CHAPTER ONE

INTRODUCTION

1.1 Project Overview

The lubricant sub-sector of the downstream industry is one with so many potential that is capable of being a major source of revenue earner for the country, and has grown over the years with increase in the number of second hand passenger and commercial vehicles in the country calling for more frequent lubricant changes. Though Nigeria has an installed lubricant capacity of 600, 000 metric tonnes the current demand is 700 million litres which is about 1% of global demand.

The lubricants market is driven by various steps being taken by government such as initiatives to increase the ease of doing business to boost manufacturing sector activities and the Nigeria Economic Recovery and Growth Plan (ERGP) to emphasize investment in infrastructure. With the increase of import duty on finished lubricants to 30% and the recent 7.5 percent VAT on finished lubes in the country, the sectors have been opened up for further investment and the proposed project considered in this study is set to explore the given opportunity. Though there are presently 34 lube blending plants in Nigeria, only two of these (5.9%) are located in the south-south region of the country (DPR, 2020). This proposed lubricating oil blending plant project by Eraskon Nigeria Ltd is thus a private effort to support the government of Nigeria on how local production of lubricant can be increased to boost its domestic availability especially in the south-south region of the country.

1.2 Project Proponent

Eraskon Nigeria Limited is a lubricant oil manufacturing company incorporated in Nigeria by the Corporate Affairs Commission (CAC) with RC No. 601947. The company is desirous of setting up a 50,000 litres lubricating oil blending plant in Izeinbou Bush, Tunama Community, Gbaran Clan, Yenagoa Local Government Area (LGA) of Bayelsa State. The proposed project area is located about 700 m to the Azikel Modular Refinery, from which the plant will source for raw materials using state-of-the-art technologies to produce high-quality lubricants suitable for a wide range of uses. The lube oils are to be distributed across the country through an extensive network of distributors.

In order to implement the proposed project and make it compliant with national environmental standards, Eraskon Nigeria Limited (here-in referred to as ENL), commissioned Geo Environmental Resources Limited (here-in referred to as GERL), an indigenous environmental consultancy firm whose head office is at Suite SB 81, New Banex (VOM) Plaza, Aminu Kano Crescent, Wuse II, FCT-Abuja, to undertake the ESIA, a basic pre-operational necessity of law.

1.3 ESIA Objectives

ESIA is a tested and globally accepted environmental management tool for proactive control of anticipated project impacts on the environment. The aim of this ESIA study for the proposed project is to proactively evaluate the potential environmental (including health and socio-economic) impacts of the proposed development. This is to ensure that the planned activities exert minimal impacts on the environment. Its specific objectives are to:

- Identify and evaluate the potential socio-economic effects of the project on the communities including impacts on cultural properties, social infrastructures and natural resources;
- Establish the baseline condition of the environment;
- Assess the potential environmental, social and health impacts of the project on the biophysical, social and health components of the environment;
- Provide appropriate mitigation measures for negative impacts and make recommendations aimed at sustaining/enhancing the beneficial impacts of the projects on the environment;

- Determine and document the sources of impact from the project activities and identify the environmental, social and health components which are critical to the impacts; and
- Develop a cost effective Environmental & Social Management Plan (ESMP) for the project.

1.4 Terms of Reference of the Project

In compliance with the EIA Procedural Guidelines of 1995, the ESIA Terms of Reference (ToR) for the proposed project was submitted by Eraskon Nigeria Limited to the Department of Petroleum Resources (DPR) and the Federal Ministry of Environment (FMEnv) for approval. The ToR for the ESIA of the proposed project was developed through extensive stakeholder consultation at the initial stages of project conception, and approved by DPR and the FMEnv. The consultation was organized in order to identify and define the project activities and aspects that may have significant environmental effects as well as scope the environmental baseline data needed as basis for impact assessment.

As contained in the Terms of Reference (ToR) the study will address the potential environmental impacts associated with the proposed project. These potential impacts will be assessed through, but not limited to the following:

- Soil contamination studies;
- Hydrological investigation;
- Meteorological/weather investigation of site;
- Noise studies (both Baseline and Operational) – impacts of noise and air quality;
- Environmental and Social Impact Assessment (ESIA) – Impacts on ecology, fauna and floral, impacts on heritage sites, impacts on visual quality and aesthetics, impacts on the social environment.

In addition, these specialist studies are to be undertaken in two phases:

- A desktop scoping study, wherein potential issues associated with all alternatives identified are evaluated and the preferred alternative nominated for consideration in the ESIA phase;
- A detailed assessment of potentially significant impacts associated with the preferred alternative identified in the scoping phase. This shall include practical and achievable mitigation measures recommended in order to minimize potentially significant impacts identified. These recommendations shall be included within the draft Environmental and Social Management Plan (ESMP).

Sequel to the above and in consonance with the laws and regulations operational in Nigeria, the Terms of Reference for this ESIA study is as captured below:

- Establish the baseline for the existing environmental conditions of the project area. The baseline environmental data for the project area shall involve field surveys to determine current status of environmental components including (Air, water, and soil quality as well as noise level and biodiversity.
    - Air Quality - Ambient air quality and pollution trends in terms of SO_2, CO_2, NO_2, NO, NH_3, H_2S, SPM, O_2, CO, etc

    - Noise level - Noise level determination in (dB).

    - Water Quality - Assessment of physical, chemical and biological analysis of both surface and ground water.

    - Soil Quality - Soil Physical, chemical and biological analysis; Soil erosion and channel erosion sites; Auger and profile samples to be taken to determine morphological, physical and chemical properties; Assessment of geomorphic features.

- Biodiversity/Ecological Studies
- To determine ecological species including composition, density, general biodiversity etc.

- Waste Management
  - Identify current waste management system of the project area;
  - Assess the likely waste type/classes from the proposed project;
  - Forecast proposed project waste quantification; and
  - Compile a comprehensive waste management handling and disposal system.

- With the aid of concise climatic data, describe the general climatic pattern of the project area particularly in terms of wind speed & direction, temperature, humidity, rainfall etc.

- Study and present study area data/details on topography, geomorphology, geology, natural hazard, drainage pattern, hydrology, and hydrogeology, land use pattern, cropping pattern etc. Data will be supported by relevant maps where applicable.

- Present details of environment sensitives such as ecology, water bodies, defence, habitation, industries, major transportation media (road, rail etc.) wetlands, natural hazards, archaeological, religious, tourism and historical monuments/places etc. 2km radius of the surrounding project site.

- Present details of demography, occupational pattern, general amenities, cropping pattern, practices used for agriculture & irrigation specific to the project area.

- Carryout a thorough and comprehensive stakeholder's workshop/public consultation as part of socio-economic assessment.

- Carryout door to door survey for the assessment of the socio-economic assessment of the project area with a target of not less than 250 households.

- Focus group discussions shall also be carried out for different groups (men, women, youths, and elderly) within the community.

- Identify and rank all project associated impacts for the pre-construction, construction, operation, and decommissioning phases of the project.

- Develop control strategies with a view to mitigate and ameliorate project potential and associated impacts.

- Recommend measures to increase the benefits derivable from the project.

- Estimate and describe the nature and likelihood of environmental damage and incidents and thus, provide a basis for contingence planning.

- Provide a comprehensive Environmental and Social Management Plan (ESMP): The ESMP shall contain, among other things, the following:
    - The environmental objectives and commitments
    - The means by which these will be achieved
    - The responsibilities/accountabilities
    - The corrective actions which will be employed should the needs arise, and
    - Review schedules and criteria.

1.5 ESIA Methodology

This ESIA study was carried out in accordance with the Federal Ministry of Environment (FMEnv) Procedural and Sectoral Guidelines 1995 and the Department of Petroleum Resources (DPR) EGASPIN, 2002. The study involved a blend of a multidisciplinary team and standard methods from science, engineering, social and health sciences in order to obtain basic data for impact identification and establishment of mitigation and amelioration measures. It involved desktop studies, field research, consultation, impact assessment and proffering of mitigation measures and development of an ESMP. The study involved desktop studies, site identification, literature review, field data gathering, impact identification and evaluation, proffering of mitigation measures and development of an ESMP. During this study the EIA process (Figure 1.1) of the Federal Ministry of Environment was strictly observed.

1.5.1. Desktop Studies

Desktop studies were undertaken to acquire information on climate and atmospheric conditions, geology, soil, vegetation, socio-economics, and other environmental components of the proposed project Catchment Area. Relevant literatures to the proposed project were reviewed. These include literatures of existing projects around the proposed area such as the Final Environmental and Social Impact Assessment of Azikel Petroleum Limited Modular Refinery facility, the Environmental data reports of Shell Petroleum Development Company (SPDC) facility, Final EIA report of Gbaran Ubie Phase II Integrated Oil and Gas Project (EIA Cluster 1 – Koroama, Gbaran and Kolo Creek Fields) conducted in 2012 as well as the Final EIA report of Adibawa-Gbaran 3D Reshoot Seismic Data Acquisition Project in Bayelsa and River States conducted in 2015, among others.

1.5.2. Reconnaissance Survey and Site Identification

A reconnaissance survey was undertaken to familiarize the ESIA Team with the proposed project area. This helped in the concept design of field study execution. Maps, photographs and GPS locations were used to generate relevant information on the lubricating oil blending plant project location. This generated information enabled the delineation of the area studied.

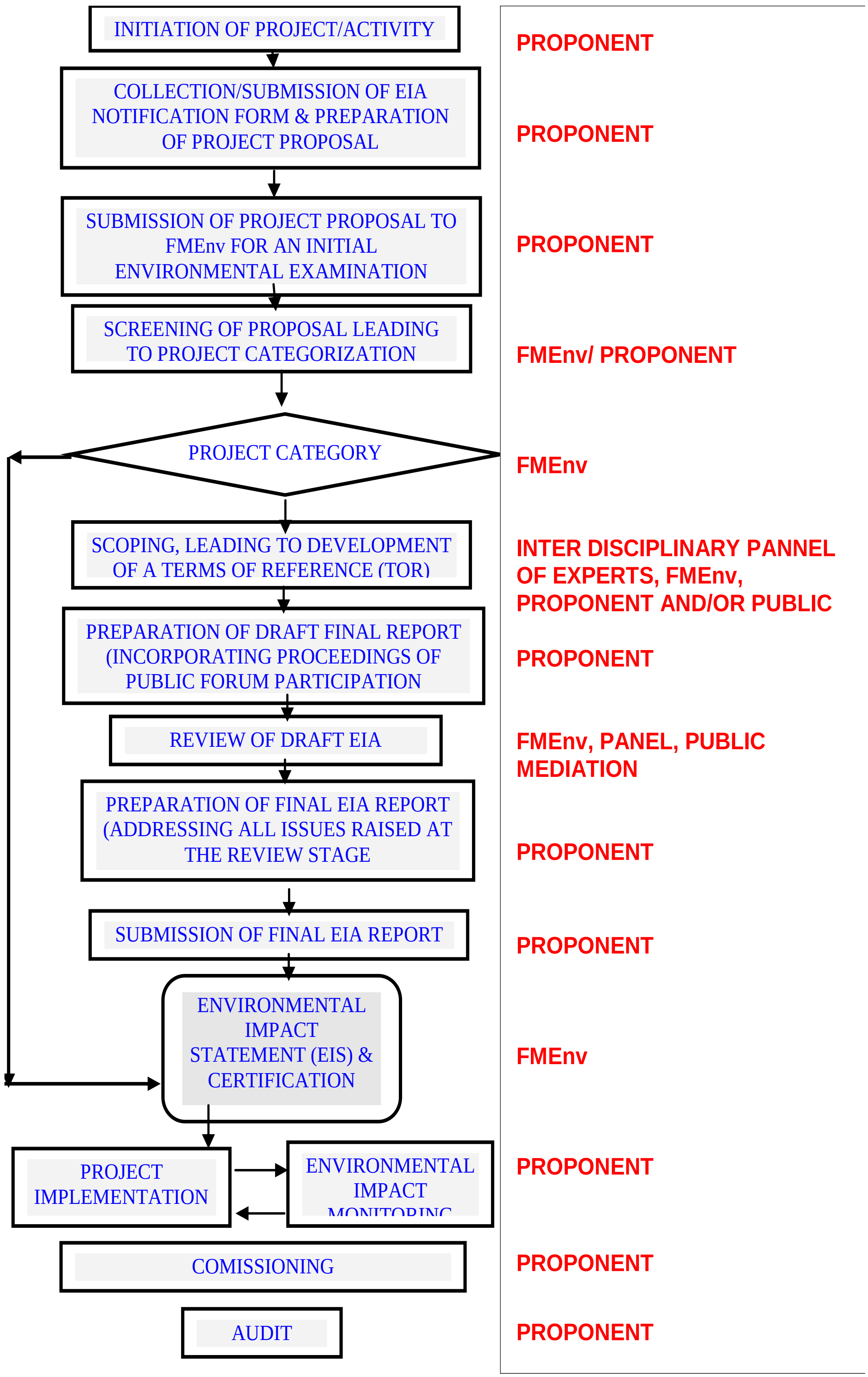

Figure 1.1: The FMEnv EIA Process (adapted from FMEnv Green book)

Field Survey

Fieldwork research was used to complement and verify information gathered from desk studies/research. The fieldwork was carried out in line with methods specified in (FMEnv) EIA/ESIA Procedural Guidelines and DPR Guidelines and Standards for Petroleum Industry in Nigeria (EGASPIN, 2002) with the Eraskon QA/QC standards maintained. It covered all the relevant aspects of the ecological, socio-economic and health environment. The field data gathering exercise was carried out to fill the information gap identified from literature review and to validate existing information. It entailed visual observation, on-site measurements and collection of samples for laboratory analysis/testing. The laboratory work was handled by Labchemnec Jans Limited (an accredited laboratory with the Federal Ministry of Environment with its head office located at No. 5 Port-Loko Street, Wuse Zone 3, Abuja), our affiliate laboratory. As earlier indicated, a multi-disciplinary team of experts was involved in the fieldwork carried out from 4th to 6th August, 2020 for wet season data gathering. Dry season baseline environmental records were obtained (with the permission of the Environmental Assessment (EA) Department of the Federal Ministry of Environment) from the Final EIA report of Adibawa-Gbaran 3D Reshoot Seismic Data Acquisition Project in Bayelsa and River States.

1.5.3. Environmental and Social Impact Assessment Methodologies

Standards and recommended environmental assessment methodologies were used to identify potential impacts (Leopold Matrix) and to evaluate such impacts (Peterson Matrix). ISO 14001 procedures were also used to identify significant impacts associated with the project activities. Other impact evaluation methodology that are applicable, verifiable, specific and quantifiable, were used while the overall assessment was carried out using the 'Strength of Relationship Matrix Approach' method and other methods that define numerically the degree of interdependence of the various environmental parameters. The environmental aspects of the project that may interact positively and negatively with the environment at the pre-construction, construction, operation and decommissioning phases were identified.

1.5.4. Mitigation/Ameliorative Measures

The identified adverse impacts were mitigated based on scientific conclusions and professional judgments in-line with safety, health and environment standards and codes (for design, operation and decommissioning/abandonment) as well as the recommended practices by the Federal Ministry of Environment (FMEnv), United Nations Guidelines and Standards, among others.

1.5.5. Consultation with Stakeholders and Experts

Since stakeholder consultation is a very important aspect of the EIA study, it was carried out with the proposed project stakeholders. Some of these were consulted during the scoping stage, prior to the start of the field campaign to ensure that the views and opinions of all stakeholders regarding the proposed project and its associated and potential impacts are integrated into the ESIA. Furthermore, consultations shall be carried out throughout the project lifecycle with all stakeholders to ensure that their views and opinions concerning the proposed project are all captured. The Stakeholders include but not limited to the following:

- Federal Ministry of Environment (FMEnv),
- Ministry of Petroleum Resources (MPR),
- Department of Petroleum Resources (DPR),
- Nigerian National Petroleum Corporation (NNPC),
- National Oil Spill Detection Response Agency (NOSDRA)
- Bayelsa State Ministry of Environment (BSME),
- Yenagoa Local Government Council,
- Tunama Community, and
- Other neighboring communities in Gbaran clan

Regulatory bodies in the Oil and Gas Industry in Nigeria include:

- The Ministry of Petroleum Resources (MPR)
- Department of Petroleum Resources (DPR)
- Nigerian National Petroleum Corporation (NNPC)

1.6 Regulatory Framework for Environmental Protection

The Federal Government of Nigeria established the Federal Ministry of Environment from the defunct FEPA with an overall mandate to protect, restore and preserve all ecosystem of the Nigerian environment. Twenty-one guidelines for pollution abatement in all categories of industries were laid out. Part of the guidelines is a mandatory requirement for environmental auditing of all existing industries and Environmental and Social Impact Assessment (ESIA) of new industries and major development projects. Today, The Federal Ministry of Environment is in the forefront of implementing the Nigerian policy on the environment coupled with some assistance from environmental friendly organizations and non-governmental organizations, especially in creating the awareness for environmental consciousness.

In order to show its readiness to ensure compliance, the Federal Government has in July 2007 released an official gazette establishing the National Environmental Standards and Regulations Enforcement Agency (Establishment) Act, 2007. The agency is charged with the enforcement of environmental standards, regulations, rules, laws, policies and guidelines. Above all the agency has been saddled with the huge responsibility for the protection and development of the environment, biodiversity conservation and sustainable development of Nigeria's natural resources in general and environmental technology, including coordination and liaison with relevant stakeholders within and outside Nigeria on matters of enforcement of environmental standards, regulations, rules, laws, policies and guidelines. The relevant policies, regulations, laws and guidelines that affect lubricating oil blending plants are highlighted in this sections.

1.6.1 National Legislation

Relevant national environmental policies, laws, regulations and guidelines are reviewed to establish their applications and their requirements to the proposed project with the overall objective of ensuring regulatory compliance. Amongst the legislation that were reviewed are:

1.6.1.1. National Policy on Environment (1989)

The National Policy on environment describes guidelines and strategies for achieving policy goal of sustainable development by:

- Preventive activities directed at the social, economic and political origins of the environmental problems;
- Abatement, remedial and restorative activities directed at the specific problems identified;
- Design and application of broad strategies for sustainable environmental protection and management;
- Enactment of legal instruments designed to strengthen activities and strategies recommended by this policy; and
- Establishment/empowerment of management organs, institutions & structures designed to achieve policy objectives.

1.6.1.2. National Guidelines and Standards for Environmental Pollution Control in Nigeria

These guidelines were promulgated in March 1991 to serve as a basic instrument for monitoring and controlling industrial and urban pollution. They were initiated sequel to the promulgation of the National Environmental Policy in 1989. The guidelines and standards relates to six (6) areas of concern, among which are: Effluent limitations; Industrial emission limitations; Noise exposure limitations; and Management of solid and hazardous wastes.

1.6.1.3. National Effluent Limitation Regulation

S.I.8 National Environmental Protection (Effluent Limitation) Regulation, 1991 (No. 42, Vol. 78, August, 1991) makes it mandatory for industries as waste generating facilities (including research institutes, clinics, hotels etc.) to install anti-pollution and pollution abatement equipments on site. The regulation is specific for each category of waste generating facility with respect to limitations of solid and liquid discharges or gaseous emissions into the ecosystem. Appropriate penalties for contravention are specified also in the regulation.

1.6.1.4. Management of Hazardous and Solid Wastes Regulation

S.I.15 National Environmental Protection (Management of Solid and Hazardous Wastes) Regulations, 1991 (No. 102, Vol. 7, August, 1991) defines the requirements for groundwater protection, surface impoundment, land treatment, water piles, landfills, incinerators etc. it also describes the hazardous substances tracking programmed with a comprehensive list of acutely hazardous chemical products and dangerous waste constituent. It also states the requirements and procedure for inspection, enforcement and penalty.

1.6.1.5. EIA Act CAP E12 LFN 2004

The Environmental Impact Assessment (EIA) Act CAP EIA LFN 2004 (formerly Act No. 86 of 1992) makes EIA mandatory for all new major public and private projects in Nigeria. The E.I.A Act, as it is informally called, deals with the considerations of environmental impact in respect of public and private projects. Sections relevant to environmental emergency prevention under the EIA/ESIA include:-

- **Section 2 (1)** requires an assessment of public or private projects likely to have a significant (negative) impact on the environment.
- **Section 2 (4)** requires an application in writing to the Agency before embarking on projects for their Environmental and Social Impact Assessment to determine approval.
- **Section 13** establishes cases where an EIA/ESIA is required, and
- **Section 60** creates a legal liability for contravention of any provision.

Consequently, the environmental management activities at each phase of the project should be guided by environmental standards including those posed by legislation and those established by self-regulating industrial codes of practice, industry standards and company policy. The FMEnv developed a National EIA/ESIA procedure in response to the promulgation of the EIA Act No. 86 of 1992 from which the present law emerged. 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.

1.6.1.6. EIA Sectoral Guidelines of the Federal Ministry of Environment (FMEnv)

The Federal Environmental Protection Agency (FEPA) now Federal Ministry of Environment (FMEnv), was established by Act 58 of 1988 to monitor and prevent the pollution of the environment following the Koko toxic wastes dump incident. This empowered FEPA to prepare Environmental Guidelines and Standards as instruments for prevention of environmental pollution.

The Act also gives specifics to FEPA/FMEnv to facilitate environmental assessment of projects. In addition, FEPA regulations S.1.8, S.1.9 and S.1.15 of 1991 provided guidelines and standards for: Solid and Hazardous waste management; Effluent limitations; and Pollution abatement in industries generating wastes. In September 1995, FEPA published EIA Sectoral guidelines for projects in the Oil and Gas industries in Nigeria. The guidelines are intended to assist in the proper and detailed execution of EIA Studies of the oil and gas projects in compliance with the EIA Act of 1992.

1.6.1.7. National Oil Spill Detection Response Agency (NOSDRA) Act No. 15 2006

The objective of the Agency is to co-ordinate and implement the National Oil Spill Contingency Plan for Nigeria through some steps including:

- Safe, timely, effective and appropriate response to major or disastrous oil pollution;
- Identify high-risk areas as well as priority areas for protection and clean up;
- Establish the mechanism to monitor and assist or where expedient direct the response, including the capability to mobilize the necessary resources to save lives, protect threatened environment, and clean up to the best practical extent of the impacted site;
- Maximize the effective use of the available facilities and resources of corporate bodies, their international connections

and oil spill co-operatives, that is Clean Nigeria Associates (CNA) in implementing appropriate spill response;

- Develop and implement an appropriate audit system for the entire plan, and
- Carry out such other activities necessary or expedient for full discharge of its functions and execution of Plan under this Act.

1.6.1.8. Wild Animals Preservation Act CAP 132 LFN 1990

This Act seeks to ensure the sustainable use and preservation of the many benefits accruing from the conservation of wild life for economic development in the country.

1.6.1.9. Forestry Law CAP 51 LFN 1994

This law provides for the preservation of forests and the setting up of forest reserves. It is an offense, punishable with up to 6 months imprisonment, to cut down trees over 2ft in girth or to set fire to the forest except under special circumstances.

1.6.1.10. Criminal Code Act CAP 77 LFN 1990

The Nigerian Criminal Code makes it an offence punishable with up to 6 months imprisonment for any person who: violates the atmosphere in any place to make it noxious to the health of persons in general dwelling or carry on business in the neighbourhood, or passing along a public way; or does any act which is, and which he knows or has reason to believe to be, likely to spread the infection of any disease dangerous to life, whether human or animal.

1.6.1.11. Land Use Act CAP L5 LFN 2004

Nigeria has a land use Act which makes it public interest the rights of all Nigerians to use and enjoy land and natural fruits thereof in sufficient quantity. It is to enable them provide for the sustenance of themselves and their families be assured, protected and preserved.

1.6.1.12. Harmful Waste Act CAP H1 LFN 2004

The Harmful Waste Act prohibits, without lawful authority, the carrying, dumping or depositing of harmful waste in the air, land or territorial water and matters relating thereto in Nigeria.

1.6.1.13. Water Resources Act, CAP W2, LFN 2004

The Water Resources Act is targeted at developing and improving the quantity and quality of water resources. The following sections are pertinent: Section 5 and 6 provides authority to make pollution prevention plans and regulations for the protection of fisheries, flora and fauna. Section 18 makes offenders liable, under this Act to be punished with a fine not exceeding ₦ 2000 or an imprisonment term of six months. He would also pay an additional fine of ₦ 100 for everyday the offence continues.

1.6.1.14. Endangered Species Act, CAP E9, LFN 2004

This Act focuses on the protection and management of Nigeria's wildlife and some of their species in danger of extinction as a result of over exploitation. These sections are noteworthy:

- Section 1 prohibits, except under a valid license, the hunting, capture or trade in animal species, either presently or likely being in danger of extinction;
- Section 5 defines the liability of any offender under this Act;
- Section 7 provides for regulations to be made necessary for environmental prevention and control regarding the purposes of this Act.

1.6.1.15. Abandonment Guidelines (FMEnv Abandonment Guidelines, 1995)

This guideline spells out the National statutory steps and procedures for the decommissioning and abandonment of a project towards ensuring environmental sustainability of the country's general environment.

1.6.1.16. Labour Act, 1999

Nigeria has ratified all eight core International Labour Organization Conventions. The Labour Act (1999) is the primary law protecting the employment rights of individual workers. It covers protection of wages, contracts, employment terms and conditions, recruitment, and classifies workers and special worker types.

1.6.1.17. Trade Union Amendment Act, 1995

In Nigeria union membership is governed by the Trade Union Amendment Act (1995). The 1999 constitution includes stipulation of equal pay for equal work without discrimination on account of sex, or any other ground whatsoever.

1.6.1.18. Oil in Navigable Waters ACT, CAP 06, LFN 2004

Oil in Navigable Waters Act is concerned with the discharge of oil from ships. The following sections are significant: Section 6 makes punishable such discharge with a fine of ₦2, 000 (Two thousand naira). Section 1 (1) prohibits the discharge of oil from a Nigerian ship into territorial waters or shorelines. Section 3 makes it an offence for a ship master, occupier of land, or operator of apparatus for transferring oil to discharge oil into Nigerian Waters. It also requires the installation of anti-pollution equipment in ships.

1.6.1.19. Petroleum ACT, CAP P10, LFN 2004

The Petroleum Act and its Regulations remain the primary legislation on oil and gas activities in Nigeria. It promotes public safety and environmental protection. Its relevant sections to this project include: Section 9(1) (b) which provides authority to make regulations on operations for the prevention of air and water pollution.

1.6.1.20. Oil Pipelines ACT, CAP 07, LFN 2004.

The Oil Pipelines Act and Regulations guide oil activities. The following sections are pertinent: Section 11 (5) creates a civil liability on the person who owns or is in charge of an oil pipeline. He would be liable to pay compensation to anyone who suffers physical or economic injury as a result of a break or leak in his pipelines; Section 17 (4) establishes that grant of licenses are subject to regulations concerning public safety and prevention of pollution.

1.6.1.21. National Resources Conservation Action Plan

The Natural Resources Conservation Action Plan aims at collating and evaluating data and knowledge on natural resources with a view to developing programmes of action for management and sustainable use. The objectives along with others is to identify, describe and analyse current state and status of each resource, misuse and abuse, propose institutional arrangement for effective implementation of the plan and examine man-lubricant blending, fiscal and legal implication of the action plan.

1.6.1.22. Nigerian Oil and Gas Industry Content Development Act 2010

The law requires that a "contractor, sub-contractor, licensee, the corporation or other allied entity carrying out a petroleum activity shall ensure that local content is a component of the petroleum activities engaged in by that contractor, sub-contractor and licensee, the corporation or allied entity".

1.6.1.23. Public Health Law CAP 103 LFN 1990

Public health law examines the authority of the government at various jurisdictional levels to improve the health of the general population within societal limits and norms. Public health law also focuses on legal issues in public health practice and on the public health effects of legal practice.

1.6.1.24. Workers Compensation Act 1987

The Law was established to provide open and fair system of guaranteed and adequate compensation for employees or their dependants for any death, injury, disease or disability arising out of or in the course of employment. It is applicable to all employers and employees in the public and private sectors.

1.6.2 Non-Governmental Organizations Concerned with Conservation of Nature in Nigeria

There are non-governmental organizations internationally acclaimed and concerned with the conservation of natural resources. Some of these include:

1.6.2.1 Nature Conservation and Environmental Development Organization (NACEDO)

NACEDO is a non-profit and non-governmental organization established in 2001 in an effort to reduce wasteful exploitation and consumption of natural resources in Nigeria. In order to curb deforestation NACEDO promotes the planting of fast-growing, nitrogen-fixing trees species in the country. NACEDO provides free training, aids, tree seeds, technical assistance and educational materials, vital for proper successful reforestation projects to farmers, individuals, groups, students, communities, organizations, governmental ministries, etc. NACEDO also empowered the local dwellers to improve their own agricultural production by training farmers to adopt improve farming system and techniques. It promotes and encourages locals on the use of solar energy (solar cookers, solar ovens, etc.) since it is the least polluting and most inexhaustible of all known energy sources. NACEDO shares and disseminate information and knowledge to the general public on sustainable use and conservation of bio-diversity.

1.6.2.2 Nigeria Conservation Foundation (NCF)

The Nigerian Conservation Foundation (NCF) is the premier Non-Governmental Organization (NGO) dedicated to nature conservation and sustainable development in Nigeria. Established in 1980, the Foundation was registered in 1982 as a Charitable Trust under the Land (Perpetual Succession) Act of 1961 - a policy that was replaced by the Company and Allied Matters Act of 1990. It has a vision of "a Nigeria where people prosper while living in harmony with nature". This drives its Mission to preserve the full range of Nigeria's biodiversity including species, ecosystems and genetic biodiversity; promotes sustainable use of natural resources for the benefit of present and future generations, and advocates actions minimizing pollution and wasteful utilization of renewable resources.

1.6.3 State Legislation

The State Environmental Protection Agencies are also saddled with responsibility of regulating environmental management in the States. States can prescribe standards for their own States while FMEnv prescribe minimum standards for all States. There is also provision for the establishment of Local Government Environmental Protection Committees to monitor issues relating to environment in their domain.

1.6.3.1. Bayelsa State Environment and Development Planning Edict of 1998

In accordance with the provision of section 24 of FEPA Decree 58 of 1988 and Chapter 131 of the laws of the Federation of Nigeria, Edict No 2 of January 1994, the Bayelsa State Environment and Development Planning was established. It was assigned the responsibility for the protection of the environment, biodiversity, conservation and sustainable development in the state. This was purposely established for "the protection and development of the environment and biodiversity conservation and sustainable development of the State's natural resources" (Section, 6/i). Part seven of the Edict, which deals with offences and penalties, prohibits:

- Discharge of untreated waste;
- Discharge of oil, grease or spill oil;
- Discharge of injurious gas such as sulphur dioxide, oxides of nitrogen, hydrogen, sulphides, carbon, ammonia, chlorine, smoke, metallic dust and particles;
- Storage of chemicals, oil, lubricants, petroleum products, cement (except for use in buildings), radioactive materials or gases in residential and commercial building (without the permission of the authority);
- Waste dumping without permission;
- Dumping of toxic or hazardous matter without permission;
- Indiscriminate sinking of well and borehole; and
- Use of chemical (Gamalin 20 or any herbicide or insecticide or other chemicals) to kill fish or destroy marine life in any river, stream, lake or pond within the state

1.6.3.2. Bayelsa State Ministry of Environment

In 1999, the State Ministry of Environment was created having dissolved the then, Environment Development & Planning Authority to the ministry. On creation, MDAs with similar functions were transferred and constitutes the present Ministry of Environment. Its policy statement is "ensure the attainment of a sustainable, healthy, safe, clean, pollution free and stable environment". It has mission to prevent, abate, remediate, restore and identify specific Environmental Problems within a given period using available resources. The functions of the ministry include:

- The Formulations of Policies and Strategies aimed at promoting Hygiene and Sanitation, maintenance of a Clean;
- To carry out Environmental Education;
- To enforce all Environmental Laws, Standards and guidelines;
- To collate Environmental Statistics and Gathering of Data Associated with Environmental Impact Assessment (EIA);
- To carryout Environmental Studies;
- To Manage and carryout Forestry awareness campaigns;
- To liaise and Supervise execution of Community Development Programmes initiated by Oil Companies arising from spillage;
- Arbitration in disputes between Oil companies and oil bearing communities arising from environmental concerns

1.6.3.3. Bayelsa State Environmental and Sanitation Authority (BAYSESA)

In 1999 the Bayelsa State Environmental and Sanitation Authority (BAYSESA) Edict was enacted by the State. Among others, the Agency has the following functions: Clear refuse from designated refuse dumps and bins along the streets and corners of the villages, towns and cities in the state; Manage the disposal and recycling of refuse and other waste materials in a manner that will cause little or no harm to the environment and people living in the state; Advise Government in the formulation of waste management policies and in the preparation review of action plans on waste management; and Perform such other functions as may be prescribed by a law of the House of Assembly.

1.6.4 International Guidelines and Conventions

In addition to the national and state legislations, there are also international laws, conventions and agreements to which Nigeria subscribes that will be affected by the proposed development. The proposed development will be developed to comply with the relevant international laws. Among those that will be reviewed and incorporated into the ESIA include the following:

1.6.4.1. Montreal Protocol on Substances that Deplete the Ozone Layer

The protocol was adopted in 1987 as an international treaty to eliminate ozone depleting chemical production and consumption. The protocol also called on industrialized countries to provide technical and financial assistance to developing countries and hence led to the Multilateral Fund for the Implementation of Montreal Protocol (MFMP).

1.6.4.2. United Nations Convention on Climate Change

The convention on the climate change was signed in 1992 during the Rio Earth summit but put into force in 1994. The convention calls on developed countries and economies in transition to limit her emissions of the greenhouse gases which cause global warming, although it does not impose mandatory emissions on developing countries.

1.6.4.3. Convention to Regulate International Trade in Endangered Species of Fauna and Flora

This convention was signed into law in 1973 during the Washington summit and restricts the trade of fauna and flora species termed as endangered organisms.

1.6.4.4. Convention on Conservation of Migratory species of Wild Animals

This convention also known as the Bonn Convention of 1979 stipulates actions for the conversation and management of migratory species including habitat conservation.

1.6.4.5. Vienna Convention for the Protection of the Ozone Layer

This convention was instituted in 1985 and places general obligation on the countries to make appropriate measures to protect human health and the environment against adverse effects resulting from human activities which tend to modify the ozone layer.

1.6.4.6. International Labour Organisation (ILO) Health & Safety Laws

ILO standards on occupational safety and health provide essential tools for governments, employers, and workers to establish such practices and to provide for maximum safety at work. In 2003 the ILO adopted a global strategy to improve occupational safety and health which included the introduction of a preventive safety and health culture, the promotion and development of relevant instruments, and technical assistance. Having adopted more than 40 standards specifically dealing with occupational safety and health, as well as over 40 Codes of Practice with nearly half of the instruments dealing directly or indirectly with occupational safety and health issues, the ILO commits itself fully to fundamental principles of occupational safety and health. Below are some specific ILO international conventions on health and safety.

1.6.4.7 Occupational Safety and Health Convention, 1981 (No. 155)

The convention provides for the adoption of a coherent national occupational safety and health policy, as well as action to be taken by governments and within enterprises to promote occupational safety and health and to improve working conditions. This policy shall be developed by taking into consideration national conditions and practice. The Protocol calls for the establishment and the periodic review of requirements and procedures for the recording and notification of occupational accidents and diseases, and for the publication of related annual statistics.

1.6.4.8 Occupational Health Services Convention, 1985 (No. 161)

This convention provides for the establishment of enterprise-level occupational health services which are entrusted with essentially preventive functions and which are responsible for advising the employer, the workers and their representatives in the enterprise on maintaining a safe and healthy working environment.

1.6.4.9 Promotional Framework for Occupational Safety and Health Convention, 2006 (No. 187)

This Convention aims at promoting a preventative safety and health culture and progressively achieving a safe and healthy working environment. It requires ratifying States to develop, in consultation with the most representative organizations of employers and workers, a national policy, national system, and national programme on occupational safety and health. The national policy shall be developed in accordance with the principles of Article 4 of the Occupational Safety and Health Convention, 1981 (No. 155), and the national systems and programmes shall be developed taking into account the principles set out in relevant ILO instruments. A list of relevant instruments is contained in the Annex to the Promotional Framework for Occupational Safety and Health Recommendation, 2006 (No. 197). National systems shall provide the infrastructure for implementing national policy and programmes on occupational safety and health, such as laws and regulations, authorities or bodies, compliance mechanisms including systems of inspection, and arrangements at the level of the undertaking. National programmes shall include time-bound measures to promote occupational safety and health, enabling a measuring of progress.

1.6.4.10 Kyoto Protocol

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change, which commits its Parties by setting internationally binding emission reduction targets. Recognizing that developed countries are principally responsible for the current high levels of GHG emissions in the atmosphere as a result of more than 150 years of industrial activity, the Protocol places a heavier burden on developed nations under the principle of "common but differentiated responsibilities."

The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005. The detailed rules for the implementation of the Protocol were adopted at COP 7 in Marrakesh, Morocco, in 2001, and are referred to as the "Marrakesh

Accords." Its first commitment period started in 2008 and ended in 2012.

In Doha, Qatar, on 8 December 2012, the "Doha Amendment to the Kyoto Protocol" was adopted. The amendment includes:

- New commitments for Annex I Parties to the Kyoto Protocol who agreed to take on commitments in a second commitment period from 1st January 2013 to 31st December 2020;
- A revised list of greenhouse gases (GHG) to be reported on by Parties in the second commitment period; and
- Amendments to several articles of the Kyoto Protocol which specifically referenced issues pertaining to the first commitment period and which needed to be updated for the second commitment period.

On 21 December 2012, the amendment was circulated by the Secretary-General of the United Nations, acting in his capacity as depositary, to all parties to the Kyoto Protocol in accordance with Articles 20 and 21 of the Protocol.

1.6.4.11 World Bank OP/BP 4.01; Environmental Assessment (EA)

This is one of the Environmental and Social Safeguard Policies of the World Bank. It is used in the Bank to examine the potential environmental risks and benefits associated with Bank lending operations. Under OP/BP 4.01, Bank lending operations are broadly defined to include investment lending, sector lending, rehabilitation lending through financial intermediaries, and investment components of hybrid lending. Prototype Carbon Fund (PCF) and Global Environmental Facility (GEF) co-financed projects are also subject to the provisions of OP/BP 4.01. Under this guideline, The Bank requires Environmental Assessment (EA) of projects proposed for Bank financing to help ensure that they are environmentally sound and sustainable, and thus to improve decision making.

Depending on the project, a range of instruments can be used to satisfy the Bank's EA requirement: environmental impact assessment (EIA), regional or sectoral EA, environmental audit, hazard or risk assessment, and environmental management plan (EMP). EA applies one or more of these instruments, or elements of them, as appropriate. When the project is likely to have sectoral or regional impacts, sectoral or regional EA is required. Other Banks guidelines and procedures that were considered in this study include:

- OP/BP 4.02, Environmental Action Plans;
- OP/BP 4.04, Natural Habitats;
- OP 4.07, Water Resources Management; and
- OP/BP 4.36, Forests;

1.6.4.12 International Finance Corporation (IFC) Performance Standards (PS)

IFC is a member of the World Bank Group which provides investment assistance to private sectors in developing countries. It applies its PSs to manage social and environmental risks and impacts and to enhance development opportunities in its private sector financing in its member countries eligible for financing. The PSs may also be applied by other financial institutions electing to apply them to projects in emerging markets. Out of the eight IFC's Performance Standards established to enable the clients ensure sustainability in projects throughout the life of an investment by IFC or other relevant financial institution, the following were considered in this EIA:

- Performance Standard 1: Social and Environmental Assessment and Management System
- Performance Standard 2: Labour and Working Conditions
- Performance Standard 3: Pollution Prevention and Abatement
- Performance Standard 4: Community Health, Safety and Security
- Performance Standard 5: Land Acquisition and Involuntary Resettlement
- Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management
- Performance Standard 7: Indigenous People
- Performance Standard 8: Cultural Heritage

1.7 The Report Structure

The ESIA is structured into nine (9) chapters, viz:

- Chapter one presents the introduction, study objectives, ESIA terms of reference, scope of work and methodology. It also provides information on the legal and administrative framework for the ESIA in Nigeria as applicable to the proposed project;
- Chapter two examines the justification for the project and its alternatives;
- Chapter three describes the technical details of the project. This includes the project processes, location, technological layout and project schedule;
- Chapter four describes the methods adopted in environmental data acquisition, description of the physical, chemical, biological as well as socio-economic aspect of the proposed project site;
- Chapter five highlights the impact assessment approach as well as the cumulative impact assessment and presents the potential and associated impacts of proposed development;
- Chapter six presents the mitigation measures to be applied and highlight the beneficial impacts of the proposed activities;
- Chapter seven provides the Environmental and Social Management Plan (ESMP) that shall be adopted throughout the project lifecycle. This includes environmental monitoring programme;
- Chapter eight outlines the decommissioning and abandonment plans of the project; and
- Chapter nine highlights the key findings of the study and the conclusions. The list of the references and appendices are included thereafter.

1.8 Declaration

Eraskon Nigeria Ltd hereby declares that the proposed lubricating oil blending plant project shall be executed in compliance with the above stated legal and institutional frameworks. Therefore Eraskon shall take responsibility to mitigate the identified impacts from the proposed project.

CHAPTER TWO

PROJECT JUSTIFICATION

As a contribution to improved local manufacturing of lubricants in the country, Eraskon Nigeria Ltd proposes to build a lubricating oil blending plant in the Izeinbou Bush, Tunama Community, Gbaran Clan, Yenagoa Local Government Area (LGA) of Bayelsa State. The plant shall get its major raw materials from a proposed petroleum refinery located adjacent to the proposed project site.

2.1 Project Benefits

The proposed project has multidimensional objectives. It is partly to get Eraskon Nigeria Ltd more active in the oil and gas sector of the country which presently remains highly underdeveloped thus imposing overpricing on lubricants. The proposed facility shall assist to address the lubricants infrastructure capacity constraints in the country and optimize the use of the products from a neighbouring petroleum refinery. Job creation and increased economic activity in Bayelsa State are also anticipated as a positive impact of this project. The specific objectives of the project are to:

- Provide a locally lubricant manufacturing plant in the south-south 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 DPR and Standards Organization of Nigeria (SON) specifications;
- Increase employment opportunities;
- Raise in GDP;
- Improve socio economic environment of the study area;
- Improve transport, communication, health and educational services through Corporate Social Responsibility;
- support efforts of Bayelsa State to increase its tax revenue
- Maintenance of access roads for the community; and

* Material support to the community and other sundry benefits.

2.2 Need for the Project

The lubricants market in Nigeria has grown over the years with growth in the number of second hand and new passenger and commercial vehicles in the country. Penetration of used cars and requirement of more frequent lubricant changes in older vehicles as compared to newer models contributed to increased volume demand of automotive lubricants in Nigeria.

Even though the total vehicle acquisition in Nigeria decreased substantially from 2014 to 2015, it has been increasing since then. The future outlook of the lubricants industry is thus positive because as the crude oil prices increase, Nigeria's economy is expected to grow at a faster rate and hence the purchasing of lubricant of people is also expected to increase in the coming years. This would push Nigeria's demand for synthetic lubricants, particularly for modern cars. The market is expected to gravitate towards higher-quality, specialized and synthetic lubricants with an increase in end user awareness on the importance of lubricant drains. Eraskon Nigeria Ltd is therefore targeting to fill the lubricant supply gap that is about to emerge in the country.

From the foregoing, the Eraskon Nigeria Limited proposed 50,000 litres lubricating oil blending plant becomes necessary to enhance lubricant oil product supply and distribution in Nigeria. This will eliminate problems associated with low lubricants product supply, boost local economic activities, and generate employment for Nigerians. The project will also stimulate the exploitation of hydrocarbon resources of Yenagoa basin translating into more revenue for the local government, as well as Bayelsa State and indeed the federal government of Nigeria.

2.3 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. It will thus support the country's efforts at reducing dependency on other imported lubricants and crashing its present overpricing.

This project is expected to support the economic base of its host Local Government and be a catalyst to further promote industrial participation in the State's improved internal generated revenue efforts. Furthermore, it is expected to result in the creation of some business and employment opportunities through direct and indirect involvement of communities, consultants, contractors, supplies and other professionals at different stages of the project. It will also assist the country in her efforts to defend the Naira that is presently weak in value.

The estimated cost of the Eraskon Nigeria Limited proposed 50,000 litres lubricating oil blending project is put at about **Thirteen Million, Forty Thousand, Eight Hundred and Seventy United States Dollars, Nine Cents ($13,040,870.09)**. That is **Five Billion Naira (₦5,000,000,000.00)** at the current exchange rate of Three Hundred and Eighty Three Naira, Forty One Kobo (₦383.41) to One United States Dollar ($1).

2.4 Envisaged Sustainability

From the feasibility studies by Eraskon Nigeria Ltd about the status of lubricants demand in Nigeria, it is established that the product is presently overpriced due to its unavailability thus not meeting consumers' demands. It is expected that provision of local manufacturing facility in the south-south region of the country as proposed to be addressed by this project will normalize its price in the region. This shall place consumers' population on the increase in Nigeria at large and in the region in particular as government continues her drive at intensifying local contents development to meet up with the present shortage of lubricants. Efforts are already in place to ensure constants supply of raw materials from the neighbouring petroleum refinery and to ensure that the manufactured product from the proposed facility is regularly released to the market at attractive price especially in the south-south region of the country.

2.4.1 Technical Sustainability

The major raw materials like base oil feedstock for the proposed facility shall be obtained from the neighboring Azikel Petroleum refinery facility (which is about 700 m from the proposed project site) to exact specifications. With this, the use and adoption of best technical practices in the design, construction, installation and operational phases of the project shall engender technical viability of the project. The project shall also be managed by both local and international experienced experts in the Oil and Gas industry. The installation of plants/equipments 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.

2.4.2 Social Sustainability

Assurance of social sustainability can be described as one of the main drives behind the proposed project. The Eraskon Nigeria Limited shall put up a mutually agreeable Memorandum of Understanding (MoU) with Tunama community detailing areas in which the company will support the host community. The MoU will in specific terms detail plans for recruitment of the host community indigenes as well as compensation programme for community land or cultural heritage sites encroached upon (if any). These initiatives will give a sense of ownership to the host community members and as such allow for the sustainability of the project from a social perspective.

2.4.3 Economic Sustainability

The target lubricant products to be manufactured by the proposed Eraskon lubricating 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.

2.4.4 Environmental Sustainability

The project shall be implemented and operated in accordance with guidelines and recommended best practices of the Federal Ministry of Environment (FMEnv), Department of Petroleum Resources (DPR), and that of other local and international environmental management regulatory bodies. The environmental sustainability compliance aspects of the project shall be given utmost attention to ensure the protection of the environment during the entire project lifespan.

Consequently, integration of the findings and recommendations of this ESIA study into the various Environmental Management Plans and phases of the project will also, to a very large extent, see to its environmental sustainability. Finally, the environmental sustainable elements conceived during the concept plan include use of eco-friendly materials (as much as possible), recyclable materials, careful handling of toxic chemicals, usage of environmental friendly products, waste minimization technologies, scientific treatment of waste (where the need arises) and energy recovery possibilities to reduce lubricant blending consumption etc. Specifically:

- The facility 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.

2.5 Project Alternatives

On the basis of technical feasibility, environmental and economic considerations, various project alternatives were considered and evaluated before taking the decision to adopt and proceed with one of the options herein indicated. The alternatives to this project considered were:

- "No Project" option
- "Project" Option

2.5.1 No Project Option

The "no project" option implies that the lubricating oil blending plant project will not be embarked upon by Eraskon Nigeria Ltd. 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 neigbouring 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 Eraskon Nigeria Ltd 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 Bayelsa State through the facility shall be lost.

Decision: Not Recommended.

2.5.2 Project Option

This project option means that the status quo changes and the proponent will proceed with the project thus bringing the proposed site into profitable use. This shall lead to proper utilization of the land and the proponent shall not miss out on the good returns from the lubricating oil blending plant and the economies of scale thus recommended for adoption. However under this option, two different project options were considered at the conception stage.

2.5.2.1 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.

Decision: Not Recommended.

2.5.2.2 Go-Ahead/Execute Project 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 ESIA study as endorsed by the Federal Ministry of Environment.

Decision: Recommended.

2.6 Site Selection

2.6.1 Alternative Site Options

Several site options within Bayelsa state were considered for the proposed Eraskon Nigeria Limited 50,000 litres lubricating oil blending plant taking into consideration the proximity to raw materials, available requisite land take, and access to transportation infrastructure for the distribution of the products, among others. These are some of the required criteria for establishing a lubricating oil blending plant. However, most of the alternative site areas considered were found to be deficient in either one or more of the aforementioned criteria.

2.6.2 Proposed Project Site Selected

Many factors favour the choice of the proposed site. These include availability and closeness to raw materials sources from the Azikel modular refinery, Shell gas gathering facility as well as a number of oil wells in Gbaran clan, including the availability of requisite land size and well-constructed access road. They all make the proposed project site area in Tunama community, Gbaran Clan, Yenagoa LGA, Bayelsa State suitable for siting the proposed project.

2.7 Alternative Technologies

Eraskon Nigeria 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 AND/OR PROCESS DESCRIPTION

3.1 Type of Project

The project under this ESIA study is a lubricating oil blending plant proposed by Eraskon Nigeria Ltd on a land coverage area of about 79248.426 m^2 (7.925ha) in Izeinbou bush, Tunama community, Gbaran clan, Yenagoa Local Government Area, Bayelsa state. It has an installed daily handling capacity of 50,000 litres (50 m^3). The plant will operate on a 20% additive raw materials with 36,000 litres implied daily feedstock for a period of 210 days in a year.`

3.2 Project Scope

This proposed project is for provision of locally manufactured lubricants in Nigeria. Its scope of work includes engineering design and survey, geotechnical investigation, 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

As earlier indicated, the Eraskon Nigeria Limited proposed lubricating oil blending plant is to be located in Izeinbou bush, Yenagoa Local Government Area, Bayelsa state (Figure 3.1). It will sit on an estimated land area of 79248.426 m^2 (7.925 ha) bordered to the west by the River Nun flowing southwards towards the Atlantic. To its North is Koroama, one of the neigbouring communties hosting the project, located at about 1 km of the site. East of the site are the Gbaran NIPP power plant at about 300 m away, as well as the project host community, Tunama, which is roughly about 800 m from the project site. On the Sorthern flank are the Azikel Modular Refinery (700 m away) and the SPDC Gas Gathering Facility (1 km from the site).

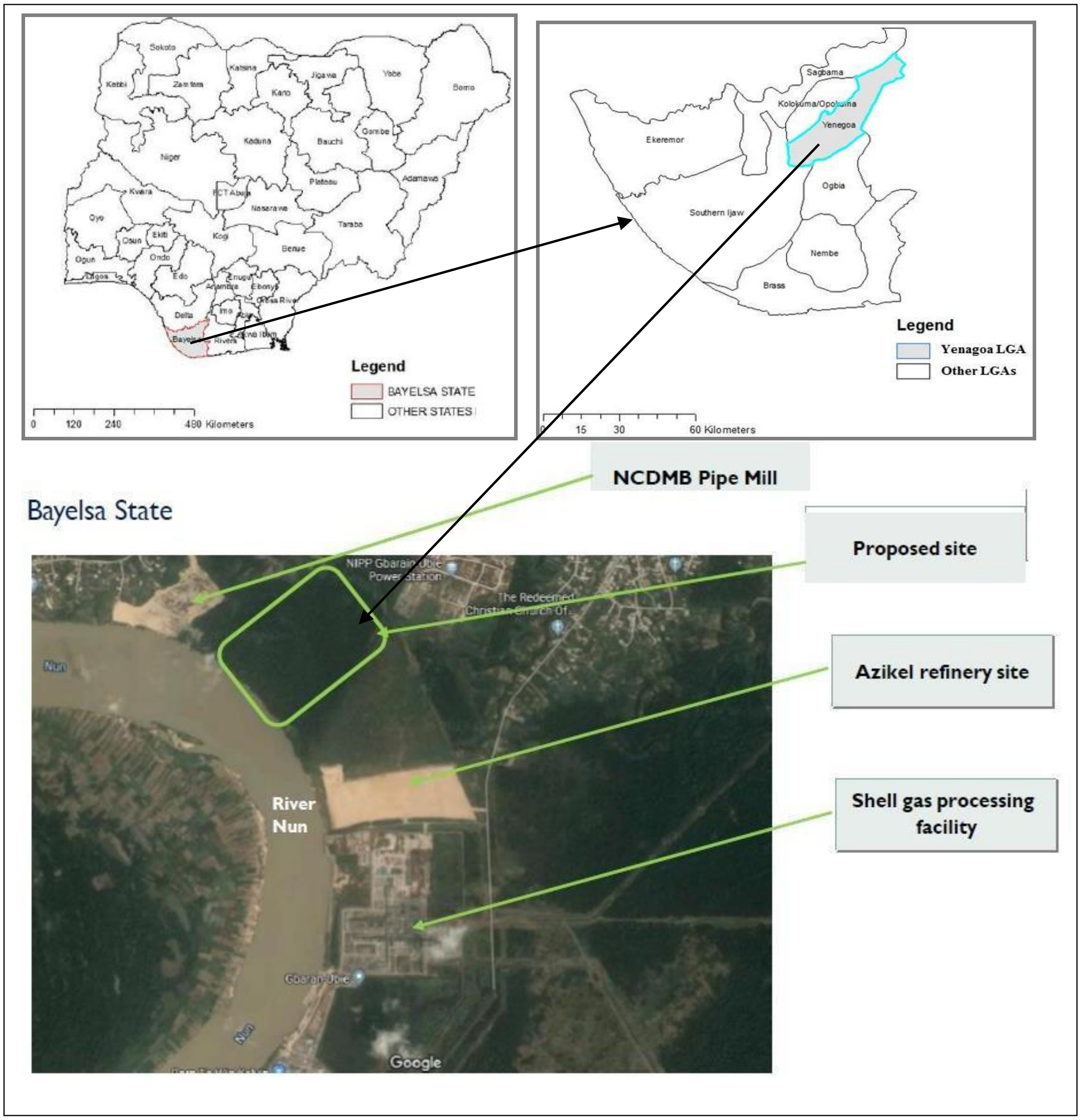

Figure 3.1: Proposed Eraskon Lubricating Oil Blending Plant Location

ERASKON NIGERIA LIMITED

3.4 Material Input/Output and By Products

This study has given adequate attention to material input, anticipated output and the by-product of the proposed project. This is for efficient environmental assessment.

3.4.1 Raw Material Input and Supply

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

- Lube base stock and
- Additives

3.4.1.1 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 summarized in Table 3.1.

Table 3.1: API Base Stock Classification*

Category	Group	Saturates %	Sulphur %	Viscosity Index
Mineral	I (solvent refined)	90	>0.03	80 to <120
	II (hydroprocessed)	≥90	≤0.03	80 to <120
	III (waxy feeds)	≥90	≤0.03	≥120
Synthetic	IV	Polyalphaolefins		
	V (naphthenic)	All other base oils not included above		

**Source: Lynch, T.R (2007) Process Chemistry of Lubricant Base Stocks*

Group I, II, and III are derived from crude oil (mineral oil) while Group IV is synthetic and Group V includes all base oils not in other groups.

3.4.2 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). Its tank arrangements 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.

Table 3.2: Base oil- Feedstock

Feedstock	Base Oil	Quantity (litres/day)
High	SN-150 Base Oil	16,000
Mid	SN-300 Base Oil	10,000
Low	SN-600 Base Oil	10,000

Source: Eraskon Nigeria Ltd

3.4.3 Additives

Additives are substances formulated for improvement of the anti-friction, 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.

The amount of additives used in the blending process can range from as low as 1% up to 30% though this proposed project has adopted 20% level (about 9000 litres per day). Typical engine oil composition is summarized in Figure 3.2.

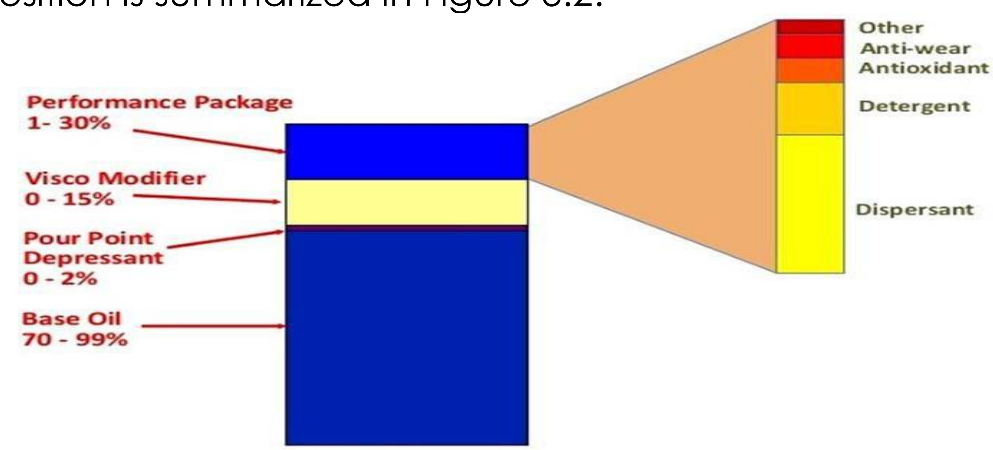

Figure 3.2: Typical engine oil composition

3.4.3.1. 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, Polytetrafluoroethylene (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).

3.4.3.2. 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 LiO_2C $(CH_2)16CH_3$ is metallic soap and an important component of grease.

3.4.3.3. Extreme Pressure (EP) Additives

Whilst AW additives are used with lighter load applications such as hydraulic and automotive engines, extreme pressure additives are commonly applied for direct metal-to-metal contact between the parts under high loads such as in gearboxes. Typical extreme pressure (EP) additives include:

- Chlorinated paraffins;
- Sulphurised fats;
- Esters;
- Zinc dialkyldithiophosphate (ZDDP); and
- Molybdenum disulfide (MoS2).

3.4.3.4. 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.

3.4.3.5. Antioxidants

Antioxidants restrict the formation of organic acids due to oxidation of lube oil, which commonly generates an increase of the oil viscosity, formation of sludge and varnish, corrosion of metallic parts and the effect of foaming. These materials are used as antioxidants:

- Zinc dithiophosphate (ZDP);
- Alkyl sulfides;
- Aromatic sulfides;
- Aromatic amines; and
- Hindered phenols (e.g. 2, 6-di-tert-butylphenol).

The requirement of antioxidants as an additive can be limited, when mainly class II base oils such as N-500 or N-600 are used in the blend and this shall be explored in the propose project.

3.4.3.6. Dispersants

Dispersants are used to keep particulate matter such as abrasion debris, sludge and varnish, dirt, products of oxidation, water etc. in a dispersed state. Typically, dispersants in lubricants are long chain hydrocarbons succinimides, such as polyisobutylene succinimides (Succinimide as known as Pyrrolidine-2, 5-dione is mostly known for its application in industrial silver plating).

3.4.3.7. Viscosity Index (VI) Improvers

Viscosity of oils decreases considerably at high temperatures. Low viscosity downgrades the oil lubrication ability, accordingly. Viscosity index improvers keep the viscosity at acceptable levels (Figure 3.3). They are widely used in multi-grade oils. Acrylate polymers are used as viscosity index improvers in lubricants.

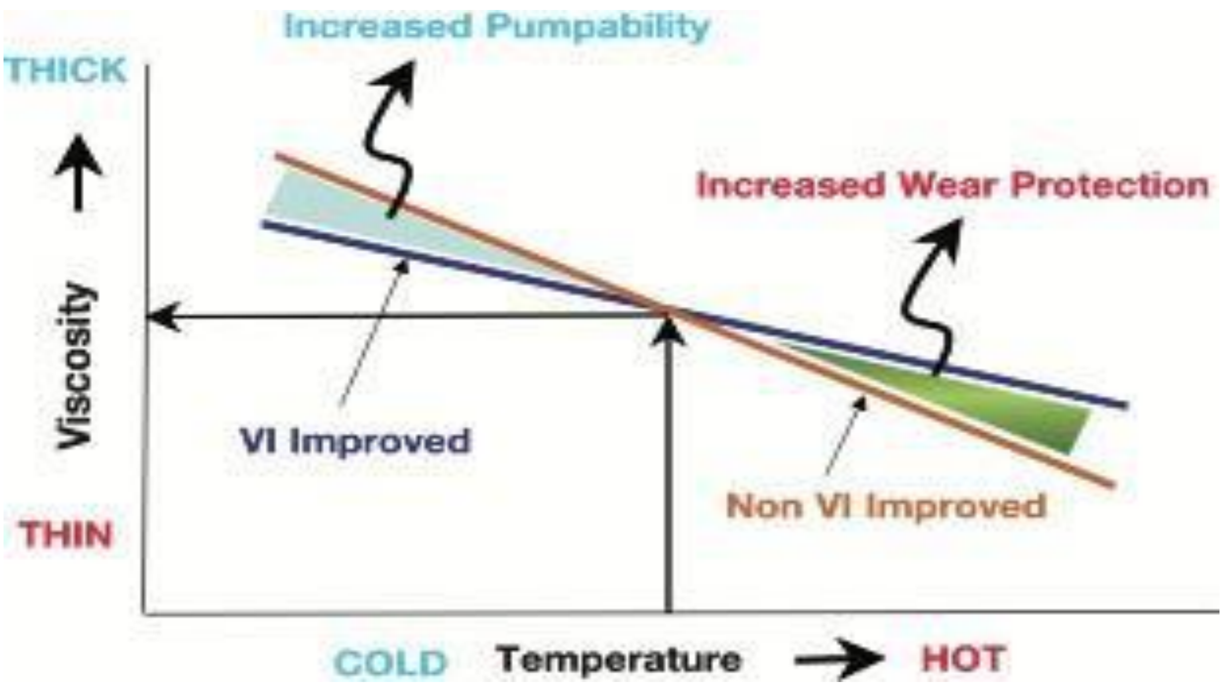

Figure 3.3: Viscosity improvers
Source: Burke Lubricants

3.4.3.8. Anti-Foaming Agents

Anti-foaming agents inhibit the formation of air bubbles in the oil. Foaming enhances oil oxidation but also decreases lubrication effect causing oil starvation. Dimethylsilicones (dimethylsiloxanes) are commonly used as anti-foaming agent in lubricants.

3.4.3.9. Pour point depressants

Pour point is the lowest temperature, at which the oil still may flow. Pour point depressants simply inhibit the generation of wax particles and their agglomeration. Co-polymers of polyalkyl methacrylates are used as pour point depressant in lubricants. The proposed additive specification for the proposed Eraskon lubricating oil blending plant is summarized in Table 3.3.

Table 3.3: Additive specification

Additives	Quantity (litres/day)
Viscosity modifier	3600
Extreme Pressure 220	3600
Extreme Pressure 320	900
Pour point depressants	900

3.4.4 Energy/Power Requirement

The proposed project will source power from the Gbaran NIPP power plant which is just about 300 m from the site. This will be complemented by two (2) units 500kVA power generating set to run on natural gas.

The brief electrical requirements and equipment considered under Outside Battery Limits (OSBL) for the development of the project are as listed below:

- 100 KW, 220V for single phase & 440V for three phase at 50HZ
- Tank farm area and complete terminal street lighting system;
- Small lubricant blending & lighting distribution boards;
- Earthing & lightning protection system;
- Cable carrier system for routing electrical cables.

3.4.5 Water Requirement & Drainage System

The water supply and drainage system 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 in-plant 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.

Geophysical studies of the site area are currently on-going to ascertain 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.

3.4.6 Output

Outputs from the lubricating oil blending plant shall be of both finished products and waste materials which can be categorized as solid, liquid and gaseous emissions. The products shall come out as liquid and semi-solid. Assuming products loss of about 0. 1%, the daily lubricants (both liquid and semi-solid) from the proposed blending plant is anticipated to be 50,000 litres.

3.5 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 Eraskon Nigeria Ltd. 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 practices.

There are two phased waste management tracking plan: waste management during construction phase and operation phase. These shall be handled by the Eraskon Nig Ltd facility management department in collaboration with the Bayelsa 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 levelling 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, packaging materials. They shall be segregated for proper disposal in appropriate waste containers and transported to approved disposal sites by Bayelsa State. Liquid effluents from the facility shall be channelled to waste treatment plant of the facility.

3.5.1 Waste Oil Recycling

As commitment by management to ensure that the proposed lubricating oil blending facility operates in line with best practices and DPR guidelines, a waste oil recycling treatment plant shall be established to take care of lube oil from workshop, petro stations and from the spent lube oil produced by the Eraskon 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 Eraskon.

3.5.2 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 3.4). The clean base oil shall be re-used in the blending process or could be applied as drilling lubricant for oil-based mud elsewhere.

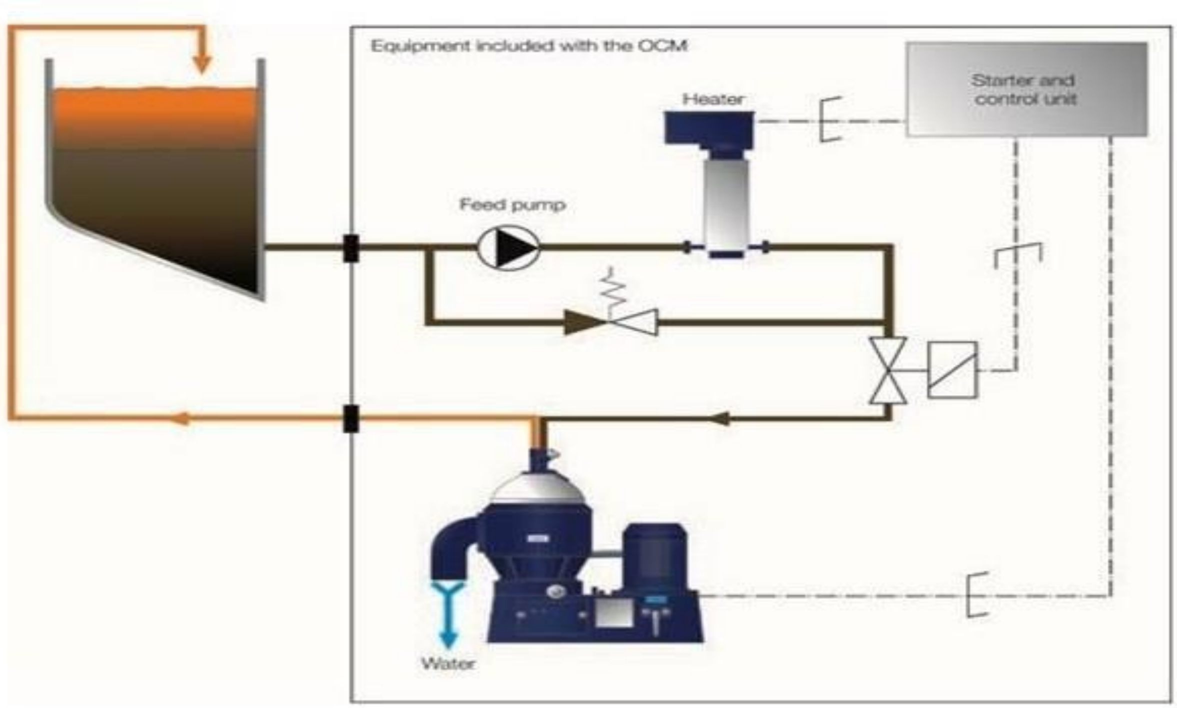

Figure 3.4: Lube oil treatment with disk stack separator

This requires a disc stack separator (high-speed separator centrifuge), where the lube oil 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 3.5) 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.

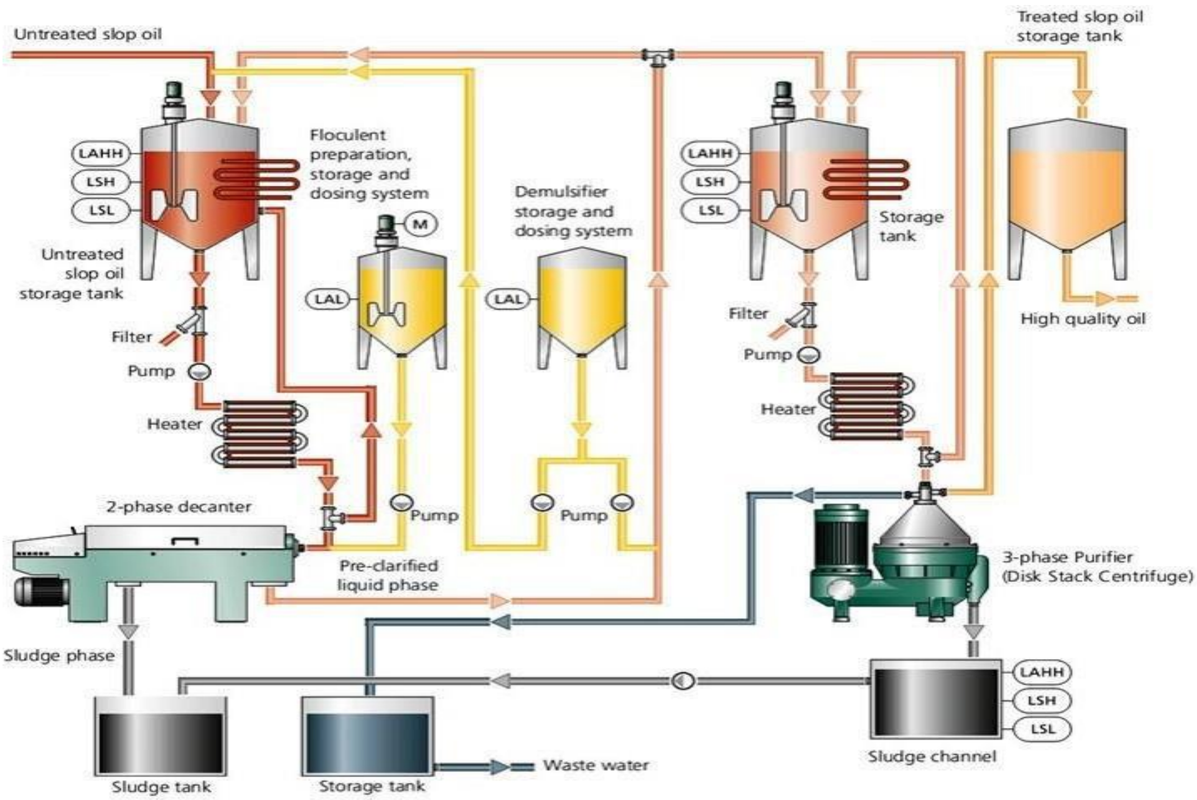

Figure 3.5: Waste oil treatment process with decanter & stack separator

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.

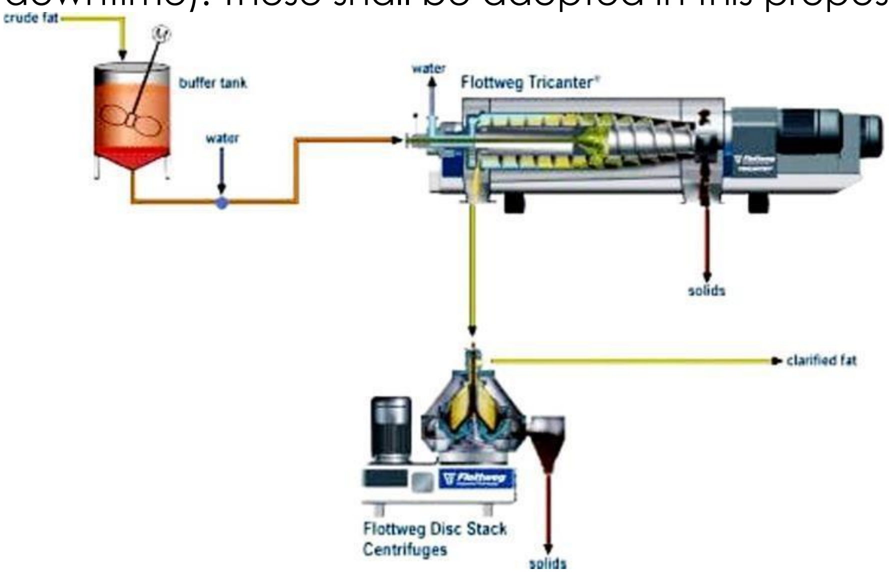

Figure 3.6: Waste oil treatment process with tricanter & stack separator

3.5.3 Air Emissions

The main source of air emissions in the proposed lubricating oil blending facility is fugitive emissions. These are air emissions from the base oil storage tanks and the product storage tanks. Though the proposed project will source power from the Gbaran NIPP power plant located at about 300 m away this will be complemented by two (2) units 500 kVA power generating set thus its identified sources of air pollutants. The total air pollutants anticipated from the power plants are 372.8 kg/day (Table 3.4).

Table 3.4: Anticipated Air Emissions from the 2 x 500 kVA Power Plant

Air Pollutant	Emission (kg/day)
NO_X	24.7
SO_2	1.6
CO	5.3
PM	1.7
VOCs	2.0
CO_2	337.5
Total	372.8

3.6 Technological Layout and Process

A proposed layout for the Eraskon Nigeria Limited lubricating oil blending plant is presented in **Figure 3.7** and **Figure 3.8** while **Figure 3.9** 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 Eraskon lubricating oil blending plant is premised 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.

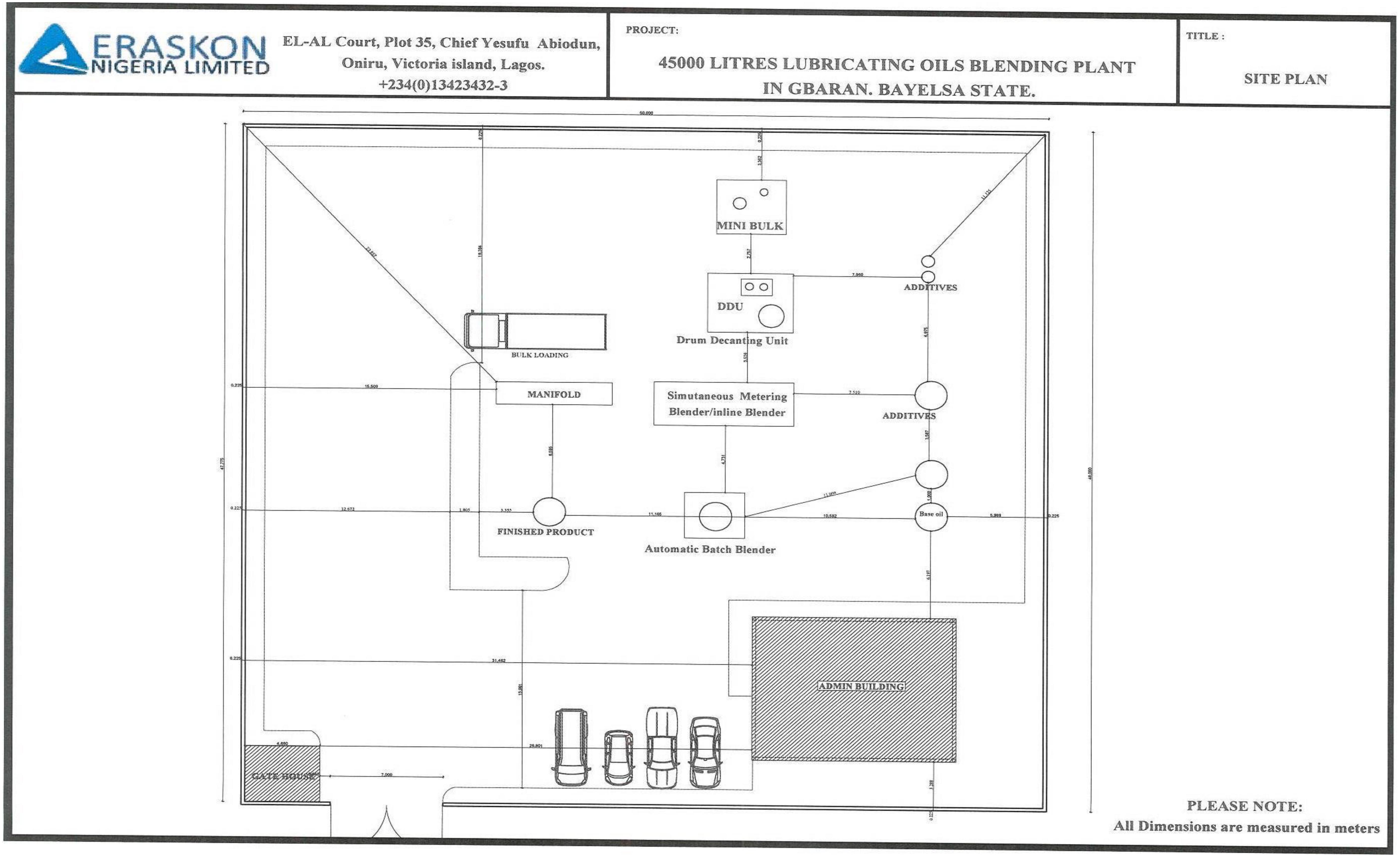

Figure 3.7: Eraskon Nigeria Limited Proposed Lubricating Oil Blending Plan Site Plan

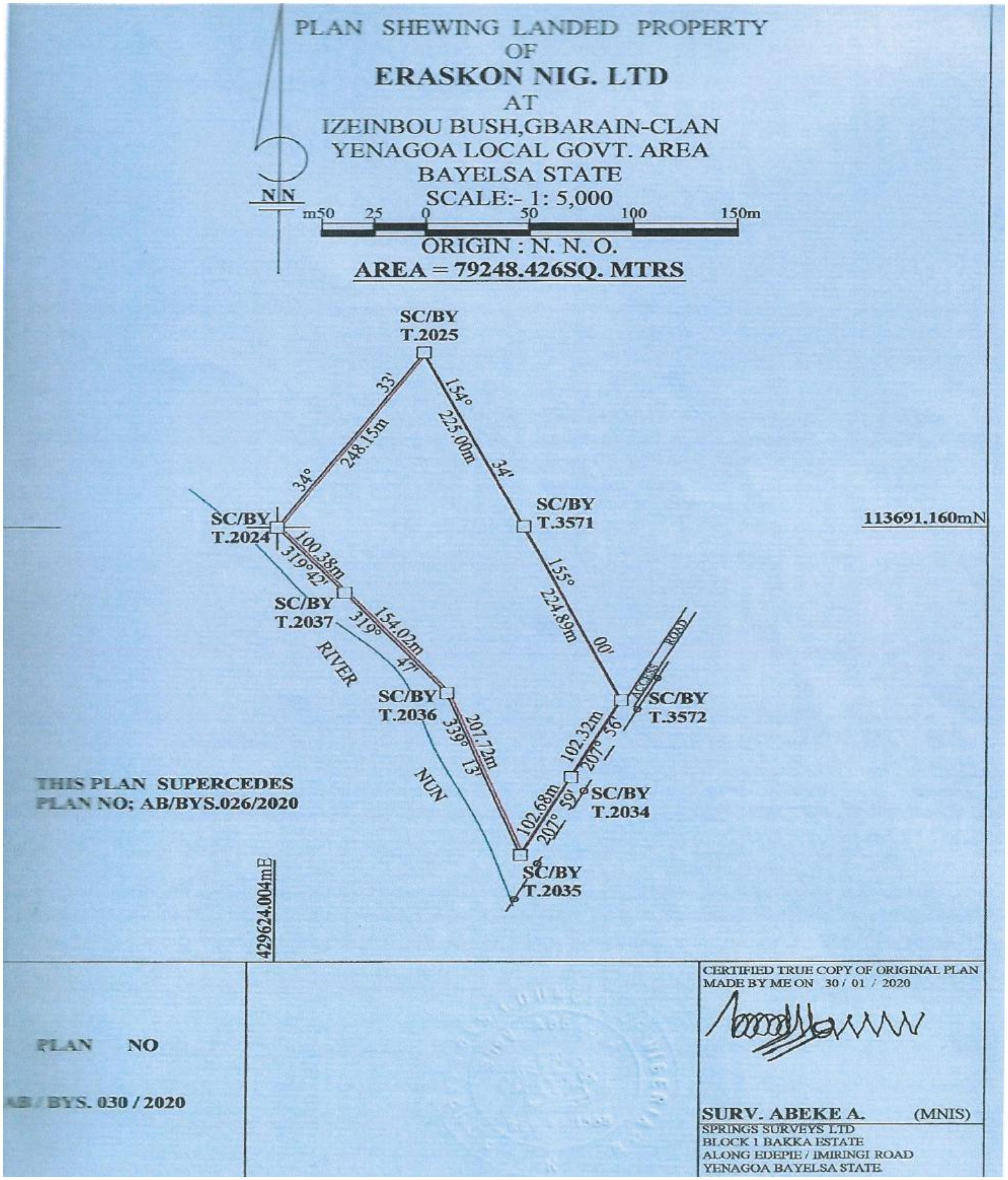

Figure 3.8: Eraskon Nigeria Limited Site Plan

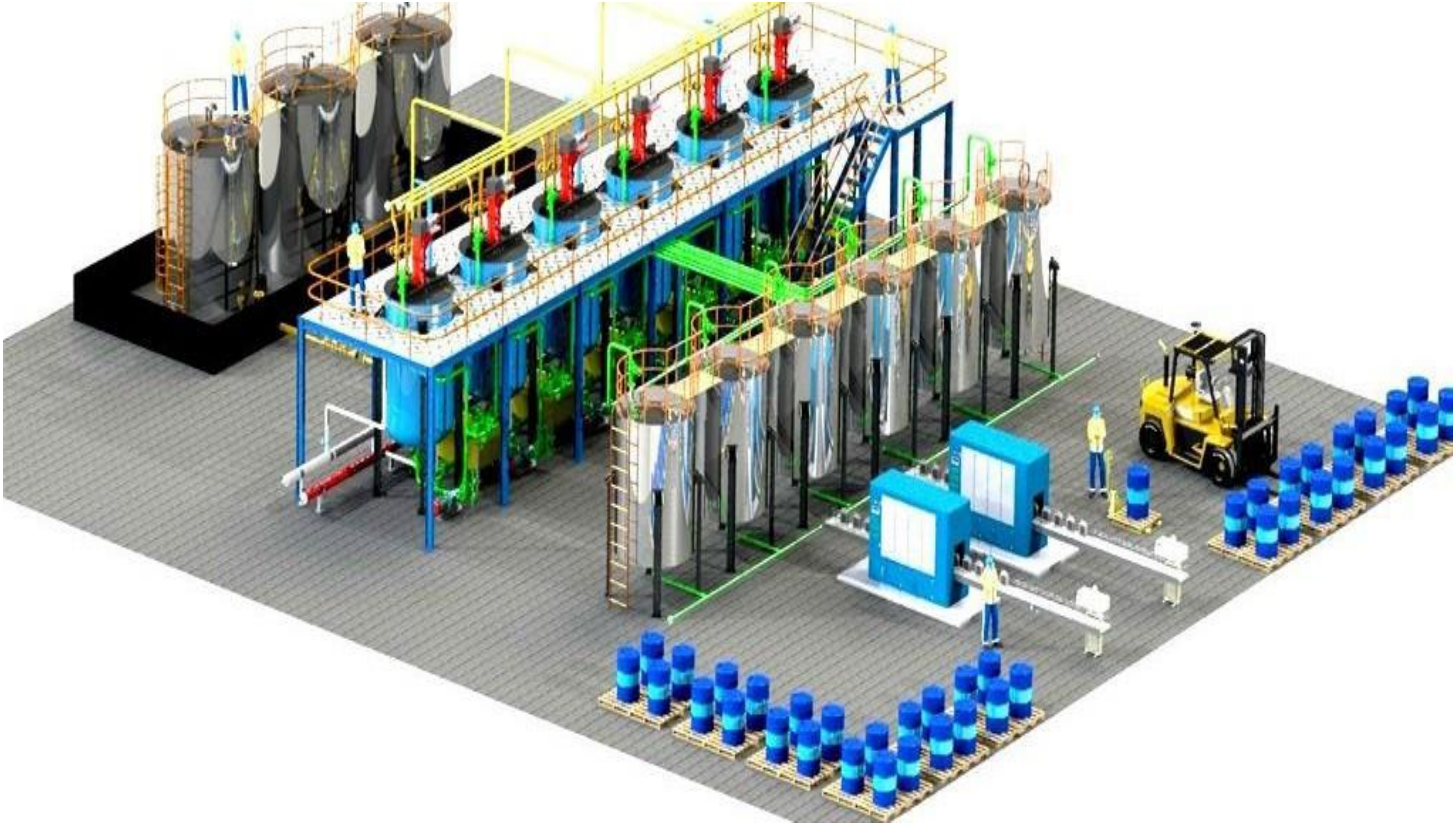

Figure 3.9: Aerial view of the proposed Eraskon Nig. Ltd 50,000litres lubricating oil blending plant

3.6.1 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 3.10. 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).

