North-West area. Thus, the planned lubricating oil blending facility project of Sahara Lubricants Ltd. is a private initiative to assist the Nigerian government in identifying how local lubricant production might be boosted to strengthen domestic availability, particularly in the country's northwestern area.

To this effect, Sahara Lubricants Limited has commissioned Silage Consult Limited to carry out their environmental and social compliance to National Environmental Laws by carrying out an Environmental Impact Assessment (EIA) study for the plant. Silage Consult Limited is a

professional environmental advisory firm fully accredited by regulatory bodies to carry out environmental, sustainability, geosciences and climate change advisory services in Nigeria. To ensure good international industry practice, this EIA report is prepared in accordance with the FMEnv EIA Procedural Guidelines, recommendations from the Preliminary Impact Assessment Report (PIAR), Environmental Screening Report (ESR), EIA Terms of Reference (ToR), the 2018 World Bank Environmental and Social Sustainability Standards, and the 2012 International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability (GIIP).

1.2 The Proponent

Sahara Lubricants Limited is a duly registered company established under the Laws of the Federal Republic of Nigeria. It is a Nigerian lubricant manufacturing company headquartered at Plot No. 11689, Cadastral Zone A15, Auta Baleifi, Karu LGA, Nasarawa State, Nigeria. The company specialize in the formulation, blending, packaging, and nationwide distribution of premium-grade lubricants — including engine oils, gear oils, hydraulic fluids, greases, and industrial lubricants. The products are engineered to meet and exceed international quality standards, providing superior protection and performance for automotive, industrial, agricultural, marine, and construction applications across Nigeria and beyond.

1.3 Objectives of the Environmental Impact Assessment

The aim of the EIA study is to proactively evaluate the associated/ potential environmental and social (including adverse and beneficial) impacts of the Sahara Lubricants. This is to ensure that the planned activities exert minimal impacts on the environment and the stakeholder communities. The objectives of the EIA therefore are to, amongst other things:

- Determine the baseline (biophysical, social and health) conditions of proposed project environment;
- Assess the potential and associated impacts of the development on biophysical, social and health components of the environment;
- determine and document the sources of impact from the development/project activities and identify the environmental, social and health components of the environment that can be potentially impacted;
- Identify and evaluate the potential socio-economic effects of the project on the communities including impacts on cultural heritages, properties, social infrastructures and natural resources;
- Proffer appropriate mitigation measures for negative impacts and make recommendations aimed at sustaining/ enhancing the beneficial impacts of the projects on the environment;
- Aid early selection of best available techniques (including technology and method of operation) that can help in realizing the project's environmental objectives; develop cost effective Environmental Management Plan (EMP) as well as provide recommendations for monitoring and management activities;

- Produce an acceptable EIA Report to be submitted to FMEnv and any other government or private institutions.

1.4 The EIA Process

An Environmental Impact Assessment (EIA) is the process of identifying, predicting, evaluating and mitigating the bio physical, social and other relevant effects of developmental proposals prior to major decisions being taken and commitments made. It aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment and present the predictions and options to decision-makers. It is a process of evaluating the likely environmental impacts of a proposed project or development, considering inter-related socio-economic, cultural and human-health impacts, both beneficial and adverse. FMEnv developed a National EIA procedure in response to the promulgation of the EIA Act as presented in figure 1.1. The procedure that has been laid down by FMEnv for undertaking an EIA to satisfy the requirements of the EIA Act. The Procedure indicates the steps to be followed from project conception to commissioning in order to ensure that the project is implemented with maximum consideration for the environment.

The process involves the submission of a project proposal by the proponent to the FMEnv. An initial evaluation of the proposal is done by the Ministry to categorize the project. The proposal is then screened and scoped and the EIA draft report is prepared by the proponent through literature reviews and field data gathering exercises. The report is then passed through a public hearing or review/meditation panel. A review report is then sent to the proponent for allowing the preparation of the EIA final report before approval by FMEnv.

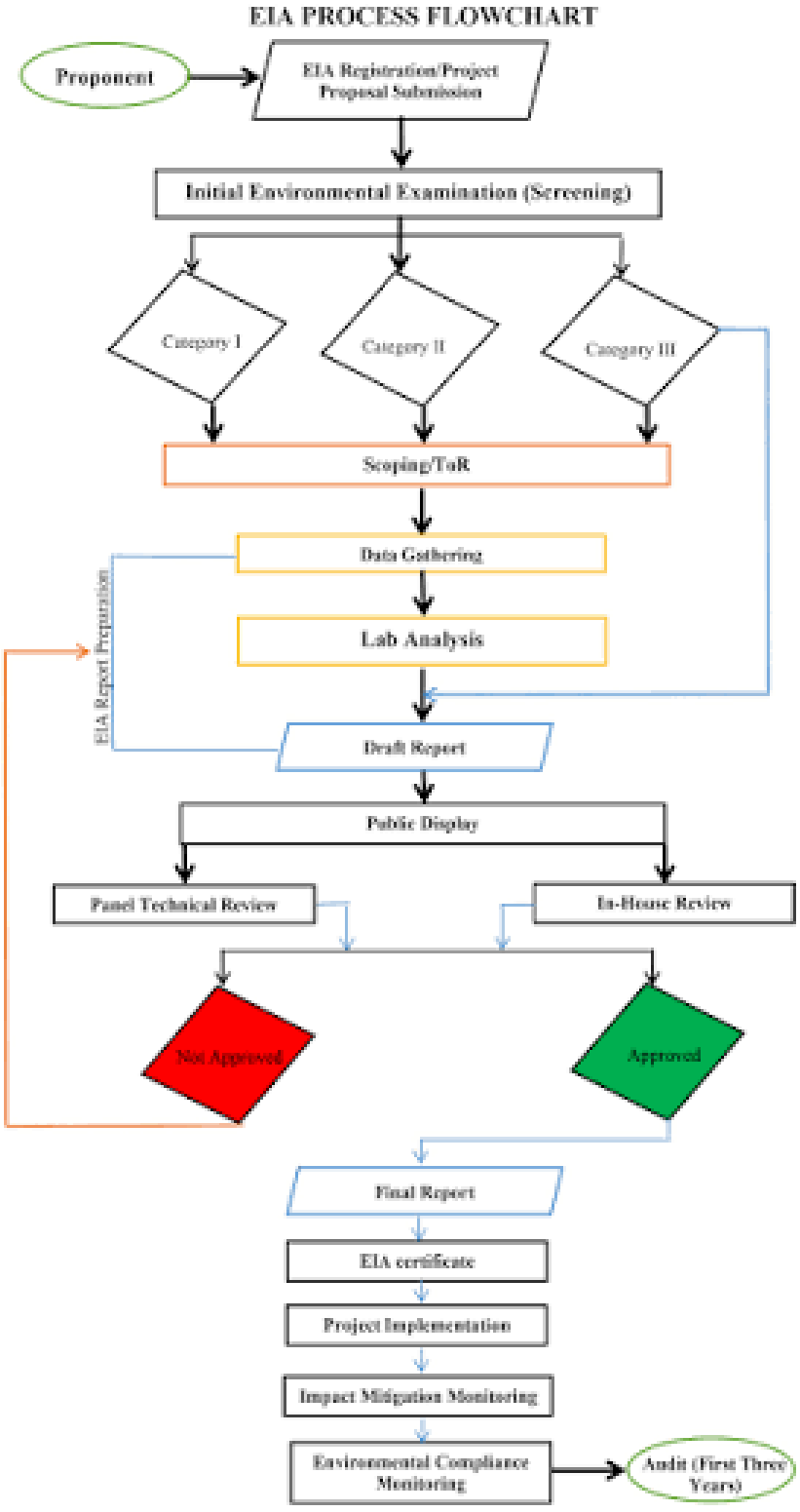


Figure 1: EIA Process Flowchart (Source: Federal Ministry of Environment)

1.5Terms of Reference for the EIA Study

The Terms of Reference (ToR) for the EIA study was prepared and submitted to the Federal Ministry of Environment (FMEnv) in line with the requirements of the EIA Procedural Guidelines. The ToR defined the objectives and highlighted the scope, approach, methodology and reporting format for the EIA study. The work scope of the EIA study includes:

- Project screening and site visit;
- Preparation of Terms of Reference (ToR) in accordance with regulatory guidelines;
- Review of national and international environmental regulations guiding the project;
- Consultations with regulators and other relevant stakeholders concerned with the proposed project;
- Extensive and comprehensive literature review specific to the project site to obtain background information on the environmental characteristics of the area;
- Field data gathering exercise and survey of the area in order to establish environmental baseline information specific to the study area;
- Impact identification, prediction, interpretation and evaluation from project activities;
- Development of an effective mitigation/ ameliorative measures and monitoring programmes for significant impacts;
- Development of comprehensive Environmental Management Plan covering the project life cycle; and
- EIA draft reporting following Federal Ministry of Environment (FMEnv) guidelines and procedures as well as public disclosure.

The collection of environmental baseline data/information, environmental impact analysis and the preparation of the report were performed by a multi-disciplinary team. The team selection was based on characteristics of the project environment and experience/discipline of each specialist. A team leader coordinated the tasks and team members towards achieving set targets as well as liaison with proponent.

1.6 Scope of the EIA

The scope of this Environmental Impact Assessment (EIA) defines the extent and level of investigations undertaken to evaluate the environmental and socio-economic implications of the proposed area. The EIA covers the review of applicable regulatory frameworks, project description, baseline environmental studies, impact assessment, and development of appropriate management and monitoring measures. Specifically, the scope of the EIA includes the following components:

- **Review of Environmental Regulatory Framework**
  A comprehensive review of relevant national and international environmental laws, regulations, standards, and guidelines governing river course alignment, proposed project operations, and associated activities. This includes compliance requirements for

environmental protection, occupational health and safety, and sustainable resource use applicable to the proposed project.

- **Description of the Proposed Project**
  The EIA provides a detailed description of the proposed proposed project project, including but not limited to:
    - Project design, mining methods, technology, and operational processes;
    - Alignment and modification (where applicable) of the river course;
    - Installation of mining facilities, ancillary infrastructure, and equipment;
    - Operational and maintenance procedures for equipment and support facilities;
    - Assessment of project-related environmental, health, and safety risks and hazards;
    - Contingency measures and emergency response plans;
    - Project implementation schedule, including pre-construction, operational, and decommissioning phases.

- **Description of the Project Environment and Baseline Studies**
  Comprehensive baseline data collection and assessment are conducted to establish existing physical, biological, and socio-economic conditions within the project area and its zone of influence. The baseline studies cover the following environmental components:
    - **Climate and Meteorology**
        - Rainfall patterns;
        - Ambient temperature;
        - Relative humidity;
        - Wind speed and wind direction.

    - **Air Quality and Noise Environment**
        - Localized ambient air quality assessment;
        - Ambient noise level measurements;
        - Identification of major noise sources;
        - Proximity of human settlements, third-party facilities, and sensitive ecological receptors to the proposed project site.
    - **Aquatic Environment**
        - Identification and characterization of surface water systems;
        - Surface water quality assessment;
        - Description of plankton communities and fisheries resources;
        - Assessment of aquatic ecosystem sensitivity and vulnerability.
    - **Soil, Land Use, and Agriculture**
        - Soil physico-chemical characteristics;
        - Soil microbiological properties;
        - Soil morphological characteristics;

- Existing land use patterns;
- Agricultural practices and productivity within the project area.

❖ **Ecology and Biodiversity**

- Preparation of flora and fauna species checklists with reference to IUCN conservation status;
- Characterization of terrestrial and aquatic plant and animal species within the study area;
- Habitat description and ecological sensitivity analysis;
- Identification of endangered, rare, or protected species;
- Recommendation for the preservation of existing vegetation where practicable.

❖ **Socio-Economic and Health Environment**

- Description of settlements and man-made features within and around the project area;
- Identification of economic, historical, and cultural heritage sites (including shrines, sacred forests, and burial grounds);
- Population distribution and demographic characteristics;
- Income distribution assessment through structured questionnaire administration;
- Existing recreational facilities within the project area;
- Social organizations and institutions;
- Occupational and employment structure
- Cultural and religious practices;
- Assessment of community health status and availability of health facilities;
- Identification of project-related health risks
- Assessment of community needs, expectations, and concerns regarding the proposed project.

❖ **Waste Management and Pollution Control**

- Identification of waste types and sources at all stages of the project lifecycle;
- Assessment of the adequacy of proposed waste storage, handling, and disposal systems;
- Development of a waste management plan;
- Pollution prevention and control measures for all project phases;
- Design of environmental and social monitoring programmes for the project.

❖ **Assessment of Associated and Potential Impacts**

The EIA includes systematic identification, prediction, and evaluation of potential and associated environmental and social impacts arising from the proposed project activities, based on:

- Identification of impact sources and pathways;

- Selection of appropriate impact indicators;
- Prediction of impact magnitude using empirical and worst-case scenario approaches;
- Evaluation of the sensitivity and importance of affected environmental and socio-economic components;
- Assessment of impact significance based on consensus and worst-case considerations.

❖ **Environmental Management and Reporting**

The study culminates in the

- Development of Environmental Management Plan (EMP);
- Definition of mitigation, monitoring, and institutional measures for impact management;
- Preparation of Draft and Final EIA Reports in accordance with the Federal Ministry of Environment (FMEnv) Environmental Impact Assessment Procedural Guidelines.

1.7 Benefits of the EIA

The benefits of this EIA include:

- The EIA is key to meet regulatory requirements necessary to secure environmental permit(s) from regulatory authorities before the commencement of the project.
- Integration of environmental consideration in the project development plan to enhance sustainability.
- Equipping the management with the necessary information that will guide the project planning and execution.
- Integration of the concerns of all stakeholders through consultation for effective take off, operation and maintenance of the project.

1.8 EIA Methodology

The methodology adopted for the conduct of the Environmental Impact Assessment (EIA) for the proposed project activities in the project area was systematic and multidisciplinary, in line with the Federal Ministry of Environment (FMEnv) Environmental Impact Assessment Procedural Guidelines. The approach integrated field investigations, stakeholder consultations, impact assessment tools, and professional judgment to ensure evaluation of potential environmental and socio-economic impacts.

- **Reconnaissance Survey**

A reconnaissance survey of the project area and its surrounding environment was undertaken to familiarize the EIA study team with the proposed project location. The survey provided preliminary information on the morphology, existing land use, ecological features, and human activities. The outcome of this exercise informed the conceptual design of the field studies, sampling locations, and mapping of sensitive environmental receptors.

• Preliminary Activities

Preliminary activities were carried out including the preparation of the Terms of Reference (ToR) for the EIA and completion of the EIA registration process, including the filling and submission of the EIA Registration Form to the Federal Ministry of Environment (FMEnv) for review and approval. These activities ensured regulatory compliance and provided the framework for subsequent EIA tasks.

❖ **Desktop and Literature Review**

A comprehensive desktop and literature review was conducted through the examination of existing environmental studies, baseline data, maps, and relevant literature related to river proposed project and the project area environment. This review was complemented by field-based baseline data collection carried out during the wet season to accurately determine existing environmental conditions. Field investigations and laboratory analyses covered physical, chemical, biological, socio-economic, and public health parameters relevant to proposed project operations.

As part of this stage, structured information dissemination and stakeholder engagement activities were undertaken to inform Project Affected Persons (PAPs) of the proposed project activities and associated operations. Stakeholder consultations were conducted to solicit views, concerns, and expectations on environmental, social, and health issues for integration into impact prediction, assessment, evaluation, and mitigation planning.

Stakeholders consulted during the study included, but were not limited to:

- Federal Ministry of Environment (FMEnv);
- Nasarawa State Ministry of Environment
- Karu Local Government Area
- Non-governmental organizations;
- Owners and occupants of adjoining facilities;
- Project engineers and environmental experts

❖ **Impact Identification and Evaluation**

Potential beneficial and adverse impacts associated with the proposed activities around the project area were identified by examining interactions between project activities and environmental components at the pre-construction, operational, and decommissioning phases. Reference was made to EIA sectoral guidelines, the project description, and relevant regulatory standards. Impact evaluation was undertaken using established criteria, including legal and regulatory requirements, magnitude and duration of impacts, level of risk, public perception, and the sensitivity and importance of affected environmental components. Analytical tools such as the Rau's Ad Hoc Matrix and the Modified Leopold Matrix were applied to ensure systematic and objective assessment. The results of the impact assessment are presented in Chapter Five of this report.

❖ Impact Mitigation and Enhancement Measures

Mitigation measures were developed to prevent, minimize, or control identified adverse environmental and socio-economic impacts of the proposed proposed project project. These measures were formulated based on professional judgment, scientific analysis, project experience, understanding of the studies area ecosystem, and consensus among subject-matter experts. In addition, enhancement measures were proposed to optimize positive impacts, including employment generation and local economic development. Detailed mitigation and enhancement measures for significant impacts are presented in Chapter Six of this report.

❖ **Reporting, Review, and Environmental Management Planning**

Findings from the EIA study were documented in this Draft EIA Report. The Final EIA Report shall be produced following regulatory and stakeholder review meetings and will incorporate all relevant comments and recommendations arising from the review process. To ensure continual improvement and adaptive management, environmental and social auditing and monitoring programmes have been integrated into the Environmental Management Plan (EMP). The ESMP provides mechanisms for early detection of unforeseen impacts and enables prompt corrective or emergency response where required during project implementation.

1.9 Legal and Regulatory Framework

The EIA for the proposed project activities around the area shall be conducted in strict compliance with applicable national legislation, sector-specific regulations, state and local government requirements, and relevant international conventions. These instruments provide the legal and institutional basis for environmental protection, sustainable river resource management, public health and safety, and social responsibility. The legal and regulatory framework relevant to the proposed project includes the following key components:

National Environmental Legislation

The proposed project activities are subject to a range of national environmental laws and policies enacted to ensure the sustainable management of natural resources, protection of public health, conservation of biodiversity, and prevention of environmental degradation. These legislative instruments provide the statutory basis for regulating activities that may impact river systems, aquatic ecosystems, and surrounding communities. The key national environmental legislations applicable to the proposed project include the following:

- **The Environmental Impact Assessment Act, CAP E12, LFN 2004**

The Environmental Impact Assessment Act, Cap E12, Laws of the Federation of Nigeria (LFN) 2004, is the principal legislation governing the conduct of Environmental Impact Assessments in Nigeria. The Act mandates the preparation and approval of an EIA for projects that are likely to have significant adverse impacts on the environment, including proposed project activities within river channels and other sensitive ecosystems. The Act outlines the procedural requirements for

project screening, scoping, baseline studies, public consultation and participation, impact assessment, review, and approval prior to project implementation. It further requires that identified mitigation measures be integrated into project design, execution, and operational phases to ensure environmental protection and sustainable development. The Federal Ministry of Environment (FMEnv), in collaboration with the National Environmental Standards and Regulations Enforcement Agency (NESREA), is the principal authority responsible for the regulation, coordination, and enforcement of environmental laws and policies in Nigeria. The enabling legislation establishing the Ministry mandates it to ensure that all development and industrial activities, emissions, and discharges comply with national environmental guidelines, standards, and regulations.

In furtherance of this mandate, the specific responsibilities of the Federal Ministry of Environment include:

- Monitoring and enforcement of environmental protection and pollution control measures;
- Enforcement and implementation of applicable international environmental laws, conventions, protocols, and treaties to which Nigeria is a signatory;
- Prescribing environmental quality standards and regulations relating to air and water quality, effluent limitations, pollution control, atmospheric and ozone layer protection, and the management of toxic and hazardous substances; and
- Promoting cooperation and collaboration with counterpart institutions in other countries and relevant international organizations involved in environmental protection and sustainable resource management.

- **National Policy on Environment, 2016**

The National Policy on Environment (NPE), 2016 provides the overarching framework for environmental management and sustainable development in Nigeria. It sets out the principles, objectives, and strategies for protecting and conserving the country's natural resources, maintaining ecological balance, and ensuring that socio-economic development occurs in harmony with environmental sustainability. For the proposed project activities along the project area, the National Policy on Environment serves as a critical reference for guiding project planning, operation, and management to minimize negative impacts on the riverine ecosystem and surrounding communities. The policy emphasizes the need for sustainable use of natural resources, including sand, while preventing environmental degradation, pollution, and loss of biodiversity.

- **National Environmental Standards and Regulations Enforcement Agency (NESREA) Act 2007**

The National Environmental Standards and Regulations Enforcement Agency (NESREA) Act, 2007 establishes NESREA as the primary agency responsible for enforcing environmental laws, standards, and regulations in Nigeria. The Act provides a robust legal framework to regulate activities that may impact the environment, ensuring sustainable management of natural resources

and protection of public health. For the proposed project, NESREA's mandate is particularly relevant, as river sand extraction has the potential to alter river morphology, degrade water quality, disturb aquatic habitats, and affect the livelihoods of communities' dependent on the river ecosystem. Under the provisions of the Act, NESREA is tasked with monitoring and enforcing compliance with environmental standards across a range of media, including water, air, noise, soil, and waste. The agency ensures that proposed project operations adhere to established national regulations, such as effluent limitations, water quality standards, noise control measures, and pollution prevention requirements. Additionally, NESREA oversees environmental protection measures aimed at conserving riverine ecosystems and mitigating adverse impacts such as erosion, habitat destruction, and biodiversity loss. The Act also emphasizes the importance of stakeholder engagement, requiring project developers to consult with host communities, traditional authorities, and other relevant stakeholders. By integrating local concerns into project planning and environmental management, NESREA ensures that proposed project activities are socially responsible and sensitive to the needs of affected populations. Moreover, NESREA possesses enforcement powers to investigate violations, impose penalties, and mandate remediation or restoration of degraded areas, thereby holding operators accountable for maintaining environmental standards.

- **The Land Use Act, Cap L5, LFN 2004**

The Land Use Act, 2004 provides the legal framework for land ownership, allocation, and use in Nigeria, vesting land in state governors to hold in trust for the people while granting rights of occupancy to individuals and organizations. For proposed project, the Act ensures lawful access to riverbanks, extraction areas, access roads, and ancillary facilities, while protecting the land rights of host communities. Compliance with the Act helps prevent land-use conflicts with local residents who rely on the river for agriculture, fishing, and other livelihoods. It also supports the implementation of Environmental Impact Assessments, mitigation measures, and environmental management plans by securing legal authority over operational areas. In essence, the Land Use Act facilitates responsible, sustainable, and socially inclusiveness, ensuring smooth project execution while safeguarding community interests and supporting environmental protection.

- **The Water Resources Act, Cap W2, LFN 2004**

The Water Resources Act, Cap W2, LFN 2004 provides the legal framework for the management, use, and protection of Nigeria's surface and groundwater resources. It establishes guidelines for the abstraction, diversion, and discharge of water, ensuring that watercourses are used sustainably and equitably while protecting aquatic ecosystems and the rights of downstream users. Under the provisions of the Act, any activity that may obstruct, pollute, or otherwise alter a watercourse requires careful regulation and, in most cases, permits from relevant authorities. In the context of proposed project, this includes controlling riverbank excavation, managing sediment runoff, preventing contamination from fuel, lubricants, or machinery, and ensuring that extraction methods do not impede natural water flow. Compliance with the Water Resources Act is essential

to maintain the hydrological integrity, safeguard aquatic biodiversity, and protect the water needs of downstream communities who depend on the river for domestic use, irrigation, and fishing. The Act also supports the integration of environmental management practices into project planning and operation. These measures ensure that sand extraction activities are sustainable and do not compromise the river's long-term ecological functions or the well-being of host and downstream communities.

- **National Environmental (construction sector) Regulations, 2011. S.I. no. 19.**

The National Environmental (Construction Sector) Regulations, 2011 (S.I. No. 19) were enacted under the National Environmental Standards and Regulations Enforcement Agency (NESREA) Act to control, minimize, and prevent environmental degradation arising from construction-related activities in Nigeria. These activities of the proposed project fall within the scope of the Construction Sector Regulations, which emphasize environmental protection during land alteration, material extraction, and infrastructure development. Consequently, the regulation imposes a duty of care on the project proponent to ensure that all activities are carried out in a manner that prevents pollution of air, land, and water resources.

- **National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Waste) Regulation 1991**;

The National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Waste) Regulations, 1991 apply to the proposed project as they govern the management and control of wastes generated from industrial and extractive operations. The Regulations require proposed project operators to prevent pollution by properly handling, storing, treating, and disposing of solid and liquid wastes, and by prohibiting the discharge of untreated effluents or wastes into surface water bodies. The Regulations mandate the adoption of pollution abatement measures such as sediment control, spill prevention for fuels and lubricants, and effective waste management practices to protect river water quality and aquatic ecosystems. Through these provisions, the Regulations promote environmentally responsible proposed project and safeguard the area from pollution-related impacts.

- **National Environmental Protection (Management of Solid and Hazardous Waste) Regulation 1991**

The National Environmental Protection (Management of Solid and Hazardous Waste) Regulations, 1991 apply to proposed project due to the generation of solid and hazardous wastes such as overburden, rejected sand, spent oils, lubricants, and contaminated materials. The Regulations require proper identification, segregation, storage, transportation, and disposal of all wastes to prevent environmental pollution. For Proposed project, the Regulations prohibit indiscriminate dumping of wastes and the discharge of hazardous substances into the river, while promoting waste minimization, spill prevention, and the use of approved waste disposal facilities.

Compliance with these provisions ensures the protection of river water quality, aquatic ecosystems, and surrounding communities.

- **Nigerian Investment Promotion Commission Act**

The Nigerian Investment Promotion Commission (NIPC) Act provides a framework for promoting and protecting both domestic and foreign investments in Nigeria, while encouraging investment, the Act requires investors to comply with all relevant sectoral laws, including environmental, and land-use regulations. It also emphasizes responsible investment practices, ensuring that operations contribute to economic development while protecting the environment and engaging host communities

- **Labour Act Cap L1, LFN 2004**

The Labour Act is the principal legislation governing employment and labour relations in Nigeria, with particular focus on the private sector. It outlines the rights, duties, and protections of both employers and employees, applying primarily to workers engaged under contracts of manual or clerical labour. For proposed project, compliance with the Labour Act ensures that all workers are legally employed, fairly compensated, and protected from exploitation. This includes adherence to minimum wage standards, working hours, leave entitlements, and provisions for termination of employment.

The Core Labour Standards

The project operations around the area is not only governed by national labour legislation but are also expected to adhere to internationally recognized Core Labour Standards (CLS). These standards establish fundamental principles for ethical and equitable treatment of workers and serve as a global benchmark for responsible labour practices. The CLS encompass four key areas: the effective abolition of child labour, the elimination of discrimination in employment and occupation, the elimination of all forms of forced or compulsory labour, and the recognition of the right to freedom of association and collective bargaining. In the context of the proposed project, adherence to these standards ensures that workers are engaged in safe and fair employment, free from exploitation, coercion, or prejudice based on gender, ethnicity, or other social factors. It also guarantees that employees can freely associate, organize, and negotiate terms of employment collectively, promoting constructive dialogue between workers and management. Compliance with the CLS is particularly important in resource like the proposed project, where the influx of labour and the presence of seasonal or migrant workers can create potential risks of labour violations. By implementing these core standards, the proposed project operators around the project area not only fulfill international labour obligations but also foster a positive working environment that enhances productivity, reduces labour disputes, and strengthens social acceptance within host communities. Moreover, adherence to the CLS demonstrates a commitment to corporate social responsibility, ensuring that economic activities contribute to sustainable development while protecting the fundamental rights of workers.

- **The Nigeria National Health Act 2014**

The Nigeria National Health Act (NHA) of 2014 provides a comprehensive legal framework for the regulation, development, and management of Nigeria's healthcare system, aiming to improve the quality, accessibility, and delivery of health services across the country. In the context of proposed project activities the project area, the NHA plays a critical role in guiding measures that protect both workers and surrounding communities from potential health hazards associated with extractive operations. If poorly managed, can expose workers and nearby residents to occupational and environmental health risks, including dust inhalation, waterborne diseases, and injuries associated with heavy machinery and manual labour. Under the provisions of the NHA, operators are required to implement measures that safeguard worker health, including access to basic healthcare services, first aid facilities, occupational health monitoring, and preventive health programs. The Act also emphasizes public health protection, mandating that activities impacting communities—including riverine populations dependent on the area for domestic or agricultural use—must not compromise access to safe water, sanitation, or general hygiene. Additionally, the NHA encourages integration of health considerations into broader development projects. For the proposed project, this entails incorporating health risk assessments into Environmental Impact Assessments (EIAs) and Environmental Management Plans (EMPs). It ensures that mitigation measures, such as controlling dust emissions, providing potable water for workers, maintaining sanitary facilities on-site, and preventing contamination of river water, are effectively implemented.

- **Employees Compensation Act, 2010**

The Employees Compensation Act (ECA) of 2010 repeals the earlier Workmen's Compensation Act and provides a comprehensive framework for compensating employees who suffer from occupational diseases or sustain injuries arising from workplace accidents. Under the provisions of the Act, operators are legally obligated to provide financial and medical compensation to workers who experience accidents or occupational illnesses in the course of their employment. This includes both immediate medical treatment and ongoing support for recovery, ensuring that employees are protected from the economic consequences of workplace injuries. The Act also mandates that employers maintain records of occupational injuries and report incidents to relevant authorities, promoting accountability and adherence to safety standards. Beyond compensation, the Act implicitly encourages operators to implement preventive measures to reduce workplace hazards. In practice, this requires adopting safe operational procedures, providing personal protective equipment (PPE) to workers, ensuring proper training on machinery operation, and enforcing health and safety protocols on-site. By complying with the Employees Compensation Act, the project will not only fulfill their legal obligations but also demonstrate a commitment to worker welfare, risk management, and socially responsible operations.

- **The Fire Service Act CAP F29, LFN 2004**

The Fire Service Act, CAP F29, LFN 2004 establishes the legal framework for fire prevention, protection, and emergency response in Nigeria. While often associated with urban and industrial settings, the Act is also highly relevant to the proposed project where the use of heavy machinery, fuel storage, and operational activities can create potential fire hazards. Under this Act, operators are required to implement measures that prevent uncontrolled fires and ensure the safety of both workers and surrounding communities. This includes the proper storage and handling of flammable materials such as diesel, lubricants, and other combustible substances used in machinery operation. The Fire Service Act emphasizes coordination with local fire authorities, mandating that mining operators notify and collaborate with the relevant fire service agencies to enhance preparedness and rapid response in the event of an incident. Compliance with this legislation minimizes the risk of injury, property damage, and environmental loss, while strengthening the operational resilience of activities. Adherence to the Fire Service Act contributes to the overall health, safety, and environmental management system of the project. It ensures that fire risks are properly assessed, mitigated, and monitored, thereby safeguarding workers, protecting equipment, and reducing potential disruptions to mining operations.

- **Public Health Law Cap 103 LFN 1995**

The Public Health Law, Cap 103, LFN 1995, provides the legal foundation for safeguarding public health and ensuring environmental hygiene in Nigeria. Its provisions empower medical officers of health at the local government level, under the supervision of state and federal authorities, to regulate activities that may impact human health and well-being. Under the Public Health Law, operators are required to maintain sanitary and hygienic conditions on-site, including proper waste management, safe disposal of refuse, and the provision of clean water and sanitation facilities for workers. Although the law does not explicitly require a Health Impact Assessment (HIA) as part of an Environmental Impact Assessment (EIA), Nigeria's ratification of various international health and human rights instruments encourages the integration of public health considerations into project planning.

- **National Policy on Occupational Safety and Health 2006 revised in 2020**

The National Policy on Occupational Safety and Health (OSH) 2006, revised in 2020, provides a comprehensive framework for promoting and safeguarding the health, safety, and welfare of workers across all sectors of the Nigerian economy. The policy derives its authority from the Nigerian Constitution, which mandates the state to enact laws that ensure the protection of workers' health and well-being in the workplace. The OSH policy requires operators to implement preventive measures that mitigate these risks. This includes conducting risk assessments, providing personal protective equipment (PPE), establishing safety procedures, training workers in safe operational practices, and monitoring compliance with safety protocols. The policy also emphasizes the harmonization of national OSH standards with international best practices, ensuring that operations not only comply with domestic regulations but also uphold global

occupational health and safety benchmarks. Furthermore, it encourages employers to foster a culture of safety, empowering workers to participate in safety management and report hazards without fear of reprisal. By integrating these standards into project planning and operations, companies demonstrate a commitment to socially responsible practices, operational efficiency, and sustainable resource management.

- **Natural Resources Conservation Act CAP 349 LFN 1990**

The Natural Resources Conservation Act, Cap 349, LFN 1990, provides a comprehensive legal framework for the conservation and sustainable management of Nigeria's natural resources, including soil, water, forests, fisheries, and wildlife. Under the Act, operators are obligated to implement conservation measures that mitigate these impacts. This includes adopting sustainable mining techniques, stabilizing excavated areas, controlling sediment runoff into the river, and rehabilitating mined-out sections to restore ecological balance. The Act also empowers the Natural Resources Conservation Council to formulate policies, programs, and projects aimed at preserving natural resources and ensuring their rational use. Compliance with these guidelines requires companies to coordinate with relevant authorities, monitor environmental impacts, and integrate conservation practices into operational planning.

- **Climate Change Act 2021**

The Climate Change Act, 2021, provides a legal framework for addressing climate change in Nigeria, establishing mechanisms to reduce greenhouse gas emissions, enhance climate resilience, and integrate climate policies across all sectors. Under the Act, operators are encouraged to adopt sustainable practices that minimize carbon emissions and environmental impacts. This includes implementing low-impact extraction techniques, rehabilitating mined-out areas, stabilizing riverbanks to prevent erosion, and maintaining vegetation buffers along the river corridor. Additionally, the Act emphasizes the integration of climate change considerations into project planning, environmental management, and operational decision making. Compliance with the Climate Change Act ensures that operations contribute to Nigeria's broader climate objectives, aligning resource extraction with national strategies for emission reduction and climate adaptation.

- **Nigeria's First Nationally Determined Contribution – 2021 Update**

Nigeria's First Nationally Determined Contribution (NDC) – 2021 Update outlines the country's commitment to the global effort to combat climate change, specifying targets and strategies to reduce greenhouse gas emissions while promoting sustainable development. The NDC encourages operators to implement mitigation measures that reduce these impacts, such as adopting low-impact extraction methods, restoring mined areas, and maintaining buffer vegetation along river channels to protect ecosystems and limit carbon emissions. Furthermore, the NDC emphasizes integrating sustainability and climate considerations into all development activities.

- **Violence Against Persons (Prohibition) Act, 2015**

The Violence Against Persons (Prohibition) Act, 2015 safeguards workers and community members from physical, sexual, psychological, domestic, and traditional forms of violence. By adhering to the Act, operators enhance social acceptance, protect human rights, and foster responsible and ethical practice.

- **National Guidelines for Decommissioning of Facilities in Nigeria (2017)**

The National Guidelines for Decommissioning of Facilities in Nigeria (2017) provide a structured framework for the safe, systematic, and environmentally responsible closure of industrial and extractive operations. The decommissioning guidelines require operators to plan for these impacts from the outset, implementing measures such as backfilling excavated areas, restoring natural drainage patterns, replanting vegetation, and removing machinery and waste materials. The guidelines also emphasize the protection of public health and safety during the decommissioning process, ensuring that abandoned sites do not pose hazards to workers, local residents.

- **Nasarawa State Waste Management and Sanitation Authority Law (2021)**

Nasarawa State Waste Management and Sanitation Authority Law (2021) is the regulatory body statutorily charged with the responsibility for the protection and management of the Environment. The Board is responsible for the enforcement of all environmental legislation and abatement of all forms of environmental degradation and nuisance. It regulates the impact of physical development on the ecosystem. Its functions include, amongst others: Preservation of all ecological processes to pre impact status for the preservation of biodiversity; Protection and improvement of air, water, land, forest, and wildlife in the ecology of the state; Municipal liquid and solid waste collections and disposal/sanitation management services; and Pollution control and environmental health fumigations and vector control services. Generally, residents of the state are expected to cooperate and participate fully in state efforts at carrying out these functions and are specifically to comply with all rules and regulations guiding best practices in environmental management.

International Environmental Legislation

International environmental legislation relevant to lube oil blending emphasizes the sustainable management of natural resources, protection of riverine ecosystems, and prevention of environmental degradation associated with riverbed material extraction. These frameworks promote responsible use of watercourses, conservation of biodiversity, and mitigation of adverse impacts such as erosion, habitat loss, and water quality deterioration. Nigeria, as a signatory to several key international conventions and treaties on environmental protection and water resource management, is obligated to ensure that the proposed project are planned and implemented in line with internationally accepted best practices and sustainability principles, thereby aligning project activities with global environmental standards.

- **United Nations Framework Convention on Climate Change (UNFCCC)**

The United Nations Framework Convention on Climate Change (UNFCCC) provides a global framework for addressing activities that contribute to climate change and environmental degradation. Nigeria, as a Party to the UNFCCC, is committed to promoting sustainable land and water resource management practices, ensuring that operations incorporate mitigation measures that minimize greenhouse gas emissions, protect riparian ecosystems, and enhance resilience to climate change impacts.

- **African Convention on the Conservation of Nature and Natural Resources**

The African Convention on the Conservation of Nature and Natural Resources was adopted in Algiers, Algeria, on September 15, 1968 and entered into force on June 16, 1969. The Convention stipulates that the contracting States shall undertake to adopt the measures necessary to ensure conservation, utilization and development of soil, water, flora and fauna resources in accordance with scientific principles and with due regard to the best interests of the people.

- **Vienna Convention for the Protection of the Ozone Layer**

The Vienna Convention was adopted in 1985 and entered into force on September 22, 1988. It places general obligations on countries to make appropriate measures to protect the environment against adverse effects resulting from human activities which tend to modify the ozone layer.

- **The Montreal Protocol on Substances that Deplete the Ozone Layer**

The Protocol was adopted on September 16, 1987 as an international treaty to eliminate ozone depleting chemicals production and consumption.

- **Basel Convention on the Control of Trans-boundary Movement of Hazardous Wastes and their Disposal**

The Convention was adopted on March 22, 1989 and entered into force on May, 1989. It focuses attention on the hazards of the generation and disposal of hazardous wastes. The Convention defines the wastes to be regulated and controlled in order to protect human and environmental health against their adverse effects.

- **International Health Regulations**

The International Health Regulations (IHR) is an international legal instrument that is binding on 196 countries across the globe, including all the Member States of World Health Organisation (WHO). This binding instrument of international law entered into force on 15 June 2007. The purpose and scope is "to prevent, protect against, control and provide a public health response to the international spread of disease in ways that are commensurate with and restricted to public health risks and which avoid unnecessary interference with international traffic and trade".

Sahara Lubricants Environmental Statements

The Company believes that protecting environment is a key pillar of its long-term success and has embedded this belief in its corporate strategy and policy. The Company seeks to achieve steady improvement in meeting its environmental standards while working to minimize any negative impact on the local and global environment as the Company grows its business.

To reach these targets, SLL:

- Conducts its operations in compliance with all applicable legislative requirements
- Applies the Coca - Cola Company and industry environmental standards and consistently taking in consideration the relevant needs and expectations of its stakeholders and interested parties.
- Commits to internal and external environmental management system certifications in compliance with the internationally recognized ISO 14001 standard.
- Applies a risks and opportunities assessment methodology, aligned with the context in which its operates, to facilitate its ability to achieve environmental management system objectives and continually improves.
- Continuously assesses environmental impacts/risks and aspects/opportunities and includes environmental objectives in its business strategy, which is underlined in leadership communications.
- Ensures innovation through employee training, involvement and knowledge- sharing mechanisms.
- Actively engages with stakeholders and business partners to develop sustainable solutions and reduce its environmental footprint.
- Sets annual measurable environmental objectives for all operations, and at group level, to ensure a culture of continuous improvement and compliance with requirements.
- Transparently communicates its environmental performance internally and externally.
- Identifies and implements opportunities to use resources efficiently, prevent pollution and minimize emissions by reducing energy use and coolants.
- Promotes sustainable packaging by light-weighting, recycling packaging and using recycled material.
- Commits to conserve watersheds by saving water, treating wastewater and implementing water stewardship standards.
- Conducts operations in compliance with all applicable laws and regulations and applies its high internal environmental standards.
- Implements and certifies the internationally recognized environmental management system, ISO 14001, in all of its operations to ensure accountability and continuous improvement.
- Includes environmental strategies and objectives in its business planning process to ensure that management of environmental impact remains an integral part of its operations.

- Identifies environmental aspects, sets environmental goals, monitors results and audits processes in order to assess its performance against internal and external environmental standards.
- Identifies and implements ways to improve the efficiency with which its uses materials and resources, prevents pollution, minimizes emissions, and recycles waste.
- Commits to conserve watersheds by saving water and treating wastewater
- Commits to protecting the climate by reducing energy use and coolant emissions.
- Plays a leading role within the beverage industry in promoting sustainable packaging by light weighting, recycling beverage containers and using recycled content in its packages.
- Encourages and equips its employees to identify and act upon opportunities to improve environmental performance and waste management in the areas where they work.

1.10 Structure of the Report

The Environmental Impact Assessment (EIA) report for the proposed project is structured to address all environmental, social, and regulatory considerations associated with sand extraction from a river system. The report is organized as follows:

- **Preliminary Pages**
- Executive Summary
- Chapter One: Introduction
- Chapter Two: Project Justification
- Chapter Three: Project Description
- Chapter Four: Description of the Existing Environment
- Chapter Five: Environmental Impact Assessment
- Chapter Six: Mitigation Measures
- Chapter Seven: Environmental Management and Monitoring Plan (ESMP)
- Chapter Eight: Decommissioning and Abandonment Plan
- Chapter Nine: Summary of Findings and Conclusion
- References and Appendices

CHAPTER TWO

PROJECT JUSTIFICATION

2.0 Need for Project

Lubricants are necessary for smooth running of engines and machineries. Once oil is used, it must be managed properly to keep it from contaminating the environment-Refining Plant of the used oil is the most preferred way of handling used oil to protect the environment and conserve limited natural resources. Re-refined Plant lube oil is environmentally friendly and can be re-refined many times over for maximum savings.

