

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIA)

For the Proposed
**CENTURY POWER GENERATION LIMITED
(CNG MOTHER /DAUGHTER STATION)
WARRI, WARRI SOUTH LGA, DELTA STATE**



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Submitted To:

**FEDERAL MINISTRY OF
ENVIRONMENT
BROWN BUILDING
ABUJA, NIGERIA**

JUNE 2026

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT

For the Proposed

CENTURY POWER CNG STATIONS (MOTHER & DAUGHTER STATIONS) WARRI, WARRI SOUTH LGA DELTA STATE

Project Proponent:

CENTURY POWER GENERATION LIMITED

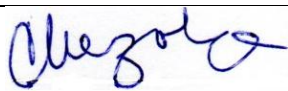
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JUNE, 2026

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LIST OF ABBREVIATIONS & ACRONYMS

%	-	Percentage
μS	-	micro Siemen
<	-	Less Than
>	-	Greater Than
°C	-	Degree Celsius
μg	-	Microgramme
μm	-	Micrometer
AIDS	-	Acquired Immune Deficiency Syndrome
ALARP-		As Low As Reasonably Possible
ANSI	-	American National Standard Institute
APHA	-	American Public Health Association
API	-	American Petroleum Institute
ASME	-	American Society of Mechanical Engineers
ASTM	-	American Society for Testing and Materials
BOD	-	Biochemical Oxygen Demand
Ca	-	Calcium
CASHES-		Community Affairs, Safety, Health, Environment and Security
CBO	-	Community Based Organizations
Cd	-	Cadmium
CDC	-	Community Development Committee
Cfu	-	Colony forming units
Cl ⁻	-	Chloride ion
cm	-	Centimetre
CNA	-	Clean Nigeria Associates
CO	-	Carbon Monoxide (Carbon II Oxide)
CO ₂	-	Carbon Dioxide (Carbon IV Oxide)
COD	-	Chemical Oxygen Demand
Cr	-	Chromium
Cu	-	Copper
dBA	-	Decibel
DO	-	Dissolved Oxygen
DPR	-	Department of Petroleum Resources
EGASPIN-		Environmental Guidelines and Standards for the Petroleum Industry in Nigeria

EIA	-	Environmental Impact Assessment
EMP	-	Environnemental Management Plan
EU	-	European Union
FAO	-	Food and Agricultural Organisation
Fe	-	Iron
FEPA	-	Federal Environmental Protection Agency
FMEEnv-		Federal Ministry of Environment
FRSC	-	Federal Road Safety Commission
ft	-	Feet
g	-	Gramme
GPS	-	Global Positioning System
GPM	-	Gallons Per Minute
hPa	-	Hectopascal
Hr	-	Hour
H ₂ S	-	Hydrogen Sulphide
H ₂ O	-	Water
HAZID	-	Hazard Identification
HAZOP		Hazard Operational Analysis
HB	-	Heterotrophic Bacteria
HUB	-	Hydrocarbon Utilizing Bacteria
HDB	-	Heterotrophic Degrading Bacteria
HIV	-	Human Immunodeficiency Virus
HSE	-	Health, Safety and Environment
IMO	-	International Maritime Organisation
ISO	-	International Organization for Standardization
ITCZ	-	Inter Tropical Convergence Zone
K	-	Potassium
Kg	-	Kilogramme
Km	-	Kilometer
Km ²	-	Square Kilometre
KVA	-	Kilovolt-Ampere
LGA	-	Local Government Area
LPM	-	Litres per minute
MARPOL		International Convention for the Prevention of Pollution from Ships

M	-	Meter
Mg	-	Magnesium
mg	-	Milligramme
mg/kg	-	Milligramme per Kilogramme
mg/l	-	Milligramme per Litre
ml	-	Millilitre
mm	-	Milimetre
Mn	-	Manganese
MPN	-	Most Probable Number
MSDS	-	Material Safety Data Sheets
MT	-	Metric tonnes
N	-	North
N/D	-	Not Detected
NA	-	Not Applicable
Na	-	Sodium
NiMET	-	Nigerian Meteorological Agency
NMDPRA-	-	Nigeria Midstream and Downstream Regulatory Authority
NOSCP-	-	National Oil Spill Contingency Plan
NFPA	-	National Fire Protection Act
NGO	-	Non-governmental Organisation
NPF	-	Nigerian Police Force
NIWA	-	National Inland Waterways Authority
Ni	-	Nickel
NO _x	-	Nitrogen Oxides
NTU	-	Nephelometric Turbidity Unit
Pb	-	Lead
PDR	-	post decommissioning report
pH	-	Hydrogen Ion Concentration
PHCN	-	Power Holding Company of Nigeria
ppm	-	Parts per Million
psi	-	Pounds per Square Inch
PTS	-	Permit to Survey
PTW	-	Permit to Work
QA	-	Quality Assurance

RoW	-	Right of Way
S	-	South
SO _x	-	Oxides of Sulphur
Sp.	-	Species (Singular.)
SPM	-	Suspended Particulate Matter
Spp.	-	Species (Plural.)
STDs	-	Sexually Transmitted Diseases
TDS	-	Total Dissolved Solids
THC	-	Total Hydrocarbon Content
TOC	-	Total Organic Carbon
ToR	-	Terms of Reference
VOC	-	Volatile Organic Compounds
WHO	-	World Health Organisation
WMO	-	World Meteorological Organization
Zn	-	Zinc

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The entire Management of Century Power Generation Limited expresses its gratitude to the Consultants, Chemtek Associates Limited for for the execution this EIA Studies and Report for the proposed Century Power CNG Mother and Daughter Stations to be located Nest Oil JBL Yard, NPA Express Way, Warri, Delta State.

We are also grateful to the staff of Federal Ministry of Environment (Abuja and Asaba Offices), for their guidance and to all the stakeholders for their support in producing this EIA Report.

EXECUTIVE SUMMARY

ES 1.0 INTRODUCTION

1.1 Project Background

Century Power Generation Limited, (hereafter referred to as “CPGL” or “CENURY POWER” “the Company”) the project proponent, is an indigenous company and a promising major player in the downstream sector of petroleum industry in Nigeria; that prides itself in developing and implementing local solutions to local problems.

The Company seeks to set up a Natural Gas Compression (CNG) Mother / Daughter Station with a capacity of 3 MMSCFD at Nest Oil JBL Yard, NPA Express Way, Warri, Delta State. Upon completion, the facility will receive natural gas via the Escravos–Lagos Pipeline, compress it to a pressure of 250 bar(g), and convert it into CNG for distribution to designated off-takers. The proposed site lies between approximately between latitudes N 5°33'37.68" - N 5°33'37.23" and E 5°43'44.12" – E 5°43'44.15" with an elevation of 474ft. The project is envisaged to have various interactions with the environment for which an Environmental Impact Assessment is required by law. Therefore, the Company engaged Chemtek Associates Limited an FMEnv. accredited Firm to conduct the EIA Studies.

Therefore, in compliance with the regulatory requirement an EIA application form was filled and submitted to FMEnv., followed by a Terms of Reference/Scope of Work (ToR/SoW). A field visit was conducted by FMEnv staff and other EIA processes ensured, thus this Environmental Impact Assessment Report was prepared and submitted for review and approval, to enable the commencement of the project.

1.2 Objectives of Study

The objective of the study are as follows;

- Describe the project, and establish the baseline conditions of the project area with respect to the biophysical, social and health environment;
- identify and evaluate the potential impacts of the project activities on the biophysical, social and health environments of the area.
- identify and assess the potential socio-economic effects of the project on the communities' livelihood patterns, including impacts on cultural properties, social infrastructures, natural resources and values.
- Show that a systematic assessment of the potential impacts of the proposed project has been carried out and mitigation measures proffered;
- Develop a cost-effective Environmental Management Plan (EMP) for the entire lifecycle of the project;
- Initiate precursory measures to obtaining Environmental Impact Statement

1.3 Legal and Administrative Framework

The proposed project has to be approved by the Federal Ministry of Environment and other national environmental regulatory ministries, agencies/authorities; and there are certain regulations, laws, edicts, guidelines that are relevant and applicable to the project. These are outlined as follows;

➤ Federal Ministry of Environment

The concern to protect the environment and the provision of an adequate institutional arrangement to address this issue began in the days of the colonial government; with efforts such as prohibiting water pollution and inspection of homes by health inspectors. Post-independence era saw the first major bold step taken by the Federal Government to provide a statutory response to environmental issues when in 1975, a division of Urban and Environment was created in the Federal Ministry of Economic Development to handle among others, pollution and other industrial matters. The Federal Government of Nigeria (FGN) by Act 58 of 1988 established the Federal Environmental Protection Agency (FEPA) to protect, restore and preserve the ecosystems of the nation. The Agency's authority was further strengthened when in January 1992 through Act 59; the FGN moved FEPA to the Presidency and expanded its mandate to include the protection of Nigeria's biodiversity and conservation of its natural resources by merging the National Resources Conservation Council with the Agency. With the creation of the Federal Ministry of Environment in June 1999, FEPA was absorbed and its functions taken over by the Ministry. The Ministry has published guidelines for environmental protection of various industries including the oil industry.