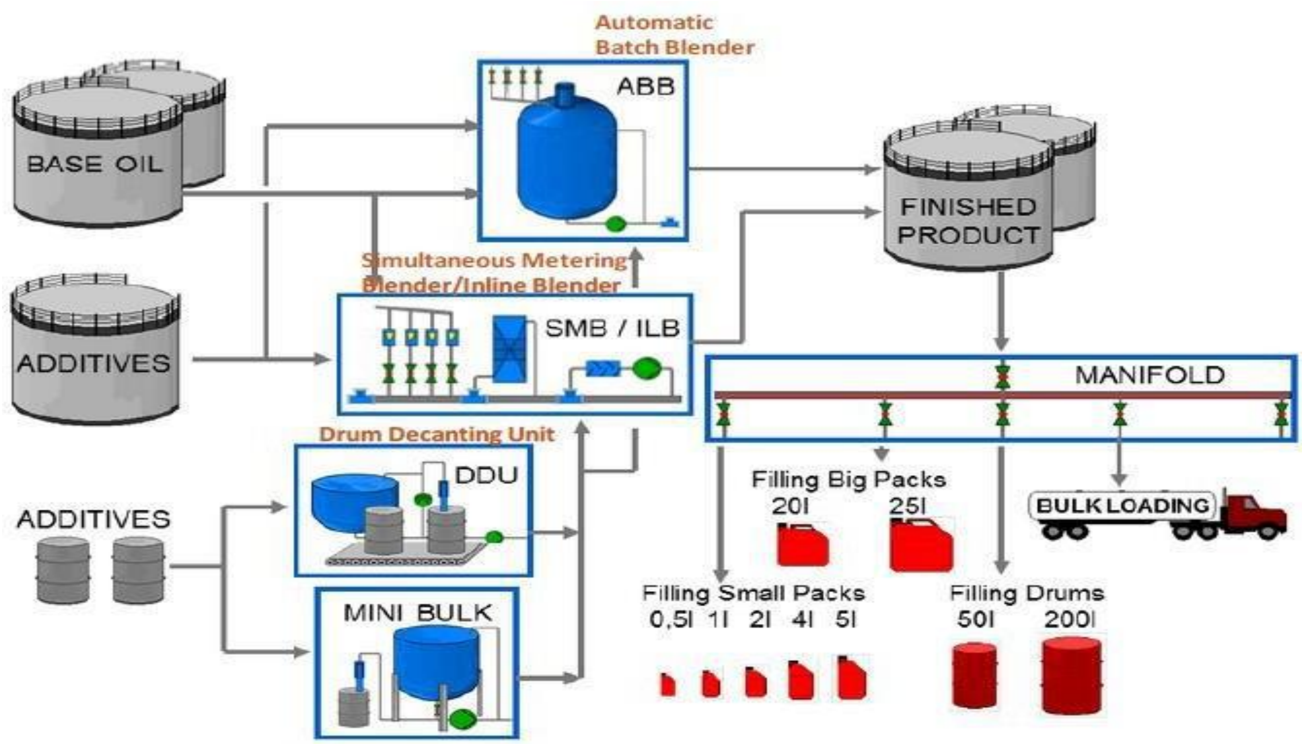

Figure 3.10: Lubricating oil blending process

3.6.2 Automatic batch blender (ABB)

The main function of an Automated Batch Blender (ABB) is to receive, dose and mix base oils and additives in accordance with the pre-defined recipes for the production of lube oils by highly precise dosing of the base oil and additive components with an adapted automation system that leads to an exact and reliable production result (Figure 3.11).

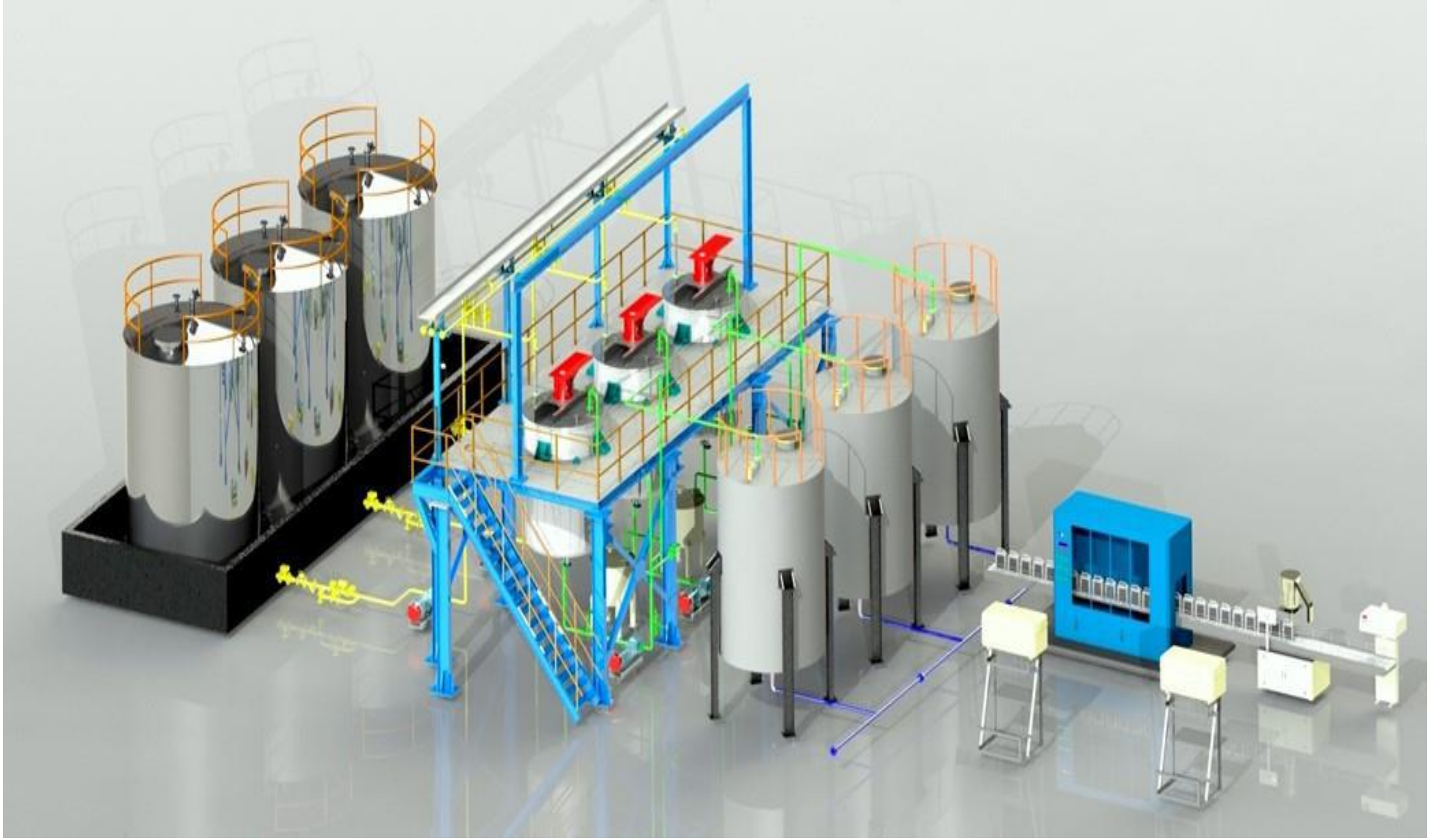

Figure 3.11: Axonometric view of the Proposed ABB plant

The adopted type is the load cell-mounted automated batch blender comprising five basic components: The blending vessel (or kettle) for base oil and additive dosing and blending; A specifically designed mixing system (agitator or dispersing mixer); Load cells, on which the entire system rests; The dosing header for base oils (weigh hopper) and for additives; and An automatic discharge valve at the bottom of the blending kettle.

The blending vessel is commonly made from stainless steel and shall be mounted on load cells in order to perform the required dosing according to customer requirements concerning physical properties and recipe specifications.

Bulk components flows shall be measured in parallel by mass flow meters. The system is connected to the dedicated pipelines for the base oils and additives from the storage tank facilities & dosing to the ABB that will be controlled by the load cells on which the complete system rests. The blending vessel commonly is equipped with external heating systems such as double jacket or welded coils, which can be operated either with saturated steam (which ensures an improved heat transfer) or hot oil in order to lower the viscosity of the batch content in the blending vessel.

The heating system can be split into different zones which are automatically set up according to the filling grade, temperature to minimize the heating of non-covered vessel wall which ensures high quality of the manufactured lubricants. The contamination inside the blending vessel is minimized by using a conical bottom and high-efficient spray nozzle system to flush the vessel after blending a batch. The ABB advantages include minimum contamination, short set-up time, direct weight measurement, and high automation. Another advantage of the ABB technology is that several blending vessels can be arranged in parallel and therefore the system is freely expandable and strongly secure thus strongly supported.

3.6.3 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 the DPR 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.

3.6.4 Process Description

In the lube oil production (summarized in Figure 3.12), blending is the first activity. Blended product then goes to the laboratory for certification and if passed, it is connected to manifolds for pipeline connection to packaging line. In the packaging line, filling of containers through the Bottle Filler is the first activity. From the Bottle Filler, filled containers go to the Capper, then to the Weight Checker. Finally, they go to the Palletizer through Wrap around. Movement of products in the packaging line from the Filler to the Palletizer shall be by conveyor. For products in 4 litres container, about 3.5176 kg of lubricants is expected and these are packed in 4 gallons per cartons; a pallet contains 48 gallons. The packaged products are put into temporary storage pending transport to the clients.

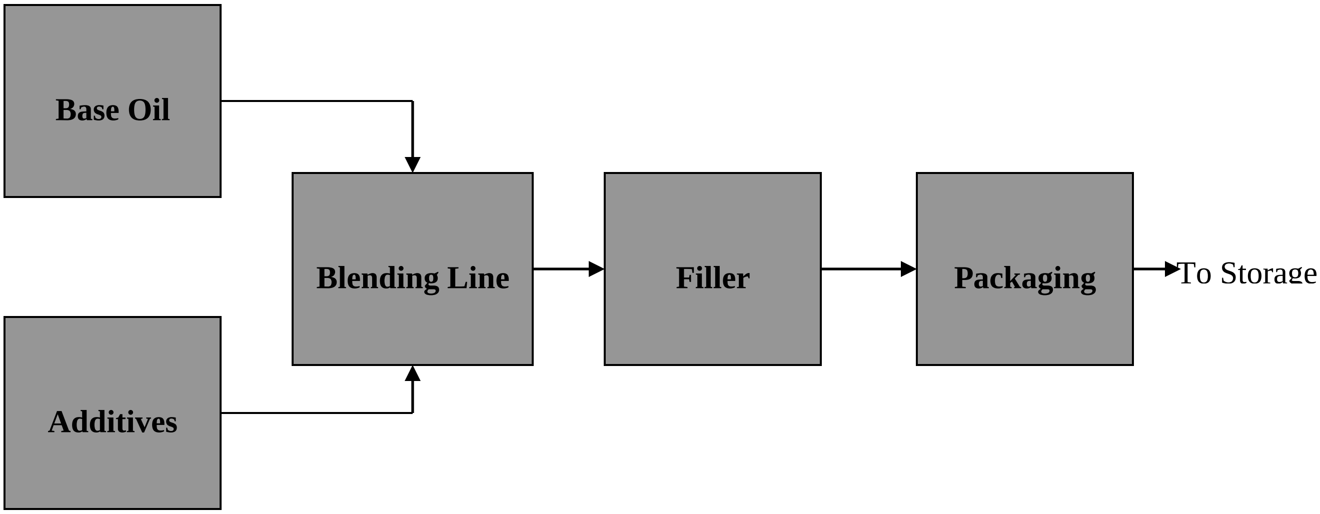

Figure 3.12: Lube Oil Plant Process Flow Diagram

3.7 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.

3.8 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.

3.8.1 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. Eraskon Nigeria Ltd 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, Eraskon has adopted time-tested International standards for lubricating oil blending plant employing new technology, where environmental, safety and economics rule.

3.8.2 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.

3.8.2.1. 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.

3.8.2.2. 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.

3.8.2.3. 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.

3.8.2.4. 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

- **Pipe Spacing**

Piping design (Figure 3.13) will take the following criteria into consideration when determining pipe spacing:

- Personal overall access,
- Fire Protection,
- Displalubricant oils/deflections due to thermal expansion,
- Lifting,
- Installation and operation of spades and line blanks & blinds,
- Valves access and equipment drop down area for maintenance,
- Pipe supports,
- Ease of dismantling for maintenance

½"	90																						
¾"	100	100																					
1"	100	100	130																				
1½"	120	120	130	150																			
2"	120	120	150	150	180																		
3"	140	150	150	180	180	200																	
4"	170	170	180	200	200	200	230																
6"	200	200	230	230	230	250	250	300															
8"	230	230	250	250	280	280	300	330	350														
10"	260	260	300	300	300	330	330	380	400	430													
12"	300	300	330	330	330	350	350	400	430	460	480												
14"	330	330	340	340	350	360	380	400	430	460	490	500											
16"	360	370	370	380	380	400	410	440	460	490	510	530	550										
18"	390	400	400	410	410	430	440	470	490	520	550	560	590	610									
20"	430	430	430	440	450	460	470	500	530	550	560	590	620	640	670								
22"	460	460	470	470	480	490	510	530	560	590	610	630	650	680	700	730							
24"	500	500	500	510	510	530	540	570	590	620	650	660	690	710	740	770	790						
26"	530	530	530	540	550	560	570	600	630	650	680	690	720	740	770	800	830	850					
28"	560	560	560	570	580	590	600	630	660	680	710	730	750	780	800	830	860	870	900				
30"	590	590	600	600	610	620	630	660	690	710	740	750	780	800	830	860	890	910	930	960			
32"	610	620	620	630	630	650	660	690	710	740	770	780	810	830	860	880	910	930	960	990	1010		
34"	640	650	650	660	660	680	690	720	740	770	790	810	840	860	890	910	940	960	980	1010	1040	1060	
36"	670	680	680	690	690	710	720	750	770	800	830	840	870	890	920	940	970	990	1020	1050	1070	1100	1120
Pipe Size	½"	¾"	1"	1½"	2"	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"	22"	24"	26"	28"	30"	32"	34"	36"

Figure 3.13: Minimum Pipe Spacing's to be considered

- **Clearance and Accessibility**

The minimum clearance between pipes, flanges with insulation in the same plane will be 100 mm. The layout will take into cognisance, the operation and maintenance requirements, ensuring sufficient access around equipment. The minimum vertical clearance from grade to the bottom of pipe, supports, insulation, flanges, valves or hand wheels shall conform to the following specifications:

- Clearance over plant roads for trucks / major mobile equipment – 6 m;
- Clearance over general plant areas accessible to mobile equipment – 4.5 m;
- Clearance for passageway for personnel (headroom) - 2.1 m;
- Clearance over pumps from high point of grade – 3 m;
- Clearance below pipes on sleepers – 0.2 m;
- Clearance below blinded/plugged end of drain valves – 0.15 m.

The minimum horizontal clearances in front of equipment, pipe, insulation, flanges, valves, instruments or hand wheels shall conform to the following:

- Clearance on platforms in front of instruments – 0.75 m (or as required for element removal);
- Maintenance access around equipment – 0.9 m;
- Clearance from Building walls or solid structures where it is not a through route - 0.3 m;
- The minimum widths of roads and access ways shall conform to the following;
- Width of main plant roads – 6 m;
- Width of aisle for forklift truck – 2 m;
- Width of staircase, passageways and elevated walkways – 0.9 m;
- Width of stairways on tanks – 0.7 m

3.8.2.5. 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.

3.8.2.6. 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

3.8.2.7. Storage Tank Piping

- **General**

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.

3.8.2.8. Tank Valve

- Block/ Isolation valves at tanks will be steel and will be bolted directly to flanged tank nozzles as much as practicable,
- Suction and filling lines will be vented to relieve pressure from line contents of thermal expansion,
- Non-return valves will be considered for the main tank inlet lines

3.8.2.9. Instrument Hook-up

- Connections for local gauges will be located such that instruments can easily be read from grade or platform,
- All gauge glasses and instruments in process services will be provided with a minimum of NPS ½" flanged/screwed tapping connections, for fuel oil 2" Flanged connections shall be considered,
- Bypass lines with isolation valves will be designed, inline, for critical instruments as per process schemes for ease of maintenance.

3.8.2.10. Utilities

For the utilities sourced from ISBL, utility lines will be tapped for use at the OSBL service points/stations where they shall be terminated.

Piping for firefighting system which is under OSBL will be fully designed. Provisions for piping connection points of areas under ISBL will be made as per project battery limits schemes.

3.8.2.11. 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.

3.8.2.12. 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

3.8.2.13. 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

3.8.2.14. 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

3.8.2.15. General Site Design Data

Details of the environmental considerations for the design are summarized in Table 3.5. Local data codes will be used for the determination and application of all environmental loads (rainfall and wind loading) and seismic loads, in the absence of such details a more conservative design assumptions may be considered, though with due consideration for economics of the design.

3.9 Project Activities

As earlier indicated the proposed project comprises design, installation and operation of lubricating oil blending plant. It shall comprise of the following components:

- Tank farm
- Base oil storage tank
- Additives storage tank
- Blending facility i.e the Automatic Batch Blender (ABB)
- Metering skids
- Drum Decanting
- Pump and piping
- Final product storage
- Reception and loading bays (tank trucks

To achieve the project set objectives, the specific activities to be carried out include:

- Stakeholder engagement;
- Pre-construction
- Procurement

Parameters	SINGLE GRADE			MULTI GRADE		ASTM TEST METHOD
	SAE 30	SAE 40	SAE 50	15W 40	20W 50	
Appearance	Bright & clear	Bright & clear	Bright & clear	Bright & clear	Bright & clear	Visual
Colour (ASTM)	Report	Report	Report	Report	Report	ASTM D1500
Specific Gravity at 15°C (Typical)	0.870	0.880	0.890.	0.880	0.885	ASTM D1298
Kinematic Viscosity@40°CcSt (mm²/sec)	Report	Report	Report	Report	Report	ASTM D445
Kinematic Viscosity@100°CcSt (mm²/sec)	9.3-12.5	12.5-16.3	16.3-21.9	12.5-16.3	16.3-21.9	ASTM D445
Viscosity Index (VI) min	95	95		120	120	ASTM D2270
Sulphated Ash wt%	Report	Report	Report	Report	Report	ASTM D874
Phosphorus % m/m	Report	Report	Report	Report	Report	ASTM D4951 D5185
Water content % vol. max	0.025	0.025	0.025	0.025	0.025	ASTM D95
Flash Point COC °C min	204		220	220	220	ASTM D92
Pour Point °C max	-18	-9	-9	-21	-21	ASTM D2097
Cold Cracking Simulation (CCS) cP	N/A	N/A	N/A	7000 @ -20 °C	9500 @ -15°C	ASTM D5293
Shear stability @ 100°C (Cst) at30cycles	Must remain in original SAE viscosity grade					D 6278 D 6709
Viscosity at high temperature and high shear rate @ 150°C and 10^6 s^{-1}shear rate mPa.s (min)	2.9	3.5	3.7	3.7	3.7	D4683 D4741
Evaporative loss % max	22	22	22	22	22	ASTM D5800
Foaming Tendency Sequence i. foaming/settling max Sequence ii. " Sequence iii. "	10/0 50/0 10/0	10/0 50/0 10/0	10/0 50/0 10/0	10/0 50/0 10/0	10/0 50/0 10/0	ASTM (option A) D892
Homogeneity and miscibility	ALL grades shall remain homogenous and when mixed with ASTM reference oils shall remain miscible.					ASTM D 6922

Figure 3.14: Technical requirements for engine lubricating oils

Source: NIS 370

Table 3.5: Project Site Environmental Data

Parameter	Description
Site Location	Yenagoa, Bayelsa State, Nigeria
Altitude	+18 to +23 m from MSL
Relative Humidity	Average 54-85 % Maximum being 100 %
Mean Monthly Ambient Temp. (Max)	28 °C
Mean Monthly Ambient Temp. (Min)	25.4 °C
Highest Maximum Ambient Temp	33°C
Lowest Ambient Temp	22°C
Atmosphere	Often contains fine dust and pollutants
Solar Radiation	400 W/m²
Rainfall	Regular, but heavy-design max intensity of 50 mm/hr and 150 mm/day and 472 mm/month.
Wind Velocity	40 m/sec, 3 sec gust 0-7 m/sec (Normal)
Seismic Zone Category	Zone 2A
Design Temp.	Maximum @ 50°C for equipment directly exposed to solar radiation and @ 33°C for equipment protected from direct solar exposure. 12°C - Minimum

- Construction and Commissioning
- Demobilization;
- Operation and Maintenance of facility; and
- Decommissioning and abandonment

In view of the significance of the afore-mentioned activities which will ensure realization of the project, this ESIA has taken cognizance of the environmental sensitivities of the project area. This is to as much as possible, ensure minimization of adverse impacts.

3.9.1 Landtake

As earlier indicated, Eraskon Nigeria Limited has acquired 79,248.426 m^2 (7.925 Ha) of private land for the proposed lubricating oil blending plant in Tunama Community, Gbaran-Clan, Yenagoa LGA, Bayelsa state. The acquired land area has a topography that can generally be described as relatively plain with an elevation of between 20 and 21 m above mean sea level. Thus, major levelling is not envisaged. However, land filling of up to 2.0 m (average) is recommended due to its proximity to River Nun. Detailed geotechnical studies will help to plan the design of foundations for the processing plants as well as other ancillary structures within the facility. The land is close to environmentally sensitive area/features like River Nun and the seasonal swamp. Effort shall be put in place in accordance with relevant guidelines in ensuring that the activities of the Eraskon Nigeria Limited during operational phase does not affect environmentally sensitive areas.

The land was acquired from the Tunama family of Tunama community, Gbaran clan and all financial as well as land transfer issues have been sorted out between the former land owners and Eraskon Nigeria Limited.

3.9.2 Construction Materials Requirement

3.9.2.1. Procurement

Materials, plant and equipment selection and procurement shall take into full consideration, economics, existing technologies, possible alternatives and their associated environmental effects. Those with low/minimal environmental impacts and carbon foot-print shall be selected, procured and installed in accordance with standard procedures by qualified professional personnel.

3.9.2.2. Construction

The actual construction work shall commence after all necessary approvals and permits have been duly obtained. The construction phase includes advance work, such as soil investigation and site preparation activities.

The detailed soil investigation of the proposed site is currently on-going. The study outcome shall be an integral input into the oil blending plant foundations design.

The site preparation activities shall start and be carried out upon the issuance of revised and confirmed project implementation schedule which is dependent on financing framework and availability. During the entire construction period, a large number of temporary, short-term construction jobs will be created. These will range in duration from several months to about two years. Labour and skill requirement shall include:

- Mechanical crafts (construction of machines, pipes, etc.)- such as pipe fitters, certified pipe welders (for carbon, stainless, nickel), riggers, mechanics, foreman, and semi-skilled labourers;

- Civil (erection of structures, tanks, industrial and non-industrial buildings) - such as form workers, carpenters, rebar workers, concreters, surveyors, structural steel, erecters, non-industrial builders, foreman and semi-skilled labourers;

- Electrical and instrumentation - such as cable pullers, electric technicians, instrumentation technicians, foreman and semi-skilled labourers;

- Cross-functional support - including insulators, sheet metal workers, painters, scaffolding, site preparation, ground improvement, temporary facility operators, heavy lifting, crane operators, construction office and foremen; and

- Other labour - such as security guards and drivers.

The existing roads outside the proposed site shall continue to be used for movement of personnel and materials during the construction phase. Offices, workshops and lay-down areas shall be situated within the Oil Blending plant acquired land. These areas will be needed for:

- Equipment and materials lay-down
- Vehicle maintenance shop
- Paint shop
- Fabrication shop/yard
- Insulation shop

- Concrete batching plant, among others.

3.9.2.3. Commissioning

Commissioning procedure shall be carried out to meet the international standards after which the lubricating oil blending plant and its supporting facilities shall be put to use to achieve the set objectives.

3.9.2.4. Demobilization

Upon completion of construction works and commissioning, the project site shall be cleaned up. Also Eraskon shall certify the completion of these activities as well as confirm that no genuine community claims are outstanding before authorizing the contractor to demobilize.

3.10 Personnel Requirement

Labour is a major force in any industry in-spite of automation, for having control over the equipment and maintenance etc. Table 3.6 indicates the minimum manpower requirements in the plant.

Table 3.6: Manpower Requirement

Description	Mobilization	Construction	Operation	Decommissioning
Manager	1	1	1	1
Lube Technologist	1	1	1	1
Lab Manager	1	1	1	1
Store Keeping	1	1	1	1
Office Help	1	1	1	1
Labour	15	15	15	15
Total	**20**	**20**	**20**	**20**

3.17 Project Schedule

The project schedule for the Eraskon Nigeria Limited proposed lubricating oil blending Plant in Tunama Bush, Izeinbou Bush, Gbaran Clan, Yenagoa LGA, Bayelsa State is as illustrated in Table 3.7. A total of about fifty (50) months is required for the activities.

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Table 3.7: Project Implementation Schedule

S/N	Task	Duration (Months)																							
		2020						2021						2022						2023					
		2	4	6	8	10	12	14	16	18	20	22	24	28	30	32	34	36	38	40	42	44	46	48	50
1.	Acquisition of the Lubricating Oil Blending Project Land																								
2.	Application to the Department of Petroleum Resources (DPR) for the Permit to Establish (PTE)																								
3.	Preliminary Site Studies including Geotechnical Ground Investigation, Geo Physical Survey etc.																								
4.	Environmental and Social Impact Assessment Study																								
5.	Application to the DPR for the Approval to Construct (ATC)																								
6.	Civil Construction Works																								
7.	Main Equipment Supply and Installation																								
8.	Facility Test Run																								
9.	Application to the DPR for the License to Operate (LTO)																								
10.	Lubricating Oil Blending Plant Operation																								

CHAPTER FOUR

DESCRIPTION OF THE PHYSICAL AND SOCIAL ENVIRONMENT

4.1 Introduction

Baseline information on the environment of any particular location is a crucial component of environmental studies. Apart from giving an idea of the existing status of an environment in which a project is to be located, baseline information also serves as a benchmark against which future measurements can be compared.

This chapter describes the existing environmental conditions including geology, hydrogeology, soil, ecology, climate, baseline conditions for air, soil, water, and ecology as well as socio-economic analysis of the proposed Eraskon Nigeria Limited 50,000 litres lubricating oil blending plant project location. The elements captured within this chapter also include overview of the methodology adopted for the collection of baseline information around the proposed site. Furthermore, an overview of the findings from the study area is aptly captured.

For the field data gathering, wet season sampling was carried out between the 4th and 6th of August, 2020 within the hours of 8.00am and 6.00pm. There was morning sampling done between 8.00am to 10.00am, afternoon sampling between 12.00noon to 2.00pm and evening sampling between 3.00pm to 6.00pm. The averages of the readings from the three sampling periods are presented in the latter part of this chapter. Dry season baseline environmental records were obtained (with the permission of the Environmental Assessment (EA) department of the Federal Ministry of Environment) from the Final EIA report of Adibawa-Gbaran 3D Reshoot Seismic Data Acquisition Project in Bayelsa and River States. The records were obtained *in-situ* in January, 2015.

Also visual observations, on-site measurements and collection of samples for laboratory analysis/testing was carried out. Labchemnec Jans Limited (an accredited laboratory with the Federal Ministry of Environment with its head office located at No.

5 Port-Loko Street, Wuse Zone 3, Abuja) carried out all the laboratory tests. Furthermore, multi-disciplinary team of experts comprising of Socio-economists, Ecologists, Water quality experts, Soil scientists, Environmental Scientists, Remote sensing and GIS data analysts were involved in the fieldwork as supervised by the Federal Ministry of Environment (FMEnv) through their representatives.

4.2 Data Source

Data presented in this chapter were obtained from a combination of sources, including review of literature (previous publications on the project environment and similar environments); previous studies around the project area, maps, satellite imageries, academic study reports, research papers etc. These were obtained from governmental departments including the Federal Ministry of Environment (FMEnv), Department of Petroleum Resources (DPR), Bayelsa State Ministry of Environment, National Environmental Standards and Regulations Enforcement oil Agency (NESREA), Universities, Research Institutes, and Non-Governmental Organisation (NGOs). Information on the climate of the project area was obtained from the Nigerian Meteorological Institute (NIMET). For this purpose, climatic data spanning a period of 33 years (1986-2019) was obtained.

4.3 Baseline Data Acquisition Methods

Baseline data of the study area was gathered using a combination of field studies; analysis of maps, plans, aerial photos; review of background project documents (feasibility studies); structured interviews; social surveys. Online researches were also carried out. Below are the various study approaches and data acquisition methodologies that were adopted.

4.3.1 Baseline Study Team

Considering the inter-disciplinary need for conducting the ESIA, Geo Environmental Resources Limited (GERL) ensured that relevant and well experienced team was assembled to deliver on the set objectives. To achieve this, a multi-disciplinary team of experienced scientists, socio-economists, GIS/Data analyst, ecologists and environmental scientists among others were assembled to carry out the required resource assessment, generation and analysis of baseline data, determination of potential impacts and recommendation of mitigation measures. An interactive approach among the environmental team members and other project professionals was adopted and facilitated by team meetings as required.

4.3.2 Sampling Design & Distribution

Sampling design and distribution was adopted in order to adequately characterize the study area. A comprehensive study was carried out for all environmental and social components as presented in Table 4.1.

Table 4. 1: Environmental components and sampling methodologies

S/No.	Environmental component	No. of Samples	Methodology
1.	Air Quality/ Climatology	15 + Control	• 4 in 1 Multi-function environment meter. • BW Technologies GAXT-A2-DL Gas Alert Extreme High Range Ammonia (NH3) Single Gas Detector, 0-400 ppm Measuring Range, • AS8905 high-precision portable industrial sulfur dioxide gas detector tester meter SO2 Monitor analyzer, • NO2 Gas Detector Nitrogen Dioxide Gas Analyzer with Alarm System Gas Leak Detector Portable NO2 Industrial Gas Monitor Sensor, • BH-4S 4 in 1 Combustible Gas Detector Oxygen O2 Carbon Monoxide Hydrogen Sulfide Toxic And Harmful Gas Concentration Detector Leak Detector COD, • Temtop M2000 Air Quality Monitor for PM2.5 PM10 Particles CO2 HCHO Temperature Humidity; and • AcuRite 01512 Wireless Weather Station with 5-in-1 Weather Sensor: Temperature and Humidity Gauge, Rainfall, Wind Speed and Wind Direction.
2.	Surface water (surface water bodies within the project influence)	4 + Control	HANNA HI 93414 in situ meter was used to determine dissolved oxygen (DO), pH, electrical conductivity (EC), total dissolved solids (TDS) and water temperature (T). Other water parameters with long holding analytical time will be preserved and analysed in a laboratory.
3	Groundwater (groundwater bodies within the project influence)	4 + Control	HANNA HI 93414 in situ meter was used to determine dissolved oxygen (DO), pH, electrical conductivity (EC), total dissolved solids (TDS) and water temperature (T). Other water parameters with long holding analytical time will be preserved and analysed in a laboratory.
4	Sediment		Sediment samples was collected into aluminium foil using Eckman Grab

S/No.	Environmental component	No. of Samples	Methodology
5	Soil	11 + control	Stainless steel screw-type soil auger. A composite sample was collected from 0-15cm and 16-30cm to represent top soil and bottom soil respectively.
6	Plankton		Phytoplankton and zooplankton species was collected with a plankton net. In situ visual identification and lab analysis methods was used.
7	Benthos		Sediment samples was collected with wide mouth glass bottles using stainless steel Eckman Grab.
8	Vegetation and wildlife		The area was divided into transects for sampling. Both in situ identification and ex situ herbarium analysis was carried out on the vegetation samples.
9	Noise and other Nuisances	15 + control	4 in 1 Multi-function environment meter was used for measuring noise level in-situ.
10	Geology and Erosion		Field survey and desktop review.
11	Socio-economics and health survey		Semi structured interviews, focus group discussion, consultations and grievance procedures.
12	Transport study		Visual assessment and desktop review.

Source: Federal Ministry of Environment (FMEnv)

4.3.3 Air Quality Assessment Method

The spatial boundary for the air quality assessment of this project was limited to 2 km radius. This is essentially so due to the land take (79,248.426 m^2) for the proposed project. For sampling of the air quality, the duration was between the hours of 8.00 am and 6.00 pm with average concentrations collated for presentation. The following specific air quality assessment were carried out:

- Micro and macro-climatology: Ambient temperature, relative humidity, rainfall, wind speed, wind direction, etc.
- Toxic gases: SOx, NOx, COx, H_2S, NO_X etc.
- Suspended Particulate Matter (SPM)
- Ambient Noise level, vibration, visual impact, odour, heat.

As presented in Plate 4.1, *in situ* monitors deployed were:

- 4 in 1 Multi-function environment meter.
- BW Technologies GAXT-A2-DL Gas Alert Extreme High Range Ammonia (NH_3) Single Gas Detector, 0-400 ppm Range,
- AS8905 high-precision industrial sulphur dioxide monitor;
- NO_2 Analyzer;
- BH-4S Combustible Gas Detector for O_2, CO, H_2S;

- Temtop M2000 Monitor for $PM_{2.5}$ PM_{10} CO_2 HCHO Temperature Humidity; and
- AcuRite 01512 Wireless Weather Station for: Temperature and Humidity Gauge, Rainfall, Wind Speed and Wind Direction.

Plate 4.1: In-situ quality Monitors Deployed during the Study

4.3.4 Vegetation Characterization Method

The spatial boundary for the vegetation studies is 2 km radius of the project site. Quadrat count method was adopted. Two (2) quadrats 100 m x 100 m was taken, one within the proposed project site and the other one was taken in Tunama community at an undisturbed area. Samples were collected and identified at the herbarium by a trained botanist. The general characterization of the vegetation of the study area includes the common name, botanical name, life forms, level of abundance, family uses and IUCN conservation status.

4.3.5 Method of Soil Studies

The spatial boundary for soil quality assessment is also 2 km radius of the proposed project site with sampling locations at the project site chosen in a way that enhances mapping. At each sampling point, soil samples were collected from two depths, representing surface (0 - 15 cm) and subsurface soil (16 – 30 cm). These two were uniformly mixed in the laboratory to obtain composite samples that were tested for physico-chemical and microbial parameters. In all, 10 samples were collected from the proposed project site with soil auger (Plate 4.2) while a control sample was collected outside the proposed project site. The samples were stored in labeled polythene bags.

Plate 4.2: Collection of soil sample with auger

The soil samples collected were analysed for the following:

- Textural description (particle sizes, composition, bulk density)
- Physico-chemical (pH, bio-oxygen demand (BOD), chemical oxygen demand (COD), electrical conductivity (EC), alkalinity, Cation exchangeable capacity (CEC), oil & grease (O&G))
- Cations and anions (Na^{+}, K^{+}, Mg^{2+}, Ca^{2+}, CO_3^{2-}, SO_4^{2-}, Cl^{-1}, PO_4^{2-}, NO_3^{-})
- Heavy metals concentration (Zn, Pb, Mn, Cr, Al, Fe, Hg)
- Total organic contents (TPH, Aliphatics, BTEX)
- Microbial composition (HUB, HUF, Faecal coliform)

Methods used for physicochemical analysis of collected samples are summarized in Table 4.2

Table 4. 2: Test methods for physico chemical parameters

Parameters	Analytical Methods
pH	Corning pH meter
Temperature (°C)	Mercury Thermometer
Turbidity (NTU)	Turbidimeter
TDS (mg/kg)	Gravimetric method
TSS (mg/kg)	Gravimetric method
DO (mg/kg)	Alkali-iodide-azide method
Oil and Grease Content (mg/kg)	Xylene extraction followed by spectrophometry
Salinity (Cl^{-}) mg/kg	Salinometer
Ammonia (NH_4^{+})	Nesslerization method
Conductivity (µS/cm)	Conductivity meter
TOC (mg/kg)	Potassium dichromate digestion followed by ferrous ammonium sulphate titration
ANIONS	
Nitrate (mg/kg)	Phenoldisulphonic acid method
Sulphate (mg/kg)	Turbidimetric meter
Phosphate (mg/kg)	Ascorbic acid method
Nitrite (mg/kg)	Colorimetric method
CATIONS	
Sodium (mg/kg)	Flame photometric method
Potassium (mg/kg)	Flame photometric method
Calcium (mg/kg)	Titration with ethylenediamine tetra acetic acid (EDTA) method
Magnesium (mg/kg)	Titration with ethylenediamine tetra acetic acid (EDTA)

Source: Geo Environmental Resources Limited

To characterize the soil reaction, classification system summarized in the Table 4.3 was used.

Table 4. 3: Soil reaction (pH) classes

Range	Class
4.5 – 5.5	Very Acidic
5.5 – 6.0	Distinctly Acidic
6.0 – 6.5	Acidic
6.5 – 7.0	Faintly Acidic
7	Neutral
7.0 – 7.5	Faintly Alkaline
7.5 – 8.0	Alkaline
8.0 – 8.5	Strongly Alkaline
8.5 – 9.0	Extremely Alkaline

Source: Geo Environmental Resources Limited

4.3.6 Method of Water Sampling

The spatial boundary for water quality assessment is 2 km. The water quality of the project environment was undertaken to provide baseline information on the water resources of the proposed plant project site environment. Surface water samples were collected from three (3) points (upstream, mainstream and downstream) at River Nun. Ground water samples (Borehole) was also obtained at three (3) points with one (1) at Azikel Refinery facility and two (2) at Obunagha community, a neighboring community to the project host community (Plate 4.3).

Plate 4.3: Collection of surface and ground water samples

Primary water sources were identified using existing topographical maps, drainage maps, aerial photos and on-the-spot field assessment were carried out. Water quality assessments were carried out:

- To give an inventory of the general water resources i.e surface and ground water.
- To obtain water quality of surface water (River Nun) and ground water (Borehole) in the area, notably the physicochemical parameters of water quality.

The analytes and the laboratory analysis methods are summarised in Table 4.4.

Table 4. 4: Laboratory analytical method summary

Parameter	Symbol	Unit	Test method
Physico-chemistry			
pH	pH		in situ
Temperature	T	°C	in situ
Conductivity	EC	S/cm	in situ
Dissolved oxygen	DO	mg/l	in situ
Salinity	S	‰	in situ
Turbidity	Turb	NTU	in situ
Total suspended solids	TSS	mg/l	APHA 2540D
Total dissolved solids	TDS	mg/l	APHA 2540C
Heavy metals			
Arsenic	As	mg/l	AAS
Cadmium	Cd	mg/l	AAS
Arsenic	As	mg/l	AAS
Chromium	Cr	mg/l	AAS
Copper	Cu	mg/l	AAS
Mercury	Hg	Mg/l	AAS
Ferric iron	Fe3+	mg/l	AAS
Ferro iron	Fe2+	mg/l	AAS
Lead	Pb	mg/l	AAS
Nickel	Ni	Mg/l	AAS
Manganese	Mn	Mg/l	AAS
Cations			
Magnesium	Mg	mg/l	AAS
Potassium	K	mg/l	AAS
Sodium	Na	mg/l	AAS
Zinc	Zn	mg/l	AAS
Aluminium	Al	mg/l	AAS
Anions			
Carbon dioxide	CO_2	mg/l	APHA 4500-CO2
Carbonate and bicarbonate	HCO_3	mg/l	APHA 2320B
Fluoride	F	mg/l	APHA 4500
Nitrate	NO_3	mg/l	APHA 4500

Parameter	Symbol	Unit	Test method
Nitrite	NO_2	mg/l	APHA 4500
Phosphorus total	P	mg/l	APHA 4500
Sulphate	SO_4	mg/l	APHA 4500
Sulphide	S^{2-}	mg/l	APHA 4500
Total Organic Contents			
Total Organic Carbon (TOC)	TOC	mg/l	APHA 5310
Dissolved organic carbon	DOC	mg/l	APHA 5310
Total mineral oil		mg/l	EPA 8015
BTEX	BTEX	mg/l	EPA 8260
Phenol		mg/l	APHA 5330C
Chemical oxygen demand	COD	mg O_2/l	APHA 5220B
Biological oxygen demand	BOD	mg O_2/l	APHA 5210B
Polycyclic aromatic hydrocarbons	PAH	mg/l	EPA8260
Macro and Micro-biology			
Chlorophyll		mg/l	UV
Phytoplankton population density		number of cells / l	Coulter Counter
Bacteria count		(cfu/100ml x 103)	APHA 9215C

4.3.6.1 Groundwater Analysis

Ground water samples (Borehole) were collected at three (3) points with all analysed for the following:

- Groundwater hydrology (water table, flow direction, seasonal fluctuations.)
- Physico-chemistry (pH, colour, appearance, temperature, turbidity, bio-oxygen demand (BOD), chemical oxygen demand (COD), electrical conductivity (EC), alkalinity, oil & grease (O&G))
- Cations and anions (Na^+, K^+, Mg^{2+}, Ca^{2+}, $CO3^{2-}$, $SO4^{2-}$, CL^{-1}, $PO4^{2-}$,NO^{3-})
- Heavy metals concentration (Zn, Pb, Mn, Cr, Al, Fe, Hg,)
- Total organic contents (TPH, Aliphatics, BTEX)
- Microbial composition (HUB, HUF, Faecal coliform

4.3.6.2 Surface Water Analysis

Surface water samples were collected from three (3) points (upstream, mainstream and downstream) at River Nun and were analysed for the following:

- Surface water hydrology (water level, flow direction, seasonal fluctuation, source, first & final destination waters)
- Physico-chemistry (pH, colour, appearance, temperature, turbidity, bio-oxygen demand (BOD), chemical oxygen demand (COD), electrical conductivity (EC), alkalinity, oil & grease (O&G), etc.)
- Cations and anions (Na^+, K^+, Mg^{2+}, Ca^{2+}, $CO3^{2-}$, $SO4^{2-}$, CL^{-1}, $PO4^{2-}$,NO^{3-} etc.)
- Heavy metals concentration (Zn, Pb, Mn, Cr, Al, Fe, Hg)
- Total organic contents (TPH, Aliphatics, BTEX)
- Microbial composition (HUB, HUF, Faecal coliform)

4.3.6.3 Microbial Parameters

The Microbial parameters measured include Total Heterotrophic Bacteria (THB), Total and Faecal coliform Count and E- coli.

4.3.7 Method of Socio Economic Assessment

The survey was undertaken with respect to demography, occupational pattern, land holding, literacy rate and other important socio-economic indicators to decipher the socio-economic nature of the entire project area. A 2 km spatial boundary was maintained to capture Yenagoa Local Government Area. The communities sampled were Tunama (host community) Obunagha, Koroama, Polaku and Okolobri.

A multi-method approach was used in gathering socio-economic data and information, namely, (i) Focus Group Discussion (FGD), (ii) In-Depth Interview (IDI) with questionnaire administration, and (iii) Field observation.

- **Focus Group Discussion (FGD)**

Consultations and engagements were held with the project host community traditional heads, community chiefs, community youth, men and women, other interest groups and individuals (Plate 4.4). Public consultation/forum with the communities represented by all social strata/groups was equally carried out.


Plate 4.4: Focus Group Discussion by the Stakeholders

- **In-Depth Interviews (IDI)**

In order to gather information and opinion of residents of Tunama (host community) and others neighbouring communities, personal interviews were conducted. Households were sampled for interview using probability sampling method. At 95% confidence level with 5% margin error using an estimated population of about 352,285 people according to the 2006 census, 500 population sample size was used. A comprehensive questionnaire (Appendix One) for data collection was developed, wherein certain information were requested such as: household bio-data, livelihoods, infrastructural facilities currently available. These included road/access, water, electricity, education and healthcare infrastructures available. A total of 500 questionnaires were administered (100 in each community) and retrieved for analysis of the socio economic baseline for the project area.

- **Field Observation**

The socio-economic study team also physically inspected major facilities and landmarks, such as water supply points, school buildings, health care facilities, markets, town halls, occupational activities, informal sector activities and conditions of roads and houses. Other areas of interest studied include cultural heritage/artefact and other historical/cultural patrimony of the communities. Demography was yet another area that wasn't left out. The size, land use, economic activities (with emphasis on low income groups highly dependent on primary activities), community structure, employment, markets, labour supply, income distribution, consumption, and migration pattern of the host and neighbouring communities was also studied.

4.3.7.1 Health Impact Assessment

Under the health impact assessment, the existing health facilities with the prevalent health issues/cases within the study area were assessed for baseline data on health status of people within the project area before commencement of the proposed project.

4.3.7.2 Traffic Impact Assessment

The baseline transport data of the study area including volume, peak period, predominant type, safety condition, existing road infrastructure, etc. were studied and documented.

4.3.8 Quality Assurance and Quality Control Measures

A quality control programme was established at the beginning of the fieldwork to ensure the validity of results and comparability of acquired biological data. This involved detailed procedural guidelines for sampling, preservation, labeling and storage and laboratory analysis. To ensure the accuracy and reliability of in-situ field measurements, field instruments were calibrated prior to use and cross checked from time to time. Field data sheets were carefully kept and inspected at the end of the day's fieldwork to make sure that no samples were missed out. Other Quality Control measures adopted in the field included:

- Representativeness of samples and repeatability of data
- Samples collection and labelling, preservation and storage
- Minimizing laboratory sampling error or bias and
- Data verification

Data sheets for relevant environmental and ecological observations as well as laboratory logbook for laboratory-based aspects of the study were kept throughout the duration of the field work. To ensure that results obtained during analysis compare favourably with the in-situ environment, all samples were analyzed soon after collection. Standard laboratory quality control procedures were maintained.

4.4 The Project Bio-Physical Environment

The environmental components of the proposed project area of influence are discussed in this subsection. Details of the sampling methodologies and locations are as given above.

4.4.1 Geology

The project area is located within the lower delta plain believed to have been formed during the Holocene of the quaternary period by the accumulation of sedimentary deposits. The major geological characteristic of the area in Bayelsa State is sedimentary alluvium (Figure 4.1). The entire state is formed of abandoned beach ridges and due to many tributaries of the River Niger in this plain, considerable geological changes still abound. In addition, quaternary sands belonging to the Sombreiro deltaic plain of the Niger-Delta basin underlie the Gbaran/Ubie node

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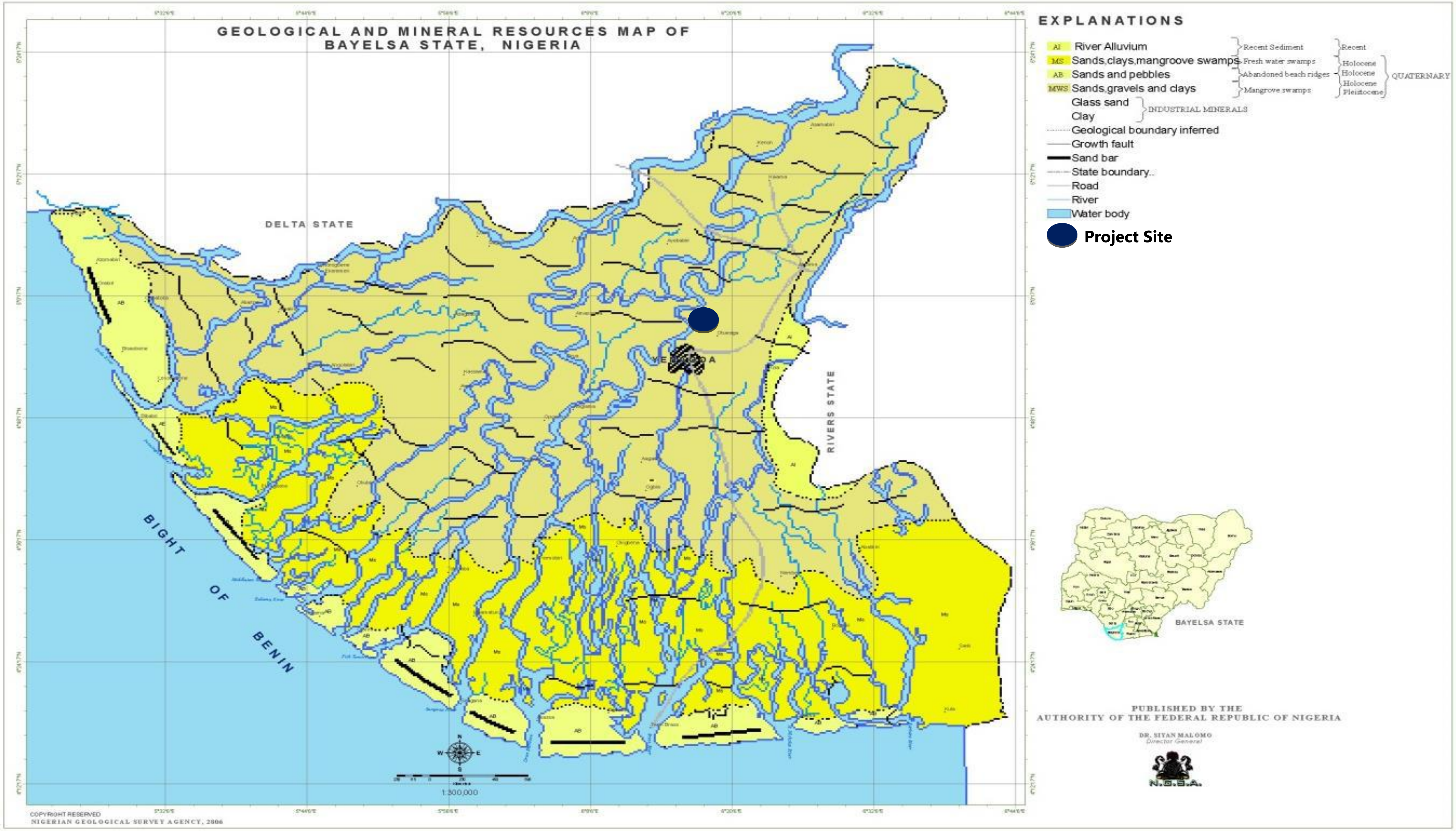

Figure 4.1: Geological and Mineral Resources Map of Bayelsa showing the Project Site
Source: Nigeria Geological Survey Agency, 2006

where the proposed site is situated. The topsoil's consisted of sandy clay while lower depths consisted of coarse sand and fine sand that are well sorted. The static water level was shallow ranging from 0.52 – 0.95 m in Gbaran zone and 0.75 – 1.35 m in Ubie zone (SPDC, 2012).

Tunama, the project site, is characterized by a typical freshwater ecology of the upper reaches of the River Nun within the Niger Delta area. It lies within the outcropping Benin Formation made up of continental deposits of Miocene to recent sediments. It is associated with freshwater swamps, back swamps and meander belts of flat to sub-horizontal elevation. There are severe drainage problems with seasonal and temporary flooding due to heavy rainfall and rise in groundwater table. This results in almost total submergence during the wet season with exception of the natural levees. The major soil types are light brown to dark grey, fine sand to silty clay.

4.4.2 Hydrogeology

Generally, in terms of relief, Bayelsa State is a lowland state characterized by tidal flats and coastal beaches, beach ridge barriers and flood. The state is generally covered by the coastal basin with two main geological formations the Benin Formation and the Niger Delta group of Formations. The state consists of a network of tidal creeks which separate small islands of less than 6 m above sea level. The islands are lined by sandy ridges and the vegetation is thick mangrove in very swampy environment. The most important aquiferous formations include Deltaic Formation and the Benin Formation (Figure 4.2).

While the drawdown at the Gbaran/Tunama borehole in the Deltaic formation is steep, because of the limited thickness and extent of the aquifers, that of the Benin formation which is much thicker, more extensive, coarser and usually more permeable, indicates a gentler slope in the drawdown.

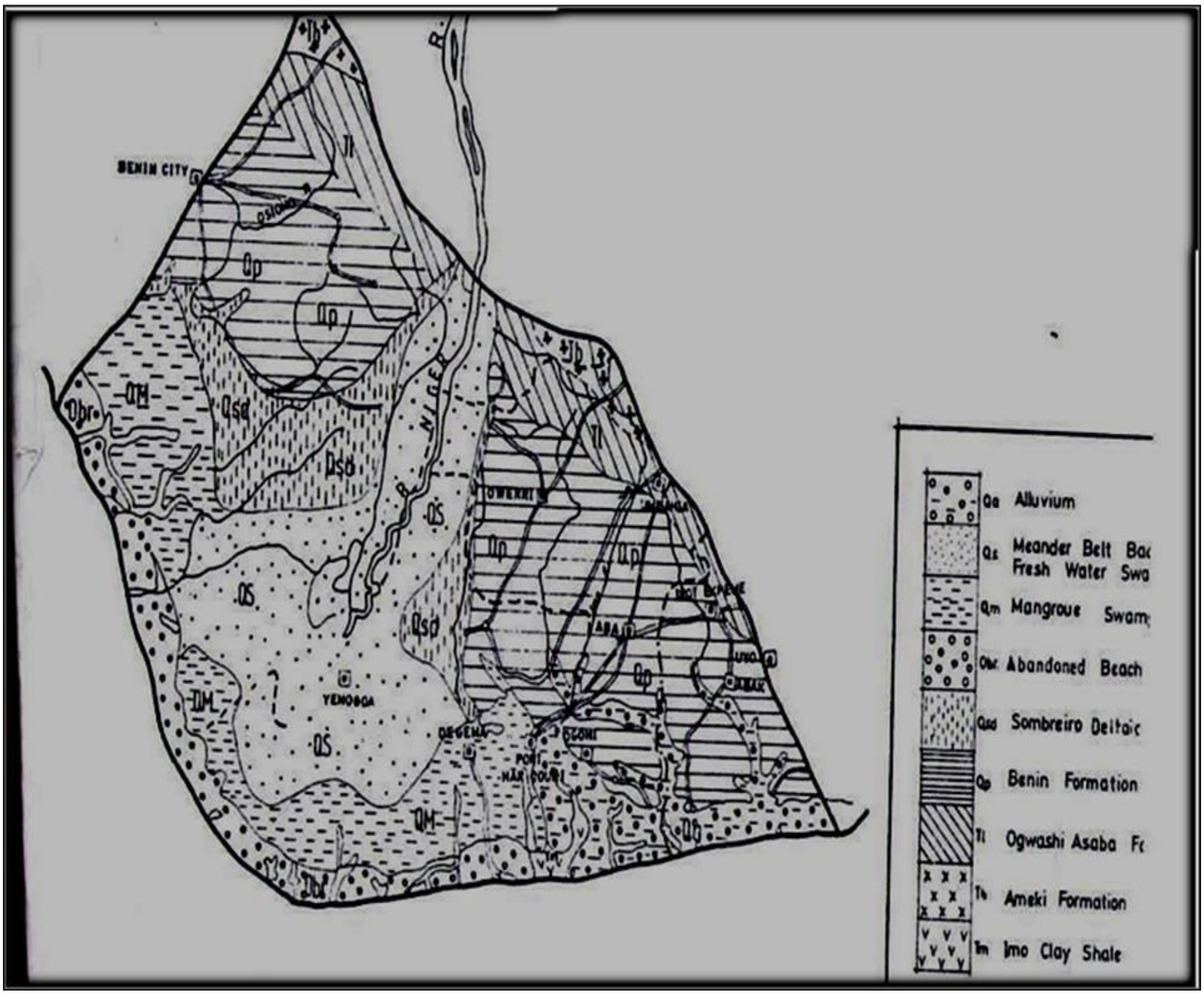

Figure 4.2: Aquiferous formation of the Delta Region
Source: Offodile (1992)

Boreholes drilled in the southern parts of the Niger Delta area, especially along the coast line, give pressure water (Table 4.5). In the borehole at Gbaran/Tunama, the aquifer is confined by a shale or clay bed. This has been confirmed by the resistivity survey results obtained in this area by the Geological Survey of Nigeria which revealed the occurrence of a shale bed within the depth range of 114 – 150 m.

Table 4. 5: Specific capacities in lit/hr/m of some boreholes in the Deltaic formation highlighting Gbaran/Tunama borehole

GSN. BH. NO	LOCATION	SPECIFIC YIELD IN aph/ft DD
3272	Ofoniama	700 (10,500 lits/hr/m)
3684	Yenagoa I	530 (7,950 lits/hr/m)
3685	Gbaran/Tunama	*902 (13,530 lits/hr/m*
3476	Oloibiri	900 (13,500 lits/hr/m)
2636	Nembe	900 (13,500 lits/hr/m)
1864	Bonny	500 (7,500 lits/hr/m)
2229	Amassama	450 (6,750 lits/hr/m)
2366	Okrika	460 (6,900 lits/hr/m)

Source: Offodile (1992)

A test borehole was drilled on the neighboring Eraskon Nigeria Limited site at a point with its coordinates (on UTM scale) as 0200770m E and 555566m N (Table 4.6). This was to carry out the following geophysical tests: Electric well logging and Pump testing including Transmissivity, Specific capacity, Pumping rate, Drawdown, Static water level and Yield. It was carried out on the 20th March, 2015.

Table 4. 6: Borehole pump test showing recovery rate

Gbaran/Tunama	**GSN. BH. No. 3835**
Depth	**Attribute/description of material content**
0-57m	Fine to medium grained sand
57-63m	Dark grey clay, silty with sand intercalations
63-75m	Coarse sand
75-114m	Sand, dark grey to black at bottom. Fine to coarse, pebbly, contains woody matter at the bottom
11-150m	Clay dark grey, compact with some coarse sand
150-174m	Sand, fine to coarse with woody matter
174-255m	Sand, fine to very coarse, decreasing in grain size beneath

Source: Offodile (1992)

- **Electric well logging result**

Table 4.7 summarizes lithological characteristics of the Logging well construction. From the lithological Log data, the drilled formations are dominantly, shale and sands. Negative Self Potential (SP) anomaly is interpreted to reflect sandy formations with SP value ranging 245 mV to 323 mV amplitude. This anomaly is accompanied by rather high values of formation resistivity ranging from 542 Ohm-m to 876 Ohm-m. Therefore, this negative SP anomaly reflects sandy formation indicating zones of fresh water saturation. Positive SP anomaly reflects clayey formation with SP values ranging from 321mV to 418mV. This is accompanied by low values of formation Resistivity 518 - 717 Ohm-m.

Table 4.7: Lithological Log Data for Borehole drilled at Tunama Bayelsa State

Depth (m)	Inferred Lithology
0.5	Human sands
10	Lateritic clay
40	Silty clay horizon
90	Highly sedimented formation
150	Highly come tent/hard shale
190	Coarse sands
200	Highly coarse aquifer sands
250	Hard shale formation

Source: Final ESIA Report for Azikel Modular Refinery (2017)

- **Water pump testing result**

In order to evaluate the ground water potentials of the aquifer of the area, a pumping test was conducted. The pumping Test was also important as a standard step in recommending type and lubricant blending rating for pumps to be installed for the site. This evaluation is through the determination of aquifer parameters such as Discharge, Storability, Transmissivity, Specific Capacity, and Drawdown. Summary of borehole parameters from the pumping test is:

- Specific Capacity - 0.502 lit/sec/m
- Transmissivity - 0.11 lit/sec/m (Table 4.8)
- Pumping Rate - 2.0 lit/sec (Table 4.9)
- Drawdown - 117.94 m
- Static Water Level - 129 m
- Yield -11.9 lit/sec (42.84 m^3/hr; 0,714 G.P.H)

Table 4. 8: Borehole pump test showing elapsed time and draw down

Date	Time (hrs & mins)	Elapsed time (mins)	Pumping rate (l/s)	Depth to water	Drawdown
	11.25 am	0	1.0 l/s	90.0m	0
	11.30 am	5		91.4m	63m
	11.35 am	10		93.4m	79m
20/03	11.40 am	15		93.4m	79m
/15	11.45 am	20		93.4m	79m
20/03	11.50 am	25		95.4m	79m
/15	11.55 am	30		95.4m	79m
20/03	12.00 Noon	35		95.4m	79m
/15	12.10 pm	40	2.0	96.2m	81m
20/03	12.20 pm	50		96.2m	81m
/15	12.30 pm	60		99.8m	95m
20/03	12.40 pm	70	0.98	100.2m	96m

/15	12.50 pm	80		103.8m	97m
	1.00 pm	90		107.8m	100m
	1.30 pm	120		108.1m	107m
	2.00 pm	150		108.1m	109m
	3.00 pm	180		109.6m	115.9m
	3.30 pm	210	0.98	111m	117.9m
	4.00 pm	240		41m	117.9m
	5.00 pm	270		41.8m	121.0m
	6.00 pm	330		41.8m	121.2m
	7.00 pm	390		41.8m	121.2m
		450	2.98	41.8m	125.4m

Source: Final ESIA Report for Azikel Modular Refinery (2017))

Table 4. 9: Borehole pump test showing recovery rate

Date	Recovery rate	Time (mins)	Water level	Elapsed time (mins)
20/03/15		7.00	41.8 m	3
		7003	38.1 m	4
		7.04	25.2 m	6
		7.06	19.2 m	7
		7.07	19.0 m	

Source: Final ESIA Report for Azikel Modular Refinery (2017))

- **Summary of results for electrical well logging and pump testing**

The lithological characteristics displayed in Table 4.7 show that the subsurface of the project site area, where the borehole is drilled, exhibits dominantly clean sands, shale and clay intercalations.

The pump testing showed that the borehole recovered to 19.0 m in 7minutes. This recovery rate indicates that the borehole has a high yield. The static water level stood at 132 m.

- **General conclusions from Geophysical test**

From the geophysical test carried out in the neighboring Eraskon Nigeria Limited 50,000 litres lubricating oil blending plant project site, it is evident that the aquifer of the proposed site area has the desired characteristics (sufficient yield and high recovery rate). These will support its water requirements without necessarily affecting ground water supply in Obunagha community (which is about 1.0 km from the site). Recommended pump size is 3 -15 Hp with installation depth between 30 and 80 m.

4.4.3 Hydrology

The study area is described as relatively plain and swampy with majorly River Nun as the major natural water body. The water table is shallow and with about 5 - 15 m depth digging, one can get ground water especially in the rainy season.

4.4.4 Ecology

Ecology of the proposed project area was thoroughly investigated.

4.4.4.1. Vegetation

Like any other State in the Niger Delta, the vegetation of Bayelsa consists of four ecological zones: coastal barrier island forests, mangrove forests, freshwater swamp and lowland rain forests. These different vegetation types are associated with various soil units in the area and constitute part of the complex Niger Delta ecosystems. The fresh water swamp forests are home to several threatened and even endangered plant and animal species.

There are coastal barrier highland forests and mangrove forests. Coastal barrier highland forest vegetation is restricted to the narrow ridges along the coast. This vegetation belt is characterised by low salinity-tolerant fresh water plants. Sometimes of the Avicinia species of mangroves prevail in this vegetation. Palms such as phoenix reclivata and other species such as Uapacia, Xylopia and land Taminalia are predominant. In this belt, commercial timber species are found. The mangrove vegetation of the state is usually found between mid-tide relief levels to extreme high-water mark. This vegetation linked with the brackish swamps which form a maze of water courses and highlands affected by the ebb and flow of tides.

In terms of the local ecology of Tunama, the vegetation is dense with a variety of floral species mostly in their primary/natural state (Plate 4.5). The vegetation comprises food crops such as plantain (*Musa paradisiacal*) and coconut palm tree (*Cocos nucifera*). There are also ferns (*Acrostichum aureum*) being among the dominant vegetal species in the project area. Table 4.10 shows a list of some of the plant species in the project area.

Plate 4.5: Typical vegetation cover at the study area, Tunama

Table 4. 10: List of Vegetation in the Study Area with the IUCN Status

S/N	Scientific Name	Common Name	IUCN Status	Economic use/ Importance
1.	*Acrostichum aureum*	Ferns	Least Concern	Food
2.	*Pemphis acidula*	Iron Wood	Least Concern	Fuel wood
3.	*Vernonia amygdalina*	Bitter Leaf	Not Been Assessed	For making soup
4.	*Andropogon gerardii*	Big Bluestem Grass	Not Been Assessed	Livestock feed
5.	*Tripsacum spp*	Tripsacum Grass	Not Been Assessed	Livestock feed
6.	*Ipomoea tricolor*	Morning Glory	Not Been Assessed	Ornamentals
7.	*Mimosa pudica*	Mimosa	Least Concern	Herbal purpose
8.	*Nypa fructicans*	Nipa Palm	Not Been Assessed	Medicinal
9.	*Megathyrus maximus*	Guinea Grass	Not Been Assessed	Fodder for feeding livestock
10.	*Ficus coronate*	Sand Paper Tree	Not Been Assessed	Fruits are consumed and leaves are used as herbs
11.	*Pennisetum purpureum*	Elephant Grass	Not Been Assessed	Fodder for dairy farmers
12.	*Pistia stratiotes*	Water Letus	Least Concern	Ornamental
13.	*Telfairia occidentalis*	Fluted Pumpkin	Not Been Assessed	Food, while leaves are used in soap manufacture
14.	*Terminalia ivorensis*	Black Afara	Vulnerable	Furniture work
15.	*Triplochiton scleroxylon*	Obeche	Least Concern	Wood work

S/N	Scientific Name	Common Name	IUCN Status	Economic use/ Importance
16.	*Spondias spp*	Hog Plum	Not Been Assessed	Herbal medicine
Food Crops				
17.	*Irvingia gabonensis*	Bush Mango	Data Deficient	Food
18.	*Musa paradisiaca*	Plantain	Not Been Assessed	Food
19.	*Musa paradisiaca*	Banana	Not Been Assessed	Food
20.	*Dioscorea spp*	Yam	Not Been Assessed	Food

Source: Fieldwork and Literature Review, 2020

4.4.4.2. Fauna Species

Information on animal resources and wildlife of the study area were gathered from interviews, field observations and published literature. A wide variety of fauna flourishes in the area include molluscs, mammals, amphibians, reptiles, fishes, and birds (**Table 4.11**). Through decades of exploitation and human—induced habitat alteration, some species have become either threatened or endangered. To combat illegal trade of the endangered species in the country, Nigeria promulgated the 'Endangered Species Control of International Trade and Traffic' Decree 11 of 1985.

Table 4. 11: List of Fauna Species in the Study Area with IUCN Status

S/No	Animal Name	Class	Scientific Name	IUCN Status
1.	Frog	Amphibian	*Anura ranidae*	Least Concern
2.	Wall Gecko	Reptilia	*Tarentola Annularis*	Not Been Assessed
3.	Cattle Egret	Bird/Aves	*Bubulcus ibis*	Least Concern
4.	Vulture	Bird/Aves	*Sarcoramphus papa*	Least Concern
5.	Broad Winged Hawk	Bird/Aves	*Buteo platypterus*	Least Concern
6.	Pigeon	Bird/Aves	*Columbidae colombiformes*	Not Been Assessed
7.	Dove	Bird/Aves	*Columbidae colombiformes*	Not Been Assessed
8.	Leaf Cutter Ant	Insects	*Atta spp*	Not Been Assessed
9.	Praying Mantis	Insects	*Stagmomantis sp*	Not Been Assessed
10.	Harleguin Bettle	Insects	*Acrocinus longimanus*	Not Been Assessed
11.	Garden Snail	Mollusc	*Helix aspersa*	Not Been Assessed
12	Cat Fish	Actinopterygii	*Clarias gariepinus*	
14.	Python	Reptile	*Python regius*	Least Concern

Source: Fieldwork and Literature Review, 2020

From the assessment of the flora and fauna within the project area there is one species (flora) that is rated as vulnerable on the IUCN list. This floral species is the Black Afara (*Terminalia ivorensis*).

4.4.5 Soil

The major soil types in the state are young, shallow, poorly drained soils (inceptisol Aquepts) and acid sulphate soils (Sulphaquepts). There are variations in the soils in the area wit some soil types occupying extensive areas whereas others are of limited extent. However, based on physiographic differences, several soil units identified in the state include:

- The soils of the high-lying levees e.g. sandy loam, loamy sandy, and silty loamy soils as well as sands;
- The soils of the low-lying leaves e.g. the moderately fine texture, red silty or clay loamy soils;
- The meander belt soils which differ only slightly from the soils of the levels;
- The silted river belt soils e.g. peat for clay water bogged soils found mainly in the beds of dead creeks and streams;
- The basin soils e.g. silky clay loam or sandy loam which are inundated by water for most of the year.
- The transition zone soils e.g. silt and sandy silt which are known to be under the daily influence of tidal floods and fresh waters. There are pockets of potash deficiency especially in the sandy soils. The texture of majority of the soils range from medium to fine grains.

4.4.6 Climate

Climate is the weather condition of a place for a long period. To describe the climate of the proposed project area, its 34 years (1986 – 2019) climatic data were obtained from the Nigerian Meteorological Institute (NIMET), as earlier indicated. The State experiences two distinct seasons which are the dry and wet. However the wet season is more in duration as a result of the peculiar nature of the climatic environment resulting from mangrove and swamp ecosystem.

4.4.6.1 Rainfall

A major balancing factor in the ecosystem is rainfall. Rainfall in Tunama community, the study area, and the entire Bayelsa State varies in quantity from one area to another. The state experiences equatorial type of climate in the southern part and tropical rain towards the northern parts. Rain occurs generally every month of the year with heavy downpour.

The state experiences major high rainfall which decreases from south to north. Its average between 1986 and 2019 had a peak of 510.0 mm (in 2019) with the lowest of 81.6 mm (in 2016) as presented in **Figure 4.3**. The wet season is not less than 340 days. July and August usually experience the highest rainfall in the area. Although rain falls almost every month of the year (wet season), there is however noticeable short dry spell in December to January. The lowest rainfall comes around December when Harmattan wind sweeps over the entire area.

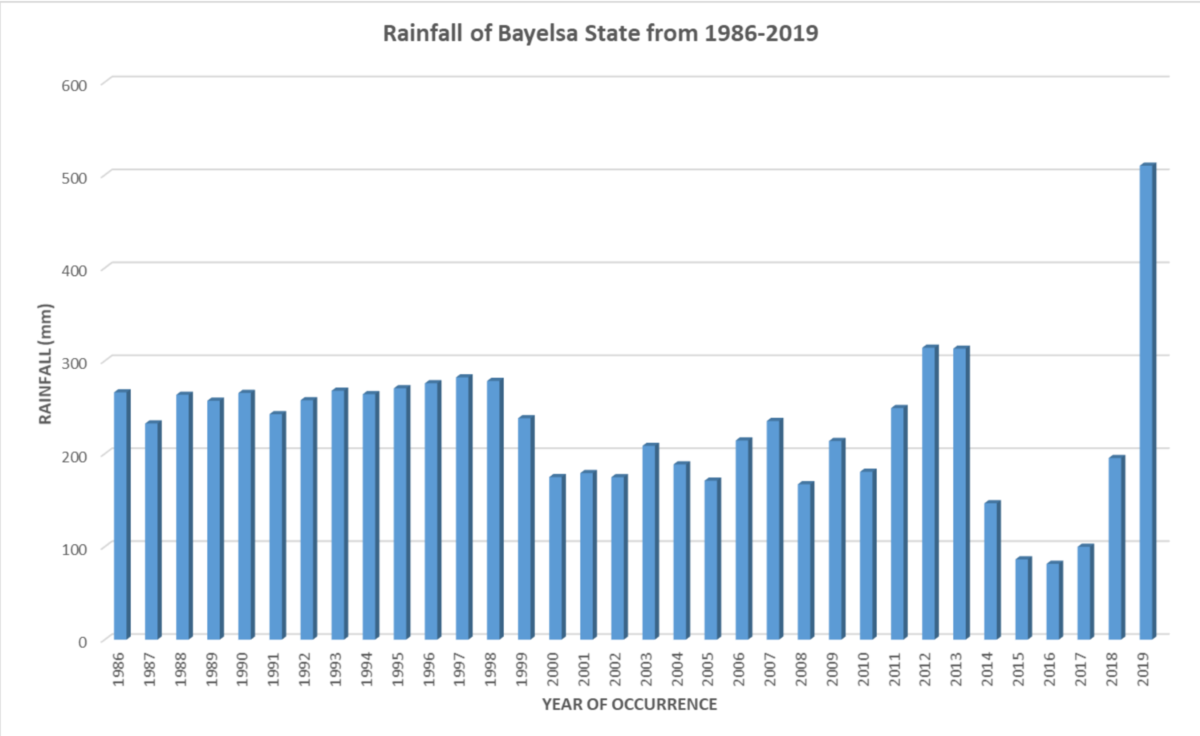

Figure 4.3: Average Rainfall Distribution of the Proposed Project Area

4.4.6.2 Relative Humidity

The amount of water content (humidity) plays a significant role in the analysis of the environmental baseline of a given geographical location. In theory, Relative humidity is the comparison of the actual water content of the air at any given temperature with the amount of water that could be held at saturation. It is a precursor for rainfall and directly related to temperature. Its annual averages in the 33 years study period is 76.9 – 85.8% at 09:00 hours (Figure 4.4) and 65.7-73.0% at 15:00 hours (Figure 4.5). These confirm the relatively high rainfall levels in the proposed project area.

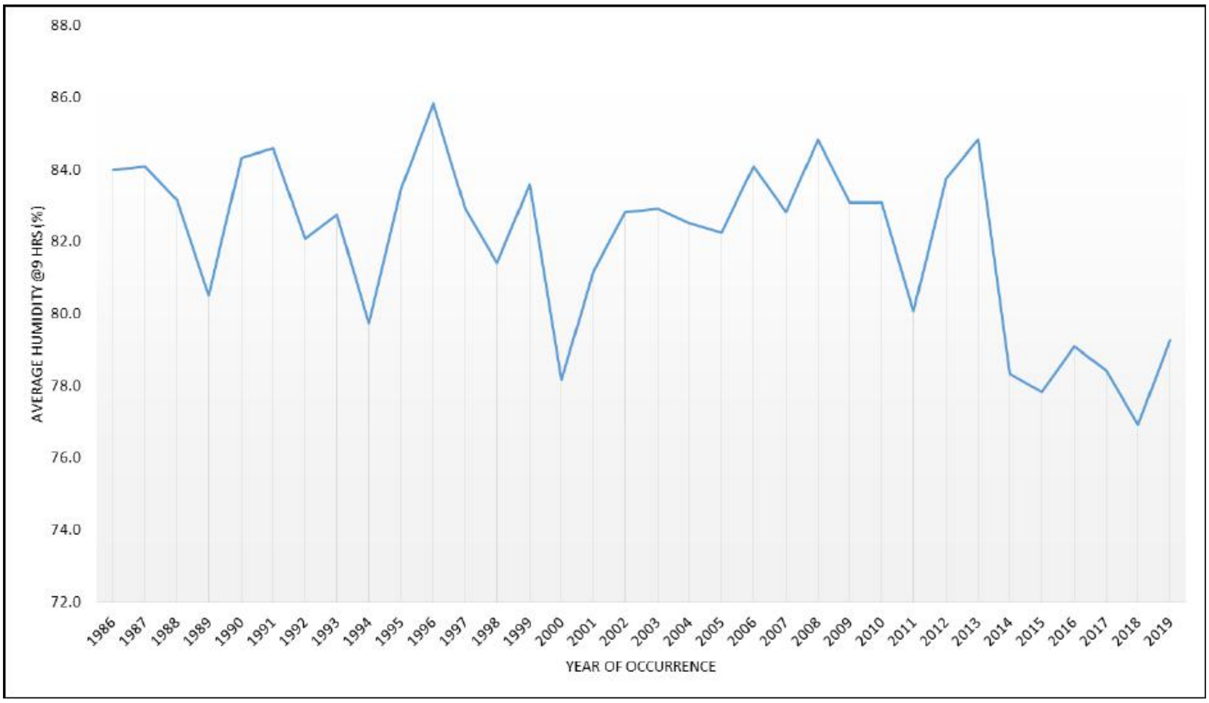

Figure 4.4: Annual Relative Humidity @9:00 Hrs in the Area (1986 – 2019)

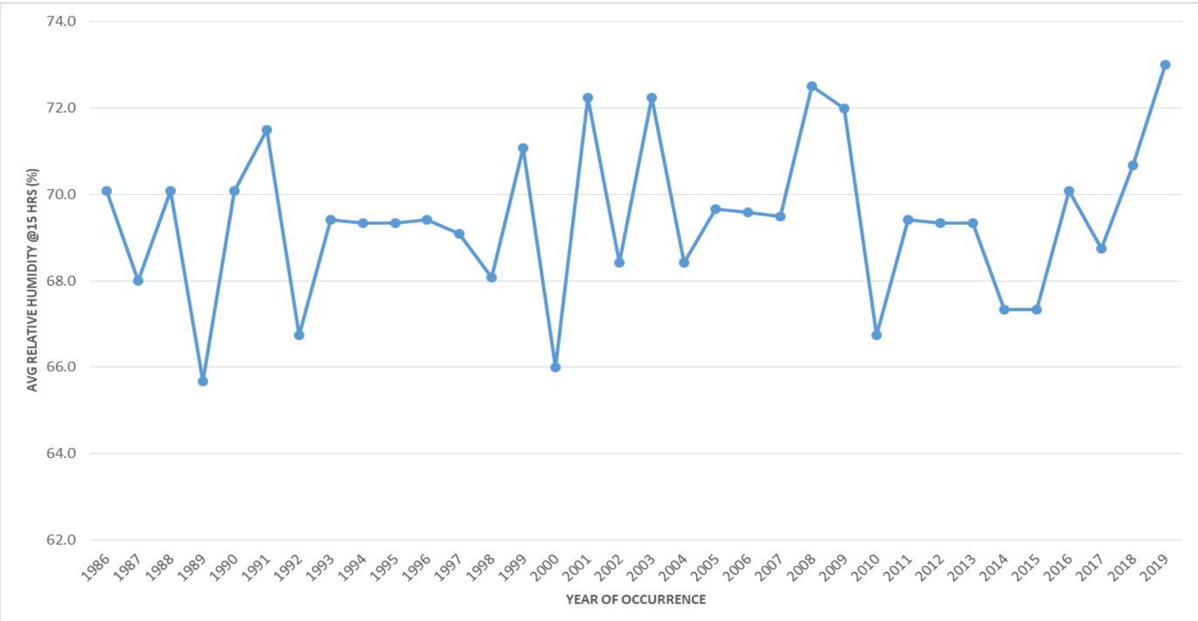

Figure 4.5: Annual Relative Humidity @15:00 Hrs in the Area (1986 – 2019)

4.4.6.3 Air Temperature

In the proposed project area, the mean monthly minimum air temperature is 21.4 – 23.6 °C (Figure 4.6) with the maximum level of 30.2 – 32.0 °C (Figure 4.7). Air temperature has considerable effect on the development of an organism and on the ecological balance of a geographical space like Tunama, the proposed project location. In Bayelsa State, annual air temperature is uniform with December - April as hottest months. Air temperature difference between wet and dry seasons is about 2 °C at most.