2.1 Value of the project

When successfully completed the proposed lubricating oil blending plant development project is expected to increase lubricants manufacturing capacity and improve its distribution efficiency in the country. This is anticipated to provide more lubricants for local consumption by domestic, commercial, industrial and transport operating customers.

2.2 Benefits of the Project

Over the last decade, there has been an increase in global demand for energy resources for both home and industrial reasons. It is no different in Nigeria, where the energy (oil) industry is virtually exclusively responsible for about 80% of the country's earnings. This has resulted in an all-time high in the exploration for hydrocarbon reserves in Nigeria and throughout the world.

The proposed blending plant shall assist to address the lubricants' infrastructure capacity constraints in the country and optimize the use of the products. Job creation and increased economic activity in Nasarawa State are also anticipated as a positive impact of this project. The specific objectives of the project are to:

- Provide a local lubricant manufacturing plant in the North-west region of the country;
- Increase lubricating oil availability in Nigeria for consumers daily struggling to get this essential industrial and transport sector ingredient;
- Release into the markets locally manufactured lubricating oil that shall meet FMEnv specifications;
- Increase employment opportunities;
- Raise the state and national GDP;
- Improve socio-economic environment of the study area;
- Improve transport, communication, health, and educational services through Corporate Social Responsibility;
- Support in the maintenance of access roads for the community; and
- Provide material support to the community and other sundry benefits.

2.2.1 Socioeconomic Benefits of the Project

The benefits of the proposed Lube Blending Plant include the following but are not limited to:

- The project will enhance the accessibility of lubricants to homes and commercial establishments.
- The proposed project will serve as an avenue for job creation and skill development throughout the lifespan of the project. This will aid in improving the livelihood of the people in that area.
- There will be an influx of economies as materials and goods for construction and operations will be sourced from suppliers.
- The project will also lead to the improvement of quality of life in the area such as better housing, markets, new businesses and increased access to social amenities.
- This project will generate national revenue for Nigeria through tax payment.

2.2.2 Environmental Benefits of the Project

- The project shall be implemented and operated in accordance with guidelines and recommended best practices of the Federal Ministry of Environment (FMEnv), Nigerian Midstream and Downstream Petroleum Regulatory Agency (NMDPRA), and that of other local and international environmental management regulatory bodies.
- The blending plant shall be designed and/or constructed to keep environmental impact at acceptable levels;
- All project activities shall be executed task by task in order to ensure maximum safety during site construction and entire period of the project;
- Construction of the facility shall be such that potential safety hazards will be minimized;
- The facility shall comply with all required setbacks;
- Best and right materials shall be used in construction; and
- The facility shall be built, operated, and maintained to acceptable standards.

2.3 Envisaged Sustainability of the Proposed Project

Various aspects of sustainability have been considered for the proposed project, including economic, environmental, social, and technological viability, because lubricants will be in constant demand and appropriate supply. This demand is expected to rise further due to expanding population and increased residential and industrial activity need for the product.

2.3.1 Environmental Sustainability

Desktop information of the project area was used to understand the potential environmental receptors of the activities of the proposed project phases. Innovative technologies that are economically viable, with minimal environmental, social and health impacts shall be utilized in the execution of the proposed project. These have been further documented in Chapter Five of this report. As noted, the project may also impact negatively on the environment. However, incorporating the findings of this EIA, and effectively implementing the EMP at the planning, design, construction, operation and decommissioning stages will ensure these negative impacts are mitigated and managed to extents as low as reasonably practicable (ALARP).

Furthermore, waste generated as a result of the project will be collected and managed by accredited waste management vendors who will collect waste materials and dispose them in an approved

manner. The regulatory supervision and requirements involving FMEnv, State and Local Government Council environmental laws, regulations, guidelines, standards, edicts, and the ratified international conventions, as well as Sahara Lubricants Limited HSE Policy, shall be adopted and implemented to sustain the project environmentally throughout its life span. Good housekeeping and waste management practices shall be adopted. There shall be continuous consultations with all stakeholders involved and a good working relationship with the host communities, including provision of mutually agreed infrastructural and social services by Sahara Lubricants Limited. The company shall commit to develop its relationship with its sub communities through proper stakeholder engagement. Consultations shall be maintained with the local community during the pre-mobilization, mobilization, and construction period to identify concerns as they arise and address same. Also, an EMP will be developed for sustainable project implementation.

2.3.2 Technical Sustainability

Sahara Lubricants Limited has a build track record of successfully completing several projects in the past. The Company should use Best Available Technology (BAT) in engineering designs and adhere to Standard Codes of Practice (SCoP) in implementation throughout the project's various phases. The project's facilities and buildings will be built to the greatest feasible safety and environmental standards, and they are expected to survive for well over twenty-five (25) years. Furthermore, periodic maintenance, which will be a continuing process, will keep the plant working at peak efficiency. The project shall also be managed by both local and international experienced experts in the Oil and Gas industry. The installation of plants/equipment and the building of facilities shall be done in consonance with internationally approved standards such that the entire project operation will have minimal adverse and maximum beneficial effect on the host community.

2.3.3 Economic Sustainability

The target lubricant products to be manufactured by the proposed lube oil blending plant include gear (transmission) oil, engine oil, and heavy-duty oil. All these commodities are in very high demand in Nigeria and as such the proposed project will guarantee. a very high return on investment. Thus, the project is economically sustainable

2.3.4 Social Sustainability

The project shall offer gainful employment to the host communities in addition to putting in place manpower skill development programme to enterprising members of the host communities. Sahara Lubricants Limited shall from time-to-time relate with neighbouring communities throughout the life of this project and shall implement sustainable community focused projects, in collaboration with the host community, in the discharge of its Corporate Social Responsibility (CSR). The host communities shall also in turn contribute to their own welfare by entering a Memorandum of Understanding (MOU) with Sahara Lubricants Limited. Continuous consultation with stakeholder communities shall further promote social sustainability of the project.

2.4. Project Options

For any given project there is usually a series of options that should be considered based on their cost, suitability of the location/site and environmental considerations. For the proposed installation of Sahara Lubricants Limited Plant, the options considered along with the aforementioned were:

- The No Project Option
- The Delay the Project Option
- The Go-Ahead Option.

2.4.1 No Project Option

The ―no project‖ option implies that the lubricating oil blending plant project will not be embarked upon by Sahara Lubricants Limited. This option means that the identified economic benefits associated with its full implementation through which improved locally manufactured lubricants shall be made available in the country at large and in the south-south region to be specific, thus reducing the present overpricing, shall be lost. This option is not environmentally friendly and involves a great deal of risks to the environment due to the anticipated raw materials from the petroleum refinery that will be not be utilized. It is also not economically wise and un-business- like having acquired useful results from feasibility studies, but will also be at variance with Sahara Lubricants Limited intention of job creation and alternative provision of lubricants. This shall deny the company and the country the anticipated financial benefits while the advantage of increased internal revenue of Imo State through the facility shall be lost.

2.4.2 Delayed Project Option

This option is considered when all determining factors for the operation of the project have not been fully explored to ascertain effects on the project. This option does not apply to this proposed project as all the necessary environmental, social, technical and economic factors have all been aptly explored and found to be majorly favourable for the proposed project.

2.4.3 The Go-Ahead Option

This option allows for full implementation of the project after all considerations of environmental, economic, technical and social factors. Based on the availability of huge crude oil reserve, high market demand for petrol and its allied products, sufficient financial capacity to implement this project, coupled with availability of requisite technology, this option is recommended for the proposed project to be carried out with strict compliance with the recommendations of the EIA study as endorsed by the Federal Ministry of Environment.

2.5. Alternative Site Options

Several site options within Nasarawa state were considered for the proposed lubricants blending plant however, the proximity to raw materials, available requisite land take, and access to transportation infrastructure for the distribution of the products, environmental sustainability among others were top considered. These are some of the required criteria for establishing a lubricants blending plant. However, most of the alternative site areas considered were found to be deficient in either one or more of the aforementioned criteria.

2.6 Alternative Technologies

Sahara Lubricants Limited shall adopt a technology that conforms to the Oil and Gas Sector (O&G) accepted standards and international best practices. Specifically, the Best Available Technology (BAT) assessment shall ensure that most efficient and state of the art technologies or processes are implemented for the proposed project to reduce the environmental impacts and guarantee overall sustainability.

CHAPTER THREE
PROJECT DESCRIPTION

3.0 General

This chapter presents activities and processes undertaken in executing the proposed project from engineering design, pre-construction, construction to operation and decommissioning phases to achieve Sahara Lubricants Limited plans to build a Lubricant Blending Plant with a capacity of 100 m3/year of lubricants with other auxiliary facilities and a raw material and final product storage tank farm. The projected blending factory project will meet Nasarawa State and environs lubricant needs.

3.1 Project Scope

This proposed project is for provision of locally manufactured lubricants in Nigeria. Its scope of work includes engineering design and survey, construction of structures and auxiliary systems, installation and erection of equipment, and installation of pipeline. Its components are Tank farm, Base oil storage tank, Blending facility (Automatic Batch Blender, ABB), Metering skids, Drum Decanting, Pump and piping, Reception and loading bays (tank trucks). It shall involve blending of base mineral oil with additives to produce lubricants (engine oil, gear oil and others).

3.3 Project Location

The proposed plant is located in Auta-Balefi community, Karu Local Government, Nasarawa State. The coordinate of the location is N 08° 56’ 00.6” E 007 41’ 11.2” The proposed facility was also strategically selected so as to facilitate the ease of production and distribution within the region (figure 3.1)

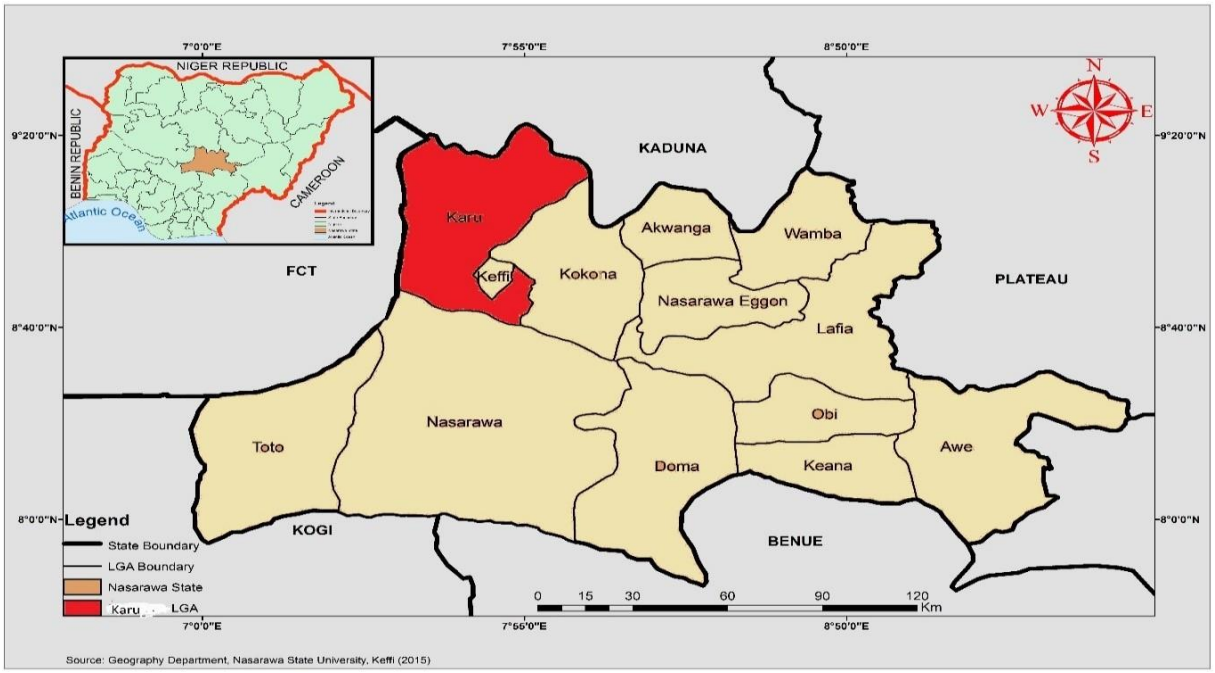


Figure 3.1: Map of Nasarawa State Showing Karu LGA



Figure 3.2 Satellite Imagery of the Study Area

3.4 Project Overview

The planned facility is expected to have a life duration of 25 years. The project is intended to comply with all Nigerian legislation and requirements. Consultations and meetings with regulatory bodies, project affected communities, and contractors must be held on a regular basis to ensure that land acquisition, labor-related, and community relations structures are well taken care of, as well as to address any concerns that may arise as a result of project development activities. The goal is to generate community support and social permission to complete the project in the shortest amount of time feasible.

The plant is designed as a "Grass-Root-Plant" with major processes modularized and housed in buildings. The main plant building, the filling unit, tank farms (raw material and finished product), the utility rooms, modules, and skidded packages are connected by structural steel pipe bridges / racks. The blending plant will comply with all European standards for equipment. Layout planning is being done according to the FMEnv guidelines.

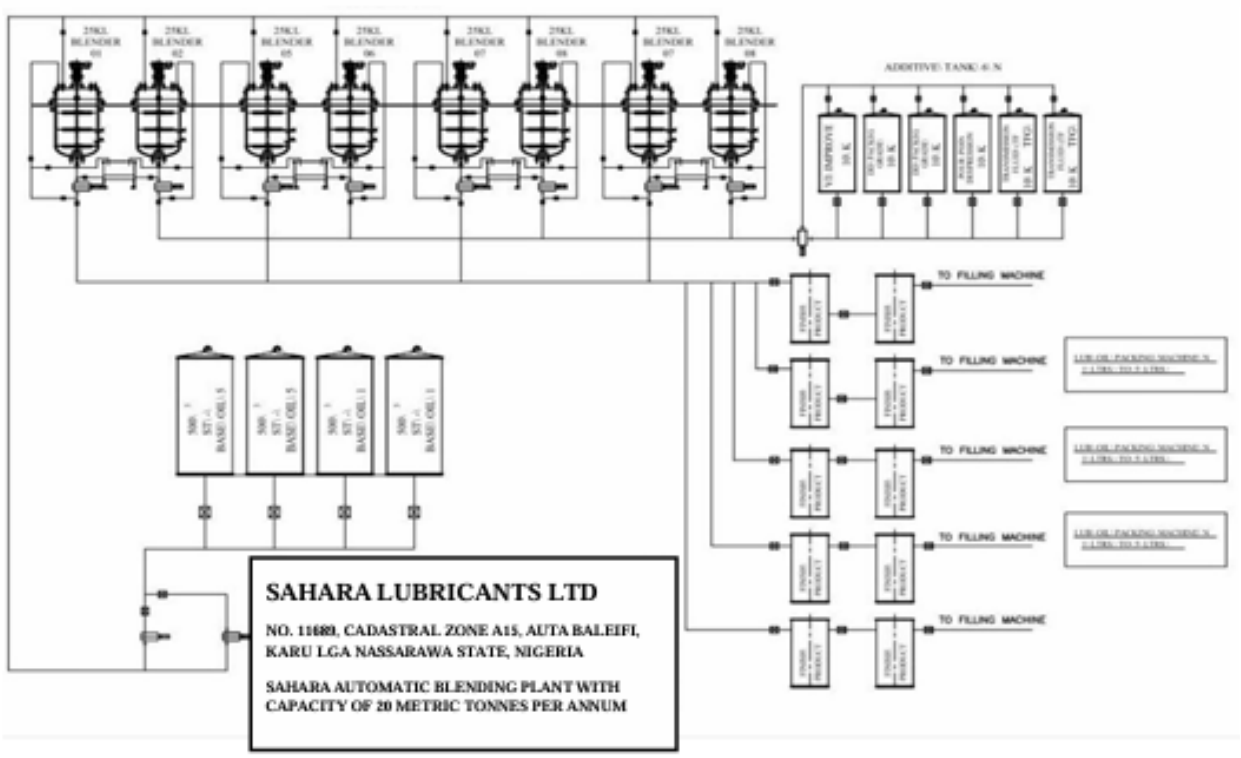


Figure 3.3: Sahara oil blending section flow process flow



Figure 3.4 Virtual plant design layout

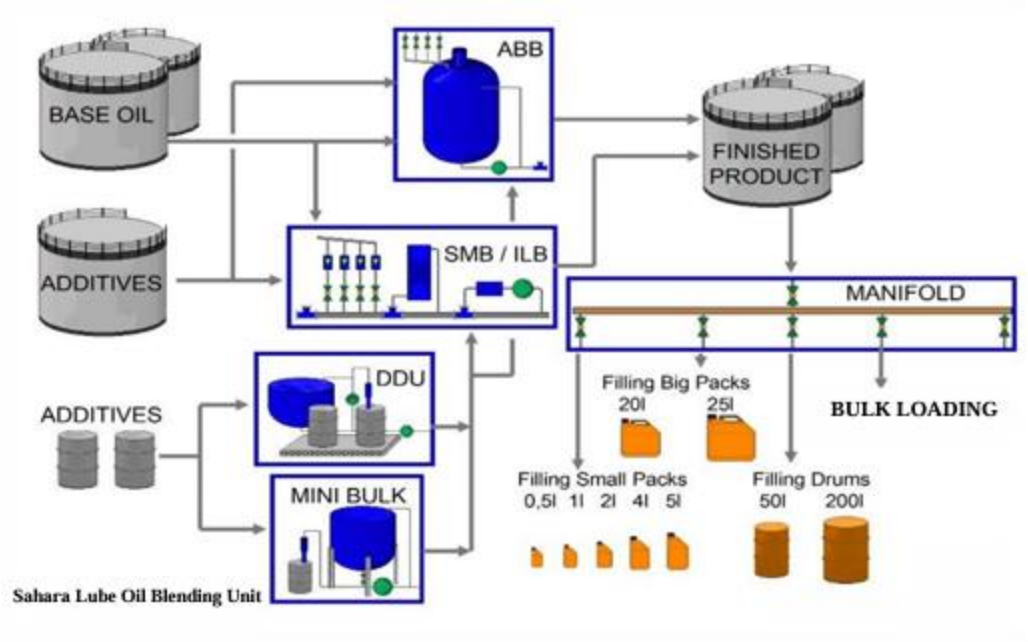


Figure: 3.5: Sahara Lube oil blending units

3.5 Material Input/Output and By Products

This study has given satisfactory consideration to material input, expected output and the byproduct of the proposed project. This is for effective environmental assessment.

3.5.1 Raw Material Input and Supply

Mainly, there are two main raw materials for the production of lubricants. These are:

Lube base stock and Additives

3.5.1.1 Lube Base Stock

Lube base stocks are raw materials which when mixed in the right components form base oil required for the production of lubricants. Base stocks are highly refined crude oil or in some cases a synthetic composition and account for about 1% of the total output of petroleum products from crude refining. Depending on the engine in which the lubricants is to be used, the ratio of base oil to additives varies from 85:15 to 90:10 and it shall be adopted in this project. Lubricant base oils are complicated mixtures of paraffinic, aromatic and naphthenic hydrocarbons with molecular weights ranging from medium to high values, which produce oils with appropriate viscosities, densities and ideal distillation curves. Base oil classes are characterized by the American Petroleum Institute (API) as shown below in three groups. The first three groups are refined from petroleum crude oil. Group IV base oils are full synthetic (polyalphaolefin) oils. Group V is for all other base oils not included in Groups I through IV. Before all the additives are added to the mixture, lubricating oils begin as one or more of these five API groups.

Group I

Group I base oils are classified as less than 90 percent saturates, greater than 0.03 percent sulfur and with a viscosity-index range of 80 to 120. The temperature range for these oils is from 32 to 150 degrees F. Group I base oils are solvent-refined, which is a simpler refining process. This is why they are the cheapest base oils on the market

Group II

Group II base oils are defined as being more than 90 percent saturates, less than 0.03 percent sulfur and with a viscosity index of 80 to 120. They are often manufactured by hydrocracking, which is a more complex process than what is used for Group I base oils. Since all the hydrocarbon molecules of these oils are saturated, Group II base oils have better antioxidation properties. They also have a clearer color and cost more in comparison to Group I base oils. Still, Group II base oils are becoming very common on the market today and are priced very close to Group I oils.

Group III

Group III base oils are greater than 90 percent saturates, less than 0.03 percent sulfur and have a viscosity index above 120. These oils are refined even more than Group II base oils and generally are severely hydrocracked (higher pressure and heat). This longer process is designed to achieve a purer base oil. Although made from crude oil, Group III base oils are sometimes described as synthesized hydrocarbons. Like Group II base oils, these oils are also becoming more prevalent.

3.5.2 Storage of base oil grades (tank arrangement)

In order to reach the minimum required flash point for engine lubricating oils, as per NIS 370 (Standards for Motor Vehicle Engine Lubricating Oil, 2017), for common multi grade types such as 15W-40 and 20W-50, a typical Class I (solvent extracted) base oil such as SN- 150 alone is not sufficient. As a result, higher base oils such as SN-500 are required in order to provide an efficient base oil mix. To achieve a flash point of 220 °C, a minimum blending ratio for SN-500/SN-150 of 3:4 would be necessary. Consequently, base oil storage/feed tanks for different types of base oil will be required. Furthermore, storage and operation capacity of at least one month would also be required. The storage tank arrangement for a small or mid-sized lubricating oils operation would then typically have: 1 or 2 tanks for SN-150; and 1 tank for SN-500. However, competing with imported engine oil qualities (15W-40 and 20W-50) from the bigger players with a flash point between 235 and 240 °C, particularly to serve the new vehicle sector, would require the increased use of higher base oil qualities, accordingly. This shall be achieved either by using only SN-500 as a feed base oil (1 tank), or replacing SN-500 with BS-150. The latter is the highest class I base oil with a minimum Flash Point (FP) of 250 °C (commonly going up to 294 °C). Tank requirements in this regard would be: 1 or 2 tanks for SN-150; and 1 tank for BS-150.

The proposed plant shall use base oil of classes SN-150, SN-300, and SN-600 of about 36000 litres per day as feedstock (Table 3.2). Their tank arrangement allows higher flexibility such as going for certain class II and class I N type oils. However, the import of many different base oil types maybe limited in terms of logistics and practicality.

3.5.3 Additives

Additives are substances formulated for improvement of the antifriction, chemical and physical properties of base oils. Typical Additives are listed below as follows:

- Friction modifiers;
- Anti-wear (AW) additives;
- Extreme pressure (EP) additives;
- Antioxidants;
- Chemical corrosion inhibitors;
- Detergents;
- Dispersants;
- Pour point depressants;
- Viscosity index improvers (viscosity modifiers); and
- Anti-foaming agents.

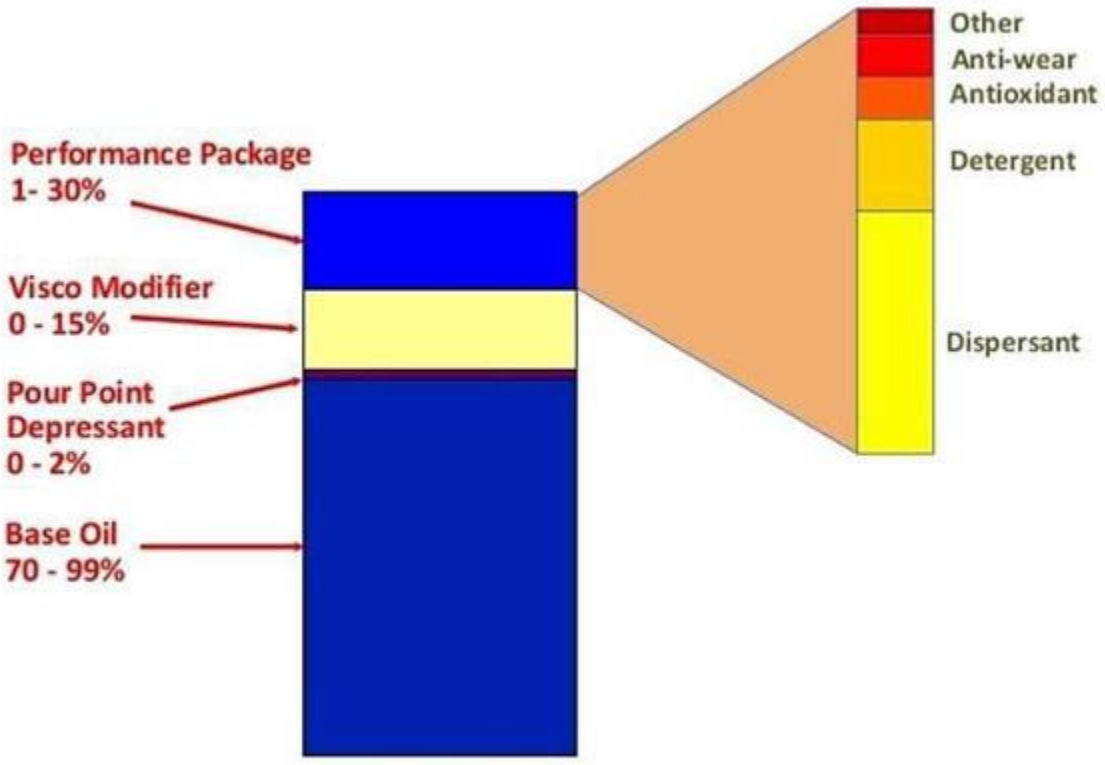


Figure 3.5: Typical engine oil composition

3.5.3.1. Friction Modifiers

Friction modifiers in order to reduce asperity contacts between opposing surfaces and therefore the coefficient of friction is either organic or inorganic substances. Organic friction modifiers are

molecules that have a polar group and an oil-soluble backbone ranging from conventional products such as: Glycerol mono-oleate; or Novel polymer-based friction modifiers.

Also, and as a solid organic friction modifier, Poly tetrafluoroethylene (PTFE) is frequently used, whilst inorganic friction modifiers are solid in general such as: Graphite; Molybdenum disulfide (MOS2); Boron nitride (BN); or Tungsten disulfide (WS2).

3.5.3.2. Anti-Wear (AW) Additives

Anti-Wear (AW) additives prevent direct metal-to-metal contact particularly in engines when the oil film is broken down. The additive reacts with the metal on the part surface and forms a film, which may slide over the friction surface. Some widely used AW additives are:

- Zinc dialkyldithiophosphate (ZDDP);
- Zinc dithiophosphate (ZDP);
- Tricresylphosphate (TCP);
- Chlorinated paraffins (Halocarbons);
- Glycerol mono-oleate; and
- Sodium salt of stearic acid.
- ZDDP is most widely used as AW additive in engine oils and also acts as corrosion inhibitor and antioxidant. Typically added in a range between 600 up to 1,200 mg/l. TCP is particularly applied for high temperature applications, such as for turbine engine lubricants also used as an extreme pressure (EP) additive. The sodium salt of stearic
- Acid is also the main component of soap. Lithium stearate LiO2C (CH2)16CH3 is metallic soap and an important component of grease.

3.5.3.3. Extreme Pressure (EP) Additives

These additives are more chemically aggressive than AW additives. They react chemically with metal (iron) surfaces to form a sacrificial surface film that prevents the welding and seizure of opposing asperities caused by metal-to-metal contact (adhesive wear). They are activated at high loads and by the high contact temperatures that are created. They are typically used in gear oils and give those oils that unique, strong sulphur smell. These additives usually contain sulphur and phosphorus compounds (and occasionally boron compounds). They can be corrosive toward yellow metals, especially at higher temperatures, and therefore should not be used in worm gear and similar applications where copper-based metals are used. Some chlorine-based EP additives exist but are rarely used due to corrosion concerns

3.5.3.4. Detergents

Detergents in lubricants are commonly added to engine oils for the neutralization of acids generated by combustion process and the prevention of high temperature deposition of the neutralization products such as sludge and varnish. Particularly phenolates, sulphonates and phosphonates of alkaline and alkaline-earth elements are used for this application.

3.5.3.5. Antioxidants

Oxidation is the general attack of the weakest components of the base oil by oxygen in the air. It occurs at all temperatures all of the time but is accelerated at higher temperatures and by the presence of water, wear metals and other contaminants. It ultimately causes acids (which produce corrosion) and sludge (which results in surface deposits and viscosity to increase) to form. Oxidation inhibitors, as they are also called, are used to extend the operating life of the oil. They are sacrificial additives that are consumed while performing their duty of delaying the onset of oxidation, thus protecting the base oil. They are present in almost every lubricating oil and grease.

3.5.3.6. Dispersants

Dispersants are mainly found in engine oil with detergents to help keep engines clean and free of deposits. The main function of dispersants is to keep particles of diesel engine soot finely dispersed or suspended in the oil (less than 1 micron in size). The objective is to keep the contaminant suspended and not allow it to agglomerate in the oil so that it will minimize damage and can be carried out of the engine during an oil change. Dispersants are generally organic and ashless. As such, they are not easily detectable with conventional oil analysis.

3.5.3.7. Viscosity Index (VI) Improvers

Viscosity index improvers are very large polymer additives that partially prevent the oil from thinning out (losing viscosity) as the temperature increases. These additives are used extensively when blending multi-grade engine oils such as SAE 5W-30 or SAE 15W-40. They are also responsible for better oil flow at low temperatures, resulting in reduction in wear and improved fuel economy. In addition, VI improvers are used to achieve high-VI hydraulic and gear oils for improved start-up and lubrication at low temperatures. To visualize how a VI-improver additive functions, think of the VI improver as an octopus or coil spring that stays coiled up in a ball at low temperatures and has very little effect on the oil viscosity.

3.5.3.8. Anti-Foaming Agents

The chemicals in this additive group possess low interfacial tension, which weakens the oil bubble wall and allows the foam bubbles to burst more readily. They have an indirect effect on oxidation by reducing the amount of air-oil contact. Some of these additives are oil-insoluble silicone materials that are not dissolved but rather dispersed finely in the lubricating oil. Very low concentrations are usually required. If too much anti-foaming additive is added, it can have a reverse effect and promote further foaming and air entrainment.

3.5.8.9 Pour Point Depressants

The pour point of an oil is approximately the lowest temperature at which an oil will remain fluid. Wax crystals that form in paraffinic mineral oils crystallize (become solid) at low temperatures. The solid crystals form a lattice network that inhibits the remaining liquid oil from flowing. The additives in this group reduce the size of the wax crystals in the oil and their interaction with each other, allowing the oil to continue to flow at low temperatures.

3.6 Energy/Power Requirement

The proposed project will source power from the national grid. This will involve the acquisition transformer by the proponent and contact appropriate authority installation and commissioning. Proponent shall also acquire power generating set(s) of about 500KVA in the case of power outage from the national grid. The brief electrical requirements and equipment considered under Outside Battery Limits (OSBL) for the development of the project. Solar energy will be used to augment power utilization particularly lightening and less power utilization appliances

3.7 Water Requirement

The water supply for the lubricating oil blending plant shall include the in-plant water supply, drainage pipe network, fresh water distribution, circulating water yard, waste water treatment facility, mini fire-fighting station, etc. Ground water (via boreholes) shall be used as the major water supply source both at construction and operation. During operation, water use will include; process water, fire-fighting water, domestic water and drinking water within the oil blending plant area. Water supply shall include the in-plant fresh water system and cold circulating water system. The water drainage system includes the implant hot circulating-water system, oily waste water system, domestic sewage system, salt-containing waste water system, other production waste water system and rainwater oil free system, etc. The generated wastewater from the plant operation process shall be treated in the Water Treatment Plant (WTP) and recycled as much as possible.

Wastewater Treatment Process

By definition, process means a series of actions or changes. Treatment facilities incorporate numerous processes which in combination achieve the desired water quality objectives. These processes involve the separation, removal and disposal of pollutants present in the wastewater. The treatment of wastewater is accomplished by four basic methods or techniques; physical, mechanical, biological and chemical. Physical methods of treatment include the use of tanks and other structures designed to contain and control the flow of wastewater to promote the removal of contaminants. Mechanical treatment techniques involve the use of machines, both simple and complex in design and operation. The action of bacteria and other micro-organisms are biological methods of treatment, which play a vital role in the removal of pollutants which cannot be effectively achieved by other means. Chemical treatment methods enhance the efficiency of other process operations and provide specialized treatment as a result of their addition at various treatment stages.

Preliminaries geophysical studies of the site area shows that the aquifer characteristics, yield, and draw-down. This will help inform the maximum allowable amount of boreholes that can be drilled to meet the quantity of water required and the design of the water supply system. Also, the results of the geo-physical studies will inform on the capacity (lubricant blending rating) of pumping machines to be installed and the depth to be drilled.

3.8 Traffic Management Plan

This Traffic Management Plan (TMP) outlines the traffic control and traffic management procedures to be implemented by the Project Manager to manage potential hazards associated with the traffic environment during the project.

Traffic Management Personnel

- At least one person on site shall be accredited in Basic Worksite Traffic Management, and shall have the responsibility of ensuring the traffic management devices are set out in accordance with the TMP
- Traffic management sites involving complex traffic arrangements'on Main Roads controlled roads, shall have at least one person with either Worksite Traffic Management or Advanced Worksite Traffic Management accreditation on-site at all times when road workers are present.
- Works not on Main Roads controlled or not involving complex traffic arrangements' At least one person accredited in Advanced Worksite Traffic Management shall be available to attend the site at short notice at all times to manage variations, contingencies and emergencies, and to take overall responsibility for traffic management.

3.9 Waste Generation and Management Plan

Effective and responsible handling and disposal of wastes are key elements in environmental management system. Wastes refer to any material (solid, liquid, gaseous or mixture) that is surplus to requirements. Waste management for the project shall be carried out in consultation and in line with the waste management guidelines of Sahara Lubricants Limited. The company shall take all practical and cost effective measures to minimize the generation of wastes, by employing the four R's (Reduce, Reuse, Recycle, and Recovery) through process of optimization or redesign, efficient procedures and good housekeeping. Waste shall be managed in the following ways:

- Inventorization
- Classification
- Segregation

Waste handling and disposal procedures shall be well defined at source and a waste inventory register kept. The waste contractor shall define and document appropriately, all wastes generated and transferred in the course of this work. The minimum general information required for the adequate definition of wastes includes:

- Waste stream identification;
- Proper waste categorization;
- Waste segregation;
- Appropriate handling and disposal practice; and
- Recommended Management

There are four phased waste management tracking plan: waste management during pre- and construction, operation and decommissioning phases. These shall be handled by the company in

collaboration with the State Environmental Protection Agency. Waste generated during construction shall include earth materials and vegetation (felled trees, tree stumps, leaves and cut grasses). The excavated earth shall be employed in the leveling of the site; felled trees and stumps shall be given out to the community members as firewood while leaves given out to be fed livestock. Also expected are packing cases (steel/wooden/plastic crates, polythene bags and cartons); metal scraps from wielding activities; atmospheric pollutants – exhaust emissions and dust particles (from internal combustion engines and movement of equipment, materials and workers); and concrete/lubricant mix from plants base construction and wall dressing activities. Packaging materials shall be collected, segregated at the site for re-use, recycle or resold. All items that cannot be re-used, re-cycled or sold shall be conveyed to government approved disposal sites. The concrete lubricant mix shall serve as wall-dressing materials for the channels and pavements. Anticipated sources and types of wastes from the accommodation facilities for work force include liquid effluent from the toilet and kitchen; gaseous emission from vehicles and lubricant blending generating plant; used oil from equipment maintenance activities, damaged bags from packaging activities. The foreign body waste shall be from scraps, metal and glass particles, newspapers, and packaging materials. They shall be segregated for proper disposal in appropriate waste containers and transported to approve disposal sites by the State. Liquid effluents from the facility shall be channeled to waste treatment plant of the facility.

3.9.1 Waste Oil Recycling

As commitment by management to ensure that the proposed lubricating oil blending facility operates in line with best practices and NMDPRA guidelines, waste oil recycling treatment plant shall be established to take care of lube oil from workshop, petrol stations and from the spent lube oil produced by the company production line. To establish a proper recycling and recovery process waste lube oil collection system shall be initiated, involving workshops and petrol stations, taking back spent lube oils produced by company.

3.9.2 Lube oil treatment to remove solids and water

Waste lube oil and spent machine oil shall be treated with centrifuge equipment to remove solid particles and water (Figure 3.6). The clean base oil shall be re-used in the blending process or could be applied as drilling lubricant for oil-based mud elsewhere. This requires a disc stack separator (high-speed separator centrifuge), where the lube oil

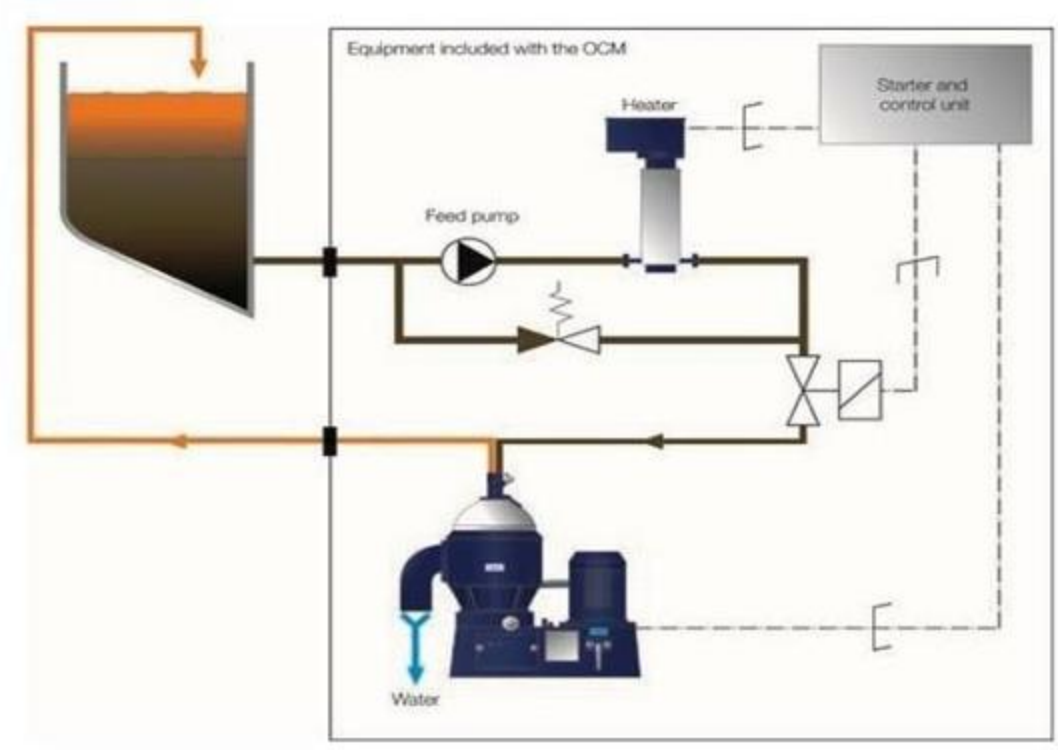


Figure 3.6: Lube oil treatment with disk stack separator

Treatment with disk stack separator is executed via an independent bypass, which doesn‘t affect the main process. Depending on the viscosity of the waste lube oil, heating is required prior to separation. The water is constantly removed from the waste oil by disk stack separator, whilst the clean oil is routed back to the lube oil tank and the solids are collected in the separator bowl and will be automatically discharged. The lube oil contamination such as particulate matter and water is already reduced considerably after only one lube oil treatment step. In order to remove small particles below 10 µm it is necessary to run the waste oil several times in a cycle, accordingly. In order to reduce the treatment cycles a decanter (two phase) centrifuge (Figure 3.7) shall be added to the process upstream to the disk stack separator. This process is applied for slop oil treatment capable of segregating oil, water and solids in one process step.