These legal instruments/guidelines stipulated by FMEnv include:

- Guidelines and Standards for Environmental Pollution Control in Nigeria.
- Regulation S.1.8 (CAP 131 LFN), National Effluent Limitations Regulations which gives the limitations of the concentrations for discharge of substances into land, atmosphere and receiving surface waters.
- Regulations S.I.9 (CAP 131 LFN), National Pollution Abatement in industries and abatement equipment to treat emissions and effluent discharges to the limits and standards prescribed in Regulations S.I.8.
- Waste Management and Hazardous Waste Regulations S.I.15. National Guidelines for Environmental Audit in Nigeria.

➤ The National Environmental Impact Assessment Act No. 86 of 1992 (Now: EIA Act CAP E12 LFN 2004).

The Environmental Impact Assessment (EIA) Act, No.86, 1992 (now: EIA: Act CAP E12 LFN 2004) is the primary Act governing any EIA in Nigeria. It was developed to enable environmental impacts be considered on specified public and private projects. The Act gives specific powers to the Federal Ministry of Environment (FMEnv) to facilitate Environmental Assessments of proposed projects. The Act clearly stipulates among other things the objectives of an EIA, list of project activities for which an EIA is mandatory; minimum content

of an EIA, regulatory authorities of FMEnv; offences and penalties. It sets out the procedures and methods to enable the prior consideration of an EIA on certain public or private projects. Chapter 2 (2) of the Act requires that where the extent, nature or location of a proposed project or activity is such that it likely to significantly affect the environment, an EIA must be undertaken in accordance with the provisions of the Act. The proponents of such projects or activities are required, prior to embarking on the proposed project, to apply in writing to FMEnv, in order that an EIA can be undertaken while the Project is still in the planning stages.

Chapter 4 (a) – (g) sets out that the minimum requirements for inclusion in an EIA report are as follows:

- Description of the proposed activities;
- Description of the potentially affected environment of the proposed project including specific information necessary to identify and assess the environmental effects of the proposed activities;
- Description of practical activities, as appropriate;
- Assessment of the likely potential environmental impacts of the proposed activities and the alternatives, including direct or indirect, cumulative, short and long-term effects;
- Identification and description of measures available to mitigate adverse environmental impacts of the proposed activities and an assessment of these measures;
- Indication of gaps in knowledge and uncertainty;
- Indication of whether the environment of any other state or Local Government Area(s) or areas outside Nigeria are likely to be affected by the proposed activity or its alternatives;
- Brief and non-technical summary of the information provided under the above provisions.

Section 7 of the Act requires that, prior to making a decision FMEnv must give opportunity to government agencies, members of the public, experts in any relevant discipline and interested groups to comment on the EIA.

Section 9 (1) requires that FMEnv is to give its decision in writing, including reasons therefore and provision, if any, to prevent, reduce or mitigate damage to the environment.

➤ **National Policy on the Environment (1989, Revised 1999; 2017)**

The National Policy on Environment, 1989, identified the key sectors in which environmental concerns were to be integrated with sustainable development. It presented specific guidelines for achieving 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, and in particular:

- Problems arising from industrial production processes;
- Problems caused by excessive pressure of the population on the land and other resources; and
- Problems due to rapid growth of urban centers.
- Design and application of broad strategies for sustainable environmental protection and management at systemic or sub-systemic levels;
- Enactment of necessary legal instruments designed to strengthen the activities and strategies recommended by this policy; and
- Establishment/emplacement of management organs, institutions and structures designed to achieve the policy objectives.

This Policy defines guidelines and strategies for achieving the policy goal, and, in particular to:

- Secure a quality of environment adequate for good health and wellbeing;
- Conserve and use the environment and natural resources for the benefit of present and future generations;
- Restore, maintain and enhance the ecosystems and ecological processes essential for the functioning of the biosphere to preserve biological diversity and the principle of optimum sustainable yield in the use of living natural resources and ecosystems;
- Raise public awareness and promote understanding of the essential linkages between the environment, resources and development, and encourage individual and community participation in environmental improvement efforts;
- Co-operate in good faith with other countries, international organizations and agencies to achieve optimal use of transboundary natural resources and effective prevention or abatement of transboundary environmental degradation.

➤ **Petroleum Act CAP 350 LFN 1990 (Formerly the Petroleum Act of 1969)**

Pollution control regulations in the oil and gas operations are governed by the principal legislation of Petroleum Act. The regulations are made pursuant to section 9(1) b (i) and (iii) of the Petroleum Act 1969 which empowers the Minister of Petroleum Resources to make regulations for safe working and the prevention of pollution of water courses and the atmosphere. The Act makes provision for the control of exploration of petroleum and the importation, storage, sale or distribution of petroleum products in Nigeria. It defines prescribes penalties for such offences.

➤ **Environmental Guidelines and Standards for the Petroleum Industry in Nigeria.**

Due to the growing concern for adverse environmental impacts or damages arising from oil related pollution, the Nigeria Midstream and Downstream Regulatory Authority (NMDPRA)

formerly Department of Petroleum Resources in 1981 issued interim Guidelines (revised 2002, 2018) concerning the monitoring, handling, treatment, and disposal of effluents, oil spills and chemicals, drilling muds and drill cuttings by leases/oil operators.

The overall objectives of the Environmental Guidelines and Standards are as follows;

- a) Establish Guidelines and Standards for the Environmental Quality Control of the Petroleum Industry taking into account existing local conditions and planned monitoring programmes.
- b) Provide, in one volume, for the operator and other interested persons a comprehensive' integrated document on pollution abatement technology, guidelines and standards for the Nigerian Petroleum Industry.
- c) Standardize the environmental pollution abatement and monitoring procedures, including, the analytical methods for various parameters.

➤ **Criminal Code Act of 1997 (Criminal Code Act CAP 77 of 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 so as to make it noxious to the health of persons in general dwelling or carry-on business in the neighborhood, 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.

➤ **Nigerian Landuse Act, 1978 (Landuse Act CAP L5 LFN 2004)**

The Land-use Act was promulgated in 1978 with commencement date of March 29, 1978, was revised in 2004. The Act states "it is in the public interest that the rights of all Nigerians to use and enjoy land in Nigeria in sufficient quality to enable them to provide for the sustenance of themselves and their families should be assured, protected and preserved"

The Act vests all land in each state of the Federation (except already vested in the Federal Government of Nigeria or its agencies) in the Governor of the state. It makes the State Government the authority for allocating land in all urban areas of residential, agricultural, commercial and other purposes, while it confers similar powers regarding non-urban areas on the local government in such cases. The governor of a state can revoke a right of occupancy for overriding public interest (e.g. projects of paramount importance for the socio-economic development of the country)

The following surface rights are permitted under Section 51 of Land Use Act.

- Fishing rights;
- Buildings and other structures, juju shrines, objects of worship;
- Farms, cultivated crops, economic trees, roads; and,

- Loss of use of the land

➤ **The Nigerian Urban and Regional Planning Act, 1992**

The Nigerian Urban and Regional Planning Act 88 of 1992 established a Development Control Department (DCD) charged with the responsibility for matters relating to development, control and implementation of physical development plans at Federal, State and Local Government levels within their respective jurisdictions.

- a. Approval of the relevant DCD shall be required for any land development
- b. A developer shall submit a development plan for the approval of the DCD of local Government, State or Federal Government
- c. A developer (whether private or government) shall apply for a development permit in such manner using such forms and providing such information including plans, designs, drawings and any other information as may be prescribed.
- d. A developer shall at the time of submitting his application for development submit to an appropriate Control Department a detailed environmental impact statement (EIS).

➤ **National Environmental Standards and Regulations Enforcement Agency (NESREA) Act No. 25, 2007**

The National Environmental Standards and Regulations Enforcement Agency (NESREA) Act of 2007 provides for the establishment of NESREA (as a parastatal of the Federal Ministry of Environment) to be charged with the 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 functions of the Agency include:

- Enforce compliance with laws, guidelines, policies and standards on environmental matters;
- Coordinate and liaise with stakeholders within and outside Nigeria on matters of environmental standards regulations and enforcement;
- Enforce compliance with the provisions of international agreements, protocols, conventions and treaties on the environment, including climate change, biodiversity conservation, desertification, forestry, oil and gas, chemicals, hazardous wastes, ozone depletion, marine and wildlife, pollution, sanitation and such other environmental agreements as may from time to time come into force;
- Enforce compliance with policies, standards, legislation and guidelines on water quality, environmental health and sanitation, including pollution abatement;

- Enforce compliance with guidelines and legislation on sustainable management of the ecosystem, biodiversity conservation and the development of Nigeria's natural resources;
- Enforce compliance with any legislation on sound chemical management, safe use of pesticides and disposal of spent packages thereof;
- Enforce compliance with regulations on the importation, exportation, production, distribution, storage, sale, use, handling and disposal of hazardous chemicals and waste other than in the oil and gas sector;
- Enforce through compliance monitoring, the environmental regulations and standards on noise, air, land, seas, oceans and other water bodies other than oil and gas sector; and
- Ensure that environmental projects funded by donor organizations and external support agencies adhered to regulations in environmental safety and protection etc.

Specific relevant regulations enforced by NESREA include

- National Environmental (Sanitation and Waste Control) Regulations, 2009 (S.I.28);
- National Environmental (Ozone Layer Protection) Regulations, 2009 (S.I.32) and;
- National Environmental (Noise Standards and Control) Regulations, 2009 (S.I.35)

➤ **Environment Protection (Industrial Noise) Policy 1994 (Industrial Noise Policy)**

This provides guidance on noise levels that may be deemed excessive under the Act. It should be noted that the Act requires site specific issues be taken into account when determining noise levels that may be excessive. The Environment Protection Authority (EPA) may issue an Environment Protection Order requiring that the excessive noise be curtailed within a specified period.