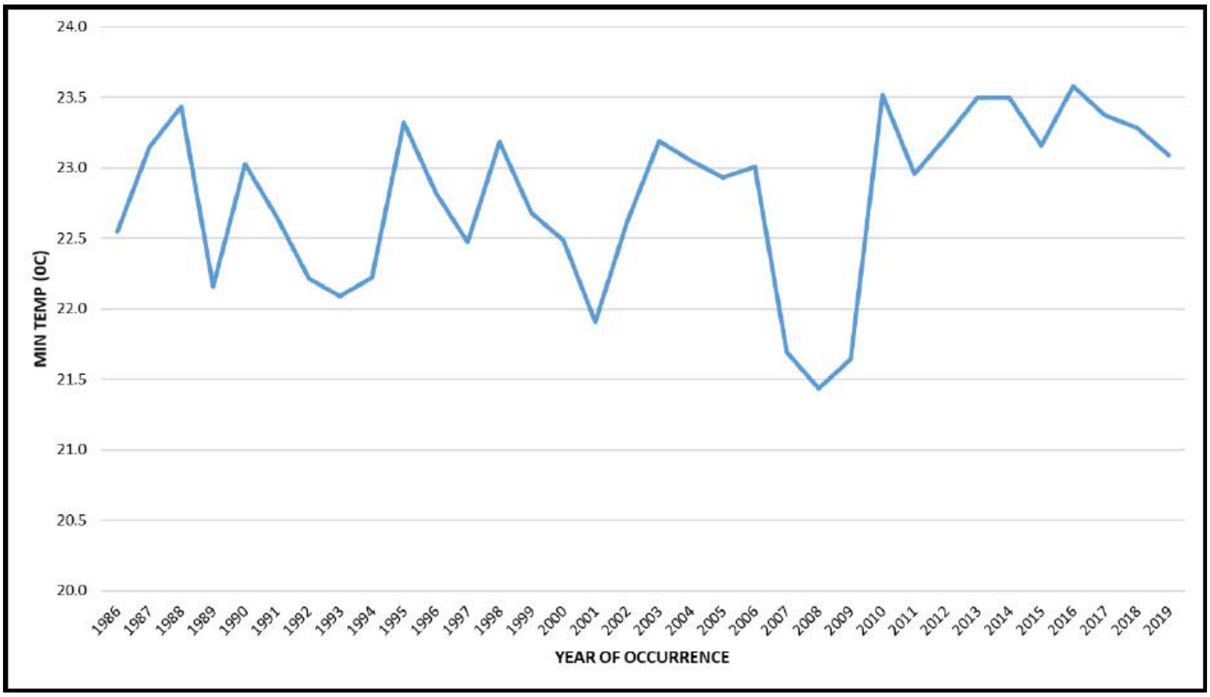

Figure 4.6: Annual Minimum Air Temperature of the Project Area (1986-2019)

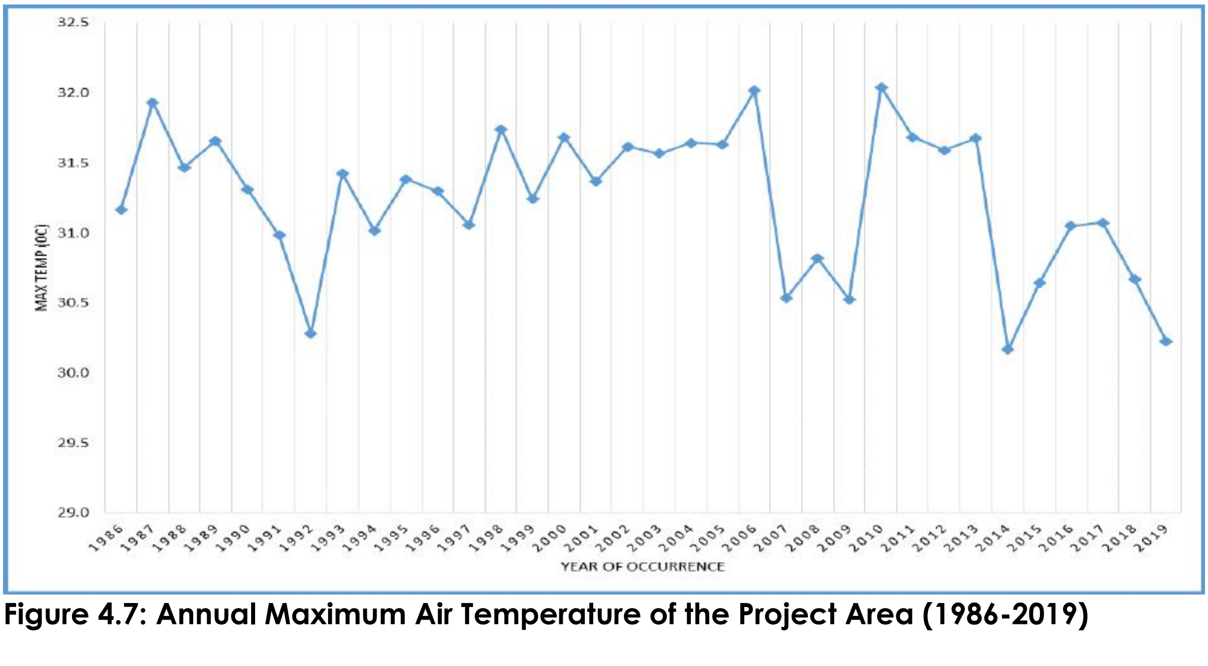

Figure 4.7: Annual Maximum Air Temperature of the Project Area (1986-2019)

4.4.6.4 Wind Speed and Direction

As presented by the wind rose of the proposed project area (Figure 4.8), its wind direction is 0.5 – 6 m/s with southwest prevailing directions. However its other wind directions include the west, south, northwest, northeast and the east directions. Wind speed and direction govern dispersion of pollutant. Over the course of a year, wind usually blows in all directions, with varying frequencies.

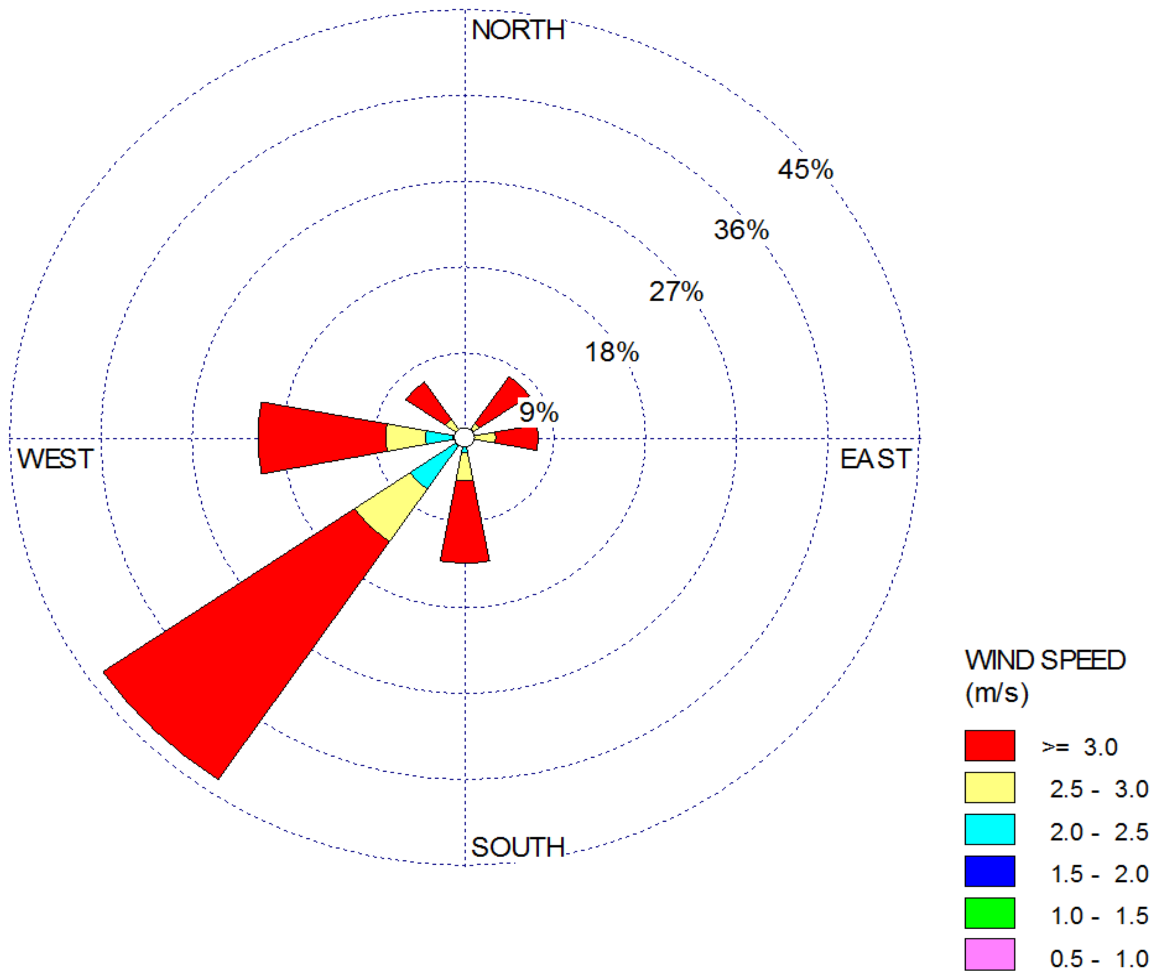

Figure 4.8: Wind Rose of the Proposed Project Area (1986 – 2019)

4.4.6.5 Sunshine Hours

The mean sunshine period in the study area is 3.4 - 7.0 hours (Figure 4.9). Sunshine duration is a function of seasonal variation of the prevailing weather condition. However, hours of daylight and darkness hardly vary for more than an hour during any period of the year because of the latitudinal location of the region. These climatic parameters agree with the measured meteorological data during the fieldwork (Table 4.12).

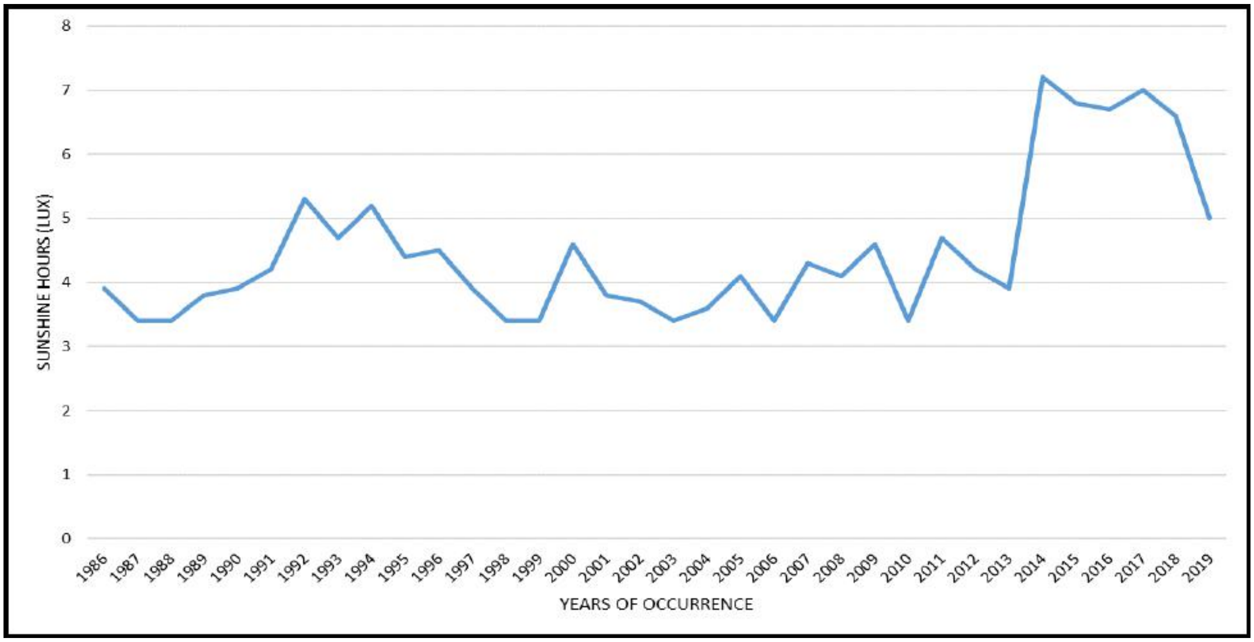

Figure 4.9: Annual Average Sunshine Period in the Project Area (1986-2019)

Table 4. 12: Measured Meteorological Parameters during the Study

Level	Temperature (°C)	Relative Humidity (%)	Wind	
			Speed (m/s	Direction
Minimum	30.8	10.8	0.1	NE
Maximum	35.6	15.8	3.1	SW
Mean	33.5	13.3	2.4	SW

4.4.7 Air Quality Assessment

The air pollutants monitored at some locations (Figure 4.10) during fieldwork are ammonia (NH_3), nitric oxide (NO), Nitrogen dioxides (NO_2), Sulphur dioxide (SO_2), Hydrogen sulphide (H_2S), Carbon monoxide (CO), particulate matter less than 2.5 microns ($PM_{2.5}$) and particulate matter less than 10 microns (PM_{10}). In all the locations, gaseous pollutants were below detection limit (BDL) in the wet season (**Tables 4.13**) thus taken to be within their respective limits. In the dry season SO_2 was 0 – 5.20 ppm in the area but NO_2, CO and VOCs were not detected (**Table 4.14**).

Particulates were detected in all the sampling locations in the wet season (Table 4.13). While $PM_{2.5}$ was 9.2 – 18.0 µg/m^3, PM_{10} was 10.4 – 22.2 µg/m^3 with both particulate fractions within set limits. Particulates were 1.26 – 21.0 µg/m^3 outdoors but 0.13 – 1.18 µg/m^3 indoors in the dry season (Table 4.14). These are also within the 250 µg/m^3 limit.

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Figure 4.10: Air Quality sampling points during the Study

Table 4. 13: Wet Season Daily Average Air Quality Status in the project Area

Points	Easting	Northing	Gases Concentration (ppm)						Particulates (µg/m³)	
			NO_2	SO_2	NO	CO	NH_3	H_2S	PM_{10}	$PM_{2.5}$
AQ1	200082	555956	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	13.1	10.6
AQ2	199857	556137	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	15.3	12.9
AQ3	199933	556144	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	15.4	12.7
AQ4	199954	556100	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	11.4	9.2
AQ5	200032	556086	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	17.1	12.2
AQ6	199988	556040	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	17.0	16.1
AQ7	200071	556032	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	22.2	18.0
AQ8	200081	556042	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	13.1	10.5
AQ9	199889	556106	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	11.2	9.8
AQ10	199935	556069	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	10.4	10.1
AQ11	199964	556020	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	12.3	11.2
AQ12	200031	555973	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	14.1	12.2
AQ13	199994	555919	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	15.6	13.2
AQ14	200065	555911	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	13.2	11.0
AQ15	200049	555838	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	14.8	12.0
Average			**<0.01**	**<0.01**	**<0.01**	**<0.01**	**<0.01**	**<0.01**	**14.4**	**12.2**
FMEnv Limits			**0.04**	**0.01**	**0.04**	**10**	**0.28**	**0.01**	**80**	**25**

Table 4. 14: Dry Season Air Quality Status in the Project Area

Sample Station	Season	Sample Station	SO_x (µg/m³)	NO_x (µg/m³)	CO (µg/m³)	VOC (µg/m³)	SPM (µg/m³)	Noise dB(A)
Gbaran	Dry Season	**Outdoor**	**3.12**	**<0.1**	**<0.1**	**<0.1**	**9.10**	**59.61**
		SD	1.16	<0.1	<0.1	<0.1	5.84	11.64
		Minimum	2.6	<0.1	<0.1	<0.1	3.60	46.50
		Maximum	5.2	<0.1	<0.1	<0.1	21.0	83.10
		Indoor	**<0.1**	**<0.1**	**<0.1**	**<0.1**	**0.63**	**61.49**
		SD	<0.1	<0.1	<0.1	<0.1	0.38	3.83
		Minimum	<0.1	<0.1	<0.1	<0.1	0.13	57.60
		Maximum	<0.1	<0.1	<0.1	<0.1	1.08	69.40
		FMEnv Limits	**26**	**75-113**	**11.4**	**160**	**250**	**90**
		WHO limits	**100-150**	**150**	**10**		**150-230**	

Source: SPDC (2009, 2015)

Carbon Monoxide (CO) is a colourless and odourless gas harmful when inhaled. Breathing air with high CO concentration reduces O_2 transported in the blood stream to critical organs like the heart and brain. Generally CO is a primary air pollutant formed from methane and non-methane hydrocarbon oxidation. In the Niger Delta area where the proposed project site is located, its sources include fossil fuel combustion in vehicles, gas flares and domestic heating. Similarly fuel combustion in electric power generators, refineries and gas gathering facilities presently located in the proposed site could be its additional sources. Though not expected to be a major source, solid waste combustion and bush burning may be additional source. Its primary sink is oxidation by hydroxyl radical (OH) and rain washout of wet season. These may be the reasons behind its non-detection during the fieldwork.

Oxides of Nitrogen (NO_X) that are of concern in atmospheric pollution are Nitric Oxide (NO) and Nitrogen Dioxide (NO_2). Elevated levels of NO_2 in the atmosphere can irritate airways in the human respiratory system which may aggravate respiratory diseases including asthma, leading to respiratory symptoms such as coughing, wheezing or difficulty breathing. In air, NO_2 along with other NO_X reacts with other chemicals to form particulate matter and ozone which could also be harmful when inhaled. Usually NO is formed from oxidation of nitrogen present either in combustion air or fuel. However it is not very stable but easily converts to NO_2 in the atmosphere. Being products of combustion their sources in the proposed project area may be those sources suggested for CO while rain washout may be the reason behind their non-detection in this wet season.

Volatile Organic Compounds (VOCs) are organic chemical compounds whose composition makes it possible for evaporation under normal indoor atmospheric conditions of temperature and pressure. Many VOCs form ground-level ozone, a constituent of photochemical smog, by “reacting” with sources of oxygen molecules such as NO_X, and CO in the atmosphere in the presence of sunlight. Their health effects may include eye, nose and throat irritation; headaches, loss of coordination and nausea; damage to liver, kidney and central nervous system. Outdoors, VOCs are volatized or released into the air mostly during manufacture or use of products (including hydrocarbon products) and materials. Sources of VOCs in the proposed project area could be hydrocarbons evaporation and combustion in vehicles, power plants and gas gathering facilities.

Ammonia (NH_3) is one of the nitrogenous compounds with high impacts on ambient air quality due to its potential for secondary particle formation. Its main local problem when released into air is the unpleasant odour, which is detectable even at low concentrations. At particularly high concentrations it can also harm vegetation. The harm caused by Ammonia in water bodies can be serious due to its toxicity to aquatic organisms. On a wider scale, ammonia plays a role in the transportation and enhanced deposition of acidic pollutants, resulting in acidification of ground and water bodies, which can harm plant and animal life. Exposure to high concentrations of NH_3 in air causes immediate burning of the nose, throat and respiratory tract. This can cause bronchiolar and alveolar edema, and airway destruction resulting in respiratory distress or failure. Inhalation of lower concentrations can cause coughing, and nose and throat irritation. Though not detected during the fieldwork, possible sources of NH_3 in the proposed site could be decaying excreta of humans and animals.

Hydrogen Sulphide (H_2S) is colourless, flammable and extremely hazardous gas. It is both an irritant and chemical asphyxiant with effects of both oxygen utilisation and central nervous system. Its health effect can vary depending on the level and duration of exposure. Low concentration irritates eyes, nose, throat and respiratory system. Repeated or prolonged exposure may cause eye inflammation, headache, fatigue, irritability, insomnia, digestive disturbances and weight loss. Moderate concentration can cause more severe eye and respiratory irritation, dizziness, nausea, vomiting and staggering. High concentration can cause shock, convulsion, inability to breathe, extremely rapid unconsciousness, coma and death. Hydrogen sulphide (H_2S) occurs naturally in crude petroleum, natural gas and hot springs. In addition, it is produced by bacterial breakdown of organic materials and human and animal waste, petroleum/natural gas drilling and refining, wastewater treatment, coke ovens, tanneries and kraft paper mills. Its source in the proposed project area could be hydrocarbons production facilities development.

Suspended Particulate Matter (SPM) is a complex mixture of organic substances, present in the atmosphere as solid particles and liquid droplets. They include fumes, smoke, dust and aerosols. Health impacts of PM vary depending on size and concentration. For regulatory purposes and health impacts, PM is measured and classified by respiratory fraction of particles including $PM_{2.5}$ and PM_{10} as monitored in this study. Suspended Particulate Matter causes respiratory morbidity, deficiencies in pulmonary (lung) functions including decreased lung function (especially in children), and lung cancer with the consequence of increased mortality, among others. They can also contribute to acid deposition and may absorb solar radiation and impair/reduce visibility. Particulates are formed during fuel combustion. This and dust re-suspension could be the major sources of particulates detected during the fieldwork around the project site.

Classification of the Proposed Project Site Airshed

Using the World Bank Group Airshed Classification, the present air quality status of the proposed site can be classified as un-degraded with respect to the fieldwork measured air pollutants.

4.4.7.1 Air Emissions Dispersion Modelling

An air emission dispersion modelling has been carried out on the the proposed lubricating oils blending plant using the ISC-AERMOD View (Version 8.2.0) air emission dispersion modelling to investigate two operating scenarios. The identified and investigated air pollutants include carbon monoxide (CO), sulphur dioxide (SO_2), oxides of nitrogen (NO_X), total suspended particulates (TSP) and volatile organic compounds (VOCs). These are from two units 500 kva electric power generators and the neighbouring two units 112.5 MW Gbaran National Independent Power Plant.

From the simultaneous operation of the two units 500 kva generator, the 24-hour CO is 0.03 – 3.46 $\mu g/m^3$. Its 1-hour SO_2 is 0.02 – 1.79 $\mu g/m^3$ with 24-hour level of 0.01 – 1.05 $\mu g/m^3$. The 1-hour, 24-hour and annual NO_x are 0.3 – 27.3 $\mu g/m^3$, 0.2 – 16.0 $\mu g/m^3$ and 0.04 – 4.32 $\mu g/m^3$ respectively with respective SPM levels of 0.02 – 1.93 $\mu g/m^3$, 0.01 – 1.13 $\mu g/m^3$ and 0.0 – 0.30 $\mu g/m^3$. Its 24-hour VOCs is 0.01 – 1.27 $\mu g/m^3$. The cumulative ground level concentrations air pollutants from simultaneous operations of the 2 x 500 kva and the 250 MW Gbaran NIPP (***scenario 2)*** show 24-hour CO of 2.9 – 287.1 μg/m^3. Their 1-hour and 24-hour SO_2 are 0.3 – 33.7 μg/m^3 and 0.2 – 19.6 μg/m^3 respectively with respective 1-hour, 24-hour and annual NO_X of 51.3 – 5127.7 μg/m^3, 29.9 – 2986.5 μg/m^3 and 4.0 – 376.0 μg/m^3. Their 1-hour SPM is 0.47 – 47.31 μg/m^3 with 24-hour level of 0.3 – 27.6 μg/m^3 and annual level of 0.03 – 3.50 μg/m^3. The cumulative 24-hour VOCs is 0.09 – 8.77 μg/m^3.

All the maximum ground level concentrations from the 2 x 500 kva generators are within their respective limits. While the cumulative maximum concentrations are also within their respective limits for all the other investigated air pollutants, NO_X concentrations breach their respective limits. However this is attributed to the existing Gbaran NIPP.

More details of the modelling methodology and results of the study are contained in Appendix Six.

4.4.8 Ambient Noise Levels

Ambient noise levels of the proposed project area as obtained during the fieldwork are reported in Table 4.15. While the minimum levels were 26.3 – 50.2 dB(A) in the wet season, the maximum were 47.0 – 62.3 dB(A). In the dry season the outdoor noise levels were 46.5 – 83.1 dB(A) but 57.6 – 69.4 dB(A) indoor. Both the minimum and maximum ambient noise levels in the wet season are within the 90 dB(A) shopfloor limit of the Federal Ministry of Environment and within the 70 dB(A) industrial area limit of the World Bank. While the minimum noise levels are within the 55 dB(A) day-time limit of the World Bank in the season, the maximum levels breach this limit in 47% of the sampling locations. The dry season indoor and outdoor noise levels are within the 90 dB(A) shopfloor FMEnv's limit but the 70 dB(A) industrial area limit is breached by the outdoor maximum noise. Similarly the 55 dB(A) day-time limit is breached by the maximum noise levels both indoor and outdoor. Several anthropogenic activities presently on-going in the study area were the identified sources of noise during the fieldwork.

Table 4. 15: Ambient Noise Levels of the Study Area

Sampling Location	Wet Season, dB(A)		Dry Season, dB(A)*	
	Minimum	Maximum	Minimum	Maximum
AQ1	33.6	56.9	Outdoor =46.5 Indoor = 57.6	Outdoor = 83.1 Indoor = 69.4
AQ2	27.8	47.0		
AQ3	27.8	60.9		
AQ4	26.3	58.4		
AQ5	28.3	55.9		
AQ6	28.1	50.9		
AQ7	27.7	50.7		
AQ8	28.8	50.8		
AQ9	30.1	50.9		
AQ10	29.3	51.8		
AQ11	26.6	53.2		
AQ12	27.7	58.2		
AQ13	28.4	50.9		
AQ14	49.0	56.9		
AQ15	50.2	62.3		

**Source: SPDC (2015)*

4.4.8.1 Noise Dispersion Modelling

Impacts of noise from the proposed 50,000 litres per day lubricating oils blending plant facility proposed by Eraskon Nigeria Limited, in Izeinbou Bush, Tunama Community, Gbaran Clan, Yenagoa Local Government Area (LGA) Bayelsa State have been investigated using NoiseMap 2000 and two operation scenarios. Its identified sources of noise include the Automatic Batch Blender, Pumps, and two units Perkins 500 kva electric power generators. For the purpose of cumulative impacts assessment, the two units 112.5 MW Gbaran National Integrated Power Plant (NIPP) were also considered.

The ambient noise levels associated with operation of the proposed plant when operated on the 2 x 500 kva electric power generators (***scenario 1***) are 32.5 – 92.5 dB(A) but 45.0 – 96.5 dB(A) when operated with the Gbaran NIPP as being proposed. It is concluded that the anticipated maximum ambient noise levels shall not breach the 90 dB(A) shopfloor limit of the Federal Ministry of Environment beyond the production floor of the lubricating oil blending plants and its electric power generators' house. Also, the 70 dB(A) industrial area and 55 dB(A) day-time limits of the World Bank shall not be breached beyond its fenceline. However for its night-time operation to be harmless there is the need for mitigation measures so that the 45 dB(A) night-time limit is not breached within 500 m radius of its fenceline. The cumulative impacts (***scenario 2)*** are not significantly different from these.

Presented in Appendix Seven are the details modelling methodology and results of the noise modelling.

4.4.9 Soil Quality Assessment

The collected samples in and around the sites (Table 4.16) as shown in Figure 4.11 were mixed together to obtain a composite sample grounded in a laboratory after oven drying for 24 hours. The 2 cm sieve then was used to remove gravel fraction. From the sieved fractions, log sub-samples were used for laboratory analyses. The samples were analyzed for texture, pH, Exchangeable cations (Ca, Mg, K and Na), total Nitrogen, available Phosphorus and other physicochemical elements.

Table 4. 16: Location of In-Situ Soil Sampling Points

S/No	Eastings	Northings	Elevation (m)
1	200072	555944	16
2	199864	556146	16
3	199933	556144	16
4	199954	556100	16
5	200032	556086	16
6	199988	556040	15
7	200071	556032	18
8	200081	556042	16
9	199889	556106	23
10	199935	556069	23
11 (Control)	200368	553823	23

Source: Fieldwork, 2020

Soil textural fractions were determined using hydrolytes method while soil pH was determined using pH meter. Available phosphorous was determined using Brays no. 1 method. Total Nitrogen was determined

![ERASKON NIGERIA LIMITED logo]

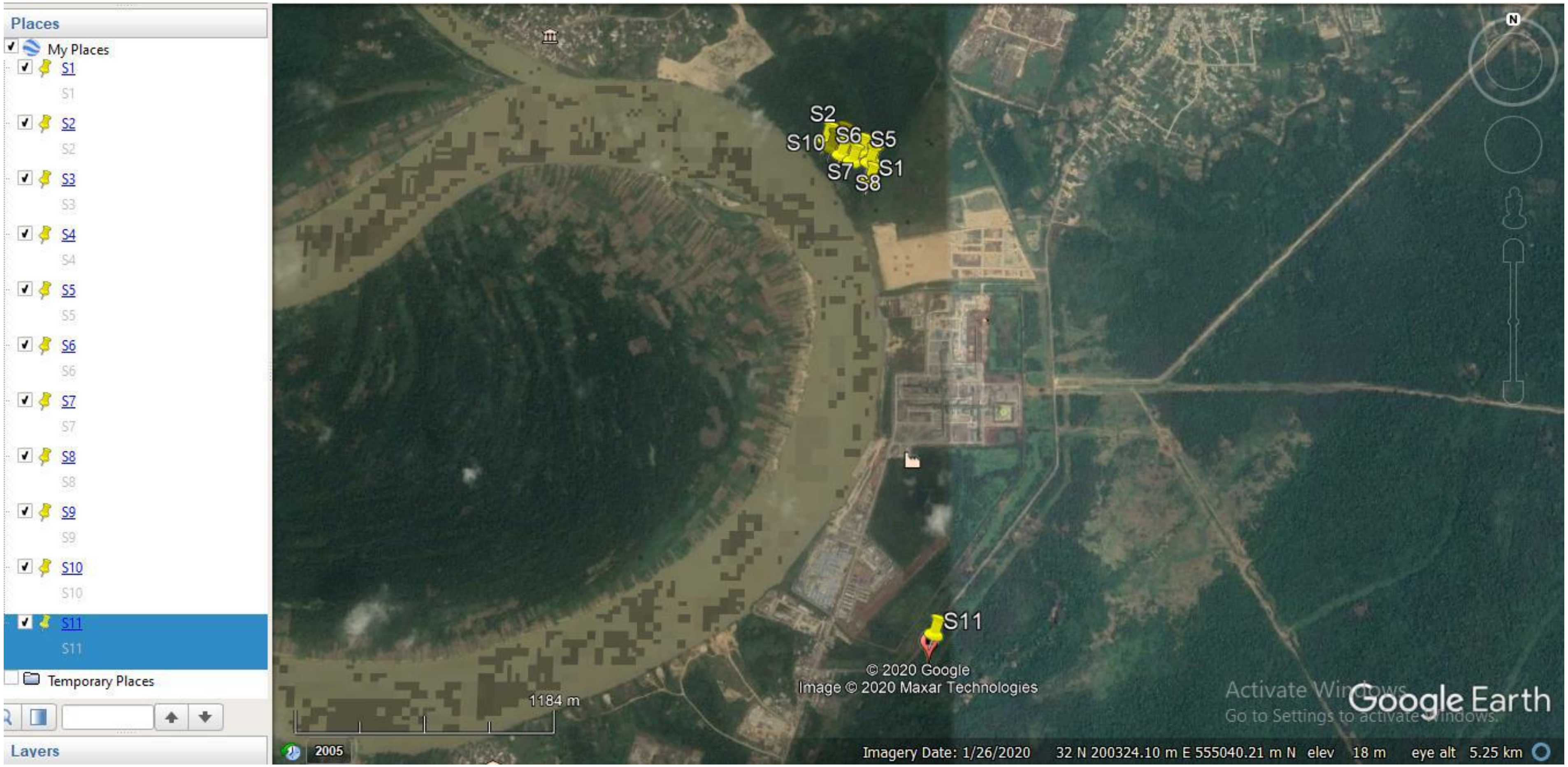

Figure 4.11: Soil Sampling Locations in the Proposed Project Site

using macro-kjeldahl method while the amounts of exchangeable bases in the samples were extracted using ammonium acetate extraction method. From the extract, propositions of Ca and Mg were determined with flame emission while those of Na and K were with Atomic Absorption Spectrophotometer. CEC was determined using ammonium acetate extraction method.

4.4.9.1. Wet Season Soil Quality Result and Analysis

The wet season soil quality were obtained from the laboratory test/analysis carried out on the 10 (ten) plus 1 (one) control samples collected from within and around the proposed Eraskon Nigeria Limited project site (Figure 4.11). From the results (Table 4.17), soil texture is generally fine, and of the silty/sticky clay type. Moisture content range from 7.0 to 10.0%, pH is 5.15 to 5.52, Temperature is 26.7 to 27.4 °C, Electrical conductivity is 10.1 to 28.6 µS/cm, Total Dissolved Solids is 4 to 15.4 mg/kg Dw, Total hardness is 4.1 to 12 mg/kg Dw, Nitrate ion is 0.70 to 3.0 mg/kg Dw, Nitrite ion is 0.01 to 0.04 mg/kg Dw, Copper ion is 0.02 to 0.35 mg/kg Dw, Calcium ion 4.0 to 8.9 mg/kg Dw, Calcium ion is 4 to 11 mg/kg Dw, Nickel is Nil, Iron ion is 1.0 to 3.1 mg/kg Dw, Vanadium is Nil, Lead ion is trace, Zinc is 0.13 to 0.18 mg/kg Dw, Total nitrogen is 0.001 to 0.21 mg/kg Dw, Magnesium ion is 0.6 to 1.6 mg/kg Dw, Manganese is 0.01 mg/kg Dw, Phosphate ion is 0.8 to 2.0, Cadmium ion is 0.001 to 0.7 mg/kg Dw, Cadmium is 0.001 to 0.7 mg/kg Dw, and potassium ion is 0.05 to 2.4 mg/kg Dw. Furthermore, soil particle size analysis was carried out on the soil samples and their results have been reported in Table 4.17.

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Table 4. 17: Results of physico-chemical and microbiological analysis of soil samples for wet season

PARAMETERS & UNITS	METHODOLOGY	SQ1	SQ2	SQ3	SQ4	SQ5	SQ6	SQ7	SQ8	SQ9	SQ10	Control
Colour	Soil Colour Chart – MUNSELL	Brownish 10YR7/6	Brownish 10YR7/5	Brownish 10YR7/4	Brownish 10YR7/5	Brownish 10YR7/4	Brownish 10YR7/4	Brownish 10YR7/3	Brownish 10YR7/6	Brownish 10YR7/4	Brownish 10YR7/5	Brownish 10YR7/6
Texture	-	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine
Type	-	Sticky clay	Silty clay	Sandy clay	Sticky clay	Sticky clay	Silty clay	Silty clay	Silty clay	Silty clay	Silty clay	Silty clay
M.C (%)	**Gravimetric**	9	9.5	10	10	10	8.5	7.0	8.0	9.0	9.0	10
pH	**Thermoelectric**	5.40	5.34	5.28	5.23	5.17	5.34	5.50	5.32	5.15	5.34	5.52
Temp. ^{0}/C	**Thermoelectric**	27.0	26.9	26.7	26.9	27.1	27.1	27.0	27.3	26.9	27.1	27.4
E. Cond. µS/cm	**Electrometric**	12.6	10.9	9.3	10.1	10.9	15.7	20.5	24.6	28.6	27.3	19.9
TDS mg/kgDw	**Electrometric**	6	6.7	7.5	7.4	7.5	5.8	4	10.0	16	15.4	10.2
T.H (mg/kgDw)	**Titrimetric**	5	5.5	6	5.0	4.1	7.1	10	11.0	12	9.3	7.2
NO_3^-(mg/kgDw)	**Colorimetric**	0.70	1.1	1.5	1.3	1.0	2.0	3.0	2.6	2.1	2.4	1.6
NO_2^-(mg/kgDw)	**Colorimetric**	ND	ND	ND	0.01	0.01	0.01	0.02	0.03	0.04	0.03	ND
Cu^{2+}(mg/kgDw)	**Colorimetric**	0.03	0.19	0.35	0.19	0.03	0.04	0.05	0.04	0.04	0.02	0.02
Ca^{2+}(mg/kgDw)	**Colorimetric**	4	7.5	11	7.6	4.1	6.1	8.0	8.5	8.9	8.7	6.0
Ni(mg/kgDw)	**Colorimetric**	Nil	Nil	ND	Nil	Nil	Nil	Nil	Ni	Nil	Nil	Nil
Fe^{2+}(mg/kgDw)	**Colorimetric**	1.0	1.5	2.1	2.6	3.1	2.5	1.9	2.1	2.3	2.2	1.7
V(mg/kgDw)	**Colorimetric**	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Pb^{2+}(mg/kgDw)	**Colorimetric**	Nil	Nil	Nil	ND	ND	ND	ND	Nil	0.011	ND	ND
Zn^{2+}(mg/kgDw)	**Colorimetric**	0.15	0.15	0.16	0.16	0.17	0.15	0.17	0.16	0.18	0.13	0.16
TN (mg/kgDw)	**Colorimetric**	0.05	0.13	0.21	0.10	0.001	0.004	0.001	0.023	0.044	0.015	0.01
Mg^{2+}(mg/kgDw)	**Colorimetric**	0.9	0.9	0.9	0.6	0.8	1.2	1.5	1.5	1.6	1.1	1.0
Mn^{2+}(mg/kgDw)	**Colorimetric**	ND	ND	ND	ND	ND	0.01	0.01	ND	0.01	0.01	ND
PO_4^-(mg/kgDw)	**Colorimetric**	1.5	1.7	2.0	1.5	0.9	0.8	1.0	1.1	1.3	1.5	1.5
cadmium(mg/kgDw)	**Colorimetric**	0.002	0.006	0.01	0.01	0.02	0.2	0.7	0.351	0.002	0.001	0.001
K^{2+}(mg/kgDw)	**Colorimetric**	0.12	0.08	0.05	0.17	0.3	0.24	0.18	2.4	2.2	I.3	0.71
Particle size	**Soil sizes**	**Soil Particle Size Results**										
Very Coarse	2.0mm	0	0	0	0	0	0	0	0	0	0	0
Coarse	1.0mm	14.0	15.7	17.5	16.8	16.1	28.1	40.0	30.4	20.8	19.5	16.8
Medium	150µm	20.8	22.9	25.0	31.8	38.7	28.1	17.4	24.9	32.3	21.5	21.2
Fine	212µm	25.2	31.4	37.5	29.9	22.4	22.9	23.3	24.6	25.9	23.3	24.3
Very Fine	355µm	-	0.2	0.3	0.1	-	-	-	-	-	0.1	-
Silt	425µm	24.4	21.7	19.1	15.4	11.6	12.2	11.6	10.9	10.2	18.4	21.4
Clay	600µm	2.7	2.6	2.4	2.2	2.0	1.8	1.9	2.5	3.1	2.6	2.5
	Pan	9.4	8.9	8.4	8.0	8.2	6.9	5.6	6.7	7.8	8.0	8.5
Porosity %		148.0	148.0	149.0	157.0	165.0	160.0	155.0	157.0	160.0	151.0	149.0
Bulk density g/cm^3	2.00	1.667	1.834	2.000	2.667	3.333	2.917	2.500	1.743	-	1.922	1.795

Source: Laboratory Analysis by Labchemnec Jans Limited

4.4.9.2. Dry Season Soil Quality Result and Analysis

Dry season soil quality results for the project site were obtained from the Final ESIA report of the SPDC Adibawa-Gbaran 3D reshoot Seismic Project (SPDC, 2015). The results are summarized in Table 4.18and discussed in this section.

Soil Physicochemical Properties: Typical physico-chemical properties of the soil in the project area are highlighted in Table 4.18 and Figures 4.12 and 4.13. The dry season mean pH values for surface and subsurface soil were 5.02 and 4.95, while the corresponding conductivity values were 178 and 110 µS/cm. Soil organic matter was 2.13 and 1.38%, while exchangeable calcium was 0.23 meq/100 g at both soil depths.

Table 4. 18: Dry Season Soil Physico-Chemical Characteristics in the Area

Parameter	Depth	ZONE 1		ZONE 2		ZONE 3		ZONE 4	
		Range	Mean	Range	Mean	Range	Mean	Range	Mean
pH	0–15	5.9 – 6.5	6.13	5.3-5.75	5.53	4.64-5.78	5.02	3.88 – 4.54	4.28
	15–30	5.6 – 6.3	5.98	5.2-5.85	5.49	4.60-5.32	4.95	3.84 – 4.52	4.21
Org. Matt %	0–15	0.80-2.40	1.54	0.42-2.03	1.14	0.90-5.24	2.33	0.42 – 3.22	12.5
	15–30	0.80-1.90	1.41	0.30-1.81	0.97	1.07-2.56	1.38	0.35 – 1.96	12.0
Avail .P mg/kg	0–15	ND	ND	16.7-28.9	22.3	ND	ND	1.98 – 4.98	3.63
	15–30	ND	ND	16.34-2.26	20.5	ND	ND	0.60 – 3.22	2.5
E.C µS/cm	0–15	93.0 – 168	129.38	20-260	80	30.0-620	178.1	93.0 – 168	129.4
	15–30	78.0 – 147	114.49	20-120	47.5	20.0-150	110	78.0 – 147	114.5
Ca^{2+} meq/100g	0–15	1.5 – 8.2	4.28	28.1-79.3	50.7	0.10-0.39	0.23	28.3 – 50.2	38.7
	15–30	0.16 – 8.60	4.62	18.3-66.9	48.8	0.06-0.21	0.23	20.3 – 41.4	31.8
Na^{+} meq/100g	0–15	ND	ND	10.1-36.1	21.9	0.91-3.16	1.71	12.7 – 35.9	23.9
	15–30	ND	ND	11.1-28.1	20.5	0.39-1.94	1.16	11.9 – 30.4	18.9
K^{+} Meq/100g	0–15	3.54 – 5.20	4.26	16.1-45.6	28.8	0.43-1.14	0.82	18.8 – 42.4	31.3
	15–30	3.86 – 5.01	4.4	10.3-40.0	24.2	0.40-0.99	0.67	12.6 – 30.3	19.8
Phosphate mg/kg	0–15	18.5 – 23.5	20.74	28.3-42.2	35.7	ND	ND	20.2 – 31.7	26.5
	15–30	17.2-22.1	19.14	30.3-42.2	35.9	ND	ND	20.2 – 31.2	26.1
Nitrate mg/kg	0–15	3.6 - 6.4	5.26	10.2-12.8	11.4	ND	ND	0.60 – 1.40	1.32
	15–30	3.6 - 8.9	5.03	10.3-12.6	11.3			0.24 – 1.26	1.08
Ni mg/kg	0–15	0.23 - 1.15	0.48	0.35-8.95	4.8			0.35- 8.95	4.8
	15–30	0.29 - 0.79	0.45	0.68 -9.64	4.7			0.68 – 9.64	4.70
Pb mg/kg	0–15	0.14 - 0.61	0.29	0.367-1.22	0.7			0.12 –0.20	0.15
	15–30	0.12 - 0.52	0.26	0.029-1.76	0.8			0.10 – 0.24	0.15
Cr mg/kg	0–15	1.02 - 12.00	3.52	0.24-2.18	1.5			0.12 – 0.19	0.16
	15–30	1.06 - 14.3	3.85	0.36-2.37	1.6			0.09 – 0.17	0.14
Zn mg/kg	0–15	1.18 - 10.2	4.07	2.98-53.7	20.5			0.18 – 0.44	0.3
	15–30	0.17 - 6.76	2.41	4.29 -47.2	18.2			0.14 – 0.69	0.44
Mn mg/kg	0–15	290 – 450	372.9	6.45-566.5	116.0			0.13 – 0.22	0.17
	15–30	45.7 – 474	371.7	3.60 -304.2	72.7			0.14 – 0.26	0.18
Fe mg/kg	0–15	512.1 - 1261.9	918.7	297.87-1481	780.9			834.5 – 1023.0	993.7
	15–30	613.1 - 1262.9	978.7	330.78-1634	965.1			609.4 – 1025.3	976.8

**Source: SPDC (2007a,b; 2008; 2009; 2010; 2012; 2015)*

Note: Our area of concentration is Zone 3 which falls within Eraskon Nigeria Limited proposed project site

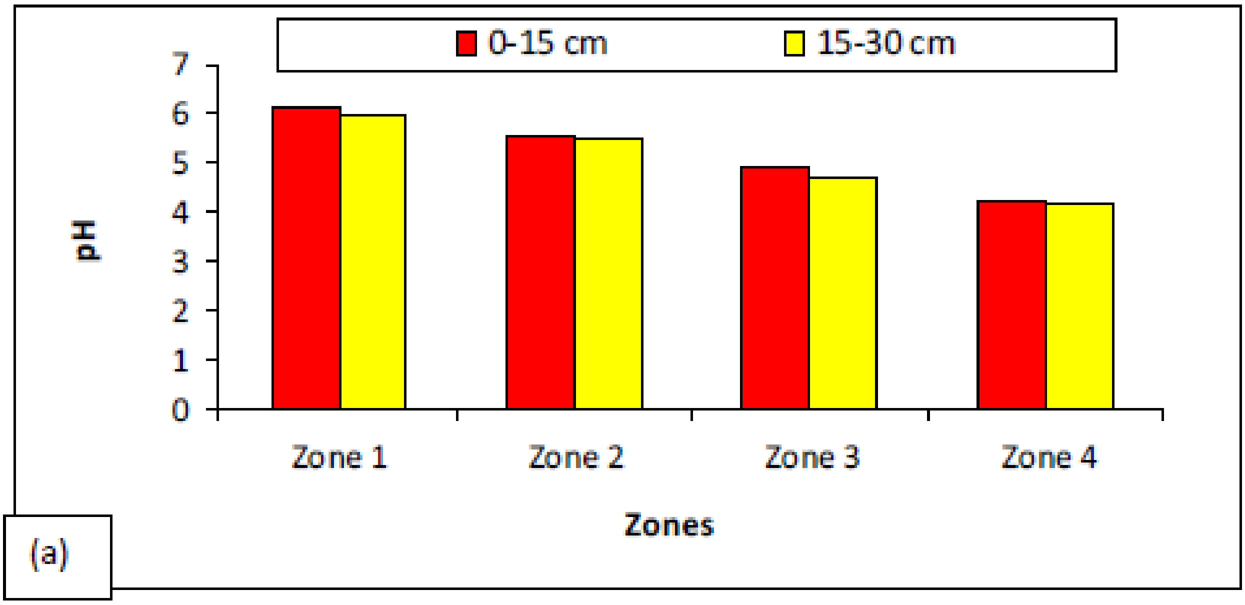

Fig. 4.12: Mean pH values in the soil at different locations within Adibawa-Gbaran Seismic reshoot area for dry season

Source: SPDC (2007a,b; 2008; 2009; 2010; 2012; 2015)

Note: Our area of concentration is Zone 3 which falls within Eraskon Nigeria Limited proposed project site

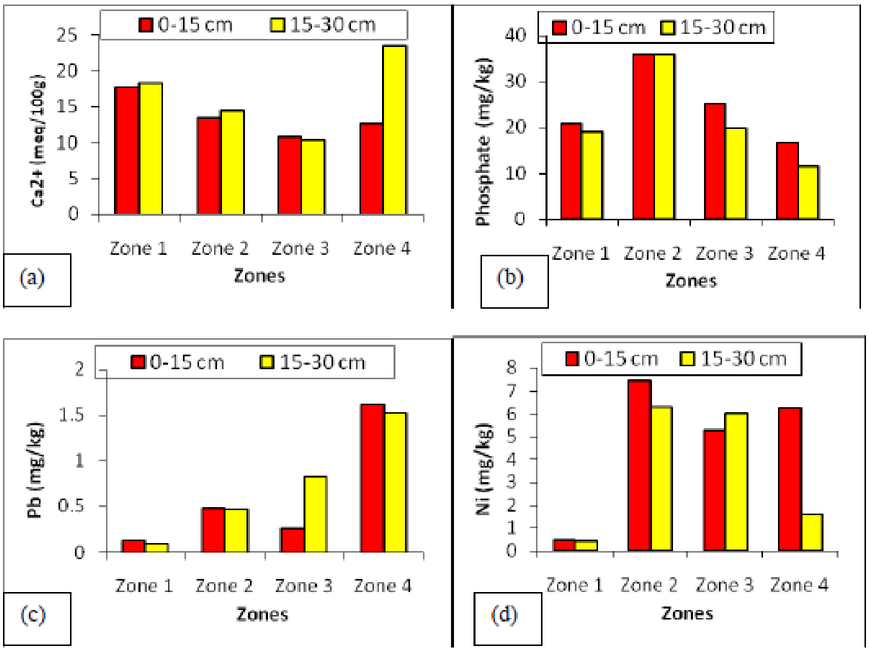

Fig. 4.13: Mean values of soil nutrients and heavy metals in the different locations within Adibawa-Gbaran Seismic reshoot area: (a) Ca^{2+} (b) phosphate (c) lead and (d) nickel.

Source: SPDC, 2007a,b; 2008; 2009; 2010; 2012; 2015

Soil Microbiology: The bacterial count varied from 1.0 x 10^3 to 7.78 x 10^5 cfu/g, while the fungi count of the soils of the study area varied from 1.8 x 10^3 to 1.22 x 10^5 cfu/g. The seasonal and depth variations in microbial load are summarized in Table 4.19 and illustrated in Figure 4.14. All parameters were higher in the top soil and in the dry season. The level of PUB and PUF did not indicate petroleum pollution in the study area thus the HDB in the soil samples can be considered as pristine levels. However, this is at variance with Atlas (1981) that considered pristine levels of HDB to be less than 1%. This variance may be attributed to hydrocarbon contamination in the soil (via anthropogenic activities, accidental spills, leakages) as observe by Zaihan and Tuah (2008).

Table 4. 19: Microbial characteristics of soil in Gbaran

Sample code	Soil depth cm	Rainy season			Dry season		
		Min	max	mean	min	max	mean
Total bacteria (x 10^5cfu/g)	0-15	0.1	7.78	4.5	4.9	8.9	7.2
	15-30	0.1	6.24	3.2	3.1	6.8	4.8
Total fungi (x 10^5cfu/g)	0-15	0.18	1.22	1.04	1.2	1.9	1.6
	15-30	0.15	1.20	1.06	0.9	1.6	1.2
Pet. Ut.Bact (x 10^3cfu/g)	0-15	0.01	0.8	0.41	1.2	2.6	3.5
	15-30	0.01	0.2	0.1	1.2	2.8	1.8
Pet. Ut. Fungi (x 10^3cfu/g)	0-15	0.01	0.14	0.06	0.2	1.4	0.8
	15-30	0.01	0.12	0.05	0.2	1.2	0.5

Source: SPDC, 2007a,b; 2008; 2009; 2010; 2012; 2015

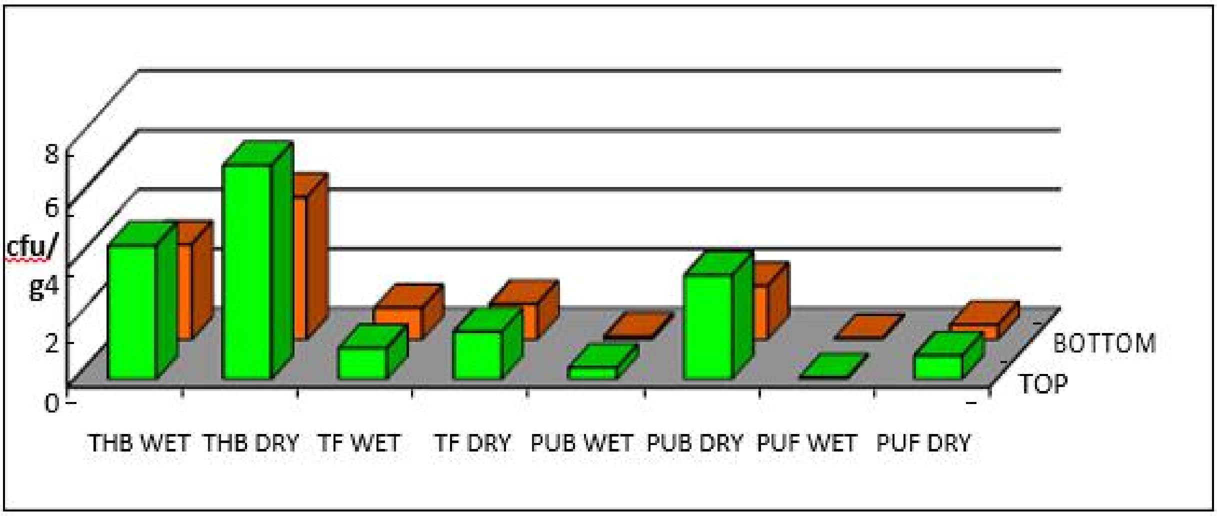

Figure 4.14: Microbial counts in the wet and dry seasons for top and bottom soil
Source: SPDC, 2007a,b; 2008; 2009; 2010; 2012; 2015

High levels of bacteria and fungi in the project area is a reflection of the eutrophic (high nutrient) nature of the environment. Nine bacterial genera *Pseudomonas, Arthrobacter, Acinetobacter, Norcadia, Klebsiella, Enterococci, Enterobacter, Vibrio, Micrococcus*, *Bacillus* were identified from the soils. Some of the genera were less frequently isolated. The fungal isolate mainly belonged to the genera *Aspergillus, Saccharomyces, Mucor, Fusarium, Candida* and *Penicillium*.

4.4.10 Water Quality Assessment

As earlier indicated, surface and ground water samples were collected for laboratory analysis. Surface (River Nun), and ground (borehole) water samples were collected (Table 4.20) as shown in Figure 4.15. The water sample sources taken were the closest to the project site. The implementation and operation of the Eraskon Nigeria Limited lubricating oil production plant project will relatively impact the surface and ground water.

Table 4. 20: Wet Season Water Sampling Locations in the Study Area

ID	Description	Eastings	Northings	Elevation (m)
W1	Azikel Refinery BH	200847	555630	24
W2	Obunagha BH 1	201564	556740	12
W3	Obunagha BH 2	201474	556906	15
W4	Upstream (River Nun)	198445	556641	4
W5	Mainstream (River Nun)	200032	555835	18
W6	Downstream (River Nun)	199878	554349	16

Source: Field Study, 2020

4.4.10.1 Wet Season Water Quality Results and Assessment

Wet season chemical analysis of ground water samples: Ground water properties in the wet season are summarized in Table 4.21 while that of surface water are reported in Table 4.22. From the groundwater properties, it is observed that:

- pH values for ground water samples collected shows that W1 and W2 are acidic which W3 is faintly acidic and the results are below FMEnv permissible limit for drinking water standard of 6.5 - 8.5,
- Colour of W2 shows it is amber,

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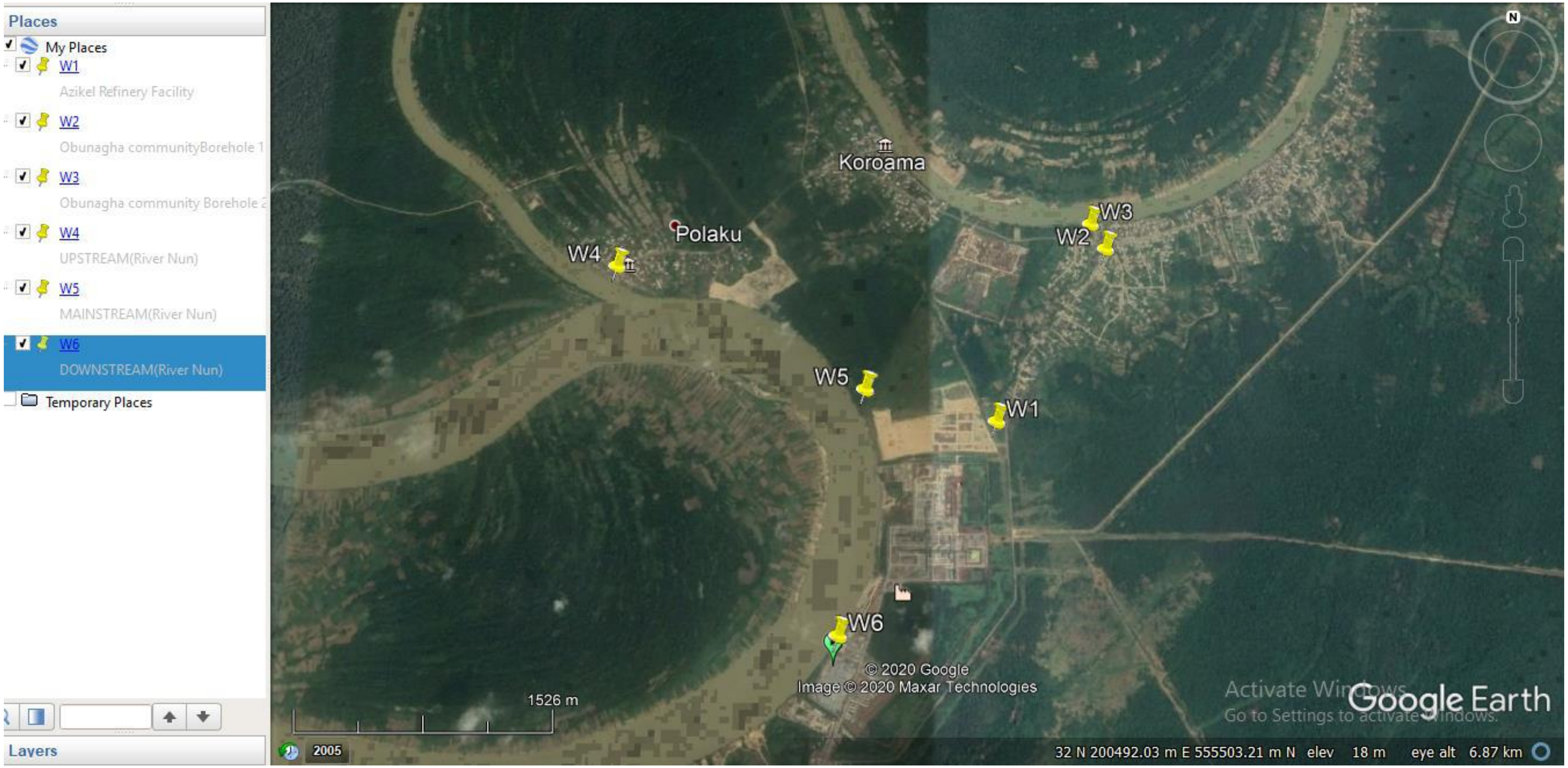


Figure 4.15: Wet Season Surface and Ground Water Sampling Locations in the Study Area

Table 4. 21: Results of ground water samples for wet season

PARAMETER	Azikel Refinery BH (W1)	Obunagha Community 1 (W2)	Obunagha Community BH (W3)	FMEnv Drinking Water Standard
Colour	Clear	Amber	Clear	Colourless
Odour	Odourless	Odourless	Odourless	Odourless
pH @20°C	6.4	6.4	6.6	6.5-8.5
Temp. °C	27.9	27.5	27.6	<40
E. conductivity µS/cm	93.5	87.0	72.3	500
Turbidity NTU	1.2	14	5	1.0
TSS mg/l	7.3	9.7	6.5	10
TDS mg/l	56.2	50.2	40.1	500
Total Hardness mg/l	48.6	52	50.5	NS
Carbonate mg/l	39.1	52	45.5	NS
Chloride mg/l	16.8	20.5	17.9	250
Total alkalinity mg/l	51	64	48	100
Nitrate mg/l	0.74	0.60	0.79	10
Nitrite mg/l	Nil	Nil	0.02	1.0
$BOD_{20}{}^{5}$ mg/l	3	5	6	0
Phosphate mg/l	0.68	0.25	0.47	500
DO mg/l	6.1	6.9	6.0	7.5
Sulphate mg/l	52	47	47	5.0
Iron mg/l	0.021	0.036	0.003	1.0
Zinc mg/l	Nil	Nil	0.2	5
Manganese mg/l	0.04	0.10	0.5	0.05
Magnesium mg/l	3.8	5.0	4.5	NS
Lead mg/l	ND	ND	0.01	0.05
Potassium mg/l	0.001	0.003	0.16	NS
Cadmium mg/l	Nil	0.001	Nil	0.01
Calcium g/l	17.5	20.0	18.9	75
Cu^{2+} mg/l	ND	0.05	ND	0.1
Cyanide mg/l	ND	ND	ND	-
Nickel mg/l	Nil	Nil	0.001	0.1
Arsenic mg/l	ND	0.001	ND	0.2
BACTERIOLOGICAL				
T B C Cfu/100ml	$1X10^2$	$2X10^2$	$2X10^2$	**1000**
Total Coliform Count Cfu/100ml	$3X10^1$	$2X10^1$	$4X10^1$	**400**
Feacal Coliform Coun MPN/100ml	Nil	Nil	Nil	**0**

Source: Laboratory Analysis by Labchemnec Jans Limited, 2020

***ND:- Not Detected, *NS:- Not Specified**

Table 4. 22: Results of surface water samples for wet season

PARAMETER	Downstream of River Nu (W4)	Mainstream of River Nun (W5)	Upstream of River Nun (W6)	FMEnv Limit for Aquatic Life (River)
Colour	Turbid	Slightly Turbid	Slightly Turbid	NS
Odour	Odourless	Odourless	Odourless	NS
pH @20°C	6.38	6.58	6.41	6.0 - 9.0
Temp. °C	27.5	26.9	27.5	20 – 33
E. conductivity µS/cm	65.9	49.5	30.5	NS
Turbidity NTU	11.0	6.5	7.0	NS
TSS mg/l	18.5	10.4	21.3	NS
TDS mg/l	40.7	33.8	21.5	NS
Total Hardness mg/l	40.1	45.2	35.5	NS
Carbonate mg/l	40.1	29.7	35.5	NS
Chloride mg/l	17.8	19.7	17.5	NS
Total alkalinity mg/l	55	51	56	NS
Nitrate mg/l	0.10	0.42	0.56	NS
Nitrite mg/l	Nil	Nil	Nil	0.06
BOD_{20}^{5} mg/l	20	11	25	4
Phosphate mg/l	0.17	0.19	0.14	NS
DO mg/l	5.9	5.5	6.5	6.8
Sulphate mg/l	38	47	55	NS
Iron mg/l	0.2	0.6	0.03	1.0
Zinc mg/l	0.01	Nil	Nil	0.03
Manganese mg/l	0.10	0.04	0.2	NS
Magnesium mg/l	4.5	1.8	2.5	NS
Lead mg/l	ND	ND	0.001	1.7
Potassium mg/l	0.11	0.01	0.15	NS
Cadmium mg/l	0.01	0.001	0.001	0.02 – 2.0
Calcium g/l	16.5	12.4	13.5	NS
Cu^{2+} mg/l	0.01	0.01	0.15	NS
Cyanide mg/l	ND	ND	ND	-
Nickel mg/l	Nil	Nil	Nil	-
Arsenic mg/l	ND	ND	Nil	0.5
BACTERIOLOGICAL				
T B C Cfu/100ml	$4.1X10^3$	$3.0X10^3$	$3.1X10^3$	**NS**
Total Coliform Count Cfu/100ml	$1X10^2$	$1.0X10^1$	$2.1X10^1$	**NS**
Feacal Coliform Count MPN/100ml	7.0	7.0	9.0	**NS**

Source: Laboratory Analysis by Labchemnec Jans Limited, 2020

***ND:- Not Detected,   *NS:- Not Specified**

- Turbidity of ground water W1, W2 and W3 recorded 1.2NTU, 14.0NTU and 5NTU respectively, which are above FMEnv permissible limit for drinking water standard of 1.0NTU,
- Sulphate of ground water samples recorded 5.2mg/l, 4.7mg/l and 4.7mg/l respectively, which are above FMEnv permissible limit for drinking water standard of 5.0mg/l,
- Manganese recorded 0.1mg/l in W2 and 0.5mg/l in W3, both figures are above FMEnv permissible limit for drinking water standard of 0.05mg/l.

Except for the above mentioned analytes which were above FMEnv permissible limit for drinking water, results from other analytes fall within the FMEnv permissible limits for drinking water.

Wet season microbiological analysis of groundwater: As reported in Table 4.21, TBC was 1×10^2 in W1, 2×10^2 in W2 and 2×10^2 in W3 which are all below FMEnv Permissible Limit for Drinking Water of 1.0×10^3. Similarly TCC was 3×10^1 in W1 but 2×10^1 in W2 and 4×10^1 in W3 which are below FMEnv Permissible Limit for Drinking Water of 4.0×10^2.

The laboratory results of water samples show that TBC and TCC were found to be below FMEnv permissible limit for drinking water in W1, W2 and W3. Nevertheless, all the water samples should be properly treated before consumption.

Chemical analysis of surface water samples during wet season: As earlier indicated, the surface water samples were from River Nun Downstream, Mainstream & upstream. From the laboratory results (Table 4.22):

- pH was 6.38 in W4, 6.58 in W5 and 6.41 in W6 implying W4 and W6 are acidic while W5 is faintly acidic. These are below FMEnv permissible limit for drinking water standard f 6.0 – 9.0; and
- BOD of W4, W5 and W6 were 20 mg/l, 11 mg/l, and 25 mg/l respectively which are above FMEnv permissible limit of 4mg/l for aquatic life standard.

This further affirms the fact that the surface water samples collected were unfit for human consumption.

Microbiological analysis of surface water during wet season: TBC recorded $4.1x10^3$ in W4, $3.0x10^3$ in W5 and $3.1x10^3$ in W6. TCC recorded $1x10^2$ in W4, $1x10^1$ in W5 and $2.1x10^1$ in W6. FCC recorded $7x10^0$ in W4, $7x10^0$ in W5 and $9x10^0$ in W6.

4.4.10.2 Dry Season Water Quality Results and Assessment

Dry season water quality results for the project site was obtained from the Final ESIA report of the SPDC Adibawa-Gbaran 3D reshoot Seismic Project (SPDC, 2015). The results and analysis are summarized in Table 4.23, Table 4.24 and Table 4.25.

Table 4. 23: Summary of Physico-Chemical Characteristics of Surface Water (Dry season)

Parameter	Gbaran (River Nun)			
	Range	Mean	SD	DPR/ *FMEnv
pH	7.13-8.80	7.95	0.34	6.5-8.5
Conductivity, µS/cm	40-250	91.9	42.73	
Bicarbonate, mg/l	3.5-10.1	6.89	1.76	
Alkalinity, mg/l	11.0-14.0	12.3	0.67	0.3
Biochemical Oxygen Demand mg/l	1.40-3.80	2.26	6.62	
Dissolved Oxygen mg/l				7.5*
Chemical Oxygen Demand, mg/l	42.0-350.0	199.3	123.5	
Salinity as Chloride, mg/l	7.09-35.5	13.82	8.09	
Total Hardness, mg/l	89.4-250.0	186.6	42.24	
Ammonium, mg/l	ND	ND	ND	
Nitrite , mg/l	ND	ND	ND	
Nitrate, mg/l	0.51-2.51	1.21	0.47	10*
Phosphorus, mg/l	4.87-8.53	6.06	0.83	<5*

Source: Final Environmental Impact Assessment (EIA) Report for the Adibawa-Gbaran 3d Reshoot Seismic Data Acquisition Project in Bayelsa and Rivers States. 2015

Table 4. 24: Dry season heavy metal content of the surface waters of the study area

Metals	Gbaran (River Nun)			
	Range	MEAN	SD	DPR/ *FMEnv
Chromium, mg/l	0.001-1.28	0.34	0.39	
Cadmium, mg/l	0.002-0.24	0.04	0.08	1.0*
Copper, mg/l	0.012-0.66	0.20	0.24	0.01*
Lead, mg/l	0.002-0.55	0.05	0.15	
Iron, mg/l	0.30-2.61	0.92	0.62	0.05*
Nickel, mg/l	0.001-0.49	0.13	0.18	15/5.0*
Vanadium, mg/l	<0.001	<0.001	0	1/1*
Zinc, mg/l	0.001-0.62	0.21	0.17	0.05*
Arsenic, mg/l	<0.001	<0.001	0	0.01*
Mercury, mg/l	<0.001	<0.001	0	0.2*

Source: Final Environmental Impact Assessment (EIA) Report for the Adibawa-Gbaran 3d Reshoot Seismic Data Acquisition Project in Bayelsa and Rivers States. 2015.

Table 4. 25: Summary of Surface water Microbiology

	Dry Season			FMEnv Limits
Parameter	**Mean**	**Range**	**Standard Deviation**	
THB ($\times10^4$) cfu/ml	510	39 – 2700	2.5	
THF ($\times10^2$) cfu/ml	2525	450 - 8500	2.73	
Total Coliform (MPN/100ml) ($\times10^3$) cfu/ml	26	9.0 - 64		0
Petroleum utilizing bacteria ($\times10^4$) cfu/ml	5.3	0-9.8	3.03	
Petroleum utilizing fungi ($\times10^3$) cfu/ml	5.56	0.9-9	2.96	
FCC (MPN/100ml)				0

Source: Final Environmental Impact Assessment (EIA) Report for the Adibawa-Gbaran 3d Reshoot Seismic Data Acquisition Project in Bayelsa and Rivers States. 2015.

4.4.11 Measurements of Soil and Groundwater Benzene, Toluene, Ethylbenzene and Xylene (BTEX), Methyl Tertiary-Butyl Ether (MTBE) and Total Petroleum Hydrocarbons (TPH) that Reflect Pollution from Hydrocarbon Production

Table 4.26 summarizes results of Benzene, Toluene, Ethylbenzene and Xylene (BTEX), Methyl Tertiary-Butyl Ether (MTBE) and Total Petroleum Hydrocarbons (TPH) of the project area. Both BTEX and MTBE were not detected in the water and soil samples investigated. However TPH levels indicate that in the soil of the project area, the concentration is 0.20 - 6.27 mg/kg with no established trend in the period covered. This is about 0.4 - 12% of its 50 mg/kg limit. Though TPH was negligible in groundwater from two of the three samples, it was 0.003 – 1.130 mg/l which is about 0.04 - 16% of the 7 mg/l limit. Sediment in the area has TPH level of 0.25 – 6.27 mg/kg but also with no defined trend. These are all about 0.5 - 12% of the limit.

Table 4. 26: Present Levels of BTEX, MTBE and TPH in the Proposed Project Area

Year	BTEX	MTBE	TPH		
			Soil (mg/kg)	G/water (mg/l)	Sediment(mg/kg)
SPDC, 2013 (Dry season)	-	-	0.20 – 0.45	<0.001	<0.01
SPDC, 2015 (Dry season)	-	-	1.88 – 6.14	<0.1	0.25 – 1.25
Wet season, 2020	0.0	-	3.56– 6.27	0.003 – 1.130	3.56 – 6.27
DPR Limit			**50**	**7**	**50**

****SPDC – Shell Petroleum Development Company**
****DPR – Department of Petroleum Resources**

These reported TPH concentrations in soil, groundwater and sediments of the proposed project area, though signifies its presence, confirms very low level. This should not be surprising because any level above the set limit calls for intervention of the regulators (the Federal Ministry of Environment - FMEnv, Department of Petroleum Resources - DPR, National Environmental Standards and Regulations Enforcement Agency – NESREA and the National Oil Spill Detection and Response Agency - NOSDRA).

4.4.12 Hydrodynamic Model of the Nun River to Assess Erosion/ Accretion and Climate Change

The Nun River around where the Eraskon Nigeria Limited proposed Lubricating Oil Blending plant is to be located has been extensively studied using several tools including hydrodynamic models. Other useful data in the public domain sufficient to take some useful scientific decision about its anticipated impacts on erosion and accretion were considered. Some of the existing relevant information is thus used to analyse how climate change anticipated as a result of the proposed project may influence both erosion and accretion in the project area. Also, some fresh data were obtained from the field and combined with already existing data for the hydrodynamic modelling of Nun River.

Adegoke et al (2010) reported that because of the 22 m/annum erosion rate established by the Shell Petroleum Development Company (SPDC) in this study area, some erosion mitigation measures were purposely implemented. Also, the Integrated Oil and Gas facility around the proposed project site, SPDC constructed a Materials Offloading Quay including a ro-ro ramp, a passenger jetty and a fire water station. This then necessitated the River bed protection in front of the quay wall and slope protection on the north and south sides of the quay wall to prevent scour by the flow of the river and propeller wash from vessels using the quay wall. The decision was informed by the results obtained from the scour protection study commissioned by SPDC (Matheja Consult, 2007) at the Nun River. The report of this study including details of its 3D numerical model with which scour simulation was executed is in the public domain and has been found very useful in this study.

In the Niger Delta area where the project is to be located, River Niger bifurcates into two main distributaries including the Nun and Forcados rivers, some 100 km south of the apex creating a coastline spanning of over 450 km (Obowu and Abam, 2014). With a total length of 195 km and average width of 370 m, Nun River is considered the largest in Bayelsa State (FDP, 1980). It flows through sparsely settled zones of freshwater and mangrove swamps and coastal sand ridges before completing its south westerly course to the Gulf of Guinea, a wide inlet of the Atlantic Ocean, at Akassa (Nwoko et al., 2017).

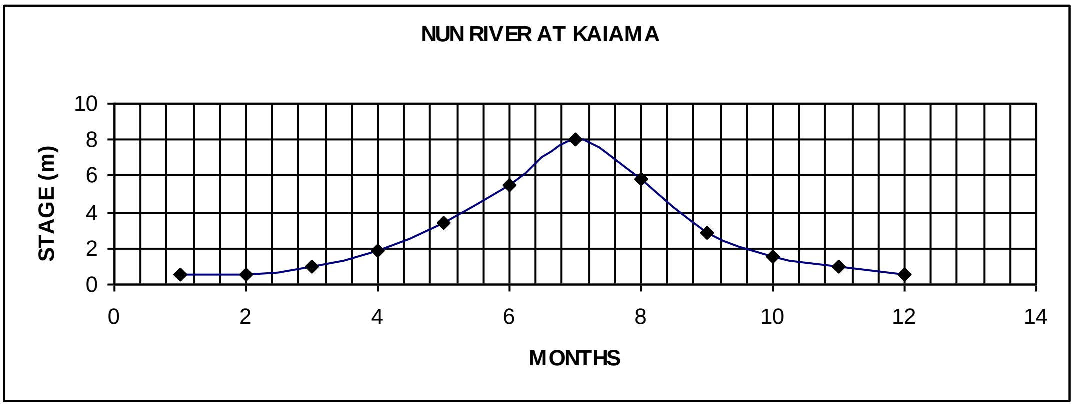
Hydrology of River Niger from which the Nun River emerged reveals it is characterised by two floods which are the "white flood" and "black flood". While the white flood is due to local rainfall within Nigeria the black flood originates from the headwaters of the Niger and the Benue outside the country (NEDECO, 1980). The black flood is relatively very clean compared to the white flood which has milky appearance resulting from its high silt load. Unlike in the middle reach of the Niger (i.e between Niamey through Kainji Lake to Jebba) where the two floods are very prominent, in the Niger Delta area, the black flood is considerably reduced. The white flood reaches a peak in September in middle Niger Valley and a month later in the Niger Delta area. The impoundment of lakes Kainji and Jebba within the middle Niger valley has great influence on the flood characteristics of the Niger Delta where the proposed site is located. The annual monthly average discharge as well as the peak discharge of the two floods in the area has become reduced to about 43 – 85% of the pre-impoundment values. Whereas the ratio of Black flood to White flood has nearly doubled in the middle Niger Valley, the value is almost halved in the Niger Delta. As summarized in Table 4.27 the discharge rates of Nun River and related water bodies in the project area clearly indicate that this river has great influence on the flood pattern of the entire region. As shown by its stage hydrographs (Figure 4.16), there is attenuation along the Nun River at some points along its course as it approaches the sea which clearly indicates that its erosion and accretion characteristics may be influenced by the way the proposed project interacts with it from its point of intersection.

Table 4. 27: Average Discharge Capacities of some Rivers in the Area

S/No	River/Creek	Discharge (m^3/s)
1.	Nun River	6800
2.	Taylor Creek	500

3.	Orashi River	2030
4.	Sombriero River	386
5.	Ekole Creek	2400

Source: NDBDA, 1980



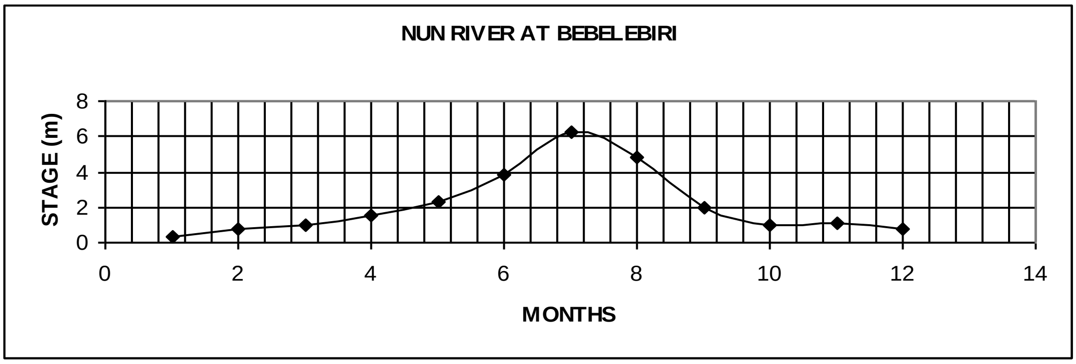


Figure 4.16: Hydrographs of Nun River

Using 1D model under normal flow conditions with Sea Level Rise (SLR) ranging from 0.14 m - 0.35 m for the Nun River, Musa (2019) reported that with higher SLR values, initial water depths in the channel (in June) are much higher than without SLR. This implies that rise in sea levels will cause the flooding of areas around the Nun River which under 'normal' conditions does not overflow its banks in the rainy season. Though the proposed project impact on global warming is not anticipated to be so significant to singularly induce SLR, Eraskon Nigeria Limited shall take necessary steps required to ensure that emissions of GHGs are always controlled. Nwoko et al (2017) used sediment concentration and hydrodynamics equations of partial differential in 3-dimensions with finite difference methods and the Crank Nicolson procedure to predict sediment concentration of the Nun River.

The model is useful in predicting sediment concentration distribution of the river. It shows higher versus lower sediment concentrations at outer and inner bends, with resultant effect of erosion and sediment deposition accordingly. As reported by Matheja Consult (2007), construction of a wall at the border of the site with the Nun River to stop erosion on-site and protect against floods may increase erosion along the banks thus erosion nearby caused by the site shall be actively monitored and Eraskon Nigeria Limited is committed to this. This is expected to guide in the further actions that may be taken in the nearest future just as adopted by the operator of the integrated oil and gas facility presently operating in the area. Youdeowei (1997) reported that degradation of river banks and their eventual collapse and erosion is prevalent at peak flood periods in the Niger delta area of Nigeria. It further asserted that current velocities close to 2.00 m/s at the upper reaches of its major rivers exert intensive hydrodynamic influences on the banks and levees of communities, which lead to erosion and extensive flooding episodes. Going by this the reported velocities of 0.02 – 0.69 m/s with mean of 0.45 m/s at the Ebb (out) of the Nun River and 0.05 – 0.32 m/s with mean of 0.23 m/s at the Flood (in) of the river reported by NDBDA (1987) clearly indicates that induced erosion by the proposed project may not introduce any new and dangerous dimensions to erosion characteristics and impacts along the Nun River (Figure 4.17).

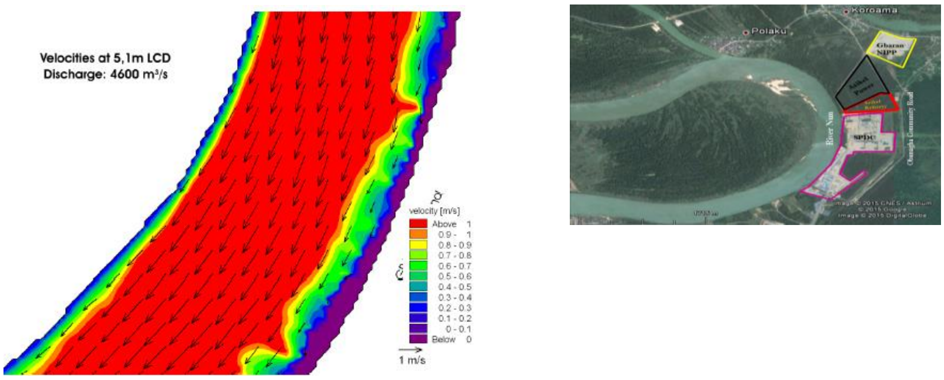


Figure 4.17: Velocities in the River Bend at High Waters

4.4.13 Groundwater Flow Direction and Pollution

While pursuing its E&P business to explore and deliver additional hydrocarbon (Oil and Gas) production, SPDC (2015) did extensive groundwater study in OMLs 27 and 28/31 covering Gbaran fields located within Bayelsa, among others. Since the proposed

Lubricating Oil Blending Plant by Eraskon Nigeria Limited is located in this Gbaran area, findings of the groundwater investigation are applied to guide in appropriate decision making during this study. The site shares the characteristic low lying topography of the Niger Delta. Lithologic logs of the boreholes drilled in the area show that the site has three main lithologies including clay, clayey sand, and sand with the first two found from the surface to a maximum depth of 7m followed by the sandy layer (Figure 4.18). These agree with the lithological characteristics also obtained during this study as summarized in Figure 4.18. The sands are commonly fine to medium grained, poorly sorted, and brown to white in colour and constitute the major aquiferous layer in the area. The upper clayey unit has permeability of 3.025 X 10^{-3} - 9.6 x 10^{-3} cm/s with the aquiferous sand having slightly higher levels of 1.21 x 10^{-2} - 2.56 x 10^{-2} cm/s. If there is pollution in the area, this permeability indicates that the pollutants would flow through the layers at the reported permeability. It implies that the flow rate would be faster within the aquifer than through the ground into the aquifer. These lithologic logs also show that the aquifers in the Gbaran location are confined by 1 to 4 m of clay.