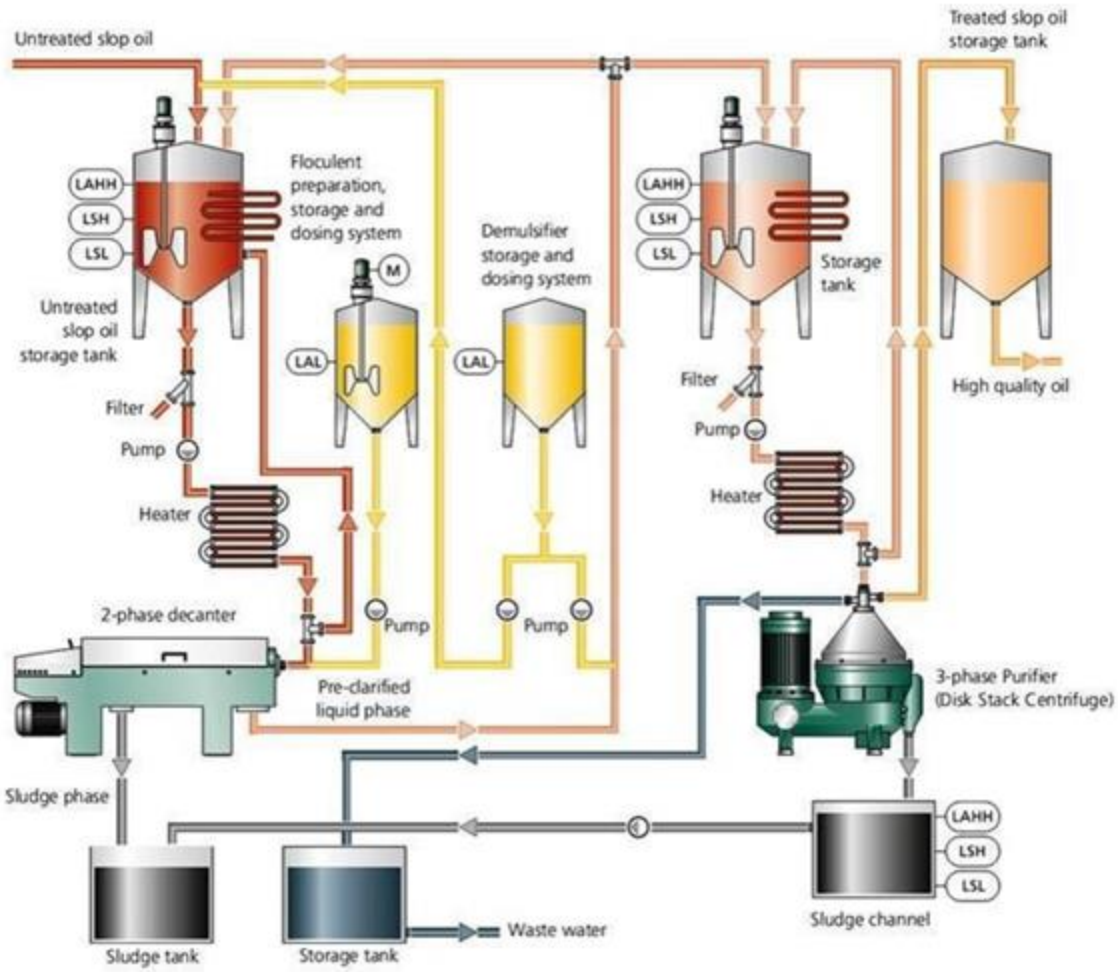


Figure 3.7: Waste oil treatment process with decanter & stack separator

Decanters and three phase centrifuges – tricanter (Figure 3.6) require minor maintenance thus reliable in terms of technical availability (low downtime). These shall be adopted in this proposed project.

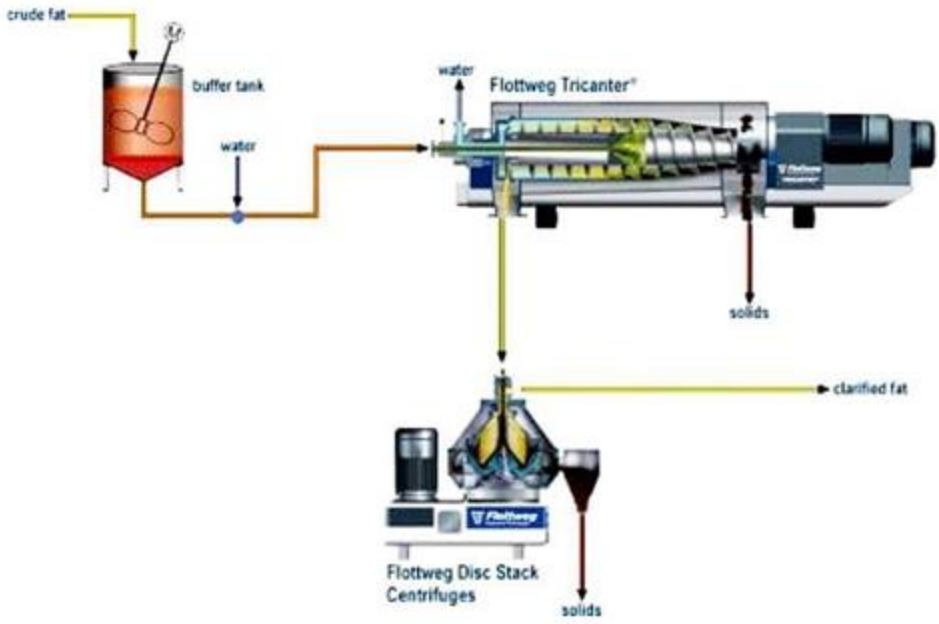


Figure 3.8: Waste oil treatment process with tricanter & stack separator

3.10 Technological Layout and Process

A proposed layout for the Sahara Lubricants Limited blending plant is presented in Figure 3.3 and Figure 3.4 while figure 3.5 is the block layout diagram of the proposed plant. From the layout design, the flammable crude and products are appropriately spaced away from the heat areas (furnaces, columns and steam generator). Levels of the units were appropriately positioned to maximize flow by gravity. The choice of technology for the Sahara Lubricants limited plant is based on the size of the proposed project in terms of daily production capacity and economic of the lubricating plant. In this plant, Automatic Batch Blender (ABB) technology shall be used.

3.10.1 Lubricating Oil Plant Specifications and Processes

In the proposed plant, the basic units include the: Automatic Batch Blender (ABB), Simultaneous Metering Blender (SMB), Inline Blender (ILB), and Drum Decanting Unit (DDU) as presented in Figure 3.9. The technology is efficient to achieve higher technical availability (lower downtime) and flexibility. This depends on the number of additives and the kind of receptacle in terms of delivery/packaging (whether in drums or as a bulky good in tank trucks).

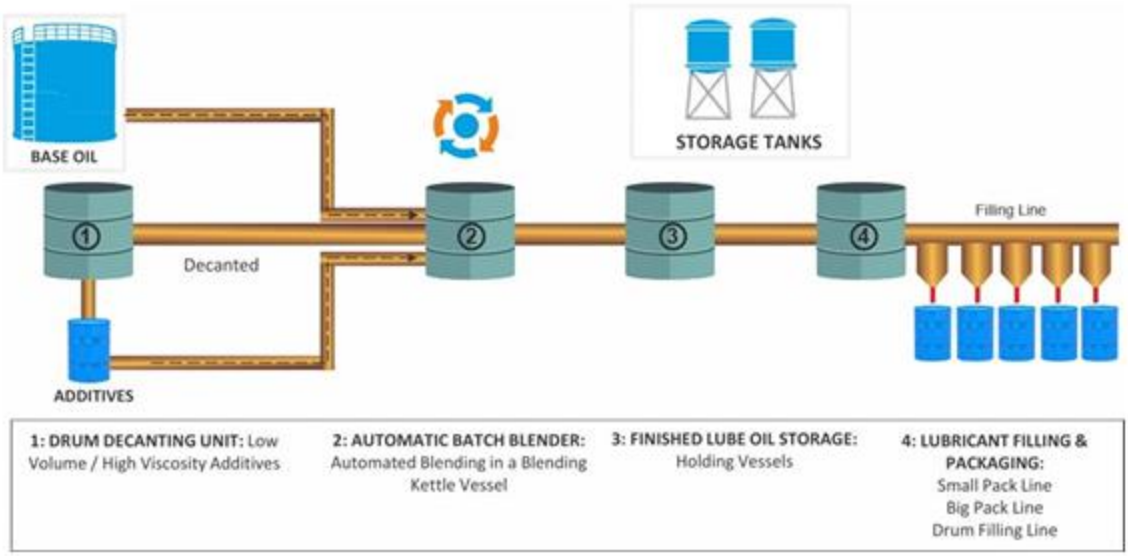


Figure 3.79: Generalized Lubricating oil blending process

3.11 Lube oil testing laboratory

A laboratory for quality control shall be established within the plant to test for a number of parameters and others as prescribed by the Nigerian Industrial Standards (NIS) for lubricants using international test methods (ASTM International and IP) as applicable. These parameters, as specified in theFME/ NMDPRA guidelines, are:

- Specific gravity;
- Flash point;
- Pour Point;
- Viscosity;
- Water content;
- Insoluble content;
- Acidity level;
- Total Base Number (TBN);
- Sulfated ash content (Trace metals Pb, Fe, Na, K, V, Ni, Co);
- Penetration;
- Drop point; and
- Acidity.

The lube oil testing laboratory shall be outfitted with adequate laboratory equipment, such as, ICP, AAS & FTIR Spectrophotometer, Automatic Viscometer, Pour Point Determiner, Density Meter, etc., supplied by reputed testing and measuring equipment makers, such as, Koehler, Metrohm, Perkin-Elmer, Cannon, Julabo, Anton Parr, Gast, etc.

3.12 Operational/Maintenance Activities

The proposed lubricating oil blending plant shall be operated in accordance with operational procedures developed through extensive experience of the technical partners. Fully trained and qualified personnel shall manage the plant. Maintenance and inspection activities shall be periodic with adequate attention given to condition of structures and performance of equipment. Refurbishment activity to restore the integrity of structures will be based on their condition. Coating systems applied to structures will be replaced on a regular basis while machinery parts will be replaced as at when due.

3.13 Basis for Design

The basis for design adopted in the proposed project development combined quality assurance with applicable standards and codes. These are to achieve the most economical, technological, social and environmentally friendly project and to ensure that the original purpose of the plant is achieved. For this to be accomplished, quality assurance and application of standard codes shall be faithfully implemented.

3.13.1 Quality Assurance

In lubricating oil blending plant development as in this project, certain basic parameters must be reasonably and accurately defined in the overall project specification to ensure that full objectives of the project are realized. The company has therefore specified the following quality objectives for the design:

- Compliance with statutory requirements;
- The system must meet performance requirements;
- Production availability;
- Environmental and Safety considerations;
- Operability and maintainability;
- Life expectancy;
- Extendibility; and
- Use of innovative technology.

To ensure that the above quality objectives are met, the company has adopted time-tested International standards for lubricating oil blending plant employing new technology, where environmental, safety and economics rule.

3.13.2 Applicable Design Codes and Standards

The following are the criteria/considerations considered for the design of piping systems for this project. ASME B31.3 & B31.4 shall be the governing/reference codes. This code shall focus on the requirements for process piping related to the design, construction, fabrication, inspection and examination in a safe and economical piping system.

3.13.2.1. Design Parameter

Operating condition shall be the normal conditions of temperature & corresponding pressure based on connected source/destination equipment parameters which vary between ambient and steady state condition during full operation/capacity. Design condition will be the maximum possible coincident operating temperature & pressure (internal & external) which shall consider all possible factors that can co-exist in the system at shut-down, down-time and/or full operation. Factors that affect the piping system operating & design parameters which will be considered include: Hydrostatic head effects due to differences in elevation between high & low points in the system, friction losses and back-pressure effects, variation in system controls and other operating pressure surges, shut-down operation, pump shutoff pressure, control valves in fully opened or closed position, solar radiation effect, Heating systems, Flaring effects, etc.

3.13.2.2. Piping System Rating

The entire piping system will be rated for 150# - 300# in accordance with ASME B16.5 requirements which shall be based on the maximum temperature & coincident pressure the MOC can handle/tolerate. However, prompt & appropriate decisions shall be made should the system exceed set limits and higher rating will be effected to contain the effect of possible stress reactions due to system heating demands.

3.13.2.3. Material

Piping material selection will be as informed in the respective design codes of prospective selected materials and various factors such as products properties, operating parameters of temperature & pressure, plant design life. Metallic materials of choice for product piping will be service-compatible carbon steel / stainless steel grades. Fire water / water based services above ground will be chiefly hot-dipped galvanized carbon steel while connecting underground parts will be of HDPE material. Pipe wall thicknesses calculation checks shall be conducted according to the reference code(s) upon which pipe wall thicknesses will be advised. Carbon steel pipe of NPS 1½‖ and smaller if used in process lines and lines containing flammables will be of Schedule 80 minimum thickness. For stainless steel under the same condition, minimum thickness will be Schedule 40S.

3.13.2.4. Design Consideration

General

OSBL (Out Side Battery Limit) facility layout will be undertaken based on the following factors; Product storage, operational flexibility, ease of maintenance, enhanced accessibility, safety & escape routes, ergonomics, provision for future expansion, local regulations, best industrial practices, etc.

Pipe Routing

The piping network configuration will follow the best possible routes such that will allow for a simple, robust, ―easy to operate and maintain‖ economic piping network.

- Sufficient flexibility will be considered in the routing of all piping network,
- Adequate supporting will be advised as much as necessary,
- Where road crossing is inevitable, culverts or pipe bridge/crossing structural members will be provided with adequate protection such as coating & wrapping at culvert crossings or crash barriers where pipes nearness to road is unavoidable,
- Suction/ bidirectional flow lines will be routed such as to avoid air pockets due to rising & dropping,

All suction lines shall have their elevations highest at source point and lowest at center line of pumps suction, All product lines will be captured in the design while key utility lines >4‖ will also be routed, Pipes will be routed aboveground as much as practicable especially in the tank farm area, Coating, wrapping and/or cathodic protection will be duly considered for buried metallic lines,

The minimum cover over buried process piping will be 1100mm in paved or unpaved areas except under a reinforced concrete,

- Sufficient headroom shall be considered at vehicular areas & heavy personal treads,
- Casing will not be considered as protection for underground pipes crossing roads. Concrete slabs will be required for protecting such pipes,
- Piping will be arranged in an orderly manner and routed as directly as practical, preferably in established banks of pipe ways,
- Piping arrangement will provide for possible thermal expansions and contractions in the lines,
- Reactions or moments causing excessive stresses in piping or equipment will be avoided by-proper design options,
- Reductions in size of 60.3 mm O.D. (NPS 2) and larger lines on supports will be made with eccentric reducers with flat bottoms down to keep the bottom of lines level,
- Vents and drains will be provided at high and low points, respectively, in the piping system. All drains shall be provided with a shut-off valve.

Tie-in to ISBN

- OSBL piping shall be interconnected to ISBL for receipt & transfer of crude & refined products as well as sharing plant utilities such as service water, air, fire water, etc.
- Connections/tie-ins between battery limits will be by flanging to avoid hot works as much as permissible,
- Where cold work connection is not feasible, minimum hot-works might be considered

3.13.2.5. Pumps

Lines from/to tanks will be routed to target pumps for selective connective to suction and discharge pump headers to facilitate product receipt/transfer.

- Adequate accessibility will be provided for ease of operation and maintenance around pumps,

- Pumps manufacturers set nozzle load limits will be respected through optimized piping design and supports,
- Pumps Suction straight runs/lengths shall be as specified in the respective codes.

3.13.2.6. Equipment Piping

General

- Piping at equipment such as pumps and others shall be arranged such that equipment may be maintained or detached without dismantling adjacent equipment or piping.
- Piping will be designed to induce the least possible loads & stresses on equipment as permitted by applicable codes and vendor limits.
- Removable flanges shall be provided where spools attached to equipment to avoid unnecessary dismantling of the group. Where grouped/assembly of piping occur, lifting lugs shall be provided to handle & lift them after isolation from the equipment.
- Piping connection to equipment will be flanged with same MOC and facing

3.13.2.7. Storage Tank Piping

The tank farm piping‘s will be routed above ground following the best possible routes. All valves below grade in the tank farm will be provided with pits for easy operation of inline components below grade with possible stem extension as applicable, Piping connection to tanks shall be such that induced loads on nozzles are within allowable limits and kept as low as safety and integrity of the connection requires.

3.13.2.8. Valves

Valve types and operation mechanism will be designed during project FEED stage and possible improvements in type selection and operation will be considered as required. Technical specification spelling out the key requirements from process schemes and governing codes will be drawn for the valves. Data sheets will also be prepared for all the valves with detailed description of design/construction and materials among others will be reflected as demonstrated in the valves respective governing codes/standards. Adequate supports will be proposed sufficient for piping design which will be improved/ consolidated in future design level. Sleepers, primary pipe supports and racks will be duly employed in providing supports for the piping system. The flexibility checks will be considered during the FEED stage after preliminary supporting activity.

3.13.2.9. Electrical

Standard codes guiding electrical components of the proposed project include:

- EN 12954 - Cathodic protection of buried or immersed metallic structures. General principles and application for pipelines;
- EN 13509 - Cathodic protection measurement techniques;
- EN 14505 - Cathodic protection of complex structures;
- API RP 500 - Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities (Class I, Divisions I and 2)

- IEC 79-10 standard, IP part 15 - Electrical application for explosive gas atmospheres. Part 10-Classification of hazardous areas;
- IEC 1024 - Protection of structures against lightning;
- ISO 15589-1 - Petroleum and Natural Gas Industries – Cathodic Protection of Pipeline transportation systems – On-land pipelines;
- ISO 15589-2 - Petroleum and Natural Gas Industries – Cathodic Protection of Pipeline transportation systems – Offshore pipelines; NACE SP0169-2007 - Control of External Corrosion on Underground or Submerged Metallic Piping System

3.13.2.10. Instrumentation

Instrumentation of the proposed project shall rely on standards and codes including:

- API RP 550 - Manual on Installation of Refinery Instruments and Control Systems; Part II-Process Stream Analysers;
- API RP 551 - Process Measurement Instrumentation;
- API RP 554 - Process Control Systems;
- API RP 555 - Process Analysers;
- ISA S5.1 - International Society of Automation Standard;
- IEC 61131, Part 1 – 3 - Standard for Programmable Controllers;

Part 1: General information (IEC 61131-1:2003); Part 2: Equipment Requirements and Tests; Part 3:Programming languages (IEC 61131-3:2013)

- IEC 60870-5, Part 1 – 6 - Telecontrol equipment and systems;
- IEC 61000, Part 1 – 4 - Electromagnetic compatibility (EMC);
- IEC 61508 – Functional safety of electrical/electronic/ programmable electronic safety related systems; • ISO/IEC 12207 - Systems and software engineering;
- IEC 61511 – Functional safety – Safety instrumented systems for the process industry sector

3.13.2.11. Technical Requirement for Engine Lubricating Oils

The technical requirements for a good engine lubricating oils that shall be adopted are as listed but not limited to the following: A high boiling point and low freezing point (in order to stay liquid within a wide range of temperature)

- A high viscosity index.
- Thermal stability.
- Hydraulic stability.
- Demulsibility.
- Corrosion prevention.
- A high resistance to oxidation

3.14 Project Activities

The project development phases are summarized below:

Pre-construction Phase

- Preliminary surveys and site investigation work (geotechnical, topographical, and geophysical environmental studies).
- Site preparation activities shall include; fencing, levelling, and grading of soil to prepare it for foundation and earthworks as well as backfilling.
- Mobilization shall include; supply of building materials, personnel, and equipment.

Construction Phase

- Earth work, excavation, concrete mixing, pilling, welding and metal works
- Construction / Installation of mounded tanks
- Piping construction and laying, Painting and coating
- Construction of plant facilities / utilities
- Non-destructive testing
- Commissioning

Operations Phase

- Storage and distribution of Lubricants
- Power generation
- Testing and laboratory analysis of product
- Product fiscalization
- Routine plants facilities maintenance
- Waste Management

Decommissioning Phase

- Personnel, equipment and material demobilization
- Containment of wastes of equipment
- Site restoration

3.14.1 Pre-construction Phase

Site Surveys and Stakeholder Engagement

In this sub-phase, feasibility, environmental, technical and financial surveys are involved. The company understands the importance of stakeholder engagement and has consulted community dwellers, interested and affected parties (IAPs) and also FMEnv at the early stages of the preparations.

Equipment and Personnel Mobilization

The activities carried out in this sub-phase shall be in accordance to FMEnv requirements. There will be provisions made for personnel and services they require shall be factored in. There shall be a reporting schedule designed by the construction contractor. Project awareness and sensitization forums shall be carried out with contractors and regulatory bodies to ensure understanding and compliance to set standards. This will further minimize any potential environmental issues that may arise. Operations routes and travel schedules shall be determined before mobilization. Sahara

Lubricants Limited shall perform a due diligence to developing this route such that they shall consult in advance with any authority or community where the operation passage shall interrupt or interfere with public activities. There shall be use of warning signs and caution equipment used in the operation route to alert other possible operation route users. Other mandatory consents such as the Freedom to Operate (FTO) from the host community, FMEnv approval and permits shall be obtained at this stage.

Site preparation and access

- Site preparatory activities shall typically involve:
- Clearing of vegetation within the proposed project location and
- Fencing and perimeter access control establishment

3.14.2 Construction Phase

This phase involves the construction of foundation structures for tanks, stands, associated earth works, and installation of electrical devices and other primary facilities. The materials to be used in the construction phase of this project include the following but is not limited to:

- Concrete
- Sandstone
- Sand
- Steel rods
- PVC pipes
- Water
- Paint
- Energy- diesel powered generators as well as the national grid Equipment will be locally and internationally sourced.

Earth-work/ excavation

This will involve the use of bulk road vehicles (BRV) such as bulldozers and excavators to smoulder sparse vegetation. Every tree stump, gravel, shale and other material encountered shall be removed completely to secure the proper subgrade or proper elevation to receive the foundations

Foundation

A mixture of water, cement, fine and coarse aggregates for building the tanks, spheres and generator stands including the floor of the plant shall be reinforced according to British standard and subjected to Slump test and compressive strength test.

Pipe Routing

The piping network configuration will follow the best possible routes such that will allow for a simple, robust, “easy to operate and maintain” economic piping network.

- Sufficient flexibility will be considered in the routing of all piping network,
- Adequate supporting will be advised as much as necessary,

- Where road crossing is inevitable, culverts or pipe bridge/crossing structural members will be provided with adequate protection such as coating & wrapping at culvert crossings or crash barriers where pipes nearness to road is unavoidable,
- Suction/ bidirectional flow lines will be routed such as to avoid air pockets due to rising & dropping,
- All suction lines shall have their elevations highest at source point and lowest at centre line of pumps suction,
- All product lines will be captured in the design while key utility lines >4" will also be routed,
- Pipes will be routed aboveground as much as practicable especially in the tank farm area,
- Coating, wrapping and/or cathodic protection will be duly considered for buried metallic lines,
- The minimum cover over buried process piping will be 1100mm in paved or unpaved areas except under a reinforced concrete,
- Sufficient headroom shall be considered at vehicular areas & heavy personal treads,
- Casing will not be considered as protection for underground pipes crossing roads. Concrete slabs will be required for protecting such pipes,
- Piping will be arranged in an orderly manner and routed as directly as practical, preferably in established banks of pipe ways,
- Piping arrangement will provide for possible thermal expansions and contractions in the lines,
- Reactions or moments causing excessive stresses in piping or equipment will be avoided by-proper design options,
- Reductions in size of 60.3 mm O.D. (NPS 2) and larger lines on supports will be made with eccentric reducers with flat bottoms down to keep the bottom of lines level,
- Vents and drains will be provided at high and low points, respectively, in the piping system. All drains shall be provided with a shut-off valve.

3.14.3 Operations Phase

The raw material tank farm consists of the Base Oil storage tanks, additive storage tanks, the Mini bulk tanks and the Drum Decanting Unit. The loading/unloading of the Base Oil Storage Tanks shall be accomplished using their designated pumps. The pumps shall operate at loading/unloading flow rates of 40 m3/ hr. The bulk of the needed additives for lubricant production are stored in the additive storage tanks. The additive tank farm has one (1) additive storage tanks having it dedicated pump. The Mini Bulk Unit consist of two (2) tanks, with each having it dedicated pump respectively. The required additives are loaded into any of the Mini Bulk Tanks through the process lines from the Drum Decanting Unit.

The Drum Decanting Unit gets it feed from the manual addition unit (FG3170), as well as the Base Oil Storage Tank through the pipe rack. The Pipe Rack serves as a uniform routing space through which the various discharge lines of the Base oil Storage Tanks, Additive Storage Tanks, Mini Bulk Tanks, well organised, passes into the Batch Blending Vessel (BBVs – U 3110/3120) or the Simultaneous Metering Blender (SMB–U-3140) through the metering systems.

After the loading process of the raw material storage tanks (Base oil Storage Tanks, Additive Storage Tanks, Mini Bulk Tanks and the Drum Decanting Unit), raw materials (base oil, additives) via the pipe racks are sent to the BBVs for blending / lubricant production. And with the aid of the dedicated pumps (P – 3110/3120), the finished product (Lubricant) is sent into the Finished Product Storage Tanks through the Finished Product Transfer Lines. With the aid of the dedicated pumps, the finished products from the storage tanks are sent to the Filling and Packaging through the Matrix Manifold, from the Matrix Manifold, finished products are sent to the filling and packaging unit where the products are kegged and ready for distribution to the customers based on demand.

3.14.4 Decommissioning Phase

Upon decommissioning of the proposed lube blending plant, rehabilitation of the project site will be carried out to restore the site to its original status or a better status than it was originally met. This will include replacement of topsoil and re-vegetation which will lead to improved visual quality of the area. During the operating life of the plant, the performance and integrity of the plant including its ancillary facilities shall be monitored in accordance with the operations and maintenance procedures developed prior to commissioning. When the plant reaches the end of its safe operating life or alternatively when the economic life is reached, it will be decommissioned. Decommissioning shall be conducted with safety and the environment its top priority. It will be decommissioned in a manner consistent with company's decommissioning guidelines, applicable Nigerian regulatory requirements, and any applicable international best industry standards. A decommissioning team responsible for the development and implementation of a decommissioning plan shall be established. The specifics associated with this plan shall be based in part on the circumstances at that time and the technology available to best manage the closure of the operations. Similarly, as for the mobilization, it is important that required documentation and certification of the facilities remain valid when demobilization commences, to demonstrate suitability, regulatory compliance, and compatibility with committed standards. Any impact for safety & emergency systems shall be addressed. Specifications for removal and transport shall be the responsibility of the operation contractor. Operation down equipment and handling for transport to shore which are not considered as ordinary operations, shall be subject to a formal pre-job meeting or a job safety analysis. Transportation and movement of operation and personnel shall be coordinated with relevant inland waterways safety authority as well as the security agencies. Equipment shall be dismantled and cleaned using safe washing agents contained in a perimeter bonding to avoid spill over to the soil. Vegetation cleared shall be re-vegetated as practicable to return the environment to as close to operational status.

CHAPTER FOUR
DESCRIPTION OF PROJECT ENVIRONMENT

4.0 Introduction

This chapter describes the biophysical, social and health environmental baseline conditions of the project area which could potentially be affected by the development. To achieve this, environmental (biophysical, health and social) setting of the area where the proposed facility is located was determined through literature search, desktop study and Environmental Field Study for a season conducted on 8th September, 2026. The objective of the baseline study is to establish the existing environmental conditions as well as the socio-economic and health conditions of the project area in a way that would facilitate the evaluation of the potential impacts of the proposed project development, monitoring of noticeable ecological changes in the study area and the preservation of the environment, its resources and sustainability of the development. The components of the environment, which were evaluated, include climate and meteorology, air quality and noise, water quality, geology and hydrogeology, soil/land use, socio-economic and health of the environment where the propose project is located.

The environmental impacts concerning this project has been categorized as either primary or secondary. Primary impacts are those which are attributed directly by the construction and operation of the project, while the secondary impacts are those which are indirectly induced and typically include the associated investment and changed patterns of social and economic activities by the construction and operation of the proposed lube blending plant

4.1 Baseline Data Collection Methodology

The baseline condition of the proposed project location was established through literature review, previous studies around the area and a two season data gathering exercise which was on 8th September, 2026

Both literature study and field sampling were carried out in accordance with FMEnv and international standards and best practices.

- Developing an EIA Terms of Reference (ToR);
- Designing a field sampling strategy and rationale to meet regulatory requirements;
- Pre-mobilization activities including calibration checks and job hazard analysis;
- Field samples collection, handling and storage;
- Regulators (FMEnv) onsite supervision;
- Demobilization and transfer of samples to FMEnv accredited laboratory for analysis

4.1.1 Desktop Research

The systematic data acquisition involved obtaining the project site's regional environmental and meteorological characteristics, geology, ecological profile as well as some elements of the socio-economic profile of the project area and similar environment through consultation of relevant textbooks, research materials, articles, journals, etc.

Secondary Public Data

Baseline data especially as it relates to social and health conditions of the project area were obtained from secondary public databases. Specifically, secondary database consulted for this study include but not limited to:

- National Population Census, 2006
- National Bureau of Statistics

4.2 Description of sampling location

The sampling environmental and social parameters was generally designed with an intent to collect representative samples within the project boundary and AOI so as to represent the range of environmental conditions.

Sampling therefore involved the following components:

• Soil samples – Ten (10) stations and two (2) control;

• Ground water – two (2) and one control points;

• Air Quality and Noise - ten (10) stations and two (2) control.

• Flora; and Fauna.

Table 4.1: Sampling Coordinates for Soil and Air Quality

Point	Latitude (N)	Longitude (E)
Point 1	8.933816	7.685760
Point 2	8.933835	7.685780
Point 3	8.933930	7.686173
Point 4	8.934083	7.686042
Point 5	8.934022	7.685724
Point 6	8.933998	7.685847
Point 7	8.934241	7.685720
Point 8	8.934344	7.685843
Point 9	8.934356	7.685675
Point 10	8.934290	7.685485

Point	Latitude (N)	Longitude (E)
C1	8.932636	7.686326
C2	8.933032	7.684914

Table 4.2 Water Sampling Points and In-Situ Measurements

Water Point	Latitude (N)	Longitude (E)	Temperature (°C)	TDS	EC	Salinity	pH
WC1	8.933539	7.686860	29	74	148	0.01	8.2
WC2	8.934818	7.685462	29	249	478	0.01	8.5
C1	8.932636	7.686326	29	81	168	0.01	8.2
C2	8.933032	7.684914	29	146	471	0.01	8.5

4.2.1 Quality Control/Assurance

Quality Assurance/Quality Control (QA/QC) forms an integral part of all aspects of the sampling and analysis and was used to address the variance associated with both sampling and analytical methods to ensure the accuracy, precision and quality of the results reported. In order to ensure quality control during sampling, the work was carried out in accordance with the general safety and environmental guidelines of NMDPRA (2018) and FME. The study will adequately encompass the project area with sufficient buffer to capture the extreme boundaries of environmental influence.

4.3 Environmental Baseline

The following sections describes the existing condition of the biophysical components of the environment in the project area.

4.3.1 Climate and Meteorology

Major elements of climate according to Thompson (1975) fluctuate with varying degrees of impacts on natural and human activities. This is not going to be different in the project area. At the microclimate level of rainfall, temperature, relative humidity and wind speed, direction and patterns are expected to influence project activities.

4.3.2 Wind Speed, Pattern and Direction

The 16year period wind characteristics of the project area were extracted form NIMET data who has responsibility of maintaining primary microclimate data for the nation. The data was secured from NIMET office in Lafia which is the closest to the project areas. The maximum yearly wind

speed through the period were predominantly uniform except for 2016 as shown in figure 4.2. the monthly wind speed for the period was also predominantly stable but for January and December as seen in figure 4.3

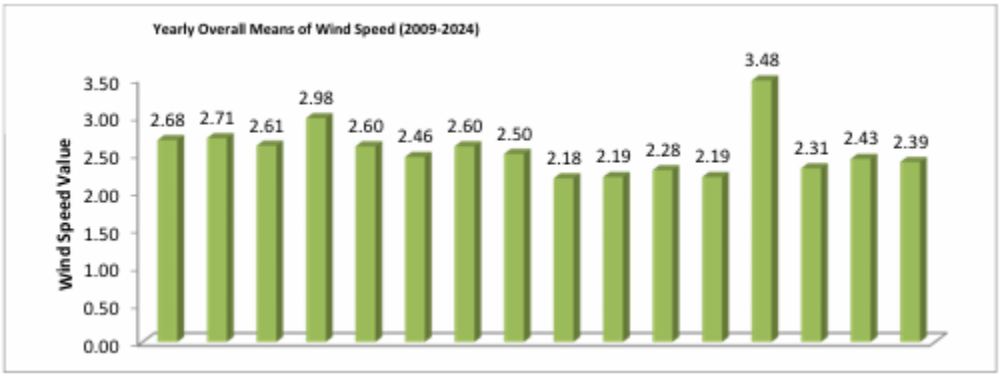


Figure 4.2 Yearly overall means of wind speed 2009 – 2024 (NIMET)

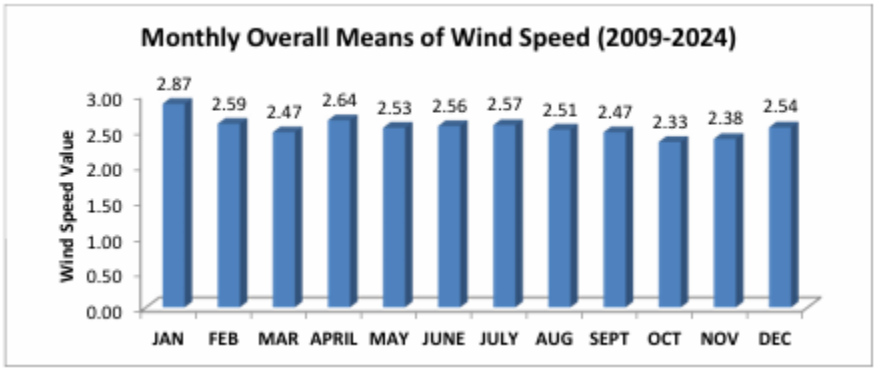


Figure 4.3: Monthly overall means of wind speed 2009 – 2024 (NIMET)

MONTH / YEAR	JAN	FEB	MAR	APR	MAY		JUNE	JUL	AUG	SEPT	OCT	NOV	DEC
2009	pNE, oSE	NE	pE, oSE-W	V	V		vS-NW	W	V	SW	V	E	NE
2010	pNE, oSE	NE	pE, oSE-W	V	V		vS-NW	W	V	SW	V	E	NE
2011	pNE, oSE	NE	pE, oSE-W	V	V		vS-NW	W	V	SW	V	E	NE
2012	pNE, oSE	NE	pE, oSE-W	V	V		vS-NW	W	V	SW	V	E	NE
2013	pNE, oSE	NE	pE, oSE-W	V	V		vS-NW	W	V	SW	V	E	NE
2014	pNE, oSE	NE	pE, oSE-W	V	V		vS-NW	pW, V	V	SW	V	E	V
2015	pNE, oSE	NE	pE, oSE-W	V	V		vS-NW	W	V	SW	V	E	NE
2016	pNE, oSE	NE	pE, oSE-W	V	V		vS-NW	W	V	SW	V	E	NE
2017	pNE, oSE	NE	pE, oSE-W	V	V		vS-NW	W	V	SW	V	E	NE
2018	pNE, oSE	NE	pE, oSE-W	V	V		vS-NW	W	V	SW	V	E	NE
2019	pNE, oSE	NE	pE, oSE-W	V	V		vS-NW	W	V	SW	V	E	NE
2020	pNE, oSE	NE	pE, oSE-W	V	V		vS-NW	W	V	SW	V	E	NE
2021	pNE, oSE	NE	pE, oSE-W	V	V		vS-NW	W	V	SW	V	E	NE
2022	pNE, oSE	NE	pE, oSE-W	V	V		vS-NW	W	V	SW	V	E	NE
2023	pNE, oSE	NE	pE, oSE-W	V	V		vS-NW	W	V	SW	V	E	NE
2024	pNE, oSE	NE	pE, oSE-W	V	V		vS-NW	W	V	SW	V	E	NE

Superscripts: p=predominant, o=occasional, v=variable Codes: NE=North East; SE=South East; SW=South West; NE=North East; V=Variable; Hyphen (-) = to (NIMET)

The table 4.1 above display the wind patterns and directions within the 16year period. The pattern and direction appeared uniform but for 2014 that varied from other years.

4.3.3 Rainfall

The figures 4.3 and 4.4 showed yearly and monthly rainfall within the 16year period of 2009 to 2024 respectively. The years 2024 had the highest rainfall followed closely by 2017, 2014, 2012 and 2011. The years 2009 and 2019 had the least rainfalls. In all the years the months of September, August, June, July, May and October had high rainfall. with the months of December and January having the least. The fall follows a pattern of the normal wet and dry season periods.

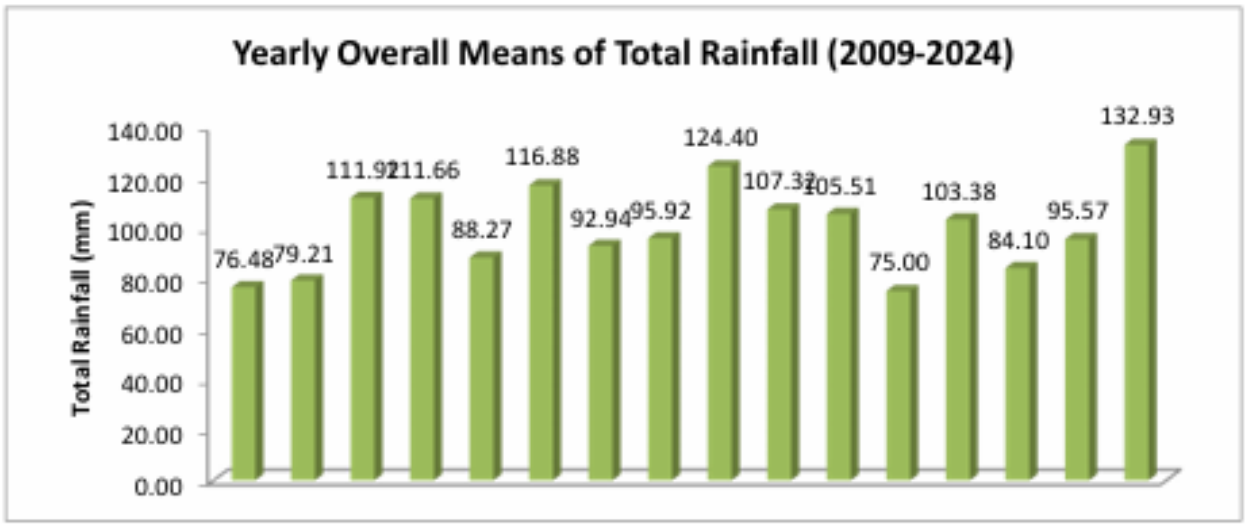


Figure 4.4: Overall yearly mean of total rainfall 2009 – 2024 (NIMET)

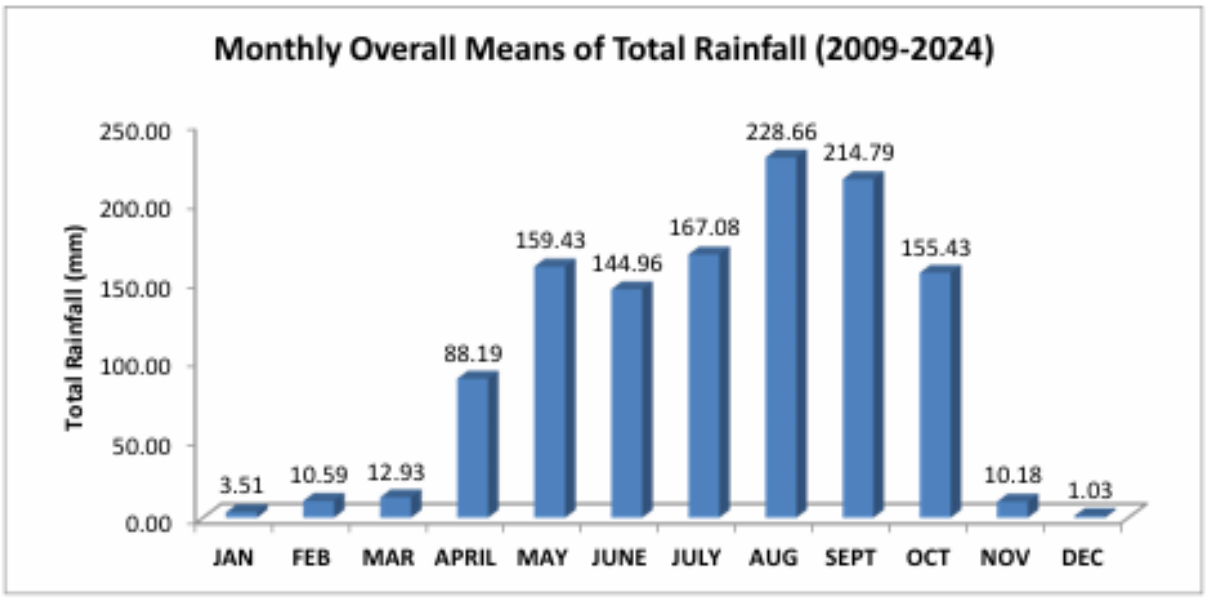


Figure 4.5: Overall monthly mean of total rainfall 2009 – 2024 (NIMET)

4.3.4 Relative Humidity

The figures 4.5 to 4.8 show the yearly and monthly means of relative humidity (high and low) 2009 – 2024. The year 2020 had the highest high relative humidity whereas the year 2012 had the lowest high relative humidity in the 16year period. The month of November for the 16year period had the highest high relative humidity where the lowest high relative humidity amongst the months occurred in December and January of each year. The lowest low relative humidity within the 16year period occurred in 2012 whereas the year 2016 had the highest low relative humidity.