➤ **State Regulation**

The Nigerian Constitution permits states to make legislations, laws and edicts on the Environment. State Environmental Protection Agencies (SEPA's) have the responsibilities for environmental protection at the state level, and therefore regulate the consequences of project development on the environment in their areas of jurisdiction.

The Delta State Ministry of Environment, has its responsibilities to amongst others:

- Formulate and enforce policies, statutory rules, and regulations on waste collection and disposal, general environmental protection, control and regulation of the ecological system and all activities related thereto;
- Advise the government on environmental policies and priorities and on scientific and technological activities affecting the environment;
- Co-ordinate the activities of the Local Government and other government agencies on environmental and ecological matters;

- Establish the measure to ensure the effective environmental structures in the State for flood and erosion control, solid and liquid wastes collection and disposal, water and air pollution eradication, noise control and general sanitation;
- Conduct public enlightenment campaigns and disseminate vital information on environmental and ecological matters;
- Prepare master plans for drainage, solid and liquid wastes management and for general aesthetic development of environmental technology and to ensure the implementation of such plans;
- Promote co-operation in environmental science and technology with bodies whose main objective is the protection of the environment;
- Monitor sources of toxic pollution in air, land and water and offer necessary advice to industrial establishments;

1.4 Scope of Work

The scope of work for this study includes:

- Review of relevant national laws, regulations and codes in respect of the proposed project.
- Review of existing literature on the proposed project area; these shall include reports on the physico-chemical, biological and socio-economic characteristics of the environment, previous environmental baseline/studies report etc., in order to characterize the existing baseline conditions.
- Describe the proposed project activity and the processes that will be involved in carrying out the exercise.
- Field data gathering covering biophysical and socio-economic components of the Project's Area of Influence and laboratory analysis of field samples and data analysis
- Impact identification, prediction, interpretation, evaluation and proffering of effective preventive, abatement and control measures.
- Development of cost-effective Environmental Management Plan (EMP) covering the project lifecycle.
- Preparation/production of EIA Report in line with the regulatory requirements.

ES 2.0 PROJECT JUSTIFICATION

2.1 Need of the Project

Nigeria has abundant natural gas but limited pipeline infrastructure, so mother/daughter stations provide a practical way to compress, transport, and distribute gas to areas that pipelines cannot reach.

Mother stations compress gas at source; daughter stations receive and dispense it. This model allows CNG distribution even where pipelines do not exist, enabling nationwide easy access.

CNG is typically 30–50% cheaper than petrol or diesel, so this means cheaper transportation and lower operating costs for small industries and factories.

From an environmental point of view, CNG is a cleaner fuel as it burns cleaner than petrol or diesel, by up to 25% less CO₂; up to 90% less particulate matter and lower NO_x and SO_x emissions. This supports Nigeria's climate commitments and improves urban air quality.

Furthermore, the project supports the he Presidential CNG Initiative (PCNGI), and boosts Local Economic Development. This is especially relevant for states like Delta, where industrial clusters are growing.

The project sustainability shall be hinged on environmental, economic, technical and socio-political factors. Alternative, delayed and no projects were all considered but the overwhelming benefits and sustainability of the proposed project are more viable and acceptable.

2.2 Value of the Project

The envisaged capital investment required for the project is N50,000,000, which shall be privately funded. The value of the project would be seen in;

- The economic boost provided by the project;
- The number of job opportunities for Nigerians;
- The level of training provided for Nigerians;
- The number of jobs to be lost if the project does not go ahead or is carried out;
- The number of foreign investors attracted by the project.

2.3 Benefits of the Project

The expected benefits of the proposed project include amongst others:

- Immediate Fuel Cost Reduction for Transport and Industry, as CNG typically sells cheaper than petrol or diesel by 30–50%.
- As the gas pipeline network is limited and slow to expand, a mother/daughter station bypasses this constraint by enabling; a rapid expansion of gas availability without pipelines.
- CNG provides a domestic alternative to diesel, reducing energy cost by up to 40%;
- CNG burns cleaner than PMS or AGO, offering an improved urban air quality and supports Nigeria's climate commitments.
- Provides job opportunities for both skilled and unskilled labour; thus helping to reduce crime through employment generation.

- The project promises to generate revenue both for the investors and government (through taxes, levies and local economic expansion).
- Supports government policy and attracts incentives;

2.4 Project Sustainability

The sustainability of the proposed project in terms of economic, technical and environmental viability is discussed as follows;

Economic/Commercial Sustainability

The project's economic/commercial viability shall span from;

- Lower CNG fuel cost compared to diesel/petrol improves long-term demand from fleets (public transport, logistics, industrial users).
- Moderate capital expenditure compared to full pipeline-connected stations; daughter stations reduce the need for pipeline infrastructure.
- Revenue stability is strong when located near high-consumption customers (bus depots, industrial clusters).
- Key risks include gas supply price volatility, transport logistics costs for CNG trailers, and utilization rates below 40–50%.

Technical Sustainability

The technical viability hinges on the following:

- Proven, mature technology for compression, storage, and cascade dispensing ensures high reliability.
- Modular design allows scalable capacity as demand grows.
- Operational challenges include maintaining trailer integrity, compressor downtime, and ensuring adequate buffer storage to avoid supply gaps.
- Safety standards (NFPA, ISO 16923/16924) are well-established, reducing technical risk when properly implemented.

Environmental Sustainability

It is envisaged that the project would utilize relevant technology available to ensure an environmentally friendly facility. The environmental sustainability is based on;

- Significant emissions reduction vs. diesel: lower CO₂ (≈20–25%), near-zero SO_x, and reduced NO_x and particulate matter.
- Supports national decarbonization goals and cleaner urban air quality.
- Methane leakage management is essential; poor maintenance can offset environmental gains.
- Noise and local pollution are minimal compared to liquid-fuel stations.

Social Sustainability

CENTURY POWER has an existing relationship with the host community and shall ensure that at all stages of this project process, that the stakeholders and host communities are

involved. It is expected that there would be continuous involvement of all stakeholders throughout the project process through employment, empowerment, skills acquisition and provision of social infrastructure.

Overall Sustainability Outlook

A CNG mother/daughter station is highly sustainable as it is:

- Located near high-volume fleet users
- Supported by stable gas supply and logistics
- Operated with strong maintenance and safety practices
- Integrated into broader clean-transport or industrial-fuel strategies

ES 3.0 PROJECT DESCRIPTION

The proposed project location is Warri, Warri South LGA of Delta State, lies between latitudes N5°33'37.68" - N5°33'37.23" and longitudes E 5°43'44.12" – E 5°43'44.15" with an elevation of 474ft. The land size is 4,969.2 m².

The proposed project is for the construction of a CNG Mother/Daughter Station. Upon completion, the facility will receive natural gas via the Escravos–Lagos Pipeline, compress it to a pressure of 250 bar(g), and convert it into CNG for distribution to designated off-takers.

The project activities shall involve, construction/installation of process machines/equipment, vertical surface tanks, warehouse, office building and security house. Most of the materials needed for the project establishment, shall be sourced locally.

Mobilization to site, site preparation and construction activities is expected to commence on the third quarter of 2026. At the end of the project life (30years) it shall be decommissioned.

ES 4.0 EXISTING ENVIRONMENT

A multi-disciplinary approach was adopted for data acquisition and ecological characterization; which included climate and microclimate, air quality and noise, soil, vegetation, wildlife and biodiversity, aquatic, geology, social and community health status; within the spatial boundaries of the study area which is about 5 km from project boundaries.

Rainfall, atmospheric temperature and sunshine hours, and wind speed and directions, relative humidity and atmospheric pressure in the study area were obtained from meteorological records.

Hand-held meters (Igeress WP69305, Forensics FD-4S and Bosean BH-4S) were used to determine the concentration of pollutants HCHO, TVOC, PM (2.5, 5.0 and 10.0), CO, H₂S, O₂, NO₂, SO₂, and Tenmars TM-103 for sound level (noise). Garmin Gpsmap 78 was used to determine the co-ordinates. Gaseous pollutants (such as SO₂, NO₂, H₂S, and CO) were completely undetected. Volatile Organic Compounds (VOCs), Hydrocarbons (HC), and Suspended Particulate Matter (SPM) are present in negligible concentrations, well below the limits set by FMEnv, NMDPRA and typical global ambient air quality limits. Noise levels across

all points were below noise exposure level of 60dBA and consistent with a quiet-to-moderate suburban or commercial baseline.

Four (4) soil samples and one (1) control were taken from the proposed project site for; the topsoil (0-15cm) and subsoil (15-30cm). The soil is sandy and brownish in colour.

The soil samples are moderately acidic, with a pH value range of between 5.06 and 5.63, with a mean of 5.41. The TOC mean concentration was 0.30% with a range of between 0.12% and 0.65%; while the control value was 0.20%. For the exchangeable anions, the mean concentrations were sulphate 83.09mg/kg; phosphate was 61.72mg/kg and nitrate 16.29mg/kg.

The exchangeable cations; Mg, K, Na and Ca mean values were 17.53mg/kg, 11.54mg/kg, 40.84mg/kg and 37.27mg/kg respectively. For the organics in the soil TPH, PAH and BTEX were not detected, while Oil & grease occurred in low concentration. For the heavy metal Fe, Zn and Cu occurred in trace amounts, while Cd, Cr, Pb, Hg, Ni, V and Ba, were not detected.