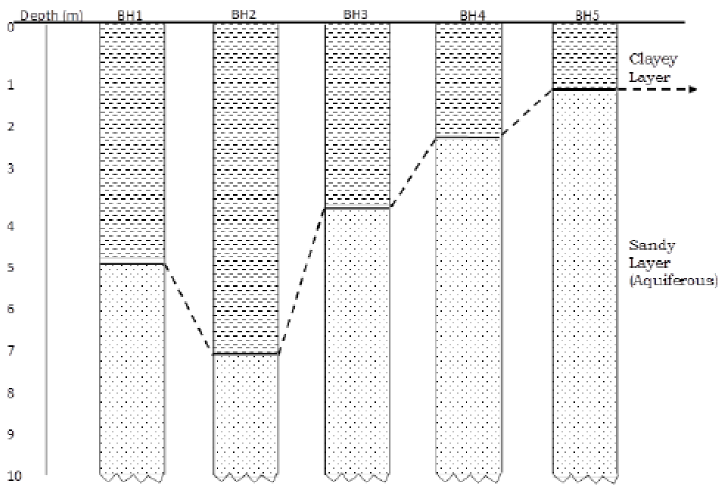


Figure 4.18: Lithologic Logs of Boreholes in the Study Area (GERL, 2020)

From hydrogeological data reported in SPDC (2015), groundwater flow direction in the study area was from the Northeast to Southwest (Figure 4.19) implying that if there is pollution of groundwater in the area, the pollutants would flow from northeast to southwest from the point of pollution. Also, the study showed the groundwater levels of the project area to be 3.00 - 4.70 m below ground level (average 3.8 m) in the dry season which can be much higher in the rainy season with water tables very close to the surface. Consequently, groundwater is susceptible to pollution from surface sources (Ekundayo, 2006).

Figure 4.19: Groundwater Flow Direction in Gbaran, the Proposed Project Site

However, at several locations including the Gbaran project site, there is a thick clay layer at the top which tends to protect the groundwater from surface pollutants. In Gbaran this clay layer is from 2.50 to 3.25 m thick (SPDC, 2007), thus reducing the susceptibility of the shallow aquifer to pollution from surface operations. However since the hydrogeological data show that Static Water Level in the area is very high pollutants cannot be dumped on the ground surface. Eraskon Nigeria Limited shall ensure that this is strictly implemented throughout the entire lifespan of the project. During this study, there is no direct evidence of groundwater contamination of either shallow or deep aquifers from oil and gas production activities in the study area. In this proposed Lubrication Oil Blending Plant, it is not anticipated that its operations will have any long-term, adverse or cumulative effects on the groundwater quantity and quality.

4.4.14 Groundwater Abstraction and Recharge Rate

Though the proposed lubricating oil blending plant requires groundwater abstraction the demand pressure and cumulative demand on the deeper aquifer arising from other projects or human settlement and habitation in the area is not expected to be much. The safe yield of deep aquifer as obtained from the borehole pumping testing (section 4.3.2) is about 43 m^3/hr thus the cumulative demand on the deeper aquifers is insignificant. This is expected to draw from the deeper aquifers not necessarily available to the local community. Aquifers with sand/gravel layer are characterized by potential yield of 20 – 500 m^3/day (FMWR, 2013) and as groundwater recharge increase, yield of borehole increases. Also as distance among boreholes increases, amount of yield of boreholes will increase. The sandy nature of the proposed project area aquifer as earlier reported guarantees good yield.

The Niger Delta hosting the proposed project is a sedimentary basin where groundwater recharge is mostly through infiltration, precipitation and rivers at the surface. The DRASTIC (Depth to water table [D], net Recharge [R], Aquifer media [A], Soil media [S], Topography [T], Impact of the vadose zone [I], and hydraulic conductivity [C]) Model of the Overlay and Index method used for aquifer vulnerability assessment of the area by Mgbolu et al., 2019) returned good results. The net recharge of about 12% of average annual rainfall in an area (Navulur, 1996) also gives promising groundwater recharge rate in the proposed project site guided by its high rainfall with July and August experiencing the highest (section 4.3.6.1). Amangabara and Ejenma (2012) reported that most ground water recharge occurred during the wet season due to continuous rainfall and deep percolation as the water infiltrates through the highly permeable sands of the Benin Formation to recharge the aquifers (Udom et al., 2018). Similarly Nwankwoala and Omemu (2019) established that aquifers in this area obtain steady recharge through direct precipitation and major rivers (including Nun River) thus very limited water table fluctuation is expected due to its heavy rainfall nearly all the year round. With these the proposed project water consumption cannot threaten groundwater abstraction in the project site.

4.4.15 Biodiversity Assessment

The vegetation and the corresponding fauna composition of the Eraskon Nigeria Limited project area reflects majorly rainforest vegetation and can be described as tropical rain forest within the equatorial climate region, characterized by high rainfall, high relative humidity and maximum temperature. It is characterized by vegetation complex of primary and secondary structure, heterogeneous in nature, with spatial (closed and sparse) and vertical distribution of trees, herbs, shrubs and climbers (leaners) belonging to different families under local environmental conditions and edaphic nature. However, the vegetation in the immediate project site area is more of slightly altered (secondary vegetation) than natural due to farming activities being carried out in some part of the area. The location is often flooded during rainy season and the clayey nature of the soil poses a challenge to farming activities.

4.4.15.1 Flora Assessment

Within the 2 km spatial boundary chosen for floral assessment, cultivated food crops observed include: cassava, oil palm, plantain, yam, banana etc (Plate 4.6). Other plants also observed are: bush mango, morning glory, iron wood/ cork wood, mimosa, opepe, guinea grass, sand paper tree, elephant grass, water letus, pumpkin, afara, obeche, hog-lum among others (Plate 4.7 – Plate 4.10). Details of local herbs in the area are summarized in Table 4.28.

Plate 4.6: Typical vegetation of the proposed Lubricating Oil Blending Plant
Source: Fieldwork, 2020

Plate 4.7: Bluestem grass

Plate 4.8: Tripsacum grass

Plate 4.9: Plantain tree

Plate 4.10: Oil palm tree

Table 4. 28: Traditional names and use of local herbs in the project location

S/No.	Tree/Shrub species Common name Family	Tree/Shrub species Common name Family	Tree/Shrub species Common name Family
1	*Elaeis guineensis*	Oil Palm tree	Palmae
2	*Raphia hookeri*	Palm wine tree	Raphia Palmae
3	*Raphia vinifera*	Bamboo	Palm Palmae
4	*Calamus deeratus*	Rattan Palm	Palmae
5	*Cleistopholis patens*	Salt & oil tree	Annonaceae
6	*Anthocleista vogelli*	Cabbage tree	Loganiaceae
7	*Anthocleista djalonesis*	Cabbage tree	Loganiaceae
8	*Monodora myristica*	English Afriacn Nutmeg	Annonaceae
9	*Macaranga barteri*	*Ohaha (Edo)*	Euphorbiaceae
10	*Hallea ledermanni*	Abura	Rubiaceae
11	*Anthostema aubreyanum*	-	Euphorbiaceae
12	*Pisidium guajava*	Guava tree	Myrtceae
13	*Gmelina arborea*	Gmelina	Verbenaceae
14	*Alchornea cordifolia*	Christmas bush	Euphorbiaceae
15	*Musanga cecropoides*	Umbrella tree	Cecropiaceae
16	*Harungana madagascariensis*	Haronga	Hypericaceae

S/No.	Tree/Shrub species Common name Family	Tree/Shrub species Common name Family	Tree/Shrub species Common name Family
17	*Terminalia ivorensis*	Black Afara	Combretaceae
18	*Terminalia superba*	White Afara	Combretaceae
19	*Alstonia boonei*	Stool wood	Apocynaceae
20	*Symphiona globulifera*	Boarwood	Guttiferae
21	*Spondianthus preussi*	Roger blench	Euphorbiaceae
22	*Ficus exasperata*	Sandpaper tree	Moraceae
23	*Irvingia gabonensis*	Bush Mango	Irvingiaceae
24	*Dracaena arborea*	Boundary tree	Agavaceae
25	*Dacryodes edulis*	Native pear	Burseraceae
26	*Pterocarpus sp*	Mukwa or Narra	Leguminosae
27	*Mangifera indica*	Mango	Annonaceae
28	*Treculia Africana*	African Breadfruit	Moraceae
29	*Tectona grandis*	Teak	Verbenaceae
30	*Leucaena leucocephala*	Lead tree	Leguminosae
31	*Uapaca sp*	Sugar plum	Euphorbiaceae
32	*Ceiba petandra*	Cotton tree	Bombacaceae
33	*Cocos nucifera*	Coconut tree	Palmae
34	*Bambusa vulgaris*	Indian Bamboo	Graminae
35	*Lophira alata*	Iron wood	Ochnaceae
36	*Hevea braziliensis*	Para rubber	Euphobiaceae
37	*Sarcoglottis gabonensis*	Bitter bark tree	Humiriaceae
38	*Acacia sp*	Black Wattle	Leguminosae
39	*Albizia ferruginea*	Albizia	Leguminosae
40	*Lonchocarpus griffonianus*	*Eponyms*	Leguminosae
41	*Baphia nitida*	Camwood	Leguminosae
42	*Vitex doniana*	African oak / black plum	Verbenaceae
43	*Xylopia staudtii*	*Guinea pepper tree*	Annonaceae
44	*Funtumia africana*	*English Rubber tree*	Apocynaceae
45	*Mammea africana*	Bastard Mahogany	Guttiferae

Source: Fieldwork, 2020

4.4.15.2 Fauna Assessment

Some fauna groups native to the study area include mammals, aves, reptiles and amphibians. Some of these were sighted during the field study, while for the others referenced, information were as obtained from farmers, hunters, some locals and literature. The dominant species encountered in the area were those associated with rain forest and aquatic habitat. This may be due to the vegetation which is mainly fallow bush, heterogeneous and coexisting with pockets of aquatic niches.

- **Mammalia**

A checklist of wildlife present in the area is as presented in Table 4.29. Grasscutters, brush-tailed porcupines, antelopes (Plate 4.11), duikers, bush-pigs and monkeys are the animals most commonly caught by hunters. The non-game animals present in the area include squirrels, civet cats, genets, mongoose and bats while giant rats are rare. Hunters report the presence of four different species of primates in the area occurring mainly in the riparian forests. The local names for some of the wildlife species were also captured.

Plate 4.11: A common species of antelope in the project area

- **Aves**

Among the commonly occurring avifauna are - Allied hornbills, kites, pied crow, cattle egret, hawks (Plate 4.12), hooded vultures, palm-nut vulture, lizard, buzzards, whistling ducks, and weavers. Others are swifts, senegal cocoul, sunbirds and parrots. All have previously been recorded in Gbaran area and the entire Bayelsa State (Ezealor, 2002).

Plate 4.12: A common species of Hawk in the project area

- **Reptilia**

They include the Nile crocodile (*Crocodylus niloticus*), Short nose crocodile (*Osteolaemus tetraspis*) and the long-nosed crocodile (*Crocodylus cataphractus*), which is critically endangered. As shown in Table 4.29, snakes (Plate 4.13) are abundant in the area, some of which are poisonous, namely *Bitis gabonica* (Gaboon viper), *Naja nigricollis* (Spitting cobra), *N. melanoleuca* (Forest cobra), and *Dendroaspis jamesonii* (Jameson's mamba). Smaller lacertilids include - Rainbow agama, Forest geckoes (*Hemidactylus sp.*), Skink (*Mabuya affinis*), and Chamaeleon (*Chamaeleo spp.*), all of which have satisfactory conservation status. Chelonians (Tortoises and terrapins) are reportedly present but are becoming rarer in recent times.

Plate 4.13: A common species of python in the project area

- **Amphibia**

The species encountered were the Bull frog (Plate 4.14, *Dicroglossus occipitalis*), the Mascariene frog (*Ptychadena mascariensis*), and Black clawed frog (*Xenopus tropicalis*).

Plate 4.14: Typical bull frog in the project area

The species in **Plates 4.11, 4.12, 4.13** and **4.14** are typically of what exist in the project area.

Table 4. 29: Wildlife Inventory and Conservation Status in the Study Area

S/No	Common Name	Scientific Name	Vernacular Name	Population Status
1.	Red-Capped Mangabey	*Cercocebus torquatus*	Ogni-obugo	E
2.	Potty-Nosed Monkey	*Cercorpitheus nictitan*	Aca-obugo	C
3.	Mona Monkey	*Cercopithecus mona*	Obugo	C
4.	Olive Colobus	*Colobus verus*	Okpari-Obugo	V
5.	Sitatunga	*Tragelaphus spekei*	Oboguru	E
6.	Bush Buck	*Tragelaphus gratus*	Ororo	C
7.	Blue Duiker	*Cepholophus monticola*	Eze	C
8.	Bush Pig	*Tragelaphus gratus*	Ogbotomu	R
9.	Crested Porcupine	*Hysteria spp.*	Okuru	C
10.	Grasscutter	*Crysitomys emini*	Ogboma	C
11.	Giant Rat	*Thryonomis spp*	Agbara	C
12.	Palm Civet	*Nandinia binotata*	-	C
13.	Civet Cat	*Vivera civeta*	-	V
14.	Red-backed flying squirrel	*Anomalurus erythronotus*	-	C
15.	Pangolin	*Manis tetradactyla*	-	C
16.	Spotted-Necked Otter	*Lutra maculicon*	-	R
17.	Allen's Galago	*Galago allieni*	-	C
18.	Common Genet	*Common Genet*	-	
19.	March Mongoose	*Atilas palidonosus*	-	C
20.	Bosman's Potto	*Perdictitus potto*	Obu	C
21.	Short Nosed Crocodile	*Crocodilus spp.*	-	R
22.	Monitor Lizard	*Varanus indicus*	Owag	C
23.	Python	*Pythonidae*	Edugul	C
24.	Tortoise	*Geochelone elegans*	-	C
25.	Green Turttle	*Chelonia mydas*	Ukpo	C
26.	Giant Snail	*Acacatiana acacatiana*	-	C
27.	Viper	*Trimereserus albolabris*	-	C
28.	Boa Constrictor	*Boa constrictor*	-	C
29.	Little Wood Pecker	*Dendropicos fuscensceaas*	-	C
30.	Blue Plantain Eater	*Corythaeola cristata*	-	C
31.	West African wood Owl	*Strix woodfordii nuchali*	-	C
32.	Lesser Lilly-trotter	*Micropara capensis*	-	R
33.	West African Goshawk	*Accipeter macroscelides*	-	R
34.	Crested Guinea Fowl	*Gutteraverreauxi*	-	V
35.	Common Tern	*Sterna hirundo*	-	C
36.	Fruit Pigeon	*Vinago australis*	-	E
37.	Grey parrot	*Psittacu erithacus timneh*	-	E
38.	Emerald Cuckoo	*Chrysocaccyx cupreus cupreus*	-	C
39.	Palm Swift	*Cyssiurus parvus*	-	C
40.	Pigmy Kingfisher	*Ispidina picta picta*	-	C
41.	Blue Bee-Eater	*Melitophacus muelleri Mentalis*	-	C

Source: Fieldwork, 2020

Key:- C; Common, E; Endangered, V; Vulnerable, R; Rare

4.4.15.3 Ecologically Sensitive Areas

The ecologically sensitive areas include the river Nun and its tributaries, the seasonally flooded forest, lakes, and ponds, including fish ponds. These water bodies serve as breeding/nursery grounds for fishes. The forest has high biodiversity made up of economic plants, medicinal plants, ornamental plants and a very wide array of animal life. This forest also serves as nesting site for aquatic and migratory birds. Certain birds and animals are endemic to the area.

4.4.15.4 Fisheries Studies

Fisheries involve the utilization of harvestable aquatic organisms in water, and represent complex interactions between the population of organisms being harvested, the population of fishermen, and environmental conditions. Fisheries studies investigated the population in fisheries in the study communities, fisheries activities, fishing gears/methods, catch composition, fish species composition in the study area, catch per unit effort, fish landing, sales and price, spawning grounds, migration routes and patterns, productivity and pathology.

- **Fisheries Activities**

Fishing within the study area is carried out mainly from permanent settlements and temporary huts set up on the banks of river. Only few fishermen were seen in fishing canoes in Taylor Creek (A tributary of the River Nun) and River Nun checking their overnight fish traps and nets for catch. The Taylor Creek together with the associated creeks, swamps, floodplains and flood areas represent rich productive fishing grounds which are exploited by itinerant fishers and indigenes. The catch composition during the dry season revealed a rich species assemblage. Women fish mainly using basket traps but sometimes they use long lines, set gill nets and lift nets.

Only few members of the communities are involved in agricultural practices, using monoculture fish ponds constructed near homes, for the rearing of catfishes.

- **Fishing Gears**

The fishermen operate different types of gear such as cast nets, gill nets, beach seines, filter nets, long lines and encircling nets in near and distant waters. Trigger hook are generally more common in fresh water bodies of the Niger Delta being employed in the capture of species as such – *Papyrocranus afer*, *Heterobranchus spp*, and even the herbivorous *Heterotes niloticus*. Though it was not possible to determine the target species of the trigger hooks in the area, their presence suggests the immigration of fishermen familiar with freshwater fishing techniques.

- **Fish Catch /Landing**

Fish catch/ landing has to do with the quality of fish captured by artisanal fishermen, stock assessment in relation to the species composition, condition factor etc. (i.e. the quantity and quality of fish that came out of water and landed), while landing sites are those areas the catch or landing is taken to for sale or assessment. Another aspect of resource assessment involves the characterization of the number of fishermen, harvesting techniques and catch per unit effort. Fish catch recorded around Kolo Creeks included *Tilapia zilli*, *Synodontis*, *Heterotis niloticus*, *Schilbe mystus*, *Channa obscura*, *Clarias spp*, *Gnathonemus abadi*, *Chrysichthys* and *distichodus brevipinnis* as presented in Table 4.30.

Table 4. 30: Checklist of fish species recorded during the study

S/No	Common name	Scientific name	River	Swamp	A1
1.	Climbing perch	*Ctenopoma kingsleyae*		X	C
2.	Black spotted catfish	*Auchenaglanis bicutatus*		X	C
3.	Armoured catfish	*Auchenaglanis occidentalis*	X		C
4.	Bayad	*Bagrus bayad*	X		C
5.	Bagrid catfish	*Bagrus docmak*	X		C
6.	-	*Parauchenoglanis akiri*		X	C
7.	-	*Parauchenoglanis fascitus*		X	C
8.	-	*Parauchenoglanis guttatus*		X	C
9.	African snakehead	*Parachanna Africana*		X	C
10.	Obscure snake	*Parachanna obscura*		X	C
11.	Pebbly fish	*Alestes baremoze*	X		C
12.	Ray-finned fish	*Brycinus brevis*	X		C
13.	African longfin Tetra	*Brycinus longipinnis*	X		C
14.	Characin	*Brycinus macrolepidotus*	X		C
15.	Nurse tetra	*Brycinus nurse*	X		C
16.	African jewelfish	*Hemichromis bimaculatus*	X	X	C
17.	Banded jewelfish	*Hemichromis fasciatus*	X	X	C
18.	Mango fish	*Oreochromis niloticus*	X	X	C
19.	Mango tilapia	*Sarotherodon galilaeus*	X	X	C
20.	Redbelly tilapia	*Tilapia zilli*	X	X	C
21.	Moonfish	*Citharinus citharus*	X	X	C
22.	Mudfish	*Clarias anguillaris*		X	C

23.	-	*Clarias buthopogon*		X	C
24.	African catfish	*Clarias gariepinus*		X	C
25.	Flat head eel catfish	*Gymnallabes typus*		X	C
26.	Sampa	*Heterobranchus longifilis*		X	C
27.	African catfish	*Heterobranchus bidorsalis*		X	C
28.	Congo barb	*Barbus callipterus*	X		C
29.	African carp	*Labeo parvus*	X		C
30.	African carp	*Labeo senegalensis*	X		C
31.	Silver fish	*Raiamas senegalensis*	X		C
32.	-	*Aphyosdemion gardneri*		X	C
33.	-	*Aplocheilichthys macrophthalmus*	X	X	C
34.	-	*Epiplatys graham*	X	X	C
35.	Six-barred panchax	*Epiplatys sexfasciatus*	X	X	C
36.	-	*Distichodus brevipinnis*	X		C
37.	Grass eater of Perch	*Distichodus engycephalus*	X		C
38.	Grass eater of Perch	*Distichodus roastratus*	X		C
39.	-	*Neolebias ansorgii*	X	X	C
40.	Neon (French name)	*Neolebias unifasciatus*	X	X	C
41.	Frankfish	*Gymnarchus niloticus*	X	X	C
42.	African pike	*Hepsetus odoe*	X	X	C
43.	African electric catfish	*Malapterurus electricus*	X		C
44.	Electric catfish	*Malapterurus minjiriya*		X	C
45.	Giant upside down catfish	*Brashysynodontis batensoda*	X		C
46.	-	*Hemisynodontis membranaceus*	X		C
47.	Budgett's synodontis (Germany)	*Synodontis budgetti*	X		C
48.	Scotcat	*Synodontis clarias*	X		C
49.	Featherfin syno (Sweden)	*Synodontis euterus*	X		C
50.	Kongowel (Germany)	*Synodontis nigritia*	X		C
51.	Large-spot catfish	*Synodontis ocellifer*	X		C
52.	Nile squeaker	*Synodontis schall*	X		C
53.	Sorex-fiederbartwels (Germany)	*Synodontis sorex*	X		C
54.	Double-trunk elephant nose	*Campylomyrus tamandua*	X		C
55.	Elephant nose fish	*Gnathonemus petersii*	X	X	C
56.	Trunkfish	*Hippopotamyrus pictus*		X	C
57.	Elephant fish	*Hyperopisus bebe*	X	X	C
58.	-	*Marcusenius abadii*	X	X	C
59.	Trunkfish	*Marcusenius cyprinoids*	X	X	C
60.	Cornish jack	*Mormyrops anguilloides*	X	X	C
61.	-	*Mormyrus macrophthalmus*	X	X	C
62.	-	*Mormyrus rume*	X		C
63.	Elephant fish	*Petrocephalus bane*	X	X	C
64.	Baby whale	*Petrocephalus bovie*	X	X	C
65.	-	*Petrocephalus sauvagii*		X	C
66.	-	*Petrocephalus soundanensis*		X	C
67.	-	*Pollimyrus adspersus*	X	X	C
68.	Elephant fish	*Pollimyrus isidori*	X	X	C
69.	African leaf fish	*Polycentropsis abbreviate*		X	C

70.	Reticulate knife fish	*Papyrocranus afer)*		X	C
71.	African knife fish	*Xenomystus nigri*		X	C
72.	African arowana	*Heterotis niloticus*	X	X	C
73.	African butterfly fish or Fresh water butterfly fish	*Pantodon buchholzi*		X	C
74.	Blood fish	*Phractolaemus ansorgii*		X	C
75.	Rope fish	*Erpetoicthys calabaricus*		X	C
76.	Guinean bichir	*Polypterus ansorhei*		X	C
77.	Nile bichir	*Polypterus bichir*		X	R
78.	Gray bichir or Senegal bichir	*Polypterus senegalus*		X	R
79.	African lung fish	*Protopterus annectens*		X	C

Source: SPDC, 2009 – EIA of Gbaran FLB/Jetty

- **Gill Nets**

Gill nets are mainly small pieces of netting wall tied to sticks and set in creeks, backwaters and flood plain lakes to capture migrating fish. The length and mesh size depends on the season and target fish. Gill nets take all kinds of fishes. It is easy to operate and used by all gender and age groups including children.

- **Traps**

Traps are reputed to be the most sophisticated of all fishing gear (Reed et al, 1967) and the most important gear operated in the study area. Several types of traps are in use including small purse – like devices to lengthy structures that are several meters long and capable of taking aquatic mammals and reptiles. Some traps are equipped with non – return values to retain fish by water pressure or when fishes are stuck to the narrow end of a seeming alley. Some of the traps are used together with fish fences where creeks channels are blocked and traps strategically placed to collect fishes.

Traps are mainly made from forest materials, but few new introductions use synthetic netting materials. For instance, the gura trap introduced by Hausa fishermen is prepared from nylon netting materials. All gender and age groups use trap. Traps take finfishes and are the main gear for collecting fresh water shrimps.

- **Hooks and lines**

Hooks and Lines are the next gears of importance after the traps. The different types comprise the single hook on short stalk and line, long pole and line with a single hook and long lines carrying many hooks. Hooks are normally baited and set stationary. An introduced long line *meri meri* constructed with close – set hooks is set without baits, fishes swimming along lines path are hooked on any part of the body. All gender and age groups operate hooks. Fishes commonly taken with hook include *Clarias Spp, Parachanna Spp, Gymnarchus niloticus* and the cichlids.

- **Wounding Gear**

Almost every kind of sharp implement is a fishing gear. Spears, matches and sticks are used in killing fish at different places especially in the thickly vegetated swamp lakes where woman use machetes to cut out dense vegetation to collect fish from the mud.

- **Pond Bailing**

Local fish ponds constructed in swamps and by the sides of swamp lakes are sources of fish supply in the study area. Pond bailing is done at the dry season when pond margins are clearly exposed and groundwater is low enough to prevent excessive seepage into the ponds. Some ponds located by the side of the lakes are bailed more than once in any given year as water is allowed into the pond immediately after bailing to collect fish. These ponds are provided with fish shelters to enhance quick settlement of fishes after bailing. Sometimes creek channels are blocked and sections bailed to collect fishes.

- **Fish Pathological Conditions**

The dominant and commercially important fish species were analysed for parasitic infections and other pathological symptoms. In *Clarias gariepinus* (African Sharptooth Catfish), a popular fish species in Nigeria, the parasites identified were mainly intestinal and they included the nematodes, *Spirocamallanus spiralis, Procamallanus laeviconchrus* and *Camallanus sp* and *Echinocephalus sp*.

In *Tilapia zilli*, an acanthocephalan worm, *Acanthogyrus tilalpiaa* was recovered from the intestine while a termatode metacecaria *Clinostomum sp*. In scales, muscles and gills. In *Xenomystus nigri*, *Clarotes laticeps* and *Hemichromis fasciatus*, the nematodes *Cucullanus sp* and *Procamallanus laeviconchus* were recovered from the intestine and body cavity.

Although the effects of these parasites were not pronounced on the fishes examined, they are known to cause nutritional imbalance and stunted growth in fishes. There were no observable physical deformities or pathological symptoms in the fishes examined.

The shell fish component plays a key role in the diet and economy of the people of the area. In the freshwater areas, the freshwater pawn (*Macrobrachium macrobrachion*) and *Desmocrais sp* are dominant. Literature and interview show that the juveniles of *Macrobrachium sp*, undergo some form of longitudinal migration during the early rains making their capture with basket (funnel) traps easy in such quantities as to be economically viable for the fishermen.

- **Relative Abundance**

The relative abundance of fish species collected from Taylor Creek is represented in Table 4.31.

Table 4.31: Relative numerical abundance of fish families in Taylor Creek during the dry season

Fish family	Numerical abundance (%)
Cichlidae	18.43
Mochokidae	21.38
Mugilidae	8.75
Notopteridae	1.89
Mormyridae	14.23
Bagridae	10.45
Channidae	4.27
Citharinidae	7.38
Clariidae	9.66
Characidae	2.84
Total number collected (N)	187

Source: SPDC, 2009 (EIA of Koroama TBUR 1,2,3 Wells drilling)

A total of 187 specimens of fish were collected from Taylor Creek and based on numerical abundance, the dominant fish families were *Cichildae, Bagridae*, *Mormyridae, Clariidae* and *Citharinidae*. None of the species encountered in the present study is threatened or endangered as they were caught with relative ease and in good quantity.

- **Size composition and index of preponderance**

The Table 4.32 shows the index of preponderance of fish in Taylor Creek. The size diversity was low in the specimens sampled with range of 4.76 – 43.75cm with percentage frequencies of 2.93 – 17.83%.

The index of preponderance (IP) indicates the degree of effective contribution of each species to the overall catch in a given study location. Index of preponderance is a weighted assessment involving both number and biomass of the fish caught. The index of preponderance showed that *Synodontis sp, Chromidotilapia guntheri, Mochocus niloticus, Gnathonemus petersil* and *Hermichromis fasciatus* were among the most dominant and abundant of all species examined.

Table 4. 32: Index of preponderance (IP) of representative fish species from Taylor Creek

Fish species	Common Names	Index of preponderance
Hermichromis fasciatus	Banded Jewelfish	10.04
Chromidotilapia guntheri	Cichlids	14.50
Synodontis spp	Catfish	16.42
Monchocus	Not available	12.23
Liza falcipinnis	Sickle fin Mullet	9.36
Xenomystus nigri	African Knife Fish	1.24
Gnathonemus petersii	Elephant-nose Fish	11.83
Chrysichthys aluensis	Mudfish	9.27
Parachanna africana	Ray-finned Fish	2.05
Citharinus distichoides	Moon Fish	5.23
Clarias gariepinus	African Sharptooth Catfish	6.00
Brycinus longipinnis	African Long-finned Tetra	1.80

Source: SPDC, 2009 (EIA of Koroama TBUR 1,2,3 Wells drilling)

- **Gonado – Somatic Index (GSI)**

The Table 4.33 shows gonado- somatic index (GSI) and condition factor of selected species collected from Taylor Creek. The GSI which is a measure of reproductive investment ranged from 0.74 – 2.60. High values were recorded in *Liza falcipinnis, Mochocus niloticus, Gnathonemus petersil, Chrysichthys aluensis* and *Brycinus longipinnis*. The high GSI in these fishes indicate higher reproductive investment with the obvious implication that yield per recruit in the following year would be high for such fishes.

Table 4. 33: Gonado - somatic index (GIS) and condition factor of selected species collected from Taylor Creek

Fish species	Common Names	GSI	K
Hermichromis fasciatus	Banded Jewelfish	0.83	1.86
Chromidotilapia guntheri	Cichlids	1.41	1.24
Synodontis spp	Catfish	1.25	2.36
Monchocus	Not available	2.49	2.68
Liza falcipinnis	Sicklefin Mullet	2.64	2.85
Xenomystus nigri	African Knife Fish	1.88	1.94
Gnathonemus petersii	Elephant-nose Fish	2.40	2.38
Chrysichthys aluensis	Mudfish	2.60	2.36
Parachanna africana	Ray-finned Fish	0.74	0.85
Citharinus distichoides	Moon Fish	0.85	1.23
Clarias gariepinus	African Sharptooth Catfish	0.93	0.76
Brycinus longipinnis	African Long-finned Tetra	1.67	1.28

Source: SPDC, 2009 (EIA of Koroama TBUR 1,2,3 Wells drilling)

- **Condition Factor (K)**

The condition factor ranged from 0.76 – 2.85. The K values for most species was greater than unity (K>1.0) and depict good body condition. The condition factor expresses the relative robustness of a fish. The good body conditions for most of the fishes indicate the abundance of food resource which ensures good body fitness and growth.

- **Total Hydrocarbon Concentrations (THC) in Fish Tissues**

The THC in fish tissues from Taylor Creek is reported in Table 4.34. It is generally low and below the GESAMP standard of 25.0 mg/kg allowed in food fish indicating no THC contamination.

Table 4. 34: Dry Season THC concentration in fishes in Taylor Creek

Fish Species	Common Names	Total Hydrocarbon Concentration (mgkg^{-1})
Hermichromis fasciatus	Banded Jewelfish	4.93
Chromidotilapia guntheri	Cichlids	6.85
Synodontis spp	Catfish	12.28
Monchocus	Not available	3.94
Liza falcipinnis	Sicklefin Mullet	6.95
Xenomystus nigri	African Knife Fish	9.27
Gnathonemus petersii	Elephant-nose Fish	10.88
Chrysichthys aluensis	Mudfish	8.23
Parachanna africana	Ray-finned Fish	7.20
Citharinus distichoides	Moon Fish	11.36
Clarias gariepinus	African Sharptooth Catfish	3.49

Source: SPDC, 2009 (EIA of Koroama TBUR 1,2,3 Wells drilling)

- **Heavy Metals Concentrations (THC) in Fish Tissues**

Heavy metals in the various fish species collected from Taylor Creek were very low, particularly for Pb, Cu, Cd, Cr and Hg and generally of background levels (Table 4.35). Also concentrations of Pb, Cr, Co and Hg were below detectable limit for the fish species analyzed. The low heavy metal concentrations indicated no contamination, although Ni and Mn were slightly higher than the WHO limit of 0.50 mg/kg.

Table 4. 35: Heavy metals (mg/kg) in fish species from Taylor Creek

Fish Species	Cu	Pb	Cd	Ni	Cr	Mn	Co	V	Zn	Hg
Liza falcipinnis	0.018	ND	0.018	0.765	ND	0.318	ND	0.225	3.639	ND
Gnathonemus petersil	0.059	ND	ND	0.496	ND	0.125	ND	0.159	1.685	ND
Chrysichthys aluensis	0.113	ND	0.058	1.255	ND	0.258	ND	0.269	0.954	ND
Citharinus distichoides	0.085	ND	0.087	1.633	ND	0.518	ND	0.473	30.760	ND
Brycinus longipinnis	0.093	ND	0.069	0.794	ND	0.637	ND	0.285	1.218	ND
Hermichromis fasciatus	0.078	ND	0.093	0.885	ND	0.385	ND	0.093	0.883	ND
WHO (1989) Limits	1.00	2.00	2.00	0.50	0.50	0.10	2.00		10.0	

Source: SPDC, 2009 (EIA of Koroama TBUR 1,2,3 Wells drilling)

- **Catch Per Unit Effort Assessment and Yield**

Catch per unit effort (CPUE) is the total catch divided by the total amount of effort used to harvest the catch. The "catch" portion of the material may be expressed as the number or weight of the entire catch, a selected subset of the catch, or a particular species in the catch. The "unit effort" portion of the rate usually refers to the time a uniformly designed and employed piece of fishing gear is employed in the water. In simple terms, CPUE is the quantity of fish caught (in number or in weight), in tons, taken per hour of trawling rate. A decline in CPUE over a time period is usually a good indication that stocks are declining. It measures only the component of the population that is vulnerable to the gear but not to the total population. The proportion of the population that is vulnerable to the fishery depends on gear selectivity, size and age of fish, horizontal and vertical distribution of fish and fishing practice of the crew.

The cast net, basket traps and gill nets were used in assessing catch per unit effort by the local fishermen 'in the study area. For quick assessment in the Nun River at Polaku location, six cast-net throws were made randomly at different portions of the river, resulting in a total catch of 47 fish specimens. At the Gbarantorun location of the Nun River, the catch for the same effort was 38 fish specimens. Because of the low catch from the castnet gear, the local resort mainly to the use of fenced seine nets which ensures more yield. The net stays up to 6 hours in the water from high tide to the onset of low tide. The catch however depends on the time and the type of net.

All the fishermen interviewed complained of declining catch over the years, which they attributed to population pressure, the use of obnoxious fishing methods and environmental degradation/ pollution. The latter is the result of sand mining and activities of oil companies along the rivers and creeks.

Prior to this period (about five years ago), they revealed that their catch levels ranged between ₦2,000 and ₦15,000 per day. At present, most of the fishermen stated that fishing is no longer profitable, thus making it extremely difficult for them to use it as their means of livelihood.

The value of the fish catch per canoe during the rainy season is said to range from ₦1,500.00 to ₦5,000.00 daily with an average value of ₦2,500.00. However, the fishermen stated that there are frequently occasions in which no fish is landed. This is common with hook and line fishing, which targets large fish species.

The catch rates (Table 4.36) for some selected species were relatively higher indicating a rich ecosystem. However, a large proportion of the fishes examined were generally of small size and some were juveniles harvested indiscriminately with no selective gears.

Table 4. 36: Average Composition of commercially important fish landed based on survey of boat landing in Taylor Creek

Fish species	Common Names	Mean catch/UE (kg)	Composition (%)
Hermichromis fasciatus	Banded Jewelfish	2.65	2.72
Chromidotilapia guntheri	Cichlids	4.88	5.02
Synodontis spp	Catfish	12.47	12.82
Monchocus niloticus	Not available	20.30	20.86
Liza falcipinnis	Sicklefin Mullet	10.54	10.83
Xenomystus nigri	African Knife Fish	5.66	5.80
Gnathonemus petersii	Elephant –nose Fish	15.80	16.24
Chrysichthys aluensis	Mudfish	18.21	18.72
Parachanna africana	Ray-finned Fish	4.30	4.42
Clarias gariepinus	African Sharptooth Catfish	2.48	2.55
Total		**97.29**	

Source: SPDC 2009 (EIA of Koroama TBUR 1,2,3 Well drilling)

4.5 Socio Economic Assessment/Results

This socio-economic survey was conducted to obtain and document the existing socio-economic condition of the immediate host community to the proposed 50,000 litres lubricating oil blending plant project at its pre-implementation stage. Socio-economic assessment is one of the studies under the broad ESIA scope which seeks to evaluate a project's host community in terms of its history, ethnic composition, geographical size, culture, religion, economic activities, education, health impact assessment (HIA), and general infrastructural base. This study aspect also investigates the perception of residents of the host community about the proposed project as well as ways in which the proponent may bring about socio-economic upliftment of the community. Furthermore, socio-economic assessment helps in reaching a right decision about the most suitable technology to employ and also to make it suit the prevailing socio-economic and environmental conditions in the project host area.

The socio economic assessment was conducted under the supervision of the federal and local regulators (Federal Ministry of Environment, Bayelsa State Ministry of Environment, Yenagoa Local Government Council and the project host communities). The socio-economic study covers the project host community (Tunama) and other neighbouring communities: Obunagha, Koroama, Okolobiri and Polaku. The community leaders and residents were all properly consulted and carried along all through the exercise.

4.5.1 Historical Background of the Project Host State (Bayelsa)

Bayelsa State was created on October 1, 1996 out of the old Rivers State. The name, Bayelsa, is an acronym of three former Local Government areas 'Brass, Yenagoa and Sagbama' in the then Rivers State, which had earlier on comprised the entire area now constituting Bayelsa State. The then Brass LGA is what makes up the present Nembe, Brass and Ogbia Local Government Areas; the then Yenagoa LGA consist of the present Yenagoa, Kolokuma/Opokuma and Southern Ijaw Local Government Areas and the then Sagbama LGA is what makes up the present Sagbama and Ekeremor Local Government Areas. The tradition in the old Rivers State, which is still the norm in Bayelsa State now, is the use of acronyms for local government areas. People referred to Brass Local Government Area as BALGA while Yenagoa was YELGA and Sagbama was SALGA. Since personalities from Balga, Yelga, and Salga made up the state creation movement prior to the 1996 exercise, the proposed name agreed upon was Bayelsa.

Bayelsa State has one of the largest crude oil and natural gas deposits in Nigeria. Bayelsa State is geographically located within Latitude 04°15' North, 05°23' South and longitude 05°22' West and 06°45' East. It shares boundaries with Delta State on the North, Rivers State on the East and the Atlantic Ocean on the West and South. The State is a picturesque tropical rain forest, with an area of about 21,110 square kilometers. More than three quarters of this area is covered by water, with moderately low land stretching from Ekeremor to Nembe. The area lies almost entirely below sea level with a maze of meandering creeks and mangrove swamps. The network of several creeks and rivers in the South, all flow into the Atlantic Ocean via the major rivers such as San Bartholomew, Brass, Nun, Ramos, Santa Barbara, St. Nicholas, Sangana, Fishtown, Ikebiri Creek, Middleton, Digatoro Creek, Pennington and Dobo. The vegetation here is characterized by the mangrove forest. In the North, it has a thick forest with arable lands for cultivation of various food and cash crops.

There are four main languages in Bayelsa State, which are Izon, Nembe, Ogbia and Epie-Atissa as presented in Table 4.37. The predominant religions in the State are Christianity and Traditional worshipers. Bayelsa State has 24 first class traditional rulers (and many second and third class traditional rulers) recognized by the State Government.

Table 4. 37: Languages of Bayelsa State listed by LGA

LGA	Languages
Brass	Abureni; Southeast Ijo; Ogbia; Kugbo
Ekeremor	Izon
Kolokuma Opokuma	Izon
Nembe	Abureni; Southeast Ijo
Ogbia	Abureni; Southeast Ijo; Odual; Ogbia; Oruma
Sagbama	Biseni; Isoko; Izon; Ogbah; Okodia; Urhobo
Southern Ijaw	Southeast Ijo; Izon

Inspite of the petroleum production in the state, most of its indigenes live in poverty. The people are mainly rural dwellers who also lack adequate transportation, healthcare, education or other infrastructure as a result of decades of neglect by the State and Federal governments, as well as petroleum prospecting companies in the state. This has been a large problem in the state since its creation and successive state governments have not been able to properly address this issue. Successive State governments have, however, embarked on various industrial projects (even venturing into the oil and gas sector), and "poverty-alleviation" programs to reverse this situation. Unfortunately, these have not fully resolved all the issues.

4.5.2 Yenagoa Local Government Area

Yenagoa is a Local Government Area in Bayelsa State. Yenagoa as the State capital is in the south of the State, at 4°55′29″N and 6°15′51″E. The LGA has an area of 706 km² and a population of 352,285 as at the 2006 census. The projected population of Yenagoa LGA as at 2020 is 500,033. The postal code of the area is 561. Yenagoa is the traditional home of the Ijaw people. English is the official language, but Epie/Atissa language, one of the Ijaw languages, is the major local language spoken in Yenagoa. Since attaining the status of state capital in 1996, construction and other activities have accelerated appreciably.

4.5.3 Gbaran Clan

Gbaran clan comprise of the following communties: Tunama, Polaku, Obunagha, Okolobiri, Koroama, Okotiama, Ogboloma, Nedugo, Agbia and Ibiaye (Ebiyai). Okotiama is the most senior community in the clan. The close proximity of Gbaran villages along Taylor Creek has helped them maintain their shared cultural traditions. The clan traditional god is known as *Gbaran Ziba* (Alagoa, 2005). The Gbaran people are part of the Izon (Ijaw) ethnic nationality. Gbaran was founded by a man called Gbaranowei, son of Oporoza the son of Izon. Gbaranowei's brothers are Kumbowei and Kabowei in Sagbama Local Government Area of Bayelsa State in Nigeria. Gbaran people speak Izon dialect. Their occupations, like other of Izon groups, include fishing, farming, canoe-carving and palm oil production (Tuaweri, 2008).

4.5.4 Approach to Socio Economic Study

A multi-method approach was used in gathering socio-economic data and information, namely, Focus Group Discussion (FGD), In-Depth Interview (IDI)/Key Informant Interview (KII), and on-site observations. In the FGD method, the groups interacted with comprise of Eraskon management team, community elders, youths, women, and other interest groups as well as individuals.

4.5.4.1 Personal Interviews

In order to gather information and opinion of residents of the host communities, personal interviews were conducted using questionnaires (Plate 4.15). 500 questionnaires were administered across Tunama, Obunagha, Koroama, Okolobiri and Polaku communities with 100 questionnaires allocated to each community via systematic random sampling method to sample the opinions and views of representatives of all groups of person in the communities

Plate 4.15 : GERL staff conducting personal interview during Socio-economic
Source: Fieldwork 2020

4.5.4.2 Physical inspection

The socio-economic study team also physically inspected major facilities and landmarks, such as source of drinking water, electricity projects, schools, health care facilities, markets, town halls, economic activities, informal sector activities and conditions of roads and houses among others (Plate 4.16). Other areas of interest studied are cultural heritage/artefact and other historical/cultural patrimony of the communities, the demographic pattern of the project host and neighbouring communities by size, land use, economic activities (with emphasis on low income groups highly dependent on primary activities), community structure, employment, markets, labour supply, income distribution and consumption and migration pattern.

Plate 4.16: Study team (Eraskon Nig Ltd team, Environmental Regulators and Consultant) on briefing before setting out for physical inspection/ socio-economic survey

4.5.5 Socio Economic Baseline Results and Discussion

The socio economic assessment was focused essentially on the project host community (Tunama community) as well as the project affected neighbouring communities within the defined 2km sampling spatial boundary namely: Obunagha, Koroama, Okolobiri and Polaku communities. However, Yenagoa town, the host of the Yenagoa Local Government council was equally sampled. The socio economic assessment findings such as education, infrastructure, occupation, financial status, health impact assessment (HIA), demography and marital status etc of the above listed project affected communities are discussed below.

4.5.5.1 Educational Enrolment and Attainment

Yenagoa town is a host to a number of educational institutions cutting across primary, secondary and tertiary (Table 4.38). Some of the tertiary institutions include: Federal Polytechnic Ekowe, Federal Science and Technical College, Institute of Science and Technology (IST), and Bayelsa State College of Health Technology. Other notable tertiary institutions in other parts of

Bayelsa State include School of Nursing, Koroama. Niger Delta University Amassoma and Federal University, Otueke. Yenagoa town hosts a very good number of public and private primary and secondary schools.

Table 4. 38: Presence of Educational Institutions in Yenagoa LGA

Characteristics	Educational Situation
Tertiary Institution	Present
College	Present
Technical/Vocational	Present
Nursery school	Present
Secondary School	Present
Primary school	Present

Source: Field data gathering

Tunama Community

Tunama is the project host community to the Eraskon Nigeria Limited 50,000 litres lubricating oil blending plant. From the Focus Group Discussions (FGD) sessions during socio economic assessment, the following primary schools were identified present with no secondary schools within the community (Table 4.39).

- **Primary Schools**

i) Community Primary School, Tunama
ii) Victobela Group of Schools, Tunama

100 questionnaires were administered in Tunama community with 50 questionnaires administered to the male respondents while 50 questionnaires to female respondents. The feedback from the completed questionnaires showed that 47 (94%) of the male respondents attended primary school up to the first school leaving certificate level, while 38 (76%) of the female respondents obtained first school leaving certificate. 34 (68%) male and 26 (52%) female respondents attended up to Senior Secondary Certificate level. 21 (42%) male and 14 (28%) female respondents have completed or are currently undergoing tertiary education. 3 (6%) male and 12(24%) female respondents reported that they have no formal education. From these observations, it is clear that the literacy level is higher in males than females. This may partly be attributable to the traditional believe in most part of the African communities that it is more beneficial to educationally empower

the male folks over the females. Another observation from the educational distribution observed in Tunama is that 85% of the respondents are literate having acquired primary education (Table 4.40). Literacy is the ability to read, write, speak and listen in a way that let us communicate effectively and make sense of the world (National Literacy Trust, United Kingdom).

Table 4. 39: Presence of Educational Institutions in Tunama Community

Characteristics	**Educational Situation**
Tertiary Institution	Absent
College	Absent
Technical/Vocational	Absent
Nursery school	Present
Secondary School	Absent
Primary school	Present
Adult education centre	Absent

Source: Field data gathering

Table 4.40: Educational Attainment in Tunama Community

TUNAMA COMMUNITY		
No. of Respondents that attained Primary Education		
Male	**Female**	**No. of respondents**
47 (94%)	38 (76%)	50 (Males) 50 (Females)
No. of Respondents that attained Secondary Education		
Male	**Female**	
34 (68%)	26 (52%)	50 (Males) 50 (Females)
No. of Respondents currently undergoing/have completed Tertiary Education		
Male	**Female**	
21 (42%)	14 (28%)	50 (Males) 50 (Females)
No. of Respondents without Formal Education		
Male	**Female**	
3 (6%)	12 (24%)	50 (Males) 50 (Females)

Source: Field data gathering

Obunagha Community

From the socio economic studies carried out in Obunagha community, it was gathered that there is no tertiary educational institution of any sort within 1.5 km radius of Obunagha community but there are presence of both primary and secondary schools within the community (Table 4.41) as shown in Plates 4.17 and 4.18.

- **Primary Schools**

i) Government Primary School, Obunagha

- **Secondary Schools**

i) Gateway International Group of School, Obunagha

Table 4. 41: Presence of Educational Institutions in Obunagha Community

Characteristics	Educational Situation
Tertiary Institution	Absent
College	Absent
Technical/Vocational	Absent
Nursery school	Present
Secondary School	Absent
Primary school	Present
Adult education centre	Absent

Source: Field data gathering

100 questionnaires were administered in Obunagha community, 50 to male respondents and 50 to female respondents. From the returned completed questionnaires, 44 (88%) male respondents and 39 (78%) female respondent reported that they have attained primary education up to first school leaving certificate level (Table 4.42). 31 (62%) male respondents and 30 (60%) female respondents attested to have obtained secondary school education up to certificate level, while 19 (38%) male respondents and 20 (40%) female respondents affirmed that they have or are currently undergoing tertiary education. 6 (12%) male respondents and 11 (22%) female respondents reported that they have no formal education. From the educational distribution results of Obunagha community, more males are educated compared to the females and also, the people are very well literate with 83% of the respondents having attained primary education.

Table 4. 42: Educational Enrolment of Male and Female in Obunagha Community

OBUNAGHA COMMUNITY		
No. of Respondents that attained Primary Education		
Male	**Female**	**No. of respondents**
44 (88%)	39 (78%)	50 (Males) 50 (Females)
No. of Respondents that attained Secondary Education		
Male	**Female**	
31 (62%)	30 (60%)	50 (Males) 50 (Females)
No. of Respondents currently undergoing/have completed Tertiary Education		
Male	**Female**	
19 (38%)	20 (40%)	50 (Males) 50 (Females)

No. of Respondents without Formal Education		
Male	Female	
6 (12%)	11 (22%)	50 (Males) 50 (Females)

Source: Field data gathering

Plate 4.17: Gateway International Group of School in Obunagha Community

Plate 4.18: Community Primary School in Obunagha Community

Koroama Community

From the socio economic studies carried out in Koroama community, it was gathered that the community has both primary and secondary schools (Table 4.43) as listed below:

- **Primary School**

i) Ogbopuru Government Primary School, Koroama
ii) Assemblies of God Primary School, Koroama
iii) Paramobiri Okpobo Primary School, Koroama
iv) Akporoko Primary School, Koroama
v) Anglican Grammar School, Koroama

- **Secondary School**

i) Ogbopuru Community Secondary School, Koroama

Table 4. 43: Presence of Educational Institutions in Koroama

Characteristics	Educational Situation
Tertiary Institution	Absent
College	Absent
Technical/Vocational	Absent
Nursery school	Present
Secondary School	Present
Primary school	Present
Adult education centre	Absent

Source: Field data gathering

100 questionnaires were administered across Koroama community. 50 were administered to male respondents while 50 questionnaires were administered to female respondents. From the completed and returned questionnaires, 40 (80%) male respondents and 32 (64%) female respondents admitted to have attained primary education up to First School Leaving Certificate level (Table 4.44). 31 (62%) male respondents and 28 (56%) female respondents stated that they have obtained secondary school education up to certificate level, while 19 (38%) male respondents and 16 (32%) female respondents affirmed that they have or are currently undergoing tertiary education. 10 (20%) male respondents have no formal education, while 18 (36%) female respondents have no formal education. Thus, the educational distribution of Koroama community show a dominance in male educational attainment compared to the females. Also, literacy level is quite commendable at 72%.

Table 4. 44: Educational Enrolment in Koroama Community

KOROAMA COMMUNITY		
No. of Respondents that attained Primary Education		
Male	**Female**	**No. of respondents**
40 (80%)	32 (64%)	50 (Males) 50 (Females)
No. of Respondents that attained Secondary Education		
Male	**Female**	
31 (62%)	28 (56%)	50 (Males) 50 (Females)
No. of Respondents currently undergoing/have completed Tertiary Education		
Male	**Female**	
19 (38%)	16 (32%)	50 (Males) 50 (Females)
No. of Respondents without Formal Education		
Male	**Female**	
10 (20%)	18 (36%)	50 (Males) 50 (Females)

Source: Field data gathering

Polaku Community

From the socio economic studies carried out in Polaku community, it was gathered that the community has both primary and secondary schools (Table 4.45):

- **Primary School**
  - Comprehensive Primary School, Polaku
  - Confluence Town Primary School (CTPS), Polaku

- **Secondary School**
  - Community Secondary School, Polaku
  - Divine Comprehensive Secondary/Primary School, Polaku (Plate 4.19)

Table 4. 45: Presence of Educational Institutions in Polaku

Characteristics	Educational Situation
Tertiary Institution	Absent
College	Absent
Technical/Vocational	Absent
Nursery school	Present
Secondary School	Absent
Primary school	Present

Adult education centre	Absent

Source: Field data gathering

Plate 4.19: A view of Comprehensive Secondary/ Divine Comprehensive High School Polaku

100 questionnaires were administered in Polaku community. 50 were administered to male respondents, and also 50 administered to female respondents. From the completed and returned questionnaires, 31 (62%) male respondents and 22 (44%) female respondents admitted to have attained primary education up to first school leaving certificate level. 23 (46%) male respondents and 19 (38%) female respondents stated that they have obtained secondary school education up to certificate level, while 11 (22%) male respondents and 8 (16%) female respondents affirmed that they have or are currently undergoing tertiary education. 19 (38%) male respondents have no formal education, while 28 (56%) female respondents have no formal education. Therefore, the educational distribution of Polaku community show a dominance in male educational attainment compared to the females (Table 4.46). Also, literacy level is slightly above par at 53%.

Table 4. 46: Educational Enrollment in Polaku Community

POLAKU COMMUNITY		
No. of Respondents that attained Primary Education		
Male	**Female**	**No. of respondents**
31 (62%)	22 (44%)	50 (Males) 50 (Females)
No. of Respondents that attained Secondary Education		
Male	**Female**	
23 (46%)	19 (38%)	50 (Males) 50 (Females)
No. of Respondents currently undergoing/have completed Tertiary Education		
Male	**Female**	
11 (22%)	8 (16%)	50 (Males) 50 (Females)
No. of Respondents without Formal Education		
Male	**Female**	

19 (38%)	28 (56%)	50 (Males) 50 (Females)

Source: Field data gathering

Okolobiri Community

From the focus group discussion section during socio economic investigation, primary learning centres and teaching institutes were observed to be present in the community.

- **Primary Schools**

i. Community Primary School, Okolobiri

100 questionnaires were administered in Okolobiri community with 50 questionnaires administered to the male respondents while 50 questionnaires to female respondents. The feedback from the completed questionnaires showed that 48(94%) of the male respondents attended primary school up to the First School Leaving Certificate level, while 37 (76%) of the female respondents obtained First School Leaving Certificate (Table 4.47). 35 (68%) male and 25 (52%) female respondents attended up to Senior Secondary Certificate level. 22 (42%) male and 13 (28%) female respondents have completed or are currently undergoing tertiary education. 4 (6%) male and 11(24%) female respondents reported that they have no formal education (Table 4.48). From these observations, it is clear that the literacy level is higher in males than females. This may partly be attributable to the traditional believe in most part of the African communities that it is more beneficial to educationally empower the male folks over the females.

Table 4. 47: Presence of Educational Institutions in Okolobiri Community

Characteristics	Educational Situation
Tertiary Institution	Absent
College	Absent
Technical/Vocational	Absent
Nursery school	Present
Secondary School	Absent
Primary school	Present
Adult education centre	Absent

Source: Field data gathering

Table 4. 48: Educational Attainment in Okorobiri Community

OKOLOBIRI COMMUNITY		
No. of Respondents that attained Primary Education		
Male	**Female**	**No. of respondents**
48 (94%)	37 (76%)	50 (Males) 50 (Females)
No. of Respondents that attained Secondary Education		
Male	**Female**	
35 (68%)	25 (52%)	50 (Males) 50 (Females)
No. of Respondents currently undergoing/have completed Tertiary Education		
Male	**Female**	
22 (42%)	13 (28%)	50 (Males) 50 (Females)
No. of Respondents without Formal Education		
Male	**Female**	
4 (6%)	11 (24%)	50 (Males) 50 (Females)

Source: Field data gathering

4.6.5.2 Economic Status

The location of the Ijaw communities around the riverine areas, give the Ijaw people the edge for economic empowerment in the merchant shipping sector in the early and mid-20th century (pre-Nigerian independence). With the advent of oil and gas exploration, the people moved into the sector.

The major source of income for the people of Gbaran clan is aqua-based - fishing (53%), and crop farming (27%). Traders/artisans and civil servants make up about 9% and 11% respectively (Figure 4.20).

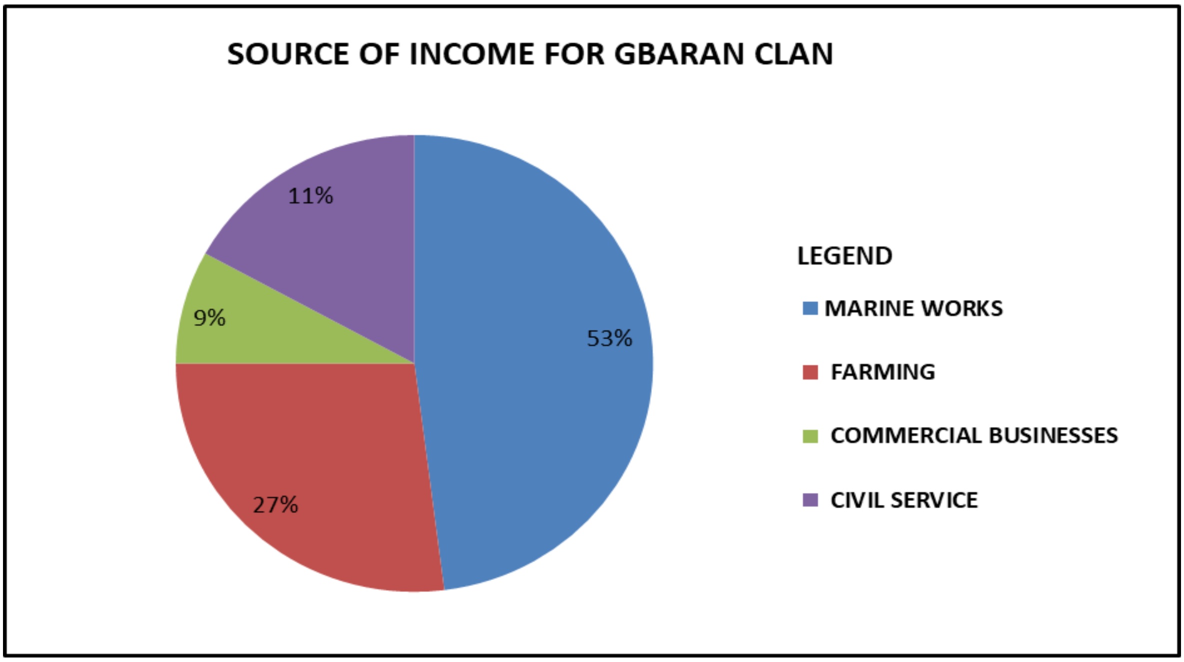


Figure 4.20: Source of Income in Gbaran Clan

Tunama Community

Tunama community the proposed project host is an agricultural area involved in activities such as fishing, farming, petty trading, artisanal works etc. The community is also a major oil and gas producing area contributing immensely to the Nigeria's oil production. Trading of farm produce and other goods is also common among the people. From the feedback of the socio-economic assessment as shown in Table 4.49, of the 100 questionnaires administered in the community, 42% of the respondents are farmers, 25% are artisans, 16% are traders, 7% are teachers, 4% civil servants, and 6% fall into others which includes car and motorcycle transporters, itinerant hawkers (Figure 4.21). some of its economic important areas are presented in Plate 4.20.

Table 4. 49: Occupational distribution in Tunama Community

No. of Respondents TOTAL: 100	Farmers	Artisans	Traders	Teachers	Civil Servants	Others
TUNAMA COMMUNITY						
100	42%	25%	16%	7%	4%	6%

Source: Field data gathering

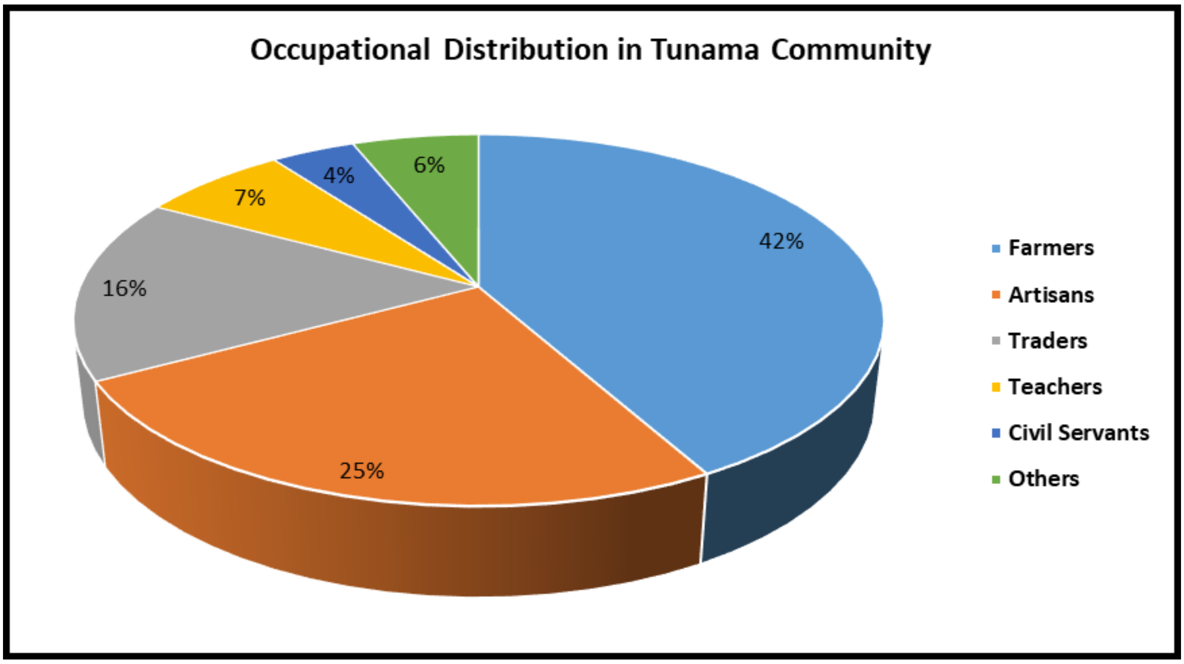


Figure 4.21: Occupational Distribution in Tunama Community

Plate 4.20: Selected views of the Economic status of Tunama community

Obunagha Community

Obunagha community is well known for its great reserve of oil and gas. However, the indigenes of the community are largely engaged in farming, fishing, hunting, trading (Table 4.50). From the 100 questionnaires administered, 43% of the respondents are farmers, 21% are artisans, 17% are traders, 9% are teachers, 4% civil servants, and 6% fall into the categories of others (Figure 4.22).

Table 4. 50: Occupational distribution in Obunagha Community

No. of Respondents TOTAL: 100	Farmers	Artisans	Traders	Teachers	Civil Servants	Others
OBUNAGHA COMMUNITY						
100	43%	21%	17%	9%	4%	6%

Source: Field data gathering

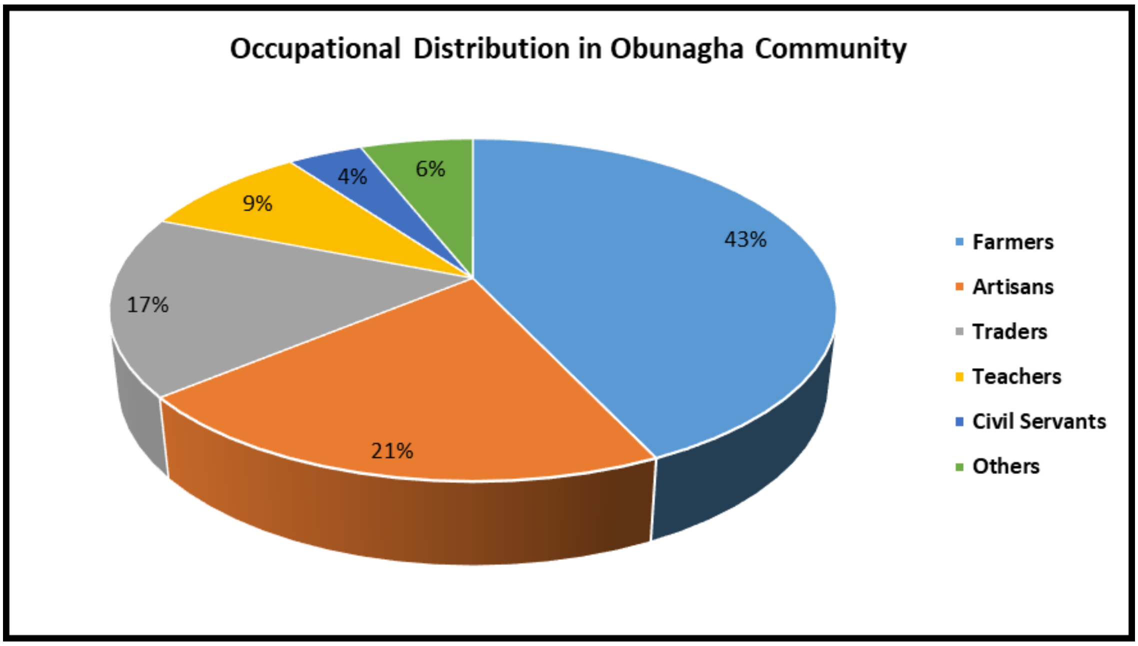


Figure 4.22: occupational distribution in Obunagha Community

Koroama Community

The socio economic studies shows that Koroama people are largely farmers, notable for the cultivation of palm oil, cassava, and plantain (Table 4.51). 100 questionnaires were administered in Koroama community to assess economic distribution of the people. From the returned completed questionnaires, 41% of the respondents are farmers, 29% are artisans, 16% are traders, 6% are teachers, 3% are civil servants, and 5% fall into the categories of others (Figure 4.23).

Table 4. 51: Occupational distribution in Koroama Community

No. of Respondents TOTAL: 100	Farmers	Artisans	Traders	Teachers	Civil Servants	Others
KOROAMA COMMUNITY						
100	41%	29%	16%	6%	3%	**5**%

Source: Field data gathering

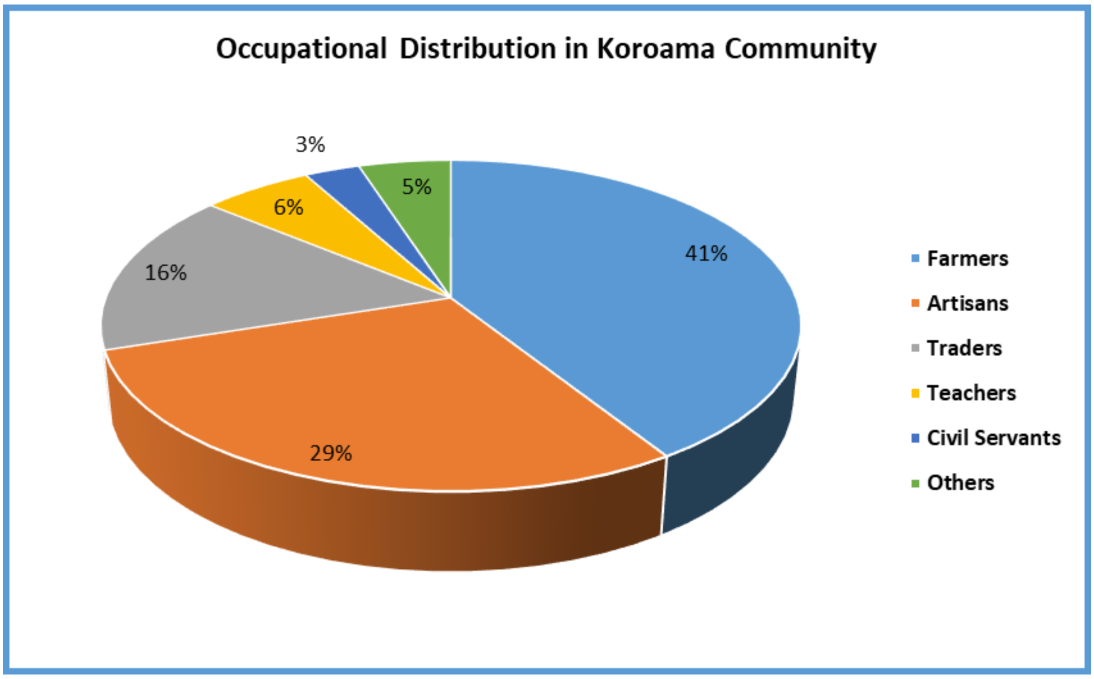


Figure 4.23: Occupational distribution in Koroama Community

Polaku Community

Polaku community like the other communities, is a home of great farmers involved in the cultivation of a variety of farm products ranging from cassava, maize, and palm oil (Figure 4.24). From the 100 questionnaires administered in Polaku, 40% of the respondents are farmers, 30% are artisans, 15% are traders, 7% are teachers, 2% are civil servants, and 6% fall into the category of others (Table 4.52).

Table 4. 52: Occupational distribution in Polaku Community

No. of Respondents TOTAL: 100	Farmers	Artisans	Traders	Teachers	Civil Servants	Others
POLAKU COMMUNITY						
100	40%	30%	15%	7%	2%	**6%**

Source: Field data gathering

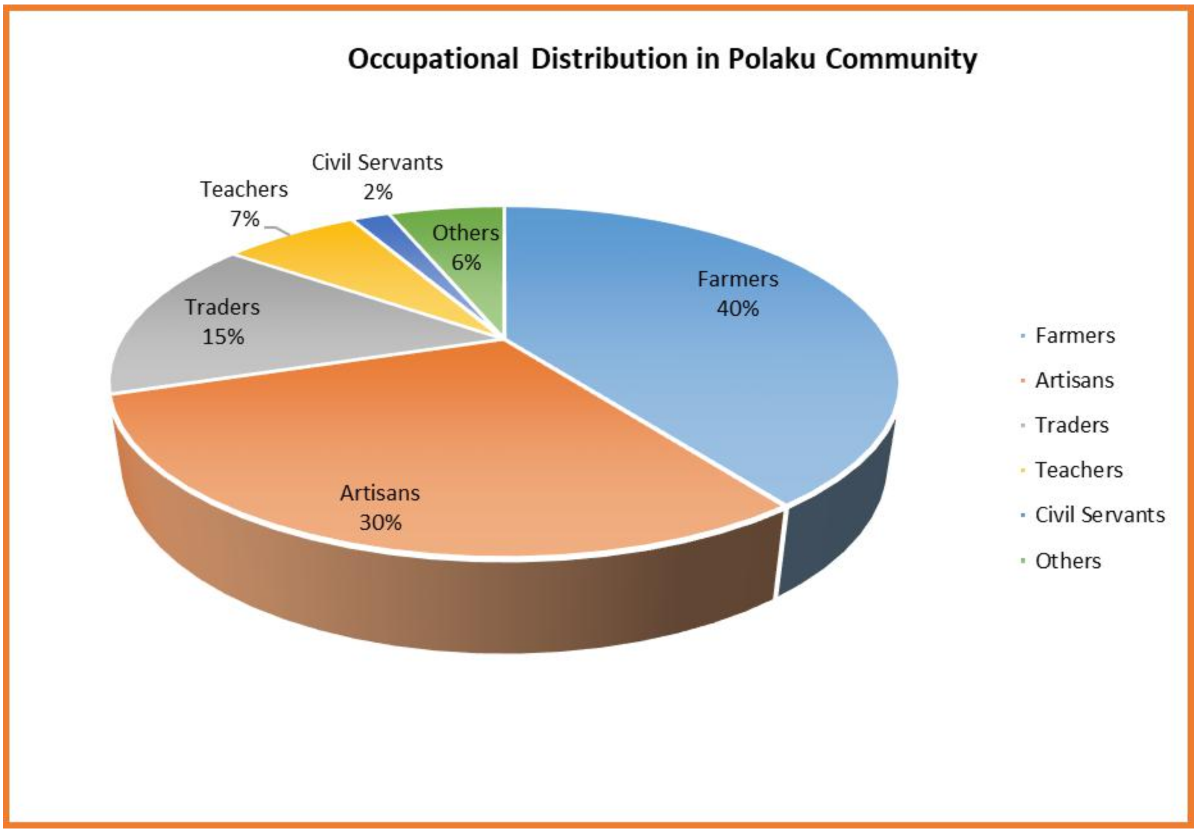


Figure 4.24: Chart showing occupational distribution in Polaku Community

Okolobiri Community

The Okorobiri community is notable for its farming and fishing prowess (Table 4.53). From the 100 questionnaires administered, 42% of the respondents are farmers, 22% are artisans, 18% are traders, 8% are teachers, 3% civil servants, and 7% fall into the categories of others (Figure 4.25).

Table 4. 53: Occupational Distribution in Okolobiri Community

No. of Respondents TOTAL: 100	Farmers	Artisans	Traders	Teachers	Civil Servants	Others
OKOLOBIRI COMMUNITY						
100	42%	22%	18%	8%	3%	**7%**

Source: Field data gathering

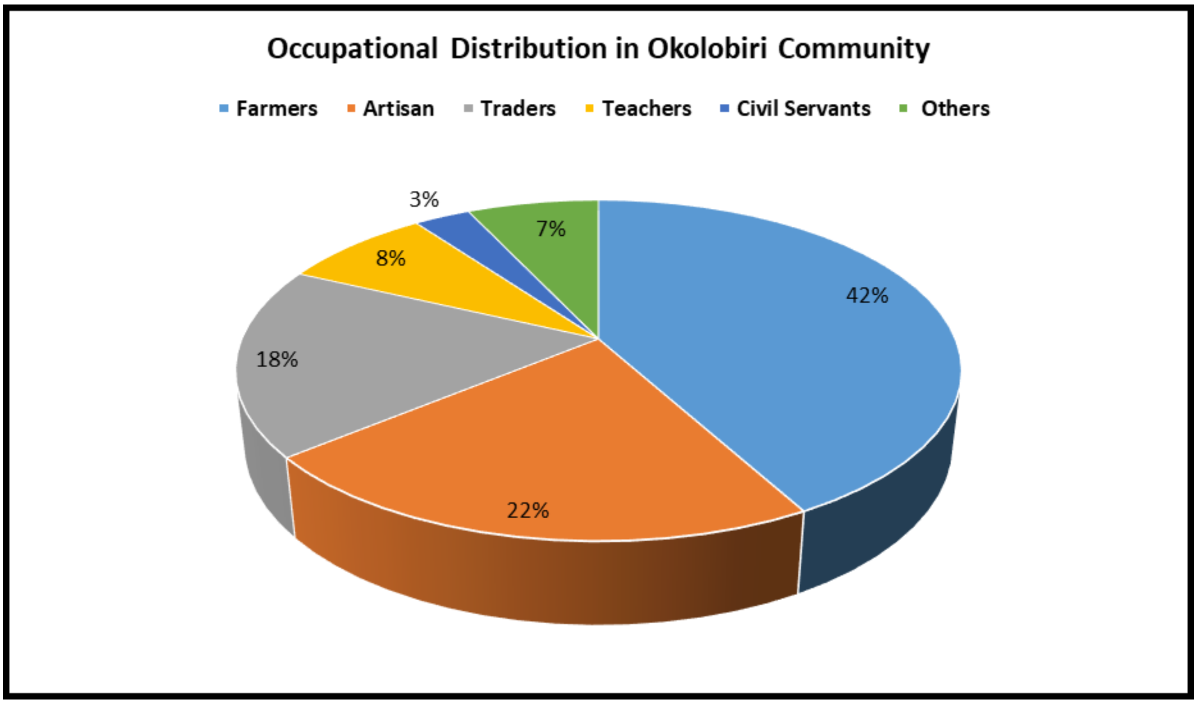


Figure 4.25: Chart showing occupational distribution in Okolobiri Community

4.5.5.3 Demography/Population Characteristics

The National population census of 2006 (which is the latest official population census in Nigeria) puts the population of Bayelsa Local Government Area at 352,285. However, the Nigerian Population Commission forecasted that the population is expected to increase to 470,800 by the end of 2016. There are no official population figures on gender distribution in Yenagoa LGA and also there are no official population figures on individual communities' basis for the LGA. However, from respondents' accounts, including key informant interview (KII) and focus group discussion (FGD), the estimated population of each of the project affected communities are presented under their respective sub-heads below. Table 4.54 presents the population characteristic of Bayelsa State according to the 2006 National Population Census by the National Population Commission (NPC) with Yenagoa Local Government Area the project host area highlighted in yellow.

Table 4. 54: Local Government Areas in Bayelsa and population figures

Name	Status	Population Census 1991-11-26	Population Census 2006-03-21	Population Projection 2016-03-21
Bayelsa	State	1,121,693	1,704,515	2,278,000
Brass	LGA	...	184,127	246,100
Ekeremor	LGA	124,279	269,588	360,300
Kolokuma/Opokuma	LGA	...	79,266	105,900
Nembe	LGA	...	130,966	175,000
Ogbia	LGA	...	179,606	240,000
Sagbama	LGA	119,759	186,869	249,700
Southern Ijaw	LGA	267,371	321,808	430,100
Yenagoa	LGA	...	352,285	470,800
Nigeria	Federal Republic	88,992,220	140,431,790	193,392,500

Source: National Population Commission of Nigeria (web), National Bureau of Statistics (web)

Tunama Demographic Characteristics

From the socio economic assessment, it was gathered that Tunama community is estimated to have a total population of about 300 inhabitant with 53% males and 47% females. Each household is estimated to have an average number of ten (10) persons per household with an average ratio of two (2) males to one (1) female. Table 4.55 summarizes the comprehensive age distribution of Tunama community and illustrated in Figure 4.26.

Table 4. 55: Demographic Distribution across Tunama Community

Sex	Male	189	(53%)
	Female	111	(47%)
	Total	**300**	**100**
Age	0 – 17	100	(33%)
	18 – 23	70	(23%)
	24 – 29	50	(17%)
	30 – 35	25	(8%)
	36 – 41	17	(6%)
	42 – 47	14	(5%)
	48 – 53	11	(3%)
	54 – 59	8	(3%)
	≥ 60	5	(2%)
	Total	**300**	**100**

Source: Field data gathering

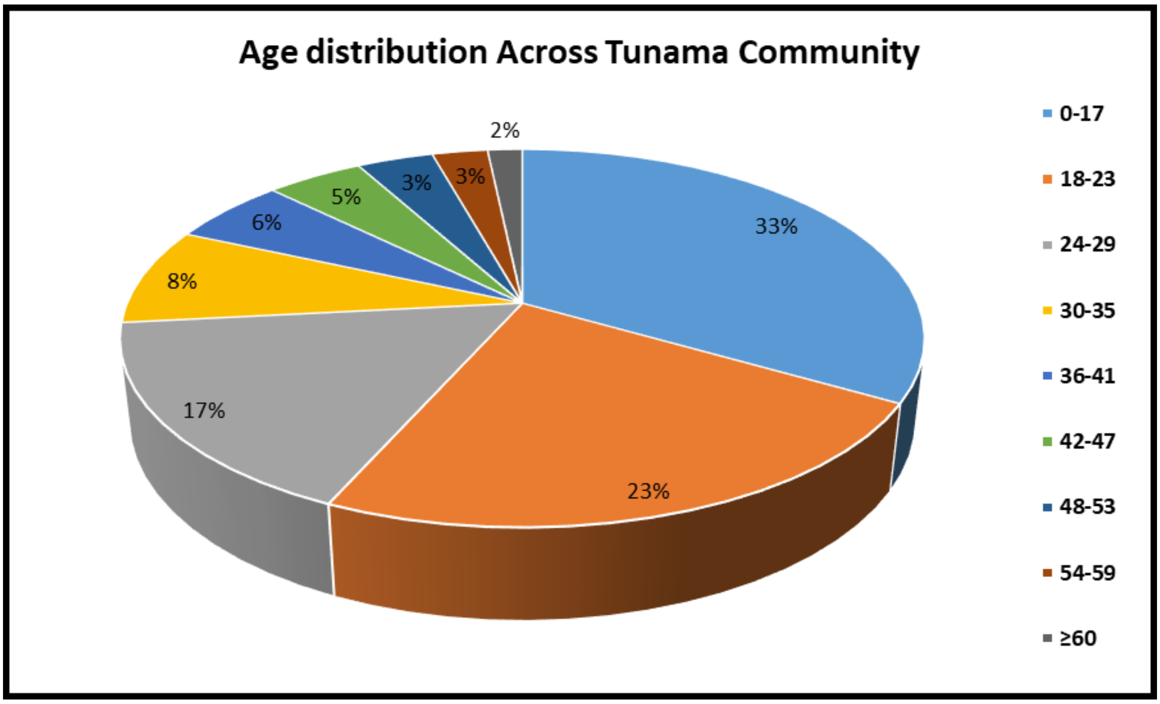


Figure 4.26: Age distribution in Tunama community

Obunagha Demographic Characteristic

Obunagha community has an estimated population of 700 comprising of 55% males and 45% females with an average of eight (8) persons per household and a gender ratio of two (2) males to one (1) female. Presented in Table 4.56 is Obunagha population by age distribution and illustrated in Figure 4.27.