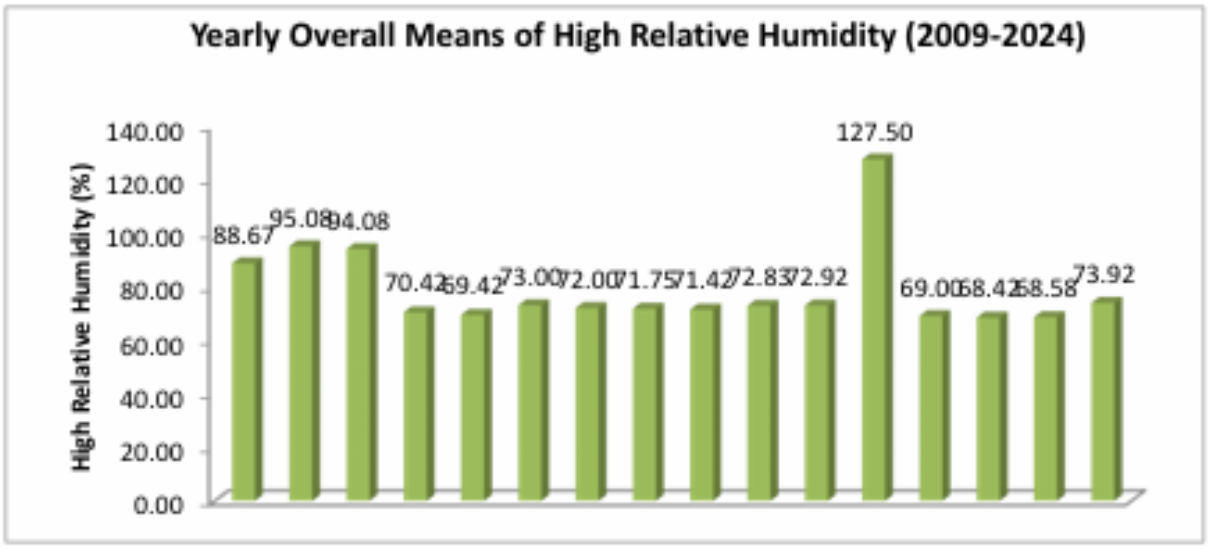


Figure 4.6: Overall yearly mean of high relative humidity 2009 – 2024 (NIMET)

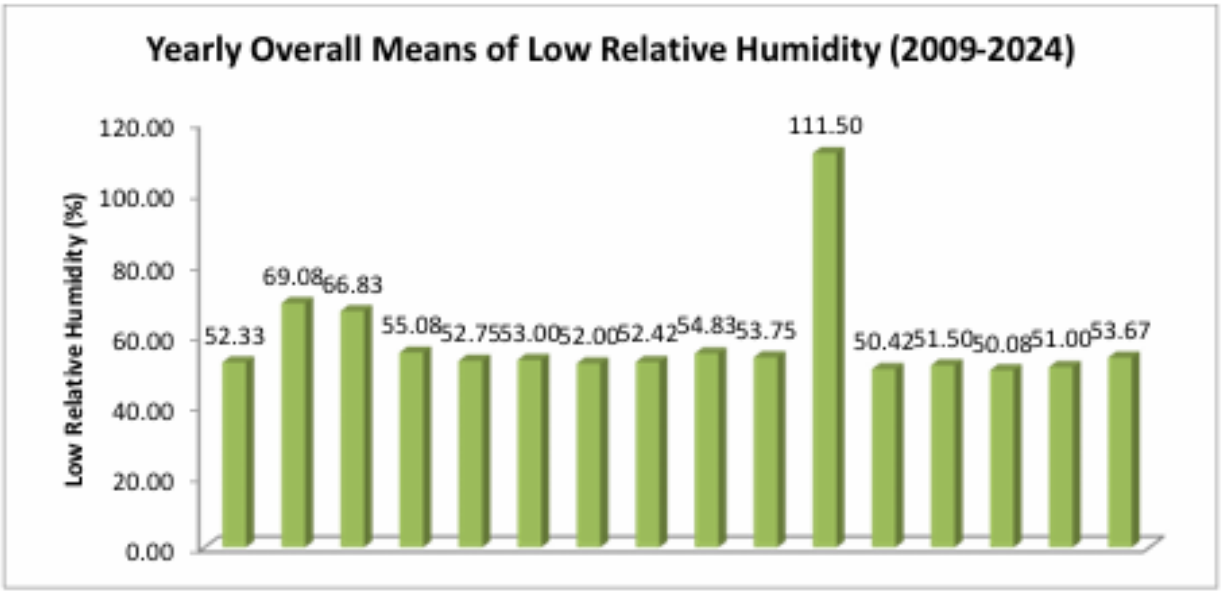


Figure 4.8: Overall yearly mean of low relative humidity 2009 – 2024 (NIMET)

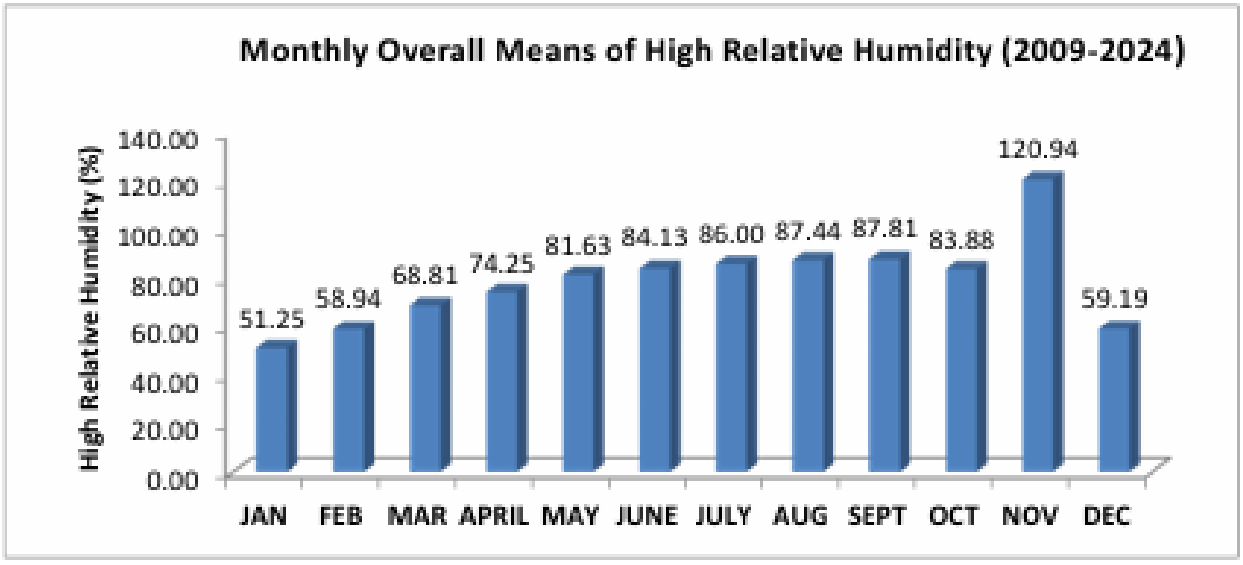


Figure 4.7: Overall monthly mean of high relative humidity 2009 – 2024 (NIMET)

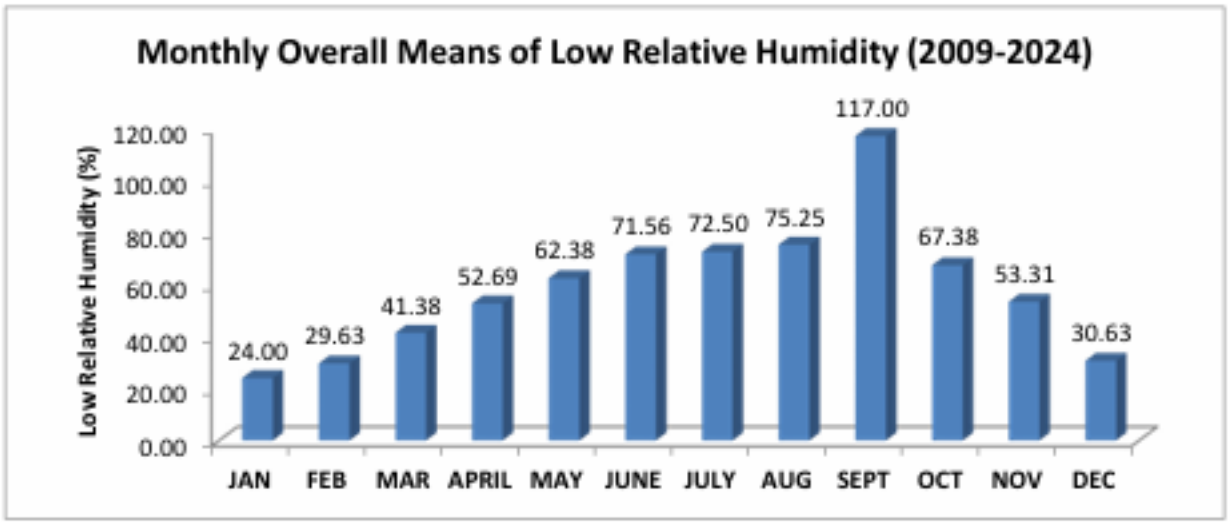


Figure 4.9: Overall monthly mean of low relative humidity 2009 – 2024 (NIMET)

4.3. 5 Temperature

The figures 4.9 to 4.12 display the mean yearly and monthly minimum and maximum temperatures of the project area within the 16year period. The yearly overall maximum temperatures as recorded were higher in 2022 followed by 2010 and 2016. The lowest temperatures were recorded in 2012 and 2006. The months February and March had the highest maximum temperatures within the 16year period in the area. The highest minimum temperatures were recorded in the years 2017, 2016 and 2019 whereas the other months had relatively uniform minimum temperatures though March and April had slightly higher minimum temperatures. The years with least minimum temperatures were 2012 and 2014 whereas January and February had the least minimum temperatures within the period.

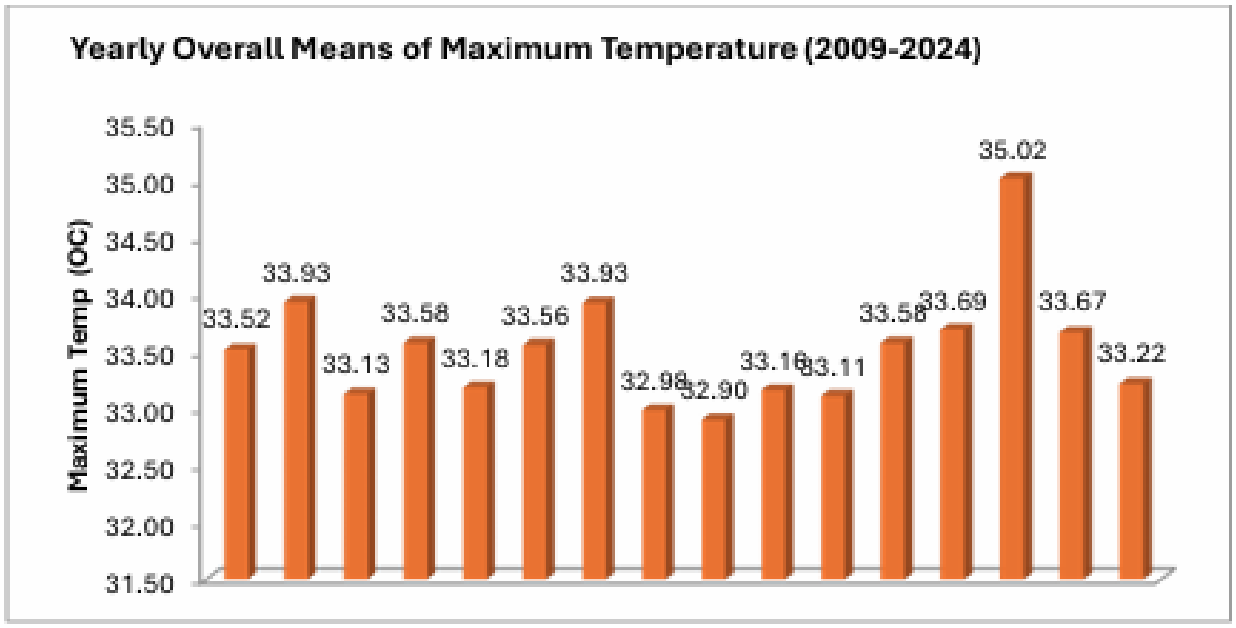


Figure 4.10: Overall monthly mean of maximum temperature 2009 – 2024 (NIMET)

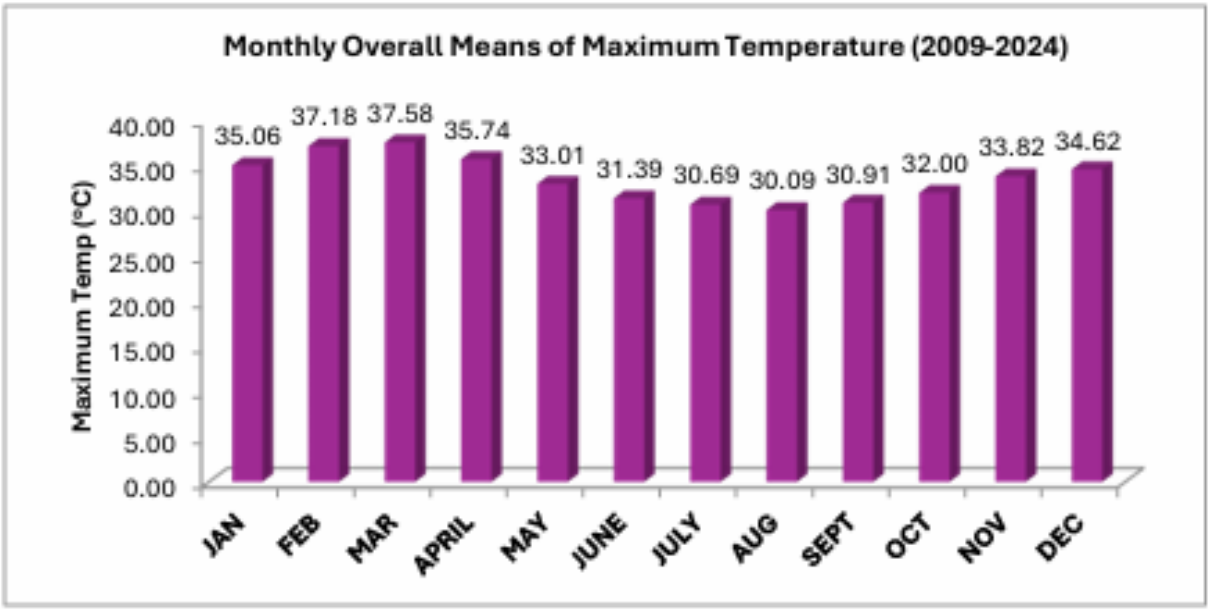


Figure 4.11: Overall monthly mean of maximum temperature 2009 – 2024 (NIMET)

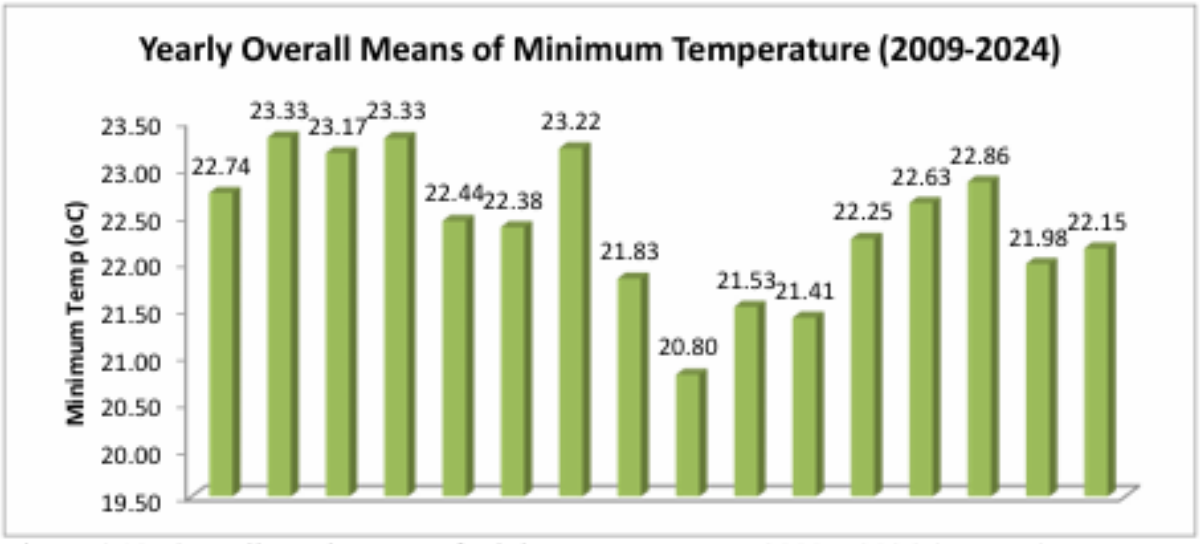


Figure 4.12: Overall yearly mean of minimum temperature 2009 – 2024 (NIMET)

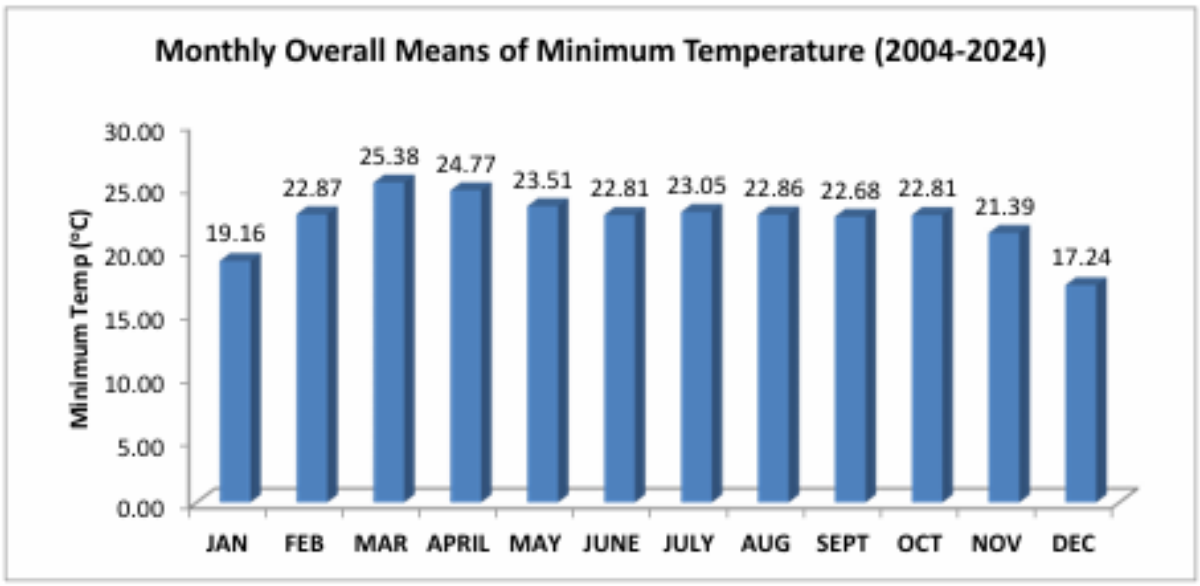


Figure 4.13: Overall Monthly mean of minimum temperature 2009 – 2024 (NIMET)

4.3.6 Climate Change Consideration

Impact of Climate Change Intergovernmental Panel on Climate Change (IPCC) confirms that the global climate has experienced significant changes characterized by global warming over the past century (IPCC, 2013). The sixth AR of the IPCC provides stronger evidence to further confirm the objective facts of global warming in the last 100 years and a clearer signal of the impact of human activities on climate warming. Global climate change has a significant impact on natural ecosystems and the social economy, which will threaten human survival and pose long-term and

severe challenges to the sustainable development of human societies; thus, global climate change has evolved from a scientific issue to a political, economic, and environmental issue of global concern.

As the largest and most important natural terrestrial ecosystem, forest plays a crucial role in reducing the concentrations of greenhouse gases in the atmosphere, mitigating global warming, maintaining the global ecological balance, and promoting global biological evolution and community succession. Numerous studies have revealed the current and future impacts of climate on plant phenology, forest succession, the composition and distribution of forest structure, biodiversity, forest productivity, and the forest carbon sink function of forest ecosystems (Lenoir et al 2008). Close material and energy exchanges exist between the climate and forests, which affect and restrict each other (Dai et al 2016). The forest ecosystem, as the largest carbon source and sink in the terrestrial ecosystem respond to climate change and exhibit feedbacks and regulation effects in relation to climate change. The direction and magnitude of climate change impacts on forests vary according to environmental factors and forest types (Richardson et al 2013). The productivity of forest ecosystems typically increases due to the growth extension benefit caused by rising temperatures and the fertilization benefit caused by rising CO2 concentrations. As an important aspect of global change, climate change is predominantly manifested as temperature increases, precipitation pattern changes, and greater climate extremes. Practically in the forest ecosystem, stomatal conductance between the leaves and canopy decreases significantly, leading to inhibited plant growth when plants are stressed by high temperatures and CO2 concentrations. The IPCC has revealed the unprecedented speed and scale of the impact of human activities on environmental change over the last 100 years, and shown that climate change is closely related to human activities (IPCC, 2013). Humans can implement a variety of forest management measures that will either exacerbate or slow down the impact of climate change caused by human activities.

4.3.6.1 Significance of Climate Change Studies for the Project

It becomes necessary in the proposed project to establish the trend in the vegetation index and land-use characteristics of the study area, assess the biomass index and then assess the cumulative effect of the project in triggering climate change as well as recommending remedial measures. These are crucial for formulating targeted management plans. In this study, climate variability was examined using remote sensing technology. All in all, the results of this study will provide data support for evaluating the ecological function and value of forest ecosystems, and for formulating reasonable forest management measures to mitigate the effects of climate change.

The vegetation index map shows a low level of vegetation concentration within the study area which denotes high level of urbanization and an increase in greenhouse carbon emission. The map shows a maximum vegetation index of 0.37 which shows weak scanty vegetation structure within the project vicinity. It therefore required an optimum planning to ensure green environment to curb the climate change concentration in the area.

4.3.6.2 Climate Change mitigation Measures

Mitigation of GHG emissions during construction can be achieved through a series of measures that can be included within the Environmental Management Plan. However, one would need to consider that paving of surfaces of the project area has an impact on emission levels, as paved surfaces yield a higher absolute number of emissions in terms of CO2 equivalent per vehicle-km travelled. Therefore, provision of grasses and trees will reduce the high level of surface runoff, thus controlling flood and erosion while on the other hand, the planting of environmentally friendly trees along the edges of the proposed plant will maintain and regulate CO2 and other greenhouse gases in the atmosphere.

4.3.7 Air Quality and Noise Levels

The air quality baseline was assessed to determine the level of atmospheric pollution over the spatial coverage of the project area. This is important for establishing the potential impacts of the proposed project on the ambient air as well as providing baseline data to benchmark the compliance of operations to national air quality standards to ensure emission reduction and control during compliance audit. The ambient air quality and noise level were measured with the use of calibrated digital hand-held monitoring equipment described in Table 4.1 using standard procedures recommended for surveillance and monitoring of air pollutants by World Health Organization (WHO) and the Nigerian Ambient Air Quality Standards (NAAQS) FMEnv.

Table 4.3: Air Quality Parameters and in-situ Measurement Equipment

Parameter	**Measured Equipment**
Sulphur (IV) Oxide (SO2),	In-situ single gas SO2 monitor (ToxiRAE Model PGM-1130)
Nitrogen (IV) Oxide (NO2)	Single gas NO2 monitor (ToxiRAE Model PGM-1110)
Carbon Monoxide (CO)	CO monitor (MultiRAE Pro Model PGM-6248)
Ammonia (NH3)	NH3 monitor (MultiRAE Pro Model PGM-6248)
Volatile Organic Compounds	MultiRAE gas monitor (MultiRAE Pro Model PGM-6248)
Hydrogen Sulphide (H2S)	MultiRAE gas monitor (MultiRAE Pro Model PGM-6248)
Particulate Matter (PM)	Haz-Dust Model EPAM-500
Oxygen (O2)	Gas alert microclip XL (4-in-One) (Model MCXL XWHM-Y-NA)
Noise Level	Extech Multifunctional sound level metre

4.3.7.1 Approach and Methods

To evaluate the prevailing air quality and noise level in the project area, in-situ measurements from every direction round the project site. The measurements were taken during the rainy season from

ten (10) selected points within the project area of influence and two others away from it to serve as control making a total of twelve (12). Based on the National Environmental Air Quality Control Regulations (2014), parameters such as suspended particulate matter (SPM) concentrations and gaseous pollutants concentrations including carbon monoxide (CO), carbon dioxide (CO2), nitrogen dioxide (NO2), sulphur dioxide (SO2), hydrogen sulphide (H2S), Ammonia (NH3) and lower explosive limit (LEL) were measured. The ambient noise levels in the project area of influence were also measured (See results of measurement in Table 4.4).



Plate 4.1: Air quality sampling

The results were compared to the Nigerian Ambient Air Quality Standards (NAAQS) and the World Health Organization (WHO) Air Quality and Noise Guidelines. The threshold for outdoor concentration of pollutants established by NAAQS and WHO are provided in Table 4.2. However, for CO2 pollutant, the United States Environmental Protection Agency (USEPA) standard was used since the FMEnv and WHO have no established emission limit. For ambient air quality index rating, the USEPA equation for air quality index was adopted. The results from the AQI computation were subjected to the air quality-rating table to determine the present condition of the prevailing air of the project area. The pollutant's index concentration is expressed as a percentage of the relevant air quality standard. USEPA (2017) AQI equation is given:

Table 4.3: FMEnv and WHO Air Quality and Noise Level Standards and Guidelines

Parameter	FMEnv		WHO		USEPA	
	Limit	Time of Average	Guideline Value	Averaging Period/Time Base		
CO	10 ppm 11.4 µg/m³	1 - hour	25 ppm	1 – hour	9 ppm	1 - hour
NO_2	0.04 – 0.06 ppm 75.0 – 113 µg/m³	1 – hour	200µg/m³	1 - hour	0.053 ppm	1 – hour
SO_2	0.01 ppm 26 µg/m³	1 - hour	0.175 ppm 500 µg/m³	10mins	0.5 ppm 0.075 ppm	1 - hour
H_2S	0.008 mg/m³	30 mins	7 µg/m³	30 mins		1 – hour
PM	80 µg/m³	1 - hour	25 µg/m³	Annual	150 µg/m³	Annual
	250 µg/m³		50 µg/m³	24 - hour	35 µg/m³	24 - hour
LEL	-	-		-	-	-
CO_2	-	-		-	1000	24 - hour
Noise (Industrial Area)	90dB(A)	8 hours	70 dB(A)	24 hours	70	24 - hour
Noise (Residential Area)	-		55 dB(A)	16 hours	55	24 - hour

Sources: Guidelines & Standards for Environmental Pollution Control in Nigeria (FEPA 1991). Air Quality Guidelines (WHO, 2005)

Table 4.5: Ambient Air Quality / Meteorological Field Measurements

Parameter	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	C1	C2
Temperature (°C)	30	30	30	31	31	31	31	31	31	30	31	30
Humidity (%)	75	70	70	67	68	67	69	70	70	78	71	74
HCHO (mg/m^3)	0.016	0.017	0.019	0.015	0.017	0.020	0.017	0.017	0.019	0.023	0.005	0.019
TVOC (mg/m^3)	0.059	0.071	0.079	0.064	0.071	0.083	0.071	0.073	0.071	0.094	0.124	0.072
$PM_{2.5}$ ($\mu g/m^3$)	6	7	7	6	6	7	7	8	8	9	10	9
PM_{10} ($\mu g/m^3$)	6	8	8	6	6	8	6	9	9	10	10	9
PM_1 ($\mu g/m^3$)	4	5	5	4	4	5	4	6	6	10	10	10

Parameter	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	C1	C2
O_2 (%)	20.9	21.5	21.7	21.3	21.2	20.9	20.9	20.3	20.3	20.2	20.1	20.9
H_2S (ppm)	0	0	0	0	0	0	0	0	0	0	0	0
CH_4 LEL (%LEL)	0	0	0	0	0	0	0	0	0	0	0	0
CO (ppm)	1	0	0	0	0	0	0	0	0	0	0	0
Noise (dB(A))	49.9	48.2	48.1	45.3	40.6	45.6	49.2	49.1	49.3	49.9	56.1	57.2
CO_2 (ppm)	431	493	431	441	421	431	432	491	490	461	521	493
Radiation (µSv/h)	0.12	0.09	0.14	0.03	0.02	0.02	0.01	0.06	0.06	0.01	0.03	0.05
NH_3 (ppm)	0.04	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.05
NO_2 (ppm)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SO_2 (ppm)	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wind Speed (m/s)	0.0	0.0	0.9	0.7	0.6	0.6	0.9	0.3	0.1	0.7	0.5	1.2

4.3.7.2 Results of Air Quality and Noise Level Measurement

The air quality of an area is largely determined by the ambient concentration of the various atmospheric gases, which are otherwise referred to as pollutants. Although, atmospheric gases occur naturally to ensure ecosystem stabilization, however, human activities could also increase the amount of these gases in the atmospheric boundary layer above tolerable limits, which signifies air pollution. The effect of air pollution is directly proportional to the toxicity of the gases, level of exposure and susceptibility of individuals exposed.

Traces of harmful gaseous pollutants were not detected within and around the proposed project area as at the time of assessment during the rainy season, except for CO2 in which few sampling points recorded values close to 1000ppm (USEPA Permissible standard limit). This indicates that there are no such activities that could emits significant level of gaseous pollutants into the immediate environs of the proposed project area. The activities of Sahara Lubricants Limited operation within the proposed project area involve the use of any mechanical device which are frequently used and thus will lead to significant emission of gaseous pollutant. Considering the

presence of harmful gas pollutants such as NO2, SO2, CO and H2S, the current state of the project environment is suitable for human habitation and outdoor activities if maintained.

Nitrogen Dioxide (NO_2)

Nitrogen dioxide (NO2) belongs to a family of highly reactive gases called nitrogen oxides (NOx). These gases are formed when fuel is burned at high temperatures. Consequently, it is commonly generated from vehicle and power generating plant exhaust. Nitrogen dioxide is a strong oxidizing agent that reacts in the air to form corrosive nitric acid, as well as toxic organic nitrates. It also plays a major role in the atmospheric reactions that produce ground-level ozone (or smog). NO_2 was not detected in the sampling locations during the wet season air quality assessment, indicating that, there are no ongoing activities leading to significant emission of NO2 pollutant in the proposed project area.

Sulphur Dioxide (SO_2)

Sulphur dioxide or Sulphur (IV) oxide (SO2) is a colourless gas with pungent smell usually produced from combustion of sulphur containing fuel (coal, oil or natural gas). This gas can also combine with particulate matter to form smog. SO_2 was not detected in the project area, except in one sampling point that recorded a value of 0.1. This could be due to the absence of activities such as mechanical operation of combustion engines which could emits significant amount of SO_2 pollutant.

Carbon Monoxide (CO)

Carbon monoxide is a colourless, odourless, tasteless, but poisonous gas, usually produced from the partial oxidation of carbon containing compounds. In the respective sampling location within the proposed project area, CO was not detected except in one sampling point that recorded a value of 1 and its fall far below the FMEnv's limit of 10. The weather condition -particularly the rains and prevailing wind velocity may have played a major role in dissipating traces of CO pollutants particularly within the mine community where fuelwood is used as the major source of cooking energy.

Hydrogen Sulphide (H_2S)

Hydrogen sulphide (H_2S) is a toxic, odorous and corrosive gas, which is rapidly oxidized to SO_2 in the atmospheres. It causes eye irritation in humans and produces offensive odours. It occurs both naturally and from human-made processes. This gas was not detected in all sampling location (see Table 4.3) during the air quality assessment in the project area.

Ammonia (NH_3)

Ammonia is a gas pollutant with a characteristic pungent odour. Ammonia reacts with oxides of nitrogen and sulphur to form secondary particles. This gas pollutant is emitted mainly from fermentation of agricultural waste. In all the sampling location, NH3 was detected during the air quality assessment with value ranging between 0.0 – 0.5. Waste from animal droppings and straws from the remains of harvested agricultural produce are pronounced within the project area. This could have been the reason for the absence of NH_3 pollutant.

Carbon Dioxide (CO_2)

Carbon dioxide (CO_2) is a colourless gas consisting of a carbon atom double bonded to two oxygen atoms. It occurs naturally as trace gas in the earth atmosphere but however, the amount of CO2 can be altered by human activities such as combustion of organic materials (wood, fossil fuels), deforestation and land degradation (disturbance to carbon pool). CO2 is a primary greenhouse gas, thus, increase in its emission is among the chief causes of global warming and ocean acidification. The concentration of CO_2 in the sampling locations ranged from 431– 493ppm within the study and reach 521ppm at the control station. The values are within the 1000ppm limit for CO2 emission set by USPA and FMEnv (NESREA).

Particulate Matter

Particulates are finely divided air borne particles, which can be of anthropogenic and/or natural origin. They are present in ambient air in the form of dust, fumes, smoke and other aerosols. Particulates may have short and long-term adverse effects on humans, animals and plants. Health effects of particulates on man depend on particle size and concentration. They include acute effects such as eye and throat irritation as well as chronic respiratory diseases such as cancer. Particles that are less than 10µm in aerodynamic diameter are of most concern because of their ability to get inhaled into the lungs to cause respiratory problems. Particulates on leaves reduces rate of photosynthesis and thereby reduces the growth of plants. $PM_{2.5}$ and PM_{10} were investigated during the air quality assessment. The ambient concentration of $PM_{2.5}$ ranged from 6-10µg/m3across the sampling location. while the mean concentration is 7 ±15.4 µg/m3. The concentration of $PM_{2.5}$ recorded in all the sampling locations were below the FMEnv (80µg/m3) hourly average values for outdoor concentration. Similarly, the average concentrations of $PM_{2.5}$ were within the hourly average values of WHO (25µg/m3) across most sampling locations. The concentrations of PM_{10} in the ambient air within the project location ranged from 6-10µg/m^3.

Noise Levels

Noise pollution is generally defined as regular exposure to elevated sound levels that may lead to adverse effects in humans or other living organisms. According to the World Health Organization, sound levels less than 70 dB are not damaging to living organisms, regardless of how long or consistent the exposure may be. The ambient noise level measurements in the project area ranged from 40.6 – 49.9dB (A) within the area and extended to 57.2dB at the control station. The values were below the FMEnv permissible noise exposure limits of 90 dB(A).

4.3.7.3 Air Quality Index

The Air Quality Index (AQI) is used for reporting daily air quality. It tells you how clean or polluted your air is, and what associated health effects might be a concern for you. The AQI focuses on health effects that may be experienced within a few hours or days after breathing polluted air. The AQI of criterial pollutants, which includes NO_2, SO_2, CO, H_2S, $PM_{2.5}$ and PM_{10} were determined using the mean concentration of the pollutants and the FMEnv standard for hourly concentration of the pollutant, while for CO_2, the USEPA standard was used since the FMEnv and

WHO have no established emission limit. The entire project area has a good air quality condition. The ambient concentration of pollutants in the area were rated good to moderate. This indicates a safe environment for human habitation. Individuals in the project area can carry out their daily activities both indoors and outdoors without any health implications. It's expected that in all the development phases of the proposed project, the current ground level atmospheric condition should be maintained.

4.3.8 Relief and Geology

As in Geology of Nigeria, Geology of Nasarawa State also comprises of Basement and sedimentary rocks. The Basement rocks cover about 60% of the superficial area of the state while the remaining 40% is made up of sedimentary rocks of the Middle Benue Trough. The Basement complex is comprised essentially of rocks of Precambrian to Cambrian age. The rocks include Older and Younger Granite of different description, and some Meta sediments and some minor intrusive. (Obaje, et al., 2006). The general succession in the Basement Complex rocks of Nigeria starts with the Older meta-sediments generally thought to be Precambrian in age. The sequence was followed by the Older Granites which comprises migmatite and gneisses quartzite and silicified rocks. This is followed by Younger meta sediments and the Younger Granite of Jurassic age. The Basement Complex rocks occupy nearly half of Nasarawa State, being confined to the northern part of the state (Map 4.1) and covering areas of Nasarawa, Keffi, and Akwanga Local Government areas. Isolated outcrops of the meta-sediments are found in Keffi, Kudaru-Aquaa and Isawa areas (Offodile, 2002; Obaje et al., 2006) The Basement Complex rocks at the southern part of the state are overlain by marine and terrestrial and transitional marine terrestrial sedimentary formations. These formations include the Asu River Group (Middle Albian), Early Cenomanian Awe formation, Keana formation and Ezeaku formations, the Turanian and Maastrictian Agwu and Lafia formations respectively. (Offodile, 1976, 2002). There are some volcanic intrusives dotting the area

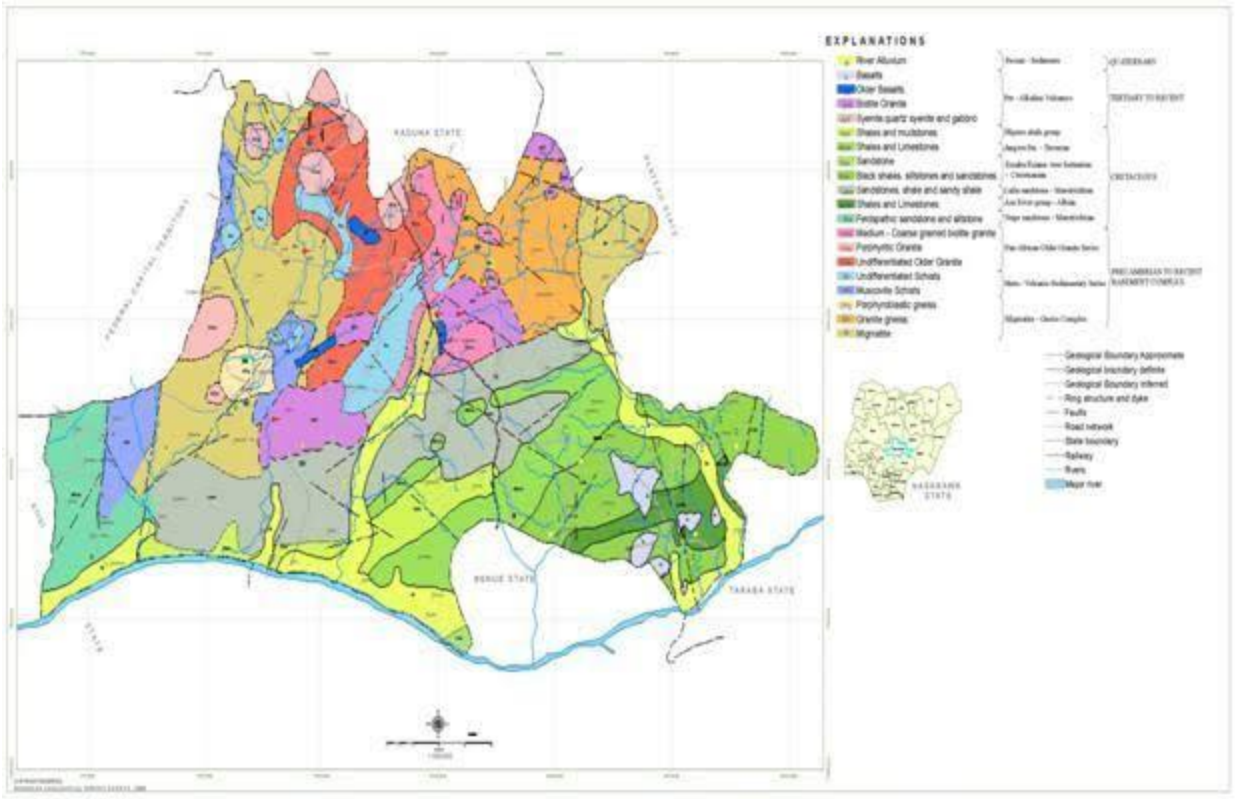


Figure 4.11: Geological map of Nasarawa State

4.3.4 Soil Quality

The major soil units of Nasarawa State belong to the category of oxisols or tropical ferruginous soils (Nyagba, 1995). The soils are derived mainly from the basement complex and old sedimentary rocks. Lateritic crust occurs in extensive areas on the plains, while hydromorphic soils (humic inceptisols) occur along the flood plains of major rivers. Loamy soils of volcanic origin are found around the volcanic cones of Awe. The hilly areas carry shallow skeletal soils. Many parts of the state are ravaged by both sheet and gully erosion, the major urban centres particularly Lafia and Keffi, are heavily gulled. Since most of the inhabitants of the state are farmers, extensive areas in the countryside are also cleared for farming, thus exposing wide areas of land to sheet erosion.

A total of ten (10) and two control composite soil samples were collected from 0 – 15cm (topsoil) and 15 – 30cm (sub soil) depths respectively using a stainless-steel hand auger. Samples from each depth range were homogenized (with removal of non-matrix particles) to form composite soil samples. Soil samples were collected into clean decontaminated containers, preserved in ice chest and transported to the laboratory for physical, chemical and microbial analyses. Sub samples for microbial analysis were wrapped up using aluminium foil. Table 4.7a for the locations for soil sampling in the project area. The results of the physical, chemical and microbial analysis of soil samples are provided in Table 4.7b.