The soil microbiological studies indicated that the total hydrocarbon utilizing bacteria (THUB) and faecal coliform were not detected in all the samples analysed. *Pseudomonas sp*, *Bacillus sp*, *Micrococcus sp*, *Chromobacterium sp* and *Actinomyces sp* were the bacteria isolated for heterotrophic bacteria (HB). *Rhodoturula*, *Mucor* was the only heterotrophic fungi (HF) isolated.

Overall, the soil quality assessment indicates that the project area is characterized by natural, slightly acidic, silt dominated soils with no evidence of chemical, hydrocarbon, or heavy metal contamination. The similarity between test and control samples demonstrates that no site-specific pollution sources are influencing soil conditions

Groundwater samples were taken from the proposed project site and two (2nos.) control stations during the field data gathering and were analysed to evaluate baseline water quality conditions within the project area. The analytical results provide insight into the physico-chemical, heavy-metal, and microbiological characteristics of the groundwater system. All samples were clear, colourless, and free from objectionable odour, indicating the absence of visible pollution or organic degradation.

All samples are clear and unobjectionable in odour which indicates no visible contamination or organic decay All samples are slightly acidic, with the project site sample having a pH value of 6.54 and control samples being more acidic with a pH value of 5.83, possibly due to natural soil acidity or minor anthropogenic influence.

Dissolved solids, conductivity, hardness, and alkalinity values were all low and well within regulatory limits, confirming that the groundwater is soft, lightly mineralized, and free from salinity intrusion. Nutrient levels (nitrate, sulphate, phosphate) were also low, suggesting no influence from agricultural runoff or sewage contamination. The exchangeable anions and cations concentrations recorded were within the permissible limits. Oil & grease occurred in low concentration with a value of 0.002mg/L for both the proposed project site and control, while TPH, PAH and BTEX were not detected. Heavy metal concentrations in all samples were generally low. Iron, copper, manganese, and zinc were detected at concentrations far below WHO and NSDWQ thresholds. Toxic metals such as lead, cadmium, chromium, and

mercury were not detected, indicating the absence of industrial or anthropogenic contamination.

Microbiological analysis showed no detection of Total Coliforms or *E. coli* in any of the samples. Total heterotrophic bacteria (THB) counts were very low, confirming that the groundwater is microbiologically safe and free from faecal contamination.

The vegetation in the study area consists of trees, grasses, weeds and cassava/yam farms. The wildlife composition includes mammalian, aves, reptilia, amphibians and insects.

Quantitative and qualitative research designs were employed in the evaluation of social impact. With the use of questionnaire administered on the residents, complemented by focus group discussion at the community, relevant data were collected and analysed.

The project host community Warri is a demographically dynamic, economically strategic city whose socio-economic conditions are shaped by oil-sector fluctuations, rapid population growth, and persistent insecurity. The native occupation of Warri people is traditionally fishing, trading, and small-scale farming, supported by craftsmanship and river transport. In modern times, these have expanded to include oil-sector employment and commercial services, reflecting Warri's evolution into an industrial and commercial centre.

There are three major traditional people of Warri, the Itsekiri, Urhobo, and Ijaw communities. The traditional religion of the Warri people (primarily Itsekiri, with significant Urhobo and Ijaw communities) is rooted in African Traditional Religion (ATR), centered on ancestral veneration, nature-based deities, and a strong belief in spiritual intermediaries.

The health status of the Warri population is characterized by a high burden of communicable diseases, rising non-communicable diseases, and significant environmental health risks associated with industrial activity and poor sanitation. While urban areas have relatively better healthcare access, riverine and low-income communities face substantial health vulnerabilities.

ES 5.0 POTENTIAL PROJECT IMPACT

The proposed project activity is likely to have minor biophysical, social and health impacts on the environment. The significant anticipated impacts arising from the proposed project were considered at four phases: site preparation/pre-construction; construction; operation and maintenance; and decommissioning/abandonment.

The envisaged significant impacts include; vegetation clearing, grading and levelling of the access road with attendant dust and particulate air load, increase in noise level, increased transportation and use of machinery during land preparation/construction and operation. The project promises to provide job opportunities, boast socio-economic activities and livelihoods.

ES 6.0 MITIGATION MEASURES

Mitigation measures were proffered for the identified impacts at the site preparation, construction, operational and decommissioning phases.

Site clearing shall be restricted to the areas mapped out for the construction, at the construction phase, and use of herbicides shall be avoided. Acoustic mufflers shall be use on heavy engines with noise levels above acceptable limits, and project activities should be restricted to daytime. Wetting of the surface should be applied where necessary to reduce dust/SPM load in the air.

Workers shall be provided with PPE (coveralls, jungle boots, hard hat and gloves) and their usage enforced. The construction site shall be warded-off with barricades to deter intruders. Time management shall be enforced to ensure that the construction of the Plant shall be executed within the shortest possible time. Warning signs shall be provided at noise prone areas and will be designated "Ear Muff Area".

Application of existing procedures/ criteria for indigenous labour sourcing and employment shall be implemented to curtail agitations and restiveness. Machinery with noise levels within acceptable limits shall be used. Wastes generated as a result of the project operations shall be handled by accredited waste managers. Fire protection facilities (detection, fighting and control) shall be provided at the Station and will be regularly inspected with regular drills carried out.

At the end of the project life, it shall be decommissioned in line with a combination of assets recovery, dismantling, and remediation. CENTURY POWER shall engage qualified contractors (particularly qualified indigenous contractors/ personnel) for the decommissioning exercise. The plant shall be returned as close as possible to the original state.

ES 7.0 ENVIRONEMNTAL MANAGEMENT PLAN

A robust Environmental Management Plan (EMP) has been developed for the phase-by-phase implementation and operations of the project, to ensure sustainability.

7.1 Objectives of the EMP

Some of the objectives of the Environmental Management Plan of this proposed project are to:

- Provide effective, site-specific, and implementable procedures and mitigation measures to monitor and control potential environmental impacts throughout the project;
- Ensure that the project activities do not adversely impact the environment / socio-economic systems in the surrounding area; and
- Present the potential environmental impacts and define the different management strategies that will be used to address them; establish procedures for monitoring; specify training, record keeping and documentation requirements.

The key components of the EMS developed for this project include:

- Commitment by leadership at all levels to foster operational excellence by assuring alignment of vision, expectations, resources and accountabilities;

- Comprehensive identification of high-level issues, risks, opportunities, and gaps in the system and operating practices that can impact on current or future ability to achieve the required level of performance;
- Establish clear yardsticks to measure statistically significant performance improvement toward goals and targets;
- Establish processes to ensure documents and records that are critical to operational excellence are current, controlled and accessible etc.

7.2 Post-EIA Environmental Monitoring

Environmental monitoring is the systematic collection of environmental data through a series of repetitive measurements. UNEP (1996) describes three known types of environmental monitoring within the conceptual EIA framework as follows:

- **Baseline Monitoring:** This refers to the measurements of environmental parameters in the pre-project period;
- **Effects Monitoring:** This involves the measurements of environmental parameters during project construction and implementation to detect changes in these parameters which can be attributed to the project; and
- **Compliance Monitoring:** This is the periodic or continuous measurements of environmental parameters or discharges to ensure that regulatory requirements and standards are met. Compliance monitoring can further be broken-down into:
 - o Mitigation measures monitoring, which relates to the prescribed mitigation measures, and
 - o Regulatory compliance monitoring, which must do with existing regulatory monitoring requirements.

7.3 Scope of Environmental Monitoring Plan:

The components to be monitored are: air quality, noise, surface and ground water, soil, sediment and waste management, traffic and transport, personnel safety and socioeconomic impacts.

The parameters to be monitored shall be according to FMEnv and NMDPRA recommendations.

ES 8.0 DECOMMISSIONING AND ABANDONMENT PLANS

At the end of a project life, usually 25-30 years, the project shall be decommissioned. In accordance with the Company's operational excellence and the regulatory requirement, adequate plans shall be put in place to decommission the proposed facility in a cost-effective and environmentally-friendly manner. The project shall be constructed, operated and decommissioned as required by FMEnv.

The Decommissioning Plan shall take into consideration the (temporary or permanent, partial or complete shutdown), plans for future use of the site (abandonment, new industrial use,

assignment to local community, non-industrial use), and the condition of the site and environment at the time of decommissioning. A detailed post-impact study of the project on the environment shall be conducted to determine appropriate restoration and remedial measures.

ES 9.0 CONCLUSIONS AND RECOMMENDATIONS

This study presented herein the outcome of the analysis conducted on the impact of the proposed project on the air quality/noise level, ground water, soil quality, geotechnical information, vegetation, fauna and flora, health and socio-economic components and mitigation measures proffered to reduce the magnitude of identified adverse impacts, to a Level As Low As Reasonably Practicable (ALARP) and further enhance the benefits of the positive impacts.

These mitigation measures are incorporated in the Environmental Management Plan developed for the proposed project. Following the Environmental Management Plan of the project, monitoring of the environmental components such as air, soil, ground water, socioeconomic, workers' health, and accident, the proposed project shall be sustainable and environmentally friendly all through the project lifecycle.

Based on this study therefore, we solicit for the approval of this EIA Report to enable the project move to the next level of its development.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Overview

Century Power Generation Limited, (hereafter referred to as “CPGL” or “CENTURY POWER” “the Company”) the project proponent, is an indigenous company and a promising major player in the downstream sector of petroleum industry in Nigeria. The Company intends to construct a Natural Gas Compression (CNG) Mother / Daughter Station with a capacity of 3 MMSCFD at Nest Oil JBL Yard, NPA Express Way, Warri, Delta State.