Table 4. 56: Demographic Distribution across Obunagha Community

Sex	Male	385	(55%)
	Female	315	(45%)
	Total	**300**	**100**
Age	0 – 17	160	(23%)
	18 – 23	120	(17%)
	24 – 29	95	(14%)
	30 – 35	80	(11%)
	36 – 41	75	(11%)
	42 – 47	70	(10%)
	48 – 53	50	(7%)
	54 – 59	30	(4%)
	≥ 60	20	(3%)
	Total	**700**	**100**

Source: Field data gathering

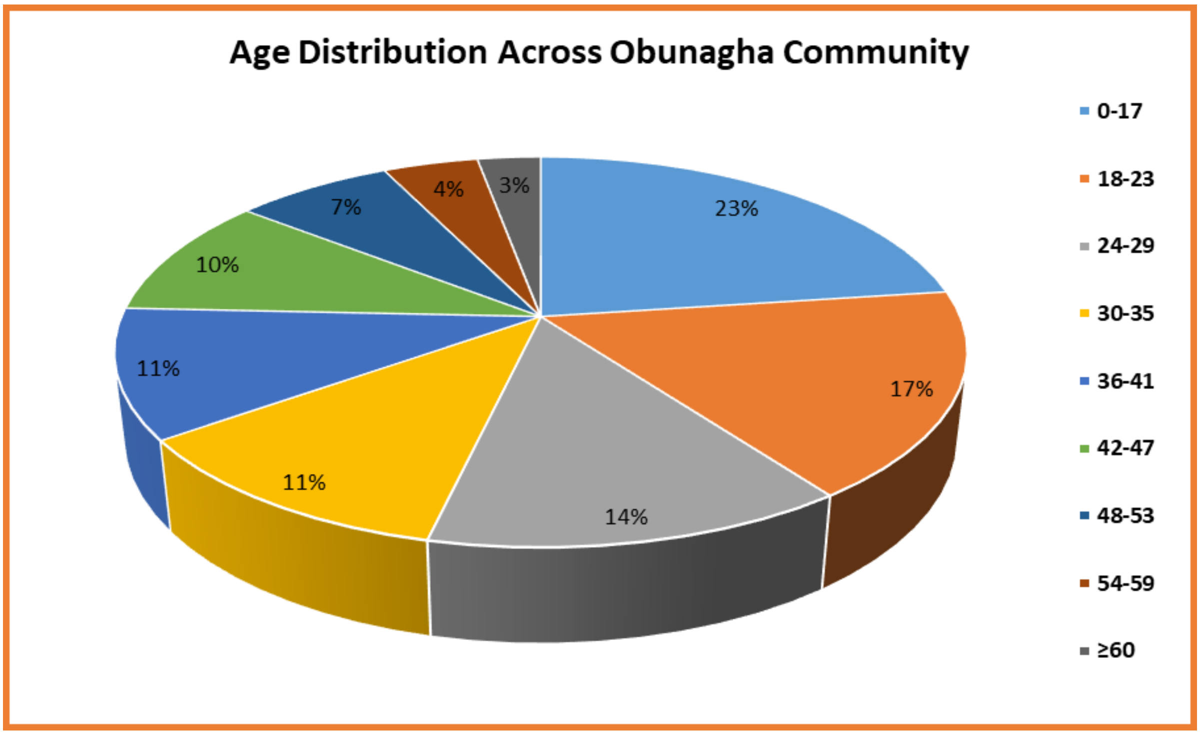


Figure 4.27: Age distribution in Obunagha community

Koroama Demographic Characteristic

Koroama community population is estimated to be 650 distributed into 58% males and 42% females with about eleven (11) persons per household (Table 4.57). Gender ratio is about two (2) males to one (1) female (Figure 4.28).

Table 4. 57: Demographic Distribution across Koroama Community

Sex	Male	377	(58%)
	Female	273	(42%)
	Total	**650**	**100**
Age	0 – 17	140	(22%)
	18 – 23	105	(16%)
	24 – 29	90	(14%)
	30 – 35	80	(12%)
	36 – 41	70	(11%)
	42 – 47	60	(9%)
	48 – 53	55	(8%)
	54 – 59	40	(6%)
	≥ 60	10	(2%)
	Total	**650**	**100**

Source: Field data gathering

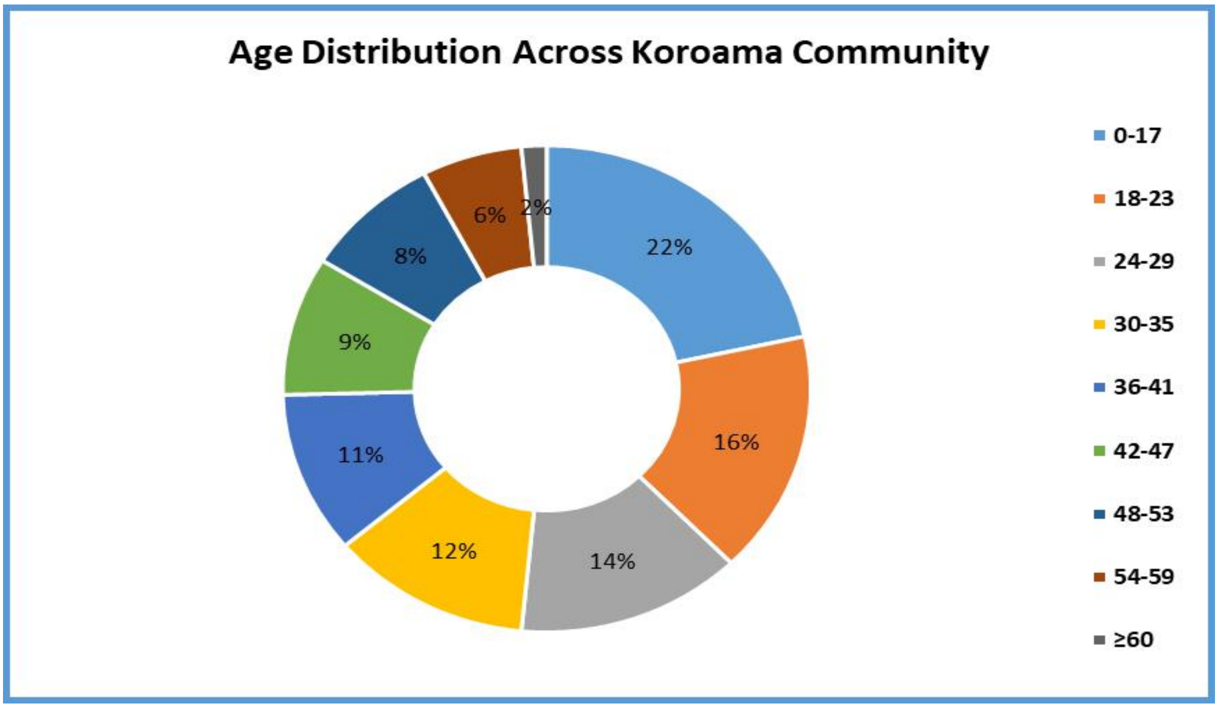


Figure 4.28: Age distribution in Koroama community

Polaku Demographic Characteristic

Polaku has an estimated population of 800 with a total number of 60% male gender and 40% female folks with nine (9) persons per household of an approximate ratio of two (2) male to two (2) female. Table 4.58 is Polaku population distribution and illustrated in Figure 4.29.

Table 4. 58: Demographic Distribution across Polaku Community

Sex	Male	480	(60%)
	Female	320	(40%)
	Total	**800**	**100**
Age	0 – 17	170	(21%)
	18 – 23	140	(17%)
	24 – 29	120	(15%)
	30 – 35	100	(13%)
	36 – 41	80	(10%)
	42 – 47	70	(9%)
	48 – 53	60	(8%)
	54 – 59	50	(6%)
	≥ 60	10	(1%)
	Total	**800**	**100**

Source: Field data gathering

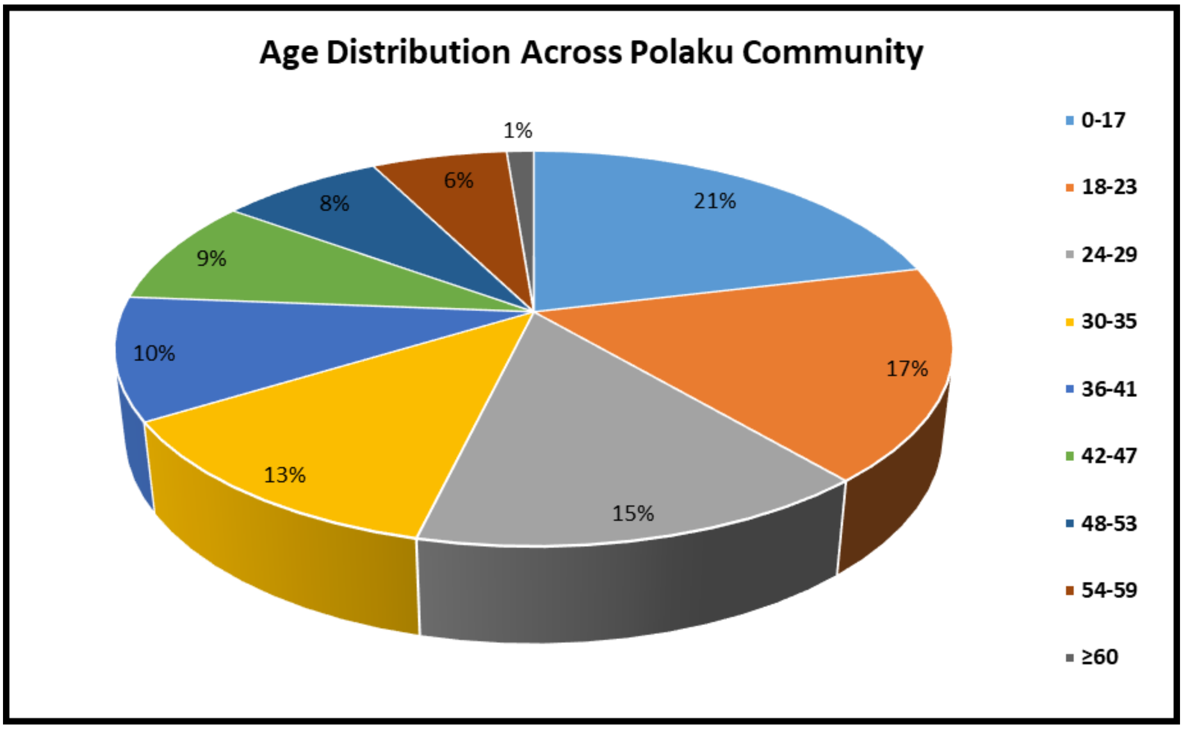


Figure 4.29: Population distribution across Polaku community

Okolobiri Demographic Characteristic

Okolobiri community has an estimated total population of 750 comprising of 56% males and 44% females with an average of eight (8) persons per household and a gender ratio of two (2) male to one (1) female. Presented in Table 4.59 is Okolobiri population by age distribution and illustrated in Figure 4.30.

Table 4. 59: Population Distribution across Okolobiri Community

Sex	Male	420	(56%)
	Female	330	(44%)
	Total	**750**	**100**
Age	0 – 17	155	(21%)
	18 – 23	125	(17%)
	24 – 29	100	(13%)
	30 – 35	95	(12%)
	36 – 41	85	(11%)
	42 – 47	80	(11%)
	48 – 53	55	(7%)
	54 – 59	35	(5%)
	≥ 60	20	(3%)
	Total	**800**	**100**

Source: Field data gathering

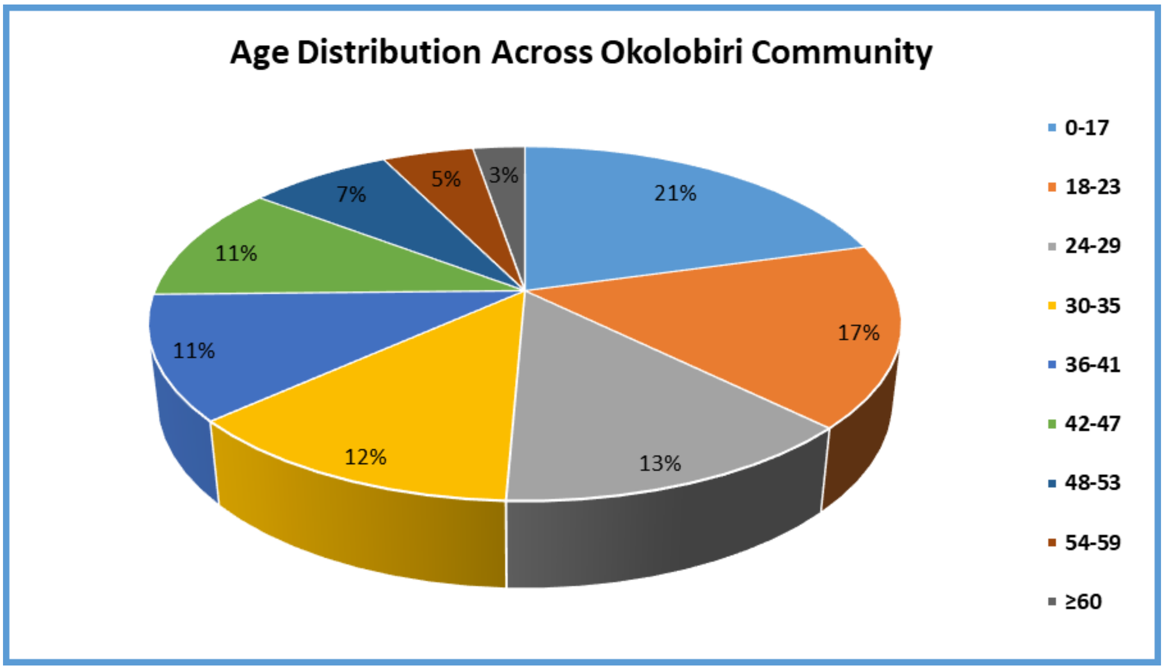


Figure 4.30: Population distribution across Okolobiri community

4.6.5.4 Income Distribution

The results of income distribution assessment from the socio economic assessment shows the following results across the five project affected communities.

Tunama Community

The socio-economic study team set out to measure income distribution on the basis of how much money is earned by Tunama community residents from engaging in economic activities. In a case where everyone earns exactly the same amount of money, then the income distribution will be said to be perfectly equal.

From the analysis of the feedback from respondents, 53% of the Tunama populace earn an estimated annual income of ₦25,000.00 - ₦50,000, 29% earn an estimated gross annual income of ₦100,000 – ₦250,000, while 18% earn an estimated annual income of over ₦500,000.00 (Table 4.60) as illustrated in Figure 4.31.

Table 4.60: Average annual income distribution of Tunama respondents

No. of Respondents TOTAL: 100	<₦25,000 – 50,000		<₦100,000 -250,000		>₦500,000	
TUNAMA COMMUNITY						
100	Men	Women	Men	Women	Men	Women
	39(%)	14(%)	19(%)	10(%)	14(%)	4(%)

Source: Field data gathering

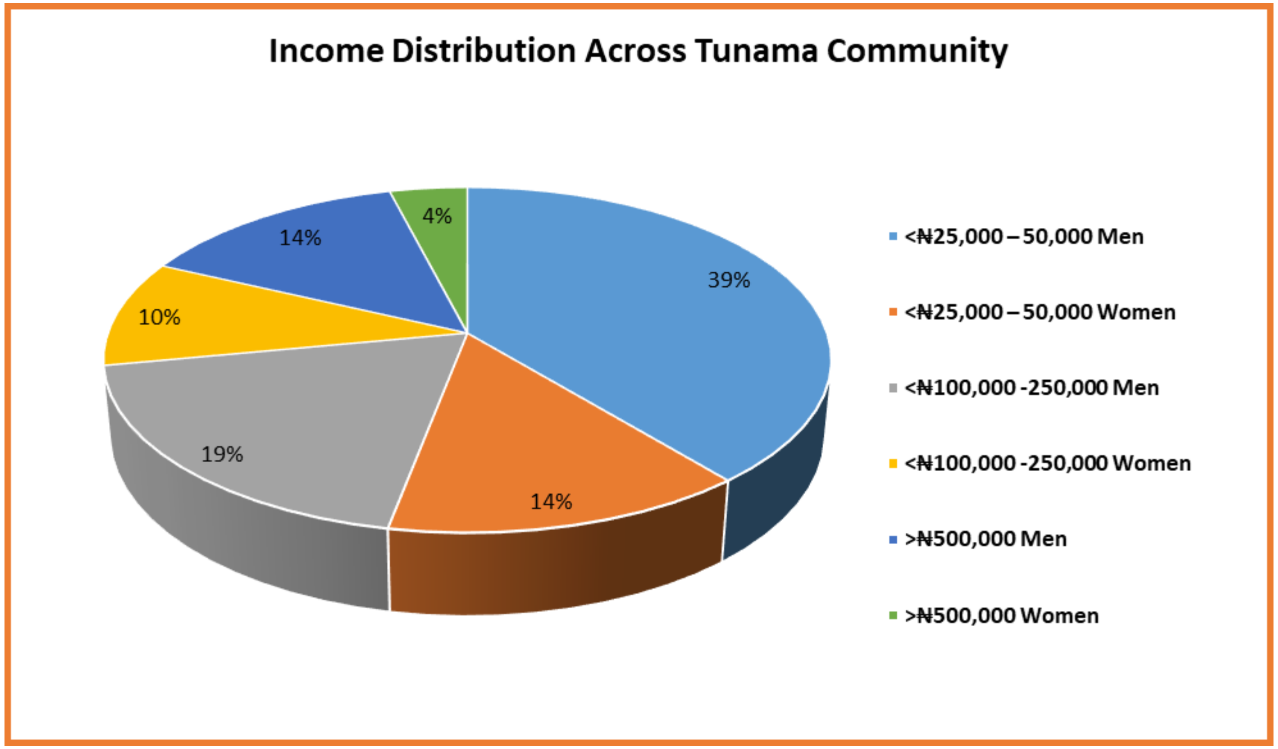


Figure 4.31: Income distribution of respondents Tunama Community

Obunagha Community

The socio economic survey particularly the questionnaire respondents in Obunagha community gave a feedback to the effect that 52% of the Obunagha populace earn an estimated annual income of ₦25,000.00 - ₦50,000, 29% earn an estimated gross annual income of ₦100,000 – ₦250,000, while 19% earn an estimated annual income of over ₦500,000.00 (Table 4.61) as illustrated in Figure 4.32.

Table 4.61: Average annual income distribution of Obunagha respondents

No. of Respondents TOTAL: 100	<₦25,000 – 50,000		<₦100,000 -250,000		>₦500,000	
OBUNAGHA COMMUNITY						
100	**Men**	**Women**	**Men**	**Women**	**Men**	**Women**
	42(%)	10(%)	20(%)	9(%)	12(%)	7(%)

Source: Field data gathering

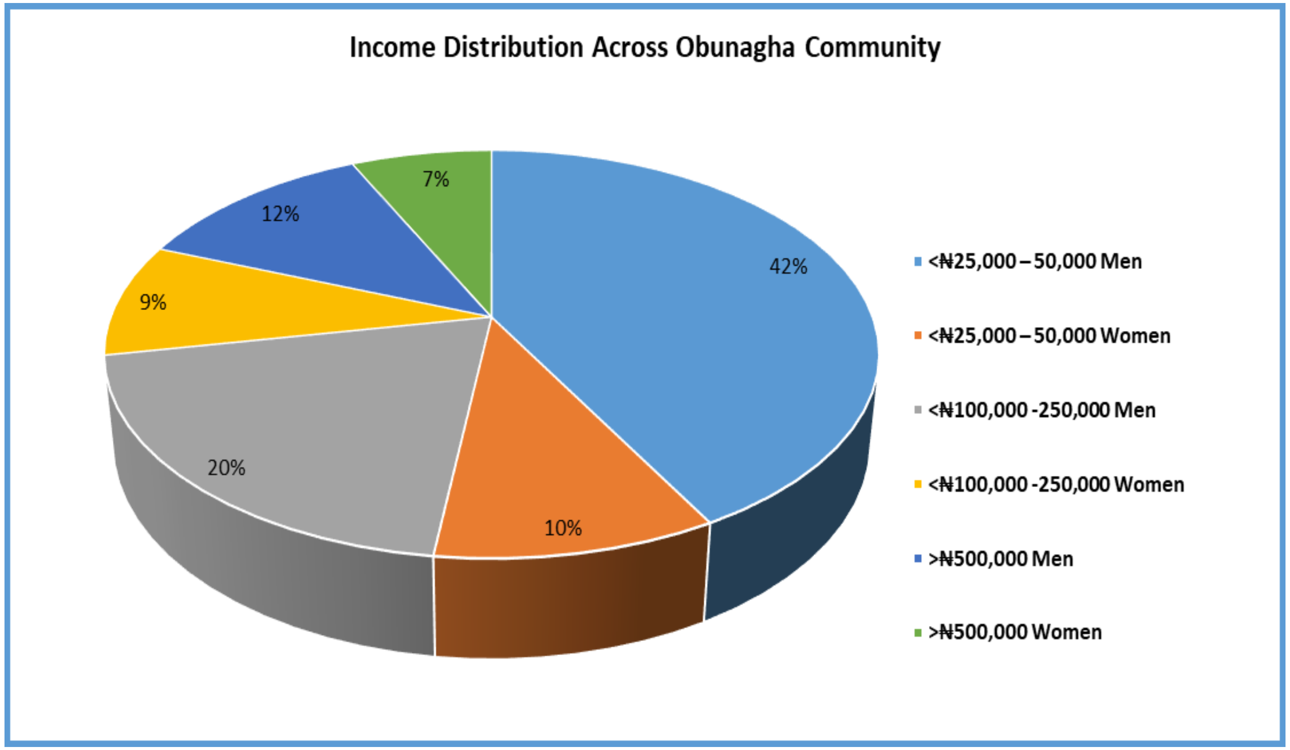


Figure 4.32: Income distribution of respondents in Obunagha Community

Koroama Community

In koroama, going by the feedback from the questionnaire by the respondents, 49% of the Okoroama populace earn an estimated annual income of ₦25,000.00 - ₦50,000, 31% earn an estimated gross annual income of ₦100,000 – ₦250,000, while 20% earn an estimated annual income of over ₦500,000.00 (Table 4.62) as illustrated in Figure 4.33.

Table 4.62: Average annual income distribution of Koroama respondents

No. of Respondents TOTAL: 100	<₦25,000 – 50,000		<₦100,000 -250,000		>₦500,000	
KOROAMA COMMUNITY						
100	Men	Women	Men	Women	Men	Women
	40(%)	9(%)	25(%)	6(%)	15(%)	5(%)

Source: Field data gathering

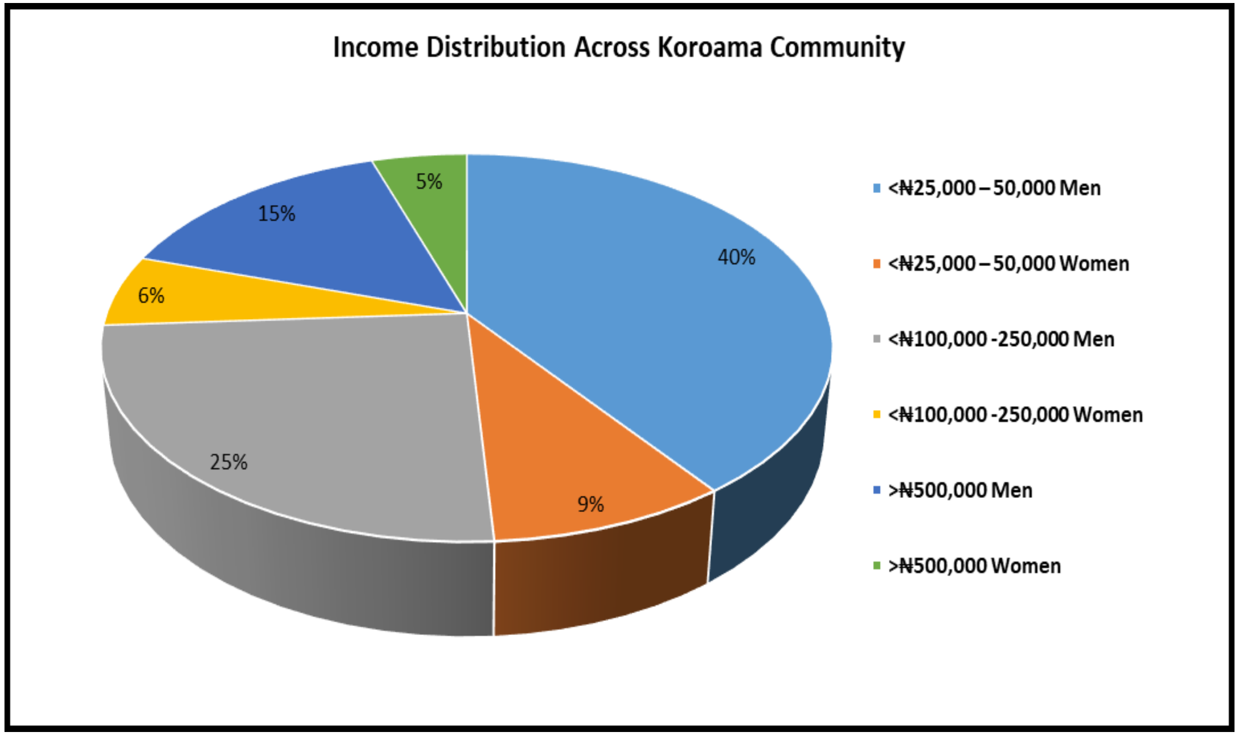


Figure 4.33: Income distribution of respondents in Koroama Community

Polaku Community

The respondents' feedback in Polaku shows that 50% of the Polaku community earn an estimated income of ₦25,000.00 - ₦50,000, 32% earn an estimated gross annual income of ₦100,000 – ₦250,000, while 18% earn an estimated annual income of over ₦500,000.00 (Table 4.63) as illustrated in Figure 4.34.

Table 4. 63: Average annual income distribution of Polaku respondents

No. of Respondents TOTAL: 100	<₦25,000 – 50,000		<₦100,000 -250,000		>₦500,000	
POLAKU COMMUNITY						
100	Men	Women	Men	Women	Men	Women
	38(%)	12(%)	25(%)	7(%)	15(%)	3(%)

Source: Field data gathering

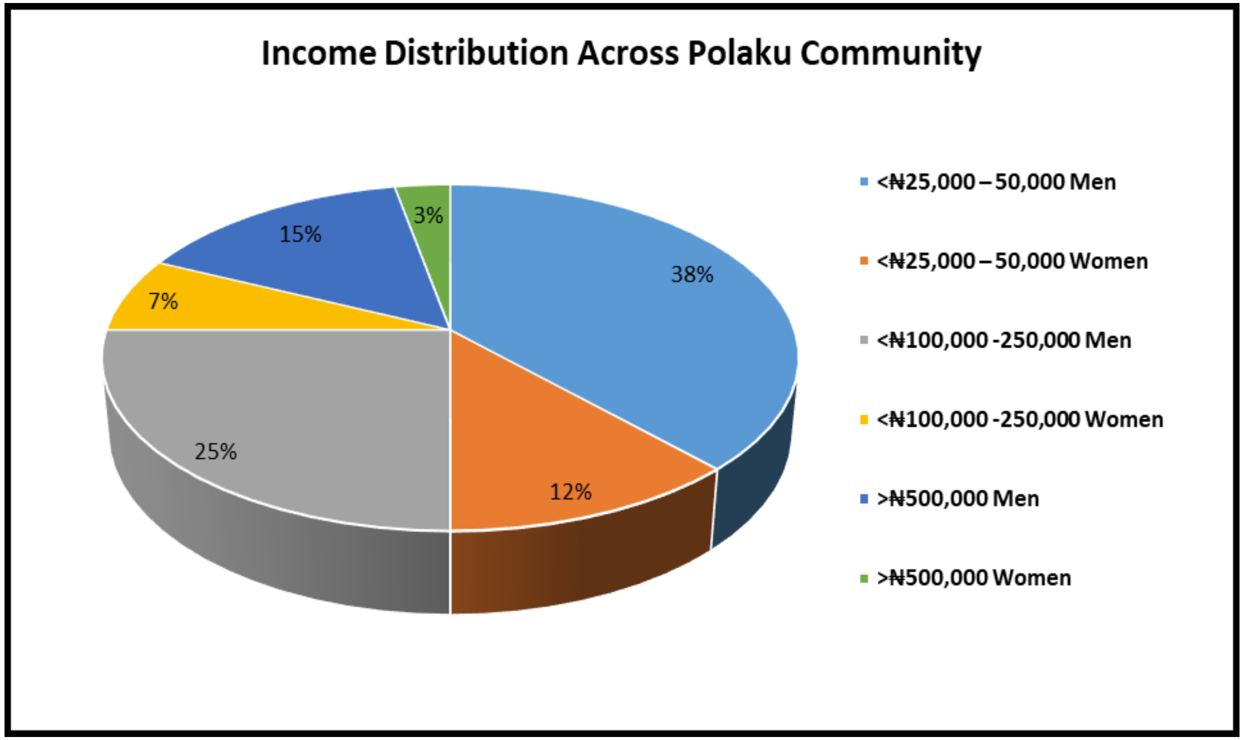


Figure 4.34: Income distribution of respondents in Polaku Community

Okolobiri Community

The respondents' feedback in Okolobiri shows that 52% of the Okolobiri populace earn an estimated annual income of ₦25,000.00 - ₦50,000, 30% earn an estimated gross annual income of ₦100,000 – ₦250,000, while 18% earn an estimated annual income of over ₦500,000.00 (Table 4.64) as illustrated in Figure 4.35.

Table 4. 64: Average annual income distribution of Okolobiri respondents

No. of Respondents TOTAL: 100	<₦25,000 – 50,000		<₦100,000 -250,000		>₦500,000	
OKOLOBIRI COMMUNITY						
100	Men	Women	Men	Women	Men	Women
	44(%)	8(%)	20(%)	10(%)	14(%)	4(%)

Source: Field data gathering

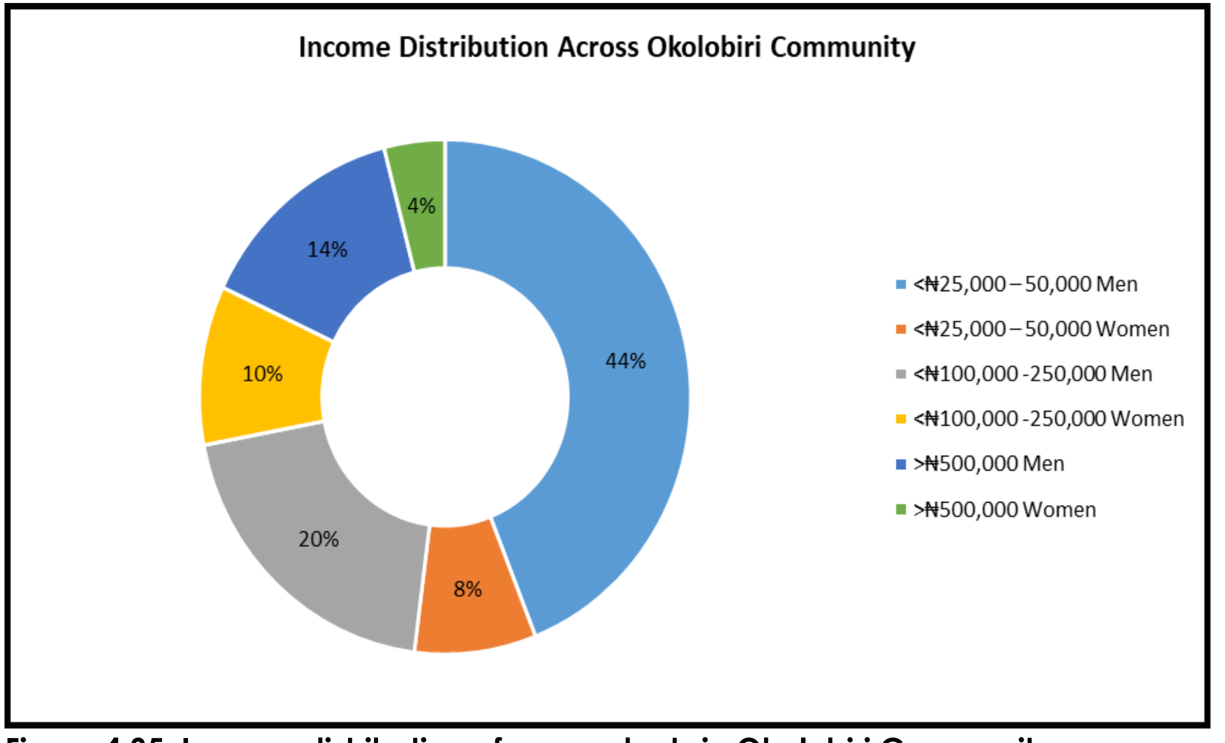


Figure 4.35: Income distribution of respondents in Okolobiri Community

4.6.5.5 Religion

Christianity is the dominant religion across Gbaran clan to include the project host community Tunama and the other project affected neighbouring communities: Obunagha, Koroama, Polaku and Okolobiri (Table 4.65). The Christians here constitute about 89% of the population. There was no testament from respondents to the presence/activities of Islam in the community except by assumption, since the area is prone to visitors' influx. Thus, 1% was allotted to Muslims. However, no physical presence of a Mosque was observed from the socio economic exercise. This further confirms the claim about the absence of Islam in the area.

There are traditional worshipers who from this socio-economic assessment constitute about 10%. Traditional worship adherents are devoted to the veneration of ancestral deities dedicated to their individual family, whose shrine is mostly constructed close to the family house. But, the overwhelming presence of Christianity has to a very large extent overshowed the practice of traditional worship. Even though the socio-economic survey team did not physically encounter any shrine, a good number of respondents claimed the knowledge of *Ziba* worship as well as devotees to other gods.

During the study, some notable names of churches sighted in the area are;

- Anglican Church.
- Living Faith Bible Church (Plate 4.21)
- Shepherd Vine Christain Centre (Plate 4.22)
- Mountain of Holiness Church (Plate 4.23)
- Christ Embassy
- Church of Christ
- Deeper Life Bible Church
- Christ Apostolic Church (CKC)
- Redeemed Christian Church
- Four Square Gospel Church

Plate 4.21: Living Faith Church in Tunama community

Plate 4.22: Shepherd Vine Christain Centre in Obunagha community

Plate 4.23: Mountain of Holiness Church (Obunagha Province)

Table 4. 65: Religion distribution across the five (5) communities

Religion	Distribution (%)
Christianity	89
Islam	1
Traditional Worshippers	10
Total	**100**

Source: Field data gathering

4.5.5.6 Culture

Ijaw (also known by the subgroups "**Ijo**" or "**Izon**") are a collection of people indigenous mostly to the forest regions of the Bayelsa, Delta, and Rivers States within the Niger Delta in Nigeria. Some are resident in Akwa-Ibom, Edo, and Ondo states also in Nigeria. Many are found as migrant fishermen in camps as far west as Sierra Leone and as far east as Gabon along the Western Africa coastline. The Ijo population is estimated to be over 10 million people. They have long lived in locations near many sea trade routes, and they were well connected to other areas by trade as early as the 15th century (Ijo Information 3 November 1998).

The Ijaw people live by fishing supplemented by farming paddy-rice, plantains, yams, cocoyams, bananas and other vegetables as well as tropical fruits such as guava, mangoes and pineapples; and trading. Smoke-dried fish, timber, palm oil and palm kernels are processed for export. While some clans (those to the east- Akassa, Nembe, Kalabari, Okrika and Bonny) with powerful chiefs and a stratified society had centralized confederacies until the arrival of the British. However, owing to influence of the neighbouring Kingdom of Benin individual communities even in the western Niger Delta also had chiefs and governments at the village level.

Marriages are completed by the payment of a bridal dowry, which increases in size if the bride is from a different village from the groom (so as to make up for the bride's village's loss of a daughter). Funeral ceremonies, particularly for those who have accumulated wealth and respect, are often hugely celebrated with bountiful feasts. Traditional religious practices in the Niger Delta area centre on "Water spirits" and tribute to ancestors. These Ijaw cultural practices are all subscribed to in Obunagha community.

The Gbaran Uzu yam festival, a major cultural festival across the five project affected communities is celebrated between 15th – 23thJuly annually and is rotated among the Gbaran clan villages on a yearly basis.

4.5.5.7 Ancestral/Historical Monuments

According to facts gathering from interactions with community head, chiefs and other indigenes, the ancestral heritages are still very well preserved as family heritage. These items are well preserved and only brought out on special occasions such as during the festive periods as well as during coronation and chieftaincy installations.

4.5.5.8 Family Patterns

The family system observed in the area was patriarchal in nature with most family responsibilities reposed on the father, who is taken to be the head of the family with a single wife for most of the families observed in the area. The possession of few children was a popular practice by most families. This may not be unconnected with the harsh economic reality of the land. The value for the female child was more compared to that of the male, as the tradition reveres the girl child. Polygamy is a rare practice among the people of this area owing largely to their religious practice (Christianity).

4.5.5.9 Traditional Leadership Structure
Every community in Nigeria has its traditional leadership structure organised in a hierarchical manner acknowledged by the political structure of the States through their Local Government Areas.

The officially recognised leadership structure in Tunama community starts with the office of the paramount ruler of Obunagha community and under this office is the deputy chief, followed by the council of chiefs representing the five (5) families in the community, viz; Tunama, Okaniwarbo, Odumu, Ougbowaribo and Adiawaribo respectively (Figure 4.36. Thereafter comes the council of elders and finally the community development committee comprising the youth population.

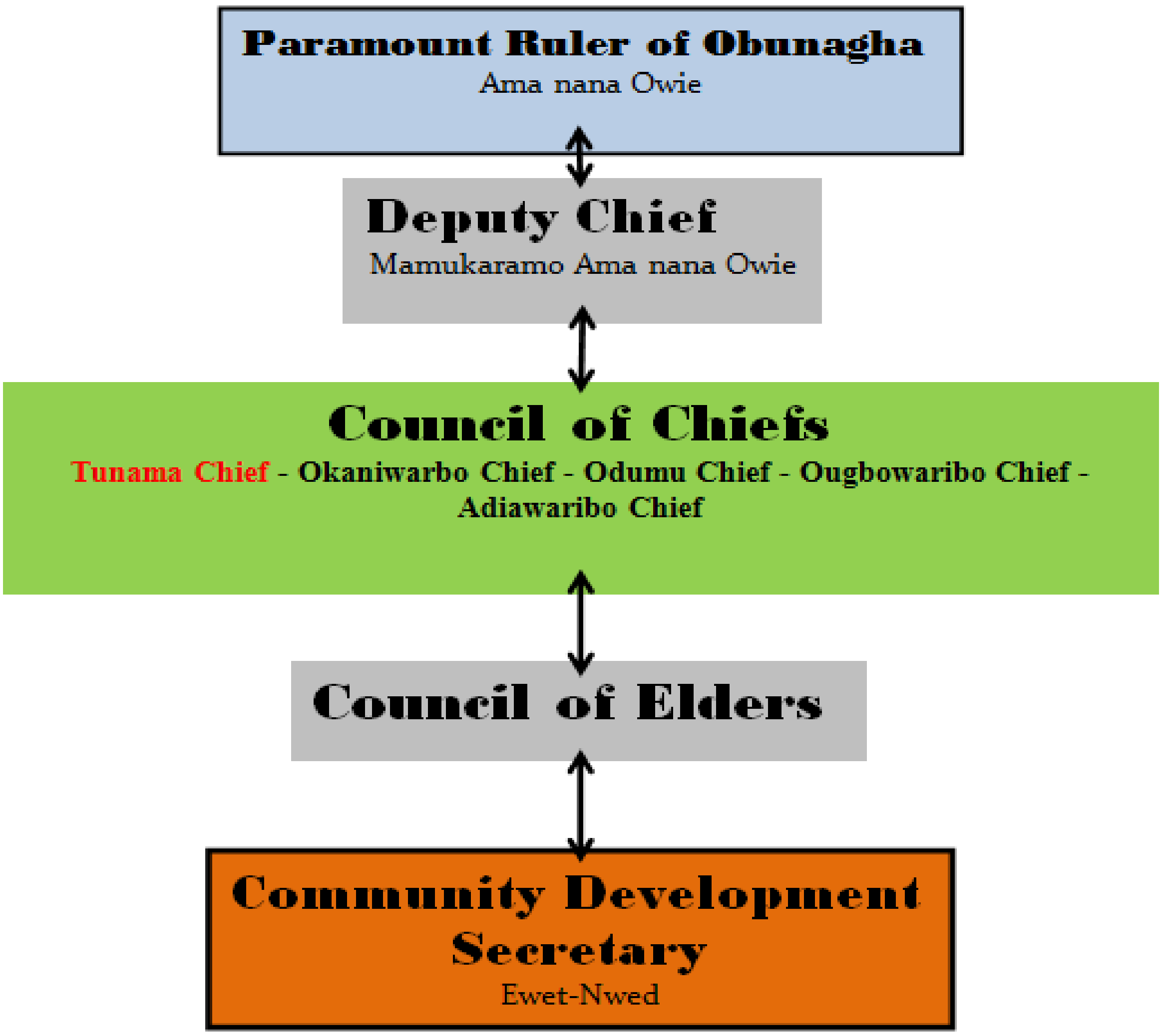


Figure 4.36: Traditional Leadership Structure of Tunama/Obunagha community

4.5.5.10 Ethnicity

The Gbaran tribe of the Ijaw people live along Taylor creek a tributary of River Nun ("Gbarantoru") in central Bayelsa State, Nigeria. Gbaran settlements include: Tunama, Okotiama, Poloaku, Obunagha, Ogboloma, Nedugo, Agbia, Ibiaye (Ebiyai), and Koroama. Okotiama is the eldest community. The close proximity of Gbaran communities along Taylor Creek has helped them maintain their shared cultural traditions. Gbaran, a clan occupying the aforementioned communities has a clan god known as *Gbaran Ziba*. Tunama community of Gbaran clan is a part of the Izon (Ijaw) ethnic nationality. Gbaran was founded by a man called Gbaranowei, son of Oporoza the son of Izon. Gbaranowei's brothers are Kumbowei and Kabowei in Sagbama Local Government Area of Bayelsa State, Nigeria. The people of Tunama community in Gbaran clan speak Izon as a major dialect.

4.5.5.11 Settlement Pattern

The residents of Tunama dwell in housing structures typical of a semi urban environment, with patches of rural settlements observed as one dispatch from the central area of Yenagoa town. The settlers of Tunama community live in settlements arranged in clusters linearly along both sides of the tarred road network, flooded at the sides for most months of the year. The area is dominated by various grades of unplanned housing with very sparse distribution of planned buildings.

4.5.5.12 Landuse and Housing Pattern

The predominant landuse in the communities is agriculture (crop cultivation) followed by residential purposes. Others uses include commercial. Tunama community has many family residences of two, three and four bedroom apartments most completed and occupied with a few under construction. Housing units are built mostly with cement blocks and roofed with corrugated iron/aluminium roofing sheets (Plate 4.24). The general housing patterns appear clustered nucleated and arranged linearly arranged along the two major roads that cut across the community. There is the need to put up an efficient drainage system for the community connecting all the housing units. However, notable observation gathered from the socio-economic assessment is that houses are built reflecting the economic status of the owner.

Plate 4.24: Settlement Pattern in the project area

4.5.5.13 Food

The bulk of what the Tunama people consume come from the water bodies around them and from their farm. For the Tunama native, no food tastes better than “loiloi”, a meal, like the “fufu”, made from cassava. Besides that, the people also eat garri, yams and cocoyams. Ogbono, banga, vegetable, egusi and okra are some of the soups enjoyed in Tunama. Rice is also a major meal for the people of Tunama. But there is some uniqueness in the way the people of Tunama enjoy their rice. For instance, the stew is not a popular choice here; most people prefer their white rice served with pepper soup (Plate 4.25) while others enjoy periwinkle soup (Plate 4.26).

Plate 4.25: A Bayelsa native pepper soup made mainly of sea food

Pepper soup is one thing you can hardly run away from in the town. Fresh fish or goat meat pepper soup, served with chilled drinks, is a common sight in bars (relaxation joints) and restaurants in the community. Another popular delicacy of the people is "kekefe", known more by the acronym, KKF. Kekefe or KKF is a meal prepared with unripe plantains and some special spices, and then served with steaming goat meat pepper soup. It's a delicacy that any visitor to Tunama will find irresistible.

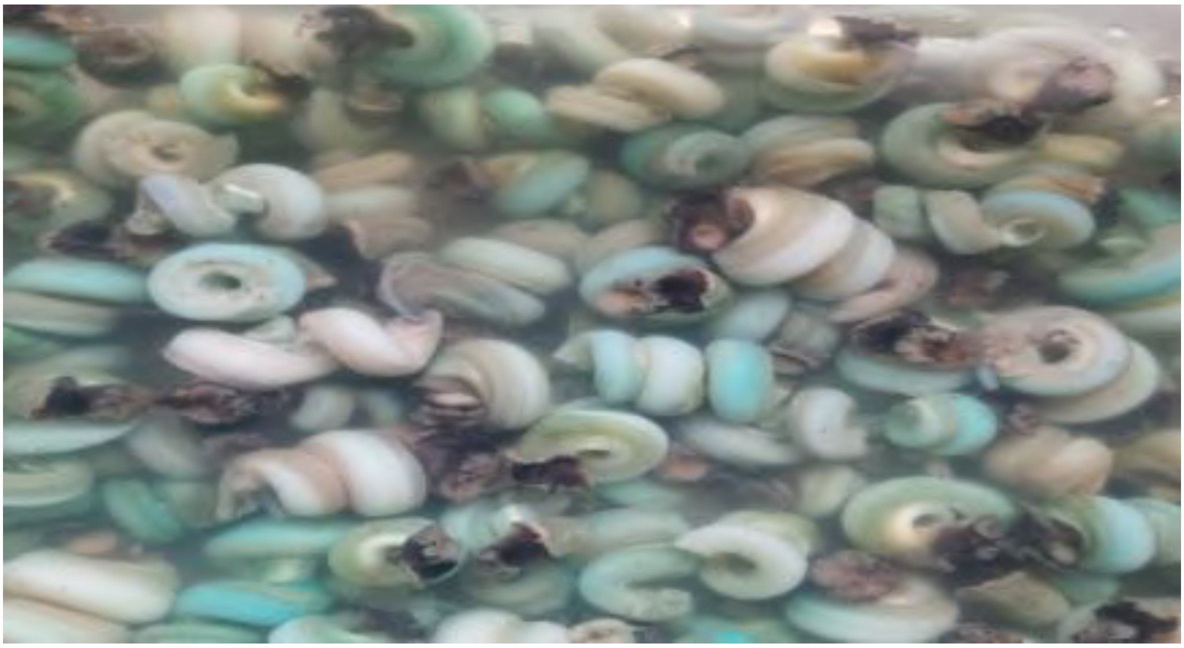


Plate 4.26: Periwinkle, a major ingredient of household soup in Tunama

4.5.6 General Infrastructure and utilities

In other to verify the availability and presence of amenities, aspects of socio economics bothering on; the road network, electricity supply and utilization, water supply and telecommunication availability in the area (Tunama and other project affected communities) were considered under these sections discussed below.

4.5.6.1 Transportation/Traffic

There are two major roads that lead to Tunama community. There is the SPDC - Tunama road and the Okolobiri - Polaku road. The roads are well tarred but are however not wide enough to sufficiently accommodate free flow between two trucks, for instance, running in opposite direction. Another issue with the major roads is the fact that there are no drainages along the roads to allow for effective flow of run-off and flood water forestall flooding of the highway. There are also minor road network branching into different streets within the community linking the nook and crannies of the residences and other public utilities in the interior parts.

Current vehicular traffic on the Tunama-Obunagha road is reported in Table 4.66. It is projected that these figures will increase with the advent of the current proposed lubricating oil blending plant. On the average, 400 vehicles ply the road per day (Figure 4.37). The vehicular traffic on the roads and other access routes/tracks on the Tunama - Obunagha road is dominated majorly by motorcycles, cars and buses. A road vehicular traffic count conducted (as part of the socio-economic assessment) on the major road, shows that on the average, at peak periods, 30 cars ply the road per hour, with 20 buses per hour, 10 trucks per hour and 33 motorcycles per hour.

Table 4.66: Average peak hourly vehicular traffic for Tunama-Obunagha Road

S/No.	Vehicles	No. Per Hour
1	Cars	30
2	Buses	20
3	Trucks	10
4	Motorcycles	33

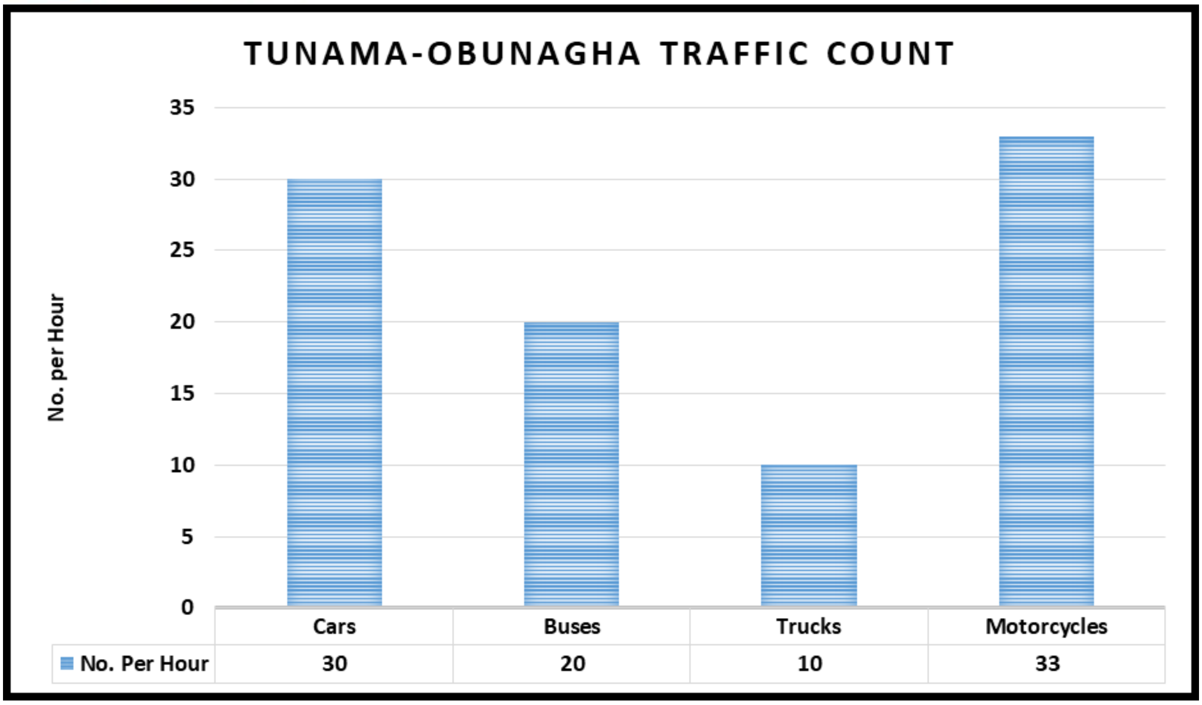


Figure 4.37: Average peak vehicular traffic (per hour) along Tunama-Obunagha Road

4.5.6.2 Electricity

The electricity distribution lines (Plate 4.27 and Plate 4.28) are very visible in the area with supplies from the facility of the SPDC gas operated turbine as well as from the state grid supply through the (Port Harcourt Electricity Distribution Company - PHEDC). However, small businesses in the community have alternative power generators to complement their electricity needs.

Plate 4.27: Distribution lines on concrete poles at Tunama community

Plate 4.28: A transformer station supplying PHCN electricity to Tunama residence

4.5.6.3 Water Supply

River Nun, the Taylor creek as well as a host of other seasonal streams has a plethora of surface water which its residents harness for fishing activities as well as irrigation in dry season farming which is usually very short. The rains which spread over 8 to 10 months of the year between March and November provide water for the residents during the rainy seasons. Other domestic activity such as laundry is yet another area in which the people use water from their surface water source. For drinking and cooking, the residents of the community rely on river nun (Plate 4.29) hand dug wells (Plate 4.30) and private boreholes (Plate 4.31).

Plate 4.29: River Nun in Tunama during the rainy season

Plate 4.30: Sales point for water storage tanks in Tunama

Plate 4.31: Water from a borehole at Azikel Refinery

4.5.6.4 Telecommunication

The major networks service such as MTN, Glo, Etisalat and Airtel are available in the area. This is evidenced in the presence of telecom masts around Tunama community (Plate 4.32). There are other TV and radio network signals from TV stations in Bayelsa and neighboring Rivers and Delta State as well as DSTV and GO-TV cables networks.

Plate 4.32: A Telecommunication transmission mast in Tunama community

4.5.6.5 Community Hall

The community hall is to serve as a rendezvous for community meetings and cultural festivals. Asides the community hall (Plate 4.33), there is also another cultural gathering point known in local parlance as Ugula. The Ugala is a place designated for communal celebrations in Tunama like cultural festivities such as the annual wrestling competition and traditional wedding ceremonies.

Plate 4.33: Community Auditorium (Okolobiri)

4.5.6.6 Market

There is no physical presence of designated market place in the entire community except for petty trading shops and stores along the road and in some street corners. It is in the nature of traders in the community to display their wares outside in front of their stores or on their tables (for petty traders) or even kiosks.

The Gbaran market (Plate 4.34) located at Okolobiri which is about 2 Km from Tunama is the nearest major market for the community residents. The market opens for trade once a week - every Saturdays.

Plate 4.34: A typical setting of Yenagoa Market structure

4.5.7 Residents Perspective of the Proposed Project

The survey findings revealed that residents of the area hold different views about the project as shown in Table 4.67. 95% of the respondents were of the view that the project would provide jobs on completion (Figure 4.38), 5% were indifferent as to whether the project will create jobs. On the other hand, 87% of the respondents are of the view that the project would attract more people to work and live in the community while 13% feel it would not, as there are already enough manpower from the community to man all the operation phases of the project (Figure 4.39). 85% of the respondents feel that the project would have significant impact on the environment while 15% think otherwise (Figure 4.40). 82% feel the project during operation would enhance the economic life of the host community while 13% think otherwise and 5% are indifferent (Figure 4.41).

Table 4. 67: Respondent Perspective of the project

S/N	Respondent's Perspective	Number of Respondents	Percentage of Respondents (%)
1	**Potential to Provide Jobs**		
	Yes	480	96
	No	0	0

	Indifferent	20	4
	Total	500	100
2.	**Potential to Boost Influx of Immigrant to the Project Area**		
	Yes	450	90
	No	0	0
	Indifferent	50	10
	Total	500	100
3.	**Project will Negatively Impact the Environment**		
	Yes	440	88
	No	0	0
	Indifferent	60	12
	Total	500	100
4.	**Project will Positively Affect the Economy of the Project Host Community**		
	Yes	430	86
	No	20	10
	Indifferent	50	4
	Total	500	100

Source: Fielworkd, 2020

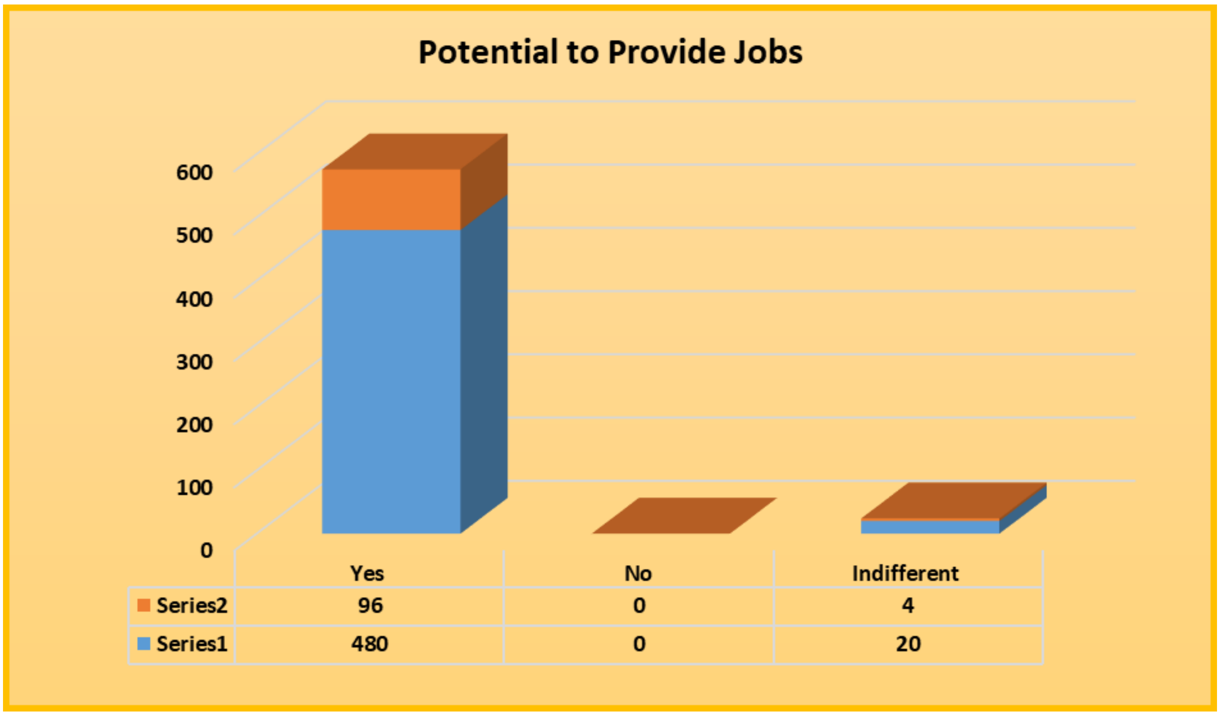


Figure 4.38: Respondents' view on the potentials of the project to provide jobs for community's inhabitants

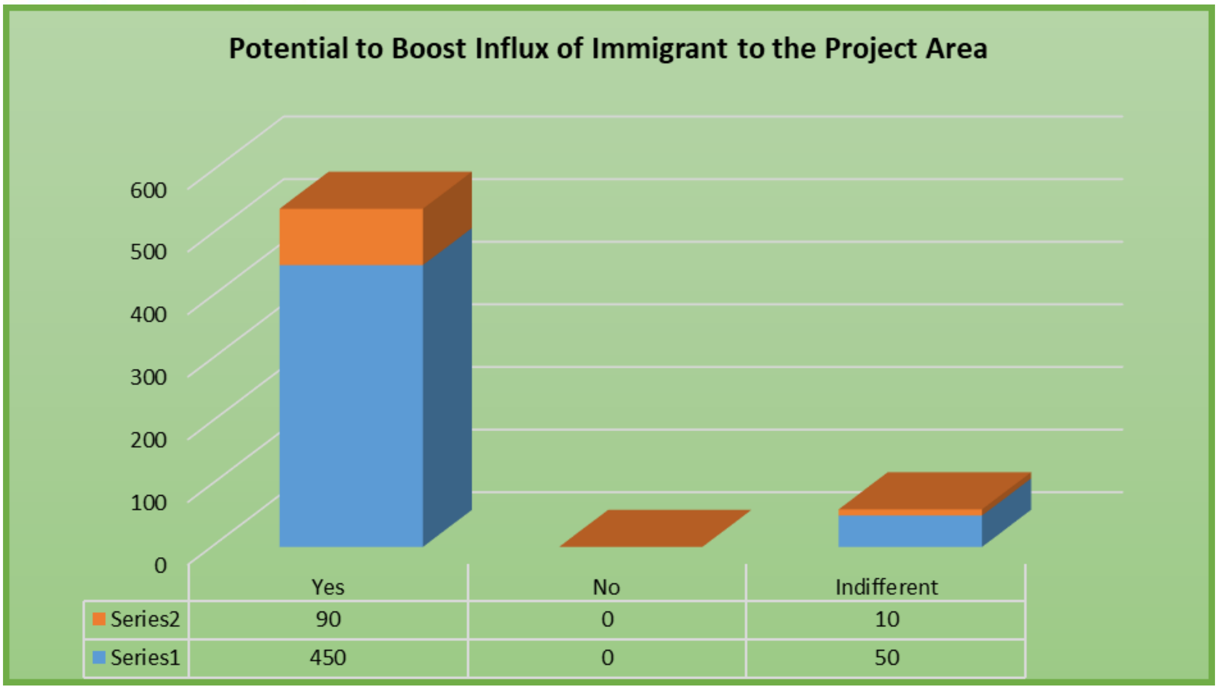


Figure 4.39: Respondents' view on the project's potential to boost influx of immigrants to the project area

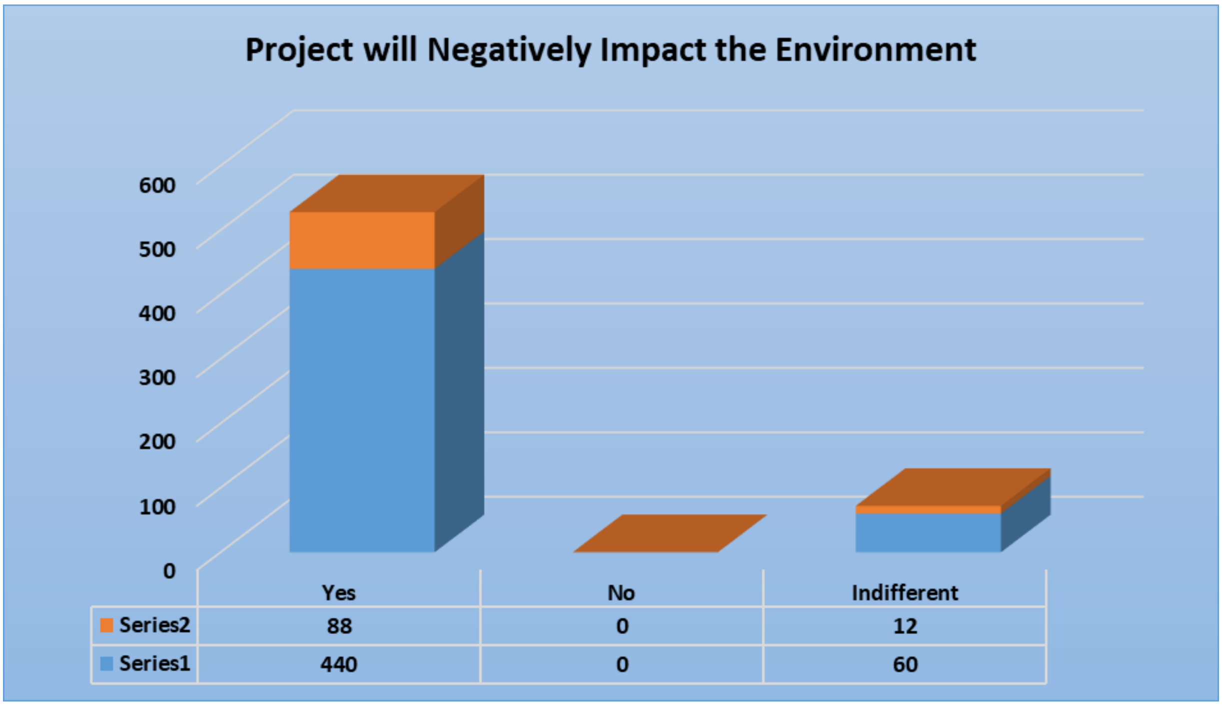


Figure 4.40: Respondents' view on the project's potential to negatively impact the environment

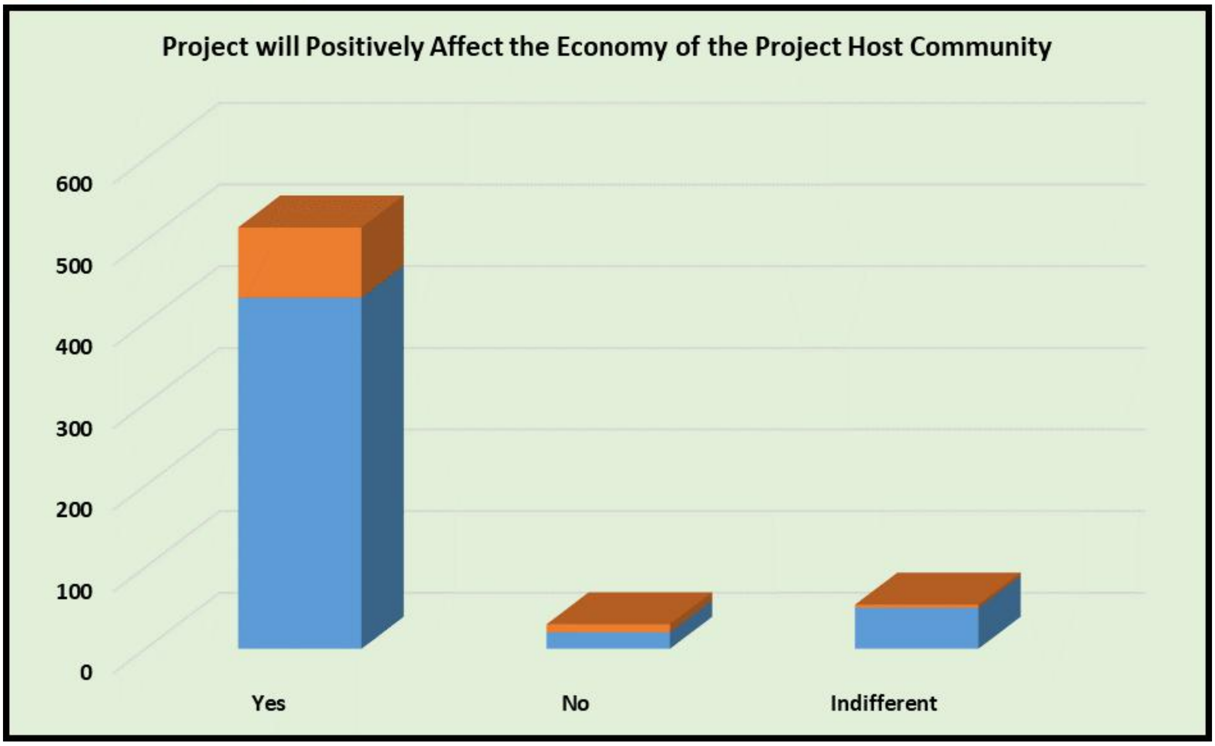


Figure 4.41: Respondents' view on the project's potential to positively affect the economy of the project host community

4.6 Feedback/Consultation Outcome

Highlighted below is a list of concerns as gathered from the consultation with the inhabitants of Tunama, the Host (Plate 4.35 – Plate 4.37), Obunagha, Koroama, Polaku and Okolobiri communities under the supervision of the representatives from both the Federal and State Ministries of Environment. Also in attendance were paramount rulers, community heads, council of chiefs/elders, community youth leaders, men, women, various groups etc from all the project affected communities.

4.6.1. Feedback from Tunama community Head

The community head expressed joy that a project of this magnitude is coming to Tunama in his time and encouraged the company to engage a good number of the indigenes as project staff not only as unskilled labour but also as managerial staff (especially for those who qualify for such positions).

4.6.2. Feedback from Tunama community Men

In their words, they encouraged Eraskon Nigeria Limited to positively engage the community youths for possible employment when the project commenced considering the fact that the community is blessed with degree holders in various fields of learning and technicians. They advocated for social amenities like good access roads, drainages, boreholes, hospitals, schools etc.

While expressing delight that the proposed project will have positive impacts on the community, they however solicit the company for a timely consideration in signing the MoU between the Tunama communities with respect to the land take.

4.6.3. Feedback from Tunama Women

They expressly desired to see their children positively engaged and employed at the commencement of the project. They expressed joy about the project and look forward to its operation.

They want women to be given a chance to own shops where they can sell provisions and other consumables. The community women also advocated that widows in the community should be adequately empowered and assisted.

4.6.4. Feedback from Tunama Youths

They expressed worries that Tunama community has been totally relegated to the back in terms of socio amenities, enumerating that the community is a host to several oil companies. They support the project as it will create jobs for the community.

They equally seek educational grants/scholarships from the project proponents/sponsors for their deserving indigenes.

Plate 4.35: Consultation with Tunama Community Men

Plate 4.36: Consultation with Tunama women

Plate 4.37: Consultations with Tunama community Youths

4.6.5. Feedback from Obunagha Community Head

The Obunagha community head solicited for capacity building for community youths especially in the area of technical skill acquisition. There should be a conscious effort to adequately compensate farm land owners in the advent of loss of land to the project.

Feedback from Obunagha community Men

Amongst other things, the men requested for Educational support (in the form of physical infrastructure and scholarship grants) by the Eraskon Nigeria Limited for both primary and secondary school pupils.

Feedback from Obunagha Women

The Obunagha look forward to financial grants to support their trading activities. Jobs for their youths.

4.6.6. Feedback from Obunagha Youths

All the community youths advocated for was for Eraskon management to ensure that eligible youths are considered for employment.

4.6.7.Feedback from Koroama community Head

He also made an appeal that a large number of the community youths be considered for employment when the project comes on board. The proponent should provide the people with boreholes, good access road, hospitals, electricity and potable water.

4.6.8. Feedback from Koroama Men

They need electricity, good roads and schools

They strongly desired to see people in the community positively engaged when the project comes on stream.

4.6.9. Feedback from Koroama Women

As much as they appreciated the initiative, the women desired to be fully involved in the benefits embedded in the project.

They need electricity, good road, modern market, potable water and employment for both their husbands and children.

4.6.10. Feedback from Koroama Youths

They desired job opportunity for both artisan and educated youths. Provision of social amenities.

4.6.11. Feedback from Polaku Community Head

He made an appeal that a large number of the community youths be considered for employment when the project comes on stream.

4.6.12. Feedback from Polaku Men

They expressed joy and anticipated for timely completion of the project.

The community pledged unalloyed support for the project and appealed for creation of jobs for the community.

4.6.13. Feedback from Polaku community

They requested for job employment opportunity for the community youths, men and women, as well as provision of social amenities.

4.6.14. Feedback from Polaku youth

They are in support of the project as it will create jobs for the community youths. They equally sought for educational grants/scholarships from the project proponents/ sponsors for their deserving indigenes.

4.6.15. Feedback from Okolobiri community Head

He encouraged the company to engage a good number of the indigenes as project staff not only as unskilled labour but also as managerial staff (especially for those who qualify for such positions).

4.6.16. Feedback from Okolobiri community Men

As much as they expressed their unalloyed support for the proposed project they however demand for opportunity to be positively engaged when the project keeps-off.

4.6.17. Feedback from Okolobiri Women

They expressed their desire to see their children positively engaged and employed at the commencement of the project.

They equally expressed joy about the project and look forward to its operation.

4.6.18. Feedback from Okolobiri Youths

They wholeheartedly gave their unalloyed support to the proposed project as they are of the opinion that it will create more jobs for the community.

They equally seek educational grants/scholarships from the project proponents/sponsors for their deserving indigenes.

4.7 Health Impact Assessment (HIA)

This section presents the baseline health data based on information generated from sampled groups in the study area. The data relies heavily on self-reporting and presumptions by respondents in the survey.

4.7.1 Healthcare Facilities Assessment across the Project Affected Communities (PAC)

4.7.1.1. Tunama Community

The socio economic assessment reveals that there exists a Primary Healthcare (PHC) center in neighboring Obunagha community. It was however gathered that malaria, typhoid, diarrhoea, cholera and pneumonia are the prevalent health challenges experienced by the Tunama people. Most of these health cases are handled by the Obunagha primary healthcare center while extreme cases are referred to the Niger Delta Teaching Hospital (Plate 4.38).

4.7.1.2. Obunagha Community

Healthcare facility assessment was carried out across the entire Obunagha community with key interest on the Primary Healthcare (PHC) center by a team of experts in order to establish and identify prevalent health cases in the community. The assessment revealed that malaria, typhoid, diarrhea are the prevalent health cases which are treated by Obunagha PHC. The other life-threatening cases referred to the Niger Delta Teaching Hospital for proper attention and care.

4.7.1.3. Koroama Community

From the detailed healthcare assessment conducted on Koroama community, it was observed that Koroama primary healthcare center was in operation during the site visit. The assessment revealed that malaria, typhoid, diarrhoea, pneumonia etc are the prevalent ailments recorded in the community.

Plate 4.38: Niger Delta Teaching Hospital Okolobiri

4.7.1.4. Polaku Community

The socio economic assessment revealed that Polaku community has Primary Healthcare (PHC) center where health challenges like malaria, typhoid, diarrhoea, cholera, pneumonia, cuts and bruises etc are treated. Its major health cases are usually referred to the Niger Delta Teaching Hospital for care.

4.7.1.5. Okolobiri Community

Healthcare facility assessment was carried out across the entire Okolobiri community by a team of experts in order to establish and identify prevalent health cases in the community. The assessment revealed that the Niger Delta Teaching Hospital is located in Okolobiri where health cases like hypertension, malaria, typhoid, diarrhea etc which are the prevalent health cases across the entire land treated.

4.7.2 Key Issues and Challenges

Inadequate and inequitable distribution of human resource for health, inadequate and poorly maintained health care infrastructures, and poverty are amongst key issues with respect to health services provision and utilization in the project area. The poor state of health management information and disease surveillance and control systems and inadequate funding are major challenges to effective planning, implementation and evaluation of the current health system.

- **Mortality Occurrence**

As earlier appraised the prevalent health issues in the area include malaria, hypertension, typhoid, diabetes, cough, catarrh and fever. Reliable records on deaths were lacking in the study area. Based on survey findings, deaths are often not recorded. Since death is a very significant event which is not likely to be forgotten easily, the health institutions in the community were advised to keep record of death (as much as possible) for proper documentations.

- **The Practice of Traditional Medicine**

The practice of traditional medicine is common in the study area. Traditional medicine involved the use of herbs and bodily charms. Body massaging and scarification to avert curses/spells and spiritual protection is common traditional medicine practice. Traditional medicine practitioners' shroud their activities and operations most of the time in secrecy. Also, they do engage in ante natal and midwifery activities for pregnant women who patronize them. A list of commonly used herbs and the diseases for which they are used is presented in Table 4.68.

Table 4. 68: Traditional names and use of local herbs in Tunama community

Leaf Group	Medicinal plant (local names)	Uses
1	Bitterleaf	Diabetes
2	Dogon Yaro	Malaria
3	Ewe madu Ubulu	Malaria Stomach ache
4	Idata Uchichi Okpubulu	Scabies Healing wounds Hernia
5	Igirya Epe	Diabetes Malaria
6	Ikite Enyi	Blood clot Stomach pains
7	Nsikala Uchichi	Stops bleeding Hernia
8	Ogbuchuru Ugbola	Healing wound Malaria
9	Uche,ubulu, Enyi	Malaria Hernia
10	Ukwoline Udo	Eye Hernia
11	Unuru, agala	Eye problems

Source: Fieldwork, 2020

- **Nutrition and Health**

Dietary pattern of the community consisted mainly of carbohydrates like yam/pounded, cocoyam, garri/cassava, rice and corn, which are eaten in various forms. Proteinous food such as beans, beef, bush meat, fish etc. are also consumed. Vitamins including fruits and vegetables are well consumed. Also oils such as vegetable and palm oil are used in the preparation of soups. The diet taken by a vast majority of the inhabitants of the project host communities can be said to be balanced.

4.7.3 Environmental Health

A cursory overview of the vicinity of the proposed project location shows a relatively clean environment. However, from study, the general sanitary status of the living environments in the communities were rated as poor, fair, or good based on a set of criteria in the checklist presented in Table 4.69. It is obvious from the table that the general condition of the environment is fair. It should be added that the people usually empty their waste directly into the water ways, improperly managed waste dumpsites, or even bury in some cases, while only a few burn their refuse when dried.

Table 4. 69: General assessment of sanitary condition in the study area

Sanitary Condition	Assessment (%)
Good	6
Fair	53
Poor	41

Source: Fieldwork, 2020

- **Sewage Disposal**

The most commonly used excreta disposal methods observed in the study area community the pit toilet and water closets. However, there are a few others who practice open defecation.

The refuse generated in the project study area include mainly kitchen wastes, which include food (such as yam bark, plantain peel) or remnants (garbage). The non-degradable wastes include plastics containers/bottles, glass plates/bottles, polythene bags, ashes, cans/tins etc. The commonest refuse disposal method was open dumping on land (Plate 4.39) which are mostly burnt when dried and the riverside approach. These disposal methods are adjudged unsanitary especially considering the fact that there is no system of waste collection and evacuation to government approved dumpsites where it will be properly managed.

Plate 4.39: A dump site in Tunama/Obunagha for solid wastes

- **Disease Vectors**

The common disease vectors in the communities include mosquitoes (anopheles and aedes), houseflies, cockroaches and rats. These vectors transmit disease causing micro-organisms from infected persons or organism to others and are partly responsible for ill-health in the study area.

4.7.4 Ecological/Health Risks Consequence of the Project

The major environmental problems and their presumed cause complained about during the FGDs in the study area include:

- Erosion mostly at waterside caused by heavy rainfall and waterlogged soil
- Gas flaring cause by SPDC, and
- Flooding due to heavy rainfall, relatively even terrain and waterlogged (muddy) soil.

As a result of these environmental problems, the people suggest increase in drainage systems to help channel surface run-off into the River Nun and its tributaries especially during rainfall.

Using the following key, viz: EH – Extremely High H – High M – Moderate L – Low, N – None, the result of the ecological risk assessment for the project area is as presented in Table 4.70.

Table 4. 70: Risk Assessment Matrix

	Risk Assessment Analysis				
	Probability				
Impacts	**Frequent**	**Likely**	**Occasional**	**Seldom**	**Unlikely**
Loss of organic rich soil		EH			
Loss of wildlife		EH			
Destruction of vegetation		H			
Noise	H				
Alteration of soil structure			M		
Extermination of soil microbial biomes			M		
Dust Emission			M		
Employment Opportunity		H			
Traffic congestion		M			
Road accident	L				
Water pollution				L	
Noxious fumes: equipment vehicular exhaust		H			
Heavy Metal Pollution		M			
Economic activities	H				
Land subsidence					L
Surface deformation				M	

Source: Fieldwork, 2020

4.8 Identification of Project Affected People (PAP) and Compliance to Resettlement Action Plan

The present scenario as witnessed by the socio economic team, FMEnv's officials and those of the State Ministry of Environment during the field visits shows that there are no settlements within the designated lubricating oil blending plant site boundary. Since the land was sold to Eraskon Nigeria Limited by the Tunama family, it is therefore, legally binding that the host community respect the contractual obligation since money has exchange hands. Hence there is no need for quantification of project affected people and therefore no need to harp on resettlement plans.

CHAPTER FIVE

ASSOCIATED AND POTENTIAL ENVIRONMENTAL IMPACTS

5.1 Methodology for Prediction of Potential Impacts

The construction and operation of a lubricant processing plant activities has the potential to create a range of impacts on the environment. These potential impacts can be both positive (beneficial) and negative (adverse) depending on the resources and receptors involved alongside with other parameters such as geographical scope (magnitude and extent), temporal scope (duration) and reversibility. It is anticipated that this project will have positive impacts on sectors such as the economy, employment and foreign exchange earnings among others. Moreover, the project is expected to result in negative impacts of short-term duration and transient in nature.

The objective of this chapter and the preceding one is to assess the likelihood of those social and environmental impacts as far as possible and to propose measures which will be incorporated in the project design, construction and operation, to, if not eliminate, at least mitigate these impacts to as low as reasonably practicable (ALARP) and to meet national Nigerian standards and regulations, international industry standards, and quality standards requirements.

5.2 Potential Impact Generation Activities

The construction and operation phase of the proposed project comprises various activities each of which may have an impact on environmental parameters. The impacts of the project are envisaged during the design and planning, during pre-construction phase, and construction phase.

During the construction phase, the following activities may have impacts on the environment:

- Site preparation;
- Excavation and leveling;
- Hauling of earth materials and wastes;
- Cutting and drilling;

- Erection of concrete and steel structures;
- Road construction;
- Painting and finishing;
- Clean-up operations;
- Landscaping and afforestation.

The activities can be divided into two categories, viz. sub-structural and super-structural work. Moreover, construction work will involve cutting of trenches, excavation, concreting etc. All these activities attribute to dust pollution. The super-structural work will involve steel work, concrete work, masonry work etc. and will involve operation of large construction equipment like cranes, concrete mixers, hoists, welding machines etc. There will be emission of dust and gases as well as noise pollution from these activities. Mechanical erection work involves extensive use of mechanical equipment for storage, transportation, erection and on-site fabrication work. These activities will generate some air contaminants and noise pollution. The electrical activities are less polluting in general.

5.3 Impact Assessment Overview

The potential for an environmental impact exists where an environmental aspect has been identified i.e. where a project activity has been determined to have the potential to interact with the bio-physical and socio-economic environment. The significance of each impact is then determined.

The methodology used for assessing the potential and associated impacts of the proposed project consists of five (5) major steps:

Step 1: Identification of the proposed project activities and their interaction (directly or indirectly) with the identified environmental receptors/resources in the Project area;

Step 2: Comprehensive preliminary identification of potential impacts as a result of cause and effect relationship;

Step 3: Comparative assessment of impact importance, identification of impacts that are likely to be significant through application of a basic set of impact significance criteria based on the preliminary information available about each impact;

Step 4: Detailed assessment of the identified focus area impacts characterization techniques, quantification of impacts to the extent possible and rigorous qualitative characterization of impacts that cannot be quantified; and

Step 5: Final assessment of the severity levels of impacts through application of the results of the quantitative and qualitative characterization of impacts developed.