Plate 4.2: Soil sampling procedure

Table 4.6: Result of Soil Measurements and Analysis

S/N	PARAMETERS	Unit	SLL SS 1	SLL SS 2	SLL SS 3	SLL SS 4	SLL SS 5	SLL SS 6
			8.933816 N 7.685760 E	8.933835 N 7.685780 E	8.933930 N 7.686173 E	8.934083 N 7.686042 E	8.934022 N 7.685724 E	8.933998 N 7.685847 E
A	**PHYSIO-CHEMICAL**							

1	TEMPERATURE	(^{O}C)	27.50	27.70	27.60	27.80	27.90	27.90
2	PARTICLE SIZES/ TEXTURE	%	SAND/ SILT/CLAY 60.65/ 28.45/ 10.90	SAND/ SILT/CLAY 56.97/28.39/14.64	SAND/SILT/CLAY 59.43/29.52/11.05	SAND/SILT/CLAY 55.17/32.61/12.22	SAND/SILT/CLAY 62.50/29.66/07.84	SAND/SILT/CLAY 58.96/29.92/11.12
3	pH		6.35	6.44	6.29	6.65	6.57	6.42
5	SOIL POROSITY	(%)	30.00	23.33	30.00	23.33	31.66	33.33
6	WET DENSITY	g/cm^{3}	0.940	0.905	0.930	1.000	1.020	0.830
7	DRY DENSITY	g/cm^{3}	1.100	1.040	1.002	1.029	1.020	0.971
8	BULK DENSITY	g/cm^{3}	0.986	0.970	0.958	1.010	1.032	0.900
B	**ORGANICS**							
9	TOTAL ORGANIC CARBON	mg/ kg	3.80	4.40	4.00	1.80	3.00	2.80
C	**EXCHANGEABLE IONS**							
10	PHOSPHATE	Mg/ kg	0.589	0.610	0.270	0.448	0.673	0.577
11	SULPHATE	mg/ kg	38.74	42.19	29.79	37.14	41.02	32.68
12	NITRATE	mg/ kg	1.017	0.985	2.017	1.725	3.008	0.985

13	CALCIUM	mg/kg	14.81	12.60	15.90	18.20	18.70	11.90
14	MAGNESSIUM	mg/kg	07.80	06.40	08.20	09.40	09.80	06.00
15	CHLORINE	mg/kg	04.10	02.90	03.10	02.60	03.00	03.40
16	POTASSIUM	mg/kg	11.60	12.10	09.40	09.80	12.06	10.61
D	**METAL/ HEAVY METALS**							
17	MANGANESE	mg/kg	1.075	0.993	0.836	0.887	1.097	0.813
18	COPPER	mg/kg	3.332	3.110	4.003	2.893	3.110	2.674
19	IRON	mg/kg	4.072	3.890	4.046	3.361	3.016	2.474
20	ZINC	mg/kg	0.788	0.792	0.664	0.750	0.914	0.578
21	CADMIUM	mg/kg	0.032	0.024	0.038	0.026	0.023	0.012
22	LEAD	mg/kg	0.003	0.004	0.007	0.007	0.005	0.008
23	NICKEL	mg/kg	0.001	0.002	0.004	0.003	0.003	0.005
24	CHROMIUM	mg/kg	0.067	0.083	0.059	0.0065	0.083	0.060
S/N	**PARAMETERS**	**Unit**	**SLL SS 7**	**SLL SS 8**	**SLL SS 9**	**SLL SS 10**	**SLL SSC 1**	**SLL SSC 2**
			8.934241 N 7.685720 E	8.934344 N 7.685843 E	8.934356 N 7.685675 E	8.934290 N 7.685485 E	8.932636 N 7.686326 E	8.933032 N 7.684914 E
A	**PHYSIO-CHEMICAL**							

1	TEMPERATURE	(^{O}C)	27.90	28.20	28.30	28.50	28.60	28.60
2	PARTICLE SIZES/TEXTURE	%	SAND/SILT/CLAY 57.12/32.88/10.00	SAND/SILT/CLAY 58.16/28.19/13.65	SAND/SILT/CLAY 61.76/28.63/09.98	SAND/SILT/CLAY 56.79/31.04/12.17	SAND/SILT/CLAY 59.57/29.81/10.62	SAND/SILT/CLAY 63.01/27.38/09.61
3	pH		6.28	6.23	6.19	6.32	6.43	6.360
5	SOIL POROSITY	(%)	30.00	26.67	23.33	27.00	30.00	23.33
6	WET DENSITY	g/cm^3	1.020	0.980	1.000	1.060	1.040	1.000
7	DRY DENSITY	g/cm^3	1.130	0.883	0.964	1.000	1.120	1.080
8	BULK DENSITY	g/cm^3	0.967	0.900	0.980	1.030	1.000	1.000
B	**ORGANICS**							
9	TOTAL ORGANIC CARBON	mg/kg	2.40	1.70	3.60	3.40	4.20	3.80
C	**EXCHANGEABLE IONS**							
10	PHOSPHATE	Mg/kg	0.670	0.509	0.632	0.447	0.733	0.562
11	SULPHATE	mg/kg	42.10	37.81	38.65	29.67	33.40	40.51
12	NITRATE	mg/kg	1.735	3.114	3.634	2.170	1.767	2.040
13	CALCIUM	mg/kg	16.64	12.40	10.80	13.50	12.20	15.40
14	MAGNESSIUM	mg/kg	08.91	06.57	05.20	07.03	06.60	07.50
15	CHLORINE	mg/kg	02.80	01.97	02.60	03.80	04.00	03.60
16	POTASSIUM	mg/kg	10.75	12.10	08.95	11.60	10.55	11.20

D	**METAL/ HEAVY METALS**							
17	MANGANESE	mg/kg	0.784	0.811	0.683	0.530	0.487	0.758
18	COPPER	mg/kg	2.934	3.370	3.717	3.785	3.479	3.773
19	IRON	mg/kg	3.525	4.004	3.983	3.558	3.206	3.360
20	ZINC	mg/kg	0.698	0.864	0.700	0.664	0.504	0.881
21	CADMIUM	mg/kg	0.018	0.023	0.019	0.025	0.026	0.012
22	LEAD	mg/kg	0.07	0.005	0.003	0.004	0.005	0.007
23	NICKEL	mg/kg	0.02	0.002	0.001	0.001	0.003	0.003
24	CHROMIUM	mg/kg	0.055	0.063	0.084	0.077	0.067	0.053

4.3.9.1 Soil Physical and Chemical Properties

The sand fractions (%) varies from very sand (55.17-63.01%) silt (28.19-32.88%) and clay (7.84-13.65%) in all the collected samples. They are mostly loamy sand materials texturally with permeability or infiltration rate and compatibility slightly below the permissible limit specified by FAO (1.43). The entire soil samples are slightly acidic with pH averagely between 6.19 and 6.65 which falls within the FMEnv permissible limit (6-9) where nutrients are most available to plants. Soil moisture content is within the FAO limit variables essential in controlling the exchange of water and heat energy between soil and the atmosphere through evaporation and plant transpiration. Sulphate (SO_4), Phosphate (PO_4) and Nitrate (NO_3) concentration varies in all the soil samples with concentration far below the FAO permissible limit of 500mg/kg for soil nutrient and plant growth. Total Organic Carbon (TOC) is entirely low in the soil samples and falls within the soil productivity limits.

Chloride (Cl-), Phosphorus (P) and Nitrite (NO_2) concentration in the soil samples are relatively low and harmless to plant even though it is an important micro-element required for plant photosynthesis at considerable limit. Although, the concentration of anions and nutrients in the soil samples from the project area was low, however it was found to be within the acceptable range for good agricultural performance.

Heavy metals are introduced into the soil majorly by weathering of the host rock (biotite granites) or associated minerals and leaching from the ongoing artisanal mining activities within the project area. The concentration of heavy metals like Iron (Fe) Chromium (Cr), Manganese (Mn) and Calcium are entirely low in the soil samples and falls below the maximum limit permitted by FAO

for good agricultural performance. Nickel (Ni) concentration in the soil samples are slightly below the FAO specified limit. While Lead (Pb) is minimally seen across samples between 0.003-0.007mg/kg; it occurrences is tied to release from parent rocks to the soil through weathering of the host rock resulting in an increased concentration of Lead (Pb) within the soil of the project area. Copper (Cu) concentration (2.674 - 4.003mg/kg) in the soil samples is entirely higher than the maximum permitted limit by FAO (0.48mg/kg) in all the samples. Cu occurred as an associated mineral which was released to the soil through weathering of the host rock resulting in an increased concentration of Cu within the project area soils. Zinc (Zn) concentration is higher than the specified limit by FAO in all the soil samples. Zn is released into the soil majorly from weathering of the host rock within the project area. Magnesium (Mg) concentration in the soil samples is higher than the permissible limit by FEPA (50mg/kg) for soil except for SS1, SS2 and SS4 which falls below the permitted limit. Magnesium (Mg) occurs within the host rock (biotite granite) and release to the soil through weathering. Potassium (K) concentration in the soil samples is higher than the permissible limit by FAO for all the soil samples. K occurs within the host rock (biotite granite) and released to the soil through weathering where it can improve soil fertility.

4.3.10 Groundwater Occurrence

Karu area comprises metasedimentary rocks (mainly mica schists and sericitized/chloritized phyllonites) intruded by a Pan-African granodiorite/ granite batholith (ca. 600Ma), fracture controlled elongate Late Pan-African granite and pegmatites. The Precambrian rocks have been subjected to many tectonic movements and pressure through geologic history such that they often have several fracture lines. Within the project area, groundwater occurs within the weathered rock or in the joint and fracture systems of the unweathered or partly weathered rocks (MacDonald et al., 1986). Du Preez and Barber, (1965) proposed that aquifer is in the weathered mantle and fractured rock where permeability and porosity are sufficient to allow appreciable amount of water to accumulate in storage. The high groundwater yield in the area is found where thick overburden overlays fractured zones. The aquifer types described by Olorunfemi and Fasuyi (1993) from the study area include: Weathered layer aquifer and Weathered/ fractured or partly weathered aquifer and Fractured aquifer.

4.3.10.1 Groundwater Quality

A total of three (3) groundwater samples (including one control sample) were collected from existing boreholes one each from the project site and community (3 km away from the project area) in order to assess potable water quality. The water samples were collected into 1-litre polyethylene bottles for general physico-chemical analysis. Samples for heavy metals analysis were collected separately in plastic containers and fixed with diluted nitric acid (10ml HNO3 in 100ml of Distilled Water). Presterilized 50ml McCartney bottles were used for samples meant for microbial analysis. In-situ measurements of fast degrading parameters including pH, Conductivity, Total Dissolved Solids (TDS), Temperature, and Dissolved Oxygen (DO) were taken at each location using calibrated Extech Digital DO700 metre and EC, etc meter. All samples collected were preserved on ice chest and transported to the laboratory for further analysis. The analysis results were compared with the prescribed limits in the FMEnv Nigeria Standard for Drinking

Water Quality (NSDWQ) in Nigeria, 1999 (Table 4.8a). The results of laboratory analysis are presented in Tables 4.8b-e.



Plate 4.3: In-situ sample analysis

Table 4.7: Results of Groundwater Quality

S/N	PARAMETERS	UNIT	GW 1	GW 2	GW 3	NSDQW
			8.933539 N 7.686860 E	8.934818 N 7.685462 E	8.932636 N 7.686326 E	
A	**PHYSIO-CHEMICAL**					
1	TEMPERATURE	^{0}C	28.40	28.40	28.50	**<40**
2	pH		7.57	7.72	7.53	**6-9**
3	ELECTRICAL CONDUCTIVITY	µS/cm	536.0	240.0	176.0	**1000**
4	DISSOLVED OXYGEN	mg/l	6.60	6.50	6.30	**7.5**

5	TOTAL DISSOLVED SOLIDS	mg/l	168.0	120.0	88.0	**500**
6	SALINITY	%	0.02	0.01	0.00	**0.0**
7	TOTAL SUSPENDED SOLID	mg/l	0.050	0.040	0.030	**<10**
B	**CHEMICAL/ANION**					
8	TOTAL HARDNESS	mg/l	136.84	119.84	102.72	**200**
9	MAGNESIUM HARDNESS	mg/l	34.24	34.24	34.24	**50**
10	CALCIUM HARDNESS	mg/l	102.72	85.60	68.48	**150**
12	MAGNESIUM ION	mg/l	8.32	6.36	4.16	**50**
13	CALCIUM ION	mg/l	34.23	24.64	20.90	**100**
13	NITRATE as NITROGEN	mg/l	0.084	0.063	0.042	**10**
14	TOTAL CHLORINE	mg/l	5.64	07.58	08.58	**250**
15	BOD	mg/l	-	-	-	**7.5**
16	COD	mg/l	-	-	-	**30**
17	SULPHATE	mg/l	21.80	20.80	18.60	**500**
C	**METAL/HEAVY METAL**					
18	MANGANESE	mg/l	0.114	0.101	0.094	**0.2**
19	IRON TOTAL	mg/l	0.578	0.415	0.388	**1.5**
20	COPPER	mg/l	0.004	0.003	0.003	**0.1**
21	CADMIUM	mg/l	ND	ND	ND	**<1**
22	ZINC	mg/l	0.104	0.094	0.089	**0.1**
23	LEAD	mg/l	ND	ND	ND	**0.05**
24	NICKEL	mg/l	ND	ND	ND	**0.05**
25	CHROMIUM	mg/l	0.008	ND	ND	**0.05**
D	**MICROBIAL PARAMETERS**					
26	*Total Coliform count*	*cfu/ml*	8.30	3.80	3.10	**1.8**
27	*Escherichia Coli*	*cfu/ml*	1.1×10^1	ND	ND	**Absent**
28	*Salmonella*	*cfu/ml*	1.5×10^1	1.5×10^1	1.0×10^1	**Absent**
29	*Shigella*	*cfu/ml*	1.0×10^1	ND	ND	**Absent**
30	*staphylococcus*	*cfu/ml*	2.0×10^1	2.1×10^1	1.8×10^1	**Absent**

4.3.10.2 Physical and Chemical Property of Groundwater

The groundwater samples analysed are not saline but are entirely slightly alkaline with an average pH of 8.35 which falls within the FMEnv permissible limit in the NSDWQ. Total dissolved Solids (TDS) and Total Solids (TD) for open wells are above the permissible limits (500mg) and well

below the permissible limit for boreholes (15-26ppm). Total Suspended Solids (TSS) is entirely low for boreholes and high for open wells, well above the permissible limit of (500mg) and well below the permissible limit for boreholes (15-26ppm). The hardness of the groundwater is caused by compounds of Mg and Ca and variety of other metals. Groundwater samples S3 and S4 are moderately hard, and this can reduce the life of industrial and domestic equipment. Nitrate (NO3) and Ammonia (NH3) concentration in the groundwater is low and falls below the permitted limit by NSDWQ.

Electrical Conductivity of the water samples are entirely low and within the permissible limit by FMEnv, except for open well two with a high value of 1,231 µs/cm. The Turbidity of the groundwater is low and not above the permitted limit (5.0 NTU). This indicates that the borehole waters may not necessarily be treated before consumption except for the open wells and stand no risk of pathogenic organisms which could be shielded by the turbidity particles and hence escapes the action of disinfection.

Heavy metals are introduced into the groundwater majorly by weathering of the host rock (biotite granites) or associated minerals and leaching from the ongoing artisanal mining activities within the project area. The concentration of heavy metals like Barium (Ba), Iron (Fe), Zinc (Zn), Calcium (Ca), Potassium (K) and Sodium (Na) are entirely low in the groundwater samples and falls below the maximum limit permitted by NSDWQ. Lead (Pb) concentration in the groundwater samples is high and far above the permissible limit for drinking water by NSDWQ (0.01) except in sample GW1 with absence of Pb concentration (0). However, NSDWQ have reported cancer, interference with Vitamin D metabolism, reduced mental development in infants, toxicity to the central and peripheral nervous systems as some of the health impacts of excessive consumption or exposure of human to lead (Pb).

Copper (Cu) concentration in the groundwater is slightly higher than the permitted by NSDWQ (1) in all the samples. Gastrointestinal disorder is reported as the health impact of Copper (Cu). Manganese (Mn) concentration is slightly higher than the permissible limit (0.2) in all the samples except for the GW4C sample which is within the maximum permitted limit (0.2) by NSDWQ. Neurological disorder is reported as the health impact on excessive consumption of manganese (Mn). Cadmium (Cd) concentration in all the groundwater samples is far above the permissible limit specified by NSDWQ for drinking water (0.003). Cadmium (Cd) is toxic to the kidney as reported by NSDWQ as the health impact of excessive consumption or exposure to the metal. Nickel (Ni) concentration in the groundwater samples is slightly higher than the maximum permitted limit by NSDWQ (0.02). Possible carcinogenic reaction is reported as the health impact on excessive consumption of Nickel (Ni) by NSDWQ. Magnesium (Mg) concentration in the groundwater samples is slightly higher than the permissible limit by NSDWQ (20) for drinking water except for GW 4C which falls below the permitted limit (19.13). NSDWQ reported that Magnesium (Mg) is based on human or consumer acceptability, drinking water rich in Magnesium may be a contributor of magnesium in the diet and could be important for those who are marginal for magnesium intake. Chromium (Cr) concentration in all the groundwater samples is slightly higher than the permissible limit by NSDWQ (0.05) for drinking water except for GW 3 with Cr within the maximum permitted limit. Cancer is reported by NSDWQ as the likely health impact of excessive consumption of Chromium (Cr).

4.3.10.3 Groundwater Microbial Properties

The coliform group of organisms is the primary bacterial indicator used in determining the portability or otherwise of a particular water system. Ideally, drinking water should not contain any microorganisms known to be pathogenic and should also be free from bacteria indicative of pollution with excreta (faecal pollution). The detection of faecal coliform organisms in all water samples provides definite evidence of faecal pollution. Escherichia coli (E-coli) is however not present in all water samples. Although all groundwater sampled showed evidence of bacterial and fungi contamination including Salmonella, there were however no presence of E-coli in the water samples. The detection of faecal coliform in groundwater samples is an indication of faecal contamination which could pose harmful health effects.

4.3.11 Vegetation (Flora)

The major floral formation of Nasarawa State is the dry woodland savannah. This broad zone can further be divided into forest savannah and southern guinea savannah. Within each formation, there exist pockets of thickets, tree savannah, open grass savannah, fringing forest in the river valleys and gallery forest at the foot of mountains and their valleys. Dense forests are few though can be continuous in some locations. Such forests are found in lowland areas, particularly where population pressure is less on the land. Gallery forests are common along major streams and pronounced depressions. Forest reserves are being developed mostly near major urban centers like Lafia, Nasarawa, Keffi, Akwanga and Wamba. The vegetation on the hilly parts of the state is composed mainly of grasses and isolated trees. Trees of economic value, including locust bean, Shea butter, mango, citrus and banana are scattered across the state, particularly the lowland areas and southern parts of the state.

A greater percentage of this vegetation cover has however been influenced through fuel-wood extraction and land clearance for cultivation. This has affected the indigenous woody plant species. The result is that most places close to human settlement are now covered with exotic species such as locust bean, Shear butter, cashew and other economic trees. Forest reserves are scattered all over the state. Deforestation which is the deliberate destruction of vegetation because of human activities and domesticated animals has altered the vegetation of the study area so much that the natural vegetation or climatic climax vegetation is rare. Instead, what one finds includes plagio-climax vegetation, secondary forest, derived vegetation, plantations of tree crops and cultivated lands (Abaje, 2007; Abaje, 2016). Clearance of vegetation for farming, fuel wood extraction for domestic and cottage industrial uses and saw milling has led to the development of regrowth vegetation at various levels of development.

The forest of Nasarawa State has been degraded largely by anthropogenic activities which include massive clearing of forest areas for farming activities, refuse dump sites, and cutting down of trees by fuel wood merchants. In addition, in such a forest which is virtually unprotected, the probability of hunting activities cannot be ruled out; which may be done indiscriminately, thus affecting the fauna populations. In most cases around Nasarawa area, forest covers have been more concentrated very close to the mountains that surround the community. The Guinea Savannah biome is characterized by heterogeneity in the physiognomy and spatial structure of the vegetation (Levick et al., 2009); where a mosaic with high and low-cover patches is created by the varied proportion

of woody plants interspersed in a grass matrix. Vegetation structure considers the composition of plant community in terms of specific morphological characteristics while composition is the floristic assemblage of plant species that characterize the vegetation (Martin, 1996). The coexistence and spatially heterogeneous distribution of different life form layers of woody and herbaceous vegetation (Sankaran et al., 2005) may be responsible for low mapping accuracies of savannah land cover classes, as shown in several comparative assessment studies (Giri et al., 2005). Thus, the properties of the mix of woody and herbaceous vegetation can be very important in understanding the complex information on the relation between land cover and the properties of each class or physiographic unit (Privette et al., 2004). Daudu et al. (2017) opined that knowledge on structural characteristics of vegetation is highly demanded both locally and globally. On the global scale, more detailed and standardized data on biomass and vegetation structure of vegetation units are required (FAO, 2001).

On the local scale, information on structural characteristics of vegetation as well as standardized inventories of these properties are important for detailed structural descriptions of both the tree and the herb layer with respect to the stratified vegetation types, and secondly, to compare the vegetation types in terms of structural parameters. Sanford and Isichei (1986) elaborated a classification for West African savannahs based on physiognomic and structural characteristics giving detailed values for stem density and girth distribution of the tree layer. On local and regional scale, some studies used floristic data for classification (Sokpon et al., 2001).

This vegetation type is the remnant of the original forest, which has been disturbed by anthropogenic activities like farming, bush clearing/burning, logging but has been left to regenerate. Though the vegetation type is only a small portion within the proposed project areas it still supports plant species like Alchornia cordifolia, Hura crepitans, Combretum spp., Albizia spp. Terminalia spp, Adansonia digitate, Ageratum conyzoides, Aspilia africana, Donania spp. Daniela oliveri. UNESCO (1996) indicated that often when forest areas are cleared for agricultural purposes remnant indicator plants are still present within the area. The identification of species was conducted in situ and ex situ. Representatives of plant species were taken from the various sites, treated and prepared as herbarium specimens and preserved at the Department of Botany Federal University of Agriculture Makurdi Herbarium. This is for future reference as it would serve as records of vegetation composition of the various locations.

The project is rich in species because of the favourable climatic condition which favours agricultural practices and other development activities. These agricultural practices and other anthropogenic activities have altered part of the original vegetation and resulted in introduction of several other species. The dynamic species composition of the fallows observed is aided by surrounding vegetation where wind-borne seeds come to colonise the fallows. Table 4.8 shows the diversity of species and their occurrence in the various project areas. The floristic arranges the plant species as grasses/sedges, herbs, shrubs and trees. X is used denote presence of a species in an area. Nasarawa State has a relatively uniform vegetation cover across the project areas.



Plate 4.5: Vegetation of the studied area

4.3.12 Fauna/Wildlife studies

The main amphibians documented in the area are the West African toads (Buffo. spp) and various species of frogs. The macro benthic fauna is composed primarily of molluscs mainly Gastropoda such as Archatina sp. (African giant land snail) and Limocolaria spp. (Garden snail). The annelids and Arachnids are also relatively abundant in the area. A sizeable number of the reptilia species were observed in the project areas. E.g. Gekko spp., Lacertillia spp. Viperidae spp. etc. The cattle Egrets (Egretta garzetta) are the dominant Aves in the area. Fish samples which were collected at fishermen berthing points and oral interviews at the major markets in the areas amongst women that deal in fresh fish were used to determine the types of fish found in the area. Table 3.9 below display Fauna and wildlife in the project area. The state of Nasarawa has a uniform fauna habitation.

4.3.12.1: Animals (Fauna Domestica)

In the middle belt region, Nasarawa State is one of the states that is blessed with a relatively high concentration of fauna population. Their spread as observed in the state is a function of vegetation, water and cultural factors. Wildlife resources are also abundant and mostly concentrated in the southern part of the state where gallery forests are many. Generally, the state can be divided into two pastural blocks. The Northern pastural block comprises the local governments North of Nasarawa. Doma. Keana and Awe. It is largely made up or guinea savannah grassland with relatively dry condition in the dry season. Table 4.8: Types and Estimates of Animal Population in Nasarawa State.

Types of Livestock	Estimated Population
Cattle	2,009,270
Goats	3,300,000
Sheep	2,008.000
Pigs	210.000
Rabbits	3.000
Poultry	
Local fowls	3.750.000
Improve fowls	3,500,000
Ducks	42,000
Turkeys	14,000
Guinea fowl	1,500

Source: Nasarawa Agricultural Development Programme and State Ministry of Agriculture and Natural Resources, Lafia (2001)

The landscape is stratified into several habitats, providing the landscape with a habitat of biological importance. However, faunal composition and abundance was poor given that the area had been occupied by the agricultural and industrial activities for a long time and that has led to the relocation and possible decrease by hunting in the region. Despite the very poor abundance of fauna in the region, the study area is rich in avifauna (birds) and arthropod (insects) taxa but massively low in mammals. The low mammalian species diversity would imply that the ecosystem integrity has been distorted by the persistent and increased human disturbance in the area. Therefore, the relatively low numbers of these mammals are indicative that the ecosystem has reached a tertiary state of anthropogenic impact. Their tertiary state is one in which the ecosystem has become impaired and is feared that it may not recover fully even if actions are taken in the medium term due to the absence of key species (Theodore and Helmut, 2006).

4.3.13 Ecosystem Services

Ecosystem services are the benefits that people, including businesses, derive from ecosystems. Ecosystem services are organized into four types:

(i) Provisioning services, which are the products people obtain from ecosystems, e.g. food, freshwater, timber, fibres, medicinal plants.
(ii) Regulating services, which are the benefits people obtain from the regulation of ecosystem processes; e.g carbon storage and sequestration, climate regulation, protection from natural hazards.
(iii) Cultural services which are the nonmaterial benefits people obtain from ecosystems; e.g sacred sites and areas of importance for recreation and aesthetic enjoyment.
(iv) Supporting services, which are the natural processes that maintain the other services, e.g. soil formation, nutrient cycling, primary production.

4.3.12.3 Invertebrate Species

The results of invertebrate species assessment indicated that phyla Arthropoda and Mollusca were the predominant species in the study area. The checklist of Arthropod species indicated that the predominant Orders were Lepidoptera, Odonata, Araneae, Isoptera, Coleoptera, Hymenoptera, Orthoptera, Diptera, and Hemiptera. Grasshoppers (i.e., Order Orthoptera, which appeared in several clusters) were the most ubiquitous arthropods across the area. Damages to tree stems by termites and other isopterans which use them as support for their mounds was evident. The tree stem provides reinforcements on which these insects construct their termitaria. These construction process leaves damaging impact on the plant as they become exfoliated and covered in earth. There were also evidences of active termite activities based on the abundance of termitaria in the area. Table 4.13 shows the classification of the invertebrate fauna observed in the project area.

Table 4.9: Invertebrate Fauna identified in the Project Area

S/No	Taxa /Common Names	Scientific Names	Order	IUCN Status
	Phylum Arthropoda			
1	Termites	Marcotermes bellicosus	Isoptera	NE
2	Common Black Ground Beetle	Pterostichus melanarius	Coleoptera	NE
3	Rhinoceros beetle	Pentodon idiota	Coleoptera	NE
4	Grasshopper	Zonocerus variegatus	Orthoptera	NE
5	Black Ant	Lepisiota sp.	Hymenoptera	NE
6	House Flies	Musca domestica	Diptera	NE
7	Monarch Butterfly	Danaus plexippus	Lepidoptera	NE
8	Plain Tiger	Danaus chrysippus	Lepidoptera	NE
9	Tawny Coster Butterfly	Acraea lycoa	Lepidoptera	NE
10	Centipede	Lithobius forticatus	Chilopoda	NE
11	Vagrant darter	Sympetrum vulgatum	Odonata	NE

NE = Not endangered. Source: Fieldwork, 2025

4.3.12.4: Vertebrate Species

The vertebrates encountered during the data gathering belonged to Class Amphibians, Class Reptilia, Class Aves (Birds) and Class Mammalia. The Aves (birds) class was by far the most numerically dominant and most obvious vertebrate species – and among the Aves class, The Order Pelicani formes was the most abundant. Table 4.14 presents the classification of the vertebrates observed in the project area.

Table 4.10: Vertebrates observed in the Project Area

SN	Common Name	Scientific name	IUCN Status	Status, Abundance, Categories
	Class Aves			
1	Black Faced Quailfinch	Ortygospiza atricollis	LC	M/P/R, c
2	Spotted Flycatcher	Muscicapa striata	LC	M/P/R, c
3	Lead Coloured Flycatcher	Myioparus plumbeus	LC	M/P/R, c
4	Yellow-billed Kite	Milvus migrans	LC	M/P/R, c
5	Oriole Warbler	Hypergerus atriceps	LC	M/P/R, c
6	Common Weaver Bird	Ploceus luteolus	LC	R, c/f
7	Vitelline Masked Weaver	Ploceus vitellinus	LC	R, c/f
8	Village Weaver	Ploceus cucullatus	LC	R, c
9	Black headed weaver	Ploceus nelanocephalus	LC	R, lc/f
10	Intermediate Egret	Egretta intermedia	LC	R/M/V, u/c
	Class Amphibian			
11	True toads	Bufo regularis	LC	NA
	Class Reptilia			
	Order Squamata			
13	Agama Lizard	Agama agama	LC	NA
14	Nile monitor	Varanus niloticus	LC	NA
	Class Mammalia			
	Order Rodentia			
15	Grass cutter /Greater cane rat	Thryonomys swinderianus	LC	NA
16	Giant rat	Cricetomysemini	LC	NA
	Order Carnivora			
17	Domestic dog	Canis lupus familiaris	LC	NA
	Order Artiodactyla			
18	Domestic goat	Capra aegagrus hircus	LC	NA
19	Domestic cow	Bos Taurus	LC	NA
20	Domestic Sheep	Ovis aries	LC	NA

4.4.0: Socioeconomic

The heads of the community invited their members for interaction with the company, consultants and representatives of inter-governmental ministries at State and Federal levels in charge of the environment and mining. A total of 30 questionnaires were administered face-to face to respondents using random sampling techniques. Illiterate respondents were assisted in filing out the questionnaire. In addition to the structured questionnaire, the consultant also adopted oral interview and Focus group discussion (FGD) to obtain information from the respondents.

4.4.1 Auta Balefi Community

The meeting was attended at the community heads and combined team representatives of the company, consultants and ministries (see attendance below). It was an interactive session. The community is in full support of the proposed project. It would bring rapid growth and development to the community. The community leaders gave assurance of a peaceful atmosphere for the business to flourish. Questionnaires were administered to 30 participants. The questions cut across

demographic parameters, socioeconomics, and likely impacts of the proposed projects on the community.



Plate 4.5: A cross section of the participants at the engagement



Plate 4.6: A cross section of the participants at the engagement



Plate 4.7: The CEO/MD delivering welcome address during the engagement



Plate 4.8: A cross section of government officials at the engagement R-L: LGA Rep; FMEnv Rep; SMEnv Rep and CEO Sahara Lubricants Limited



Plate 4.9: FMEnv Rep addressing the participants at the engagement

4.4.3: Demographic and Socio-Economic Data

Male respondents (> 60%) were more than females, and dominated by age group 18-65 years, and the married populations. Respondents are basically farmers, civil servants, and traders. They are permanent residents in the area. The level of education of the respondents 90% of the responding population had formal education; 50% attained higher level while the remaining attended 50% attained primary and secondary education. The informal section education had 10% of the responding population. Many of the respondents disposed of their waste at community dumpsite which are mostly at the backyards. The community water is the majorly sourced from boreholes. Monthly income is relatively low. This is an indication of a high poverty level. About 70% of residents earn more than N70,000 at while 30% earn less than N70,000 per month in the community.

Table 4.11: Demographic and socio-economic data of respondent's community

Sociodemographic information			Number of respondents (total = 30)	% respondents
Sex	Male		22	74.5
	Female		08	26.6
Age	18-45		15	50
	46-60		8	26.6
	Above 60		7	23.33
Marital Status	Married		10	33.33
	Single		10	33.33
	Divorced		6	20.0
	Widow		4	13.33
Occupation	Farmer		3	10
	Salary earner		21	70
	Trading		6	20
Residency	Permanent		27	90
	Visiting		3	10
Education	Informal		2	6.67
	Formal	Tertiary	20	66.6
		Secondary	6	20
		Primary	2	6.67
Disposal of solid waste	Backyard		9	30
	Dumpsite		17	56.67
	Burning		4	13.33
Major sources of water	Borehole		29	96.67
	Rainwater		1	3.33
Average monthly income	≥70,000.00		21	70
	≤70,000.00		9	30