The facility is designed to support Nigeria’s ongoing transition toward cleaner, more sustainable energy sources by providing reliable CNG supply for industrial, commercial, and transportation users. The Mother Station will receive natural gas from the Escravos–Lagos Pipeline, compress it to a pressure of 250 bar(g), and load it into specialized CNG tube trailers. These trailers will transport the gas to Daughter Stations, where it will be decompressed and distributed to end-users. The project will incorporate modern compression technology, safety systems, and metering infrastructure to ensure efficient and environmentally responsible operations.

As part of the regulatory requirements of the Federal Ministry of Environment, CENTURY POWER is required to prepare an Environmental Impact Assessment Report (EIA) in order to determine the level and category of the environmental liabilities or otherwise of the proposed project. Chemtek Associates Limited was commissioned to conduct the Environmental Impact Assessment Studies.

1.2 Site Location

The proposed project site is located at Nest Oil JBL Yard, NPA Express Way, Warri, Delta State. The site lies between approximately between latitudes N5°33'37.68" - N5°33'37.23"; and longitudes E 5°43'44.12" – E 5°43'44.15" with an elevation of 474ft. **Fig 1.1** and **1.4** shows the location of the proposed facility. The land acquired for the project is 4,969.2 m².



Fig 1.1: Land Acquired for the Proposed Project

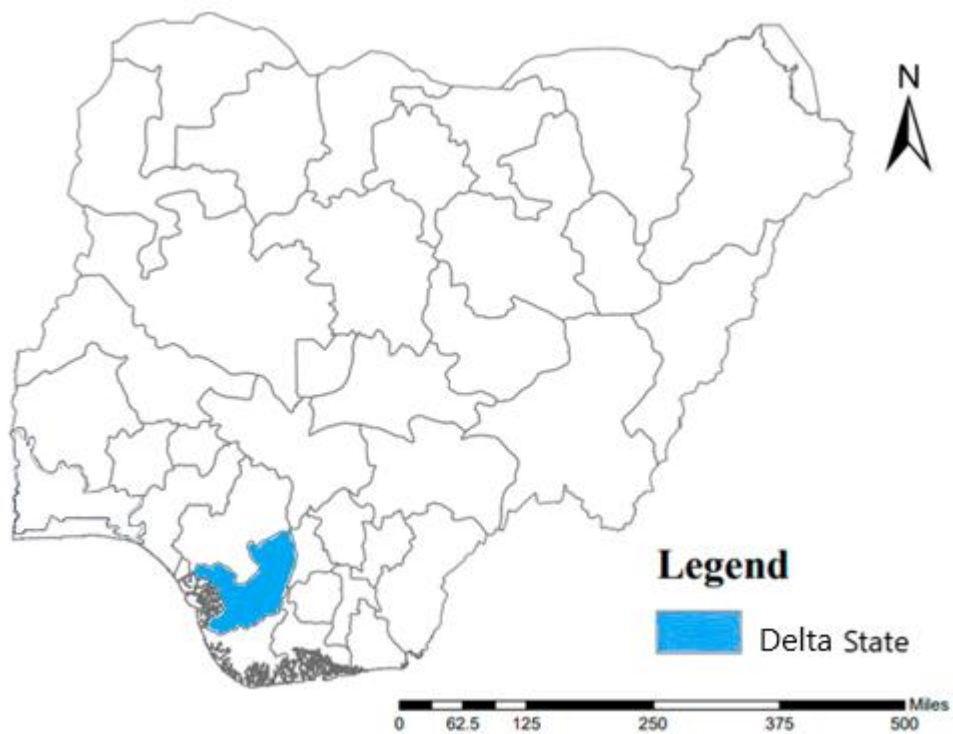


Fig 1.2: Map of Nigeria showing Delta State

1.3 Objectives of the EIA

The objectives of the Environmental Impact Assessment studies include the following:

- Acquire baseline data of the environment as well as the socio-economic and health conditions of the host communities;
- Use the baseline data to describe and characterize the study area;
- Identify the environmental sensitivities of the project area;
- The study will help the regulator in decision making to warrant termination of the process with this study or proceed to a full-blown EIA study;
- Determine and evaluate the potential impacts of the proposed project activities on the identified environmental sensitivities and the interactions between the sensitivities;
- Recommend appropriate mitigation measures; the EIA involves all stakeholders through consultation so as to address common problems, impacts and mitigating measures that might be proposed.
- Develop an Environmental Management Plan (EMP).

1.4 Terms of Reference (ToR) and Scope of Work (SOW)

The specified scope of work for the EIA for the proposed project shall cover the following:

- Literature review and desktop study; an extensive and comprehensive literature review specific to the area of study
- Investigation of national and international environmental regulations guiding the activities to be carried out as well as consultation with FMEnv. and other stakeholders;
- Field sampling for one (1) season and compilation of comprehensive environmental baseline
- Laboratory analyses of samples and data acquisition;
- Understanding the proposed project activities thereby identifying associated impacts of and hazards posed by the pursuit of the project;
- Consultations with relevant stakeholders including government institutions, project affected persons;
- Impact identification, prediction, interpretation and evaluation;

- Modification/ mitigating/ ameliorating plans to either eliminate or reduce adverse impacts to the extent possible;
- Recommendation of preventive, reduction and control measures for identified associated adverse impacts of the project
- Development of a cost effective EMP that recommends plans and procedures to manage the consequences and recovery from events throughout the lifetime of the project.

1.5 The EIA Process

The FMEnv has established guidelines for the conduct of Environmental Impact Assessment (EIA) for development projects as shown in **Fig 1.5**, which is the decision tree that summarizes the EIA Process flowchart. In conducting the EIA Study, the process is followed step-by-step sequentially as outlined in the procedural guideline.

1.6 The Proponent

The project proponent Century Power Generation Limited, is a company incorporated under the laws of Nigeria to do business in the petroleum sector and other sectors of the Nigerian economy. Century Power Generation Limited will own and operate the proposed CNG Mother/Daughter Station in Warri, Warri South LGA, Delta State.

1.7 Legal and Administrative Framework

The applicable legislations and guidelines relating to the operation of the proposed CNG Mother/Daughter Station at `Warri, Warri South LGA, Delta State broadly includes: the Federal Government's laws and regulations; International conventions, protocols and agreements to which Nigeria is signatory; Delta State Government legislation and the proponent's environmental guidelines/policies.

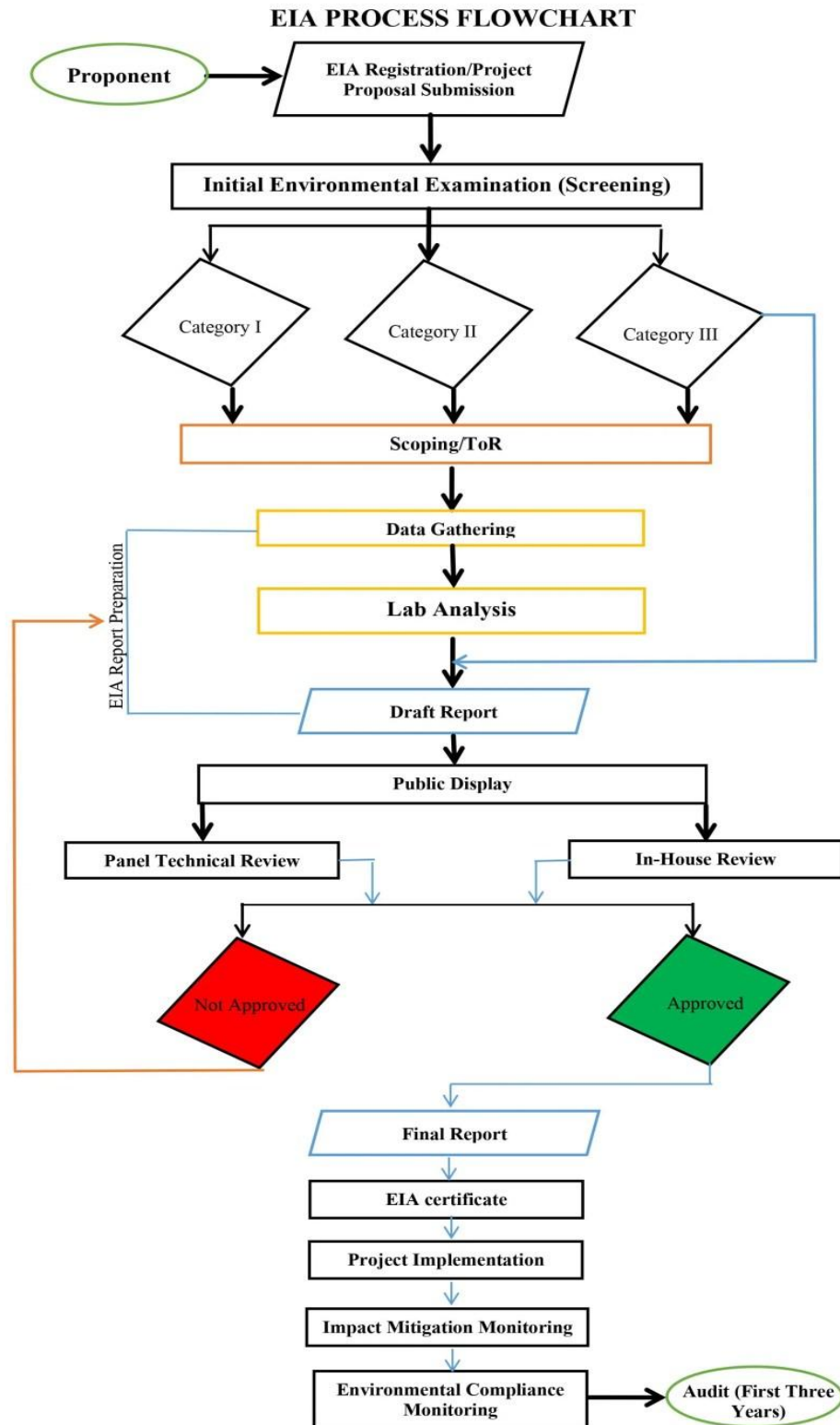


Fig 1.5: The FMEnv EIA Process Flowchart

1.7.1 FGN Requirements and Relevant Legislation

The Constitution of the Federal Republic of Nigeria (1999), as the national legal order, recognises the importance of improving and protecting the environment and makes provision for it. The relevant sections are:

- **Section 20** makes it an objective of the Nigerian State to improve and protect the air, land, water, forest and wildlife of Nigeria;
- **Section 12** establishes, though impliedly, that international treaties (including environmental treaties) ratified by the National Assembly should be implemented as law in Nigeria; and
- **Sections 33 and 34** which guarantee fundamental human rights to life and human dignity, respectively, have also been argued to be linked to the need for a healthy and safe environment to give these rights effect

1.7.2 Environmental Regulators

1.7.2.1 Federal Ministry of Environment (FMEnv), which was formerly the Federal Environmental Protection Agency (FEPA) was established by Act No 58 of 1988 and charged with the responsibility for environmental protection, development of the environment, biodiversity conservation and sustainable development of the nation's national resources. In addition, it was tasked to make regulations for environmental protection in Nigeria. In 1992, the agency was handed the responsibility to prepare Environmental Impact Assessment procedures for all development projects. Following a Presidential Directive in 1999, the functions of the defunct FEPA were absorbed by the Federal Ministry of Environment. The **EIA Act Cap E12 LFN 2004** gives specific powers to Minister of Environment to facilitate the EIA of Developmental Projects.

As environmental issues have become more challenging, the ministry's desire to operate more effectively has led to the establishment of new agencies: the National Oil Spill Detection and Response Agency (NOSDRA) and National Environmental Standard and Regulation Enforcement Agency NESREA (2007).

1.7.2.2 State Ministries of Environment have the responsibility for environmental protection in their representative states and enforce each state's environmental laws and edicts. Delta State Ministry of Environment created in 2001, is responsible in this case for environmental protection relating to activities at the proposed project.

In accordance with the provision of **Chapter 131** of the Laws of the Federal Republic of Nigeria, the Delta State Government mandated the ministry to:

- Ensure good and quality environment for human habitation in the state
- Monitor and control all forms of environment degradation in the State
- Monitor and control disposal of solid, gaseous and liquid wastes
- Carry out public enlightenment and education on environment protection and management
- Set, monitor and enforce standards and guidelines on gaseous emissions and effluent discharges
- Cooperate with other statutory bodies and research agencies on matters relating to environmental conservation/protection.

Delta State Ministry of Environment issues environmental guidelines to companies, industries and the general public for enhanced environment protection and management.

The Ministry is responsible for:

- Formulating and enforcing environmental protection and sustainability policies.
- Regulating waste management and sanitation enforcement.
- Controlling ecological challenges like flooding and erosion.
- Reviewing Environmental Impact Assessments (EIA) for state projects.
- Ensuring that companies/industries conspicuously display safety and warning signs in their premises.
- Challenging industries to set-up in-house waste management.
- Encouraging and enforcing the use of Personal Protective Equipment (PPE) in companies.

The ministry operates alongside several key parastatals

- Delta State Environmental Protection Agency (DELSEPA)
- Delta State Waste Management Board (DSWMB)

1.7.3 National Policy, Legislation, Regulations, Guidelines and Standards

1.7.3.1 National Policy on Environment (1989): This document contains guidelines and strategies for achieving the policy goal of sustainable development by:

- securing for all Nigerians a quality of environment adequate for their health and well-being;
- conserving and using the natural resources for the benefit of present and future generations;
- restoring, maintaining and enhancing the ecosystem and ecological processes essential for the preservation of biological diversity;
- raising public awareness and promoting understanding of the essential linkages between the environment, resources and development, and
- collaboration with other countries, international organizations and agencies to achieve optimal use of trans-boundary co-operation in order to protect environmental resources.

1.7.3.2 The National Effluent Limitation Regulation: The National Effluent Limitation Regulation, **S.1.8 of 1991 (No. 42, Vol. 78, August, 1991)**, makes it mandatory for industries (including research institutes, clinics, hotels, etc) as waste generating facilities to install anti-pollution and pollution abatement equipment on site (e.g. incinerators, thermal de-sorption units, wastewater treatment plants etc.) The regulation is specific for each category of waste generating facility regarding limitations of solid and liquid discharges or gaseous emissions into the ecosystem. Specified penalties for flouting are stated in the regulation.

1.7.3.3 Pollution Abatement in Industries, Industries Generating Wastes Regulation: The Pollution abatement regulation, **S.1.9 of 1991 (No. 42, Vol. 78, August, 1991)** places restrictions on the release of toxic substances and specifies the requirements for pollution monitoring units, machinery for combating pollution and contingency plan by industries. It also requires; the submission of lists to FMEnv that would include the types and details of chemicals used by industries; permit by industries for the storage and transportation of harmful or toxic waste; the generator's liability; approaches for waste reduction; permissible limits of discharge into public drains; protection of workers and safety

requirements; for environmental audit (or Environmental Impact Assessment for new industries) and penalty for contravention.

1.7.3.4 Management of Hazardous and Solid Waste Regulation: The management of hazardous and solid waste regulation, **S.1.15 of 1991 (No. 102, Vol. 78, August, 1991)** details the requirements for groundwater protection, surface impoundment, land treatment, waste piles, landfills, incinerators etc. It also contains the hazardous substances tracking programme with a comprehensive list of extremely hazardous chemical products and dangerous waste constituent. Additionally, it stipulates the requirements and procedures for inspection, enforcement and penalty.

1.7.3.5 Environmental Impact Assessment Act CAP E12 LFN 2004: The **EIA Act Cap E12 LFN 2004** (formerly EIA Act No 86 of 1992) makes EIA mandatory for all new major public and private projects in Nigeria. The EIA Act sets out to:

- consider the likely impacts and the extent of these impacts on the environment before embarking on any project or activity;
- promote the implementation of appropriate policy in all Federal Lands consistent with all laws and decision-making processes through which the goal of this Act may be realized, and
- encourage the development of procedures for information exchange, notification and consultation between organizations and persons when the proposed activities are likely to have significant environmental effects on boundary or trans-state or on the environment of bordering towns and villages.

The Act empowers the FMEnv to engage in environmental assessment of projects. In September 1995, FEPA published The EIA Sectoral Guidelines for Oil and Gas Industry Projects to provide assistance for proper and detailed execution of EIA studies in oil and gas projects, to conform to the **EIA Act Cap E12 LFN 2004**.

1.7.3.6 The Petroleum Act, 1969: This Act was enacted to prevent the pollution of water courses and the atmosphere. **Section 9-(1)(b) (iii) of the Petroleum Act 1969 (Decree 51)** states that the Minister of Petroleum Resources may make regulations on the prevention of pollution of water courses and the atmosphere.

1.7.3.7 Environmental Guidelines and Standards for the Petroleum Industry in Nigeria (EGASPIN), 1991: In 1991, the Department of Petroleum Resources (DPR) issued the first Environmental Guidelines and Standards for the Petroleum Industry in Nigeria (EGASPIN). These regulations are a comprehensive guide to all areas of operation in the oil and gas industry. They have been reviewed and updated since then, with the latest revision published in November 2018.

The Environmental Guidelines and Standards of 1991 (amended 2018) contains in **Part VIII (A), sections 3, 4, 5 and 6**, the EIA report process, significant effects/ impacts, content of an EIA Report and environmental screening respectively.

Part VII (1) 1.4.4.2.5 states that construction of a product depot shall require an Environmental Impact Assessment (EIA) Report, which must be approved by the Director of Petroleum Resources.

Part VII (1) 1.1.1 requires that bulk storage tanks in a depot should be surrounded by a main retaining bundwall which is capable of containing the content of the largest storage tank plus 10% of the content of the remaining tanks though if there is only one tank, the bundwall shall, in the event of any emergency, be capable of containing the contents of the tank while **Part VII (1) 1.4.3.2** lists the corrosion control measures to be adopted for the storage tanks to keep them in optimum condition.

Part VII (1) 1.4 summarizes the environmental management system where it mandates the licensees/ operators of depot, and associated pipelines to institute planned and integrated environmental management practices, aimed at ensuring that unforeseen, identified and unidentified environmental issues are contained and brought to an acceptable minimum.

Part VII (1) 1.4.3.1 – 1.4.3.7 of EGASPIN deals with the pollution control measures that should be adopted in the operation of the depot while **Part VII (1) 1.4.7** mandated depots to have their spill prevention and countermeasures plan approved by the Director, Department of Petroleum Resources.