Step 4 to a set of objective impact severity criteria; identification of impacts warranting mitigation.

In determining the significance of impacts, the factors considered included: magnitude of impacts (which is a function of the combination of the following impact characteristics: extent, duration, scale and frequency); value/sensitivity/fragility and importance of relevant environmental and social receptors; legal/regulatory requirements; and public perceptions (based on stakeholders' consultation).
The assessment of impact significance is qualitative and quantitative.

Qualitatively, the impact significance is ranked on the following accepted levels namely:

Major	4
Moderate	3
Minor	2
Negligible	1
Beneficial	+

These rankings are used for both bio-physical and socio-economic impacts. While for sensitivity of receptor, the following is used:

High	3
Medium	2
Low	1

The impact assessment undertaken for the proposed project covers the entire life cycle of the project i.e.:

- Pre-construction;
- Construction/Installation;
- Operation; and
- Decommissioning and Abandonment

5.4 Impact Prediction Methodology

Various impact prediction guidelines and methodologies have been developed and applied in various ESIA activities. Internationally acceptable methods of impact prediction and evaluation include the following:

- Checklist (Canter, 1977);
- Interaction Matrix (Leopold *et al.*, 1971);
- Overlays Mapping (Mc Harg, 1968);
- Networks; and
- Battelle Environmental Evaluation System (Dee *et al.*, 1972)

The Interaction Matrix method, when compared to the other approaches, provides the same level of details requires comparable knowledge of the environment and relies on limited data unlike the other methods that rely on availability of large historical data bank. It also has a wide range of application. Thus, a modified Leopold Interaction Matrix was selected for the purpose of impact screening for this ESIA.

5.4.1 Potential Impact Characteristics

The following characteristics were also used to define potential impacts that may be associated with the proposed project:

i) **Negative:** An impact that is considered to represent an adverse change from the baseline or to introduce a new undesirable factor.

ii) **Positive:** An impact that is considered to represent an improvement to the baseline or to introduce a new desirable factor.

iii) **Direct:** Impacts that result from the direct interaction between a planned project activity and the receiving environment.

iv) **Indirect:** Impacts that result from other activities that are encouraged to happen as a consequence of the project.

v) **Temporary:** Temporary impacts are predicted to be of short duration, reversible and intermittent/occasional in nature.

vi) **Short-term:** Short term impacts are predicted to last only for a limited period but will cease on completion of the activity, or as a result of mitigation measures and natural recovery.

vii) **Long-term:** Impacts that will continue for the life of the project, but cease when the project stops operating.

viii) **Permanent:** Potential impacts that may occur during the development of the Project and cause a permanent change in the affected receptor or resource that endures substantially beyond the project lifetime.

ix) **On-site:** These are limited to the project site.

x) **Local:** Impacts that affect locally important environmental resources or are restricted to a single (local) administrative area or a single community.

xi) **Regional:** Impacts that affect regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries.

xii) **National:** Impacts that affect nationally important environmental resources; affect an area that is nationally protected; or have macroeconomic consequences.

xiii) **Reversible:** An impact that the environment can return to its natural state.

xiv) **Irreversible:** An impact that the environment cannot return to its original state, e.g. the extinction of an animal or plant species.

xv) **Cumulative:** Potential impacts that may result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project.

xvi) **Residual:** Both environmental and social impacts that will remain after the application of mitigation measures to project impacts during each of the project phases (preconstruction, construction, operation, decommissioning/post-decommissioning).

5.4.2 Screening and Scoping for Potential Impacts

A modified version of the Leopold Interaction-matrix technique was employed to screen and scope for the potential impacts of the proposed project on the environment. The basis for the screening was derived from the following:

- Knowledge of the project activities as summarized in **Table 5.1.**
- Detailed information on the environmental and socio-economic setting of the study area/project's area of influence.
- Review of other EIA/ESIA reports on similar projects/environments.
- Series of experts group discussions, meetings and experience on similar projects.

Table 5.1: Summary of the proposed project activities

S/No.	Project Phase	Associated Project Activities
1.	Pre-Construction	Land acquisition
		Site clearing and leveling (cutting, stripping, excavation, earth movement, compaction)
		Transportation and storage of construction material/ equipment
2.	Construction	Civil construction activities
		Influx of labour and construction of temporary houses
		Transportation and disposal of construction debris
3.	Operation	Transportation and haulage
		Base oil feedstock processing
		Lubricant production operation
		Solid and liquid waste generation and disposal/recycling
4.	Decommissioning	Dismantling of plants and equipment
		Rehabilitation of disturbed land
		Waste generation and disposal

The Leopold Interaction Matrix developed for the proposed project is presented in **Tables 5.2 and 5.3.** The Interaction Matrix was developed by placing the proposed project activities in the rows and the identified existing environmental and socio-economic components in the columns. The interaction was then established.

Table 5.2: Activity-Receptor Interaction for Impact Screening

Summary of Project Activities at Phases	Receptors																
	Physical						Biological		Socio-economic						Others (Health & Safety		
	Air Quality	Ambient Noise	Soil	Ground Water	Hydrological System	Landscape/ Topography	Terrestrial Flora	Terrestrial Fauna	Land use	Population	Utilities	Infrastructure	Employment/ Income	Visual Prominence	Construction workers	Workplace & health	General Public
Pre-construction																	
Land acquisition									x				x				
Site clearing and leveling (cutting, stripping, excavation, earth movement, compaction)	X	X	x	X	X	x	x	x		x			x	x			
Transportation and storage of construction material/equipment	X	X	x									x	x				
Construction																	
Civil construction activities	X	x	x	X	X		x	x		x	x	x	x	x	x		
Influx of labour and construction of temporary houses	X	x	x	X	X	x	x	x		x	x	x	x		x		
Transportation and disposal of construction debris	X	x	x	X			x	x	x			x	x		x		x
Operation																	
Transportation and haulage	X	x										x	x			x	x
Base oil feedstock processing	X	x	x	x	X		x	x	x		x	x	x	x		x	x
lubricant production operation	X	x	x	x			x	x	x	x	x	x	x	x		x	x
Solid and liquid waste generation and disposal/recycling	X	x	x	x	X		x	x	x							x	x
Decommissioning																	
Dismantling of plants and equipment	X	x	x		X				x		x	x	x	x			
Rehabilitation of disturbed land	X	x	x	x	X		x	x	x		x						x
Waste generation and disposal	X	x	x	x			x	x	x			x					x

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Table 5.3: Leopold's activity-receptor interaction matrix

Summary of Project Activities at Phases	Receptors																
	Physical						Biological		Socio-economic						Others (Health & Safety		
	Air Quality	Ambient Noise	Soil	Ground Water	Hydrological System	Landscape/ Topography	Terrestrial Flora	Terrestrial Fauna	Land use	Population	Utilities	Infrastructure	Employment/ Income	Visual Prominence	Construction workers	Workplace health & safety	General Public
Pre-construction																	
Land acquisition									1(2)				+				
Site clearing and Leveling (cutting, stripping, excavation, earth movement, compaction)	2(1)	2(1)	4(2)	1(1)	3(2)	3(2)	4(2)	3(1)		2(2)			+	3(2)			
Transportation and Storage of Construction Material/ Equipment	2(1)	2(1)	2(1)									2(2)	+				
Construction																	
Civil Construction Activities	3(1)	2(3)	4(1)	2(2)	2(2)		3(2)	3(2)		3(2)	1(2)	1(2)	++	2(2)	2(3)		
Influx of Labour and construction of temporary houses	2(1)	2(2)	4(1)	2(2)	2(2)	2(1)	2(1)	2(1)		2(2)	2(1)	2(1)	++		1(2)		
Transportation and Disposal of Construction Debris	2(1)	2(1)	2(1)	2(1)			2(1)	2(1)	2(1)			2(1)	+		2(2)		2(1)
Operation																	
Transportation and haulage	2(1)	2(1)										2(1)	+			3(2)	2(1)
Base oil feedstock processing	4(3)	3(2)	2(3)	2(3)	2(3)		4(3)	4(3)	2(2)		2(1)	2(1)	++	3(2)		4(3)	3(2)
Lubricant production operation	4(3)	3(2)	2(3)	2(3)			4(3)	4(3)	2(2)	4(3)	2(3)	2(1)	++	3(2)		4(3)	3(2)
Solid and liquid waste generation and disposal/recycling	4(3)	3(2)	2(1)	2(2)	2(2)		2(3)	2(3)	2(3)							2(2)	2(2)
Decommissioning																	
Dismantling of plants and equipment	2(1)	2(1)	3(2)		3(2)				2(2)		2(2)	2(1)	+	2(3)			
Rehabilitation of disturbed land	2(3)	2(3)	2(2)	2(2)	2(2)		2(2)	2(2)	2(2)		2(1)						2(2)
Waste generation and disposal	2(3)	2(3)	2(1)	2(2)			2(2)	2(2)	2(2)			2(1)					2(2)

***x(y) = impact magnitude (sensitivity of receptor**

Table 5.4 presents the resources/receptors considered together with the changes that might indicate a project-related impact.

Table 5.4: Resource/receptor and impacts Indicators considered

Environmental Receptor	Comment	Potential Impact Indicators
Physical		
Soil	The soil environment of the project site and its surroundings	Changes in physical, chemical and biological properties, loss of soil ecology and fertility, compaction, erosion etc.
Hydrology	Water flow pattern along the ground surface in the project area.	Increased intensity and volume of storm water runoff; increased sediment load in the drainage channels as a result of erosion; and reduced water quality.
Groundwater/Aquifers	The groundwater resources and aquifers of area within the area of influence of the proposed project.	Groundwater level, changes in physical, chemical and biological properties, contamination.
Landscape/Topography	The geomorphological land forms and terrain of the project area.	Alteration in drainage pattern, changes in landscape.
Ambient Noise	Ambient noise level in the project site and its surrounding environment.	Increased ambient noise level, night and day-time disturbance, hearing loss, communication impairment etc.
Air Quality	Air quality in and around the proposed Project site.	Increased concentrations of gaseous and particulate pollutants (such as NO_x, SO_x, CO, particulate in form of dust).
Biological		
Terrestrial Flora	Terrestrial plant species that occur within the project site and its immediate surroundings.	Loss of terrestrial flora, introduction of new species.
Terrestrial Fauna	Terrestrial fauna rely on the Project site as a habitat and/or food source	Loss of terrestrial fauna; involuntary migration.
Socio-economic Environment		
Land Use	Existing land use of the Project site	Loss of land value for grazing
Population	Existing demography of	Increased in local population

Environmental Receptor	Comment	Potential Impact Indicators
	the communities in the study area	due to influx of workers
Utilities	The utilities (e.g. lubricant blending supply, water, sewerage services, etc.) of the project area	Changes in existing utilities, pressure on public utilities.
Infrastructure	Infrastructure such as roads, waste handling facilities in the Project area.	Access to road, access to waste management facilities, access to emergency services Employment
Employment	The employment situation in the project area and beyond.	Opportunities for local and national employment; changes in income level
Visual Prominence	The view of the Project site and its surroundings	Landscape alterations resulting in unpleasant changes in the visual character of the area
Other (Health and Safety)		
Construction workers	The health and safety of workers involved in the construction phase of the proposed project	Accidents, injury, fatality, exposure to nuisance (dust, noise), fire, spread of sexually transmitted diseases such as HIV (Human Immunodeficiency Virus)
Workplace Health and Safety	The health and safety of employees involved with the operations phase of the Project.	Accidents, injury, exposure to radiation (Electromagnetic Field), explosion, ergonomics.
General Public	The health and safety of general public including people residing or working in the Project's area of influence.	Exposure to radiation (Electromagnetic Field), accident, fire, explosion, etc.

5.4.3 Determination of Impact Significance

Once all environmental aspects were identified, the levels of impacts that may result from the proposed Project activities were assessed. Three (3) stages were utilized to establish significance of impacts as follows:

- **Impact Magnitude** which is a function of the combination of the following impact characteristics: extent, duration, scale and frequency;
- **Value/Sensitivity/Fragility and importance of the identified receptor or resources;**

- **Identification of the impact significance**, which is the "product" of a combination of the above two key variables.

The magnitude of an effect is often quantifiable in terms of, for example, the extent of land take, or predicted change in noise levels while the sensitivity, importance or value of the affected resource or receptor is derived from:
- Legislative controls;
- Designated status within the land use planning system;
- The number of individual receptors, such as residents;
- An empirical assessment based on characteristics such as rarity or condition; and
- The ability of the resource or receptor to absorb change.

The determination of significance also includes consideration of performance against environmental quality standards or other relevant pollution control thresholds; and compatibility with environmental policies.

All through the impact prediction and evaluation process, expert discussions were constituted and employed extensive use of matrices and predefined criteria in predicting environmental impacts, determining their magnitude, and impact significance. To minimize subjectivity, independent scores were thereafter statistically analyzed and the results of the scores judged as follows:
- If variance, s2 < 5% of the mean, subjectivity is minimal and the score is good; and
- If s2 > 5% but < 10% of the mean, the score is fair and scorers were given the opportunity to review their scores.
-

5.4.3.1 Impact Magnitude

Magnitude is in practice a continuum, and evaluation along the spectrum requires the exercise of professional judgment and experience. Each impact is evaluated on a case-by-case basis, and the rationale for each determination is noted. The magnitude designations employed for potential negative impacts, are:
- Negligible,
- Low,
- Medium and

- High.

In the case of a positive impact, it is considered sufficient for the purpose of the impact assessment to indicate that the Project is expected to result in a positive impact, thus no magnitude designation has been assigned.

The magnitude of an impact takes into account the various dimensions of a particular impact in order to make a determination as to where the impact falls on the spectrum from negligible to high. These criteria are discussed further in the sub-sections below.

1. Determining Magnitude for Bio-physical Impacts

For bio-physical impacts, the quantitative definitions for the spatial and temporal dimension of the magnitude of impacts used in this assessment are provided in Table 5.5 and summarized in the following paragraphs:

A **High Magnitude Impact** affects an entire area, system (physical), aspect, population or species (biological) and at sufficient magnitude to cause a significant measureable numerical increase in measured concentrations or levels (to be compared with national or international limits and standards specific to the receptors) or a decline in abundance and/or change in distribution beyond which natural recruitment (reproduction, immigration from unaffected areas) would not return that population or species, or any population or species dependent upon it, to its former level within several generations.
A high magnitude impact may also adversely affect the integrity of a site, habitat or ecosystem.

A **Medium Magnitude Impact** affects a portion of an area, system, aspect (physical), population or species (biological) and at sufficient magnitude to cause a measurable numerical increase in measured concentrations or levels (to be compared with national or international limits and standards specific to the receptors) and may bring about a change in abundance and/or distribution over one or more plant/animal generations, but does not threaten the integrity of that population or any population dependent on it.

A medium magnitude impact may also affect the ecological functioning of a site, habitat or ecosystem but without adversely affecting its overall integrity. The area affected may be local or regional.

A **Low Magnitude Impact** affects a specific area, system, aspect (physical), group of localized individuals within a population (biological) and at sufficient magnitude to result in a small increase in measured concentrations or levels (to be compared with national or international limits and standards specific to the receptors) over a short time period (one plant/animal generation or less, but does not affect other trophic levels or the population itself), and localized area.

A **Very Low/Negligible Magnitude Impact**: Some impacts will result in changes to the environment that may be immeasurable, undetectable or within the range of normal natural variation. Such changes can be regarded as essentially having no impact, and are characterized as having a very low or negligible magnitude.

A number of considerations have been built into these Impact Magnitude Criteria including temporal, spatial, impact reversibility, direct and indirect impacts and relevant legal or policy constraints

Table 5.5: Impact Magnitude Criteria for Bio-physical Impacts

Category	Ranking	Definition
High	4	• Regional to national scale impact resulting in: o Medium term change and/or damage to the natural environment and its ecological processes. o Reduction in regional habitat and species diversity. o Direct loss of habitat for endemic, rare and endangered species of fauna and/or flora and for species' continued persistence and viability

Category	Ranking	Definition
		nationally and regionally (for species unable to disperse). • Breach of environmental regulations and company policy and/or 100%-200% exceedance of international, national, industry and/or operator standard for an emission parameter.
Medium	3	• Local to regional scale impact resulting in: o Short term change and/or damage to the natural environment and its ecological processes. o Direct loss of habitat crucial for species' (including listed species) continued persistence and viability in the project area (for species unable to disperse). o Introduction of exotic species of fauna in invasive floral species replacing resident 'natural communities' within the project area. o Environmental stress lowering reproductive rates of species within the project area. • Potential breach of environmental regulations and company policy and/or 50%-100% exceedance of international, national, industry and/or operator standard for an emission parameter. • Complaints from the public, authorities and possible local media attention.
Low	2	• Local scale impact resulting in: o Short term change and/or damage to the local natural environment and its ecological processes. o Short-term decrease in species diversity in selected biotopes/areas within the project area.

Category	Ranking	Definition
		o Increased mortality of fauna species due to direct impact from project activities. • 10%-50% exceedance of international, national, industry and/or operator standard for an emission parameter. • Public perception/concern.
Negligible	1	• Impact largely not discernible on a local scale being absorbed by the natural environment; areas adjacent to disturbed areas absorb exodus of species able to disperse. • Up to 10% exceedance of international, national, industry and/or operator standard for an emission parameter. • Public perception/concern.
Beneficial	+	• Activity has net positive and beneficial effect resulting in environmental improvement for example: • Positive feedback from stakeholders. • Potential financial gains.

2. Determining Magnitude for Socio-economic Impacts

For socio-economic impacts, the magnitude considers the perspective of those affected by taking into account the likely perceived importance of the impact, the ability of people to manage and adapt to change and the extent to which a human receptor gains or loses access to, or control over socio-economic resources resulting in a positive or negative effect on their well-being. The quantitative elements are included into the assessment through the designation and consideration of scale and extent of the impact. Table 5.6 presents the impact magnitude criteria for socio-economic impacts.

Table 5.6: Impact Magnitude Criteria for Socio-economic Environmental Impacts

Category	Ranking	Definition
High	4	• Major impacts on human health (e.g. serious injury). • Significant impact on the livelihoods of individuals (i.e. access to income source restricted over lengthy period of time). • Serious impact on access to community facilities and utilities. • Breach of economy social policy and/or regulation.
Medium	3	• Modest impact on human health and well-being (e.g. noise, light, odour, dust, injuries to individuals). • Medium impact on access to community facilities and utilities (e.g. access to utilities restricted for long periods (weeks) of time). • Moderate impact on the wider economy, at a local, regional and/or national scale (e.g. only moderate levels of employment and supplies sources within Nigeria). • Potential breach of company social policy and/or legislation.
Low	2	• Limited impact on human health and well-being (e.g. occasional dust, odour, traffic noise). • Some impact on access to community facilities and utilities (e.g. access to cultural centers restricted to a limited extent, i.e. (days).
Negligible	1	• Possible nuisance to human health and well-being (e.g. occasional unpleasant odour) • Inconvenience experienced in accessing community facilities and utilities (e.g. electricity supply disruption for short (hours) period of time).

		• No impact on livelihood, community facilities and human health.
Positive	+	• Beneficial improvement to human health. • Benefits to individual livelihoods (e.g. additional employment opportunities). • Improvements to community facilities/utilities. • Increased economy (e.g. local procurement, sourcing of supplies).

5.4.3.2 Determining Receptor Sensitivity

In addition to characterizing the magnitude of impact, the other principal variable necessary to assign significance for a given impact is the value, and sensitivity/fragility of the receptor. This refers to economic, social, and/or environmental/ecological importance of the receptor, including reliance on the receptor by people for sustenance, livelihood, or economic activity, and to the importance of direct impacts to persons associated with the resources.

Impacts that directly affect people or vital natural resources are deemed to be more important than impacts that indirectly affect people or vital resources. The sensitivity of the receptor criterion also refers to potential impacts to Environmentally Sensitive Areas (ESAs) and impacts to species, including loss of endangered species, effects of introduction of invasive species, and similar environmental / ecological impacts.

There are a range of factors to be taken into account when defining the sensitivity of the receptor, which may be physical, biological, cultural or human. Where the receptor is physical (for example, soil environment) its current quality, sensitivity to change, and importance (on a local, national and international scale) are considered. Where the receptor is biological (for example, the aquatic environment), its importance (for example, its local, regional, national or international importance) and its sensitivity to the specific type of impact are considered. Where the receptor is human, the vulnerability of the individual, community or wider societal group is considered.

The receptors-sensitivity designations employed in this impact assessment process are low, medium and high which are universally acceptable.

The sensitivity/fragility/value criteria for physical, biological and socio-economic receptors are defined in Table 5.7.

Table 5.7: Physical, Biological and Socio-economic Receptor Sensitivity/ Fragility/ Value Criteria

Category	Ranking	Definition
Physical (for example, air quality)		
High	3	All ambient conditions/concentrations exceed guideline limits and are indicative of the resource being impacted or polluted. There is no (or very little) assimilation capacity for increased concentrations/ change in conditions.
Medium	2	Some ambient conditions/concentrations exceed guideline limits while others fall within the limits. There is some small assimilation capacity for increased concentrations/ change in conditions. Resource use does affect other users
Low	1	All ambient conditions/concentrations are significantly lower than guideline limits and there is capacity for assimilation for additional concentrations/ change in conditions. Resource use does not significantly affect other users.
Biological (for example, terrestrial ecology)		
High	3	Specifically protected under Nigerian legislation and/or international conventions; listed as rare, threatened or endangered e.g. IUCN.
Medium	2	Not protected or listed but may be a species common globally but rare in Nigeria with little resilience to ecosystem changes, important to ecosystem functions, or one under threat or population decline.

Low	1	Not protected or listed as common / abundant; or not critical to other ecosystem functions.
Socio-economic and health		
High	3	Those affected will not be able to adapt to changes and continue to maintain pre-impact status.
Medium	2	Able to adapt with some difficulty and maintain pre-impact status but only with a degree of support.
Low	1	Those affected are able to adapt with relative ease and maintain pre-impact status.

5.4.3.3 Significance

The significance of the impact is determined by calculating the "product" of impact magnitude and severity/fragility of the relevant receptor(s). Figure 5.2 illustrates the process for combining the impact magnitude with the receptor sensitivity.

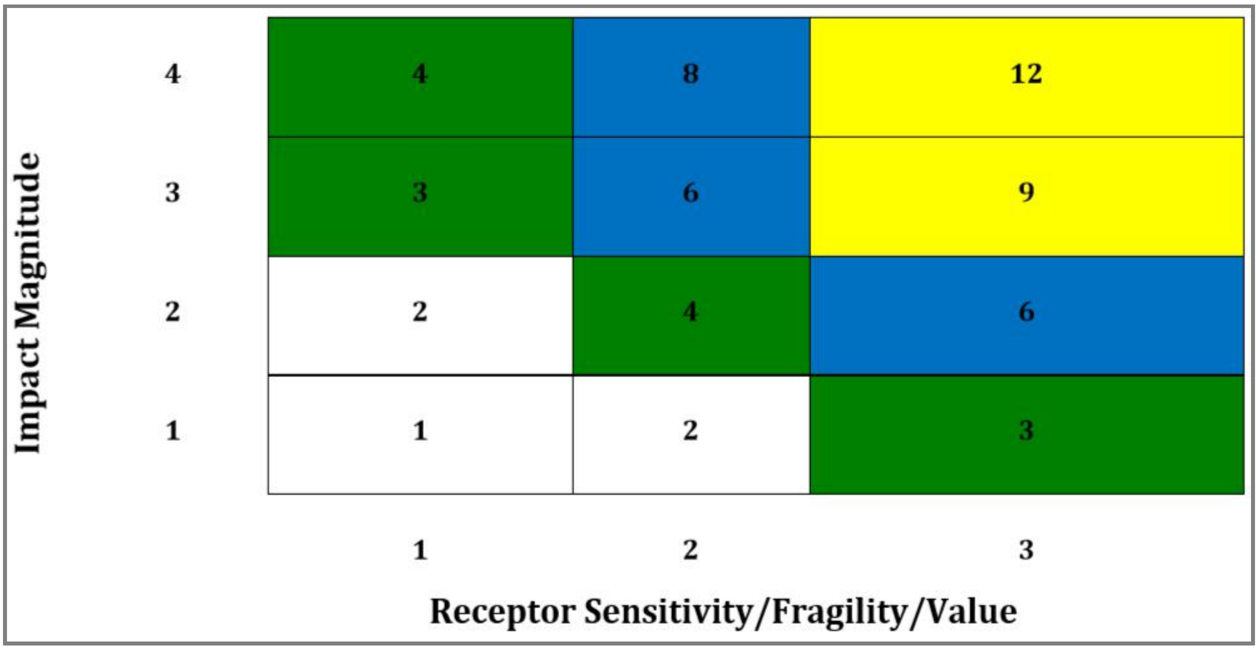

Figure 5.1: Impact Magnitude-Receptor Sensitivity Product Results

Based on its impact magnitude-receptor sensitivity/fragility/value score, each impact was again ranked into four (4) categories or orders of significance as illustrated in Table 5.8.

Table 5.8: Environmental Impact Significance Ranking

Ranking (Impact Magnitude x Sensitivity of Receptor)	Significance
9-12	Major
6-8	Moderate
3-5	Minor
1-2	Negligible

Negligible impacts are where a resource or receptor (including people) will not be affected in any way by a particular activity or the predicted effect is deemed to be 'negligible' or 'imperceptible' or is indistinguishable from natural background variations.

An impact of minor significance is one where an effect will be experienced, but the impact severity is sufficiently low (with or without mitigation) and well within accepted standards, and/or the receptor is of low sensitivity/value.

An impact of moderate significance is one within accepted limits and standards. Moderate impacts may cover a broad range, from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is ALARP (As Low as Reasonably Practicable).

An impact of major significant is one where an accepted limit or standards may be exceeded, or high magnitude impact occurs to highly valued/sensitive receptors/resources.

5.5 Environmental and Social Impacts associated with the Lubricating oil blending plant

5.5.1 Environmental and Social Impacts during Pre-Construction Phase

The potential adverse/beneficial environmental and social impacts of this proposed project during pre-construction stage are aptly captured in Table 5.9. In Table 5.10, the major preconstruction activities vis-à-vis impact receptors are highlighted.

Table 5.9: Identification of activities & impact receptors (pre-construction phase)

S/No.	Pre-construction Activities	Receptors
1.	Land acquisition	Land
		Socio-economics
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 infrastructure

Table 5.10: Identified environmental and social impacts with impact significance during pre-construction phase

Receptors	Identified impacts	Impact Significance
Biophysical Impacts		
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 Utilities	Increased flow of traffic.	Minor (-ve)
Economic Impacts	Generation of direct, indirect and induced employment and income	Moderate (+ve)

5.5.2 Environmental and Social Impacts during Construction Phase

The environmental and social 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 5.11 and Table 5.12.

Table 5.11: Identification of activities & impact receptors (construction phase)

S/No.	Construction Activities	Receptors
1.	Civil construction activities	Air quality
		Ambient Noise
		Soil/land capability & landuse
		Water resources
		Ecology & biodiversity
		Terrestrial fauna
		Terrestrial flora
		Socio-economics
		Health & Safety
2.	Influx of labour	Ambient Air
		Noise Level
		Soil/land capability & landuse
		Water Resources
		Terrestrial fauna
		Terrestrial flora
		Socio-economics
		Construction workers
3.	Transportation and disposal of construction debris	Ambient Air quality
		Land/ Soil
		Water quality
		Traffic
		Health, safety

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Table 5.12: Identified environmental and social impacts with impact significance during construction

Receptors	Identified impacts	Impact Significance
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 (SO_2, NO_x, 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 Tunama (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 aquatic 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	Increase in dust particle due to vehicular movement.	
	Impact of construction related traffic on traffic flow in Tunama community, Bayelsa state.	Moderate (-ve)
	Impact of construction related traffic on utilization capacity on the Bayelsa road	Moderate (-ve)

Receptors	Identified impacts	Impact Significance
	Safety impacts on local communities and other road users due to increased road accident rates during construction	Moderate (-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.	Major (+ve)
	Increased pressure on healthcare infrastructure due to project related influx	Moderate (-ve)
	Increased risk of accidents and injuries to communities from improved roads and additional traffic	Moderate (-ve)
Economic impacts	Local and regional benefits resulting from increased revenue to Government	Major (+ve)
	Stimulation of increased regional investment in the Nigerian economy	Moderate (+ve)
	Generation of direct, indirect and induced employment and income	Major (+ve)
Ecosystem services	Reduced availability of natural resources and ecosystem services to local communities	Moderate (-ve)

5.5.3 Environmental and Social Impact during Operation Phase

Various activities of the operation phase and their probable impacts on various environmental and social aspects are presented in Table 5.13 and Table 5.14.

Table 5.13: Identification of Activities and Probable Impacts (Operation Phase)

S/No.	Operation Activities	Receptors
1.	Transportation and haulage	Air Quality
		Ambient Noise
		Public Utilities
		Traffic
		Water
		Health, Safety
2.	Base oil feedstock processing	Air Quality
		Ambient Noise
		Soil, Landuse capability & Landuse
		Ecosystem Services
		Economic Impacts
		Health, safety
3	Lubricant Production operation (Production line)	Air Quality
		Ambient Noise Level
		Soil, Landuse
		Water
		Terrestrial Fauna
		Terrestrial Flora
		Socio-economics
		Health & Safety

Table 5.14: Identified environmental and social impacts with impact significance during operation

Receptors	Identified impacts	Impact Significance
Biophysical Impacts		
Air Quality	Hazardous emissions such as H_2S 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 SO_2, 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 SO_2, NO_x and CO from activities 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.	Moderate (-ve)

Receptors	Identified impacts	Impact Significance
	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.	Major (-ve)
	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.	Moderate (-ve)
	Seepage from waste affecting surface and groundwater quality.	Moderate (-ve)
Traffic	Impact on utilization capacity on the Tunama-Obunagha road affecting other road users	Moderate (-ve)
	Increased road accident rates and road safety of other road users especially considering the high volume of trucks required in conveying lubricant products.	Major (-ve)
Socio-economic impacts		
Economic Impacts	Source of employment especially for indigenes of the project host community.	Major (-ve)
	Serve as a basis for technological advancement.	Major (-ve)
Ecosystem Services	Reduced availability of natural resources and ecosystem services to local communities due to use by the project and impacts on these resources.	Minor (-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.	Major (-ve)

Receptors	Identified impacts	Impact Significance
	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.	Major (-ve)
	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.	Major (-ve)

5.5.4 Environmental and Social Impacts during Decommissioning Phase

Once the facility reaches the end of its lifespan, the production equipment may be refurbished, replaced or upgraded to a newer technology to continue operation or the facility could be closed and decommissioned. If decommissioned, all components and equipment would be removed and the site rehabilitated, returning to its current land use or better. The decommissioning and restoration of the site will involve many activities that may have some environmental and social impacts as highlighted in the Table 5.15 and Table 5.16.

Table 5.15: 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	Air Quality
		Water Resources
		Ecology & Biodiversity
		Soils, Land capability & Landuse
		Health & safety
3	Waste Generation and Disposal	Air Quality
		Terrestrial flora
		Terrestrial fauna
		Water Resources
		Health & Safety
		General public

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Table 5.16: Identified environmental and social impacts with impact 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)
	Introduction of alien invasive flora and fauna.	Moderate (-ve)
	Increased hunting/poaching of wildlife and loss of habitats for crop production.	Moderate (-ve)
Social and economic	Loss of jobs.	Major (-ve)
	Falter of many small enterprises.	Major (-ve)
Water resources	Chemical contamination of surface water resulting from accidental spills during transportation and handling, and seepage from waste.	Minor (-ve)
	Sedimentation of surface water resulting from erosion and runoff from exposed surfaces and roads.	Minor (-ve)
	Contamination of groundwater resulting from seepage from hazardous materials and waste	Minor (-ve)
Soils, land capacity &	Demolition of project infrastructure, resulting to increase in soil contamination.	Moderate (-ve)
Air quality	Increase in Particulate Matter (PM) emissions resulting from land clearing, earthworks, and vehicular movement.	Minor (-ve)
Visual	Dust generation and site disturbance due to earth moving and removal of project infrastructure, affecting the visual character for communities	Moderate (-ve)
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)

5.6 Cumulative Impacts Arising from the Proposed Project

Cumulative impacts are those impacts resulting from the combined effects of past, present or reasonably foreseeable actions 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.

Table 5.17: Cumulative impact of the Eraskon Nigeria Limited proposed lubricating oil blending plant

Receptors	Identified impacts	Impact Significance
Air quality	From the results of the air emission dispersion modelling (See Appendix Fourteen), the cumulative impact of the proposed development on the environment will be as: • Daily NO_X increases by 26 folds of the limit; • Daily SO_2 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 SPDC -Obunagha road and little pockets of lumbering activities around the site.	Moderate (-ve)
Water Resources	Two (2) 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 (Tunama-Obunagha), 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 current population estimate of Tunama community is 300, while Obunagha is 700, Koroama 650, Polaku 800 and Okolobiri 750. The operation stage of this project will bring in an additional 40 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)

5.7 Risk and Hazard Assessment

5.7.1 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 5.18: Risk Assessment Matrix

0-5 = Low Risk		**Severity of the potential injury/damage**				
6-10 = Moderate Risk **11-15 = High Risk** **16-25 = Extremely High (Unacceptable Risk)**		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
Likelihood of the Hazard Happening	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**

5.7.2 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 downtime 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 militancy group conflict common in the Niger Delta southern part of the country is a factor that calls for concern, 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.

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CHAPTER SIX

MITIGATION MEASURES/ALTERNATIVES

6.1 Introduction

This chapter identifies and defines socially, environmentally and technically acceptable and cost effective mitigation measures and enhancement oil measures to the impacts presented in Chapter 5. Generally, the acceptability and/or suitability of a particular project is premised on several considerations, not the least of which is the reduction of adverse environmental and social impacts to tolerable levels. Impact significance reduction is usually achieved by introducing mitigation/amelioration measures to cater for the adverse impacts identified.

In this section of the report, we present a summary of those measures that are deemed adequate to achieve this objective. Also, in this chapter no mitigation measures are provided for positive impacts as they are desirable.

6.2 Basis for Development of Mitigation Measures

Mitigation measures are options that can be used to either completely eliminate or minimize identified adverse impacts of a development project to levels that can be acceptable. The traditional approach to the design and operation of facilities such as that for which this ESIA has been prepared, is to ensure compliance with the applicable safety codes and standards during design. However, compliance with regulations, codes and standards may not be sufficient to achieve an appropriate level of Health Safety and Environmental (HSE) performance in design. Design codes are generic and applicable to facilities in a number of geographical areas that face a wide range of technical challenges unique to the project. The design of the proposed project will be based on the strictest of international codes and best-practices.

The HSE objective, with respect to the design and construction plan for the proposed lubricating oil blending plant project is to implement all cost effective measures to reduce the risk and effects from major hazards, including accidents. The approach has been to use this as a goal rather than a prescriptive objective that cannot be achieved without following a documented process of identification, assessment, reduction and continuous monitoring.

Thus the steps to be taken in the HSE process for the project shall include the following:

- Design based on codes, standards and regulations;
- Improved design based on quantitative risk assessment and environmental impact assessment; and
- Improved design from human factors evaluation.

6.3 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.
- Eraskon Nigeria Limited 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 for 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.

6.4 Mitigation Measures

Table 6.1 highlights the mitigation measures for the predicted potential and associated impacts for the different phases of the project lifespan.

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 Impact)
Pre-Construction				
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)	• Storing all potential sources 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 and effective stockpiling management.	Minor (-ve)
Ecology	Loss of vegetation/habitat	Moderate (-ve)	• Access roads to the site for preliminary studies shall be made in a way that sensitive ecosystems are avoided.	Minor (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
			• A programme for the control of alien invasive plants in the concession shall be developed and implemented. • No fauna shall be hunted or destroyed by any project personnel. Severe penalty shall be meted to defaulting staff. • Cutting vegetation (weed) shall be left to decompose and given to farmers as manure.	
Public Utilities	Increased flow of traffic	Minor (-ve)	• Prohibit parking of trucks along the Tunama-Obunagha 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. • There shall be the use of	Minor (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
			directional lighting in areas operating at night, if communities are affected by lighting.	
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 the 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 the 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	Minor (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
			liquid, Collect and contain the clean-up residue, Dispose the waste and Decontaminate the area affected and the equipment.	
	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	Minor (-ve)	• Speed limits shall be set to minimize the generation of fugitive dust • Vehicles carrying dusty materials shall be covered to prevent materials being blown from off the vehicles. • There shall be the application of dust suppressants (water sprinkling) to sections of roads used routinely by vehicles that pass through and close to communities.	Negligible
	Increase in gas (SO_2, NOx, CO and VOCs) emissions resulting from vehicle exhaust emission	Minor (-ve)	• Vehicle idling shall be limited and vehicles well maintained to minimize particulate and gaseous emissions.	Minor (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
	and biomass burning.		• As much as possible, biomass burning shall be discouraged. • Enlightenment campaigns against bush burning as farming practice. • Teaching them better 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	
Water resources	Chemical contamination of surface water resulting from accidental spills during transportation and handling, and seepage from waste.	Minor (-ve)	• There shall be the 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 the use oil & silt traps to remove these types of contaminants from storm water, and the use designated areas for equipment servicing.	Minor (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
			• Monitoring discharge water quality to ensure it is compliant with the necessary guidelines shall be implemented. • Where contaminants are transported along roads, emergency contaminant and mitigation measures shall be developed to minimize impacts should accidental spillages occur along the transport routes.	
	Sedimentation of surface water resulting from erosion and runoff from exposed surfaces and roads.	Moderate (-ve)	• There shall be the construction of access roads and infrastructure in a way that sensitive ecosystems are avoided. • Proper designs shall be prepared and implemented to manage storm water runoff in a manner that minimizes sediment transport to the receiving water resource and minimizes erosion along runoff channels. • There shall be the construction of concave surfaces to ensure run-off is directed. • Effective storm water management shall be developed	Negligible (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
			for all project components to address storm water run-off volumes, velocity, water quality to minimize impacts on natural areas, focusing on minimizing increased sedimentation.	
	Contamination of groundwater resulting from seepage from sewage and other waste.	Minor (-ve)	• There shall be an effective waste collection mechanism including proper waste sorting, storage and disposal at approved dumpsites. • Properly constructed toilets with septic tanks shall be made available for construction staff to take care of sewage and minimise seepage.	Negligible (-ve)
Noise level	Continuous noise impact on Tunama and other neighbouring communities resulting from night-time. construction works.	Minor (-ve)	• There shall be the restriction of construction activities at the facility to daytime hours 07:00 am to 07:00 pm. • Noise screening measures shall be implemented	Minor (-ve)
Ecology & Biodiversity	Loss of forest habitat due to site clearing and earthmoving activities	Moderate (-ve)	• A rehabilitation plan shall be developed and implemented (overseen by an appropriately qualified botanist/ ecologist), with different objectives and rehabilitation approaches	Minor (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
			established for each habitat/ecosystem.	
	Loss of aquatic habitat due to site clearing and earthmoving activities.	Moderate (-ve)	• Aquatic habitats and areas immediately adjacent to them that have been degraded during the construction phase shall be restored (through reconstruction of antecedent physical condition, chemical adjustment of soil and water, reintroduction of absent native flora and fauna) to their pre-construction condition.	Minor (-ve)
	Loss or disturbance of species of special concern due to site clearing and construction activities.	Moderate (-ve)	• Site clearing shall be limited to the area acquired for the project. Adjacent land shall not be encroached upon.	Minor (-ve)
	Loss or degradation of ecological processes due to site clearing and construction activities.	Moderate (-ve)	• Site clearing shall be limited to the area acquired for the project. Adjacent land shall not be encroached upon.	Minor (-ve)
	Fragmentation of habitats and ecological processes due to positioning of project infrastructure.	Moderate (-ve)	• Aquatic habitats and areas immediately adjacent to them that have been degraded during the construction phase shall be restored to their pre-construction condition.	Minor (-ve)
	Modification or	Moderate (-ve)	• A programme for the control of	Minor (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
	degradation of aquatic habitats due to altered hydrological regimes and surface or groundwater quality.		alien invasive plants in the concession shall be developed and implemented as a component of the Biodiversity Action Plan.	
	Introduction of alien invasive plants due to site clearing and disturbance of vegetation.	Moderate (-ve)	• Application of dust suppressants (water sprinkling) to mitigate fugitive dust generation.	Minor (-ve)
	Impeded photosynthesis and transpiration rate of plants due to dust generation	Minor (-ve)	• Site clearing shall be limited to the area acquired for the project. Adjacent land shall not be encroached upon.	Negligible (-ve)
Traffic	Impact of construction related traffic on utilization capacity on Tunama-Obunagha highway.	Moderate (-ve)	• Prohibit trucks from parking along the Tunama-Obunagha road. • 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.	Minor (-ve)
	Impact of construction related traffic on traffic flow in Tunama.	Moderate (-ve)	• Provision of temporary on-site accommodation for construction personnel to limit the volumes of daily commuter traffic to the	Minor (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
			project site shall be implemented. • Provision of dedicated buses for construction personnel not accommodated on the site to reduce daily commuter traffic to the project site shall be put in place • There shall be the scheduling of delivery of materials outside peak traffic times • Project proponent shall specify maximum loads for the transportation of equipment to site (size and weight) • Rest area for drivers shall be implemented, and maximum driving hours per driver established and enforced.	
	Safety impacts on local communities and other road users due to increased road accident rates during construction	Moderate (-ve)	• There shall be the provision of temporary on-site accommodation for construction personnel to limit the volumes of daily commuter traffic to the project site. • There shall be the provision of dedicated buses for construction personnel not accommodated on the site to reduce daily commuter traffic to the project site.	Minor (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
			• Rest area for drivers shall 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.	Moderate (-ve)	• There shall be optimization of the use of local labour as far as practically possible. • There shall be the 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. • There shall be the development and communication of a clear and concise employment and recruitment policy to prevent opportunistic job seekers from settling in the area.	Minor (-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.	Moderate (-ve)	• There shall be the development of a comprehensive HIV/AIDS program to employees through employee wellness programmes which should include the following: - Awareness campaigns targeting project workers, senior	Minor (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
			management, contractors, sub-contractors and their spouses, communities near project facilities, risk groups (commercial sex workers, truck drivers). - Prevention, voluntary counselling for HIV testing, as well as anti-retroviral treatment for employees and surrounding communities.	
	Increased pressure on healthcare infrastructure due to project related influx.	Moderate (-ve)	• 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 Niger Delta Teaching hospital in Okolobiri community, for service provision to the local workforce and their dependents. • There shall be the development and implementation of community development/sustainability plans to support infrastructure development in the area.	Minor (-ve)
	Increased risk of accidents and injuries to communities from	Moderate (-ve)	• Awareness campaigns shall be carried out in Tunama and other neighbouring communities, with a	Minor (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
	improved roads and additional traffic.		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 sub-contractors' 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 activity.	
	The visible presence of Nigerian Police within the project area, and their secondment as a subcontractor for the lubricating oil blending plant security.	Minor (-ve)	• 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	Negligible (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
			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.	
Ecosystem Services	Reduced availability of natural resources and ecosystem services to local communities.	Moderate (-ve)	• Remaining Forest habitat that has been degraded shall be restored to their pre-construction condition. • Discourage deforestation. • 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.	Minor (-ve)
Operation				
Air Quality	Air pollutants resulting from burning oil and natural gas.	Major (-ve)	• 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	Minor (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
			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 (C_6H_6), formaldehyde (HCHO), Hydrogen sulfide (H_2S), Polycyclic aromatic hydrocarbons (PAHs), Sulphur (IV) Oxide (SO_2), and	Major (-ve)	• 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	Minor (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
	Nitrogen Oxides (NOx), as well as Carbon (II) Oxide (CO).		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. • Eraskon Nig. Ltd shall choose the latest technology that have minimum heat generation and dust emission capacity in the market which is the Automatic Batch Blender (ABB) Technology for the lubricant production. • 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 (SO_2), Nitrogen Oxides (NOx), Particulate Matter (PM), and heavy metals, leading to smog, acid rain, toxins in the	Major (-ve)	• 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	Moderate (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
	environment, and numerous respiratory, cardiovascular, and cerebrovascular effects		equipment operational procedure.	
	Emission of greenhouse gases and other gases such as SO_2, NO_x and CO from activities at the lubricant production plant.	Major (-ve)	• 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.	Minor (-ve)
	Lube oil is transported via trucks, release air pollution such as soot and can lead to disasters that ruin the environment.	Major (-ve)	• 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	Minor (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
			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.	Moderate (-ve)	• 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	Minor (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
			emission. • Equipment operators will be trained in and will follow equipment operational procedure	
Greenhouse gases	Black carbon resulting from incomplete combustion contributes to climate change.	Major (-ve)	• Additives shall be added in the blending kettles according to the requirement and plan to reduce the emissions especially those related to Sulphur. • Likewise, Eraskon Nig. Ltd shall 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. • Periodic maintenance shall be done as per machinery specifications.	Moderate (-ve)
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	Moderate (-ve)	• Waste water from the Eraskon Nig. Ltd proposed lubricant oil plant shall be recycled in the operational activities of the proposed plant • Even though the plan is to recycle wastewater, if there are going to be discharge at all into the receiving environment, it shall first	Minor (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
	temperature impacts organisms by decreasing oxygen supply, and affecting ecosystem composition.		be treated to meet both local regulatory and international standards.	
	Introduction of alien invasive flora and fauna.	Moderate (-ve)	• The ecological water requirements of the aquatic ecosystems shall be determined. Water abstraction from any of the rivers and from groundwater shall not exceed levels that result in the ecological water requirements of the aquatic ecosystems being compromised. Abstraction from wetlands and swamps shall be completely avoided • Sessile fauna present at the project site will be relocated by appropriate experts prior to the commencement of site clearing.	Minor (-ve)
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	Moderate (-ve)	• Bunded wall shall be constructed in the fuel dump section to contain fuel/oil spill. • There shall be the preparation of procedures to ensure that spillage during mobile equipment	Minor (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
	capability and land use.		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 characteristics, land capability and land use.	Moderate (-ve)	• The provision of appropriate secondary containment (to hold 110% of the stored volume) in areas where hydrocarbons, solvents and other potentially hazardous 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.	Minor (-ve)
Water Resources	Water contamination due to effluent, wash water and cooling water discharges, and seepage from storage and waste tanks.	Major (-ve)	• No wastewaters 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.	Minor (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
			• 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).	Moderate (-ve)	• Water effluents 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 is 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.	Minor (-ve)
	Seepage from waste	Moderate (-ve)	• Proper waste management	Minor (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
	affecting surface and groundwater quality.		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).	Moderate (-ve)	• Trucks parking along the Tunama-Obunagha road 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 would 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	Minor (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
			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 coal to the plant from the coal mine sites.	Major (-ve)	• 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 sub-contractors' employees. • Appropriate signalling 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	Minor (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
			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.	
Ecosystem Services	Reduced availability of natural resources and ecosystem services to local communities due to use by the project and impacts on these resources.	Minor (-ve)	• A Biodiversity Action Plan shall be developed to inform the protection and management of biodiversity in the entire project area.	Negligible (-ve)
Population & Demographic Movement	Influx of potential job seekers into the area and associated risks	Moderate (-ve)	• Optimizing the use of local labour as far as practically possible. • 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.	Minor (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
			• 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.	Major (-ve)	• 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 equipments 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	Minor (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
			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	Moderate (-ve)	• 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.	Minor (-ve)
	Loss or disturbance of	Moderate (-ve)	• Areas immediately adjacent to	Minor (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
	fauna species of special concern due to collisions and noise disturbance.		important habitats (e.g. wetlands, swamps, Gallery and Swamp Forest) that have been degraded shall be restored to their natural, pre-construction condition.	
	Increased hunting/poaching of wildlife and loss of habitats for crop production.	Moderate (-ve)	• As a management policy for staff, hunting/ poaching shall be vehemently prohibited for project staff and sub-contractors. Defaulters shall be severely penalized. • Enlightenment campaign shall be carried out at the host communities on the need to stop hunting/poaching of wildlife. • The host communities shall be encouraged to go into poultry, ranching and game farming. These activities will reduce the pressure on the environment and also get the residents of both communities fully engaged.	Minor (-ve)
Water Resources	Chemical contamination of surface water resulting from accidental spills during transportation and	Minor (-ve)	• There shall be the equipping of all trucks and equipment carrying oil with spill response materials and train personnel in the use of such materials	Negligible (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
	handling, and seepage from waste.		• Oil & silt traps shall be used to remove these types of contaminants from stormwater, and use designated areas for equipment servicing. • Where contaminants are transported, emergency contaminant and mitigation measures shall be developed to minimize impacts should accidental spillages occur along the transport routes. • All potential sources of contamination shall be stored 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.	
	Sedimentation of surface water resulting from erosion and runoff from exposed surfaces.	Minor (-ve)	• All cleared spaces and land after decommissioning shall be massively revegetated to prevent the direct exposure of the surface to rain and run off.	Negligible (-ve)
	Contamination of groundwater resulting	Minor (-ve)	• Caping waste landfill facility after closure to limit artificial recharge	Negligible (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
	from seepage from hazardous materials and waste.		and seepage forming shall be implemented.	
Soils, Land capacity & Landuse	Remediation of contaminated soils and demolition of project infrastructure, resulting in re-establishment of baseline soil characteristics and land capability.	Moderate (-ve)	• Phytoremediation shall be carried out on contaminated soils. • Trees shall be planted around areas that cannot be land filled.	Minor (-ve)
Air Quality	Increase in (Particulate Matter) emissions resulting from land clearing, earthworks, and vehicular movement.	Minor (-ve)	• 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 (-ve)
Visual	Dust generation and site disturbance due to earth moving and removal of project infrastructure,	Moderate (-ve)	• There shall be the revegetation and landscaping of disturbed areas as soon as possible, to reflect the surrounding	Minor (-ve)

Receptors	Identified Impacts	Rating before Mitigation	Mitigation Measures	Rating after Mitigation (Residual Impact)
	affecting the visual character for communities.		topography and vegetation.	

CHAPTER SEVEN

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

7.1 Introduction

Environmental and Social Management Plan (ESMP) for environmental protection/remediation is an important component which must necessarily be integrated into the ESIA process. It provides the means for continuous self-assessment of the predictive accuracy of the impact and the management effectiveness of project implementation and operation. The objectives of this Environmental and Social Management Plan (ESMP) are to:

- Ensure compliance with relevant legislations and Eraskon Nigeria Limited's policy;
- Integrate environment fully into business;
- Rationalize and streamline environmental activities to add value to efficiency and effectiveness;
- Achieve, enhance and demonstrate sound environmental performance built around the principle of continuous improvement;
- Encourage and achieve the highest performance and response from individual employees and company;
- Provide standards for overall planning, operation, audit and review; and
- Enable management to establish priorities in environmental protection.

The Environmental and Social Management Plan (ESMP) of the facility will include the following:

- 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.

Environmental & Social Management Plan is an implementation plan to mitigate and offset the potential adverse environmental & social 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 Eraskon Nigeria Ltd will own and operate.

7.3 Environment & Social Management Cell

Eraskon Nigeria Ltd shall establish an Environment & Social Management Cell (ESMC) 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 ESMC shall be responsible for coordinating and implementing all environmental and social activities. During project implementation, the ESMC 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 ESMC will include a safeguard specialist and supporting staff, together forming the Environmental and Social Unit, to be appointed by Eraskon Nigeria Ltd to look at environmental, social and safety issues. The ESMC 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 Eraskon Nigeria Ltd site staff and contractor's staff, to be assigned by the ESMC as necessary.

The duties of the Environmental and Social Unit of the ESMC 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, Bayelsa State Ministry of Environment, and Yenagoa 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 ESMC 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 ESMC will comprise of a team of qualified and experienced environmental engineers, analytical chemists, horticulturists, safety engineers and well trained personnel for environmental monitoring. The ESMC 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 ESMC will be supported by well-equipped testing laboratory and other facilities to facilitate effective working.

The responsibilities of the various members of the environment and social management cell are presented in Table 7.1 while Figure 7.1 summarizes the framework.

Table 7.1: Responsibilities of the members of the ESMC

S/No.	Designation	Responsibility
1.	Project Director (1 no.)	Environmental and Social policy and directions.
2.	Head-Operations (1 no.)	In-charge of the overall operation of environmental & social management facilities; Ensuring legal compliance by properly undertaking activities as laid down by various regulatory agencies.
3.	General Manager	Secondary responsibility for environment & social management and decision making for all environmental issues including Safety and Occupational Health.
4.	Social Expert (1 no) & Environmental Expert (1 no)	Ensure environmental monitoring and social issues related to project as per appropriate procedures.

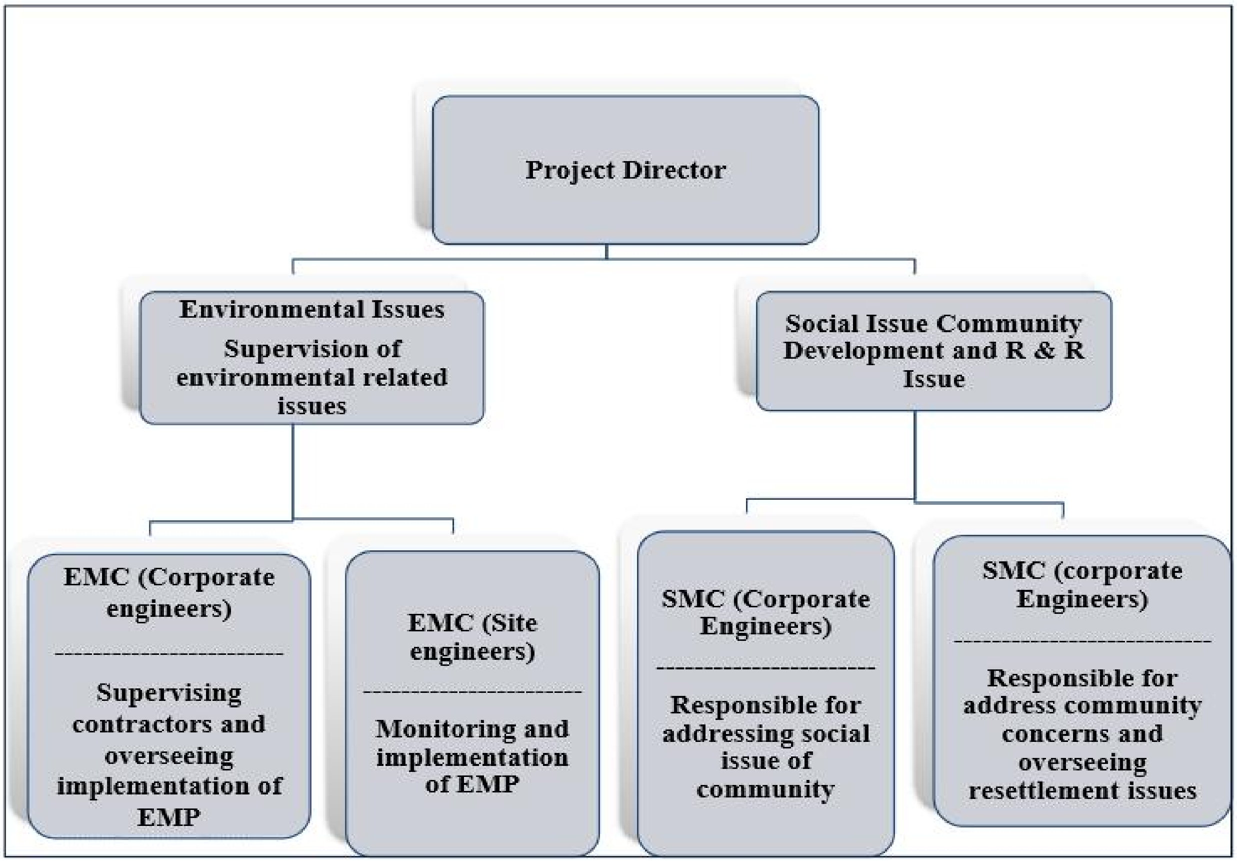

Figure 7.1: Framework of Environment & Social Management Cell

7.4 Corporate Social Responsibility Plan (Community Development Plan)

Corporate social responsibility is Eraskon Nigeria Ltd self-regulation integrated into a business model. CSR policy functions are built-in, 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

- Eraskon Nigeria Ltd 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 Eraskon Nigeria Ltd 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.
- Eraskon Nigeria Ltd CSR initiatives are being designed in line with the above principles. The CSR activities are also being designed keeping in mind local requirements.
- 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.

7.4.2 Identifying CSR initiatives in line with local requirements

Based on site visits by Eraskon Nigeria Ltd team and discussions with local/indigenous people (Tunama community) and other adjacent neighboring communities: Obunagha, Polaku, Koaroama and Okolobiri, the highlighted issues are summarized in Table 7.2.

Table 7.2: Identified areas for CSR application in local communities

S/No.	Area	Community Need
i.	Health	• Periodic provision of medical consumable to government owned primary healthcare centre in the project host community.
ii.	Education	• Provision of educational grants and

		scholarships to indigent students of the project host communities.
iii.	Employment / Livelihood	• Available labour force, for the most part, is either unskilled or semi-skilled.
iv.	Financial literacy	• Lack of information/about long term fiscal planning needs. This is important to prevent misuse of compensation package.

Keeping in mind the above mentioned issues, Eraskon Nigeria Ltd CSR initiatives would focus on the following areas:

- Improving awareness and providing sufficient training in hygiene, sanitation and proper diet.
- Provision of educational grants and schorlarships to indigent students of the project host communities.
- Improving educational infrastructure by supporting the state government through rehabilitation of schools, scholarships and grants to both communities.
- Skill acquisition training for indigenous youth especially during the project construction as well as operations phase.
- Encouraging entrepreneurial spirit among people and supporting such initiatives by conducting training programmes to acquire and enhance skills.
- Creating awareness about long term financial planning.
- Provision of potable water through drilling of boreholes

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. The summary of the EMP is given in Table 7.3.

Table 7.3: Summary of Environmental and Social Management Plan during Pre-construction phase

Mitigation Measure	Purpose	Failure consequence	Responsible Organization
Selection of lands adhering to local laws	To combat adverse impact to the	Environmental Degradation	Eraskon Nigeria Ltd Management

Mitigation Measure	Purpose	Failure consequence	Responsible Organization
and regulations. Construction facilities shall be placed at least 1 km away from water bodies, natural flow paths, important ecological habitats and residential areas.	existing environment.		
Maintain adequate clearance, construction of retaining structures, minimise cut and fill operations adjoining to the dwellings.	To avoid disturbance to the adjacent lands and the people due to cut and fill operations.	Impacts on nearby dwellings	Eraskon Nigeria Ltd Management
Consideration of site location to avoid water bodies or agricultural land as much as possible. Careful site selection to avoid existing	To ascertain site location, (distance to dwelling, water and/or agricultural land) to minimize adverse impacts on environmental	Environmental degradation	Eraskon Nigeria Ltd Management

Mitigation Measure	Purpose	Failure consequence	Responsible Organization
settlements.	attributes.		
Avoid encroachment by careful site and alignment selection and reconnaissance before final sitting of activities. Utilizing existing power transmission line for power evacuation.	To monitor the impacts on ecological environment	Floral and faunal habitats loss	Eraskon Nigeria Ltd Management

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).

7.6.1 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.

7.6.2 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.

7.6.3 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 fulfil 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.

7.6.4 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.

7.6.5 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 fulfil its corporate social responsibility.

Table 7.4: Environmental Impact and Mitigation Measures during construction and erection

S/No.	Possible Impact	Mitigation During Operation
1.	Air Impact	• Dust suppression such as use of water sprinklers. • Construction machinery shall be

S/No.	Possible Impact	Mitigation During Operation
		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.
2.	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.
3.	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.
4.	Safety of Workers	• Security arrangements to prevent entry of unauthorized 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

S/No.	Possible Impact	Mitigation During Operation
		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.**

7.7.1 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 SO_2, CO, H_2S 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.

7.7.2 Noise Level

The major area where noise is anticipated is from the generators, and production line. These are however not significantly sufficient to affect Tunama and other neighbouring communities considering their distances away. Nevertheless, Eraskon Nigeria Limited 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.

7.7.3 Socio-economics Environment

Eraskon Nigeria Limited, 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.

7.7.4 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 channelled to the receiving body.

7.7.5 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 re-cycling.
- 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 7.5: Environmental Impact and Mitigation Measures during operation phase

S/No.	Possible Impact	Mitigation during Operation
1.	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 Eraskon Nigeria Ltd 50,000litres lubricating oil blending plant area shall be ensured. • Implementation of noise screening measures for the Eraskon Nigeria Ltd in the plants design shall be pursued.
2.	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.
3.	Occupational health hazard	• Periodic health check-up.
4.	Safety of 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

Note: ERASKON NIGERIA LTD management shall have the responsibility to implement mitigation measures during operation phase

7.8 EMP during De-Commissioning Phase

This project involves a huge investment. While in Operation, the Eraskon Nigeria Ltd 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. Eraskon Nigeria Ltd 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

Eraskon Nigeria Limited shall be responsible for monitoring, quantifying, transportation and disposal of all wastes generated during the construction phase. Waste generated within Eraskon Nigeria Ltd 50,000litres 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

Eraskon Nigeria Limited 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.

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7.9.3.1 Waste Generation Forecast

This proposed project aims at a maximum of 40 personnel including truck drivers at the peak of the project. Allowing for occasional visitors, waste generation has been estimated with 40 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.

Table 7.6: Estimated Rate of Wastes Generated

WASTE TYPE	**Rate of Waste Generated**
Domestic	
Food/Kitchen Wastes	5 kg/day
Garden Waste	3 kg/day
Garbage	4 kg/day
Plastic Waste Polyethylene / Urethane, Packaging plates, Bags)	5 kg/day
Wood	0.05 kg/day
OFFICE	
Feedstock	500 kg/day
Toner Cartridge	2 kg/Month
Paper	0.2 kg/day
INDUSTRIAL	
Glass	0.4 kg/day
Scrap Metal	2.5 kg/day
Cans and Tins	0.5 kg/day
Computer Scraps & Consumables	0.4 kg/day
Oil/Fuel Filters	1 kg/month
Cables	5 kg/month
Absorbent	2 kg/day
Spent Oil	2 lit./day/capita
Construction Debris	5 kg/month
Clinical Waste	1 kg/month
Fluorescent/tube bulbs	1 kg/month
Sewage	5 lit./day/capita
Metallic and Plastic Drums	5 kg/week
Batteries from cars, calculator, radios, torches, cameras	0.1 kg/day

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.

7.9.5.2 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

7.9.5.3 Waste Inventorisation and Tracking

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

7.9.5.4 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.

7.9.5.5 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.

7.9.5.6 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.

7.9.5.7 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 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.

7.9.6.1 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 7.7: Waste Categories and Definitions

Category	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	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.

Table 7.8: 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 7.9: Colour codes for Hazardous and Non-hazardous Medical Wastes

Type of waste	Colour code
Hazardous medical waste	
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
Non- hazardous	
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. Labelled 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.

7) 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.

7) 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.
- Re-injection; this is the injection of waste material into a suitable formation.

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 7.10: Wastes Identification, Handling and Disposal

WASTE TYPE / WASTE NAME	Handling			Minimization/Disposal Method /Facility
DOMESTIC	**Colour Code of Bin**	**Storage**	**Transportation**	
Food/Kitchen Wastes	Green	in bins or neatly packaged in a well labelled polythene	in bins or neatly packaged in a well labelled polythene inside a covered truck	Disposed at government approved dumpsite
Garden Waste	Green	designated storage site in the facility	in covered vehicles with fully completed Waste Consignment Note (WCN)	Disposed at government 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	Reuse or moved to government approved dumpsite by waste contractor or sale to other end users.

WASTE TYPE / WASTE NAME	Handling			Minimization/Disposal Method /Facility
			appropriate label for recycling	
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 be collected and disposed by Bayelsa State Environmental Protection Board	Disposed at government approved dumpsite
Computer Scraps & Consumables	Orange	Arrange neatly in a cool dry place	In covered truck with fully completed WCN	Sale to other end users
Oil/Fuel Filters	Blue	Drain oil, cut open to remove diaphragm and crush metal case	In trucks to the scrap metal yard	Recycled for kiln firing

WASTE TYPE / WASTE NAME	Handling			Minimization/Disposal Method /Facility
Cables	Grey	Neatly kept in the Waste Depot	In covered truck disposal site	Re-use; Can be sold to vendor for re-cycle 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
Clinical Waste	Yellow	Neatly place in black polythene before putting in the red bin	Transport in sealed bags to Eraskon Nigeria Ltd incinerator	Incinerated in the rotary kiln
Fluorescent/tube bulbs	Blue	Arrange neatly to avoid breaking	In covered trucks with fully completed WCN	Recycle; Sell to vendors to recycle mercury
Computer Scraps & Consumables	Orange	Arrange neatly in a cool dry place	In covered truck with fully completed WCN	Sale to other end users
Sewage	N/A	Septic/sewage tank or sewer	Transported via sewage pipes to sewage tanks/sewers	Degraded by biological processes
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

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 equipments 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 equipments and materials. Also, regular safety inspections shall be ensured of all buildings, equipments, work places and operations.

7.12.1 Safety Organization

Eraskon Nigeria Ltd 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 equipments. 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.

The disaster management plan shall be periodically revised based on experiences gained from the mock drills.

7.12.8 Other Safety Measures

Considering that fire explosion is a likely hazard in projects of this nature, the company is being provided with systems to guard against such hazards. Salient among these are:

- A proper layout to prevent and minimize the effects of any hazardous situation.
- Provision of operating systems to conduct the process through well-established safe operating procedures.
- Control system, which has trip provisions to prevent hazard conditions escalating.
- Provision of a fire protection system to control fire.
- Provision of flame-proof lighting system in the fire prone areas.

7.12.9 Safety Review Check List

A checklist is one of the very useful tools for hazard identification. A checklist will be prepared and used as a final check that nothing has been neglected.

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, Eraskon Nigeria Ltd 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/equipments 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 equipments, and other operational areas.

7.13.2 Fire Protection System

Eraskon Nigeria Ltd 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 Bayelsa 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 mitigatory 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.

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Table 7.11: Proposed Monitoring Requirements for the Proposed Project (Environmental Performance Monitoring)

EPI No.	Environmental Performance Indicator (EPI)	Monitoring Parameter	Location	Period & Frequency	Responsibility
A.	**Construction phase**				
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 equipments particularly generating sets	• Near noise sources (5m)	Monthly during site preparation	HSE Manager
A4	Sourcing of water	• Volume of water sourced and consumed	• Sourcing and usage areas	Daily during construction phase	HSE Manager
A5	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	CLO

EPI No.	Environmental Performance Indicator (EPI)	Monitoring Parameter	Location	Period & Frequency	Responsibility
		• No. of Accidents	• Safety records	phase	
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	Daily during construction phase	
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, handling and disposal	• Quantity of waste generated and recycled • Visual observation of waste segregation and storage conditions viz. usage of labelled and covered bins, insect repellents etc. • Awareness level of onsite	• Waste generating areas viz. canteen, labour camps etc • Workers involved in	Weekly during construction phase	HSE Manager

EPI No.	Environmental Performance Indicator (EPI)	Monitoring Parameter	Location	Period & Frequency	Responsibility
		workers	waste handling and storage		
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	• Hazardous waste storage areas • Workers involved in waste handling and storage	Weekly during construction phase	HSE Manager
B.	**Operational Phase**				
B1	Fugitive emissions	• Visual observation of dust generated • Water sprinkling details viz frequency and quantity	• Maintenance Records	Daily during operational phase Weekly during operational phase As per supplier's manual	HSE Manager
B2	Noxious and GHG	• Gases such as NOx, SOx, COx,	• Emission	Daily	HSE Manager

EPI No.	Environmental Performance Indicator (EPI)	Monitoring Parameter	Location	Period & Frequency	Responsibility
	emission	CH_4 etc.	chimney stacks		
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. Accidents	• Grievance Records • Safety Records	Monthly during operational phase	CLO
B6	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 (LTIs). Near misses, fatalités etc	• Medical records • Office building maintenance records • Drinking water storage tank • Operational sites	Monthly during operational phase Daily during operational phase	HSE Manager

Table 7.12: Proposed Monitoring Requirements for the Proposed Project (Environmental Quality Monitoring)

EQI No	Environmental Quality Indicator (EQI)	Monitoring Parameter	Location	Period & Frequency	Responsibility
A	**Construction Phase**				
A1	Ambient noise quality	Measurement of Noise Pressure Level in dB	Nearest receptor viz. villages, schools, ecological habitat	Monthly during construction phase	HSE Manager
A2	Surface water quality	Parameters as per FMEnv limits	Drainage channel	Quarterly during construction phase	HSE Manager
A3	Ground water quality	Depth of ground water table		Quarterly during construction phase	HSE Manager
B	**Operational Phase**				
B1	Ambient noise quality	Measurement of Noise Pressure Level in dB	Nearest receptor viz. villages, schools, ecological habitat	Monthly during operational phase	HSE Manager

7.15 Budgetary Provisions for EMP Implementation

Adequate budgetary provision has been made by Eraskon Nigeria Ltd for the execution of this environmental management plan. The estimated cost of Environmental Protection measures for this project has been estimated as 0.1% of the gross project cost. This amounts to $13,040.87 United States Dollars.

Table 7.13: Proposed Environmental Monitoring Programme (both during construction and operation Phases)

Area of Monitoring	Number of Sampling Stations	Frequency of Sampling	Parameters to be Analysed	Responsibility
Meteorology	1	Continuous/ Daily	Wind speed and direction, Max. and Min. Temperature, Humidity, Solar Insolation, Atm. Pressure, Rainfall	HSE Manager
Noise	14 within plant premises and 1 outside plant premises	Monthly and reported quarterly to the FMEnv	Ambient Equivalent continuous Sound Pressure Levels (Leq) at day and Night time.	HSE Manager
Water Quality	Ground and Surface Water (4 each at different Locations)	Monthly and reported quarterly to the FMEnv	pH, Temp, Cond, TSS, TDS, BOD, O&G Heavy metals	HSE Manager
Soil	11 locations	Monthly and reported quarterly to the FMEnv	Physico-chemical properties, Nutrients	HSE Manager

7.16 Social Management Plan

7.16.1 Resettlement Budget and Financing Plan

Eraskon Nigeria Ltd acquired 7.925 hectares of land for the 50,000litres lubricating oil blending plant. The project would not result in any physical displacement as the land duly acquired from the land owners.

7.16.2 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 communities, Eraskon Nigeria Ltd 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 (Tunama), however, it shall be expanded to other neighbouring communities as well as Yenagoa (the host local government headquarters). The various areas where involvement shall be made are discussed below:

Health Care Facilities: Eraskon Nigeria Ltd shall work out the feasibility of assisting the immediate host community (Tunama) 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 Eraskon Nigeria Ltd. However it would ensure (through the implementing agency) that the communities are involved in the planning process. The main stakeholders for the project include:

- Local communities
- Yenagoa Local Government Council
- Bayelsa State Ministry of Environment
- Federal Ministry of Environment (FMEnv)
- National Environmental &Regulations Enforcement Agency (NESREA)

The detailed plan for each of the community facility shall be planned through a participative process. Even though Eraskon Nigeria Ltd would be primarily responsible for the implementation of the plan it shall be done in consultation with local administration with the involvement of the Local Government Council in monitoring the implementation.

7.17 Community Liaison Plan

The community liaison plan concentrates on communication with the host and other neighboring communities. Eraskon Nigeria Ltd 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.

Eraskon Nigeria Ltd has kept a provision in its project budget for implementing the Community Development and Liaison plan.

7.18 Monitoring and Reporting

Environmental and social key performance indicators will be developed in accordance to the FMEnv guidelines and the International Finance Corporation (IFC)/World Bank Group's performance Standards. This will be monitored at regular intervals to identify changes in conditions, new issues, mitigation, successes and opportunities for improvement in consultation and disclosure. The monitoring results will be reported as required, and will be available to the public. Stakeholder perceptions will also be monitored by Eraskon Nigeria Ltd Community Relations Team Representatives.

Furthermore, Eraskon Nigeria Ltd shall also take up robust CSR programme geared towards community welfare and support activities for socio-economic development of the nearby areas, to build a good rapport with the local communities by engaging the local community along with the administrative machinery to develop an ongoing process of development of the communities/villages surrounding the plant.

Eraskon Nigeria Ltd shall provide Environmental and Social monitoring report in an appropriate format as shown below:

7.19 Grievance Redressal 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. Eraskon Nigeria Ltd shall have a standard mechanism to:

(i) Inform the Affected Person(s) (AP), if any about GRM and its functions,
(ii) Determine how peoples representatives in the GRM will be selected,
(iii) Set the procedures and mechanisms adopted for making the complaints,
(iv) Support the complainants in communicating their grievance and attending the GRM meetings and
(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), Eraskon Nigeria Ltd 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) 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 Eraskon Nigeria Ltd and to the GRC.

7.19.1 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 communities. 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.

Eraskon Nigeria Ltd 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, Eraskon Nigeria Ltd 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.
Figure 7.2 shows a process flow diagram of the proposed Grievance Redressal Mechanism by Eraskon Nigeria Ltd.

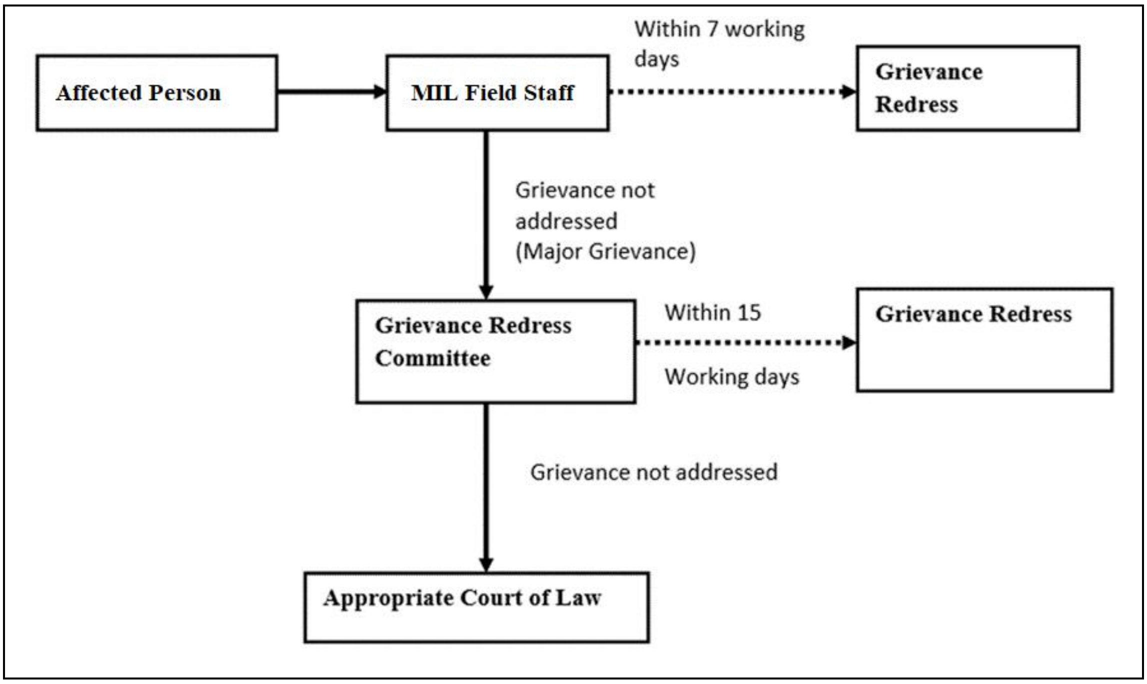

Figure 7.2: Process flow diagram of Grievance Redressal Mechanism

CHAPTER EIGHT

REMEDIATION PLANS AFTER DECOMMISSIONING, CLOSURE AND ABANDONEMENT

8.1 Introduction

The Decommissioning and Abandonment Plan outlines the ways and methods to be adopted for decommissioning and abandonment of the facilities such as the civil structures at the end of the project. This chapter illustrates a logical process of managing abandonment effectively from conception, through execution, to completion stage resulting in an abandoned site that is restored to a clean, safe, usable and environmentally acceptable condition.

8.2 Objectives of Decommissioning and Abandonment

The Objectives of the Decommissioning and Abandonment Plan of the proposed Eraskon Oil blending plant project includes but not limited to the following:

- To ensure that identified issues arising from the project activities have been addressed;

- To minimize impacts to the environment and land use while implementing a cost effective abandonment system.

8.3 Decommissioning and Abandonment Alternatives

The advantages and disadvantages of the Decommissioning and Abandonment alternatives for the proposed project are presented in Table 8.1.

Table 8.1: Decommissioning and Abandonment Alternatives

Project Activity	Advantages	Disadvantages
Option1: Leave facilities (e.g. civil structures) *insitu* for future reuse	• Least expensive to execute • Risk of accidents during transportation is reduced. • Metal scrap is	• Maybe used as hide out for criminal • Vandalism by host and neighbouring communities

	reduced • Low cost of abandonment	
Option 2: Removal of structures	• Facilities may be reused for another project • Environment can be properly reinstated	• Third party agitation • High cost of abandonment • Risk of road accidents is high

Note: The decision to fully decommission or abandon-in-place shall be made on the basis of a comprehensive site-specific assessment. However, No option has been chosen.

8.4 Decommissioning and Abandonment Considerations

The decommissioning and abandonment of the proposed Eraskon Oil blending plant project shall be executed with keen considerations to issues arising from the need to address public safety, legal requirements, environmental protection, and future land use. During the pre-abandonment review a risk assessment shall be performed to identify and closeout all applicable risk issues arising from the abandonment scope, and execution methods and issues identified shall be documented for implementation in the execution contractor's procedures and method statements and tracked for closure by the project team.

8.4.1 Environmental Conditions

The project EIA report and environmental impact monitoring reports of the proposed project shall form input to the pre-abandonment environmental impact assessments. Requirements for environmental reinstatement during abandonment shall be captured in the Environmental Monitoring Plan for abandonment phase.

8.4.2 Soil and Groundwater Contamination

Any soil or ground water contamination noted prior to the abandonment activities shall be cleaned up to the applicable regulatory standards prior to commencement of the decommissioning and abandonment work program by the execution contractors, unless it can be demonstrated that environmental damage will not be amplified. The execution contractor's work programme shall provide controls to prevent effluent release to the environment or seepage to the ground water table leading to ground water contamination.

8.4.3 Site Reinstatement/Restoration

Site reinstatement activities are anticipated around the oil blending plant area and damaged roads. The following site reinstatement activities are proposed to be executed post abandonment of the pipeline in-situ:

- Exhume contaminated soil around the base camp area, workshops etc. Contaminated soil shall be incinerated in line with Eraskon Nigeria Limited's Waste Management Plan
- Back-fill with appropriate top soil
- Repair damaged roads (if any)
- Allow two rainy seasons for natural vegetation to sprout and root

8.4.4 Regulatory Interfaces

Implementation of decommissioning and abandonment of the Eraskon Oil Blending plant project facilities/structures shall be carried out in line with applicable statutory requirements. As a statutory requirement, a letter-of-intent shall be dispatched seeking the consent for abandonment approval from the FMEnv/DPR before the planned abandonment. In addition, The Federal Ministry of Environment shall be invited to witness the decommissioning and abandonment activities and a Joint Monitoring Site Visits with Representatives of the Federal Ministry of Environment shall be performed during the abandonment phase.

8.4.5 Community Interfaces

The decommissioning plan to be adopted shall have minimum negative impact on the project host and neighbouring communities. Community concerns related to Eraskon Nigeria Limited's exit plans would be taken on board to ensure successful decommissioning.

8.4.6 Scrap Handling

All recovered scraps shall be treated in accordance with standard procedures on handling/sales of scrap. Eraskon Nigeria Limited will investigate the possibility of donation to the local community, local government council or Bayelsa State government.

8.4.7 Abandonment Cost

Decommissioning and Abandonment Cost estimate shall be prepared for the proposed Eraskon Oil Blending plant project to support the decommissioning initiation process.

8.5 Potential and Associated Impacts of Decommissioning and Abandonment activities

Detailed description of the Potential and Associated impacts of the Decommissioning and Abandonment activities have been highlighted in the Environmental Management Plan (See Chapter Seven).

8.6 Labour Demobilization

Labour demobilization for the proposed project shall take the following sequence of implementation;

- Consult with labour at least one year before the commencement of decommissioning.
- Embark on a re-training process to enable labour acquire other skills.
- The Eraskon Nigeria Limited 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.

CHAPTER NINE

CONCLUSION AND RECOMMEDATIONS

9.1 Conclusion

Eraskon Nigeria Limited is investing in the development of a lubricating oil blending plant with a production capacity of 50,000 litres per day (lpd), as a strategic alignment with the Nigerian Government's plan towards boosting local lube oil production and complete deregulation of the oil and gas sector. The project is structured as a private lubricant oil production plant and is proposed to be set-up in the oil and gas rich Tunama community of Yenagoa LGA in Bayelsa State.

As required by law, every potential project capable of impacting the natural and human environment must be certified by the government and an Environmental and Social Impact Assessment (ESIA)/Environmental Impact Assessment (EIA) is required. In other to carry out the ESIA an independent government accredited environmental consultant must be involved. This led to the engaging of Geo Environmental Resources Limited (GERL) by Eraskon Nigeria Limited (ENL) (the project proponent). GERL is a reputable indigenous environmental management firm with highly qualified and vast consultants in the various fields of the earth and environmental management. The terms of reference for this study is to carry out the Environmental and Social Impact Assessment of Eraskon Nigeria Limited's proposed 50,000 litres per day (lpd) lubricating oil blending plant in Tunama community, Gbaran clan, Yenagoa Local Government Area (LGA), Bayelsa State, Nigeria in line with the requirements of the government of Nigeria as regulated by the Federal Ministry of Environment (FMEnv) and Bayelsa State Ministry of Environment (BSME).