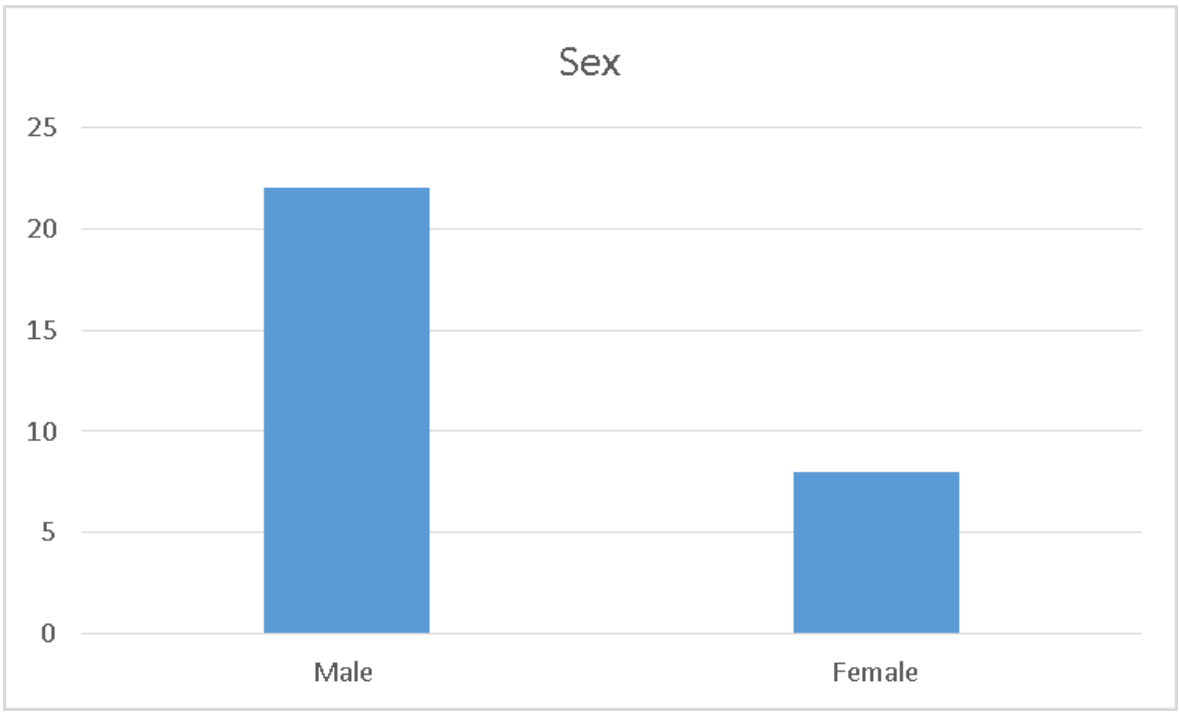


Figure 4.12a: Sex Distribution of respondents

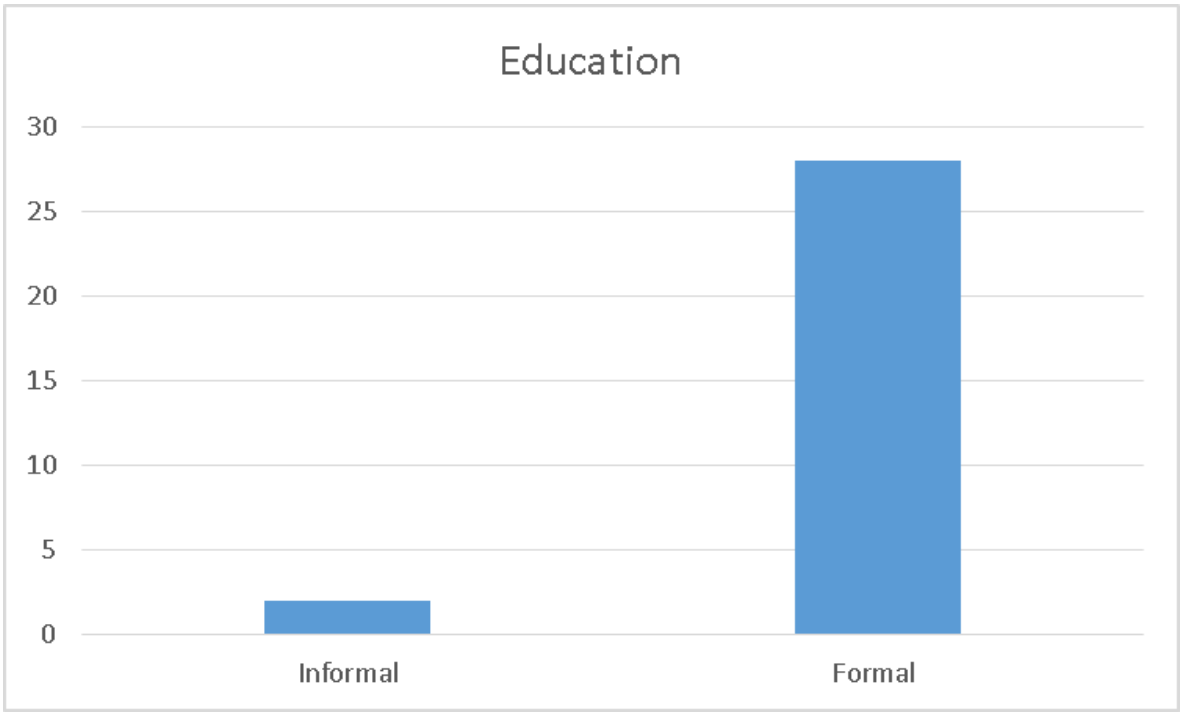


Figure 4.12b: Levels of education of respondents

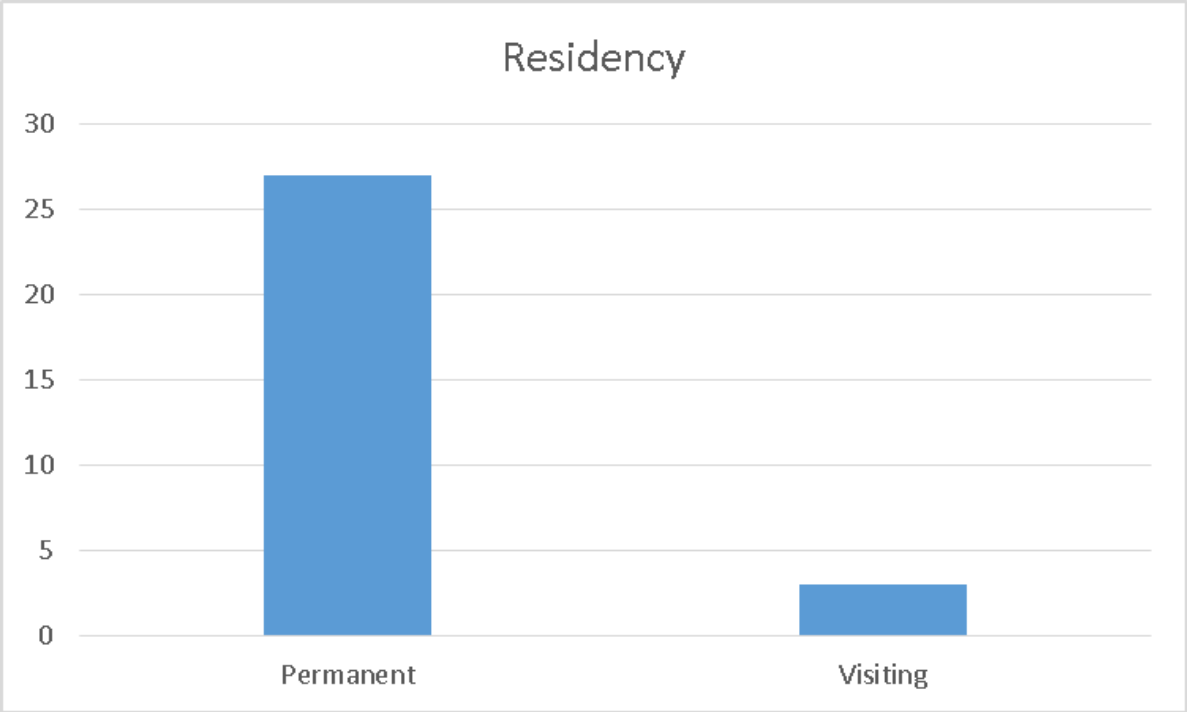


Figure 4.12c: Residency Status of respondents

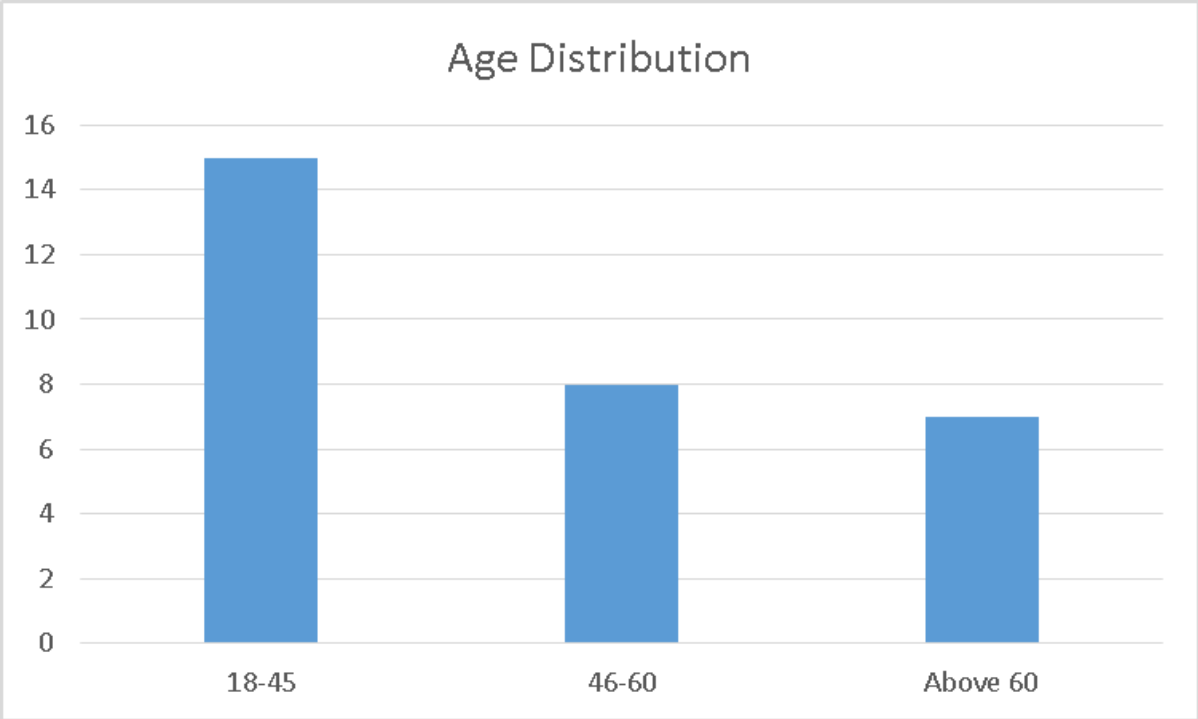


Figure 4.12d: Age Distribution of respondents

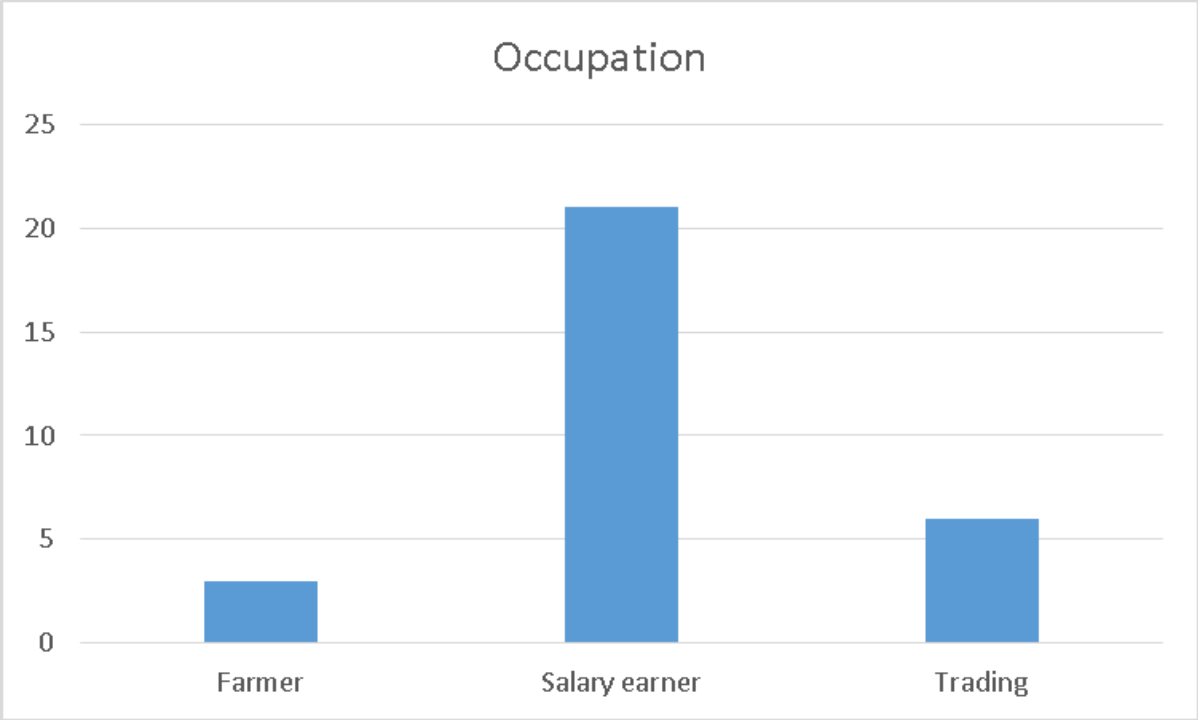


Figure 4.12e: Occupational Distribution of respondents

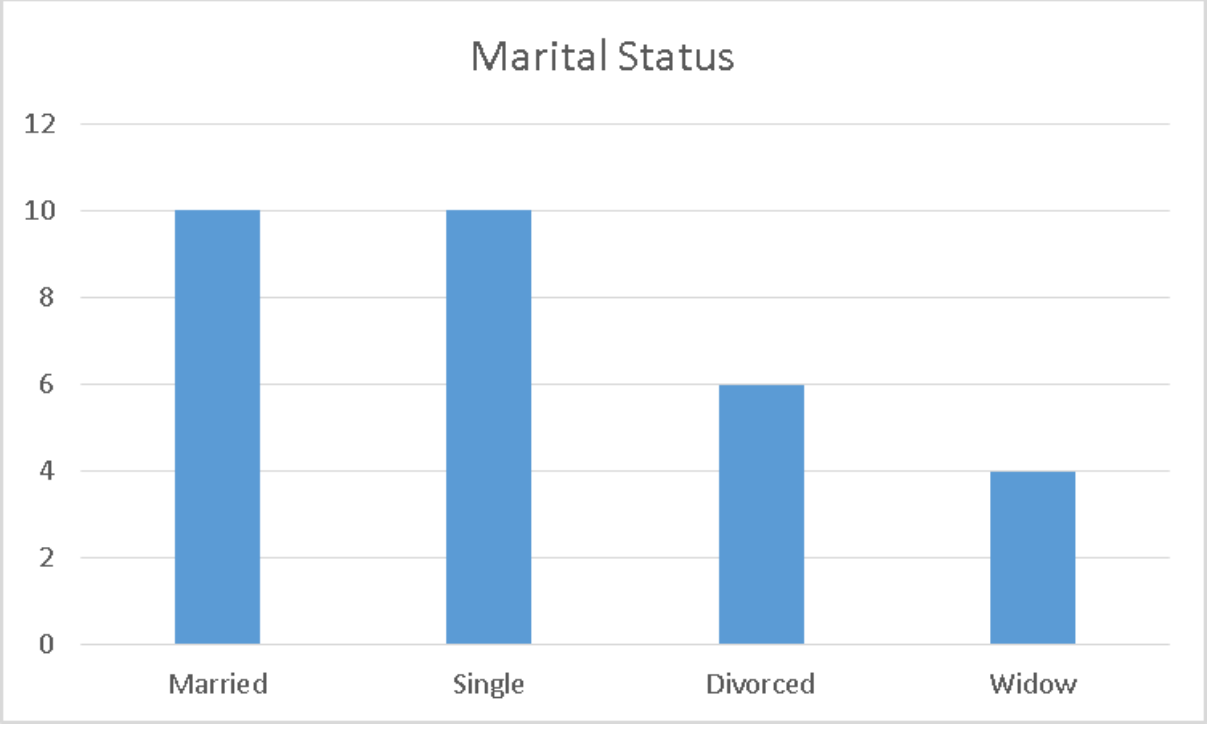


Figure 4.12f: Marital of respondents

CHAPTER FIVE
ASSOCIATED AND POTENTIAL IMPACT

5-1 Background Information

The chapter focuses on identifying and evaluating the likely effects of sand dredging and associated activities on the surrounding physical, biological, and socio-economic environment. The proposed project involves activities such as dredging of sand from the river channel, temporary stockpiling, loading of sand into trucks arranged by buyers, and the movement of equipment within the designated mining corridor. These activities have the potential to interact with various environmental components including surface water, river morphology, soil, vegetation, aquatic life, air quality, and noise levels, as well as the livelihoods and well-being of communities located along the river corridor.

This assessment therefore examines how the proposed sand mining operations may influence environmental resources such as water quality, riverbank stability, terrestrial and aquatic ecosystems, and land resources within and around the project area. In addition, socio-economic considerations such as employment opportunities, community livelihoods, traffic, health, and safety are evaluated in order to understand how the project may affect the host community and surrounding settlements. The purpose of this analysis is to identify both the positive and adverse impacts that may arise during the pre-construction, construction, operation, and eventual decommissioning phases of the sand mining project. By systematically evaluating these impacts, appropriate mitigation and management measures can be developed to minimize negative environmental and social consequences while enhancing the potential benefits of the project.

5.2 Impacts Identification and Evaluation

The main effects of the project activities are identified using the Screening Matrix. The Screening Matrix has distinguished between positive and negative impacts, direct/indirect, local or widespread, short or long term impacts, as well as the level of importance attached to each impact. These impacts in the form of residues and emissions include but are not limited to:

- Discharges to land.
- Emissions to air.
- Noise and vibrations.
- Effects on Ecosystems.
- Effects on Socio-economics
- Effects on People‘s Health

The ISO 14001 requires identification, evaluation and registration of environmental aspects associated with company‘s activities. The company‘s HSE MS is the tool for achieving ISO 14001 requirement, and this EIA report is a component of the HSE-MS. We identified impacts associated with activities of the project through many sources of documentation including:

- Regulator-approved Environmental Impact Assessment for similar projects, e.g. Synod
- EIA 2015; NMDPRA EGASPIN 2O18.

The impacted components of the environment and the checklist of the associated and potential impacts are shown in Tables 5.2 and 5.3.

5.3 Impacts Assessment Methodology

Several methods of impacts assessment are available. The methodology adopted for the impact study of the proposed project was in phases as follows:

vii. Evaluation of major Project Activities.

viii. Identification of environment sensitivities: E.g. Air Quality, Ecology, Unrest, traffic situation using baseline data from fieldwork and previous studies in the project area.

ix. Relating environmental sensitivities to project activities using an interaction matrix:

x. Prediction the magnitude of impacts using the modified ISO 14001 method (Vesilind et al., 1994), i.e. the consequences of the proposed impact on the environment.

xi. Evaluation of the importance (or significance) of impacts. Development of mitigation measures to avoid, reduce or manage the impacts.

xii. Assessment of residual significant impacts after the application of mitigation measures.

Where significant residual impacts remain, other options for mitigation may be considered and impacts re-assesses until they are as low as reasonably practicable for the project.

Screening

The FMEnv and NMDPRA Environmental Guidelines and Standards for the Petroleum Industry in Nigeria (EGASPIN, 2018) and FME Sectoral guidelines require that a screening process must precede an impact assessment. The information required for assessing the likely impacts of the proposed project include:

- knowledge of the project activities, equipment types, and operational procedures;
- the results of baseline studies, and expert group discussions; findings of other EIA studies on similar projects and other literature
- findings on the primary project activities;
- comparison with FMEn/ NMDPRA/ WHO guidelines and standards;
- Environmental audit reports on similar existing projects.

The criteria applied to the screening of various activities and used to make decision as to the potential impacts associated with Project:

- **Magnitude:** Probable level of severity (High, Medium, Low); this is defined as the probable severity of each potential impact. It is measured by the percentage of a population or resource that may be affected by project impact.
- **Prevalence:** Likely extent of the impact (Local or Widespread).
- **Duration:** likely duration – long-term, short-term or medium. Duration is time that is estimated for a population or resource to recover from impact.
- **Frequency:** This is number of times an activity is estimated to occur in the lifetime of the project (Once, Intermittent, Continuous).
- **Risks:** Probability of serious impacts (High, Medium, Low) — using Risk Matrix.
- **Importance:** Value that is attached to a project area in its present undisturbed status (High, Medium, Low). Degree of Reversibility: This refers to whether or not an adverse or negative impact is reversible or irreversible over a certain period of time (5 years).
- **Reversible Impacts**: Impact that can revert to previous conditions.
- **Irreversible impact**: Impacts that will remain permanent even if the activity causing the impacts is terminated.

Environmental Impact Scoping

Scoping was used to determine the terms and boundaries (spatial and temporal) of the study. Each process ensured full attempt to answer such likely questions as:

- What impacts will occur as a result of the project?
- What will be the extent, magnitude and duration of the impacts?
- What will be the significance of these impacts within local, national and international contexts?
- What can be done to mitigate, reduce or avoid altogether, the adverse impacts or to optimize positive impacts?

Scoping was a vital part of the impact assessment process and involved the identification and narrowing-down' of potential environmental impacts to ensure that the assessment focuses on the key issues for decision-making. It is an activity aimed at identifying those components of the biophysical and social environment which may be impacted by the project and for which there is a common concern. (African Development Bank, 2001).

5.3.1 Potential and Associated Impacts

Anticipated Impacts

Impacts can be positive or negative, direct or indirect. The magnitude of each impact is described in terms of being significant, minor or negligible, temporary or permanent, long term or short-term, specific (localized) or widespread, reversible or irreversible. Some impact mitigation has already been addressed in the proactive design and other mitigations can only be guaranteed through active, responsible management, helped by following the guidelines in the project Environmental Management Plan.

The project will be implemented in this phases, construction, commissioning, operation, and decommissioning phase. The activities in each phase and the duration also varies, this will also have a weight on the impact screening. Table 5.1 below gives the list of project activities which interact with the social and natural environment and which have been used in the interaction matrix.

Table 5.1: Project Phases and Duration

Project Phases	Activities	Duration
Project Conception and Preparatory Stages	Design/Contract award, Site survey mobilization of equipment and Personnel site clearing, Sand filling and Earthwork	6 months
Civil Works, Construction and Installation of Equipment	Foundation and civil construction installation of tanks and pipes building construction and finishes	6 months
Commissioning	Commissioning of all equipment both offshore and onshore	4 weeks
Operation and Maintenance	Terminal operation and maintenance periodic maintenance of equipment effluents and waste management.	25 years

Decommissioning	Dismantling of facilities containment of wastes and disposal	8 weeks

Table 5.2: The Potential Environmental Indicators Associated with the Project

Environmental Components	Impact Indicators
Climate	Humidity, temperature, rainfall, wind speed and direction
Air Quality	Particulates (dust), NOx, Sox, CO2, CO, VOC, H2S
Water Quality	Solids (DS, SS), turbidity, toxicity, eutrophication, contamination, microbiology, E. coli
Hydrology	Drainage, discharge, hydrologic balance, sedimentation, erosion
Geology/Hydrogeology	Stratigraphic/Lithologic properties, ground water level and quality
Soil/Land Use	Permeability, porosity, texture, physic chemical/biological properties, erosion tendency Land Use: Recreational, agricultural, industrial, residential, institutional, and commercial
Vegetation/Forestry/Wildlife	Loss of biodiversity, low density/ distribution. Low, rare and significant species of flora and fauna; conservation areas
Noise and Vibration	Day-time disturbance, hearing loss, communication impairment, annoyance
Population	Total population, gender ratio, age distribution
Infrastructure	Existing urban/rural infrastructure including waste handling facilities
Social & Cultural Structure	Local authority and governance structure, social vices, intra and inter-ethnic clashes
Culture and Archaeology	Harvest sites for fishes
Transportation	Road transportation
Macro & Micro economy	Employment, income
Pollution Related Health Problems/ Diseases	Concentration of air pollutants (NOx, SOx, VOC, CO, SPM, Greenhouse gases). Contamination of surface waters and potable ground water, vibration, noise, illumination
Communicable & Non-communicable Diseases	Disease burden, disease causing factors
Nutritional Status	Nutritional status, malnutrition starvation, diets
Health/Recreational Facilities	Availability of and access to health care and recreational facilities

Psychosocial Factors	Drug use/abuse, communal violence, crime, suicide, depression, prostitution
Fertility	Fertility levels, birth rates
Accidents/Fires/Explosion	Rate of occurrence and severity

5.4 Impact Quantification

Using Risk Assessment Matrix and the ISO 14001
The identified associated and potential impacts of the proposed Project where quantified using the Risk Assessment Matrix and the ISO 14001 (1996) criteria for identifying significant/adverse environmental impact. The ISO criteria are shown in Table 5.5.

Criteria and Rating Used:

- **Legal/Regulatory Standard (S**) – is there a legal/regulatory requirement or a permit requirement?
  2 = Low requirements
  2 = Medium/Intermediate breach 50% of the time
  3 = High risk, breach 100% of the time

- **Importance of Affected Environmental Components and Impact (I)** – What is rating of importance based on consensus of opinions?
  3 = Low requirements
  3 = Medium/Intermediate Importance
  5 = High Importance

- **Public Perception (P)** – What is the rating of public perception and interest in proposed project and impacts based on consultation with stakeholders?
  1 = Low perception and interest
  3 = Medium/Intermediate perception and interest
  5 = High perception and interest

- **Environmental Impact Frequency (F)** – What is frequency rating of impact based on Risk Assessment Model, the probability of impact occurring?
  1 = Low Frequency
  3 = Medium/Intermediate Frequency
  5 = High Frequency

Determination of Significant Potential Impacts

The factors used to weigh the significant of the impact quantified are listed below:

- $L + R + F + I + P \geq 15$: Significant
- $F + I \geq = 6.0$: Significant
- $P = 5.0$: Significant

Table 5.4: Consequence – Severity Rating for Risk Assessment Matrix (RAM)

Severity			
0	Zero effect or no risk	No environmental damage. No change in the environment. No financial consequences.	
1	Slight effect or very low risk	Local environmental damage within the fence and within systems. Negligible financial consequences.	Negligible
2	Minor effect, low risk	Contamination, damage sufficiently large to reach the environment, single occurrence limit of statutory or prescribed criteria. No permanent effect on the environment.	Short term
3	Localised/moderate effect/risk	Limited loss of discharge of known toxicity. Repeated exceeding of statutory or prescribed limits. Affecting the neighbourhood.	Medium term
4	Major effect or high risk	Severe environmental damage. The company is required to take extensive measures to restore the contaminated environment to its original state. Prolonged exceeding of statutory or prescribed limits.	Long term
5	Massive effect or very high risk	Persistent severe environmental damage or severe nuisance extending over a large area. In terms of commercial	Long term

		or recreational use or nature conservancy, a major economic loss for the company. Consistently exceeding statutory or prescribed limits by wide margins.	

Table 5.4 Risk Assessment Matrix for Environmental Consequences

Consequences		Increase Probable				
		A	B	C	D	E
Severity	Environment	Never heard of incident in industry	Incident has occurred in oil industry	Incident has occurred in SLL	Happens several times per year in SLL	Happens several times per year in District
0	No effect					
1	Slight effect		Low			
2	Minor effect		Risk			
3	Localized effect			Medium		
4	Major effect			Risk		
5	Massive effect					

Table 5.5: Impact Matrix for Proposed Project

Project Phases	Activities	Description of Impact	Impact Identification							
			Posit.	Neg.	Direct	Indirect	Short Term	Long Term	Rever	Irrever
Project Feasibility and Preparatory Stages	Land acquisition	Income generation in the community from the land sold	*		*		*		*	
	Design contract award site survey	Availability of work to design engineers and surveyor	*		*		*		*	
Site Clearing and Land Preparation	Mobilization of equipment and personnel	Income generation to contractors and workers employed from neighbourhood	*		*		*		*	*
	Site clearing, removal of top soil and grubbing	Loss of topsoil, erosion tendency		*	*		*		*	
		Loss of biodiversity, rare and significant species of flora and fauna		*	*		*		*	
Construction & Installation of Facilities	Earthwork: Sand-filling & grading	Spoiling Road		*	*		*		*	
		Dust and noise during grading		*	*		*		*	

	Waste generation	Waste not properly disposed		*	*		*		*	
	Concrete works and foundation laying, fabrication and installation of tanks and pipelines and other office building	Air quality degradation from fine cement dust, dusty roads, sand blasting and welding of tanks and pipes		*	*		*		*	
		Welding hazards during welding of tanks and pipes		*	*		*		*	
		Noise from tank fabrication and installation		*	*		*		*	
	Pigging pipes with chemicals; hydro testing for pipes and tanks	Discharging into public drains effluent with suspended solids and chemicals		*	*		*		*	

	Waste generation	Waste not properly disposed		*	*		*		*	
Construction & Installation of Facilities	Commissioning	Waste management issues		*	*		*		*	
	Demobilization of labour	Conflicts from loss of jobs by work		*	*		*		*	
Operation and Maintenance	Product transfer to plant	Truck accident enroute to site		*	*		*		*	
	Employments of workers	Workers are trained to run the petroleum product facility and some are employed indirectly by sub-contractors	*		*		*		*	*
	Making petroleum product available for consumers	Petroleum product is made available for consumers in states close	*		*		*		*	*
	Dispensing to consumer container	spilling causing fire		*	*		*		*	
		Release of VOCs, Sox, NOx		*	*		*		*	

Decommissioning	Laying off personal	Loss of employment by workers		*	*		*		*	
	Dismantling of facilities	Creation of jobs for immediate community	*		*		*		*	*
	Sorting and managing scraps and rubbish	Huge waste for recycling and disposal		*	*		*		*	

5.5 Environmental Impacts associated with the Lubricating oil blending plant

5.5.1 Environmental and Social Impacts during Pre-Construction Phase

The potential adverse/beneficial environmental impacts of this proposed project during pre-construction stage are appropriately netted in Table 5.9. In Table 5.10, the most important preconstruction activities about impact receptors are stressed.

Table 5.7: Identification of activities & impact receptors (preconstruction phase)

S/No.	Pre-construction Activities	Receptors
1	Land acquisition	Land
		Socioeconomic
2	Site clearing and leveling (cutting, stripping, excavation, earth movement, compaction)	Air
		Land
		Water
		Ecology
3	Transportation and storage of construction material/equipment	Air
		Land
		Water
		Public Infrstructure

Table 5.7: Identified environmental impacts with impact significance during pre construction phase

Receptors	Identified impacts	Significance Impact
Air	Fugitive dust emissions from vehicles	Moderate (-ve)
	Gaseous) emissions from construction equipment and machinery	Moderate (-ve)
Land	Loss of top soil	Minor (-ve)
Ecology	Loss of vegetation/habitat	Moderate (-ve)
Socio-economic impacts		
Land and Natural Resources	Impact due to rehabilitation & resettlement issues	Minor (-ve)
Public Utility	Increased flow of traffic.	Minor (-ve)
Economic Impacts	Generation of direct, indirect and induced employment and income	Moderate (-ve)

5.5.2 Environmental Impacts during Construction Phase

The environmental impact during construction phase is mostly localized and of short term magnitude. Impact is primarily related to the civil works and some intensive impact due to erection of the equipment. The details of the activities and probable impact are brought out in Table 5.7 and Table 5.8

Table 5.8: Identification of activities & impact receptor (construction phase)

S/No.	**Construction Activities**	**Receptors**
1	Civil construction activities	Air quality
		Ambient Noise
		Soil/land capability & land use
		Water resources
		Ecology & biodiversity
		Terrestrial fauna
		Terrestrial flora
		Socio-economics
		Health & Safety
2	Influx of Labour	Water resources
		Ecology & biodiversity
		Terrestrial fauna
		Terrestrial flora
		Socio-economics
3	Transportation and disposal of construction debris	Ambient Air quality
		Land/ Soil

		Water quality
		Traffic
		Health, safety

Table 5.9: Identified environmental impacts with impact significance during construction

Receptor	Impact Identified	Significance Impact
Visual	Loss of sense of place affecting local communities due to site clearing and construction activities	Moderate (-ve)
Soils, land capability & land use	Placement of project infrastructure, resulting in loss of soil resource, and change in soil characteristics, land capability and land use	Moderate (-ve)
	Spillage of chemicals and seepage from waste resulting in permanent loss of soil resource, and change in soil characteristics, land capability and land use	Moderate (-ve)
	Site clearance resulting in a permanent loss of soil resource, and potential change in soil characteristics, land capability, land use and land slide as a result of increased erosion	Moderate (-ve)
Air Quality	Increase in Particulate Matter (PM) emissions resulting from land clearing, earthworks, and vehicular movement	Minor (-ve)
	Increase in gas (SO2, NOx, CO and VOCs) emissions resulting from vehicle exhaust emission and biomass burning	Minor (-ve)
Water resources	Sedimentation of surface water resulting from erosion and runoff from exposed surfaces and roads	Moderate (-ve)
	Contamination of groundwater resulting from seepage from sewage and other waste	Minor(-ve)
Noise	Continuous noise impact on Auta Balefi (Host community) and other neighboring communities resulting from construction works.	Moderate (-ve)
Ecology & biodiversity	Loss of forest habitat due to site clearing and earthmoving activities.	Major (-ve)
	Loss of habitat due to site clearing and earthmoving activities.	Major (-ve)

	Loss or disturbance of species of special concern due to site clearing and construction activities.	Major (-ve)
	Loss or degradation of ecological processes due to site clearing and construction activities	Major (-ve)
	Fragmentation of habitats and ecological processes due to positioning of project infrastructure.	Major (-ve)
	Modification or degradation of aquatic habitats due to altered hydrological regimes and surface or groundwater quality.	Major (-ve)
	Impeded photosynthesis and transpiration rate of plants due to dust generation.	Minor (-ve)
Traffic	Impeded photosynthesis and transpiration rate of plants due to dust generation.	Moderate (-ve)
	Increase in dust particle due to vehicular movement.	Moderate (-ve)
	Impact of construction related traffic on traffic flow in the community, Nasarawa state.	Moderate (-ve)
	Impact of construction related traffic on utilization capacity	Moderate (-ve)
	Safety impacts on local communities and other road users due to increased road accident rates during construction	Minor (-ve)
Population & demographic movement	Influx of potential job seekers into the area and associated risks	Moderate (-ve)
Health & safety	Increased chances of the spread of communicable diseases such as HIV/AIDS and STDs linked to influx of predominantly male job-seekers and workers.	
	Increased pressure on healthcare infrastructure due to project related influx	Moderate (-ve)
	Increased risk of accidents and injuries to community from improved roads and additional traffic	Moderate (-ve)
Economic impacts	Local and regional benefits resulting from increased revenue to Government	Minor (-ve)

	Stimulation of increased regional investment in the Nigerian economy	Moderate (-ve)
	Generation of direct, indirect and induced employment and income	Minor (-ve)
Ecosystem services	Reduced availability of natural resources and ecosystem services to local community	Moderate (-ve)

Table 5.10 Environmental Impact during Operation Phase

Operation Activities	Receptors
Transportation and haulage	Air Quality
	Ambient Noise
	Public Utilities
	Traffic Water
	Water
	Health, Safety
Base oil feedstock Processing	Air Quality
	Ambient Noise
	Soil, Landuse capability & Landuse
	Ecosystem Services
	Economic Impacts
	Health, safety
Lubricant Production operation (Production line)	Air Quality
	Ambient Noise
	Soil, Landuse
	Water
	Terrestrial Fauna
	Terrestrial Flora
	Socio-economics
	Health & Safety

Table 5.11: Identified environmental impacts with impact significance during operation

Receptor	Impact Identified	Significance Impact
Biophysical Impacts		
Air Quality	Hazardous emissions such as H2S and HCl and sludge obtained during purification of dithiophosphates, overbased calcium sulphonates, succinimidic dispersants, and polymer VI improvers into the environment.	Major (-ve)
	Emission of SO2, a pollutant gas that contributes to the production of acid rain and causes significant health problems.	Major (-ve)

	Emission of greenhouse gases and other gases such as SO2, NOx and CO from ctivities at the lubricant oil production line.	Major (-ve)
Greenhouse gases	Carbon and Hydrogen as major components of oil, natural gas and pesticides contribute to the greenhouse effect and climate change and deplete the ozone layer.	Major (-ve)
	Methane and chlorofluorocarbons are two hydrocarbons that can drastically alter the atmosphere. Methane oxidizes into carbon dioxide (CO2), increasing the amount of CO2 in the atmosphere and adding to the greenhouse effect and global warming	Major (-ve)
Ecology and Biodiversity	Thermal pollution from the lubricant production plants - when water used as a coolant is returned to the natural environment at a higher temperature, the change in temperature impacts organisms by decreasing oxygen supply, and affecting ecosystem composition.	Major (-ve)
	Introduction of alien invasive flora and fauna	Moderate (-ve)
Soil, Land Capability and Landuse	Oil is not only detrimental in large spills; small emissions from automotive leaks and other sources can have cumulative effects that can damage the environment (Soil, land capacity and landuse) in devastating ways. Operational activities causing increased erosion, resulting in a permanent loss of soil resource, and change in soil characteristics, land capability and landuse.	Moderate (-ve)
Water Resources	Oil spill into nearby rivers and streams or seep downward to pollute ground water.	
	Thermal pollution from the lubricant production plants - when water used as a coolant is returned to the natural environment at a higher temperature, the change in temperature impacts organisms by decreasing oxygen supply, and affecting ecosystem composition.	
	Seepage from waste affecting surface and groundwater quality.	
Socio-economic impacts		
Traffic	Impact on utilization capacity on the expressway road affecting other road users	Moderate (-ve)

Population & Demographic Movement	Influx of potential job seekers into the area and associated risks.	Moderate (-ve)
Health and Safety	Eco-toxicity, incomplete biodegradability, and highly probable carcinogenicity of base oils derived from crude oil causes long-term health effects on humans.	
	Oil mist generated during the operation of the device with the open cutting system gets through the respiratory tract, causing changes in the lungs, liver, kidneys, adrenal glands, and the heart.	
	Oil is also absorbed by the skin, causing significant health consequences. These include irritant and allergic reactions. People exposed to long-term contact with oil mist emitted during operation of the cutting device show higher incidence of cancer, including, most often, skin cancer.	

5.5.4 Environmental Impacts during Decommissioning Phase

As soon as the facility reaches the end of its lifespan, the production equipment may be overhauled, replaced or improved to original technology to continue operation or the facility could be closed and decommissioned. If decommissioned, all components and equipment would be removed and the site renewed, returning to its existing land use or better. The decommissioning and restoration of the site will involve several activities that may have some environmental impacts as highlighted in the Table 5.10 and Table 5.16.

Table 5.12: Identification of Activities and Probable Impacts during Decommissioning

S/No.	Decommissioning Activity	Receptors
1	Dismantling/closure	Water Resources
		Air Quality
		Ambient Noise
		Soil
		Social and Economic
		Health & Safety
2	Rehabilitation of disturbed land	Water Resources
		Air Quality
		Ecology & Biodiversity
		Soils, Land capability &
		Landuse
3	Waste Generation and Disposal	Air Quality
		Terrestrial flora
		Terrestrial fauna
		Water Resources

		Health & Safety
		General public

Table 5.13: Identified environmental Impacts significance during decommissioning

Receptors	Identified impacts	Impact significance
Ecology and Biodiversity	Loss or disturbance of fauna species of special concern due to collisions and noise disturbance	Moderate (-ve)
	Re-establishment of habitats or creation of new habitats via rehabilitation.	Moderate (-ve)
	Increased hunting/poaching of wildlife and loss of habitats for crop production.	Moderate (-ve)
	Introduction of alien invasive flora and fauna.	Moderate (-ve)
Social and economic	Loss of jobs.	
	Falter of many small enterprises.	Moderate (-ve)
Water resources	Chemical contamination of surface water resulting from accidental spills during transportation and handling, and seepage from waste.	
	Sedimentation of surface water resulting from erosion and runoff from exposed surfaces and roads.	
	Contamination of groundwater resulting from seepage from hazardous materials and waste	
Soils, land & capacity	Demolition of project infrastructure, resulting to increase in soil contamination.	
Air quality	Increase in Particulate Matter (PM) emissions resulting from land clearing, earthworks, and vehicular movement.	
Visual	Dust generation and site disturbance due to earth moving and removal of project infrastructure,	

	affecting the visual character for communities	
Health & Safety	Reduced chances of the spread of communicable diseases such as HIV/AIDS and STDs due to decommissioning.	Minor (-ve)
	Reduced pressure on healthcare infrastructure due to decommissioning.	Minor (-ve)
	Increased risk of accidents and injuries to workers due dismantling of equipment.	Minor (-ve)

Table 5.14 Cumulative Impacts Arising from the Proposed Project

Receptor	Identified impacts	Impact Significance
Air Quality	From the results of the air emission dispersion modeling , the cumulative impact of the proposed development on the environment will be as: • Daily NOX increases by 26 folds of the limit; • Daily SO2 increases by 75.4% of its limit; • Daily CO increases by 2.5% of its limit; • Daily VOCs increases by 5.5% of its limit; and • Daily SPM increases by 17.5% of its limit	Moderate (-ve)
Noise	• Present average noise level is 83.10 dB in dry season but 54.4 dB in wet season; • Noise modelling shows cumulative level of 45.0 – 96.5 dB(A); • Cumulative noise breaches 90 dB(A) limit only at power houses and production floor; • Cumulative noise is within the 70 dB(A) industrial area limit at fenceline; • Cumulative noise is within the 55 dB(A) day-time limit at fenceline; • Cumulative noise breaches 45 dB(A) night-time limit only	

	within 500 m radius; • The major sources of noise as observed from the field are from vehicular movement along the road	
Water resources	one (1) boreholes proposed for the oil blending plant project may impact on the ground water resources of the project area	Moderate (-ve)
Traffic	The current traffic volume along the major road through the project area (Irete), from the field traffic count conducted show that there is an average peak traffic of 30 cars per hour, 20 buses per hour, 10 trucks per hour, and 33 motocycles per hour. During the operation of this proposed project Not less than 75 trucks will come in for the dispatch of lubricant oil. Also, other project vehicles will come in and thus, the traffic volume will increase.	Moderate (-ve)
Population & demographic movement	The operation stage of this project will bring in an additional project staff excluding the truck drivers, food vendors and other commercial merchant that will also troop in due to the presence of demand for their goods and services. This shall significantly increase the population of the project host communities.	Moderate (-ve)

Owing to the project aspects and activities outside the project (GSI, 2003). The concept of cumulative effects is an important one. It holds that, while impacts may be small individually, the overall impact of all environmental changes affecting the receptors taken together can be significant. When a resource is nearing its tolerance threshold, a small change can push it over. The cumulative impacts associated with the proposed lubricant production plant activities are as highlighted in Table 5.17.

5.6 Risk and Hazard Assessment

5.6.1 Overview

Risk assessment is the determination of quantitative or qualitative estimate of risk related to a concrete situation and a recognized threat (also called hazard). The assessment of the risks and hazards associated with the proposed project involves the following steps:

- Identification of hazards/risks
- Likelihood of occurrence
- Consequence/severity of the hazards

The risk assessment matrix is then developed as presented in the Table 5.18.

Table 5.15: Risk Assessment Matrix

0-5 = Low Risk 6-10 = Moderate Risk 11-15 = High Risk 16-25 = Extremely High (Unacceptable Risk)		Severity of the potential injury/damage					
		Insignificant damage to Property, Equipment or Minor Injury 1	Non-Reportable Injury, Minor loss of Process or slight damage to Property 2	Reportable Injury moderate loss of Process or limited damage to Property 3	Major Injury, Single Fatality critical loss of Process/damage to Property 4	Multiple Fatalities Catastrophic Loss of Business 5	Multiple Fatalities Catastrophic Loss of Business
Likelihood of the Hazard Happening	Almost Certain 5	Almost Certain 5	5	10	15	20	25
		Will probably occur 4	4	8	12	16	20
		Possible occur 3	3	6	9	12	15
		Remote possibility 2	2	4	6	8	10
		Extremely unlikely 1	1	2	3	4	5

5.6.2 Project Specific Risks and Hazards

The potential risks and hazards associated with the construction and operation of the proposed lubricant production plant are described below

- **Fire and Explosion**

One major risk associated with lubricant oil production is fire and explosion. Petrol and diesel required to run lubricant oil generating sets as well as trucks and vehicles required for the haulage and transportation of finished products, are highly inflammable. These petroleum products if wrongly handled or a mishap occurs around its storage area, could result in serious conflagration. Any outbreak of uncontrolled fire in the plant area can escalate to dangerous dimensions which could lead to multiple fatalities and catastrophic loss of business. The overall significance is high. Careful handling is necessary to mitigate fire and explosion risks.

- **Security Threat and Attack**

Security systems are essential for a suitable operation of a lubricant production plant in order to avoid damage and possibly plant own time from theft and vandalism. The plant may be subject to sabotage or attack and thus result in less than optimal production capacity as a result of uprising. Although, the likelihood of such invasion by an attack at the project site is considered to be of faraway possibility. The severity of such attack if happens would be a major injury and critical loss of process and damage to property. The risk significance is rated minor.

- **Occupational Hazards**

Workers may be exposed to occupational hazards when working at elevation during construction. The use of elevated platforms during plant installation pose a physical hazard to workers. Also, there could be electrical hazards to workers. Common electrical accidents result in shocks and/or burns, muscle contractions, and traumatic injuries associated with falls after a shock. The likelihood of the hazards occurring is considered to be possible while its severity may lead to reportable injury and limited damage to property. The overall significance is rated moderate.

CHAPTER SIX
MITIGATION MEASURES

6.1 Introduction

The principal objective of the EIA is the development and establishment of suitable procedures (mitigation measures) for identified, significant and adverse impacts of a proposed project. This chapter presents the mitigation measures for the identified associated and potential environmental impacts for the proposed Power Plant project. The mitigation measures have been proffered to prevent, eliminate or minimize the impacts and their effects to levels that are considered as low as reasonably practicable (ALARP).

In proffering mitigation measures, the primary objectives were:

- Prevention – ensuring that significant and adverse potential impacts and risks do not occur.
- Reduction – ensuring that the effects or consequences of those significant associated and potential impacts that cannot be prevented are reduced to as low as reasonably practicable. Reasonable practicability was determined in reference to best industry practice and to economic, environmental, technical, health and safety considerations.
- Control – ensuring that residual associated impacts are reduced to a level as low as reasonably practicable.

6.1 Management Procedure for Mitigation Measures

Mitigation measures have been proffered for adverse significant potential impacts. These measures (prevention, reduction, control strategies) were developed for the adverse impacts through review of industry experience (past project experience), consultations and expert discussions with multi-disciplinary team of engineers and scientists.

6.2 Mitigation Measures for the Identified Project Risks and Hazards

The mitigation measures for the identified project risks and hazards are highlighted below:

Fire and Explosion

- Considering the nature of the facility, working area shall be properly insulator as specified in the project design to prevent any likely fire outbreak.
- Fuel storage facilities which comply with international and local standards for performance and safety shall be used.
- Only suitable electrical cables shall be used.
- An internal firefighting department equipped with the requisite equipment shall be set up.
- The local fire department shall be informed of and familiarized with the project facility.
- Project equipment and facilities shall only be installed by qualified contractors.
- Facility shall be inspected regularly by qualified professionals.
- Periodic checks shall be regularly carried out to look out for damages from rodents and other pests, which could compromise electrical wiring or insulation.
- Emergency response plan shall be developed and implemented.
- Fire suppression system and equipment (such as fire extinguishers, fire notices, and warning signs) shall be installed at different locations within the facility.

Security Threat and Attack

- No authorized person(s) shall be allowed into the facility without adequate check. •
- A 24-hour site security shall be put in place.
- The proponent shall maintain regular communication with the Nigerian Police/Army and other relevant local security

Occupational Hazards

- Installation of fixtures on tower components to facilitate the use of fall protection systems.
- Provision of an adequate work-positioning device system or workers.
- Hoisting and lifting equipment shall be rated and maintained and operators trained in their use.
- Appropriate Personal Protective Equipment (PPEs) shall be worn.
- Electrical installation shall be carried out by trained personnel in line with the approved procedures.