1.7.3.8 Petroleum Regulations (1967): These regulations focus on the prohibition of discharge or escape of petroleum into waters within residential districts. They also

stipulate safety measures to be adopted when conveying petroleum through pipelines. The regulations also require that licenses should be obtained for premises where petroleum is to be stored.

1.7.3.9 Oil in Navigable Waters Act (1968): The Oil in Navigable Waters Act (**Act No 34 of 1968**) was put in place to implement the terms of the International Convention for the Prevention of Pollution of the Sea by Oil of 1954 as amended in 1962. It made provisions for such prevention in the navigable waters of Nigeria. The Act prohibits the discharge of oil or any mixture containing oil into the territorial or navigable inland waters from land, or from any apparatus used for transferring oil from or to an ocean-going vessel. The Act also points out the equipment that must be present in ships to prevent oil pollution and specifies the penalties for offences among others.

1.7.3.10 Oil Terminal Dues Act (1969): The Oil Terminal dues Act (1969) is deemed to have come into effect on January 01, 1965. This Act implements the Convention on the Continental Shelf (Geneva 1958) and incorporates the prohibition of oil discharge that applies under the Oil in Navigable Waters Act of 1968. In addition, the Act provides for the levy on terminal dues on any ship evacuating oil at any oil terminal and in respect of any services and facilities provided by the Nigerian Port Authority. Under this Act, it is the duty of the Authority to provide such navigational services or extend such facilities as may be necessary or expedient to serve the public interest in accordance with the requirements of the Convention on the Continental Shelf (Geneva 29/04/1958) which Nigeria is a party.

1.7.3.11 Mineral Oil (Safety) Regulations: The key requirements of the Mineral Oils (Safety) Regulations of 1963 (amended 1997) with respect to the operations at the proposed petroleum products depot are that a licensee or lessee shall:

- Provide clear, comprehensive, safe and practical operational procedures and guidelines for the work force;
- Develop and maintain contingency procedures and measures for the safety of personnel and equipment in the event of an emergency;

- maintain a documented system, stating the responsibilities of competent persons involved in the terminal operations, their mutual relations and lines of reporting and communications; and
- ensure that the use of personal protective equipment is compulsory and maintained in serviceable condition at all times.

The regulations also oblige licensees or lessees to ensure that handling and disposal of liquid and solid wastes including sanitary and domestic wastes, and accidental oil spills conform to requirements of the regulators.

1.7.3.12 Land Use Act CAP 15 LFN 2004

The Act vests all land in the urban areas of each state under the control and management of the Governor of the state. The Governor of the state holds the land in trust for the people of the state and is solely responsible for the allocation of land in all urban areas to individuals who reside in the state and to organizations for residential, agricultural and commercial purposes. All other land in the state subject to conditions under the Land Use Act is under the control and management of the local government. The Act divests traditional owners of land and vests such land in the state Governor for the benefit and use of all Nigerians.

1.7.3.13 Sectoral Guidelines for manufacturing section

In furtherance of the mandate of the Federal Ministry of Environment as the apex organization for the overall protection of the Environment and Conservation of Natural Resources as contained in Decree 58 of 1988 and 59 of 1992, is this set of guidelines on various sectors of the Nigerian Economy developed. These Sectoral Guidelines provide advice and guidance to assist in the preparation of the EIA Reports for industrial projects. This is to ensure the environmental sustainability of these sectors through compliance with E.I.A Decree 86 of 1992 which makes Environmental Impact Assessment (EIA) mandatory for all new major projects.

1.7.3.14 Harmful Waste (Special Criminal Provision) Act CAP N138 LFN 2004

The Harmful Waste Act prohibits, without lawful authority, the carrying, dumping or depositing of harmful waste in the air, land or waters of Nigeria. The following sections are notable:

- **Section 6** provides for a punishment of life imprisonment for offenders as well as the forfeiture of land or anything used to commit the offence.
- **Section 7** makes provision for the punishment accordingly, of any conniving, consenting or negligent officer where the offence is committed by a company.
- **Section 12** defines the civil liability of any offender. He would be liable to persons who have suffered injury as a result of his offending act.

1.7.3.15 Factories Act, 1987/ Factories Act CAP F1 LFN, 2004

The Factories Act promotes the safety of workers and professionals exposed to occupational hazards. Under this Act, it is an offence to use unregistered premises for factory purposes. In particular:

- **Section 13** allows an inspector take emergency measures or request that emergency measures be taken by a person qualified to do so in cases of pollution or any nuisance.

1.7.3.16 Criminal Code Act Cap C38 LFN, 2004

The Criminal Code contains provisions for the prevention of public health hazards and for environmental protection. Hence:

- **Sections 245-248** deal with offences ranging from water fouling, to the use of noxious substances.

1.7.3.17 Endangered Species Act, now 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 overexploitation. These sections are noteworthy:

- **Section 1** prohibits, except under a valid license, the hunting, capture or trade in animal species, either presently or likely to be 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 as regards the purposes of this Act.

1.7.3.18 Endangered Species Act, now CAP E9 LFN 2004

This Act prohibits hunting, capture and trade of some endangered species like crocodile, alligator, turtles, Parrot, etc. The Endangered (Control of International Trade and Traffic) Decree (No. 11 of 1985) has been enacted by the Federal Republic of Nigeria specifically to implement CITES. It is broader than CITES in that it also covers domestic taking of listed species. Two schedules are included: Schedule 1 (Endangered Species – Animals in relation to which International Trade is absolutely Prohibited), and Schedule 2 (Animals in Relation to which International Trade may only be conducted under License). The decree prohibits taking of Schedule 1 species and requires that taking of Schedule 2 species be in accordance with a license issued under the decree.

1.7.3.19 Labour Act CAP LI LFN 2004

The Labor Act of 2004 set the legislation on conditions of work and employment in Nigeria. Its application extends to employees engaged under a contract of labour or clerical work in both the private and the public sectors.

1.7.3.20 Employee's Compensation Act, 2011

The Employee's Compensation Act ("the Act" or "ECA") 2011, which repeals the Workmen's Compensation Act (WCA) of 2004, is designed to provide an open and fair system of guaranteed and adequate compensation for employees or their dependants in the event of death, injury, disease or disability arising out of, or in the course of, employment. The Act is also intended to provide for safer working conditions for employees by ensuring that all relevant stakeholders contribute towards the prevention of workplace disabilities and other occupational hazards.

1.7.3.21 Public Health Law (L.N. 47 of 1955, CAP 103)

Public Health Law refers to the legal framework and regulations used to address public health issues, establish norms for disease treatment, and protect the overall health of the population. It involves balancing government powers to ensure public health with individual rights and freedoms.

1.7.3.22 The Climate Change Act; 2021

The Act provides a legal framework to achieve its climate goals, long-term social and economic sustainability, and resilience. The primary aim of the Act is to develop and implement mechanisms that will foster low carbon emission and develop a sustainable environment in the country and achieve a net zero emissions between 2050 and 2070.

1.7.3.23 National Environmental Standards and Regulations Enforcement Agency (NESREA) Act No. 25, 2007

The National Environmental Standards and Regulations Enforcement Agency (NESREA) Act of 2007 provides for the establishment of NESREA (as a parastatal of the Federal Ministry of Environment) charged with the responsibility of enforcement of environmental standards, regulations, rules, laws, policies and guidelines. NESREA has developed about thirty-five **(35)** Environmental Regulations, the regulations relevant to this project include;

- National Environmental (Sanitation and Waste Control) Regulations, 2009 (S.I.28);
- National Environmental (Ozone Layer Protection) Regulations, 2009 (S.I.32) and;
- National Environmental (Noise Standards and Control) Regulations, 2009 (S.I.35)
- National Environmental (Soil Erosion and Flood Control) Regulations, S. I. No. 12, 2011.
- National Environmental (Surface and Groundwater Quality Control) Regulations, S. I. No. 22, 2011.
- National Environmental (Air Quality Control) Regulations, S. I. No 88, 2021 (Amended).
- National Environmental (Healthcare Waste Control) Regulations, B2565-2592, 2021.
- National Environmental (Control of Vehicular Emissions from Petrol and Diesel Engines) Regulations, S. I. No. 20, 2011.
- National environmental (Ozone Layer Protection) Regulations, 2009 (S.I.32);

1.7.3.13 Delta State Requirements

Delta State Ministry of Environment

The Nigerian Constitution permits states to make legislations, laws and edicts on the Environment. The State Environmental Protection Agencies (DELSEPA and DSWMB) have the responsibilities for environmental protection at the state level, and therefore regulate the consequences of project development on the environment in their areas of jurisdiction.

The Delta State Ministry of Environment is charged with the responsibility of providing a decent, orderly and reasonable conducive environment for habitable society, as contained in the assignments of Ministerial responsibilities. Functions of the ministry include but not limited to the following:

- liaise routinely and ensure effective harmonisation with the FMEnv in order to achieve the objectives of the National Policy on Environment;
- co-ordinate the activities of ministries, parastatals, local government councils, departments, statutory bodies and research organisations on matters relating to environmental protection and conservation;
- identify the ecological problems of the State including the devastating erosion and flood, brief the government on their sources and effects and find solutions to them;
- monitor and determine degradations of coastlines, river basins and estuaries and carry out measures to protect and remedy their ecosystems;
- identify water, air and soil pollution and their sources and carry out measures to prevent them;
- monitor the implementation of the EIA and environmental audit report guidelines and procedures on all policies and projects within the State; and
- carry out other activities as are necessary or expedient for the protection and sustainable development of the environment and for the full discharge of functions of the agency.