This ESIA document therefore presents the assessment of the potential and associated environmental and social impacts together with mitigation measures for adverse impacts of the proposed project. Also the baseline of the environmental and socio economic data of the project area were obtained and presented in this document. Furthermore, an environmental and social management plan detailing the management plan of all environmental and social components of this lubricating oil blending plant at pre-operation, operation and decommissioning stages were also aptly documented. From the outcome of this study, it is safe to say that the perceived beneficial environmental and social impacts of the project far outweighs the adverse effects but nevertheless mitigation measures that are feasible and practicable have been developed to address potential adverse impacts based on industry best practices.

In addition, the various mitigative measures developed were aimed at ensuring that the impact on land use, vegetation, air, socio economics and health are mostly localized and can be controlled and remediated to a level reasonably practicable. The lubricating oil blending plant associated project impacts identified can be controlled if the recommended mitigation measures are applied.

Based on the findings of the ESIA study the following conclusions are made:

- The activities of the proposed lubricating oil blending plant in Tunama will not pose any major threat to human lives or the general environment and social life of the host community if operated within the recommended standards.

- The general environmental baseline conditions of the project area are within human tolerable limits and the project area shall be returned to this state after the completion of the project operation (at decommissioning).

- The ambient air quality of the immediate environment of the project environment conforms to the standard limits for healthy living condition.

- The proposed project has more beneficial impacts on the host community than negative effects.

9.2 Recommendations

Based on the conclusions summarized above, the following recommendations are made for implementation:

1. The approved ESIA report should be incorporated to form the basic guideline for the operation of the lubricating oil blending plant and should be used by the project supervisors/management in checking any adverse effect that the project activity may have on various environmental components.

2. The proposed mitigation measures, monitoring plans and overall environmental management plans should be implemented to the latter.

3. The ENL project management should set up a functional environmental management office during operational stage to coordinate all matters relating to environmental protection and monitoring.

4. The lubricating oil blending plant should be supported by all stakeholders as it portends great economic gains with negligible and manageable adverse environmental and social impacts.

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APPENDIX ONE

SOCIO ECONOMIC SURVEY QUESTIONNAIRE

COMPANY NAME: --

Date: PROJECT TITLE --

PROJECT LOCATION: --

SOCIO-ECONOMIC DATA QUESTIONNAIRE FOR ENVIRONMENTAL IMPACT ASSESSMENT

The questionnaire is intended to collect social, economic and health data of people living around the project site as required by the EIA Act No. 86, of 1992 as well as the EIA Guidelines and other relevant requirements. Therefore, as a member of the community within the defined boundary, we need you to complete the questionnaire honestly and truthfully, to enable us evaluate the impact of the project on the socio-economic and health of the community. The information you provide will not be used for any other purpose apart from what is stated here, except compelled by a law court.

IDENTITY OF THE RESPONDENT	
Questionnaire number: __|__|__	
State: ______ LGA: ______	Village: ______
Family Name:	First Name:
Phone #:	No Phone ☐
Email address	No email ☐
Is the respondent the Head of House? Yes ☐ No ☐ If not, what is his/her status: Spouse ☐ Child ☐ Sibling ☐ Others ☐ Specify: ______	

SECTION A: DEMOGRAPHIC DATA

1. Gender: Male ☐ Female ☐		
2. Age: ______ year old		
3. Marital status: 1. Single ☐ 2. Married ☐ 3. Widowed ☐ 4. Divorced/Separated ☐ 5. Don't Know (DNK) ☐	**If married:** 1. Polygamous ☐ 2. Monogamous ☐ 3. Don't Know (DNK) ☐	
4. State of Origin: ______	**5. Ethnic group:** ______	**6. Religion:** ______
7. Education: i) Highest education level attained: No education ☐ Primary ☐ Secondary ☐ Tertiary ☐ University ☐ NFE* ☐ DNK ☐		
ii) Non formal education attained: Quar'anic/Islamiyya Sch. ☐ Adult Education ☐ Vocation ☐ Others ☐ If other, specify: ______		

NFE*: non-formal education, DNK= don't know

8. OCCUPATION		
(a) Nature of Occupation:	**(b) If self-employed, what do you do?**	**(c) If an employee, what else do you do?**
Private Sector Employee ☐	Farmer ☐	Farmer ☐
Public Sector Employee ☐	Pastoralist ☐	Pastoralist ☐
Self-employed ☐	Fisherman ☐	Fisherman ☐
Full Time House Wife ☐	Trader ☐	Trader ☐
Student ☐	Business man ☐	Business man ☐
Other ☐	Taxis/Bus Driver ☐	Taxis/Bus Driver ☐
	Okada/Keke ☐	Okada/Keke ☐
	Carpenter ☐	Carpenter ☐
	Builder ☐	Builder ☐
	Mechanic ☐	Mechanic ☐
	Plumber ☐	Plumber ☐
	Electrician ☐	Electrician ☐
	Others (please specify) ☐	Others (please specify) ☐

9. House Hold Size: Total No. ______, Female ______, Male ______

(**NOTE:** Definition of members of household: People sleeping and eating in the house for at least the last 6months. Do not count visitors, boarding children BUT children of the household away for school, visiting others, etc.)

10. **Household Incomes:** State amount of incomes received from these activities during the past 12 months where no income received, leave it blank

SOURCE OF INCOME	AMOUNT (₦)
Agriculture	
Livestock	
Fishing form river or fish pond	
Hunting	
Wood (collection)	
Charcoal (production)	
Business	

SOURCE OF INCOME	AMOUNT (₦)
Pension	
Money transfer (family)	
Renting (land, house, etc.)	
Salary (official)	
Casual jobs (okada, electrician, etc.)	
Trading	
Other sources (specify)	

11. **Household Facilities:** Does your household have any of the following facilities?

Power generator	Yes ☐	No ☐	Bicycle	Yes ☐	No ☐
Gas or kerosene stove	Yes ☐	No ☐	Plough	Yes ☐	No ☐
Refrigerator	Yes ☐	No ☐	Cart	Yes ☐	No ☐
Television	Yes ☐	No ☐	Cable TV (subscription)	Yes ☐	No ☐
Radio/cassette/music system	Yes ☐	No ☐	Air conditioner	Yes ☐	No ☐
Car/Truck	Yes ☐	No ☐	Fan	Yes ☐	No ☐
Motor cycle	Yes ☐	No ☐	Others (specify) ______		

12. **What is the housing pattern prevalent in the community:**

Roof	Walls	Floor
1. Corrugated iron sheets ☐	1. Plain mud ☐	1. Earth/sand/dirt/straw ☐
2. Thatch ☐	2. Mud ☐	2. Smoothed mud ☐
3. Asbestos ☐	3. Mud bricks ☐	3. Smooth cement ☐
4. Concrete/cement ☐	4. Wood ☐	4. Wood/planks ☐
5. Wood and mud ☐	5. Grass ☐	5. Ceramic tiles ☐
6. Bamboo/reed ☐	6. Compacted ☐	6. *Other, specify:* ______
7. Plastic canvas ☐	7. Burnt bricks ☐	
8. Bricks ☐	8. Concrete ☐	
9. *Others, specify:* ______	9. *Other, specify:* ______	

13. **Nature of accommodation: 1)** Live with parents/ spouse ☐ , **2)** Owned (Inherited) ☐, **3)** Owned (Bought) ☐, **4)** Rented ☐, **5)** Borrowed ☐, **6)** Rent Shared ☐, **7)** Squatting ☐, **8)** Others form of tenure ☐.

14. ENERGY CONSUMPTION (used for cooking and lighting, etc.)			
What is the household's source of energy for…? (tick all that applies)			
Cooking	1. Main electricity ☐ 2. Solar ☐ 3. Gas (biogas) ☐ 4. Bottled gas ☐ 5. Paraffin/kerosene ☐ 6. Charcoal ☐ 7. Firewood (biomass) ☐	**Lighting**	1. Main electricity ☐ 2. Solar ☐ 3. Gas (biogas) ☐ 4. Hurricane lamp ☐ 5. Pressure lamp ☐ 6. Wick lamp ☐ 7. Candles ☐
	8. Crop residues ☐ 9. Livestock dung ☐ 10. *Others, specify:* ______		8. Firewood (biomass) ☐ 9. *Others, specify:* ______

15. DRINKING WATER			
What is the household's source of drinking water during...? (tick all that applies)			
Dry season	1. Piped water ☐ 2. Rainwater catchment ☐ 3. Protected spring ☐ 4. Unprotected spring ☐ 5. Water vendor (mai ruwa) ☐ 6. Tanker truck ☐ 7. Bottled water ☐ 8. Surface water (lake/dam/river/stream) ☐ 9. Borehole (commercial) ☐ 10. Borehole (private) ☐ 11. *Other, specify:* ______	Wet season	1. Piped water ☐ 2. Rainwater catchment ☐ 3. Protected spring ☐ 4. Unprotected spring ☐ 5. Water vendor (mai ruwa) ☐ 6. Tanker truck ☐ 7. Bottled water ☐ 8. Surface water (lake/dam/river/stream) ☐ 9. Borehole (commercial) ☐ 10. Borehole (private) ☐ 11. *Other, specify:* ______
What is the distance between the MAIN source of water and house?			
Dry season	______ Km	Wet season	______ Km

16. Household Food Consumption

1. How many meals, does the household normally have per day?......./Day (between 1 and 3)
2. Do you need to buy food to satisfy your household needs, or you have enough from your farm? Yes ☐ No ☐

SECTION B: HEALTH AND VULNERABILITY

1. Are you handicapped or chronically sick? Yes ☐ No ☐ if yes, provide details on his/her sickness or handicap: ______
2. Are there any other members of the household handicapped or chronically sick? Yes ☐ No ☐ if yes, provide details on their sickness or handicap: ______
3. Where there any deaths in the household in the last year? Yes ☐ No ☐ if yes, provide details on cause(s) of deaths: ______
4. Which of the following is available in your community? (tick all that are available)
   a. Teaching Hospital ☐
   b. Federal Medical Center ☐
   c. General Hospital ☐
   d. Clinic/Maternity ☐
   e. Primary Health Care ☐
   f. Pharmaceutical Chemist ☐
   g. Patent Medicine Store ☐
   h. Traditional Doctor/Herbs ☐
   i. Others (specify) ☐
5. What constitutes your main diet? (tick all that are applicable)
   a. Carbohydrate source (garri, rice, yam, etc) ☐
   b. Protein source (beans, meat, fish, egg, etc) ☐
   c. Vitamins (fruits, vegetables, etc) ☐
   d. Fatty and oil source (margarine, palm fruit, etc) ☐

6. Substance use (Alcohol and drugs):

Do you engage in the following habits			If yes, how many times daily
Take alcohol	Yes ☐	No ☐	
Drugs (without prescription)	Yes ☐	No ☐	
Smoke cigarette	Yes ☐	No ☐	
Others (specify)	Yes ☐	No ☐	

7. Do you have qualified Doctors, Nurses and other health personnel? ______________________

8. How are very serious medical cases handled? ______________________

9. Name the prevalent diseases in the area; ______________________

____

10. Peculiar disease (if any)

____

____

SECTION C: SOCIAL INFRASTRUCTURE/ECONOMIC INFRASTRUCTURE

1. What is the nature of the access road in this area?______________________

____

2. What type of transportation do you have? ______________________

3. Do you have market? Yes ☐ No ☐, If yes; Mention their names and the days of function?

____

____

____

4. Do you have Bank(s)? Yes ☐ No ☐, If yes, mention their names

____

____

____

5. What recreation facilities do you have in your community? Describe them as brief as you can.

____

____

6. Economic/industrial facilities around the area;______________________

____

7. Are there private/public institutions in the area/community? If yes name them;

____

____

____

7. How is solid waste disposed of? Thick the box(es) applicable and for more options, write on others.

Burning; ☐ dumping; ☐ throwing in running/stagnant water ☐ , Others: ______________________

8. How is human waste disposed of? Pail systems; ☐ Pit toilet; ☐ Defecation into water channels ☐

Any other (specify): ______

9. Do you have primary schools? ______ If yes, mention their names

______

10. Do you have secondary schools? ______ If yes, mention their names

______

11. Do you have higher institutions? ______ If yes, mention their names

______

11. What is the proportion of the people in your community who attended different levels of educational institution? (If you were to select 100 school students/pupils)

Primary school; ______

Secondary school; ______

Higher institutions; ______

12. What is the proximity of the educational institution to your community? ______

SECTION D: CULTURE AND RELIGION

1. What religious organizations are present in your community? State their proportions:

Christian: ______ Moslems: ______ Traditional Religion: ______

Others: ______

2. Do you have shrines and Deities in your community? Yes ☐ No ☐ If yes, mention their names and where they are located and what time are they worshiped?

______

Monthly ☐ Quarterly ☐ Yearly ☐ Any specific time of worship Day/Month

______

2. Do you have any areas (forests, rivers, etc.) being regarded as sacred? Yes ☐ No ☐ If yes, mention their names and locations

____

____

____

3. Do you have any historical or archeological site/monuments in your community? Yes ☐ No ☐ If yes, mention their names and locations

____

____

4. Mention the kind of festival being celebrated in your community and at what time of the year?

____

____

____

5. What are the Dos and Don'ts in the community?

____

____

____

6. List the major ethnic groups in the area/community;

i ____________ ii ____________ iii ____________ iv ____________ v ____________

SECTION F: SOCIAL ENVIRONMENT

1. Briefly describe the structure of authority in your community (List in order of importance)

____

____

____

2. What type of land tenure system do you have in your community?

____

____

3. List the common community based social groups and organization found in the community and their Functions;

____

____

____

4. What do you think are the reasons for poverty in this community?

____

5. What would you say is the proportion of jobless people in this community? (If you were to select from among 100 persons) ____

SECTION G: ENVIRONMENTAL PROBLEMS

1. List the main environmental problems in this community (e.g. deforestation, erosion, oil, spillage, gas, flaring etc.) and give perceived causes for the different problems.

S/No	Environmental Problems	Causes
1		
2		
3		
4		
5		

2. How seriously do these problems affect your income generating activities?

   Has little effect; ☐ Has serious effect; ☐ Has forced us to stop some activities ☐

   (Please provide further information on any serious effect)

   ____

   ____

   ____

3. Has the government or any other organization embarked on the activity to help reduce environmental problems in your community? Yes ☐ No ☐

4. If yes, what is the type of development programme; which organization; and what have been the impact?

   ____

   ____

   ____

SECTION H: CONCERNS ABOUT THE IMPACTS OF THE PROJECT

CONCERNS ABOUT THE IMPACTS OF ESTABLISHING THE PROJECT

Do you have concerns about establishing the PROJECT in your community?	Yes ☐ No ☐
If YES, what are they? (you can attach more sheets if more information exist about your response)	

(I). How do you think this project will benefit this community during the construction stage?

Item	Very Minimal	Minimal	Great	Don't Know
Job opportunity				
Improved social life				
Increase income				
Improvement of living standard				

(II). How do you think the project will benefit this community during the operational phase?

Item	Very Minimal	Minimal	Great	Don't Know
Job opportunity				
Improved social life				
Increase income				
Improved better communication				
Occupational Change				
Improvement of living standard				

(III). How do you think the project will adversely affect this community during the construction phase?

Item	Very Minimal	Minimal	Great	Don't Know
Job opportunities				
Destruction of/encroachment on land				
Loss of farmland				
Ground water contamination				
Surface water contamination				
Occupational Change				
Noise level				
Loss of wildlife species				

(IV). How do you think the project will adversely affect this community during the operational phase?

Item	Very Minimal	Minimal	Great	Don't Know
Pollution of drinking water				
Land pollution				
Land vibration				
Ground water contamination				
Surface water contamination				
Occupational Change				
Noise level				
Loss of wildlife species				

Thank You for your cooperation

APPENDIX TWO

ATTENDANCE LIST FOR THE SITE VERFICATION EXERCISE OF THE PROPOSED 50,000 LITRES LUBRICATING OIL BLENDING PLANT

FEDERAL MINISTRY OF ENVIRONMENT, ABUJA

ATTENDANCE LIST FOR THE EIA SITE VERIFICATION EXERCISE OF THE PROPOSED 45,0000LITRES LUBRICATING OILS BLENDING PLANT IN IZEINBOU BUSH, GBARAN CLAN, YENAGOA LGA, BAYELSA STATE BY ERASON NIG LIMITED

DATE: 5TH AUGUST, 2020

S/NO	Names of Participants	Organization	Designation	Phone Nos.	E-mail Address	Signature
1	Beraga Gladys	FMENV	Scientist	08151857126	adekunle.gladys@yahoo.com	
2.	Alale George	FMENV-BYS	Controller	08033091397	alalegeorge@yahoo.com	
3	Imoyo, J-J	FMENV-EAS	Director EAS	08063584528	deruleman@gmail	
4.	ADESEHINWA ADEGBULUGBE	GEO ENVIRONMENTAL RESOURCES LTD	ENVIRONMENTAL CONSULTANTS	08163060517	adeitphil.ps@gmail.com	
5	Engr Preye K. Nimame	ERASKO	Ops Mgr	08033136 557	nimamep@gmail.c	
6	Barr. Kingsley Enegesi	ERASKO	CSP Officer	08037441802	kingsley.enegesi@eraskoenergy.com	
7	Adaga Martins	ERASKON	Yen	08105609606	Adagaedu@gmail	
8	Julius Ebhesi	ERASKON	Yen.	08067242504	–	
9	Precious Edet Okon	ERASKON	Yen	08034941670	Okonprecious001@gm	
10	Engr Usman Lucky	GEOENV	Field officer	08034525692	luckyusman55@yahoo	
11	Engr Austell Nwachukwu	GEO ENV	Operations	07067408135	austyno123@gmail.com	
12	Abu Ibrahim Clinton	GEO ENV	Operations	08138868081	Ibrahim.Clinton@yahoo.c	
13	Awe Oluwatobiloba L.	GEO Env.	Operations	08171201020	awetholy@gmail.com	

ERASKON NIGERIA LIMITED

APPENDIX THREE

BASELINE DATA FIELD TEAM ATTENDANCE SHEET

FEDERAL MINISTRY OF ENVIRONMENT, ABUJA

ATTENDANCE LIST FOR THE EIA BASELINE SURVEY OF THE PROPOSED 45,0000LITRES LUBRICATING OILS BLENDING PLANT IN IZEINBOU BUSH, GBARAN CLAN, YENAGOA LGA, BAYELSA STATE BY ERASON NIG LIMITED

DATE: 5TH AUGUST, 2020

S/NO	Names of Participants	Organization	Designation	Phone Nos.	E-mail Address	Signature
1	Benaga Gladys	FMENV	Regulator	08151851126	adekunle.gladys8@yahoo.com	
2.	ADESEHINWA ADEGBULUGBE	GEO ENV. RESOURCES LTD	ENVIRONMENTAL CONSULTANT	08163060517	gabriephilips@gmail.com	
3.	Alale George	FMEnv. Dyl	Controller	08033091392	alalegeorge@yahoo.ae	
4.	Imoyo J. J	MSNV-BYS	Director SAD	08063584528	demlesman@gmail	
5	Adaga Martins	ERASKON		08105609606	Adagacdu@gmail	
6	Engr Preye K. Nimame	ERASKO	Ops Mgr	08033136557	nimamep@gmail.com	
7	Barr. Kingsley Enegesi	ERASKO	CSP Officer	0803744802	Kingsley.enegesi@eraskoenergy.com	
8.	Ebhesi Julius	ERASKON	Tech.	08067242504		
9	Precious Edet OKON	ERASKO	Tech	08034941670	OKON precious001@gmail.com EOKON42@yah	
10	Engr. ISMAIL LUCKY	GEOENV	FIELD OFFICER	08034525692	luckyismaissa@yahoo.com	
11	Engr Austell Ihedioha	GEO Env	Operations	07067408135	austyno123@gmail.com	
12	Abu Ibrahim C.	GEO Env	Operations	08138868051	Ibrahim.Clinton@yahoo	
13	Awe Oluwatobiloba L.	GEO Env.	Operation	08171201020	awethoby@gmail.com	

ERASKON NIGERIA LIMITED

APPENDIX FOUR

SOCIO-ECONOMIC/FOCUS GROUP DISCUSSION ATTENDANCE SHEET FOR THE PROJECT HOST AND NEIGBORING COMMUNTIES

GEO ENVIRONMENTAL RESOURCES LIMITED
SOCIO ECONOMICS/FOCUS GROUP DISCUSSION
ATTENDANCE SHEET

PROJECT TITLE: EIA for Eraskon Nigeria Limited
PROJECT LOCATION: Izeinbou Bush, Gbaran Clan, Yenagoa LGA, Bayelsa State
DATE: 05/08/2020

S/N	NAME	ORGANISATION	TELEPHONE	E-MAIL	SIGNATURE	TIME
	AMOS LAYE	TUNAMA	09011725617			
	EMINA EBIKIENMO	TUNAMA	08025919246			
	OFOIN INIMO	TUNAMA	08132561598			
	HOPE GAMAGB	TUNAMA				
	JENNIFER OLALI	TUNAMA	09073562511			
	PREYE OGONA	TUNAMA				
	SOLOMON BOFA	TUNAMA	08174082190			
	PATRICK IPIDEI	TUNAMA				
	KEME MAGNUS	TUNAMA				
	TEMI EDMUND	TUNAMA	09065479275			
	JUNIOR NNEGI	TUNAMA				
	EBI MAB	TUNAMA				
	TAMM ROMEO	TUNAMA	08176281576			
	BODISERE EMI	TUNAMA				
	TIMI BOUBAI	TUNAMA				
	HILARY IKPUTU	TUNAMA	08077092518			
	OTOBO ALLEN	TUNAMA				
	BRIGHT BAKARI	TUNAMA				
	REUEL POUBINI	TUNAMA	09025181935			
	GOODDAY EDIDI	TUNAMA				
	TONYE ZIPREBO	TUNAMA				
	KEN BRA	TUNAMA	09076134586			
	SEIMO WALSON	TUNAMA				
	ROMEO SERE	TUNAMA				
	PRECIOUS TIMI	TUNAMA	08011973419			
	MERCY TARIYE	TUNAMA				
	LIZZY IKATUBOH	TUNAMA				

GEO ENVIRONMENTAL RESOURCES LIMITED

SOCIO ECONOMICS/FOCUS GROUP DISCUSSION

ATTENDANCE SHEET

PROJECT TITLE: EIA for Eraskon Nigeria Limited

PROJECT LOCATION: Izeinbou Bush, Gbaran Clan, Yenagoa LGA, Bayelsa State

DATE: 05/08/2020

S/N	NAME	ORGANISATION	TELEPHONE	E-MAIL	SIGNATURE	TIME
	MARTINS NANA	TUNAMA	08137654013			
	GODSPOWER TIMI	TUNAMA				
	QUEEN KENDO	TUNAMA				
	EBIMOBOWEI NANA	TUNAMA	07019347981			
	YERI DEKUMO	TUNAMA				
	STEPHEN EMI	TUNAMA	08016667897			
	TAMA LAMBERT	TUNAMA				
	JONAH DEKUMO	TUNAMA	09078911731			
	TOUPI OKPOBO	TUNAMA				
	AMOS TAMA	TUNAMA				
	JULIUS MORRIS	TUNAMA	08063792721			
	RITA YOUNG	TUNAMA				
	CHACHA BERES	TUNAMA				
	BODEI AGELE	TUNAMA	08033560971			
	MURPHY BEST	TUNAMA	09039287670			
	BODEI AGELE	TUNAMA				
	LUE PREYE	TUNAMA				
	OKUBAMA TIGA	TUNAMA				
	ANI JOHN	TUNAMA				
	BEATRICE SAMUEL	TUNAMA	08062347189			
	PENIEL SUONFA	TUNAMA	08172358910			
	BASIL KENBO	TUNAMA				
	OTOBO DANIEL	TUNAMA				
	LUCKY IMBOKO	TUNAMA	07063452717			
	OGOLO ENEFA	TUNAMA				
	INAS LEEN	TUNAMA	08037163570			
	LAWRENCE ASUQUO	TUNAMA				

GEO ENVIRONMENTAL RESOURCES LIMITED

SOCIO ECONOMICS/FOCUS GROUP DISCUSSION

ATTENDANCE SHEET

PROJECT TITLE: EIA for Eraskon Nigeria Limited

PROJECT LOCATION: Izeinbou Bush, Gbaran Clan, Yenagoa LGA, Bayelsa State

DATE: 05/08/2020

S/N	NAME	ORGANISATION	TELEPHONE	E-MAIL	SIGNATURE	TIME
	AMAEBI LYON	TUNAMA	09011534561			
	EBITIMI TONKUMOH	TUNAMA				
	BENJAMIN OPUENE	TUNAMA				
	PAKAPIRI WOKO	TUNAMA	08135711892			
	TIMI TIKO	TUNAMA				
	BOB DESMOND	TUNAMA	08031241694			
	NWINA ORDERLY	TUNAMA				
	FAITH OGBOMO	TUNAMA	09075245311			
	TEMERITY BONNKE	TUNAMA				
	ANDREW PEREKEME	TUNAMA				
	TIMI TARI	TUNAMA	08017572192			
	OKUMBIRI TIMIPERE	TUNAMA	08163271591			
	OJIKUTU OLAWALE	TUNAMA				
	OTOBO DOGOOD	TUNAMA	09071561372			
	ESINKUMO MESHACK	TUNAMA				
	EBI DRESSMAN	TUNAMA	08163175216			
	MATHIAS OKWORI	TUNAMA	08075241898			
	PARKINS OGEDE	TUNAMA				
	ELEKE GILNET	TUNAMA				
	DAVIDSON SAGBASON	TUNAMA	08162345691			
	INEYE JENNIFER	TUNAMA				
	DANIEL EBI	TUNAMA				
	ISAAC MOBIA	TUNAMA				
	PREYE WILLIAMS	TUNAMA	08173541976			
	GABRIEL EFEBO	TUNAMA				
	BUNA ALAMENE	TUNAMA				
	NIMIS ABULE	TUNAMA				

GEO ENVIRONMENTAL RESOURCES LIMITED

SOCIO ECONOMICS/FOCUS GROUP DISCUSSION

ATTENDANCE SHEET

PROJECT TITLE: EIA for Eraskon Nigeria Limited

PROJECT LOCATION: Izeinbou Bush, Gbaran Clan, Yenagoa LGA, Bayelsa State

DATE: 05/08/2020

S/N	NAME	ORGANISATION	TELEPHONE	E-MAIL	SIGNATURE	TIME
	TAMAR JOHN	TUNAMA	07011973216			
	KINDNESS SUNNY	TUNAMA				
	INIYE APPAH	TUNAMA				
	PREYE IKOLI	TUNAMA	08164592319			
	INIPERE JAMES	TUNAMA	09073211921			
	FRANCIS DAMINGO	TUNAMA				
	HAROLD NIMIS	TUNAMA				
	LEADER BINI	TUNAMA	08015673250			
	OKI TONY	TUNAMA				
	OLOTUKEME JOHN	TUNAMA				
	JUSTICE TONYE	TUNAMA	09075211672			
	AKPOFE EBI	TUNAMA				
	OKILO LONDON	TUNAMA				
	OTOBO ALLEN	TUNAMA	08162572018			
	GODGIFT INIYE	TUNAMA				
	BONNIE PROMINENT	TUNAMA				
	IYENIMI SLING	TUNAMA	09073215284			
	MERCY BIYE	TUNAMA	08085211972			
	INNOCENT OKIAKPE	TUNAMA				
	SAM KURO	TUNAMA	09021746719			
	SOLOMON AFAH	TUNAMA				
	THOMAS OBEGBAM	TUNAMA				
	SIMON BUNA	TUNAMA	07015792316			
	ENEGI PRAISEGOD	TUNAMA				
	BENJAMIN OGBARA	TUNAMA	08165278019			
	SIMON BUNA	TUNAMA				
	IBINMO NIGER	TUNAMA	09011768219			

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GEO ENVIRONMENTAL RESOURCES LIMITED

SOCIO ECONOMICS/FOCUS GROUP DISCUSSION

ATTENDANCE SHEET

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PROJECT LOCATION: Izeinbou Bush, Gbaran Clan, Yenagoa LGA, Bayelsa State

DATE: 05/08/2020

S/N	NAME	ORGANISATION	TELEPHONE	E-MAIL	SIGNATURE	TIME
	ETUELE ALANDU	OBUNAGHA	09034567320			
	OWEI JOBE	OBUNAGHA				
	GBOGU GIFT	OBUNAGHA	08172365210			
	EMILIA TARRIYE	OBUNAGHA				
	DIBOFA QUEEN	OBUNAGHA	09037276718			
	GABRIEL INAM	OBUNAGHA				
	AMAVTARI MELI	OBUNAGHA				
	AGBORU SEIMIEGHA	OBUNAGHA	09046798231			
	TOBOPERE SIMEON	OBUNAGHA				
	EBIKI THOMAS	OBUNAGHA	08171102010			
	TOBOPERE SIMEON	OBUNAGHA				
	KINGSLEY ATOKO	OBUNAGHA	08171281196			
	PREZIGHA FAFI	OBUNAGHA				
	KEZITO KASH	OBUNAGHA				
	SAMES JULIET	OBUNAGHA	09063367507			
	BERNARD FAITH	OBUNAGHA				
	ALEX TONBARA	OBUNAGHA				
	GRAHAM OPUBERE	OBUNAGHA				
	AZIBATO WILCOX	OBUNAGHA	08071637507			
	WEIBAA UYAKUMO	OBUNAGHA				
	BUBARAYE SUSAN	OBUNAGHA	09082312763			
	JATTO EBIERE	OBUNAGHA				
	PANEBI UGO	OBUNAGHA				
	PERESTUBO VICTOR	OBUNAGHA	08163456970			
	RAPHAEL BRIGHT	OBUNAGHA				
	INEYE GRACE	OBUNAGHA	09073589621			
	GEORGE EREFAGHA	OBUNAGHA				

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DATE: 05/08/2020

S/N	NAME	ORGANISATION	TELEPHONE	E-MAIL	SIGNATURE	TIME
	OBONBABEI ISAAC	OBUNAGHA	08012738970			
	ITUEGHI HOPE	OBUNAGHA				
	AGARA DESMOND	OBUNAGHA				
	BOLOUEBI DOGOOD	OBUNAGHA	09037672710			
	AGORO EGBE	OBUNAGHA	08139078121			
	OKPEKE EBIS	OBUNAGHA				
	OBONS JUSTICE	OBUNAGHA	07063671120			
	OPUENE DIDI	OBUNAGHA				
	JONAH EYENGOGHA	OBUNAGHA				
	JOY KABOWEI	OBUNAGHA	08197106811			
	ENIKIOUBI DIVINE	OBUNAGHA	09036671021			
	INEIFE PERES	OBUNAGHA				
	ANDERSON LAYEFA	OBUNAGHA	08163248121			
	YAKEGBA AWIKI	OBUNAGHA				
	AYAKPO OKIDI	OBUNAGHA				
	APPAH KALAS	OBUNAGHA	08021134390			
	FAFI JUDE	OBUNAGHA				
	INORU GEORGE	OBUNAGHA				
	INEMOTIKIVEI	OBUNAGHA	08173563217			
	POWEIGHA BEN	OBUNAGHA				
	OYABA JACOB	OBUNAGHA	09073245631			
	OLAZIDO BURUTOLU	OBUNAGHA				
	TARILABO BINA	OBUNAGHA				
	IPAMOKOBOERE JOY	OBUNAGHA	08173765410			
	INEYE JENNIFER	OBUNAGHA				
	ISAAC DINIPRE	OBUNAGHA				
	DIBAGHA PANEBI	OBUNAGHA				

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DATE: 05/08/2020

S/N	NAME	ORGANISATION	TELEPHONE	E-MAIL	SIGNATURE	TIME
	ADUBA BRIAN	OBUNAGHA	09037218910			
	DIONGOLI DADI	OBUNAGHA	07061528631			
	EBIKPOEMI BOBBY	OBUNAGHA				
	MOTIMIFAGHA WENER	OBUNAGHA				
	OKPONYA OWEN	OBUNAGHA				
	ZITUA ZITUA	OBUNAGHA				
	ANGAYE WISDOM	OBUNAGHA	08161231521			
	MILTON YALAH	OBUNAGHA				
	DIRI AMOS	OBUNAGHA	08030563110			
	BODISERE WORU	OBUNAGHA				
	TONY OKI	OBUNAGHA				
	DANIEL OFONIAMA	OBUNAGHA	07045312730			
	YALAPI BOLOU	OBUNAGHA				
	EBI OLOLO	OBUNAGHA				
	OGREGADE KELVIN	OBUNAGHA				
	LUKAS PEKENE	OBUNAGHA	09036541310			
	PAUL EBIKESEWE	OBUNAGHA				
	OWEI MICHAEL	OBUNAGHA				
	SEHU MUSA	OBUNAGHA	08162839114			
	OTOKO INOWEI	OBUNAGHA				
	BURUBOYEFE DON	OBUNAGHA				
	SILAS BORNO	OBUNAGHA	08134214410			
	CLAUDIUS TIMI	OBUNAGHA				
	ISAAC TOPMAN	OBUNAGHA	08023562011			
	EBIOKPO EWELI	OBUNAGHA				
	ARANKA JULIUS	OBUNAGHA	08045637940			
	OLOKUMO RUTH	OBUNAGHA	08134763821			

ERASKON NIGERIA LIMITED

GEO ENVIRONMENTAL RESOURCES LIMITED

SOCIO ECONOMICS/FOCUS GROUP DISCUSSION

ATTENDANCE SHEET

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PROJECT LOCATION: Izeinbou Bush, Gbaran Clan, Yenagoa LGA, Bayelsa State

DATE: 05/08/2020

S/N	NAME	ORGANISATION	TELEPHONE	E-MAIL	SIGNATURE	TIME
	RUTH PETER	OBUNAGHA	08163579820			
	ABILA MARY	OBUNAGHA				
	TIMI SEASON	OBUNAGHA	09072389617			
	NDUTIMIPERE ORUPOU	OBUNAGHA				
	EBIKIBINA TARABINA	OBUNAGHA	08122134678			
	KEMEBI ALIKA	OBUNAGHA				
	TUBU MERCY	OBUNAGHA	09081707021			
	AYIBAOKPO TEE	OBUNAGHA				
	DOUBARA FAFI	OBUNAGHA	07021862941			
	DAVID WEKUMO	OBUNAGHA				
	MOTIMIFAGHA JUDE	OBUNAGHA				
	TARI VINCENT	OBUNAGHA	08033677291			
	OLOTU DINPREBOFA	OBUNAGHA				
	BILABOU RUTA	OBUNAGHA	08121962814			
	UNDUS AGBOZU	OBUNAGHA				
	TIMI ETIFA	OBUNAGHA				
	ESTHER YALAH	OBUNAGHA	0813459861			
	OKOBA GABRIEL	OBUNAGHA				
	TONYE ABADANI	OBUNAGHA				
	VICTORIA BODUS	OBUNAGHA	09027111363			
	OVIETEME GEORGE	OBUNAGHA				
	JOHN AJOKO	OBUNAGHA				
	DIMIE PERES	OBUNAGHA	07032763198			
	KOFI AZIBAOLA	OBUNAGHA				
	DIRI BUBOYE	OBUNAGHA				
	GESIYE ORUAKAIN	OBUNAGHA				
	DOUYE ITUECHI	OBUNAGHA	08163579812			

GEO ENVIRONMENTAL RESOURCES LIMITED

SOCIO ECONOMICS/FOCUS GROUP DISCUSSION

ATTENDANCE SHEET

PROJECT TITLE: EIA for Eraskon Nigeria Limited

PROJECT LOCATION: Izeinbou Bush, Gbaran Clan, Yenagoa LGA, Bayelsa State

DATE: 05/08/2020

S/N	NAME	ORGANISATION	TELEPHONE	E-MAIL	SIGNATURE	TIME
	UBAHA MMILI	POLAKU	08039230473		[illegible]	
	JOY EDO	POLAKU				
	FAITH UMBU	POLAKU				
	RAPHAEL ANTHONY	POLAKU	08182772559		[illegible]	
	VICTORY TAMUNO	POLAKU				
	DENGIMOERE EBI	POLAKU	08055264390		[illegible]	
	FRANCIS ROMEO	POLAKU	08064852727		[illegible]	
	AYAFA COMFORT	POLAKU				
	FRED ABIADE	POLAKU				
	DARIUS DILO	POLAKU	08161212379		[illegible]	
	RUFUS SOLOMON	POLAKU				
	JOHN CHIMASI	POLAKU	08023362685		[illegible]	
	JASON AMAYA	POLAKU				
	COTONOU BINTARI	POLAKU				
	SYLVIA CHISHOKE	POLAKU	08099994499		[illegible]	
	BUSERI EBIKABO	POLAKU				
	GBOLAKORO BLESSING	POLAKU				
	JUSTINA PAMO	POLAKU	08179706338		[illegible]	
	BOMA SIMON	POLAKU	08012696250		[illegible]	
	JOHN MARIAM	POLAKU				
	NORA KARAMO	POLAKU	08013134245		[illegible]	
	IRENE McDonald	POLAKU	08080451572		[illegible]	
	TARILADEI WALTER	POLAKU				
	EBIKIRI CLEVER	POLAKU	08036192658		[illegible]	
	PAUL AGANABA	POLAKU	08158715999		[illegible]	
	TARI AMAKORU	POLAKU				
	DESMOND PARIS	POLAKU				

ERASKON NIGERIA LIMITED

GEO ENVIRONMENTAL RESOURCES LIMITED

SOCIO ECONOMICS/FOCUS GROUP DISCUSSION

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DATE: 05/08/2020

S/N	NAME	ORGANISATION	TELEPHONE	E-MAIL	SIGNATURE	TIME
	TIM NANAS	POLAKU	08138659806		[illegible]	
	EKWERI ANNOINTED	POLAKU				
	CHARLES EBIEMI	POLAKU				
	KURAH AYIBANOA	POLAKU	08035956540		[illegible]	
	MAUREEN GOODLUCK	POLAKU	08033559971		[illegible]	
	ABAS NYONG	POLAKU				
	MARK DIAMINI	POLAKU				
	GILDA ANTHONY	POLAKU	08036166301		[illegible]	
	JOSEPH NWOGWU	POLAKU				
	KATE OKURU	POLAKU				
	EBIPAMOWEI INGA	POLAKU	08146948842		[illegible]	
	OGBENETEGA G.	POLAKU				
	PIPA BOUTUAOWEI	POLAKU				
	PECULIAR MOSES	POLAKU	07041858189		[illegible]	
	BEINMOTE OSAKEME	POLAKU				
	BRIGHT NAUAI	POLAKU				
	ROLAND IKUROMO	POLAKU				
	IBOUBO NANABOEMI	POLAKU				
	BELEMA DAGOGO	POLAKU	08083234315		[illegible]	
	BAMUS ULOLO	POLAKU				
	MINH NGUYEN	POLAKU	08023770157		[illegible]	
	EDEN ITU	POLAKU				
	KUKU NATARI	POLAKU				
	KIM KEMEPRE	POLAKU	08062566654		[illegible]	
	VIRTUE AKPURUKU	POLAKU				
	CHRIS NWAKON	POLAKU	07063160366		[illegible]	
	SEIYEFA UGO	POLAKU				

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	TARI JOHN	POLAKU	08182772559		[illegible]	
	PRECIOUS AGANABA	POLAKU				
	SARAH DATEME	POLAKU				
	WISDOM NICK	POLAKU	08055264390		[illegible]	
	EBUBE ABA	POLAKU	08064852727		[illegible]	
	RICHARD OYABRAD	POLAKU				
	GIFT MARCELO	POLAKU				
	FRANCIS BOLOUERE	POLAKU	08162123791		[illegible]	
	MARTINS KEVILE	POLAKU				
	COMFORT AYAFA	POLAKU	08023362685		[illegible]	
	BENEDICT OGIDI	POLAKU				
	CYNTHIA OGBOLE	POLAKU	08099997356		[illegible]	
	FAVOUR OGBEBE	POLAKU				
	SIMEON UME	POLAKU				
	PRAISE ACHALU	POLAKU				
	ISREAL OSAGIE	POLAKU	08055330616		[illegible]	
	OBUA FAITH	POLAKU				
	IFEOMA ANIMBA	POLAKU				
	LOVELYN AMUSI	POLAKU	08052250679		[illegible]	
	KATE NEWMAN	POLAKU				
	ASUKA PROSPER	POLAKU				
	VICTOR TORBORLAYEFA	POLAKU	08080451572		[illegible]	
	APIA EMMANUEL	POLAKU				
	IMOMOEMI WISDOM	POLAKU				
	EBIEGBERI GODWIN	POLAKU	08142696250		[illegible]	
	FRANK OBOKU	POLAKU				
	IPREDEYE BASSEY	POLAKU	08023170157		[illegible]	

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S/N	NAME	ORGANISATION	TELEPHONE	E-MAIL	SIGNATURE	TIME
	DIEPIRIYE EBI	OKOLOBIRI	08173245912			
	AZI EBITIMI	OKOLOBIRI				
	JUSTELLE NGAMI	OKOLOBIRI	09073128911			
	IGINA TRACY	OKOLOBIRI				
	EBIERE AMAKS	OKOLOBIRI	08063573218			
	RICHARD ORUFA	OKOLOBIRI				
	RHOLIN ODIKEME	OKOLOBIRI	08173271192			
	YEIGBA ESTHER	OKOLOBIRI	08092389621			
	GOODLUCK OGBA	OKOLOBIRI				
	BLESSING OMOPE	OKOLOBIRI				
	OBRIZI PETER	OKOLOBIRI				
	FAVOUR JOSEPH	OKOLOBIRI	08012456811			
	MSAYI GUMLA	OKOLOBIRI				
	OWEI JUDE	OKOLOBIRI				
	ISAIAH EMOMOTIMI	OKOLOBIRI	08094832511			
	PERE EBI	OKOLOBIRI				
	JUMBO ERE	OKOLOBIRI				
	YEIGBA JOSIAH	OKOLOBIRI	07074563412			
	SANTEL KOKO	OKOLOBIRI	08171231567			
	SUKU IBOMZI	OKOLOBIRI				
	STEPHEN IZEDONW	OKOLOBIRI				
	WOYENG PREYE	OKOLOBIRI	08011921785			
	TIMIPRE RICHARD	OKOLOBIRI				
	PRINCE OTOWORO	OKOLOBIRI				
	EBIERE BERE	OKOLOBIRI	09031761532			
	VICTORIOUS EBEM	OKOLOBIRI				
	ASIEMO CHRISTABEL	OKOLOBIRI				

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S/N	NAME	ORGANISATION	TELEPHONE	E-MAIL	SIGNATURE	TIME
	PEREOWEI SMART	OKOLOBIRI	09134563141			
	OKPOWE JUDE	OKOLOBIRI				
	TOMMY EBIAKPO	OKOLOBIRI				
	AKPURUKU AUSTIN	OKOLOBIRI				
	AMIEBI TIMOTHY	OKOLOBIRI	08718619310			
	SOLOMON WEREGBA	OKOLOBIRI	09031241911			
	ALUGE GIFT	OKOLOBIRI	08041861410			
	UGESE BEN	OKOLOBIRI				
	JESSICA NDIRIPO	OKOLOBIRI				
	SAMUEL EBI	OKOLOBIRI				
	OCHUKO EMMA	OKOLOBIRI	08172231520			
	ANITA BENJAMIN	OKOLOBIRI				
	YEIGBA WISDOM	OKOLOBIRI				
	EBI MUKE	OKOLOBIRI	08131563015			
	GLORIA MACKSON	OKOLOBIRI	09072231568			
	JULIET FABIAN	OKOLOBIRI				
	EMI SAUL	OKOLOBIRI	09172231562			
	GODSPOWER BEREDUGO	OKOLOBIRI				
	KPUN EBIMO	OKOLOBIRI				
	DESTINY ETIMO	OKOLOBIRI				
	EBI OGINIKE	OKOLOBIRI	08163478210			
	SAMUEL AKPOMIE	OKOLOBIRI				
	OWEISANA OYINLAYEFA	OKOLOBIRI				
	GENESIS JABULANI	OKOLOBIRI	09034564711			
	ZEBULUN ALAYE	OKOLOBIRI				
	KEME JAMES	OKOLOBIRI	08172115672			
	TAMUNO JENEWARI	OKOLOBIRI				

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S/N	NAME	ORGANISATION	TELEPHONE	E-MAIL	SIGNATURE	TIME
	ONISOKPESEME V.	OKOLOBIRI	08163478870			
	JUDE OFOROFO	OKOLOBIRI				
	CHIJIOKE ALERU	OKOLOBIRI				
	AYEBATARI KEME	OKOLOBIRI				
	EVANS OKIA	OKOLOBIRI	07064563910			
	CHERISH EFE	OKOLOBIRI	08073274829			
	WISDOM OMEKWE	OKOLOBIRI				
	OSAEMEKE JOY	OKOLOBIRI	08103641531			
	OTELE PECULIAR	OKOLOBIRI				
	OKIOGU EBIOWOR	OKOLOBIRI	09037143761			
	GODKNOWS ENOCH	OKOLOBIRI				
	DANIEL OGBOMA	OKOLOBIRI				
	JAMES RUTH	OKOLOBIRI	08163789410			
	TIMAYA OJA	OKOLOBIRI				
	EMMANUEL ONUNU	OKOLOBIRI				
	JIKUME SAMUEL	OKOLOBIRI	09036814731			
	PRINCE IKAH	OKOLOBIRI				
	TOKONI WEEK	OKOLOBIRI	08164041871			
	JUDE OKOSON	OKOLOBIRI				
	ONIGBMO FAWAZ	OKOLOBIRI				
	CHIDALU NZOM	OKOLOBIRI	08173481671			
	NWEKE EKENE	OKOLOBIRI				
	EGWOREFA PAUL	OKOLOBIRI				
	JOHNSON AKNEGBE	OKOLOBIRI	08034541791			
	EBI AWINE	OKOLOBIRI	08192863411			
	OGHENEGWEKE ISREAL	OKOLOBIRI				
	OTES JOHN	OKOLOBIRI				

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S/N	NAME	ORGANISATION	TELEPHONE	E-MAIL	SIGNATURE	TIME
	BIONGBO GLORY	OKOLOBIRI				
	OPULA OKORO	OKOLOBIRI	08131741640			
	PEACE ANYIKE	OKOLOBIRI				
	OTITO SAMUEL	OKOLOBIRI	08031473215			
	PRINCE DEBE	OKOLOBIRI				
	ASUKA WOYENGI	OKOLOBIRI	09035781920			
	OMANIE EBIYE	OKOLOBIRI				
	OTOLO BLESS	OKOLOBIRI	08172935720			
	OGHENEVWEDE JOY	OKOLOBIRI				
	PETER KALAIGO	OKOLOBIRI	08120719628			
	DINIPRE PROGRESS	OKOLOBIRI				
	EBI SOLOMON	OKOLOBIRI	09045671293			
	BRIGHT UFOMA	OKOLOBIRI				
	ODEDE VICTORY	OKOLOBIRI				
	TIMINIPR WOYENG	OKOLOBIRI	08135611873			
	ODI ADELEKE	OKOLOBIRI				
	OBAKANA FAME	OKOLOBIRI	07063578911			
	LESEDI HENRY	OKOLOBIRI	08164512398			
	JOHN EBI	OKOLOBIRI				
	TOUMO MICAH	OKOLOBIRI	08074189615			
	TARIMOBOWEI F.	OKOLOBIRI				
	ITU PROMISE	OKOLOBIRI				
	AMBELI DEBORAH	OKOLOBIRI	09073249968			
	WALSON EBI	OKOLOBIRI				
	CLARK NELSON	OKOLOBIRI				
	DUFA SAEYUNG	OKOLOBIRI				
	OM GODSTIME	OKOLOBIRI				

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S/N	NAME	ORGANISATION	TELEPHONE	E-MAIL	SIGNATURE	TIME
	ETIPOU AGADAH	KOROAMA				
	PRECIOUS OGREGA	KOROAMA	08022038101		[illegible]	
	UTOVIE EGBA	KOROAMA				
	CHRISTIAN PORIPOO	KOROAMA	09071876354		[illegible]	
	PEACE EBERI	KOROAMA				
	JULIUS BOKORU	KOROAMA				
	JAMES MATT	KOROAMA	08162519887		[illegible]	
	CALABAR ARIMIEYE	KOROAMA				
	EBI ALFREDS	KOROAMA				
	AREBEBEOYAGHA T.	KOROAMA	08172334561		[illegible]	
	ADA GWEGWE	KOROAMA	08023201622		[illegible]	
	PETER KAKATEI	KOROAMA				
	EKEMI BECKY	KOROAMA				
	ESTHER IBIKARI	KOROAMA	08023068184		[illegible]	
	KALIO JANET	KOROAMA				
	RUTH EBISINIMI	KOROAMA				
	VINCENT KIENIMOVIE	KOROAMA	07035927621		[illegible]	
	EGEMUZE OTULO	KOROAMA				
	JANICE MELVIN	KOROAMA				
	PAUL TIMI	KOROAMA				
	EMMANUEL OVUNDA	KOROAMA	08178812910		[illegible]	
	TIMI KPUN	KOROAMA				
	KEN OKOKO	KOROAMA				
	OVIE OMELEH	KOROAMA	08171113216		[illegible]	
	PERE PABLO	KOROAMA				
	DEE MUTIN	KOROAMA				
	SARA IBITORU	KOROAMA				

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S/N	NAME	ORGANISATION	TELEPHONE	E-MAIL	SIGNATURE	TIME
	TOUPI OKPOBO	KOROAMA	08165219617			
	BEBABA ABAYE	KOROAMA				
	PREYE OWUTUAMO	KOROAMA	09073765217			
	INEIKADE TIMITIMI	KOROAMA				
	JACOB MUME	KOROAMA	08164598281			
	EBI FRED	KOROAMA				
	TAMARA EZEKIEL	KOROAMA	09011921542			
	ATABIRI SEIGHA	KOROAMA				
	ELIJAH MOSISE	KOROAMA				
	TARINHO THOMAS	KOROAMA				
	UNGOBOS IKETE	KOROAMA	08163542150			
	ZIKIYE JUDE	KOROAMA	08075061591			
	GIFT APROKO	KOROAMA				
	OSHO FATAI	KOROAMA				
	EKENE AMADI	KOROAMA	09073219681			
	FRED GODEN	KOROAMA				
	DENNIS GUEMBE	KOROAMA				
	LALA ABOYE	KOROAMA	08191765219			
	DENNIS GUEMBE	KOROAMA				
	ZEUS BURUBOYEFE	KOROAMA				
	EDUVIE OGOHAFOR	KOROAMA	07011986250			
	OVOKE BENARD	KOROAMA				
	OYABA JACOB	KOROAMA	08019065219			
	JOHN ETUK	KOROAMA				
	KENNETH OTOBO	KOROAMA	09021575509			
	OPUBO JAPHET	KOROAMA				
	FELIX BENJAMIN	KOROAMA				

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S/N	NAME	ORGANISATION	TELEPHONE	E-MAIL	SIGNATURE	TIME
	ELAH JOY	KOROAMA	08163215782			
	JOSHUA UGE	KOROAMA				
	ESIADA OMONIGHO	KOROAMA				
	PAUL OKORO	KOROAMA	09063579217			
	GEORGE AKPAYEN	KOROAMA				
	TONYE SOLOMON	KOROAMA				
	ERNEST ONOMUEFE	KOROAMA	08067375412			
	OPUKEME STEPHEN	KOROAMA				
	DAVID ORIANZI	KOROAMA	08172089521			
	PAUL REUBEN	KOROAMA				
	YAKUBU FELIX	KOROAMA	08056798211			
	EBIMOTIMI NOEL	KOROAMA				
	EBENEZER ATAYARO	KOROAMA	08192179817			
	OBUEBITE SUNDAY	KOROAMA				
	APPAH KALAS	KOROAMA	09072186712			
	AWUDUMU REIGNETH	KOROAMA				
	DIDI OPUENE	KOROAMA				
	OYABA JACOB	KOROAMA	08017673811			
	ABAIYABAWA PAUL	KOROAMA				
	YERI DEKUMO	KOROAMA	09011973216			
	BODRI AGALE	KOROAMA				
	KEI TIMIPAH	KOROAMA				
	PROMISE DOMINIC	KOROAMA	07011673216			
	IGONI CHRISTIANA	KOROAMA				
	ISAAC DINIPRE	KOROAMA	08179120196			
	WERIS TIKE	KOROAMA				
	FELIX ATIE	KOROAMA				

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	ODEDE PRECIOUS	KOROAMA	08162584513			
	AMAIGBANI DORTA	KOROAMA				
	ALOGIDI TAMMY	KOROAMA				
	JONAH EYENGOGHA	KOROAMA	07011345673			
	ETE OPUSAM	KOROAMA				
	GINAH IKIO	KOROAMA				
	AUGUSTA OFORSI	KOROAMA	08015763218			
	JOHN SAMBO	KOROAMA				
	KATE PRIYE	KOROAMA				
	GRACE FAKIMI	KOROAMA	09017268572			
	JULIUS OKI	KOROAMA				
	EBINEBO ESAU	KOROAMA				
	ARIRI KEME-EBIYE	KOROAMA	08114567232			
	BODMAS KEME	KOROAMA				
	HENRY FENTE	KOROAMA				
	NIMIZUOA EGBE	KOROAMA				
	GIFT LOVE	KOROAMA	08062519817			
	SASIME DICKSON	KOROAMA	07017321672			
	NUMIPRE ISAAC	KOROAMA				
	OZU FREDRICK	KOROAMA				
	ALIYAH RASAK	KOROAMA	08162345670			
	ESTHER BUSERI	KOROAMA				
	SINWIE GODWIN	KOROAMA				
	RICHARD PEREYEI	KOROAMA				
	LUCIA FAKIMI	KOROAMA	09072511920			
	PERE BETHEL	KOROAMA	08137045624			
	ETIPOU AGADAH	KOROAMA				

APPENDIX FIVE

FEDERAL MINISTRY OF ENVIRONMENT (FMENV) ESIA SITE VERIFICATION LETTER

FEDERAL MINISTRY OF ENVIRONMENT

Environment House

Independence Way South, Central Business District, Abuja - FCT.
Tel: 09-2911 337 Email:ea@ead.gov.ng, www.ead.gov.ng

ENVIRONMENTAL ASSESSMENT DEPARTMENT

FMENV/EA/EIA/5437/Vol.1/73
17th August, 2020.

The Managing Director,
Eraskon Nigeria Limited,
El-Al Court, Plot 35, Chief Yesufu Abiodun,
Oniru, Victoria Island,
Lagos State.

RE: APPLICATION FOR THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT(ESIA) OF ERASKON NIGERIA LIMITED PROPOSED 45,000 LITRES LUBRICATING OILS BLENDING PLANT IN IZEINBOU BUSH, GBARAN CLAN, YENAGOA LGA, BAYELSA STATE.

Please refer to your letters dated 4th May, 2020 and 10th August, 2020 on the above subject.

2. Following the conclusion of the EIA Site Verification exercise, the Ministry has placed the project in Category One (1) EIA process with a one season baseline survey exercise in line with International Best Practices: secondary data may be sourced from existing EIA approved data within the zone of influence of the proposed project . Please note that the Ministry shall participate in the exercise alongside the Laboratory Analysis of the samples collected.

3. You are also required to conduct a scoping workshop involving relevant stakeholders in attendance while the regulators from the Federal and State Ministries of Environment shall participate as observers.

4. A report of the scoping workshop and the projects Terms of Reference (ToR) incorporating significant issues raised at the scoping should be submitted to the Ministry before proceeding to the next stage of the EIA process. Also, the parameters and sampling units in the TOR shall be the minimum requirement for the EIA study.

5. The laboratory analysis of the samples shall be carried out in a FMEnv accredited laboratory .Also, you are to ensure full quality assurance /quality control (QA/QC) measures for the laboratory analyses in line with standard practices and notify the Ministry in good time to enable adequate participation in the exercise.

6. The following should be forwarded to the Federal Ministry of Environment before submission of the Draft EIA Report;

   i. Evidence of accreditation of the Federal Ministry of Environment for the Laboratory where the samples analysis would be carried out.
   ii. Chain of custody
   iii. Certificate of Analysis duly stamped and signed by the laboratory Manager.
   iv. Evidence of Laboratory witnessing by the Federal Ministry of Environment.

7. Consequently, you are to submit Ten (10) hard and two (2) electronic copies of the Draft Environmental Impact Assessment (EIA) Report and also mail a copy to eia@ead.gov.ng.

8. You may contact the undersigned on number 08055270104 for further information on the exercise.

9. Thank you for your cooperation.

Joshua, Taiwo L.
For: Honourable Minister

APPENDIX SIX

AIR EMISSIONS DISPERSION MODELLING

**Air Emissions Dispersion Modelling:
Proposed Eraskon Nigeria Limited
50,000 Litres/day Lubricating Oils Blending Plant
Gbaran,
Yenagoa Local Government Area
Bayelsa State, Nigeria**

Report Prepared for:

Eraskon Nigeria Limited
C/O Geo Environmental Resources Limited
Suite SB 81, New Banex Plaza,
Aminu Kano Crescent, Wuse II,
Abuja
FCT. Nigeria

By:

Jacob Ademola Sonibare, ***Ph.D***
(MNSE; MNSChE; R.Eng)
Professor of Chemical Engineering
Environmental Engineering Research Laboratory
Department of Chemical Engineering
Obafemi Awolowo University
Ile-Ife. Nigeria

+234-8033837896
asonibar@oauife.edu.ng and asonibar@yahoo.com

September 2020

Report Title	Air Emissions Dispersion Modelling: Proposed Eraskon Nigeria Limited 50,000 Litres/day Lubricating Oils Blending Plant, Gbaran, Yenagoa Local Government Area, Bayelsa State, Nigeria
Technical Report No.	Cleanair/Modelling/589
Released By	Engr. Prof. J.A. Sonibare (R.8671) Consultant Air Quality & Noise Specialist/Life Cycle Analyst
Date Released	6th September 2020
Signature	06-09-2020

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ACRONYMS AND ABBREVIATIONS

FMEnv	-	Federal Ministry of Environment
CO	-	carbon monoxide
HC	-	hydrocarbon
NO_x	-	oxides of nitrogen
SO_2	-	sulphur dioxide
PM_{10}	-	particulate matter less than 10.0 microns in diameter
AGO	-	Automotive Gas Oil (Diesel)
SE	–	Southeast
E	–	East
SW	–	South West
N	–	North
NE	–	Northeast
NW	–	Northwest
MW	–	Megawatts
PMS	-	Premium Motor Spirit
TSP	–	Total suspended particulates
WHO	–	World Health Organization

EXECUTIVE SUMMARY

An air emission dispersion modelling has been carried out on the the proposed Eraskon Nigeria Limited 50,000 Litres per Day (LPD) lubricating oils blending plant. It is proposed to be located in Izeinbou Bush, Tunama Community, Gbaran Clan, Yenagoa Local Government Area (LGA), Bayelsa State. This is in support of the Environmental Impact Assessment (EIA) of the project. The ISC-AERMOD View (Version 8.2.0) air emission dispersion modelling was used in the study to investigate two operating scenarios. The identified and investigated air pollutants include carbon monoxide (CO), sulphur dioxide (SO_2), oxides of nitrogen (NO_X), total suspended particulates (TSP) and volatile organic compounds (VOCs). These are from two units 500 kva electric power generators and the neighbouring two units 112.5 MW Gbaran National Independent Power Plant.

From the simultaneous operation of the two units 500 kva generator, the 24-hour CO is 0.03 – 3.46 $\mu g/m^3$. Its 1-hour SO_2 is 0.02 – 1.79 $\mu g/m^3$ with 24-hour level of 0.01 – 1.05 $\mu g/m^3$. The 1-hour, 24-hour and annual NO_x are 0.3 – 27.3 $\mu g/m^3$, 0.2 – 16.0 $\mu g/m^3$ and 0.04 – 4.32 $\mu g/m^3$ respectively with respective SPM levels of 0.02 – 1.93 $\mu g/m^3$, 0.01 – 1.13 $\mu g/m^3$ and 0.0 – 0.30 $\mu g/m^3$. Its 24-hour VOCs is 0.01 – 1.27 $\mu g/m^3$. The cumulative ground level concentrations air pollutants from simultaneous operations of the 2 x 500 kva and the 250 MW Gbaran NIPP (***scenario 2)*** show 24-hour CO of 2.9 – 287.1 $\mu g/m^3$. Their 1-hour and 24-hour SO_2 are 0.3 – 33.7 $\mu g/m^3$ and 0.2 – 19.6 $\mu g/m^3$ respectively with respective 1-hour, 24-hour and annual NO_X of 51.3 – 5127.7 $\mu g/m^3$, 29.9 – 2986.5 $\mu g/m^3$ and 4.0 – 376.0 $\mu g/m^3$. Their 1-hour SPM is 0.47 – 47.31 $\mu g/m^3$ with 24-hour level of 0.3 – 27.6 $\mu g/m^3$ and annual level of 0.03 – 3.50 $\mu g/m^3$. The cumulative 24-hour VOCs is 0.09 – 8.77 $\mu g/m^3$.

All the maximum ground level concentrations from the 2 x 500 kva generators are within their respective limits. While the cumulative maximum concentrations are also within their respective limits for all the other investigated air pollutants, NO_X concentrations breach their respective limits. However this is attributed to the existing Gbaran NIPP.

CHAPTER ONE

INTRODUCTION

1.0 Preamble

An air emission dispersion modelling carried out in support of Environmental Impact Assessment (EIA) of the proposed 50,000 Litres per Day (LPD) lubricating oils blending plant is presented in this report. The facility is proposed by Eraskon Nigeria Limited, a member of Eraskorp Nigeria Limited (ENL) which is an industrial conglomerate with assets and operating interests in natural resources, infrastructure and services. It shall be in Izeinbou Bush, Tunama Community, Gbaran Clan, Yenagoa Local Government Area (LGA), Bayelsa State.

This study was commissioned by Geo Environmental Resources Limited, Suite 22, Sheriff Plaza, Wuse II, Abuja, FCT, Nigeria. It was carried out by Engr. Jacob Ademola Sonibare, ***a Professor of Chemical Engineering, Consultant Air Quality Expert, Noise Specialist, and Life Cycle Analyst*** with the Environmental Engineering Research Laboratory, Chemical Engineering Department, Obafemi Awolowo University, Ile-Ife, Nigeria. Presented in this report are the details of the protocol employed and findings of the study.

The Plant is proposed on 79248.426 m^2 (7.925 ha) of land in Izeinbou Bush, Tunama Community, Gbaran Clan, Yenagoa Local Government Area, Bayelsa state. The site area is defined by coordinates 199806 Northing and 556134 Easting in the Northwest, 200171 Northing and 556091 Easting in the Northeast, 200139 Northing and 555624 Easting in the Southwest and 200177 Northing and 555635 Easting in the Southeast with average elevation of 22 m above sea level. As shown in Figure 1.1, this site is bordered to the west by River Nun. To its North is Koroama, a neigbouring community at about 1 km North. East of the site is the Gbaran NIPP power plant at about 300 m away, as well as the project host community, Tunama, which is roughly about 800 m from the project site. On the Southern flank of the proposed project site are the Azikel Modular Refinery (700 m away) and the SPDC Gas Gathering Facility (1 km from site).

The proposed project is a lubricating oil blending plant involved in the mixing and blending of base mineral oil with additives to produce blended lubricants. It shall be of 50,000 Litres per day capacity operating on a 20% additive raw materials with 36,000 implied daily feedstock. It consists of Base oil tanks: 2 storage & feed tanks for SN-150 each of 300,000 litres capacity, 2 storage & feed tanks for SN-300 each of 300,000 litres capacity and 3 storage & feed tanks for SN-600 each of 300,000 litres capacity. Its final product storage tanks are: a lube storage tank for SAE 20W-50 (300,000 litres capacity), a lube storage tank for SAE 15W-40 (300,000 litres capacity), 2 lube storage tanks for SAE 40 range (each of 100,000 litres capacity), and a lube storage tank (back-up) of 100,000 litres capacity. There shall be five storage tanks for additives with each having 50,000 litres capacity. To service these storage tanks are pumps and piping system, Reception and Loading Bays (Tank Trucks) as well as Metering skids. Its blending facility shall include two complete ABBs handling 5 batches/day each handling 18,000 litres per facility. These shall be equipped with a Control Panel, a Filling Station for 1 litre and 5 litres container, and a Drum decanting and additive metering unit. The facility shall also be serviced with a 3 ton Forklift.

Emissions inventory of criteria air pollutants was carried out on the proposed facility. Their ground level associated air pollutants' concentrations within 20 km radius Zone of Influence (ZoI) were computed and compared with the standards of ambient air quality derived from the World Bank Environmental Guidelines, and the Nigerian Ambient Air Quality Standards of the Federal Ministry of Environment (FMEnv).

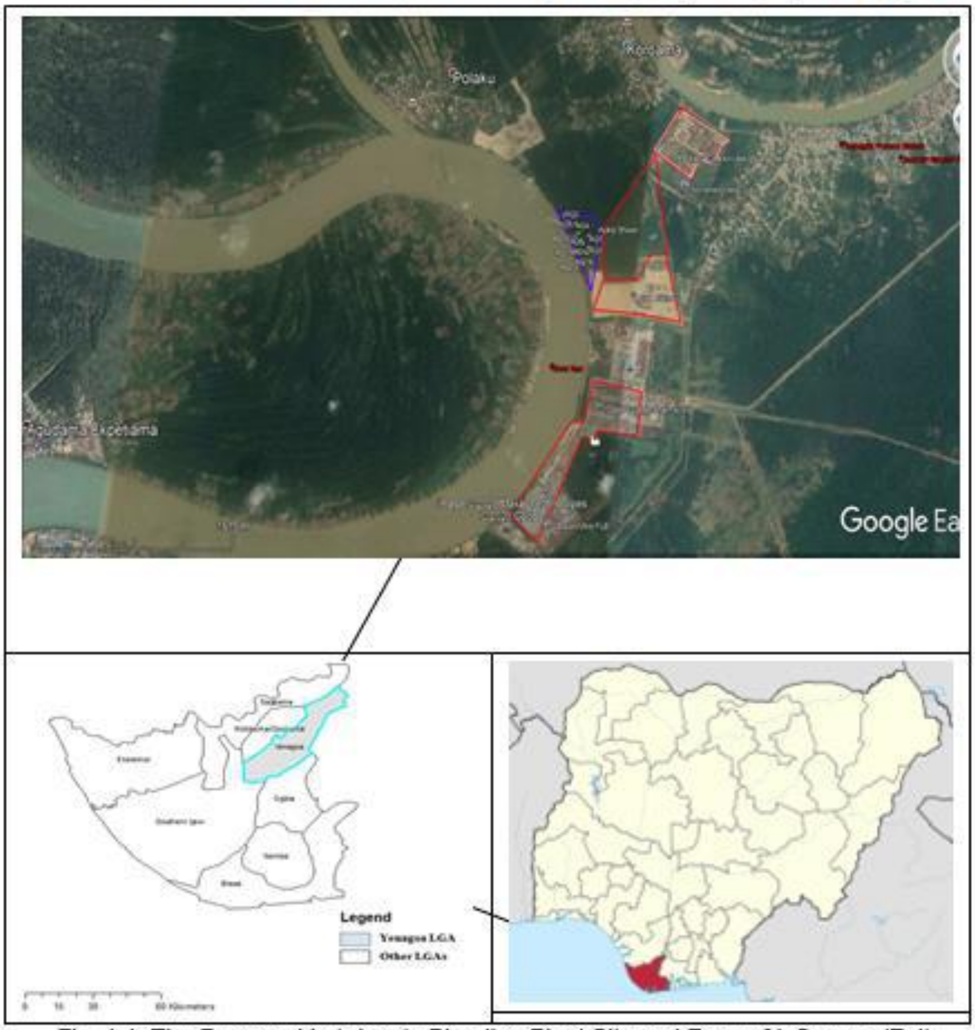

Fig. 1.1: The Proposed Lubricants Blending Plant Site and Zone of Influence (ZoI)

1.1 Purpose and Objectives

The aim of this study is to assess the impacts of air quality associated with operation of the proposed lubricating oils blending plant. This is achieved through the following activities:

i. Identification of air emissions sources originating from the proposed blending plant;
ii. Quantification of air pollutants from the identified emission sources;
iii. Execution of air emission dispersion modelling for the proposed blending plant; and
iv. Prediction of change in ground level air quality associated with the plant.

1.2 Legal, Regulatory and Administrative Framework

This air emission dispersion modelling has been conducted in accordance with relevant laws, guidelines, standards and conventions.

1.2.1 National Ambient Air Quality Standards (NAAQS), Nigeria

Nigeria has ambient air quality standards which recognize that emissions from industries and other sources may have impact on ambient air quality. For this reason, it prescribes guidelines for safe levels of air pollutants tolerable to humans, aquatic organisms and vegetation. The main objective of the standards is to ensure that atmospheric environment in the country either in the industrial or residential areas is not loaded with air pollutants at any point in time beyond tolerable level. These standards are documented in Table 3.4 of the National Guidelines and Standards for Industrial Effluents, Gaseous Emissions, and Hazardous Wastes Management in Nigeria (FEPA, 1991).

1.2.2 DPR Environmental Guidelines and Standards for the Petroleum Industry in Nigeria (EGASPIN)

In Nigeria, operations of oil and gas industry are governed by the Petroleum Act 1969. Section 8(1) b (iii) of the Act empowers the Federal Ministry of Petroleum Resources to make regulations for the prevention of pollution. In order to effectively plan, protect and prudently enhance the environmental resources in the areas of development of the oil industry in the country, the Department of Petroleum Resources (DPR) was set up by Section 191 of NNPC Act, 1979. In 1991 it issued Environmental Guidelines and Standards for the Petroleum Industry in Nigeria (EGASPIN). The EGASPIN, was revised in 2002 and focuses on oil/gas activities. In Section 4.4.5, the National Air Quality Guidelines for Maximum Exposure was issued for petroleum products related development and operation in the country summarized in Table III-3 of the Guidelines (EGASPIN, 2002)

1.2.3 National Environmental (Air Quality Control) Regulations, 2013

In 2007 the National Environmental Standards and Regulations Enforcement Agency (NESREA) was established via the National Environmental Standards and Regulations Enforcement Agency (Establishment) Act, 2007 (NESREA, 2007). Among its functions, is setting specifications and standards to protect and enhance the quality of Nigeria's air resources, to promote public health or welfare and the natural development and productive capacity of the nations' human, animal, marine or plant life including. In 2013, the Agency released its National Environmental (Air Quality Control) Regulations (NESREA, 2013) through which it intends to further manage the country's ambient air quality, among others.

1.2.4 World Bank Group Environment, Health and Safety (EHS) Guidelines: Air Emissions and Ambient Air Quality

The World Bank Group in its EHS Guidelines (World Bank, 2007) indicated that Projects with significant sources of air emissions, and potential for significant impacts on ambient air quality, should prevent or minimize the impacts. This should be by ensuring that emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards. National legislated standards, or in their absence, WHO Air Quality Guidelines or other internationally recognized sources are to be applied.

1.2.5 World Bank Group Industry Sector Guidelines on Power Plants: Environment, Health and Safety (EHS) Guidelines for Thermal Power Plants

The World Bank Group has another sector guideline that advices and regulates environmental challenges including air emissions in thermal power plants asking for its support. The guideline includes information relevant to combustion processes powered by gaseous, liquid and solid fossil fuels and biomass and designed to deliver electrical or mechanical power, steam, heat, or any combination of these, regardless of the fuel type (except for solid waste), with a total rated heat input capacity above 50 MW thermal input (MWth) on Higher Heating Value (HHV) basis. It applies to all significant sources of air emissions in new and existing thermal power plant facilities.

1.2.6 World Bank Group Environmental, Health and Safety (EHS) Guidelines for Petroleum Refining

The Environmental, Health and Safety challenges anticipated in Petroleum Refining processing operations from raw crude oil to finished products are addressed in this World Bank Group Guidelines (WBG, 2016). It identified all the possible atmospheric emissions sources in the petroleum refineries including those from the process and utility equipment and facilities. The composition of the anticipated atmospheric emissions from these facilities is spelt out with emphasis on carbon dioxide (CO_2), oxides of nitrogen (NOX), sulphur dioxide (SO_2), carbon monoxide (CO), volatile organic compounds (VOCs) and suspended particulate matter (SPM). Also included are the primary pollution prevention and control measures necessary for consideration to adequately manage atmospheric emissions in this sector both from point and fugitive sources. The standards used in this study to assess the anticipated air pollutants associated with operation of the proposed plant are summarized in *Table 1.1*

Table 1.1: Standards of Ambient Air Quality

Air Pollutant	Time Average	Limit (µg/m^3) FMEnv[a]	WBG[b]
CO	24-hour	11,400 (10 ppm)	-
SO_2	1-hour	260 (0.1 ppm)	-
	24-hour	26 (0.01 ppm)	20
NO_X	1-hour	-	200
	24-hour	75 – 113 (0.04 – 0.06 ppm)	-
	Annual	-	40
TSP	1-hour	600	-
	24-hour	250	50 (PM_{10})
	Annual	-	20 (PM_{10})
HC	24-hour	160	-

***Source:** [a]FEPA (1991); [b]World Bank (2007)*

1.3 Overview of Evaluation

The ISC-AERMOD View air dispersion modelling tool was employed in this study using air emissions from the proposed project. It is a complete and powerful modelling package which seamlessly incorporates the popular U.S. EPA models into one interface: AERMOD, ISCST3, and ISC-PRIME. Its AERMOD option of version 8.2.0 licensed to Dr. J.A. Sonibare of the Environmental Engineering Research Laboratory, Department of Chemical Engineering, Obafemi Awolowo University, Ile-Ife, was used.

AERMOD dispersion model was used in the past for cumulative impact assessment of the Gbaran Integrated Oil and Gas located around the same location (SPDC, 2007; Sonibare and Ede, 2009) and for a similar project belonging to the same operator (SPDC, 2015). Proton Energy (2016) used the same AERMOD for analysis of projected emission pattern and concentration for project emissions and cumulative impacts of its 150 MW power plant in the same Niger Delta Region of the country that went for the World Bank credit facility. The World Bank Group recommends AERMOD for modelling of air emissions from projects presented for its support (World Bank Group, 2007). Since several previous studies have confirmed accuracy of results from AERMOD within 50 km radius of emissions sources, this study did not go beyond the radius in its consideration.

CHAPTER TWO

EMISSION SOURCES

The basic tool on which facility emission dispersion modelling stands in an Environment Impact Assessment is emission inventory. This was carried out on the proposed lubricating oil blending facility and its utilities to identify the various point sources of air emissions. The air pollutants modelled for the ground level concentrations determination are: Carbon Monoxide (CO), Oxides of Nitrogen (NO_X), Suspended Particulate Matter (SPM), Volatile Organic Compounds (VOCs) and Sulphur Dioxide (SO_2). Emission rates and stack parameters used as model input were obtained from the project details.

2.1 Process Air Emission Sources

The main source of atmospheric pollutant in the proposed lubricating oil blending facility is fugitive emissions. These are air emissions from the base oil storage tanks which are:

- 2 storage & feed tanks for SN-150 each of 300,000 litres capacity,
- 2 storage & feed tanks for SN-300 each of 300,000 litres capacity and
- 3 storage & feed tanks for SN-600 each of 300,000 litres capacity

There are fugitive emissions from product storage tanks including:

- a lube storage tank for SAE 20W-50 (300,000 litres capacity),
- a lube storage tank for SAE 15W-40 (300,000 litres capacity),
- 2 lube storage tanks for SAE 40 range (each of 100,000 litres capacity), and
- a lube storage tank (back-up) of 100,000 litres capacity.

Five additives storage tanks with 50,000 litres capacity each are expected to release fugitive emissions from additives with volatile organic compounds (vocs) as component.

To service these storage tanks are pumps and piping system, Reception and Loading Bays (Tank Trucks) as well as Metering skids. Its blending facility shall include two complete ABBs handling 5 batches/day each handling 18,000 litres per facility while the Filling Station for 1 litre and 5 litres container, and a Drum decanting and additive metering unit are also its essential features. All these shall also be characterized with fugitive emissions but which adequate control measures have been put in place for their control as indicated under the impact mitigation measures. The facility shall also be serviced with a 3 ton Forklift which is expected to generate line air emission within its area of operation in the plant.

2.2 Auxiliary Facilities

Though the proposed project will source power from the Gbaran NIPP power plant located at about 300 m away this will be complemented by two (2) units 500 kVA power generating set. These are thus the only identified sources of air pollutants in the proposed facility.

2.3 Point Sources of Air Emissions from Third Party Facilities

As indicated above, the third party facility with air emission of concern to the proposed project is the 2 x 112.5 MW Gbaran National Independent Power plant (NIPP). This was then considered along in the air emission dispersion modelling for cumulative impact assessment. Summarized in Table 2.1 are all these identified sources.

Table 2.1: Point Emission Sources Considered in the Lubricating Oil Blending Plant

Emission Source	Location		Temp (°C)	Stack Height (m)	Stack diameter (m)	Exit Velocity (m/s)
	Easting	Northing				
Proposed Blending Plant Electric Power Generators						
Perkins 500 kva Gen 1	200017 E	555991 N	335	6.2	0.3	44.2
Perkins 500 kva Gen 2	200078 E	555976 N	335	6.2	0.3	44.2
Third Party Gbaran National Independent Power Plant (NIPP)						
112.5 MW Gbaran 1 Plant	200793 E	556658 N	475	9.1	0.5	53.5
112.5 MW Gbaran 2 Plant	200798 E	556649 N	475	9.1	0.5	53.5

Table 2.2: Proposed Emission Sources Characteristics in the Lubricating Oil Blending Plant

Emission Source	Emission (g/s)				
	CO	NO_x	SPM	VOCs	SO_2
Proposed Blending Plant Electric Power Generators					
Perkins 500 kva Gen 1	0.0308	0.1430	0.0101	0.0113	0.0094
Perkins 500 kva Gen 2	0.0308	0.1430	0.0101	0.0113	0.0094
Third Party Gbaran National Independent Power Plant (NIPP)					
112.5 MW Gbaran 1 Plant	9.2610	80.7982	0.7454	0.2371	0.5309
112.5 MW Gbaran 2 Plant	9.2610	80.7982	0.7454	0.2371	0.5309

CHAPTER THREE

EMISSION MODELLING PROTOCOL

The study used the ISC-AERMOD View, a user-friendly interface for three U.S. EPA air dispersion models: ISCST3, ISC-PRIME and AERMOD developed specially for Microsoft Windows and runs under Windows 95/98/Me/NT/2000 and XP. It uses pathways that compose the runstream file as the basics for its functional organization. These pathways include: Control Pathway (CO) where the modelling scenario, and the overall control of the modelling run is specified; Source Pathway (SO), where the sources of pollutant emissions are defined; Receptor Pathway (RE), : where the receptors to determine the air quality impact at specific locations are defined; Meteorology Pathway (ME), where the atmospheric conditions of the area being modelled are defined, so it can be taken into account when determining the distribution of air pollution impacts for the area; Terrain Grid Pathway (TG): where the option of a gridded terrain data to be used in calculating dry depletion in elevated or complex terrain are taken; Output Pathway (OU): where the output results necessary to meet the needs of the air quality modelling analyses are determined.

The model has a wide range of options for modelling air quality impacts of pollution sources. These include the use of stack-tip downwash, buoyancy-induced dispersion, final plume rise (except for sources with building downwash), a routine for processing averages when calm winds occur, default values for wind profile exponents and for the vertical potential temperature gradients, and the use of upper bound estimates for super-squat buildings having an influence on the lateral dispersion of the plume. Downwash occurs at structures nearby the emission sources, where wind currents are influenced by the structure. It will increase onsite or fenceline concentrations, reducing concentrations at distant receptors. For any of these options, source emission rates can be treated as constant throughout the modelling period, or may be varied by month, season, hour-of-day, or other optional periods of variation.

The model is capable of handling multiple sources, including point, line, volume, area and open pit types. Several source groups may be specified in a single run with contributions combined for each. There is provision for the choice of study area's terrain which may be simple terrain, complex terrain or both. In the latter case, the model will select the higher of the simple and complex terrain calculations on an hour-by-hour, source-by-source and receptor-by-receptor basis for receptors in intermediate terrain, i.e., terrain between release height and plume height. Similarly, there is provision for the use of either rural or urban dispersion parameters, depending on the characteristics of the source location. The typical output available from the model are: summaries of high values (highest, second highest, etc.) by receptor for each averaging period and source group combination; summaries of overall maximum values (e.g., the maximum 50) for each averaging period and source group combination; and tables of concurrent values summarized by receptor for each averaging period and source group combination for each set of data processed.

The identified point sources and parameters listed in Table 2.1 were considered as input into the modelling. Table 1.1 was used to investigate their impacts on ambient air quality.

3.1 Emission Sources Input Scenarios

This study considered two operation scenarios. While ***scenario 1*** considered simultaneous operations of the 2 x 500 kva generator on natural gas, ***scenario 2*** investigated cumulative ground level concentrations associated with simultaneous operations of the two units 500 kva along with the two units 112.5 MW gas turbine of the National Integrated Power Plants from where the plant anticipates to get its main electricity supply.