Table 6.1: Proposed Mitigation Measures for the Identified Potential Impacts associated with the lubricating oil blending plant

Receptors	Identified Impacts	Rating before mitigation	Mitigation Measures	Rating after Mitigation (Residual Impacts
Air	Fugitive dust emissions due to vehicular movement	Moderate (-ve)	• Application of dust suppressants (Water sprinkling) • Speed limits shall be set to minimize the generation of fugitive dust	Minor (-ve)
	Gaseous emissions from construction equipment and machinery	Moderate (-ve)	Regular and effective maintenance will be carried out to keep vehicles in good working condition and limit the release of noxious gases	Minor (-ve)
Water	Run-off from storage areas of construction materials	Minor (-ve)	rces of contamination in secure facilities with appropriate Storm Water management systems (policies, regulations and planning) in place to ensure that contaminants are not released to the water resource through Storm Water runoff.	Minor (-ve)
Land	Loss of top soil	Minor (ve)	There shall be the undertaking of stripping	Minor (-ve)

			and effective stockpiling management.	
Ecology	Loss of vegetation/habitat	Moderate (-ve)	Access road to the site for preliminary studies shall be made in a way that sensitive ecosystems are avoided. control of alien invasive plants in the concession shall be developed and implemented. No fauna shall be destroyed by any project personnel. Severe penalty shall be meted to defaulting staff. (weed) shall be left to decompose and given to farmers as manure.	Minor (-ve)
Public utilities	Increased flow of traffic	Minor (ve)	• Prohibit parking of trucks along the road and enforce the use of truck parking lot to be constructed within the project facility. • Clear signage and traffic calming measures on the intersection between the facility‘s access road and the main expressway	Negligible (-ve)
CONSTRUCTION				
Visual	Loss of sense of place affecting local communities due to site clearing and construction activities	Moderate (-ve)	Vegetation shall be cleared in phases so that only those areas required for immediate development are cleared. Directional lighting in areas operating at night, if communities are affected by lighting.	Minor (-ve)
Soils, land capability & land use	Placement of permanent project infrastructure, resulting in a permanent loss of soil resource, and change in soil characteristics, land capability and land use	Moderate (-ve)	Community members shall be assisted where livelihood is impacted with establishing new agricultural areas on land of equal or better land capability.	Minor (-ve)

	Spillage of chemicals and seepage from waste resulting in permanent loss of soil resource, and change in soil characteristics, land capability and land use.	Moderate (-ve)	There shall be provision of appropriate secondary containment (to hold 110% of the stored volume) in areas where hydrocarbons, solvents and other potentially hazardous materials are stored. There shall be preparation of procedures to ensure that spillage during mobile equipment maintenance is minimized, and that only designated areas will be used for this purpose. The procedures include; Prevent the spread of dust and vapour, Neutralize the acids and bases if possible, Control the spread of the liquid, Absorb the liquid, Collect and contain the clean-up residue, Dispose the waste and Decontaminate the area affected and the equipment.	Minor (-ve)
	Site clearance resulting in a permanent loss of soil resource, and potential change in soil characteristics, land capability and land use as a result of increased erosion	Moderate (-ve)	Stripping, stockpiling and stockpile management shall be undertaken Community members shall be assisted where livelihood is impacted with establishing new agricultural areas on land of equal or better land capability.	Minor (-ve)
Air Quality	Increase in Particulate Matter (PM) emissions resulting from land clearing, earthworks, and vehicular movement		Speed limits shall be set to minimize the generation of fugitive dust materials shall be covered to prevent materials being blown from off the vehicles. There shall as possible application of dust suppressants (water	Negligible

			sprinkling) to sections of roads used routinely by vehicles that pass through and close to communities.	
	Increase in gas (SO2, NOx, CO and VOCs) emissions resulting from vehicle exhaust emission and biomass burning.	Minor (ve)	As much as possible biomass burning shall be discouraged. Enlightens campaigns against bush burning as farming practice. methods (Reduce, reuse and recycle, plant a tree, using energy efficient bulbs etc.) to reduce release of gases like CO to minimize negative cumulative impacts	Negligible
Water Resources	Chemical contamination of surface water resulting from accidental spills during transportation and handling, and seepage from waste.	Minor (ve)	There shall be equipping of all trucks and equipment carrying fuels or oil with spill response materials and train personnel in the use of such materials. Storing all potential sources of contamination in secure facilities with appropriate Storm Water management systems in place to ensure that contaminants are not released to the water resource through storm water runoff. There shall be silt traps to remove these types of contaminants from storm water, and the use designated areas for equipment servicing. Monitoring discharges of water quality to ensure it is compliant with the necessary guidelines shall be implemented.	Negligible
	Contamination of groundwater resulting from		There shall be restriction of construction activities at the facility to daytime	

	seepage from sewage and other waste.		hours 07:00 am to 07:00 pm. Noise screening measures shall be implemented	
Noise Level	Continuous noise impact on community resulting from night-time. construction works.		There shall be restriction of construction activities at the facility to daytime hours 07:00 am to 07:00 pm. Noise screening measures shall be implemented	
Ecology & Biodiversity	Loss of forest habitat due to site clearing and earthmoving activities		A rehabilitation plan shall be developed and implemented (overseen by an appropriately qualified botanist/ ecologist), with different objectives and rehabilitation approaches established for each habitat/ecosystem.	
	Introduction of alien invasive plants due to site clearing and disturbance of vegetation.		Site clearing shall limited to the area acquired for the project.	
	Impeded photosynthesis and transpiration rate of plants due to dust generation		Adjacent land shall not be encroached upon.	
Traffic	Impact of construction related traffic on utilization capacity on expressway.		Prohibit truck parking along the Expressway. Clear signage and traffic calming measures on the intersection between the facility‘s access road and the main expressway. This will warn motorists of the intersection and would reduce potential traffic safety impacts at this intersection.	
	Safety impacts on local communities and other road		There shall be provision of temporary on-site accommodation for	

	users due to increased road accident rates during construction		construction personnel to limit the volumes of daily commuter traffic to the project site. There shall be provision of dedicated buses for construction personnel not accommodated on the site to reduce daily commuter traffic to the project site. Rest area for driver be implemented, and maximum driving hours per driver established and enforced.	
Population & Demographic Movement	Influx of potential job seekers into the area and associated risks.		There shall be optimization of the use of local labour as far as practically possible. Development of a code of conduct with which contractors and their employees must comply. The code shall deal with the interaction with local communities and substance abuse among other things. Development and communication of a clear and concise employment and recruitment policy to prevent opportunistic job seekers from settling in the area.	
Health & Safety	increased chances of the spread of communicable diseases such as HIV/AIDS and STDs linked to influx of predominantly male job-seekers and workers		There shall be development of a comprehensive HIV/AIDS program to employees through employee wellness programmes which should include the following: - Awareness campaigns targeting project workers, senior management, contractors, subcontractors and their spouses, communities near project	

			facilities, risk groups (commercial sex workers, truck drivers). - Prevention, voluntary counseling for HIV testing, as well as antiretroviral treatment for employees and surrounding communities	
	Increased pressure on healthcare infrastructure due to project related influx.		A dispensary will be built at the lubricating oil blending plant to handle health care service delivery to project staff. • There shall be the development of an MOU with the Teaching hospital in Irette community, for service provision to the local workforce and theirdependents. • There shall be the development and implementation of community development/sustainability plans to support infrastructure development in the area.	
	Increased risk of accidents and injuries to communities from		• Awareness campaigns shall be carried out in Expressway and other neighbouring communities, with a focus on school children, women and the elderly, about risks related to traffic. • Enforcement of speed limits and sanctions for any personnel found in violation including senior staff and contractors‘ as well as subcontractors‘employees. • There shall be appropriate signaling of moving heavy machinery, and escort vehicles where needed. • All drivers shall be given safety education focusing	

			on speed and conflicts between pedestrians and cyclists. • Advanced warning signs including sirens shall be erected at locations of high pedestrian and cyclist	
	The visible presence of Nigerian Police within the project area, and their secondment as a subcontractor for the lubricating oil blending plant security.		• There shall be the development of a code of conduct for police personnel, especially in relation to handling community violence. • There shall be proper screening of appointed security personnel to ensure they were not implicated in human rights abuses in the past. • There shall be the Monitoring of violence by the lubricating oil blending plant security in instances of labour unrests.	Negligible
Operations				
Air Quality	Air pollutants resulting from burning oil and natural gas.		• Particulate matter that are released by dust, exhaust, and other air emissions shall be adequately arrested and supressed by the application of different dust suppressant like the Electro-Static Precipitator (ESP) and Bag Filters (as at when necessary). This shall be carried out to ensure the emission remains within the standard limits throughout the plant life span. • Frequent monitoring to ensure the initial design emissions remain the same throughout and if not immediate corrective	

			actions can be taken. • 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.	
	Emissions of Particulate Matter and gases including benzene (C6H6), formaldehyde (HCHO), Hydrogen sulfide (H2S), Polycyclic aromatic hydrocarbons (PAHs), Sulphur (IV) Oxide (SO2), and Nitrogen Oxides (NOx), as well as Carbon (II) Oxide (CO).		• The exhaust gases from the project shall be cleaned using cyclones and an electro-static precipitator (ESP) system (as at when necessary) that will be covered in the design of the lubricant oil plant. This shall remove most of the fine dust 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 span. Frequent monitoring to ensure the initial design emissions remain the same throughout and if not immediate corrective actions can be taken.	
	Air pollution including Sulphur (IV) Oxide (SO2), Nitrogen Oxides (NOx), Particulate Matter (PM), and heavy metals, leading to		• Equipment maintenance to be undertaken in accordance with manufacturer's instructions and at the specified maintenance interval to reduce exhaust emission. • Equipment operators will	

	smog, acid rain, toxins in the environment, and numerous respiratory, cardiovascular, and cerebrovascular effects		be trained in and will follow equipment operational procedure.	
	Air pollution including Sulphur (IV) Oxide (SO2), Nitrogen Oxides (NOx), Particulate Matter (PM), and heavy metals, leading to smog, acid rain, toxins in the environment, and numerous respiratory, cardiovascular, and cerebrovascular effects		• 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.	
	Emission of greenhouse gases and other gases such as SO2, NOx and CO from activities at the lubricant production plant.		• Frequent monitoring to ensure the initial design emissions remain the same throughout and if not immediate corrective actions can be taken. • Equipment maintenance to be undertaken in accordance with manufacturer's instructions and at the specified maintenance interval to reduce exhaust emission	
	Lube oil is transported via trucks, release air pollution such as soot and can lead to disasters that		• Equipment maintenance to be undertaken in accordance with manufacturer's instructions and at the specified maintenance interval to reduce exhaust emission	

	ruin the environment.		• 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.	
	Emission of hydrocarbons, which contribute to smog formation.		• The exhaust gases from the project shall be cleaned using appropriate system that will be covered in the design of the lubricant plant. This shall remove most of the fine dust being released into the atmosphere. • Frequent monitoring to ensure the initial design emissions remain the same throughout and if not immediate corrective actions can be taken. • Equipment maintenance to be undertaken in accordance with manufacturer‘s instructions and at the specified maintenance interval to reduce exhaust emission. • Equipment operator will be trained in and will follow equipment operational procedure	
	Gases- Black carbon resulting from incomplete combustion		Additive shall be added in the blending kettles according to the requirement and plan to reduce the emissions	

	contributes to climate change.		especially those related to Sulphur. SLL choose the Automatic Batch Blender (ABB) composed with the lithium hydroxide dispersion one of the best available technology for this range of equipment for pressure cycle.	
Ecology and Biodiversity	Thermal pollution from the lubricant plants - when water used as a coolant is returned to the natural environment at a higher temperature, the change in temperature impacts organisms by decreasing oxygen supply, and affecting ecosystem composition		Waste water from the facility proposed lubricant oil plant shall be recycled in the operational activities of the proposed plant. Even though the plan to recycle wastewater, if there are going to be discharge at all into the receiving environment, it shall first be treated to meet both local regulatory and international standards.	
Soil, Land Capability and Landuse	Fuel and Chemical spills and release of contact water resulting in permanent loss of soil, and change in soil characteristics, land capability and land use.		Bund wall shall be constructed in the fuel dump section to contain fuel/oil spill. There shall be preparation of procedures to ensure that spillage during mobile equipment maintenance is minimized, and that only designated areas are used for this purpose.	
	Operational activities causing increased erosion, resulting in a permanent loss of soil resource, and change in soil		The provision of appropriate secondary containment (to hold 110% of the stored volume) in areas where hydrocarbons, solvents and other potentially hazardous	

	characteristics, land capability and land use.		materials are stored shall be implemented. Implementation of storm water control measures around mine facility. The preparation of procedures to ensure that spillage during mobile equipment maintenance is minimized, and that only designated areas are used for this purpose shall be pursued.	
Water Resources	Water contamination due to effluent, wash water and cooling water discharges, and seepage from storage and waste tanks.		No wastewater shall be discharged without appropriate treatment into rivers or other locations where infiltration may occur. Proper containment or collection point shall be constructed for the collection of wastewaters Collection of wastewaters Wastewater shall be managed and treated through screening, sedimentation and skimming.	
	Water contamination due to discharges of water effluents rich in inorganic salts without appropriate treatment (saline pollution).		Water effluent shall be treated using a combination of some of the following treatment processes: neutralization, evaporation, aeration, flocculation, oil and grease separation, Carbon adsorption, reverse osmosis and ioni exchange, bio treating etc depending on the level of contaminant before discharging into the receiving waters bodies. Even though the plan to recycle wastewater, if there are going to be discharge at	

			all into the receiving environment, it shall first be treated to meet both local regulatory and international standards. • Effluent from raw water treatment plant shall be neutralized to normal pH levels and thereafter directed to on site waste water treatment plant.	
	Seepage from waste affecting surface and groundwater quality.		• Proper waste management practices shall be employed in the handling and disposal of wastes from the facility. • Areas for storing and handling of raw materials and products should be waterproofed and have a drainage system, so that any spills and wash waters can be directed to treatments.	
Traffic	Impacts on local traffic due to truck circulation (including dangerous cargos).		• Trucks parking along the Expressway will be prohibited for truck drivers. Truck drivers will all be compelled to utilize the truck car park. • Clear signage and traffic calming measures shall be put in place on the intersection between the facility‘s access road and the main expressway. This will warn motorists of the intersection and could reduce potential traffic safety impacts at this intersection. • Scheduling the delivery of materials outside peak traffic times shall be implemented. • There shall be the provision of dedicated buses for	

			project personnel to reduce daily commuter traffic to the project site.	
	Increased road accident rates and road safety of other road users especially considering the high volume of trucks required in conveying materials to the plant.		• There shall be awareness campaigns in neighbouring communities, with a focus on school children and mothers, about risks related to traffic. • There shall be enforcement of speed limits and sanctions for any personnel found in violation of speed limits, including senior staff and contractors' and subcontractors' employees. • Appropriate signaling of moving heavy machinery, and escort vehicles where needed shall be implemented. • All drivers shall be given safety education focusing on speed and conflicts between pedestrians and cyclists. • Advanced warning signs including sirens shall be erected at locations of high pedestrian and cyclist activity. • Provision of dedicated buses for project personnel shall be provided to reduce daily commuter traffic to the project site • There shall be scheduling of the delivery of materials outside peak traffic times. • Rest area for drivers shall be implemented, and maximum driving hours per driver established and enforced.	

Ecological Services	Reduced availability of natural resources and ecosystem services to local communities due to use by the project and impacts on these resources.		A Biodiversity Action Plan shall be developed to inform the protection and management of biodiversity in the entire project area.	Negligible
Population & Demographic Movement	Influx of potential job seekers into the area and associated risks		• There shall be the development of a code of conduct with which contractors and their employees must comply. The code should deal with the interaction with local communities and substance abuse among other things. • Developing and communicating a clear and concise employment and recruitment policy to prevent opportunistic job seekers from settling in the area shall be pursued.	
Health and Safety	The oil mist which contain Aromatic Hydrocarbons, Polycyclic Aromatic Hydrocarbons (PAHs), also benzene, toluene, or methylbenzene, may have negative influence on the respiratory and nervous systems of the workers.		• Care shall be taken to ensure that PAHs are removed from the atmosphere by using appropriate PAHs removal mechanism. • The employer shall supply the employee with respiratory protection equipment to reduce exposures to or below the permissible exposure limit. • Catalytic converters shall be installed in the lubricant oil machines to reduce PAHs emissions into the air. • Bag filters shall be replaced when worn out to ensure the emission remains	

			within the standard limits throughout the plant life. • The company shall choose the latest technology that have minimum dust emission capacity in the market which is the Automatic Batch Blender (ABB) Technology for the lubricating oil plant. • Frequent monitoring to ensure the initial design emissions remain the same throughout and if not immediate corrective actions can be taken. • Public awareness and education about the sources and health effects of exposure to PAHs should be improved throughout the project life span	
Decommissioning				
Ecology and Biodiversity	Introduction of alien invasive flora and fauna		• A Rehabilitation Plan shall be developed and implemented (overseen by an appropriately qualified botanist/ ecologist), with different objectives and rehabilitation approaches established for each habitat/ecosystem. • A programme for the control of alien invasive plants in the concession shall be developed and implemented	
	Loss or disturbance of fauna species of special concern due to collisions and noise disturbance		Area immediately adjacent to important habitats (e.g. wetlands, swamps, Gallery and Swamp Forest) that have been degraded shall be restored to their natural, preconstruction condition.	

	Contamination of groundwater resulting from seepage from hazardous materials and waste.		Capping waste landfillfacility after closure to limit artificial recharge and seepage forming shall be implemented.	Negligible
Soils, Land capacity & Landuse	Remediation of contaminated soils and demolition of project infrastructure, resulting in re establishment of baseline soil characteristics and land capability.		Phytoremediation shall be carried out on contaminated soils. • Trees shall be planted around areas that cannot be land filled.	
Air Quality	Increase in (Particulate Matter) emissions resulting from land clearing, earthworks, and vehicular movement.		• Dust suppressants (Water sprinkling) shall be applied to sections of roads used routinely by vehicles that pass through and around neighboring communities. • Vehicles carrying dusty materials will be covered to prevent materials being blown from the vehicles. • Speed limits shall be set to minimize the creation of fugitive dust within the project boundary.	Negligible
visuals	Dust generation and site disturbance due to earth moving and removal of project infrastructure,		There shall be revegetation and landscaping of disturbed areas as soon as possible, to reflect the surrounding topography and vegetation.	
	Dust generation and site disturbance due to earth moving and removal of project infrastructure, affecting the		• There shall be the re vegetation and landscaping of disturbed areas as soon as possible, to reflect the surrounding topography and vegetation.	

	visual character for communities.			

CHAPTER SEVEN
ENVIRONMENTAL MANAGEMENT PLAN (EMP)

7.1 Introduction

The environmental management plan involves risk management strategies that should be undertaken by the project proponent and the project manager to mitigate environmental degeneration. They are approaches to monitor, control, reclaim and restore the environment back to its appropriate state. EMPs for projects thus provide logical frameworks within which the identified issues of environmental concern can be mitigated, monitored and evaluated. Environmental monitoring involves measurement of relevant parameters, at a level of details accurate enough, to distinguish the anticipated changes. Monitoring aims at determining the effectiveness of actions to improve environmental quality. The environmental management and monitoring plans have been developed and outlined to bring home the key findings of the Environmental Impact Assessment of the project in mention, recommending necessary mitigation actions, defining roles, monitor able indicators and the estimated cost. The EMPs outlined in tables hereafter address the potential negative impacts and mitigation measures as well as roles, costs and monitor able indicators that can help to determine the effectiveness of actions to upgrade the quality of environment; as regards the proposed project.

The EMPs have considered construction, operation and decommissioning phases. It thus provides the means of assessing the accuracy of the predicted project impacts and the monitoring of the effectiveness of the proposed mitigation measures contained in the EIA report.

The objectives of this Environmental Management Plan (EMP) are to:

- Ensure compliance with relevant legislations and Company's policy;
- Integrate environment fully into business;
- Rationalize and streamline environmental activities to add value to efficiency and effectiveness;
- Health, Safety and Environment Department
- Pollution control
- Dust control
- Use of best available technology
- Removal of solid waste
- Monitoring programme
- Audit (three years interval)
- Environmental training and awareness program.
- Encourage and achieve the highest performance and response from individual employees and company;
- Provide standards for overall planning, operation, audit and review.

Environmental Management Plan is an implementation plan to mitigate and offset the potential adverse environmental impacts of the project and enhance the positive impacts. Based on the environmental baseline conditions, planned project activities and impacts assessed earlier, this section enumerates the set of measures to be adopted to minimize the adverse impacts. Process of implementing mitigation and compensatory measures, execution, agencies responsible for their implementation and indicative costs is discussed in this chapter.

7.2 Environmental Management Process

The EMP has been designed within the framework of requirement under Nigerian legislation and will address key International Finance Corporation (IFC) Performance Standards, particularly on environmental and socio-economic aspects.

The mitigation measures to be adopted for the implementation of the proposed project include the following:

- Environmental Management Plan;
- Clean Development Mechanism;
- Occupational Health and Safety;
- Labour Working Conditions;
- Construction Labour Management;
- Environmental Action and Monitoring Plan;
- Community Development Plan;
- Public Consultation and Information Disclosure Plan;
- Grievance Redressal Mechanism;
- Disaster Management Plan

The EMP has been prepared considering life cycle approach of the project that the company will own and operate.

7.3 Environment & Social Management Cell

The company shall create an Environmental Management Cell (EMC) at both corporate and site level, headed by a Project Director (who shall be an experienced Engineer) to be responsible for day-to-day implementation of the project. The cell shall be accountable for coordinating and implementing all environmental and social activities. During project implementation, the cell will be responsible for reflecting the occurrence of new and significant impacts resulting from project activities and integrating sound mitigation measures into the EMP. The EMC will include a safeguard specialist and supporting staff, together forming the Environmental and Social Unit, to be appointed by the company to look at environmental, social and safety issues. The EMC will be empowered to implement safeguards, plans and monitor implementation.

The safeguards specialist shall, as part of his/her duties gives guidance to the Project Manager and other member of staff to adopt good environmental practice while implementing the project. The safeguard specialist will be responsible for implementing safeguard issues associated with the project through a site team composed of site staff and contractor‘s staff, to be assigned by the EMC as necessary.

The duties of the Environmental and Social Unit of the EMC at corporate level are to:

- Monitor the implementation of mitigation measures during construction and operation phases of the project.
- Prepare suitable environmental management reports at various sites.
- Advice and coordinate field unit activities towards effective environment management.

- Liaise with the Federal Ministry of Environment, Nasarawa State Ministry of Environment, and Karu Local Government Council and seek their help to solve the environment related issues of the project implementation.
- Advice during project planning/design cells on environmental and social issues to avoid negative environmental impact.
- Provide training and awareness creation on environmental and social issues related to coal fired captive power plant projects to the project/contract staff.

The duties of the Environmental and Social Unit at site level are to:

- Implement the environment policy guidelines and environmental good practices at the sites.
- Advise and coordinate the contractor(s) activity towards effective environmental management.
- Implement environment and safety manual.
- Carry out environmental and social survey in conjunction with project planning cell while route selection of the alignment at the planning stage to avoid negative environmental impact. Make the contractor staff aware of environmental and social issues so that EMP could be managed effectively.

The EMC will be responsible for processing and implementing all sub-project(s). Sub projects will be monitored by qualified technical staff/experts (e.g., design and technical reports, feasibility studies, environmental and/or social assessments, and associated EMP's and budgets), who will also ensure and monitor compliance with IFC performance standards and Nigerian national environmental regulatory safeguard requirements. Activities to be monitored by the ESMC include: all planning, coordination and management activities related to the implementation of safeguard issues; the identification of corrective and preventive actions; records of health and safety matters and training activities; consultations with project affected peoples (as and when needed, particularly during the implementation); feedback, trouble shooting and project related grievances (per the project grievance redress mechanism); preparation of progress and monitoring reports as required by the Federal Ministry of Environment (FMEnv) & the World Bank Group (Project‘s International Finance lenders); and verifying the projects overall compliance with safeguard measures and its progress towards achieving the intended loan outcomes. The World Bank Group will continue to monitor project compliance with IFC performance standards/safeguard plans and requirements on an on going basis throughout the duration of the contract.

The EMC will comprise of a team of qualified and experienced environmental engineers, analytical chemists, horticulturists, safety engineers and well trained personnel for environmental monitoring. The EMC shall also conduct regular training programs for the other personnel in the areas of the environment, air quality and water quality aspects, energy and water conservation measures, safety and health aspects etc. The EMC will be supported by well-equipped testing laboratory and other facilities to facilitate effective working. The responsibilities of the various members of the environment management cell are presented in Table 7.1 while Figure 7.1 summarizes the framework.

Table 7.1: Responsibilities of the members of the EMC

Designation	Responsibilities
Project Director	Environmental and Social policy and directions
Head-Operations	In-charge of the overall operation of environmental and management facilities; Ensuring legal compliance by properly undertaking activities as laid down by various regulatory agencies.
General Manager	Secondary responsibility for environment and management and decision making for all environmental issues including Safety and Occupational Health.
Social Expert & Environmental Expert	Ensure environmental monitoring issues related to project as per appropriate procedures.

7.4 Corporate Social Responsibility Plan (Community Development Plan)

Corporate social responsibility is self-regulation incorporated into a business model. CSR policy functions are integrated, self-regulating mechanisms whereby a business monitors and ensures its active compliance with the spirit of the law, ethical standards, and international norms. The goal of CSR is to embrace responsibility for the company's actions and encourage a positive impact through its activities on the environment, consumers, employees, communities, stakeholders and all other members of the public sphere.

7.4.1 Philosophy - Corporate Social Responsibility

Corporate Social Responsibility (CSR) shall conform to International best practices as per global benchmarks and it includes inclusive effort towards ensuring holistic and sustainable community development in all of its project areas. The company believes that the goodwill of the communities in which her projects are an integral part, must be paid back their generosity in every way possible.

- In line with company philosophy, social responsibility would not be an occasional act of charity or a one-time token financial contribution to a local school, hospital or environmental NGO. It would rather be an on-going all through project lifespan commitment, which would be integrated into the very core of business objectives and strategies.
- The objective is to communicate to the local community, the nature, importance and impact of the project on the local community, the state and the country. The initiatives are being designed, to create a positive impact on the lives of the local people and improve their living conditions.
- Monetary and short term initiatives are kept to the minimum. Major focus is to initiate activities which are sustainable and will help to build lasting relationship with the local community. This would also help in creating inter-dependencies with local community, so that they also have a sense of responsibility towards the well-being of the project.

- The proposed action plan will serve as a preliminary framework and would be modified based on results of such initiatives and feedback from community and stakeholders.

7.5 EMP during Planning and Design/Pre-construction Phase

The environmental issues during pre-construction stage generally involve land acquisition, facility layout design, requisite quantity for construction raw materials, and avoiding encroachment into precious ecological areas as well as farmlands

7.6 EMP during Construction Phase

The problems envisaged during construction phase can mainly be due to accident and noise. To overcome these problems, the contractors in charge of construction and erection activities have to maintain noise levels within threshold limit values and the workers shall also be made to be provided with personal protective equipment (PPE).

Air Environment

At the project construction phase, there will be increase of dust concentrations due to fugitive dust emission from vehicular movement and other such associated work activities. Frequent water sprinkling in the vicinity of the site shall be undertaken to mitigate dust emission. It shall also be ensured that both gasoline and diesel powered vehicles are properly maintained to comply with exhaust emission standard limits.

Noise Level

There will be marginal increase in noise levels during Construction phase from vehicular use, operation of equipment such as concrete mixers, borehole drilling rig, generators etc. This however will be temporary and shall be approached with the aim of suppressing impacts especially on humans working within the site area by adequately providing Personnel Protective Equipment (PPEs) such as ear mufflers. Also, regular servicing of generators and vehicles shall be imbibed to reduce noise from these.

Water Quality

During construction, water shall be sourced from both ground water (construction of boreholes) and surface water bodies in the community. However, drilling shall be done to fulfill standard industrial best practices and water from streams/rivers shall be collected with the aid of a water pump via water tankers or pipes in a way that will least pollute the water body or even endanger the aquatic ecosystem contained therein.

Land

Generally, the cutting of herbaceous vegetation, during construction phase results in the loosening of the topsoil. However, after the construction work, there shall be massive re vegetation by way of vigorously planting greeneries to check soil erosion and enhance aesthetics.

Socio-economics Environment

Construction work will be made to benefit the local population in a number of ways. The company management will give preference to local eligible people through both direct and indirect employment in the area of working as labourers, drivers, security personnel, machine operators etc. All these will be in an attempt to provide ample opportunities for the indigents to enjoy

improved living standards and also to demonstrate the company‘s readiness to make them a part of the project and not just to fulfill its corporate social responsibility.

Table 7.2: Environmental Impact and Mitigation Measures during construction and erection

Possible Impact	Mitigation During Operation
Air Impact	• Dust suppression such as use of water sprinklers. Construction machinery shall be properly maintained to minimize exhaust emissions of CO, SPM and Hydrocarbons. • Construction activity shall be restricted to daytime as far as possible to avoid disturbance to surrounding areas.
Noise	• All noise generating equipment used during the construction shall be provided with noise control devices and properly maintained. • Wherever required, personal protective equipment such as ear plugs, earmuffs etc. shall be provided for workers in high noise areas.
Hazardous materials	• Hazardous materials stored at the construction site like acetylene cylinders, petroleum, spirit, diesel, lubricating oil, paints etc. shall be stored as per the statutory provisions of manufacturers, National Environmental protection (Management of Hazardous and Solid Wastes Regulation) Regulations of 1991.
Safety of Workers	Security, arrangement to prevent entry of authorization personnel and proper control of hazardous materials on site. • Training on safety for all the employees as well as contractor‘s labour. • All the personnel shall be provided with safety appliances such as face shields, helmets, safety goggles, safety shoes, hand gloves etc., as per the job requirement. To ensure that the local inhabitants are not exposed to these hazards, the site shall be secured by fencing and manned at entry points.

7.7 EMP during Operation Phase

During the operation phase of the proposed project, pollution impacts are projected to be major. The major pollution sources envisaged include vehicles moving in or going out of the facility, gaseous emission from operations within the facility. However, in order to limit within predicted

impact levels and to further mitigate the impacts wherever possible on individual environment components, the following mitigation measures are recommended in Table 7.5.

Air Environment

The major pollution sources envisaged include vehicles moving in or going out of the facility, gaseous emission from the kiln, ash emission stacks. These emit gases such as SO2, CO, H2S etc. All of these emissions shall be checked by regular and proper servicing of vehicles. Also, regular and effective monitoring of these ambient air parameters within and outside (adjoining developments) the project boundaries would be monitored as per the direction of regulatory authorities.

Noise Level

The major area where noise is anticipated is from the generators, and production line. These are however not significantly sufficient to affect Irete and other neighbouring communities considering their distances away. Nevertheless, the company shall employ the use of PPEs (such as ear mufflers) for staff working within these sections. The company shall also ensure that all machineries where noises are generated shall be constantly checked and in the event of a fault, it is promptly fixed. Also, company vehicles used are regularly serviced by qualified and experienced engineers. By these measures, it is anticipated that noise level will be maintained within the permissible limit.

Socio-economics Environment

The company at project operation phase shall take measures to put in place various amenities and socio economic benefits in a bid to improve the general living standards of the indigenes of the host community. Some of these include;

- Provision of employment to indigenes as both casual and permanent staffs.
- Provision of basic infrastructures where necessary, etc.

Water Management

Water shall be sourced from borehole at the project site. Ground water shall be adequately and continuously monitored to prevention pollution and minimize wastewater generation. Periodic water audits shall be conducted to engender water use management and also check water quality. Based on the rainfall intensity of project site area, storm water drainage system will be designed to consist of well-designed network of surface drains and rainwater harvesting pits along the drains and channeled to the receiving body.

Waste Management

The following include plans that shall be put in place for the effective management of all classes of wastes generated during the operation phase of the project.

- Spent oil shall be collected in collection trays, stored in leak proof steel drums and resold to authorized buyers.
- Oil drums would be collected and stored properly for recycling.
- Dust bins with lids shall be strategically placed at requisite locations with appropriate signage urging people to use them.
- Metal scrap wastes shall be collected and stored either to be reused/re-cycled or resold.

- Paper and first aid waste will be collected in waste bins and frequently evacuated by company trucks to approved dumpsites.
- Used plastics shall be collected upon generation and recycled.
- Used cartons, empty cans and bags shall be collected and disposed.

Table 7.3: Environmental Impact and Mitigation Measures during operation phase

Possible Impact	Mitigation during Operation
Air Impact	• 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 • Dust suppressants shall be applied continuously to the entire area of the facility. • There shall be set speed limits to minimize the creation of fugitive dust within the project boundary. • Regular maintenance and efficient operation of the lubricating oil blending plant area shall be ensured. • Implementation of noise screening measures for the plants design shall be pursued.
Soil quality degradation	• Bunded wall shall be constructed in the fuel dump section to contain fuel/oil spill. • The preparation of procedures to ensure that spillage during mobile equipment maintenance is minimized, and that only designated areas are used for this purpose shall be pursued.
Occupational health hazard	Periodic health check-up.
Safety workers	• Workers would be provided with PPEs: hand gloves ear muffs, safety boots, safety goggles, helmets etc. • Workers shall be trained to follow safe working practices

7.8 EMP during De-Commissioning Phase

This project involves a huge investment. While in Operation, the company management will employ the best maintenance techniques and systems. These efforts result in extended life of the plant. Similarly, efforts and investment for renovation and modernization will result in further life extension of the plant. From the present trends, the life of the plant would not be less than 80 to 99 years. However, when the plant becomes unviable due to major technological changes or due to regulations, decommissioning of the plant will be undertaken. This involves a series of steps to be planned and executed. The total operation can be broadly categorized in to De-operationalization and dismantling phases. De-operationalization is a technical activity carried out

by experts. Dismantling operation however will have impact on environment due to noise and dust arising out of it.

7.9 Waste Management Plan

7.9.1 Scope & Purpose of the Plan

This Waste Management Plan identifies the wastes that are likely to be generated during the construction and operation of the proposed plant and also documents cradle to grave waste management practices to be employed for collection, storage, treatment and/or disposal.

Specifically, the waste covered by this WMP includes the following sources:

- Construction and commissioning of plant and the associated facilities.
- Operation of plant and the associated facilities throughout the project life-cycle.
- Temporary accommodation during construction phase for the workers.
- Other operations like equipment maintenance, road construction, site preparation etc.
- Operation and maintenance of infrastructures both during construction and operation phase

WMP is intended to serve as a guideline for the project proponent & the contractor(s) to manage wastes effectively during construction and operation phase. The contractor(s) shall prepare their own WMP in compliance with this WMP and implement the same during the construction phase. The company shall implement this WMP throughout the operational phase.

The WMP describes how wastes will be managed during the construction and operation phase of the project and how the project will:

- Minimize the potential to cause harm to human health and the environment.
- Comply with the World Bank‘s general EHS guidelines and with Nigeria‘s Federal Ministry of Environment‘s waste management regulations.
- Reduce operational costs and any potential liabilities which may arise from waste handling operations.

This plan also ensures that every waste stream and solid waste materials from the main plant site and the associated facilities are managed effectively.

7.9.2 Waste Management during Construction Phase

The company shall be responsible for monitoring, quantifying, transportation and disposal of all wastes generated during the construction phase. Waste generated within the lubricating oil blending plant shall be disposed by the contractors in accordance with regulatory requirements using identified existing waste disposal / treatment / recycling facilities. Each waste movement shall be accompanied by a Waste Consignment Note (WCN) appropriately signed by the HSE co-coordinator or the contractor‘s supervisor and dumped at the government approved site.

7.9.3 Waste Management during Operational Phase

The company shall be responsible for monitoring, controlling and disposal of all waste generated during the operational phase. A waste inventory shall be kept and approved by the Project Manager

to guarantee data integrity. The site HSE officer shall ensure that the waste segregation scheme is fully implemented at the site. Vehicular waste oil shall be collected and disposed of accordingly.

7.9.3.1 Waste Generation Forecast

This proposed project aims at a maximum of 30 personnel including truck drivers at the peak of the project. Allowing for occasional visitors, waste generation has been estimated with 30 personnel working all – time – across all project sites. Using a weighted average waste generation of 1kg/capital/day, the rate of waste generation is estimated.

7.9.4 Waste Management during Decommissioning Phase

Prior to site abandonment or decommissioning, inventory of past practices shall be conducted with the aim of eliminating and avoiding liabilities. Consideration shall be given to re-using equipment from abandoned site. All contaminated sites shall be adequately remediated prior to abandonment. All materials shall be evacuated from site and the wastes disposed accordingly.

7.9.5 Waste Management Organization

7.9.5.1 Roles and Responsibilities

This waste management plan is binding on all staff and contractors involved on the proposed project with respect to the following:

- Emission or release of pollutants, exhaust and/fugitive gases.
- Discharge or spill or effluent into surface water or land.
- Discharge of solid wastes (including domestic waste) into surface water or land.
- Generation of noise and vibration.

Waste Management Focal Point

- Participate in the review of master plan, procedures and standards with company‘s waste management team.
- Develop plan for the project and adopt/ implementation plan after reviewing with company corporate waste management team.
- Participate in inspections and audits.
- Submit performance report to company‘s corporate waste management team.
- Participate and contribute to the review of the processes.
- Participate in stakeholders‘ workshop when necessary.
- Manage waste streams generated in the projects

Waste Inventorisation and Tracking

Company‘s Waste Consignment Note (WCN) shall be used for tracking and a tracking database shall be properly maintained.

Monitor and Review / Improvement Performance
The project HSE team together with environmental consultants shall participate in inspections and audits of the facilities as well as project activities. They shall drive and also participate in quarterly reviews and the annual workshops when necessary. Monitoring document will be reviewed yearly during the life of the project.
Monitor and Review / Improvement Performance
The project HSE team together with environmental consultants shall participate in inspections and audits of the facilities as well as project activities. They shall drive and also participate in quarterly reviews and the annual workshops when necessary. Monitoring document will be reviewed yearly during the life of the project.

Training
State owned waste management companies and/or environmental consultants shall be contracted for training on basic Waste Management System (WMS) standards, tools and approach. Company HSE team shall coordinate the training programmes and monitor performance to identify further training needs.

Contractor's Role
Waste management contractor shall develop her waste management procedure/ plan or review it in line with the proposed project plan. The contractor shall also monitor and implement the plan for compliance.

Awareness
General waste management awareness shall be raised among personnel through short presentations, site inductions, toolbox talks and the use of posters, as applicable. All waste contractors shall be made aware of the project waste management procedure and guidelines through contract specification.

7.9.6. Waste Identification and Characterization
Project generated wastes shall be managed in an environmentally friendly manner. Once waste streams are identified, the properties of the waste stream shall be analyzed for proper classification of the waste type. Hazardous waste includes oxidizing, highly flammable, corrosive, toxic to humans, radioactive, harmful to the environment (eco-toxic). Non hazardous wastes are further categorized into: industrial, domestic and office. Classification of waste also simplifies qualification and inventory data management as well as enhances ease of transportation and choice of treatment process.

Table 7.4: Waste Categories and Definitions

Categories	Definition
Hazardous Waste	A hazardous waste is any gaseous, liquid or solid waste, which due to its quantity, physical, chemical or infectious characteristics have the potential to harm human health or the

	environment when improperly handled, stored, transported, treated or disposed.
Non Hazardous Waste	A non-hazardous waste is any gaseous, liquid or solid waste, which does not have the potential to harm human health or the environment.
Domestic Waste	This category includes kitchen waste from offices, operational and residential locations, and waste arising from estate management activities including garden wastes.
Office waste	These are wastes generated from office services.

a) Waste collection

Waste segregated at source and well contained in appropriate waste receptacle shall be manually handled or trucked to designated collection points before it is taken to appropriate disposal facilities.

b) Waste Segregation

This is the physical separation of different waste streams and is a pre-requisite for implementing minimization options. Waste segregation shall be done at source through the provision of colour and/or text coded bins. Only containers in good condition and with properly fitting lids shall be used for waste containment. Plastic bin liners shall also be used for temporary containment to ensure hygienic waste handling.

7.9.6.1 General Waste Management Procedures

This highlights the key principles of the 4-Rs in waste management. They include; reduce, recycle recovery treatment and responsible disposal. These principles shall be incorporated into the design and management of project‘s associated activities. Where elimination of waste is not possible, minimization alternatives shall be explored.

Table 7.5: Colour Codes for Generated Wastes

Type of waste	Colour code
Food/vegetable waste	Green
Glass waste	Blue
Plastic waste	brown
General (non-useable)	Black
Medical waste (combustible)	yellow
Toner /developer	white

Table 7.6: Colour codes for Hazardous and Non-hazardous Medical Wastes

Type of waste	Colour code
Base oil	N/A

Clinical combustibles	Yellow or yellow tagged bags
Sharps	Grey
Non sharp/non-combustible	Black or black tagged bags
Foul or infected linen	Red or pink bags
Recyclable linen	White or white tagged bag
Cytotoxic waste	Orange bin
Paper	Clear or clear tagged bag

Wastes shall be segregated according to the company's waste segregation scheme at all times. All wastes shall be stored in specific storage areas which have appropriate containment.

Labeled containers for different waste streams shall be appropriately located at strategic and easily accessible areas within the different project locations. Clear texts and pictorial signs urging the use of wastes bins shall also be placed at strategic locations within the project site. All evacuated waste shall be accompanied by completed waste consignment note (WCN) from source to the final disposal site in order to ensure proper waste tracking.

Waste Minimization

Waste minimization may be achieved through one of a combination of two or more of the following strategies.

i) **Source Reduction** – This refer to the generation of minimal waste through more efficient practices such as:
   - Material elimination; this involves the reduction eliminating over stock unused materials. This can be achieved through buy-back arrangement/policy.
   - Material substitution; which involves effective use of an alternative or substitute material to eliminate or significantly reduce waste.
   - Process modification; this involve the evaluation of material process which generate waste to determine if alternative processes were both technically and financially feasible.
   - Improved housekeeping; waste reduction can be achieved through careful storage and maintenance of materials for easy identification.

ii) **Re-use** – This refer to the use of waste material or product in its original form e.g. containers and packaging materials.

iii) **Recycling/recovery** – This is the destruction, detoxification and/or extraction of energy or materials from wastes.

Waste Treatment

Waste treatment is the destruction, detoxification and/or neutralization of residues through processes such as:

- Biological methods: tank based degradation, composting.

Thermal methods: incineration, thermal desorption.

- Chemical methods: neutralization.

- Physical methods: filtration, centrifugation and stabilization.

Waste requiring treatment shall be treated before disposal. Such wastes include effluents from the facilities and sewage. Treatment methods to be used for each waste stream (where applicable) are presented in the waste management charts.

Waste Disposal

Waste disposal is the deposition of wastes on land or in water using methods appropriate for a given waste stream. Disposal methods depending on the waste stream, recommended by the Federal Ministry of Environment (FMEnv) include:

- Landfilling; this is a site used for disposal of solid waste in which wastes are buried between layers of dirt so as to fill in or reclaim low-lying ground. • Surface discharge; this is the management of release of materials into water or land.
- Land spreading or land farming; this is the treatment of near surface soil contamination for hydrocarbons and pesticides.
- Encapsulation/Stabilization; this disposal method involves the fixing of waste into materials that could be useful in construction activities.
- Solidification; this is when waste is solidified from one state to another stage in their production. This is the final or near-final step.
- Incineration; this is the burning of waste materials in a closed chamber at high temperature.

7.9.6.2 Implementation Strategies

It is the responsibility of the project health and safety management team to ensure that the above procedures are implemented in a manner that is Specific, Measurable, Attainable, Realistic and Time based (SMART).

- Waste management issues shall be reviewed quarterly after audits.
- Project management team shall include waste management issues in routine HSE inspections and findings from such inspections shall be tracked for closure.
- The Project management team and project contractor shall jointly carry out waste management audit/inspections of facilities. Occasionally project HSE team as well as environmental consultant shall be involved in the project audits. Findings from the audits and inspections shall be properly documented and followed up.
- Contractors shall be responsible for the management of waste from their activities in line with Project management team/company requirements and policies.
- Waste management performance monitoring shall be reported to the project management.
- Waste management shall be included in the agenda of project management review meetings as part of management commitment when the need arises. The project team shall in conjunction with company HSE team carry out regular awareness campaigns on waste management issues across the project.

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Table 7.7: Wastes Identification, Handling and Disposal

WASTE TYPE / WASTE NAME	Handling/Colour Code of Bin	Storage	Transportation	Minimization/Disposal Method /Facility
DOMESTIC				
Food/Kitchen Wastes	Green	in bins neatly packaged in a well labeled polythene	in bins or neatly packaged in a well labeled polythene inside a covered truck	Disposed at approved dumpsite
Garden Waste	Green	designated storage site in the facility	in covered vehicles with fully completed Waste Consignment Note (WCN)	Disposed at approved dumpsite
Garbage	Green	Can be sorted to recover recycle items	In covered truck with fully completed WCN	Disposed at government approved dumpsite
Plastic	Brown	Collect, segregate & store temporary in company‘s waste dump	Land transport by the company‘s waste contractor	Be Sold to third party for recycling
Wood	N/A	Stored at designated scrap yard	Transport in trucks	Dumped at government approved dump sites or used for land fill or better still sale to vendors
Office				
Toner Cartridge	White	Good housekeeping procedure	Collected with the waste bag closed and transported with appropriate label for recycling	Reuse or moved to government approved dumpsite by waste contractor or sale to other end users.

Paper	clear	Store under waste shed	Transport to waste dump by waste contractor	Recycle/Disposed at government approved dumpsite
Industrial				
Base oil	N/A	Well covered storage facility with concretised floor	Transported by trucks to the facility	Recycled in the production line
Glass	blue	Collect, segregate & store temporary in company‘s waste dump	Transport in closed waste bag with appropriate label by waste contractor	Recovery & Recycling; Send to glass manufacturing company
Scrap metal	grey	Store in designated areas in the facility	Transport in vehicle/trucks fit for the type of metal to be moved	Re-use, Recycle or sale to other end users.
Cans and Tins	Grey	N/A	It shall becollected and disposed by Imo State Environmental Protection Board	Disposed at government approved dumpsite
Official fuel filter	blue	Drain oil, cut open to remove diaphragm and crush metal case	In trucks to the scrap metal yard	Recycled for kiln firing
Cables	Grey	Neatly kept in the Waste Depot	In covered truck disposal site	Re-use; Can be sold to vendor for recycle and reuse
Used polythene Bags	N/A	Stored in bins	Transported to the kiln	Incinerated in the rotary kiln
Construction Debris	N/A	Move neatly to a corner	Mostly done in open vehicles, depending on the size and location for reuse	Reuse in minor road mending
EWASTE				

Computer scraps & Consumables	Orange	Arrange neatly in a cool dry place	In covered truck with Fully completed WCN	Sale to other end users
Fluorescent/tube Bulbs	Blue	Arrange neatly to avoid breaking	In covered trucks with fully completed WCN	Recycle; Sell to vendors to recycle mercury
Spent Batteries	orange	Arrange neatly without breakage in a cool dry place	In covered trucks with dully completed WCN	Recycle/Recovery; Sell spent batteries to recycling companies
Medical Waste				
Clinical Waste	yellow	Neatly place in black polythene before putting in the red bin	Transport in sealed bags to incinerator	Incinerated in the rotary kiln

7.10 Road Safety & Traffic Management Plan

The plan encompasses the addresses of community safety related impacts that may arise from the increased vehicular traffic due to movement of equipment/machineries and vehicles along the site access and approach roads particularly during construction phase. The plan will be regularly reviewed and as vehicle movement requirements are identified in detail.

7.10.1 During Construction Phase

The following mitigation measures will be implemented during this phase:

- Project vehicular movement will be restricted to defined access routes.
- Proper signages will be displayed at important traffic junctions along the vehicular access routes to be used by construction phase traffic. The signage will serve to prevent any diversion from designated routes and ensure proper speed limits are maintained near residential areas.
- Any road diversions and closures will be informed in advance to the project vehicles accessing the above route.
- Usage of horns by project vehicles will be restricted near sensitive receptors viz. schools, settlements etc.
- Traffic flows will be timed wherever practicable during period of increased commuter movement in the day.

- Temporary parking facilities shall be provided within the work areas and the construction sites to avoid road congestion.
- Vehicular movement to be controlled near sensitive locations viz. schools, colleges, hospitals identified along designated vehicular transportation routes.
- Routine maintenance of project vehicles will be ensured to prevent any abnormal emissions and high noise generation.
- Adequate training on traffic and road safety operations will be imparted to the drivers of project vehicles. Road safety awareness programs will be organized in coordination with local authorities to sensitize target groups viz. school children, commuters on traffic safety rules and signages.

7.10.2 During Operational Phase

Since limited vehicular movement is anticipated during operational phase considering only the daily movement of project personnel any impacts arising from the same can be effectively addressed through implementation of mitigation measures as discussed during the construction phase.

7.11 House Keeping

Better housekeeping can improve the working conditions. The following measures shall be imbibed:

- Regular cleaning
- Avoiding accumulation and dumping of wastes and damaged equipment and items anywhere inside the plant affecting aesthetics and increasing risk of fire and other hazards.
- Keeping ventilation systems of premises in good working condition to avoid ingress of dust inside the pressurized room.
- Keeping air conditioning plants in good running conditions for control/instrumentation rooms.
- Regular watering of untarred/unpaved roads by spraying water during construction as well as operation and maintenance to avoid dust emission from vehicle movement.
- Maintaining hygienic conditions in areas like canteens, near drinking water sources and toilets.
- Developing a positive outlook in the employees for improving the working place, both in plant and office.

7.12 Safety & Emergency Plan

Safety of both men and material during construction and operation stages are of concern to industries. Keeping in view the safety requirements during construction and operation and maintenance phases, a safety policy will be formulated for the proposed captive power plant project. Separate safety rules shall be prepared for each type of occupation/processes involved in

the project in consultation with manufacturer/supplier of equipment and materials. Also, regular safety inspections shall be ensured of all buildings, equipment, work places and operations.

7.12.1 Safety Organization

The company shall put a safety department for the proposed captive power plant project and this will be headed by an HSE Manager and having qualified and experienced supporting staff. The responsibilities of Safety Department will include identification of the hazardous conditions and unsafe acts of workers and advise on corrective action, organize training programs and provide professional expert advice on various issues related to occupational safety and health. He/She shall also be responsible for ensuring compliance of Safety Rules/Statutory provisions.

7.12.2 Safety Awareness among Workers/Employees

Training programmes in safety and accident prevention shall be organized at all levels of employees with a view to familiarize them with the general safety rules, safety procedures in various operational activities and to update their knowledge in safety and accident prevention, industrial hygiene and emergency equipment. These training programmes shall be conducted periodically in a planned manner to refresh their knowledge.

7.12.3 First Aid Training

First aid training programmes shall also be conducted for all employees with the help of qualified medical and para-medical staff. This programme may be conducted in batches. The programme shall include basic first-aid techniques and will be repeated periodically to refresh knowledge.

7.12.4 Muster Point

In an emergency, it will certainly be necessary to evacuate visitors and personnel from affected areas. The evacuation will be effected on getting necessary message on evacuation; visitors and employees would be directed to a predetermined safe place called muster point. The chosen location shall be the point, where all visitors and staff would assemble in the case of emergency before evacuation.

7.12.5 Declaration of Emergency

An emergency may arise due to major outbreak of fire. In case of major outbreak of fire the state of emergency has to be declared by the HSE Manager by sounding emergency siren. A siren audible to a distance of 5km range will be available for this purpose.

7.12.6 Emergency Management Training

The key personnel (HSE Manager and His/Her team) shall regularly undergo special courses on disaster management. The General Manager, senior and junior staff will periodically undergo courses on the use of personal protective equipment and response to emergency.

7.12.7 Mock Drills

The procedures as laid down in this plan are imperative, and shall be occasionally tested via periodic mock drills. To avoid any lethality, the emergency response time shall be clocked below 2 minutes during the mock drill.

- 1st step: Test the effectiveness of communication system.
- 2nd step: Test the speed of mobilization of emergency teams.
- 3rd step: Test the effectiveness of search, rescue and treatment of casualties.
- 4th step: Test emergency isolation and shut down and remedial measures taken on the system.
- 5th step: Conduct a full rehearsal of all the actions to be taken during an emergency.

7.13 Fire Fighting & Protection System

7.13.1 Safety policy and Regulations

Keeping in view of the safety requirement during construction, operation and maintenance phase, The company will formulate safety policy with the following regulations:

- Take steps to ensure that all known safety factors are taken into account in the design, construction, and maintenance of machinery/equipment and the entire building complex.
- Ensure that adequate safety instructions are given to all employees.
- Provide wherever necessary safety appliances and to ensure their proper use.
- Ensure proper implementation of fire prevention and appropriate fire-fighting service together with training facilities for personnel involved in this service.
- Prepare separate safety rules for both staff and visitors.
- Ensure regular safety inspection at suitable intervals of equipment, and other operational areas.

7.13.2 Fire Protection System

The company shall install adequate number of well mounted type of portable fire extinguishers at strategic areas which includes the administrative building, control room, security post, car park, etc. these portable fire extinguishers shall basically contain carbon dioxide in dry powdery form. The company shall also sign a MoU with the closest Imo State‘s fire station (with an average response time of not more than 20 minutes).

7.14 Environmental Monitoring Programme (EMP)

Regular monitoring of critical environmental parameters is of immense importance to assess the status of environment during captive power plant operation. The monitored data can serve as an indicator for any change in environmental quality due to operation of the plant with respect to baseline environmental conditions, so that suitable mitigation steps could be taken in time to safeguard the environment.

Monitoring indicators have been developed for each of the activity considering the mitigation measures proposed. Indicators have been developed for ascertaining the environmental quality and the performance of the EMP implementation through Environmental Quality Indicators (EQI‘s) and Environmental performance Indicators (EPI‘s) respectively which focus not only on quantifying or indexing activity-environment interactions that may potentially impact the environment but at the same time also help in comparing different components of environmental

quality against previously established baseline values. Monitoring results would be documented, analyzed and reported by contracted accredited environmental consultant in conjunction with the HSE Manager. Monitoring requirements (including monitoring frequency) have been presented in the table below.

Table 7.8: Proposed Monitoring Requirements for the Proposed Project (Environmental Performance Monitoring)

EPI NO	Environmental Performance Indicator (EPI)	Monitoring Parameter	location	Period & frequency	Responsibility
Construction					
A1	Air emissions from vehicles and machineries	• CO, HC based on emission Factors • % of vehicles possessing valid Personal Use of Company Car (PUCC) Certificates	Exhausts	Monthly during Construction phase	HSE Manager
A2	Dust generated from site clearance / leveling	• Visual observation of dust generation • Noise pressure level in dB(A)	Site & approach road	Daily during site preparation	HSE Manager
A3	Noise emissions from vehicles and machineries	• Compliance with FMEnv noise limits • Check for valid certificates of Type Approval and also valid certificates of conformity of production for equipment particularly generating sets	Near noise sources (5m)	Monthly during site preparation	HSE Manager
A3	Sourcing of water	Volume of water sourced and consumed	Sourcing and usage areas	Daily during construction phase	HSE Manager

A4	Fugitive emissions from handling and storage of raw materials	Visual observation	Material Stockpiles	Daily during construction phase	HSE Manager
A6	Community and health safety	Complaints registered by local communities	Grievance records	Monthly during Construction phase	CLO
A7	Occupational health and safety	• Health surveillance of workers • Sanitation status of labour camps and canteen • Potable nature of drinking water viz. coliform, pH, TSS, Residual chlorine • Usage of proper PPEs • Safety performance indicators viz. LTIs. Near misses, fatalities etc	• Medical records • Labour camp Maintenance records • Drinking water storage tanks • Construction site	Monthly during construction phase Daily during construction phase	HSE Manager
A8	Disposal of sewage	• Visual observation of leaks, overflows etc • Odour	• Septic tank and soak pits discharges point	Daily during Construction phase	HSE Manager
A9	Surface run-off Discharge	• Visual observation of water logging due to drainage disruption • FMEnv Inland Water Discharge Parameters	• Areas abutting Construction site • Discharge point	Monthly during Construction phase	HSE Manager
A10	Domestic waste generation, storage,	• Quantity of waste	• Waste generating	Weekly during	HSE Manager

	handling and disposal	generated and recycled • Visual observation of waste segregation and storage conditions viz. usage of labelled and covered bins, insect repellents	areas viz. canteen, labour camps etc • Workers involved in waste handling and storage	construction phase	
A11	Hazardous chemicals and waste storage, handling and disposal	•Visual observation of chemical storage conditions viz. presence of spill kits, drip trays, fire extinguisher, display of Material Safety Data Sheet (MSDS) etc. • Quantity of waste oil and other hazardous waste generated and recycled to registered recyclers • Awareness level of onsite workers	waste storage areas involved in waste handling and storage	Weekly during construction phase	HSE Manager
Operation					
B1	Fugitive emissions	• Visual observation of dust generated • Water sprinkling details viz	Maintenance record	Daily during operational phase Weekly during operational phase As per	HSE Manager

		frequency and quantity		supplier's manual	
B2	Noxious and GHG	• Gases such as NOx, SOx, Cox and CHX	Chimney Stack	Daily	HSE Manager
B3	B3 Noise generated from operation	• Noise pressure level in dB(A) • Maintenance parameter check with respect to equipment noise attenuation and control	• Near noise sources (5m) • Noise generating equipment	Weekly during operational phase As per supplier manual	HSE Manager
B4	Water sourcing and consumption	• Volume of water sourced and consumed	•Water usage areas	Daily during operational phase	HSE Manager
B5	Community health and safety	• Complaints registered by the local communities • No. of. Accident	• Grievance Records •Safety Records	Monthly during operational phase	CLO
B7	Occupational health and safety	•Health surveillance of workers •Sanitation status of onsite office building and canteen •Potable nature of drinking water viz. coliform, pH, TSS, Residual chlorine •Usage of proper PPEs • Safety performance indicators viz. Learning Tools Interoperability	Medical records •Office building maintenance records •Drinking water storage tank • Operational sites	Monthly during operational phase Daily during operational phase	HSE Manager

		(LTIs). Near misses, fatalités etc			

7.14.2 Community Development Plan

A company has a role to play in development of an area in which it does business. In most cases, it is difficult to operate and do business without the cooperation of the local communities and other stakeholders. To build a good rapport with the local community the company shall engage the local communities along with administrative machinery to develop an ongoing process of development of these communities The community development plan will initially be targeted at the host community, however, it shall be expanded to other neighbouring communities as well as the host local government headquarters. The various areas where involvement shall be made are discussed below:

Health Care Facilities:

The company shall work out the feasibility of assisting the immediate host community by arranging health care support in form of providing support with medical supplies to the Primary Healthcare Centre, in consultation with the districts' administration and the health facilities' management.

Educational Support:

To support educational pursuits particularly at the primary level, a partnership will be reached with the State Government on siting a primary school in the community. Grants in the form of scholarships will be granted to distinguished indigenous pupils. Learning aids, such as text books and writing materials will also be provided for selected public schools.

Technical and Vocational Training:

Technical and vocational training shall also be made available for indigenous youth to aid skill acquisition, empowerment and capacity building. The primary responsibility of planning, implementing financing of the community development would rest with the company. However it would ensure (through the implementing agency) that the communities are involved in the planning process.

7.15 Community Liaison Plan

The community liaison plan concentrates on communication with the host and other neighboring communities. The company shall disclose the project details to make the community aware of the important features of the project. A Project Information Booklet would be prepared and distributed in the project vicinity/neighboring communities. This booklet shall preferably be presented in vernacular language. The booklet in addition to containing the salient features of the project shall have a map depicting the boundaries of the plant and its ancillary facilities. The important landmarks e.g. settlement, schools and roads, etc. shall also be demarcated so that it becomes easy for the people to relate to the ground conditions. To ensure wide circulation of the Project Information Booklet, it will be made available at all the schools, centres, markets and other public

facilities in the project host and neighboring communities. The company have kept a provision in its project budget for implementing the community Development and Liaison plan.

7.16 Grievance Redressed Mechanism

Environmental and social grievances will be handled in accordance with the project grievance redress mechanism. Open and transparent dialogue will be maintained with persons that may be affected in the course of project construction or operation, in compliance with FMEnv and IFC/World Bank safeguard policy requirements. The Grievance Redress Mechanism (GRM) for the project shall provide an effective approach for complaints and resolution of issues made by the affected person(s) or community (ies) in a reliable way. This mechanism will remain active throughout the life cycle of the project.

(i) Inform the Affected Person(s) (AP), if any about GRM and its functions,

(ii) (ii) Determine how peoples representatives in the GRM will be selected,

(iii) (iii) Set the procedures and mechanisms adopted for making the complaints,

(iv) (iv) Support the complainants in communicating their grievance and attending the GRM meetings and

(v) (v) Implement compliance with a GRMs' decision, its monitoring and communication to the people.

A Grievance Redress Committee (GRC) will be formed immediately the EIA is approved prior to site preparation/construction to ensure APs grievances on both environmental and social concerns are adequately addressed and to facilitate timely project implementation. The GRC will have representatives from APs, the Community Liaison Officer (CLO), Project Engineer, and the concerned community head. The GRC will meet as and when major grievances arise. The main responsibilities of the GRC are to:

(i) Provide support to APs on problems arising from environmental and social impacts and land/property acquisition (if any);

(ii) (ii) Record AP grievances and action them within 4 weeks. The procedure for grievance redress will be done through various steps such as

a. Minor grievances will be redressed at the site level through the concerned project engineer and contractor (7 working days),

b. If this fails the grievance will be referred to the GRC which will take all necessary actions within 15 working days,

c. If still unresolved, the AP will have the option to approach the appropriate court of law for redress.

The CLO will keep a record book of all grievances (concerning the environment, health, safety, labour and working conditions, land compensation, etc.) brought to the attention of the company and to the GRC.

7.17. Communication with Contractor Staff

During the construction phase, there would be influx of people into the project area. As these persons would expectedly have cultural differences with the resident population, there are potentials that conflicts may arise due of issues relating to the environment, safety/privacy of the indigenous women, spread of various communicable diseases, nuisance caused by workers due to

improper sanitation facilities, etc. Effective communication shall be made to all contractor staff with respect to the Dos‘ and Don‘ts‘ of the host and neighboring community. Contractor staff will, as part of their engagement agreement, be required to show proper behaviour and discipline amenable with the local customs and traditions. The Project will provide a grievance mechanism where employees may raise reasonable work place concerns. The mechanism shall involve appropriate level of management involvement and address concerns promptly, using a transparent process that provides feedback to those concerns without any retribution. The company shall place special emphasis on Grievance redressal for addressing concerns/problems of employees or project affected persons. The company shall prepare a framework for redressal of grievances/complaints during all phases of the project. This framework will be continuously monitored & improved as the project moves from one stage to other. Following its policy of building and maintaining strong community relationships, the company shall formulate a Grievance Procedure, in order to proactively manage and appropriately address complaints/ concerns/ grievances of the community during its different phases (i.e., planning, construction and operation).

As a part of the grievance redressal, it will perform the following actions.

- Continuously collect and analyze complaint/grievance related data;
- Disseminate this information into its organizational set up; and
- Review and upgrade exiting plans if required;

In addition, this procedure will help to improve the project social performance. This is because the number and nature of received complaints including punctuality, nature and effectiveness of grievance redressal are indicators of the manner in which the project is to be implemented and the behaviour of employees and contractors.

CHAPTER EIGHT
DECOMMISSIONING, CLOSURE AND ABANDONEMENT PLANS

8.0 Preliminary Decommissioning Framework

This chapter outlines the primary activities that will be undertaken during the decommissioning phase. It should be noted that the actual sequence of work may vary from the order presented herein, and detailed procedures for each activity are not provided. The initial decommissioning plan presents the company management approach for the suspension, decommissioning, dismantling, and/or abandonment of the proposed Lube Blending Plant project upon reaching the end of its lifecycle. The decommissioning process may extend until achieving a "greenfield" status.

As per the decommissioning plan of the proposed project, the Nasarawa State Waste Management Authority is responsible for ensuring the appropriate treatment of all solid wastes. Excavated areas will be properly backfilled and graded. Additionally, all non-scrap solid waste will be disposed of in an environmentally sound manner, while scraps will be recycled to the maximum extent possible. The State Government is also committed to restoring the site to the best of its ability, implementing measures such as stabilizing and protecting surfaces to prevent landslides, subsidence, erosion, water pollution, and potential hazards to humans. If the area is not decommissioned properly, degradation could occur and potentially present an environmental hazard in the future. Abandoning or leaving the project facilities after ceasing operations is not considered to be an acceptable alternative to decommissioning thus the reason for this chapter. The plan is to aid as a guide for the decommissioning activities to assure an effective and environmentally sustainable process, compatible with intended future land use on health related concerns and environmental impacts.

8.1 Objective

State Government have a legal and social responsibility to decommission the Lube Blending Plant. Therefore, a decommissioning plan/framework is to serve as a guide to the process. It is necessary to satisfy legal obligations. This plan also complements the primary ESMS put in place for the project's sustainability. This decommissioning plan is a set of guidelines and actions developed to ensure that decommissioning activities are implemented in a manner that reduces the socio-economic, environmental, health and safety risks. The overview of the strategy is to ensure the delivery of a timely and cost-effective program while maintaining high standards of safety, security, and environmental protection. Specifically, this plan aims to achieve the following:

- To comply with legal and regulatory requirements and Nasarawa State Government's project approvals.
- To meet stakeholders' expectations.
- To ensure safe, stable, and non-polluting land area which will be compatible with post closure land use.
- To provide for the retention and beneficial reuse of constructed infrastructures.

8.2 Scope and Requirement

This decommissioning framework provides an overview approach to manage decommissioning activities. It focuses on identifying the types of activities to be carried out during the decommissioning of the Lube blending plant such as:

- Seal entrance
- Revegetation and water barring
- Remove fills and culverts
- Establish drainage ways
- Full obliteration recontouring and restoring natural slopes
- Measures to minimize or manage potential adverse impacts associated with decommissioning of the activities.

Specific effects of each activity are strongly influenced by local factors which include climate, geology, topography, soil, project design and construction.

8.3 Requirements, Roles and Responsibilities

A description of the plans for the decommissioning of the lube blending plant project is to include:

- The activities related to the restoration of the project site to land.
- The procedures for managing excess material and waste.

The roles, responsibilities, and accountability under the decommissioning plan shall be assigned in line with documented ESMS for the lube blending plant project. The decommissioning team set in the future shall comply with all applicable regulations at the time of decommissioning.

8.4 General Decommissioning Process

Effectively, the decommissioning of the proposed facility is itemised below:

- Electrical and mechanical equipment's/devices/materials shall be removed and recycled off-site by an approved recycler
- Building shall either be demolished or retained and converted to other uses.
- Concrete pavements/foundations shall be removed and recycled off-
- Roads constructed for the project will remain onsite should the landowner(s) choose to retain them, or be removed and the gravel reused either on- or off-site.
- The project site may be converted to other uses in accordance with applicable land use regulations in effect at that time of decommissioning there are no permanent changes to the site and it can be restored to its original condition including re-vegetation. Any soil removed for construction purposes will be relocated on the site or used for landscaping after construction is complete.

Decommissioning during Construction (Abandonment of Project)

If the project is abandoned during the construction phase, the decommissioning procedures outlined for post-operation decommissioning will be followed, and the same decommissioning and restoration program will be implemented to the extent that construction has progressed before abandonment. This entails dismantling the facility, recycling removed materials, grading the excavated soil, and restoring the site to its pre-construction condition.

Decommissioning after Ceasing Operation

The project consists of numerous recyclable materials, including glass, semi-conductor material, steel, wood, aluminium, copper, and plastics. When the project reaches the end of its operational life, the component parts will be dismantled and recycled. The Project components will be dismantled and removed using minimal impact conventional construction equipment and recycled or disposed of safely.

In general, decommissioning of the Project will involve the following activities:

• Safe dismantling and demolition of Project components.
• Removal of equipment from the site and disposal at an approved facility if not re-useable
• Flushing-out, filling-in and abandonment of the drainage wastewater management system in accordance with applicable regulations.
• Removal of all remaining debris.
• Ensuring that there are minimal environmental impacts related to decommissioning activities.

8.5 Rehabilitation Process

The land that will be rehabilitated is the land on which the project components and associated infrastructure will be situated. All structures built on the site would have been dismantled and demolished before rehabilitation would commence. Once demolition is completed, the damaged site shall be restored to its original or near-original condition. The following items must be included in site rehabilitation:
• Filling of all depression including trenches that could have been done for the project.
• Levelling and appropriate landscaping of the entire site.
• Removal of all debris and scrap from site
• Carrying soil tests and analysis from various site locations where different structures and activities were being undertaken to ensure that any site soil contamination is handled appropriately and required soil amendments and treatments are done to ensure the result soil in that site supports the required vegetation that will later be planted. Soil amendments that may be done may include physical removal of affected soils and replacement with desired soil or phytoremediation.

8.6 Closure Outcomes/Completion Criteria

The expected closure outcomes for all site components are as follows:
• The community and future generations have no residual liability for site rehabilitation and maintenance • Public health and safety are not jeopardized
• Landscape function and vegetation are resilient, self-sustaining, and comparable to surrounding areas; and there is no increase in contamination level above baseline condition.

These are the completion criteria:
• Government acceptance of project completion report which demonstrates achievement of all completion criteria.
• Audit shows if any remaining project infrastructure is left in a safe and secure manner, and discourages public access.

• Landscape and vegetation report undertaken and reported to show function is resilient, self sustaining and comparable to the surrounding environment.
• Site contamination survey (conducted to relevant Nigerian standards) demonstrates no elevated level of selected contaminant.

Table 8.1: Decommissioning Outcome

Area	Impact
General	
All site components (Building)	The community and future generation are left with residual liability for site rehabilitation or maintenance
	Landscape function and vegetation is not resilient, self-sustaining and comparable to the surrounding areas.
	Long term contamination of land.
	Infrastructure is not removed
Overburden stockpile	
Overburden stockpile	Excavated construction soil stockpile not physically or chemically stable
	Self-sustaining vegetation is not established over excavated construction soil storage areas.
	Decrease in visual amenity of landform compared to baseline.
Lube Blending Plant and other associated infrastructure	
Infrastructure	Landscape function and vegetation is not resilient self-sustaining and comparable to the surrounding areas

8.6.1 Post Closure Monitoring

An environmental monitoring program after the closure of the site shall be performed to determine whether (or not) the objectives of closure are being met. Aspects to be monitored include:

- Air quality
- Flora and fauna: species composition, condition and abundance
- Ground water quantity and quality (if any)
- Soil quality

Schedule
The orderly and efficient rehabilitation of the project area shall be in phases as may be determined by State Government. The progress of closure will be done carrying both the Federal Ministry of Environment (FMEnv) and State Ministry of Environment.

8.7 Decommissioning Procedures as per Environmental, Social and Health Aspects

General Site Safety

The lube blending plant project should implement risk management strategies to protect the community from physical, chemical or other hazards associated with sites under decommissioning. Risks may arise from inadvertent or intentional trespassing. Including potential contact with hazardous materials, contaminated soils and other environmental media, structures that may pose falling and entrapment hazards. Risk management procedures may include:

- Reducing access to the decommissioned site.
- Removing hazardous materials.

Traffic Safety

Decommissioning activities will impact on traffic as heavy vehicles for transport of decommissioning materials and equipment will result to an increased risk of related accidents and injuries to workers and local communities. Awareness raising, education and training during decommissioning will minimize such impacts.

Labour Demobilization

For labour demobilization, the following shall be implemented;

- Consult with labour at least one year before the commencement of decommissioning.
- Embark on a re-training process to enable labour acquire other skills.
- Project workers shall either be adequately paid off or shall be relocated to other areas for employment. • Appropriate pension schemes shall be put in place for project workers for their upkeep when project is closed or de-commissioned.

Handling of the Host Community

Closure of the project will have significant impact on the local community. This is likely to include;

- Reduced purchasing power of the local people as a dependable source of income would have ceased to exist
- A number of locally sourced employees will be laid off
- Closure and/or relocation of businesses and services that were drawing clientele from the project
- Termination of certain services from the project operators to the community.

Residual Wastes Handling

The decommissioning activities will generate several waste streams. All wastes generated during decommissioning must be contained, characterized, labelled, marked, stored, transported, and disposed of according to regulatory requirements (Federal and State Waste Management Authorities).

The set team is expected to do the following before decommissioning:

- Conduct a waste audit to determine the amount of waste that will be generated during the dismantling process; prepare an audit report in writing;
- Create a work plan for waste reduction and,

- Implement measures to ensure that all other workers at the dismantling site are aware of the plan.

The waste reduction work plan will entail efforts to find industry users that could benefit from the waste materials generated during dismantling and demolition. They include:

- Concrete and aggregate manufacturers,
- Electrical equipment manufacturers and resellers,
- Mechanical equipment manufacturers and resellers and
- Metal recyclers.

All excess waste materials shall be transported off-site to approved facility. Any hazardous wastes that are used on site such as lubricating oils, shall be removed, and disposed of at licensed facility.

8.8 Other Considerations

Emergency Response Plan

This plan is of utmost importance and will be implemented throughout all project phases in the event of any emergencies. The potential emergency situations that may arise during decommissioning are identical to those previously identified during the construction and operation phases.

The primary objective of this plan is to establish and uphold emergency procedures necessary for efficiently responding to accidents and other emergency situations, while minimizing potential losses. During the decommissioning phase, potential emergency scenarios such as fire, personal injury, and spills are taken into consideration. To ensure preparedness, all operating staff will receive comprehensive training in emergency response protocols and communication procedures.

Communication Notification

The proponent shall create an effective communication plan that clearly outlines a process for two-way correspondence with stakeholder. This shall be always made available on site. All non-emergency communications shall be disseminated through various media (TV, Radio, Newspaper, Signage, and Letters) avenues to ensure stakeholders are well informed on project updates and activities.

CHAPTER NINE
CONCLUSION

9.0 General

A preliminary analysis of the probable environmental and social effects of the proposed lube blending plant Development Project in Auta Balefi, Karu LGA, Nasarawa State has been provided in this report. To ensure compliance with environmental laws and standards, the EIA has identified mitigation strategies in connection to the pre-construction, construction, and operation phases.

A description of the assessment process followed and reviewed legal, administrative, and institutional frameworks guiding the project development and the surrounding environment (Chapter one) have been documented. More so, the justification, sustainability and alternatives considered as seen in (Chapter two) have been also documented. Given the detailed description of project development activities (Chapter three) the existing environment baseline information on receptors and resources has also been reviewed and analyzed from secondary data sources and previous studies from a wide range outside the project area which is not adequate and sufficient to fully characterize the area existing environmental and socio-economic conditions (Chapter four) and the impact assessment (Chapter five), mitigations (Chapter six) and EMP (Chapter seven) that has been presented in earlier sections of this EIA report, it is therefore concluded that; the technology, equipment and facilities that is proposed to be employed in the lube blending plant project is one of the best available and environmentally friendly technology, which has been used by a number of developers in Nigeria; The project will be attended with a number of positive impacts such as

- Job Creation: Lube blending oil facilities require a skilled workforce to operate and manage the blending processes. The establishment and operation of these facilities can create employment opportunities, contributing to job growth and reducing unemployment rates.
- Local Manufacturing: Lube blending plants enable the local production of lubricants, reducing the need for importation. This promotes domestic manufacturing and contributes to the growth of the manufacturing sector. It also helps in reducing reliance on foreign markets, potentially improving trade balance and fostering economic independence.
- Value Addition: Lube blending oil involves the blending of base oils with additives to create various lubricant formulations tailored to specific applications. This value addition process increases the market value of the base oil and creates a product with higher utility. This added value benefits the economy by generating increased revenue and profitability.
- Export Potential: Lube blending oil plants can facilitate the production of high-quality lubricants that meet international standards. This opens up opportunities for export, contributing to foreign exchange earnings and expanding the export sector.
- Revenue Generation: Lube blending oil operations contribute to government revenue through taxes, licensing fees, and other forms of levies. The growth of the lubricants industry, driven by lube blending plants, can lead to increased tax revenue for governments,

which can be allocated towards infrastructure development, public services, and other essential areas.

9.1. Impact Summary

A number of positive impacts were identified and assessed; impacts relating to local employment were seen to be of significant benefit post-enhancement. In addition to that, business opportunities to local vendors and contractors, were also assessed and seen to be beneficial. Air quality; air pollutant gases emission during site preparation activities, tank construction, soil and groundwater contamination from waste materials and operational activities and HSE impacts were identified as negative impacts of medium and major significance prior to mitigation. These negative impacts require careful implementation of effective mitigation measures and ongoing monitoring. The significance of air quality and workplace HSE impacts waste material can be reduced to moderate if the implementation of the mitigation measures and monitoring requirements outlined in chapter seven are implemented can be reduced to low, while impact of soil and groundwater contamination from waste material can be reduced to moderate if the implementation of the mitigation measures and monitoring requirements outlined in chapter seven are implemented.

9.2. Conclusion and Recommendation

In conclusion, the EIA for the lube blending plant project has predicted that the project will comply with all environmental standards and legislation after the proposed mitigation measures are implemented. This EIA has also demonstrated the acceptability of the residual impacts from the project and protection of the identified environmentally sensitive resources. Environmental monitoring and audit mechanisms have been recommended as part of the overall EMP, where necessary, to verify the accuracy of the EIA predictions and the effectiveness of recommended mitigation measures. It is therefore suggested that this EIA, having sufficiently assessed and mitigated environmental and socio-economic impacts associated with the field development project follows established national and international guidelines on environmental impact assessment process and is hereby recommended for approval.

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Appendix A
Attendance for Scoping / Stakeholders engagement exercise

FEDERAL MINISTRY OF ENVIRONMENT
ENVIRONMENTAL ASSESSMENT DEPARTMENT
SCOPING WORKSHOP
ATTENDANCE SHEET

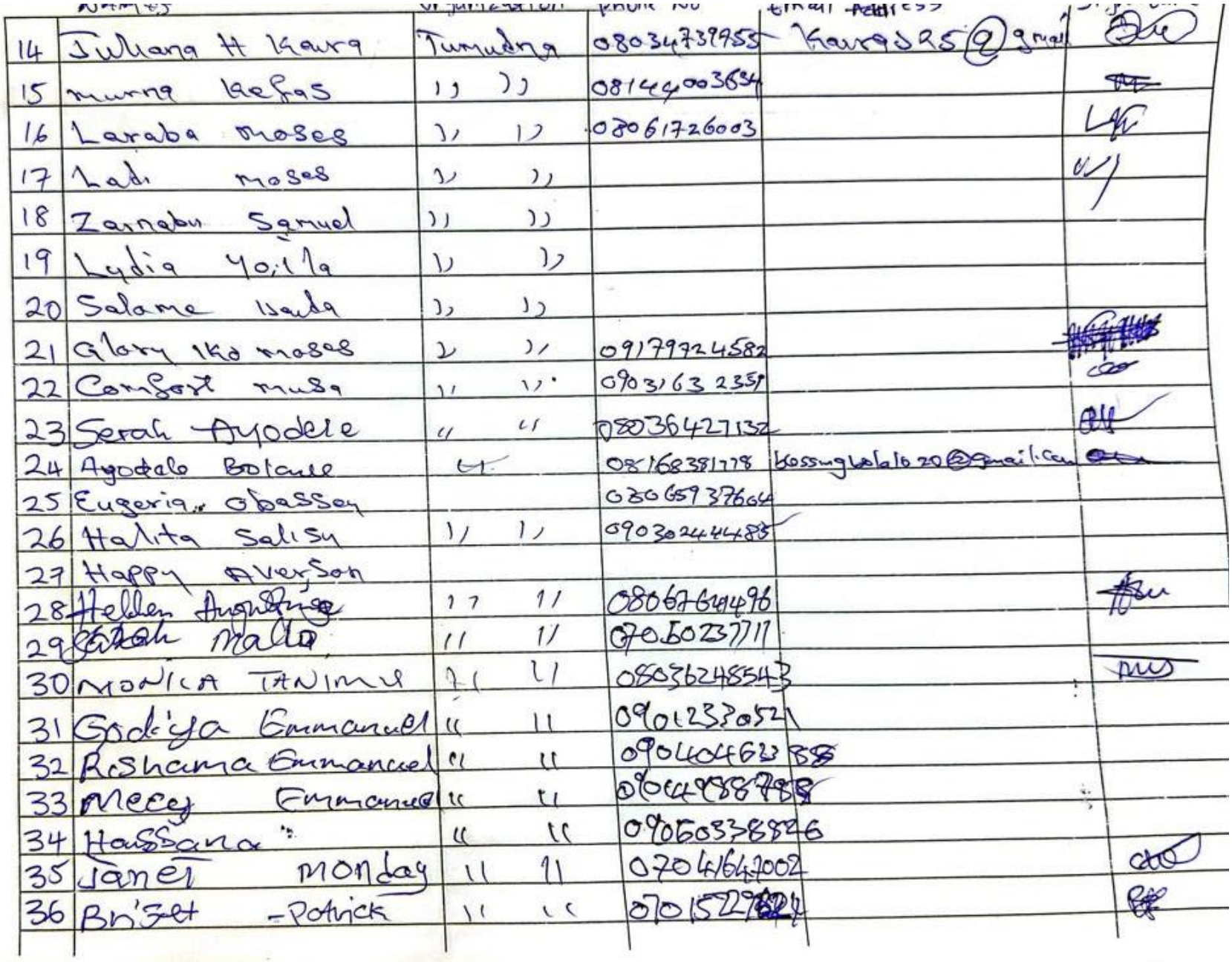
PROJECT TITLE: Sahara Lubricants Limited

PROJECT PROPONENT: Construction of lubricant blending plant

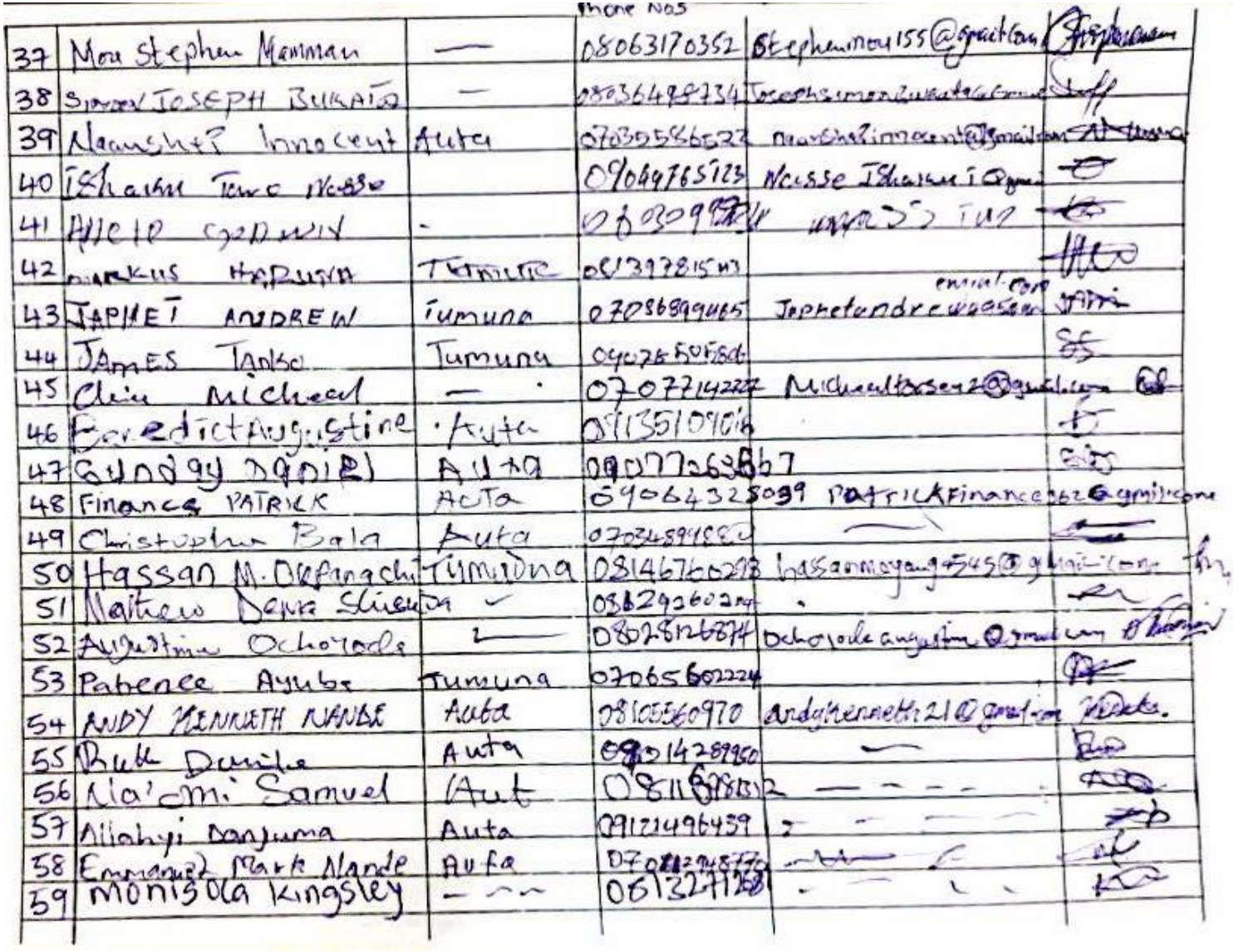
LOCATION: Ants, Bakeki, Kam LGA Nasarawa State

DATE: 08/09/2026

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30	MONICA TANIMU	11 11	08036248543		
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APPENDIX B