3.2 Receptors Locations

Both the immediate and distant environments of the proposed lubricating oil blending plants site were considered as receptors to its anticipated air pollutants. About 5 km radius of the proposed location was given adequate attention.

3.3 Meteorological Data

An essential input requirement for the AERMOD dispersion modelling is the hourly Meteorological information. Valid hourly data for at least one year with good data-capture for a number of specific parameters are required. The hourly meteorological data on the project area was acquired from Lakes Environmental meteorological observations (Met Data Order # MET 167831). The surface and upper air observations were compiled from the data. As shown in Figure 3.1, the wind of the area has prevalence for a south-westerly direction.

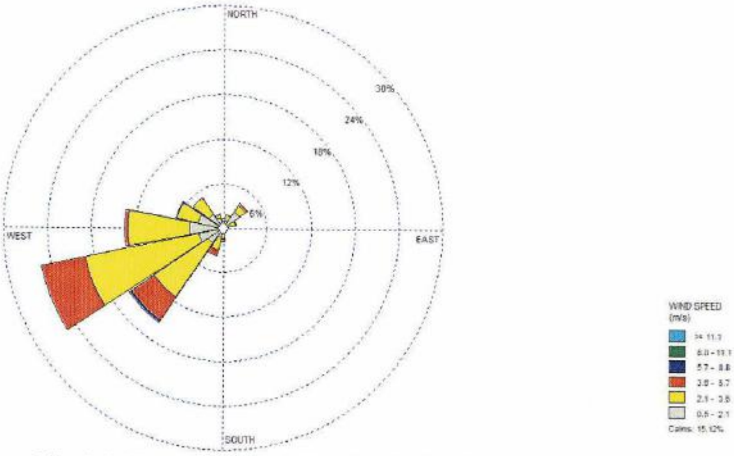

Fig. 3.1: Prevailing Wind Direction in the Proposed Project Area

3.4 Land Surface Characteristics Data

The ISC-AERMOD View uses several parameters to represent certain features that affect complex dispersion processes to accomplish its calculations. Information is sought about the nearby terrain and surface features that induce turbulence in addition to hourly surface and upper air meteorological data. These include the roughness length which represents the height of trees or other obstructions to wind flow. The parameters were specified for each upwind sector since they would vary depending on land use in each direction the wind may blow from. The necessary parameters were selected based on the nature of the area.

There is provision for the use of rural or urban parameters. These include the mixing height which is the depth through which pollutants released into the atmosphere are typically mixed by dispersion processes. This determines the vertical extent of dispersion for releases occurring below that height. According to EPA (1995), land use pattern is the most useful criterion for proper clarification. With land use pattern classification by Auer (1978), an urban classification of project site area requires more than 50% of the following land use types: heavy industrial, light-moderate industrial, commercial, single-family compact residential and multi-family compact residential. Otherwise, the site is considered rural. Since the area surrounding the project site falls under the rural classification using these parameters, it is classified as rural. To allow for the "worst case" scenario, both the tree heights and the building data were excluded in the dispersion exercise.

CHAPTER FOUR

MODELLING RESULTS

Presented in this section are the ISC-AERMOD View modelling generated results from the two investigated operation scenarios. These are guided by the available NAAQS averaging period standards.

4.1 Ground Level Concentrations

From the simultaneous operations of the two units 500 kva generator in the lubricating oils blending plants as investigated with ***scenario 1***, the anticipated 24-hour averaging period ground level CO concentration is 0.03 – 3.46 μg/m^3 (Figure 4.1). While their 1-hour averaging period SO_2 concentration is 0.02 – 1.79 μg/m^3 (Figure 4.2), their 24-hour concentration is 0.01 – 1.05 μg/m^3 (Figure 4.3). Their anticipated 1-hour, 24-hour and annual averaging period NO_x concentrations are 0.3 – 27.3 μg/m^3 (Figure 4.4), 0.2 – 16.0 μg/m^3 (Figure 4.5) and 0.04 – 4.32 μg/m^3 (Figure 4.6) respectively. Also from these two units 500 kva simultaneous operations, the anticipated 1-hour averaging period SPM concentration is 0.02 – 1.93 μg/m^3 (Figure 4.7) with 24-hour concentration levels of 0.01 – 1.13 μg/m^3 (Figure 4.8) and annual averaging period concentration of 0.0 – 0.30 μg/m^3 (Figure 4.9). Their 24-hour averaging period VOCs concentration is 0.01 – 1.27 μg/m^3 as presented in Figure 4.10.

The cumulative ground level concentrations of air pollutants associated with simultaneous operations of the 2 x 500 kva in the proposed lubricating oil blending plant and the 250 MW Gbaran NIPP located northeast away investigated with ***scenario 2*** show 24-hour averaging period CO level of 2.9 – 287.1 μg/m^3 (Figure 4.11). Their 1-hour and 24-hour averaging period SO_2 concentrations are 0.3 – 33.7 μg/m^3 (Figure 4.12) and 0.2 – 19.6 μg/m^3 (Figure 4.13) respectively with respective 1-hour, 24-hour and annual averaging period NO_X concentrations of 51.3 – 5127.7 μg/m^3 (Figure 4.14), 29.9 – 2986.5 μg/m^3 (Figure 4.15) and 4.0 – 376.0 μg/m^3 (Figure 4.16). Their 1-hour averaging period SPM concentration is 0.47 – 47.31 μg/m^3 (Figure 4.17) with 24-hour level of 0.3 – 27.6 μg/m^3 (Figure 4.18) and annual level of 0.03 – 3.50 μg/m^3 (Figure 4.19. As shown in Figure 4.20 the cumulative 24-hour averaging period VOCs is 0.09 – 8.77 μg/m^3.

4.2 Maximum Ground Level Concentrations Impact on the Environment

Summarized in Table 4.1 are the maximum ground level concentrations of air pollutants anticipated from point sources in the proposed lubricating blending oil plant. From the 2 x 500 kva generators (***scenario*** 1) in the lubricating oil plant, the maximum 1-hour air pollutants are 1.79 – 27.3 μg/m^3 with 24-hour averaging period levels of 1.05 – 16.0 μg/m^3 and annual levels of 0.3 – 4.32 μg/m^3. The maximum cumulative (***scenario 2***) 1-hour averaging period concentrations are 33.7 – 5127.7 μg/m^3 with 24-hour averaging period levels of 8.77 – 2986.5 μg/m^3 and annual levels of 3.5 – 47.31 μg/m^3. All the maximum ground level concentrations from the 2 x 500 kva generators are within their respective limits. While the cumulative maximum concentrations are within their respective limits for all the other investigated air pollutants, the three averaging period NO_X concentrations breach their respective limits. This is attributed to the existing Gbaran NIPP.

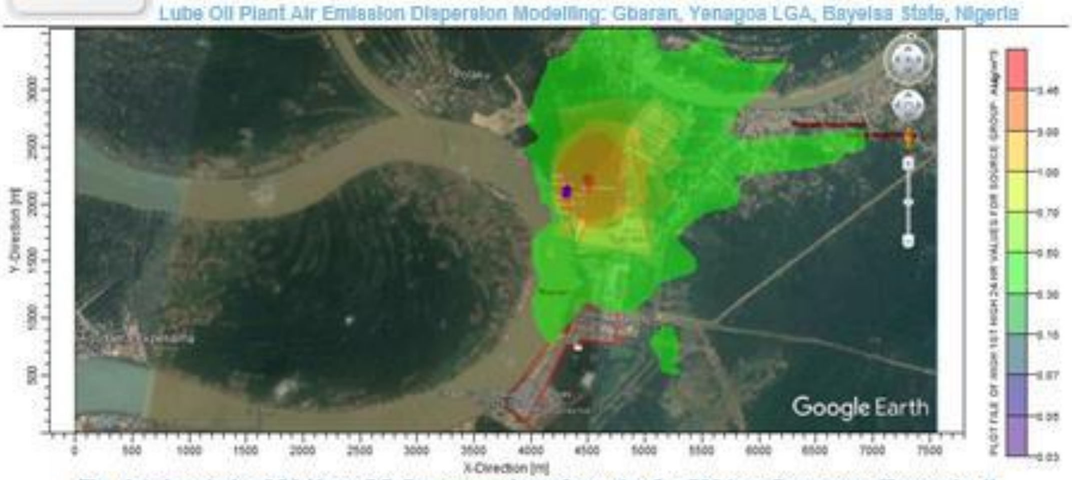

Fig. 4.1: Isopleth of 24-Hour CO Concentrations from the 2 x 500 kva Generator (Scenario 1)

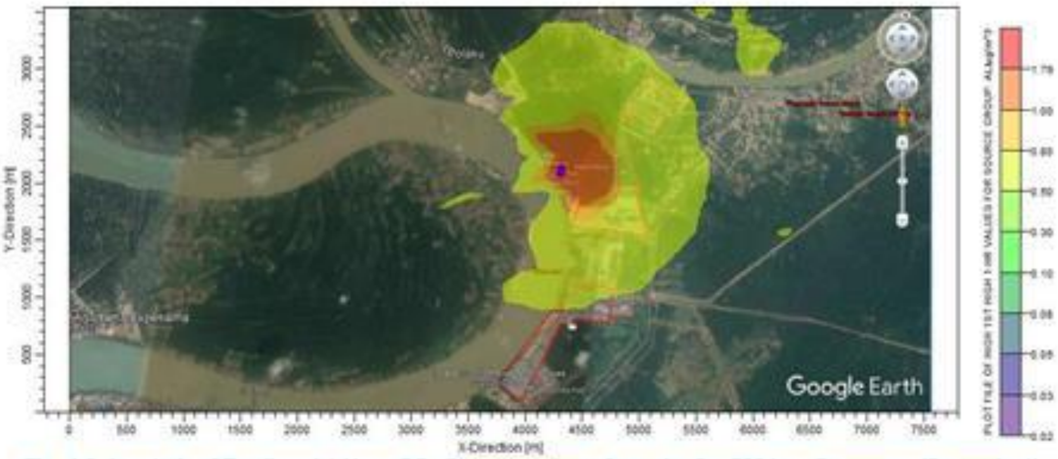

Fig. 4.2: Isopleth of Predicted 1-Hour SO_2 Concentrations from the 2 x 500 kva Generator (Scenario 1)

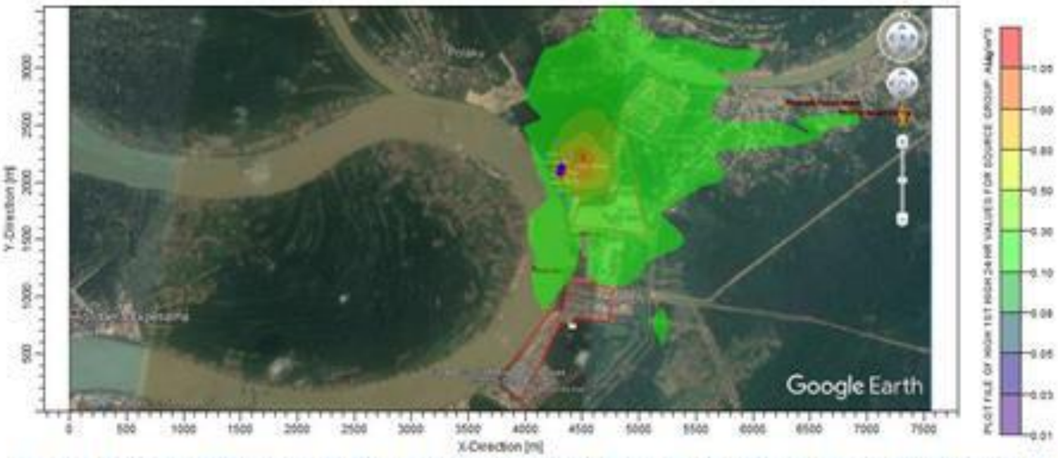

Fig. 4.3: Isopleth of Predicted 24-Hour SO_2 Concentrations from the 2 x 500 kva Generator (Scenario 1)

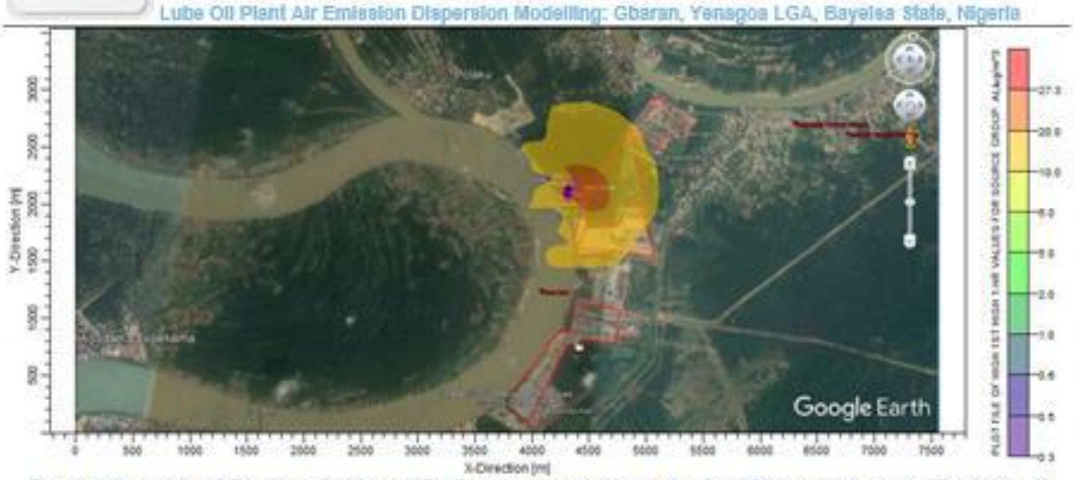

Fig. 4.4: Isopleth of Predicted 1-Hour NO_X Concentrations from the 2 x 500 kva Generator (Scenario 1)

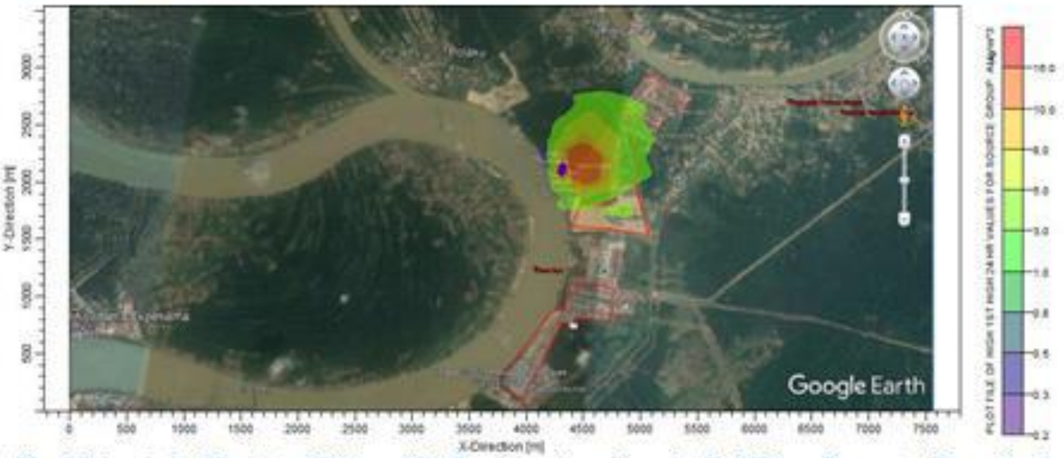

Fig. 4.5: Isopleth of Predicted 24-Hour NO_X Concentrations from the 2 x 500 kva Generator (Scenario 1)

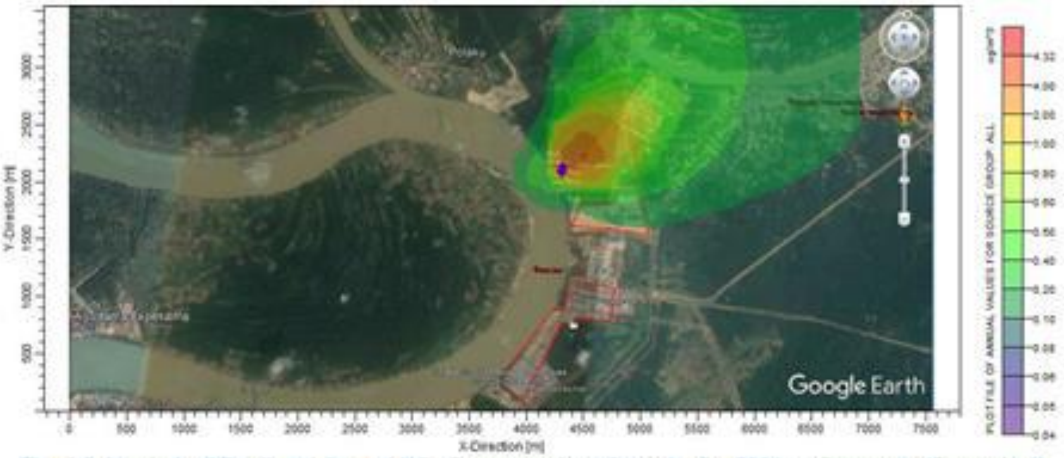

Fig. 4.6: Isopleth of Predicted Annual NO_X Concentrations from the 2 x 500 kva Generator (Scenario 1)

Lube Oil Plant Air Emission Dispersion Modelling: Gbaran, Yenagoa LGA, Bayelsa State, Nigeria

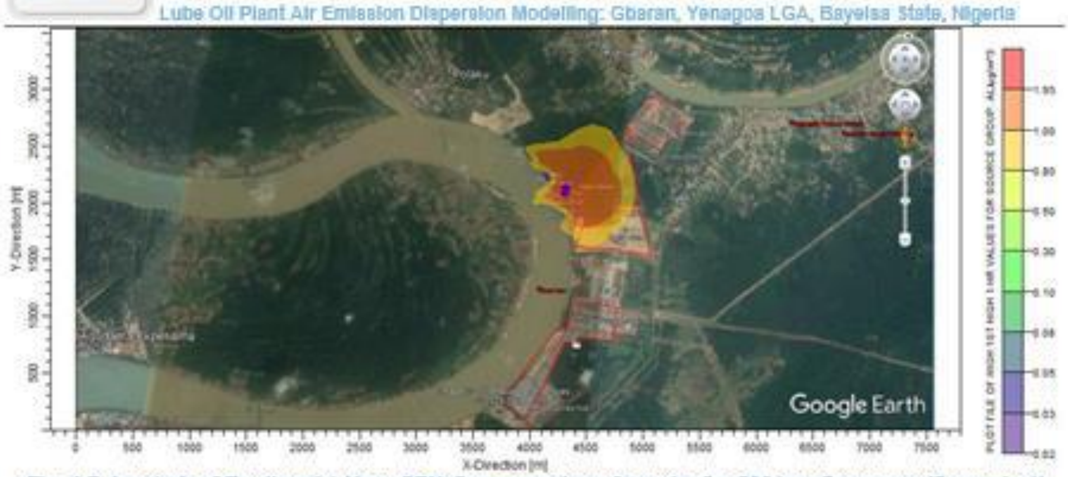

Fig. 4.7: Isopleth of Predicted 1-Hour SPM Concentrations from the 2 x 500 kva Generator (Scenario 1)

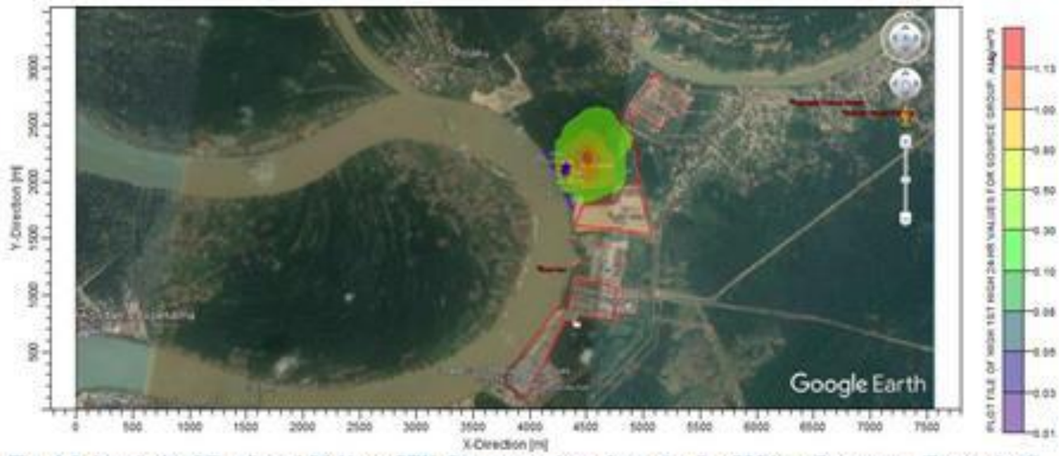

Fig. 4.8: Isopleth of Predicted 24-Hour SPM Concentrations from the 2 x 500 kva Generator (Scenario 1)

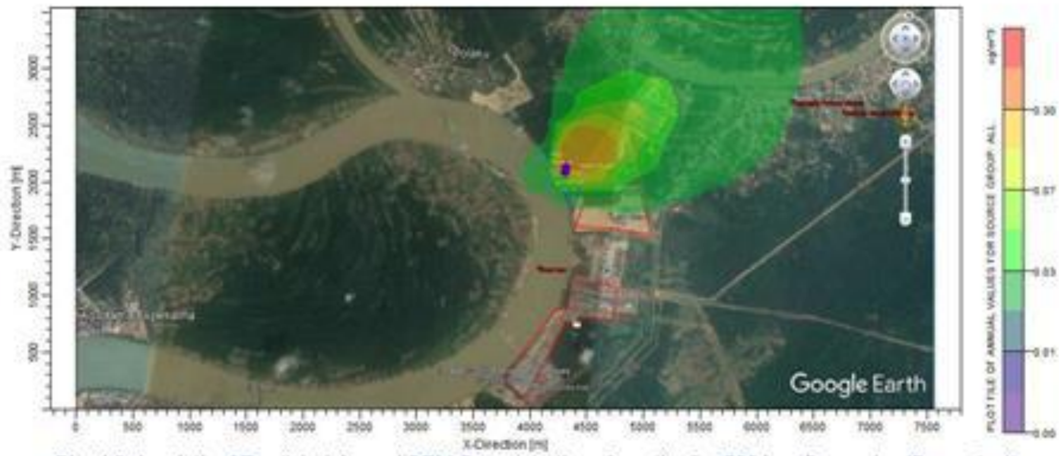

Fig. 4.9: Isopleth of Predicted Annual SPM Concentrations from the 2 x 500 kva Generator (Scenario 1)

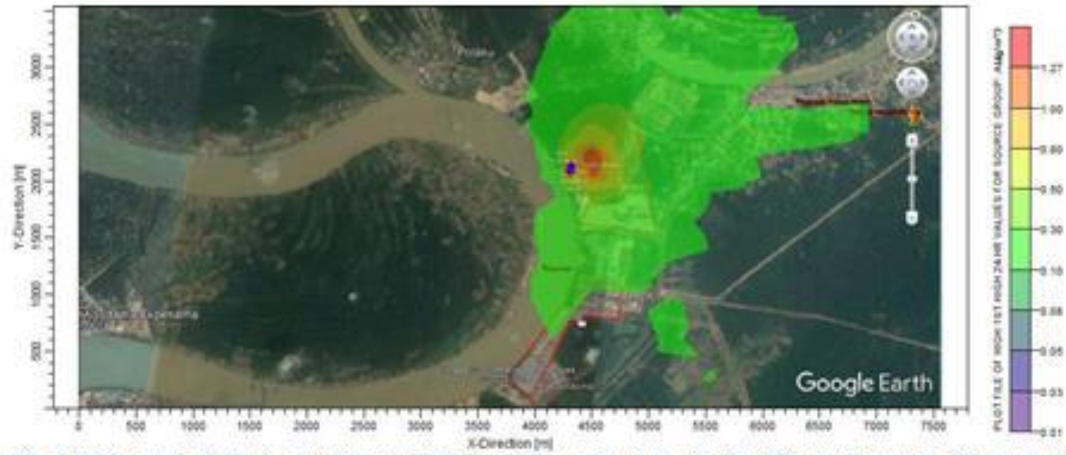

Fig. 4.10: Isopleth of Predicted 24-Hour VOCs Concentrations from the 2 x 500 kva Generator (Scenario 1)

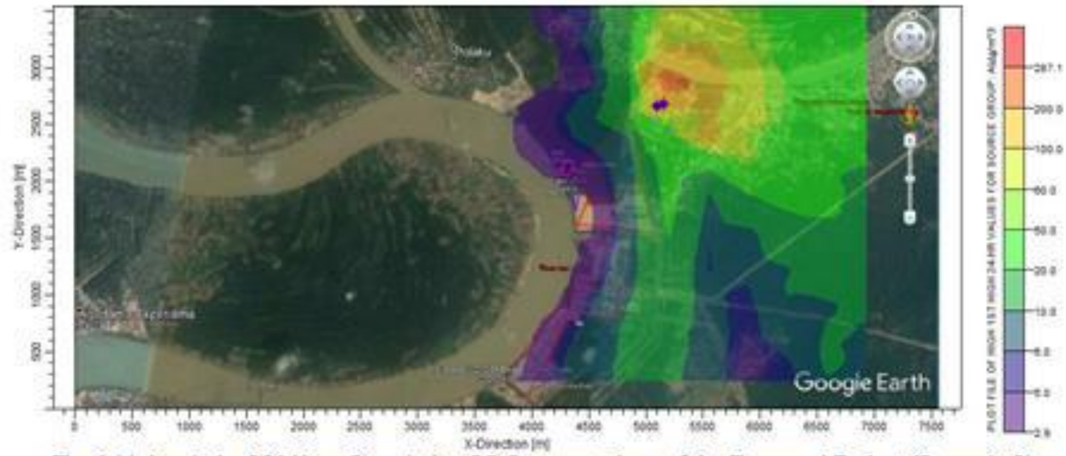

Fig. 4.11: Isopleth of 24-Hour Cumulative CO Concentrations of the Proposed Project (Scenario 2)

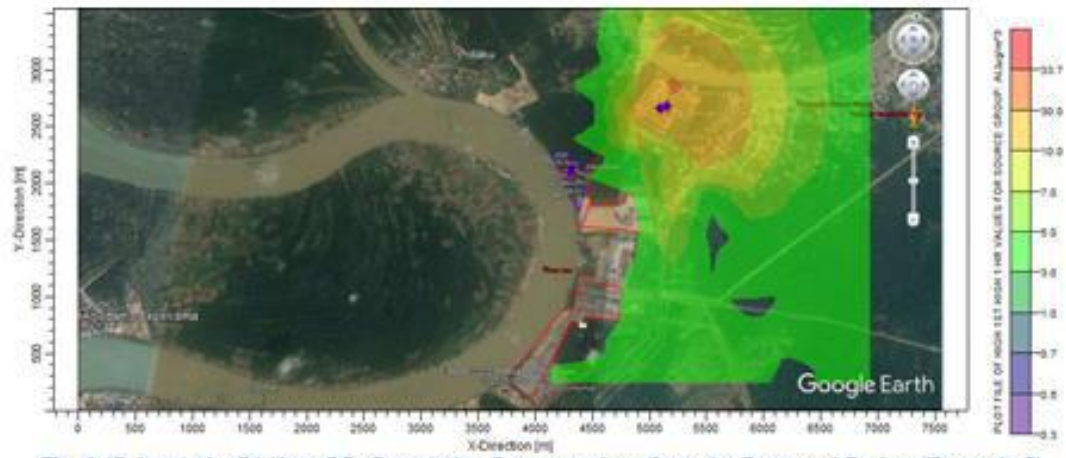

Fig. 4.12: Isopleth of 1-Hour SO_2 Cumulative Concentrations from the Proposed Project (Scenario 2)

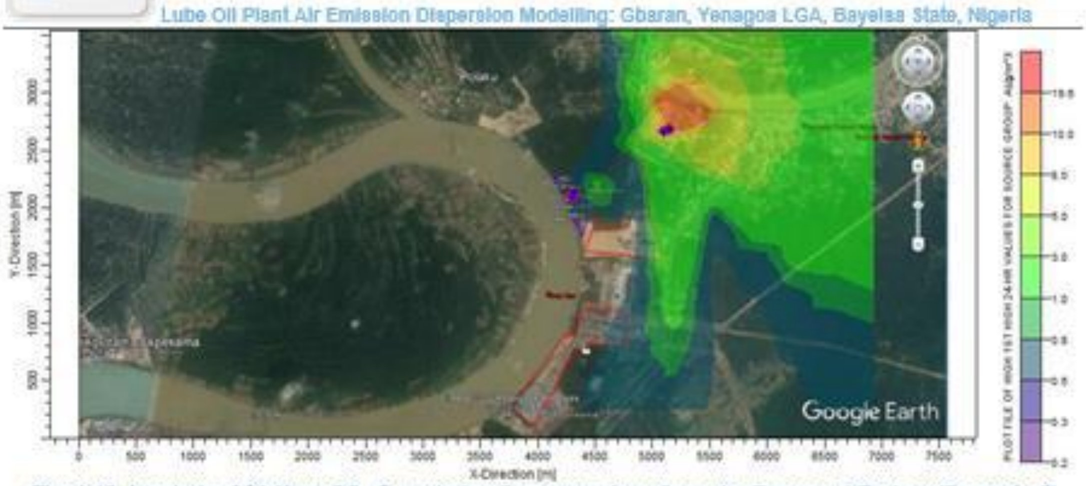

Fig. 4.13: Isopleth of 24-Hour SO_2 Cumulative Concentrations from the Proposed Project (Scenario 2)

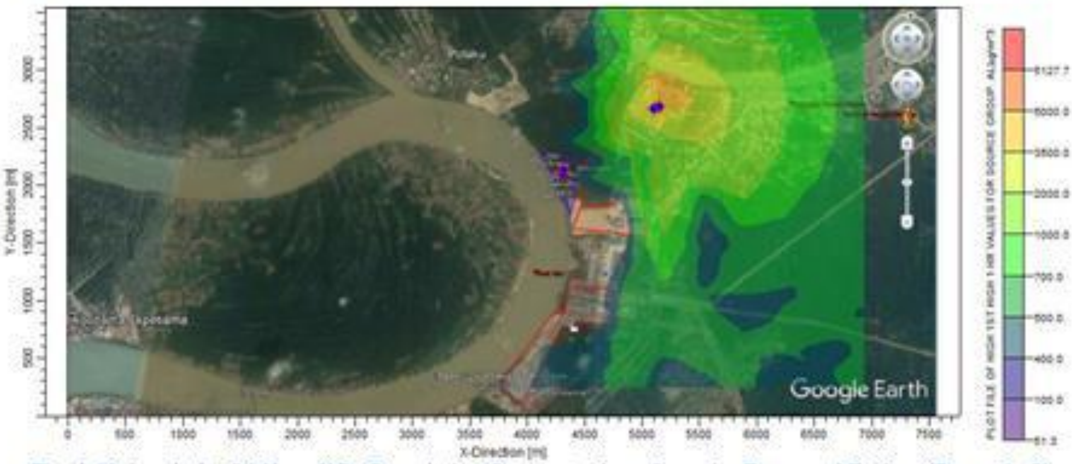

Fig. 4.14: Isopleth of 1-Hour NO_x Cumulative Concentrations from the Proposed Project (Scenario 2)

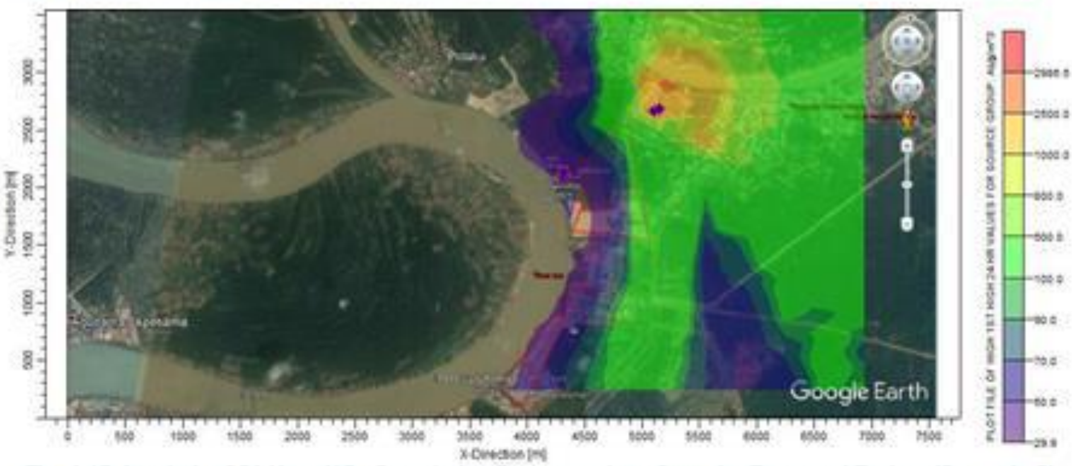

Fig. 4.15: Isopleth of 24-Hour NO_x Cumulative Concentrations from the Proposed Project (Scenario 2)

Lube Oil Plant Air Emission Dispersion Modelling: Gbaran, Yenagoa LGA, Bayelsa State, Nigeria

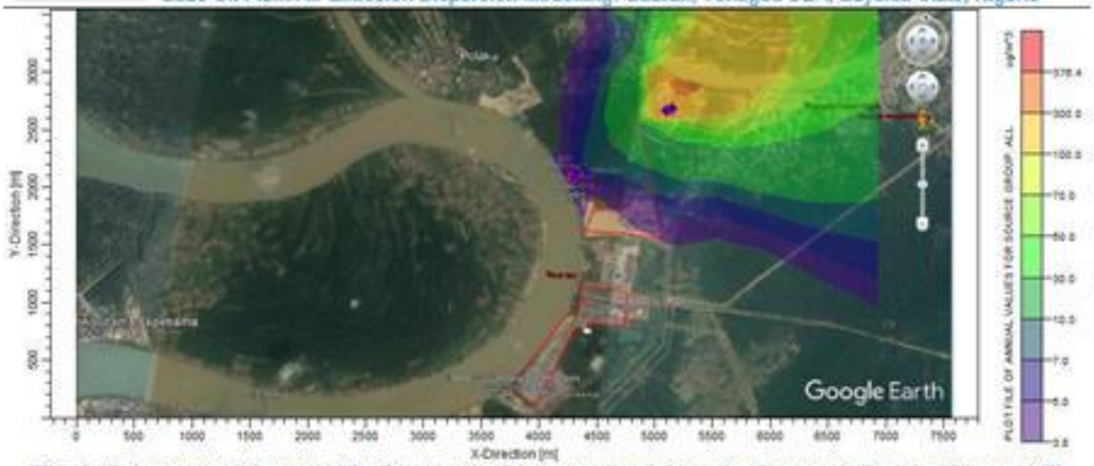

Fig. 4.16: Isopleth of Annual NO_x Cumulative Concentrations from the Proposed Project (Scenario 2)

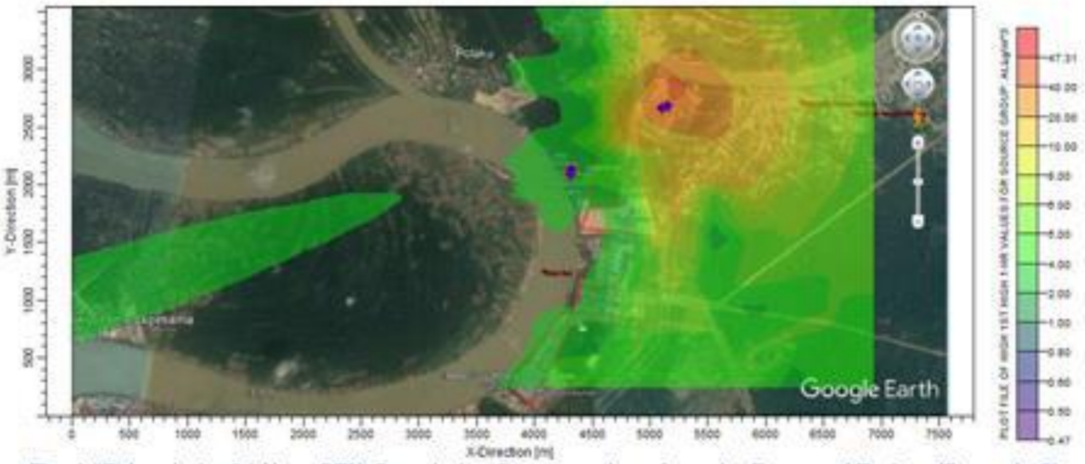

Fig. 4.17: Isopleth of 1-Hour SPM Cumulative Concentrations from the Proposed Project (Scenario 2)

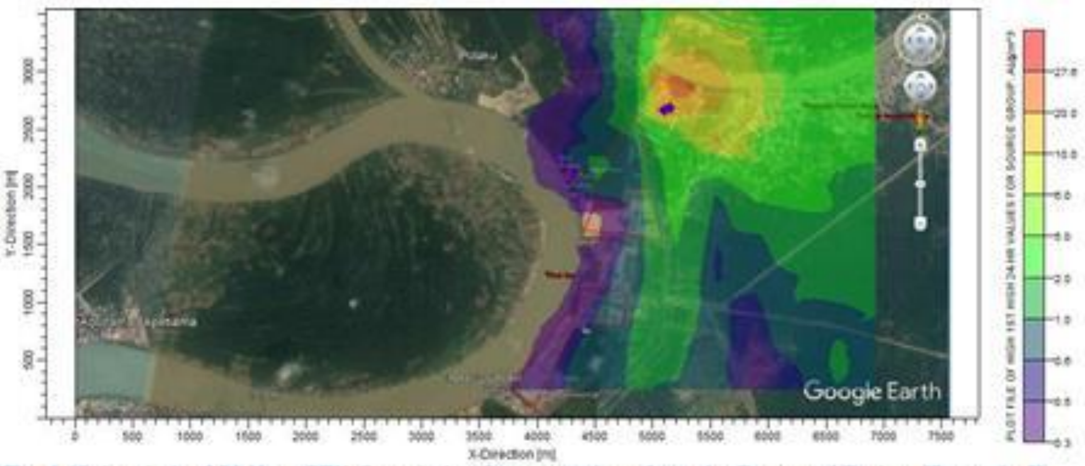

Fig. 4.18: Isopleth of 24-Hour SPM Cumulative Concentrations from the Proposed Project (Scenario 2)

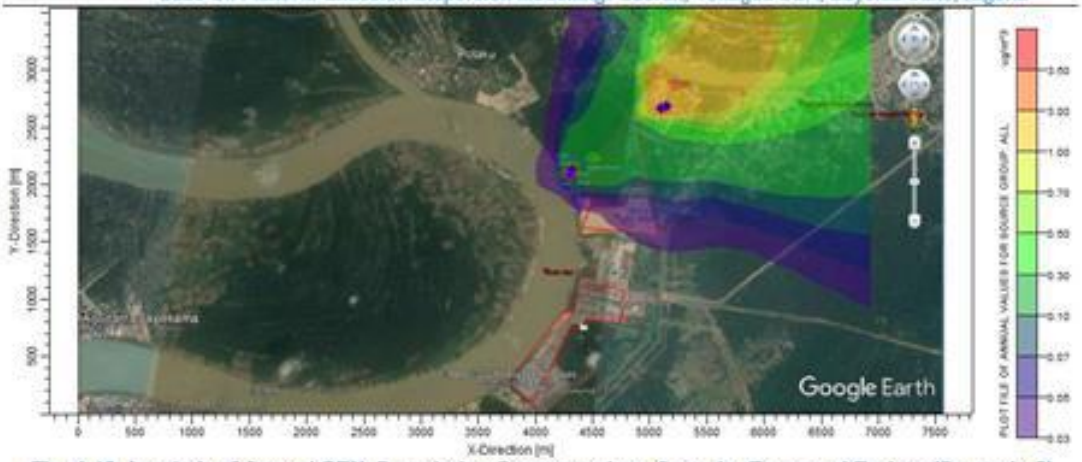

Fig. 4.19: Isopleth of Annual SPM Cumulative Concentrations from the Proposed Project (Scenario 2)

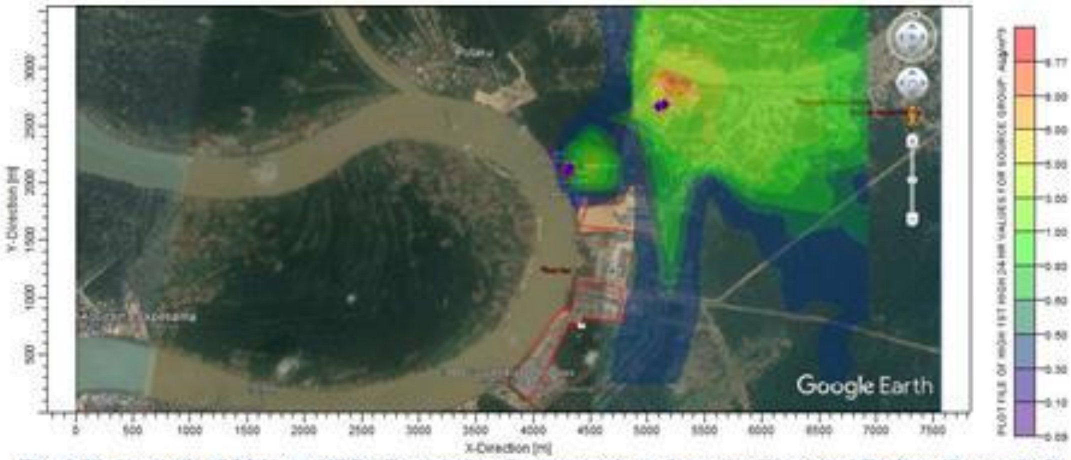

Fig. 4.20: Isopleth of 24-Hour VOCs Cumulative Concentrations from the Proposed Project (Scenario 2)

Table 4.1: Maximum Ground Level Air Pollutant Concentrations from the Proposed Project

Air Pollutant	Averaging Period	From the 2 x 500 kva Generators (Scenario 1)			Cumulative Concentrations (Scenario 2)		
		Predicted Concentration ($\mu g/m^3$)	% of Standard		Predicted Concentration ($\mu g/m^3$)	% of Standard	Location
CO	24-Hour	3.46	0.03	**Within the Lubricating Oil Blending Plant Fenceline**	287.1	2.52	**Within the Gbaran NIPP Fence line**
SO_2	1-Hour	1.79	0.69		33.7	12.96	
	24-Hour	1.05	4.04		19.6	75.38	
NO_x	1-Hour	27.3	13.65		5127.7	25.64 folds	
	24-Hour	16.0	14.16		2986.5	26.43 folds	
	Annual	4.32	10.80		376.0	9.40 folds	
SPM	1 – Hour	1.93	0.32		47.31	7.89	
	24 – Hour	1.13	0.45		27.6	11.04	
	Annual	0.30	1.50		3.50	17.50	
VOCs	24-Hour	1.27	0.79		8.77	5.48	

CONCLUSIONS

An air emission dispersion modelling has been carried out on the the proposed Eraskon Nigeria Limited 50,000 Litres Per Day (LPD) lubricating oils blending plant. It is proposed to be located in Izeinbou Bush, Tunama Community, Gbaran Clan, Yenagoa Local Government Area (LGA), Bayelsa State. The ISC-AERMOD View (Version 8.2.0) air emission dispersion modelling was used in the study to investigate two operating scenarios. It is concluded that all the maximum ground level concentrations of air pollutants associated with simultaneous operations of the 2 x 500 kva generators to power the lubricating oil blending plants are within their respective limits. While the cumulative maximum concentrations of the investigated air pollutants are also within their respective limits, the three averaging periods NO_X concentrations breach their respective limits. This is attributed to the existing Gbaran NIPP facility air emissions in the same zone of influence with the proposed project.

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APPENDIX SEVEN

NOISE DISPERSION MODELLING

Noise Dispersion Modelling:
Proposed Eraskon Nigeria Limited
50,000 Litres/day Lubricating Oils Blending Plant
Gbaran,
Yenagoa Local Government Area
Bayelsa State, Nigeria

Report Prepared for:

Eraskon Nigeria Limited
C/O Geo Environmental Resources Limited
Suite SB 81, New Banex Plaza,
Aminu Kano Crescent, Wuse II,
Abuja
FCT. Nigeria

By:

Jacob Ademola Sonibare, ***Ph.D***
(MNSE; MNSChE; R.Eng)
Professor of Chemical Engineering
Environmental Engineering Research Laboratory
Department of Chemical Engineering
Obafemi Awolowo University
Ile-Ife. Nigeria

+234-8033837896
asonibar@oauife.edu.ng and asonibar@yahoo.com

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Report Title	Noise Dispersion Modelling: Proposed Eraskon Nigeria Limited 50,000 Litres/day Lubricating Oils Blending Plant, Gbaran, Yenagoa Local Government Area Bayelsa State, Nigeria
Technical Report No.	Cleanair/Modelling/590
Released By	Engr. Prof. J.A. Sonibare (R.8671) Consultant Air Quality & Noise Specialist/Life Cycle Analyst
Date Released	11th September 2020
Signature	11-09-2020

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ACRONYMS AND ABBREVIATIONS

dB(A)	-	deciBel, A-weighted (unit of noise adjusted to human sensitivities)
FEPA	–	Federal Environmental Protection Agency
FMENV	-	Federal Ministry of Environment
WHO	–	World Health Organization

EXECUTIVE SUMMARY

Impacts of noise from the proposed 50,000 litres per day lubricating oils blending plant facility proposed by Eraskon Nigeria Limited, in Izeinbou Bush, Tunama Community, Gbaran Clan, Yenagoa Local Government Area (LGA) Bayelsa State have been investigated using NoiseMap 2000 and two operation scenarios. Its identified sources of noise include the Automatic Batch Blender, Pumps, and two units Perkins 500 kva electric power generators. For the purpose of cumulative impacts assessment, the two units 112.5 MW Gbaran National Integrated Power Plant (NIPP) were also considered.

The ambient noise levels associated with operation of the proposed plant when operated on the 2 x 500 kva electric power generators (***scenario 1***) are 32.5 – 92.5 dB(A) but 45.0 – 96.5 dB(A) when operated with the Gbaran NIPP as being proposed. It is concluded that the anticipated maximum ambient noise levels shall not breach the 90 dB(A) shopfloor limit of the Federal Ministry of Environment beyond the production floor of the lubricating oil blending plants and its electric power generators' house. Also, the 70 dB(A) industrial area and 55 dB(A) day-time limits of the World Bank shall not be breached beyond its fenceline. However for its night-time operation to be harmless there is the need for mitigation measures so that the 45 dB(A) night-time limit is not breached within 500 m radius of its fenceline. The cumulative impacts (***scenario 2)*** are not significantly different from these.

CHAPTER ONE

INTRODUCTION

1.0 Preamble

This is the report of noise modelling carried out in support of Environmental Impact Assessment (EIA) of the proposed 50,000 Litres Per Day (LPD) lubricating oils blending plant facility proposed by Eraskon Nigeria Limited, in Izeinbou Bush, Tunama Community, Gbaran Clan, Yenagoa Local Government Area (LGA) Bayelsa State. The study was carried out by Engr. Jacob Sonibare, a ***Professor of Chemical Engineering*** and ***Consultant Air Quality Expert, Noise Specialist, and Life Cycle Analyst*** with the Environmental Engineering Research Laboratory, Chemical Engineering Department, Obafemi Awolowo University, Ile-Ife, Nigeria.

The Plant is proposed on 79248.426 m^2 (7.925 ha) of land defined by coordinates 199806 Northing and 556134 Easting in the Northwest, 200171 Northing and 556091 Easting in the Northeast, 200139 Northing and 555624 Easting in the Southwest and 200177 Northing and 555635 Easting in the Southeast with average elevation of 22 m above sea level (Figure 1.1). It is bordered to the west by River Nun and to the North by Koroama, a neigbouring community at about 1 km North. East of the site is the Gbaran NIPP power plant at about 300 m away, as well as the project host community, Tunama, which is roughly about 800 m from the project site. On the Southern flank of the proposed project site are the Azikel Modular Refinery (700 m away) and the SPDC Gas Gathering Facility (1 km from site).

The facility is a lubricating oil blending plant of about 50,000 Litres per day capacity. It consists of Base oil tanks: 2 storage & feed tanks for SN-150 each of 300,000 litres capacity, 2 storage & feed tanks for SN-300 each of 300,000 litres capacity and 3 storage & feed tanks for SN-600 each of 300,000 litres capacity. Its final product storage tanks are: a lube storage tank for SAE 20W-50 (300,000 litres capacity), a lube storage tank for SAE 15W-40 (300,000 litres capacity), 2 lube storage tanks for SAE 40 range (each of 100,000 litres capacity), and a lube storage tank (back-up) of 100,000 litres capacity. There shall be five storage tanks for additives with each having 50,000 litres capacity. To service these storage tanks are pumps and piping system, Reception and Loading Bays (Tank Trucks) as well as Metering skids. Its blending facility shall include two complete ABBs handling 5 batches/day each handling 18,000 litres per facility. These shall be equipped with a Control Panel, a Filling Station for 1 litre and 5 litres container, and a Drum decanting and additive metering unit. The facility shall also be serviced with a 3 ton Forklift.

Noise inventory was carried out on the proposed facility. Its associated noise levels at the proposed site and within 1 km radius Zone of Influence (ZoI) were then computed for comparison with Nigeria standards and that of the World Bank Group.

1.1 Purpose and Objectives

The aim of this study is to assess the impacts of ambient noise associated with operation of the proposed lubricating oils blending plant. The specific objectives are to:

- i. identify specific sources of noise originating from the proposed plant;
- ii. establish maximum Sound Power Level from each of the identified sources;
- iii. predict the noise propagation towards some important receptor locations; and
- iv. assess effect of the predicted noise at some important receptor locations.

1.2 Legal, Regulatory and Administrative Framework

Relevant laws, guidelines, standards and conventions have been considered in conducting this noise dispersion. These include:

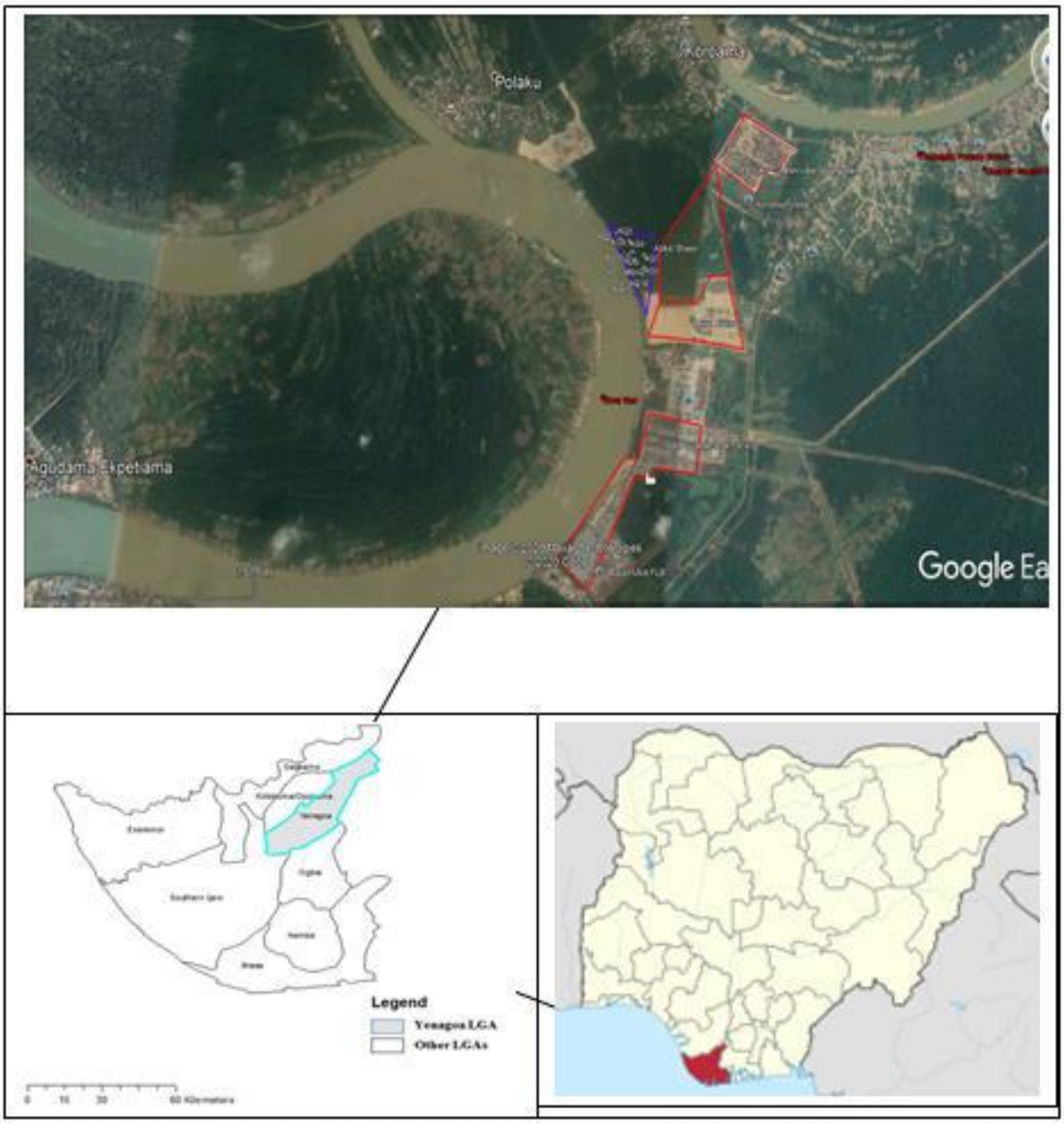

Fig. 1.1: The Proposed Lubricants Blending Plant Site and Zone of Influence (ZoI)

1.2.1 Noise Exposure Limits for Nigeria

Nigeria has noise exposure standards which recognize that noise from industries and other sources like the proposed project may have impact on health and the environment. It thus prescribes guidelines for safe levels of noise tolerable to humans. Objective of the standards is to ensure that the environment in the country in the industrial or residential areas is not loaded with noise beyond tolerable level. These standards are documented in Table 4.2 of the National Guidelines and Standards for Industrial Effluents, Gaseous Emissions, and Hazardous Wastes Management in Nigeria (FEPA, 1991).

1.2.2 National Environmental (Air Quality Control) Regulations, 2013

In 2007 the National Environmental Standards and Regulations Enforcement Agency (NESREA) was established via the National Environmental Standards and Regulations Enforcement Agency (Establishment) Act, 2007 (NESREA, 2007). In 2009, the Agency re leased its National Environmental (Noise Standards and Control) Regulations, 2009. S. I. No. 35. Objective of the provisions of this Regulation is to ensure tranquility of the human environment or surrounding and their psychological well-being by regulating noise levels.

1.2.3 World Bank Group Environment, Health and Safety (EHS) Guidelines: Air Emissions and Ambient Air Quality

The World Bank Group in its EHS Guidelines (World Bank, 2007) indicated that Projects with significant sources of noise, and potential for significant impacts on the environment, should prevent or minimize the impacts. This should be by ensuring that noise emissions do not result in ambient levels that reach or exceed relevant guidelines and standards. National legislated standards, or in their absence, WHO Air Quality Guidelines or other internationally recognized sources are to be applied. Its section 1.7 addresses impacts of noise beyond the property boundary while worker exposure to noise is covered in its Section 2.0.

1.2.4 World Bank Group Industry Sector Guidelines on General Manufacturing: Environment, Health and Safety (EHS) Guidelines for Large Volume Petroleum-based Organic Chemicals Manufacturing

The World Bank Group has another sector guideline that advices and regulates environmental challenges including noise emissions in lubricating oil blending plants asking for its support. The guideline identifies noise as an environmental issue in such facilities and provides levels for recommended noise abatement measures and ambient noise levels. Information relevant to the major sources of noise emissions in the sector is also provided. The guidelines apply to all significant sources of noise in new and existing lubricating oil facilities. The standards used in this study to assess the anticipated ambient noise levels associated with operations of the facility are summarized in *Table 1.1*

Table 1.1: Standards of Ambient Noise Levels Considered in the Study

<table>
<tr><th colspan="3">Standard Noise Level as set by the Federal Ministry of Environment[a]</th></tr>
<tr><td>Duration per Day, hour</td><td colspan="2">Permissible Exposure Limit (dB (A))</td></tr>
<tr><td>8</td><td colspan="2">90</td></tr>
<tr><td>6</td><td colspan="2">92</td></tr>
<tr><td>4</td><td colspan="2">95</td></tr>
<tr><td>3</td><td colspan="2">97</td></tr>
<tr><td>2</td><td colspan="2">100</td></tr>
<tr><td>1.5</td><td colspan="2">102</td></tr>
<tr><td>1</td><td colspan="2">105</td></tr>
<tr><td>0.5</td><td colspan="2">110</td></tr>
<tr><td>0.25 or less</td><td colspan="2">115</td></tr>
<tr><th colspan="3">Maximum Allowable Log Equivalent (hourly measurements), in dB (A)[b]</th></tr>
<tr><td>Receptor</td><td>Day-time (7:00 – 22:00)</td><td>Night-time (22:00 – 7:00)</td></tr>
<tr><td>Residential, institutional, educational</td><td>55</td><td>45</td></tr>
<tr><td>Industrial, commercial</td><td>70</td><td>70</td></tr>
<tr><th colspan="3">Guidelines values for Community Noise in Specific Environments[c]</th></tr>
<tr><td>Specific Environments</td><td>Critical Health Effect(s)</td><td>Noise Level dB(A)</td></tr>
<tr><td>Outdoor living area</td><td>Serious annoyance, daytime and evening
Moderate annoyance, daytime and evening</td><td>55
50</td></tr>
<tr><td>Dwelling, indoors
Inside bedrooms</td><td>Speech intelligibility and moderate annoyance, daytime and evening
Sleep disturbance, night-time</td><td>35
30</td></tr>
<tr><td>Outside bedrooms</td><td>Sleep disturbance, window open (outdoor values)</td><td>45</td></tr>
</table>

[a]Source: FEPA (1991); [b]Source (World Bank, 1998); [c]Source: Berglund et al. (1999).

1.3 Overview of Evaluation

The noise dispersion modelling was carried out using NoiseMap 2000. It is an environmental noise mapping software from the Atkins Ltd. The predicted noise levels were then used to determine the potential impacts of the proposed project on its ZoI. The background noise levels obtained during project's environmental baseline data collection were combined with the calculated noise levels for comparison with the occupational noise standards of the Federal Ministry of Environment, the fenceline recommended limits of the World Bank, and the World Health Organization Guidelines for some specific environments (Table 1.1). This was to determine the carrying capacity of the project area in terms of noise.

CHAPTER TWO

NOISE SOURCES

Two major sources of noise identified in the proposed lubricating oil plant are the process and utilities facilities. The detail information about these sources and their Sound Power Level (SPL) required by the noise dispersion modelling exercise are reported in this section.

2.1 Process Noise Emission Sources from the Proposed Blending Plant

Lubricating oil blending plants are characterized with averagely noise levels due to the blending and pumping of materials. The Sound Power Level (SPL) of each of the sources is essential input into the modelling exercise (Table 2.1).

Table 2.1: Lubricant Blending Plant Operation Noise Generating Sources

Equipment	Easting	Northing	Typical Sound Power Level (dB(A))
Automatic Batch Blender	201159	555246	105
Pumps	200005	555246	80

2.2 Noise Sources from Utilities

Though the proposed project will source power from the Gbaran NIPP located 300 m away this will be complemented by two (2) units 500 kVA power generating set. They are the only identified sources of noise in the proposed facility. As anticipated in the operation of these generators, their operations will result in noise as summarized in Table 2.2.

2.3 Point Sources of Air Emissions from Third Party Facilities

A third party facility with noise of concern to the proposed project is the 2 x 112.5 MW Gbaran National Independent Power plant (NIPP). It was then considered along in the modelling for cumulative assessment (Table 2.2).

Table 2.2: Sound Power Level (SPL) from the Proposed Power Plants

Emission Source	Location		Sound Power Level (SPL), dB(A)
	Easting	Northing	
Proposed Blending Plant Electric Power Generators			
Perkins 500 kva Gen 1	200017	555991	95
Perkins 500 kva Gen 2	200078	555976	95
Third Party Gbaran National Independent Power Plant (NIPP)			
112.5 MW Gbaran 1 Plant	200793	556658	117
112.5 MW Gbaran 2 Plant	200798	556649	117

CHAPTER THREE

NOISE MODELLING PROTOCOL

Anticipated ambient noise levels at some receptors locations were carried out with the NoiseMap 2000 software, the latest version of WS Atkins' noise calculation software, used by many major companies and governmental authorities (NoiseMap 2000, 2006). It is available as separate modules: RoadNoise 2000; RailNoise 2000; and SiteNoise 2000 with a number of other applications, such as noise insulation assessments, planning applications, noise barrier design, environmental impact assessments, designing housing layouts and creating environmental liability databases. It uses UK standard calculation procedure: Calculation of Road Traffic Noise 1988; Calculation of Railway Noise 1995; and BS 5228: 1997: Part 1 Code of practice for control of noise on construction and open sites. Its SiteNoise Module Version 2.6.9 with Serial Number 3118 Licensed to the Consultant was used.

NoiseMap 2000 imports Ordnance Survey and other digital maps for the generation of accurate noise maps for a combination of noise sources, including predicted noise levels for road traffic, railways and industrial sites. A NoiseMap 2000 model can be built either by importing the information from a digital map, tracing the model on-screen over a scanned map, or digitising using a standard digitising tablet. For this exercise, a scanned copy of the CPF and FLB was converted to Bitmap and imported into NoiseMap for source exact location identification by tracing the model on-screen over it. The typical outputs available from the model are: Plant Data, Working and Ground Type, Activity data, Barrier Data, Contour Data, and Receptors location to noise sources, among others. The calculated noise away from source and interaction of noise from different sources can be represented in contour by the model.

The identified noise with all parameters in Tables 2.1 and 2.2 were considered as input into the modelling while Table 1.1 was used to investigate their impacts on ambient noise levels.

3.1 Emission Sources Input Scenarios

The study considered two operation scenarios. While ***scenario 1*** considered simultaneous operations of the 2 x 500 kva generator, ***scenario 2*** investigated cumulative ground level noise associated with simultaneous operations of the two units 500 kva along with the two units 112.5 MW gas turbine of the National Integrated Power Plants.

3.2 Receptors Locations

Both the immediate and distant environments of the proposed lubricating oil blending plants site were considered as receptors to its anticipated noise. About 1 km radius of the proposed location was given adequate attention.

CHAPTER FOUR

MODELLING RESULTS

Reported in this section are results from the noise modelling as obtained in NoiseMap 2000. Also included are the findings from the results and the anticipated cumulative impacts.

4.1 Ambient Noise Levels Associated with the Plant's Operations

As presented in Figure 4.1 the ambient noise levels associated with operation of the proposed Lubricating Oil Blending Plant when operated on the 2 x 500 kva electric power generators (***scenario*** 1) are 32.5 – 92.5 dB(A). The 70 dB(A) industrial area ambient noise limit of the World Bank shall be achieved within the shopfloor of the facility (Figure 4.2). Similarly the 55 db(A) day-time ambient noise limit of the World Bank shall be achieved by the plant's associated ambient noise level within its fenceline (Figure 4.3). However for the facility to operate successfully at night without breaching the 45 dB(A) night-time limit of the World Bank within its 500 m radius, some noise mitigation measures are required (Figure 4.4). beyond this radius no mitigation measure is required to operate within the limit.

4.2 Cumulative Ambient Noise Levels Associated with the Plant's Operations

Cumulative ambient noise levels associated with operation of the facility as investigated with ***scenario 2*** gives ambient noise levels of 45.0 – 96.5 dB(A) as shown in Figure 4.5. This cumulative noise levels shall not breach the 70 dB(A) industrial noise limit within the noise sources fencelines (Figure 4.6). Its operation without breaching the 55 dB(A) day-time noise limit requires some mitigations measures within 200 m of the Gbaran NIPP though none is required for the proposed lubricating oil blending plant (Figure 4.7). Both the proposed lubricating oil blending plant and the existing Gbaran NIPP power plant requires mitigation measures within their 500 m radius for 45 dB(A) day-time noise limit of the World Bank not to be breached (Figure 4.8).

4.3 Impacts of Ambient Noise Levels Associated with the Plant's Operations

The 90 dB(A) shopfloor limit of the Federal Ministry of Environment shall not be breached beyond the production floor of the lubricating oil blending plants and its electric power generators' house. Also, the 70 dB(A) industrial area and 55 dB(A) day-time limits of the World Bank shall not be breached beyond its fenceline. However for its night-time operation to be harmless there is the need for mitigation measures so that the 45 dB(A) night-time limit is not breached within 500 m radius of its fenceline. The cumulative impacts are not significantly different from these.

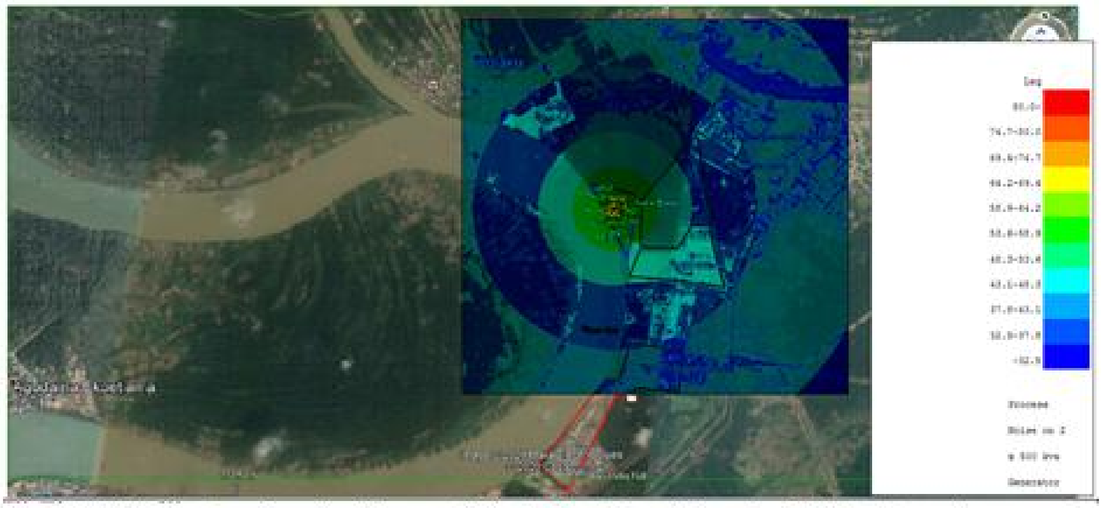

Fig. 4.1: Noise Contour from the Proposed Plant when Operated on 2 x 500 kva Generators

ERASKON NIGERIA LIMITED

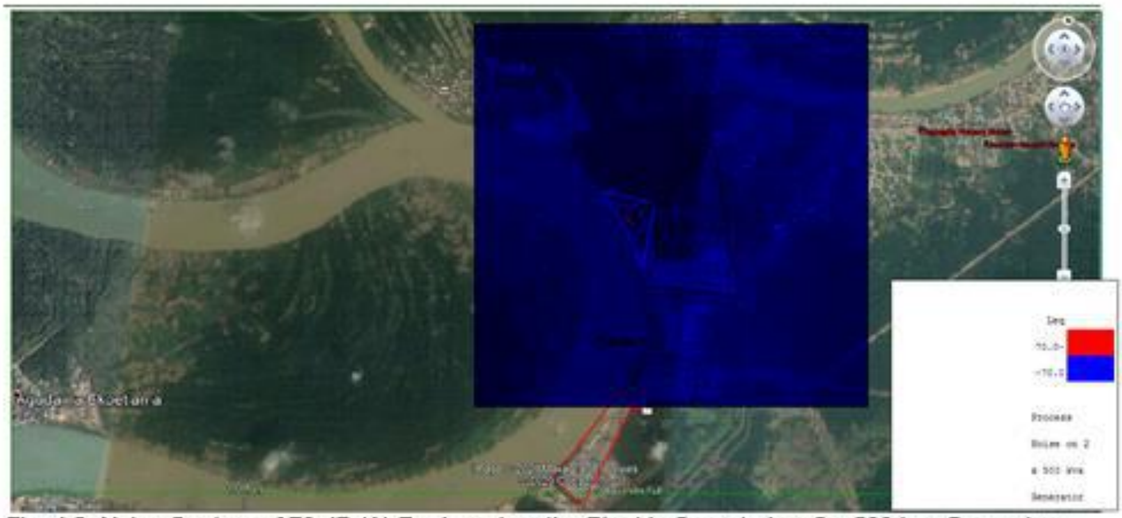

Fig. 4.2: Noise Contour of 70 dB (A) Region when the Plant is Operated on 2 x 500 kva Generators

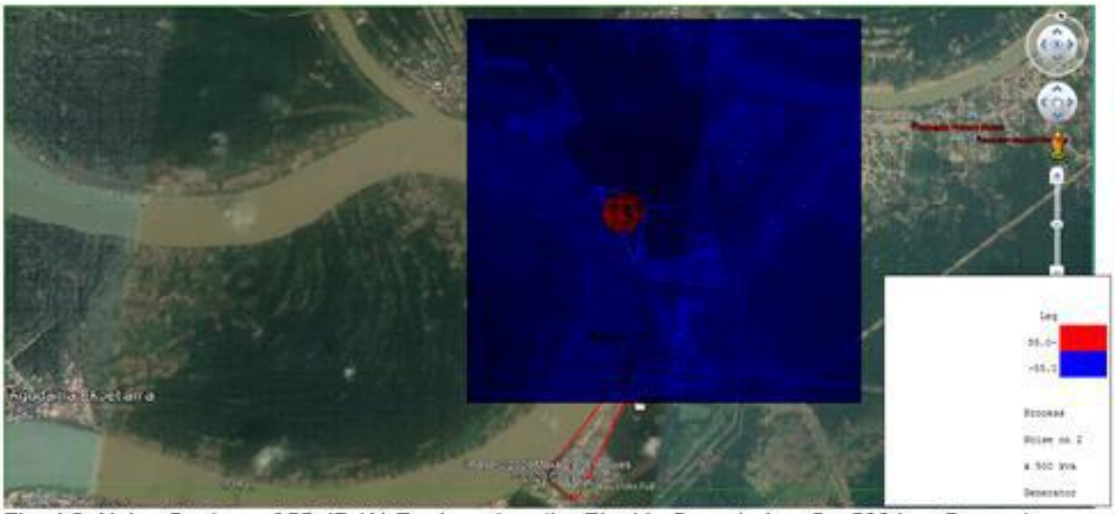

Fig. 4.3: Noise Contour of 55 dB (A) Region when the Plant is Operated on 2 x 500 kva Generators

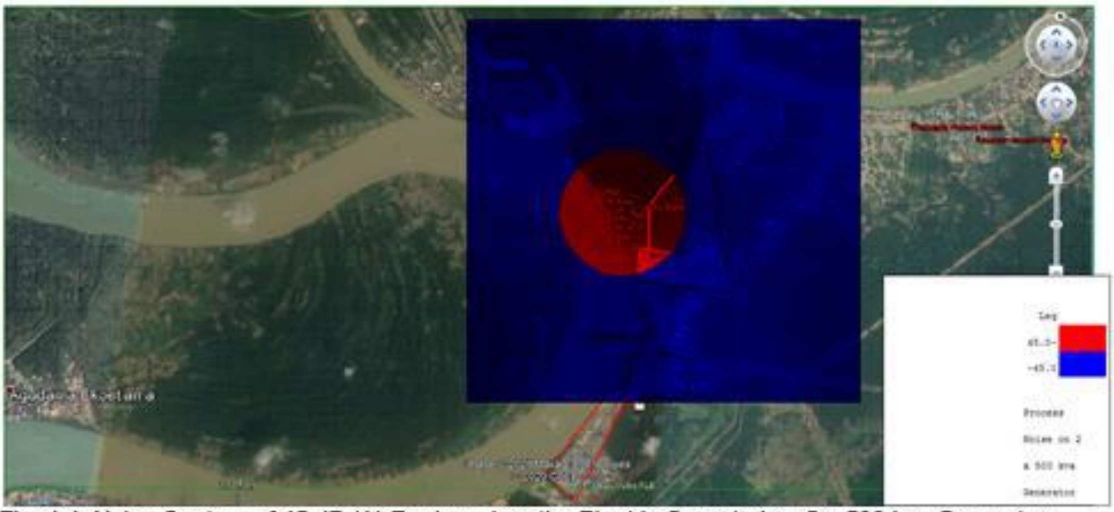

Fig. 4.4: Noise Contour of 45 dB (A) Region when the Plant is Operated on 2 x 500 kva Generators

8

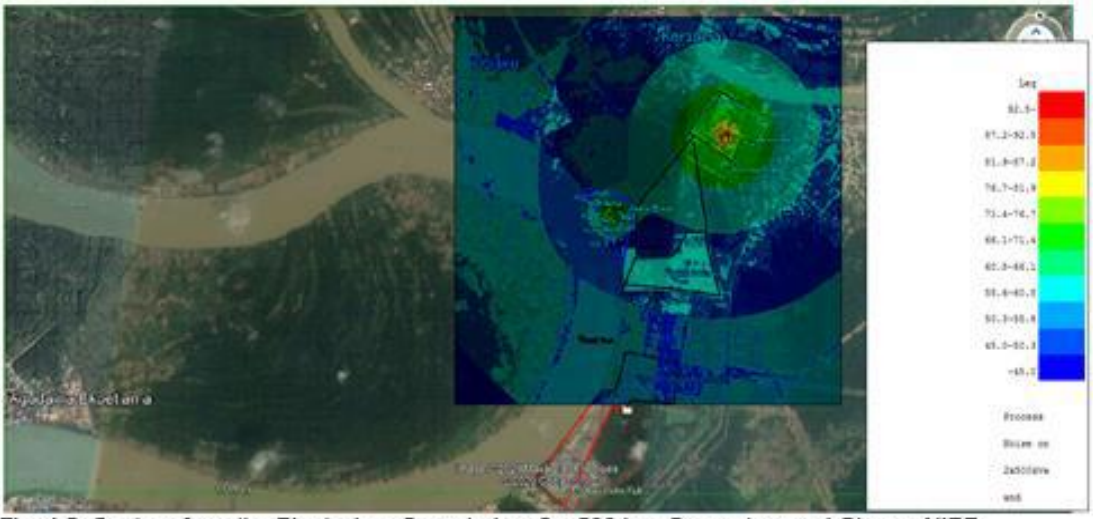

Fig. 4.5: Contour from the Plant when Operated on 2 x 500 kva Generators and Gbaran NIPP

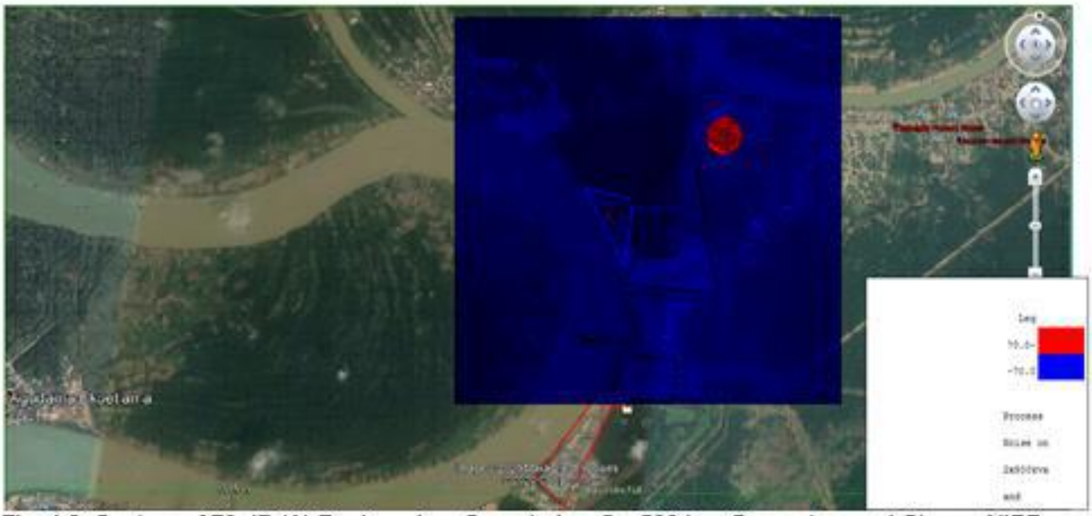

Fig. 4.6: Contour of 70 dB (A) Region when Operated on 2 x 500 kva Generators and Gbaran NIPP

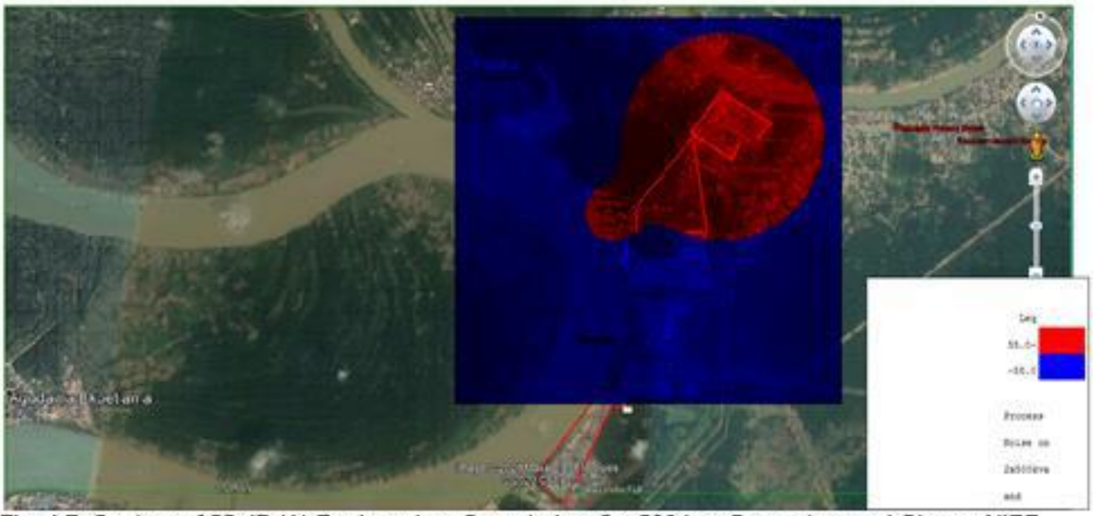

Fig. 4.7: Contour of 55 dB (A) Region when Operated on 2 x 500 kva Generators and Gbaran NIPP

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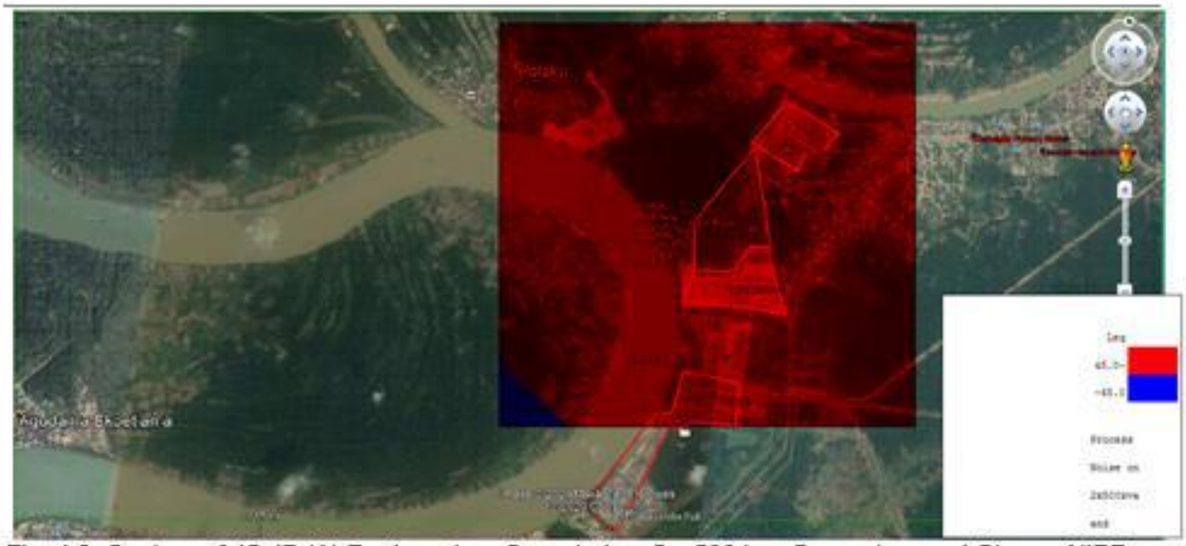

Fig. 4.8: Contour of 45 dB (A) Region when Operated on 2 x 500 kva Generators and Gbaran NIPP

CONCLUSIONS

Impacts of noise from the proposed 50,000 litres per day lubricating oils blending plant facility proposed by Eraskon Nigeria Limited, in Izeinbou Bush, Tunama Community, Gbaran Clan, Yenagoa Local Government Area (LGA) Bayelsa State have been investigated using NoiseMap 2000 and two operation scenarios. It can be concluded that its anticipated maximum ambient noise levels of 32.5 – 92.5 dB(A) shall not breach the 90 dB(A) shopfloor limit of the Federal Ministry of Environment beyond the production floor of the lubricating oil blending plants and its electric power generators' house. Also, the 70 dB(A) industrial area and 55 dB(A) day-time limits of the World Bank shall not be breached beyond its fenceline. However for its night-time operation to be harmless there is the need for mitigation measures so that the 45 dB(A) night-time limit is not breached within 500 m radius of its fenceline. The cumulative impacts are not significantly different from these.

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