Highlights of relevant legislations and regulations applicable to the proposed project are summarized and presented in **Table 1.1**

Table 1.1: Summary of Relevant National Legislations and Regulations

S/N	Regulations	Areas of Focus	Relevant Agency/Body
1	Environmental Guidelines & Standards for the Petroleum Industry in Nigeria, 1991, revised 2018	Permitting Requirements, Effluent Discharge, Atmospheric emission	FMEEnv, NMDPRA, NNPC, DSMOE
2	Petroleum Act, 1969 Cap. 350 Vol. XIX. p.12644	Permitting Requirements, Effluent Discharge, Atmospheric emission	FMEEnv, NMDPRA, NNPC, DSMOE
3	Mineral Oils (Safety) Regulations, 1963 Cap 350 Vol. XX. p112667	Permitting Requirements, Effluent Discharge, Atmospheric emission	NMDPRA
4	Oil in Navigable Waters Regulations 1968, Cap 337 Vol. XIX p. 12352	Permitting Requirements, Effluent Discharge	FMEEnv, NMDPAR, DSMOE, NNPC
5	Oil Terminal Dues Act 1969, Cap 339, Vol. XIX, p 12385	Effluent Discharge	NMDPRA
6	Factories Act, 1987, Cap 126 Vol. VIII	Occupational Health	Director of factories
7	Labour Act Cap L1 LFN 2004	General provisions as to protection of wages and conditions of employment for unskilled labour.	Minister, Labour and Productivity
8	Labour Regulations 1974 Cap 198 Vol. X p 7418	Regulation for Labour Health areas	Minister, Labour and Productivity
9	Workmen Compensation Act 1987 Cap 470 Vol. XXIV p. 16079	Occupational Health Safety	Minister, Labour and Productivity
10	Land Use Act, Cap 202, LFN 1990	Ownership, management and control of land.	Delta State Governor, Ministry of Lands and Urban Development
11	Environmental Protection Agency Act 1988, Cap 131, Vol. IX p.6303	Permitting Requirement, Effluent Discharge, Atmospheric Emission	FMEEnv, NMDPRA, DSMOE
12	National Environmental Protection (Effluent Limitation) Regulations 1991	Permitting Requirement, Effluent Discharge, Atmospheric Emission	FMEEnv, NMDPRA, DSMOE
13	National Environmental Protection (Pollution and Abatement in Industries in Facilities Producing Waste) Regulations 1991	Permitting Requirement, Solid Waste, Effluent Discharge, Atmospheric Emission	FMEEnv, NMDPRA
14	National Environmental Protection (Management of Solid Hazardous Waste)	Solid Waste	FMEEnv

15	Harmful Wastes (Special Criminal Provisions etc) Act 1988, Cap 165, Vol. IXp. 6303	Solid Waste, Effluent Discharge	State Authorities, Ministry of Power, Works and Housing
16	Environmental Impact Assessment Act Cap E12 LFN 2004	Permitting Requirement, EIA Solid Waste, Effluent Discharge, Atmospheric Emission, EIA of project	FMEEnv
17	Nigerian Urban and Regional Planning Act No. 88 of 1992	Permitting Requirement, oversees a realistic, purposeful planning of the country to avoid overcrowding and poor environmental conditions	Ministry of Lands and Urban Development, FMEEnv.
18	Water Resources Act No. 101 of 1993	Groundwater and surface water protection and use	FMEEnv, Ministry of Water Resources.
19	Nuclear Safety and Radiation Protection Decree No. 9 of 1995	Permitting Requirement, Nuclear Radiation	NNRA
20	National Inland Waterways Authority Decree, 1987	Reclamation of Use of Inland Waterways and Permitting Requirements for use of waterways by tanker vessels, building of jetties, Dredging, etc.	NIWA, Ministry of Transport
21	Guidelines and Standards for Environmental Pollution Control in Nigeria, 1991 Part I: Interim Guidelines and Standards for Industrial Effluent, Gaseous Emissions and Noise Limitations Part II: Guidelines for the Management of Solid Hazardous Waste	Permitting Requirements, Effluent Discharge, Atmospheric emission and solid waste disposal	FMEEnv

1.7.4 International Conventions and Protocols

Nigeria is signatory to a number of conventions, protocols, agreements, laws and regulations that are relevant to the proposed CNG Mother/Daughter Stations at Warri, Warri South LGA, Delta State.

1.7.4.1 Abidjan Convention: The Convention for Co-operation in the Protection and Development of the Marine and Coastal Environment of the West and Central African

Region (Abidjan Convention) was adopted in March 1981 and was meant for co-operation in the protection and development of the marine and coastal environment of the West and Central African Regions. Like many other regional conventions, the Abidjan Convention deals with pollution from ships, via incidental discharges and dumping by simply referring the contracting parties to the applicable global convention.

1.7.4.2 International Convention on Oil Pollution Preparedness, Response & Co-operation (OPRC, 1990): This convention came into force in 1995, with the objectives of the Convention being the preparation and establishment of a system for rapid response for treatment of severe pollution of the sea by oil and establishment of a mechanism for international cooperation.

The Convention obligates member countries to set national emergency plans, set coordinated enterprise plans, appoint a competent national authority, obtain designated equipment, execute preparedness drills, report to neighbouring countries and assist them when needed.

The convention recognizes the serious threat posed to the aquatic environment as a result of oil pollution from ships, offshore facilities, seaports and oil handling facilities. It also focuses on the need to take precautionary measures to avoid oil spills as well as effective combat and corrective action in the event of an oil pollution incident. The OPRC takes into account the 'polluter pays principle' and the importance of international practiced legal instruments on liability and compensation in case of oil damage.

Each party to the convention should ensure that ships and facilities under its jurisdiction possess oil pollution emergency plans, report immediately, any event involving discharge or probable oil discharge, assess the event to determine whether it is an oil pollution incident and in the event of an established oil pollution incident, assess the nature, extent and environmental consequences, inform without delay all party states whose interests are affected or likely to be affected. Each party shall also establish a national system to oil pollution incidents that must be carried out promptly and effectively and shall be included in a national contingency plan for oil spill preparedness and response.

Vessels are required to report incidents of pollution to coastal authorities and the convention details the actions that are then to be taken. The convention calls for the

establishment of stockpiles of oil spill combating equipment, the holding of oil spill combating exercises and the development of detailed plans for dealing with pollution incidents.

1.7.4.3 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1987): The Basel Convention tackles the dangers posed by the generation and disposal of hazardous wastes. This convention defines the wastes to be regulated and controls the transboundary movement of hazardous wastes. This is done to protect human health as well as the environment, against adverse effects from these wastes. Accordingly, the main objectives of this convention are:

- Reduction of transboundary movement of wastes to a minimum consistent with the environmentally sound and efficient management of such wastes;
- Minimizing the amount and toxicity of hazardous wastes generated and ensure their environmentally sound management as close as possible to the source of generation; and
- Assisting developing countries in environmentally sound management of the hazardous and other wastes they generate.

1.7.4.4 Vienna Convention for the Protection of the Ozone Layer, including the Montreal Protocol and the London Amendment (1964): This convention is aimed at protecting human health and the environment against adverse effects resulting or likely to result from human activities, which could modify the ozone layer. The Montreal Protocol was amended for the first time on 29th June 1990 in London. A second set of amendments were adopted in Copenhagen in November 1992 and came into force in 1994.

1.7.4.5 Convention on the Conservation of Migratory Species of Wild Animals or Bonn Convention (1979): The Bonn Convention was adopted in 1979. It recognizes the need to conserve and manage migratory species (including waterfowl and other wetland species) as well as the promotion of measures for their conservation, including habitat conservation. Conservation of these habitats is one of the principal actions taken for endangered species.

1.7.4.6 Convention on Biological Diversity (1992): The objectives of this Convention, which was opened for signature at the Earth Summit in Rio De Janeiro in 1992, are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of benefits arising from the utilization of genetic resources through appropriate transfer of relevant technologies, taking into account all rights over those resources. The convention covers all ecosystems, species and genetic resources.

In support of conserving biological diversity, governments are mandated to commit to the integration, conservation and sustainable use of biological resources into national decision-making, establishing a system of protected areas and requiring Environmental Impact Assessment of proposed projects that may adversely affect biological diversity.

1.7.4.7 Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (IOPC Fund, 1992): The IOPC Fund Convention was implemented to provide additional compensation for victims of oil pollution in addition to the transfer of some of the economic consequences to the owner of the oil cargo and ship owner. Compensation payable under the Fund is limited to 450 million francs per incident and an aggregate of 450 million francs for pollution damage resulting from a natural phenomenon of an exceptional, inevitable, and irresistible character.

1.7.4.8 United Nations Framework Convention on Climate Change (1992) including the Paris Agreement (2015): The convention on climate change was signed in 1992 during the Earth summit in Rio de Janeiro, though its implementation did not come into force till 1994. In this declaration, developed countries and economies in transition were mandated to limit their emissions of greenhouse gases which cause global warming. However no mandatory emission/restrictions were placed on developing countries. This convention has been reviewed including binding higher emission reduction by developed countries and at the 22nd meeting of the Conference of Parties (COP22) to the Convention in Paris between November and December 2015, an agreement was reached, with the main thrust of the Paris Agreement being a resolution to limit carbon dioxide levels in the atmosphere to within 1.5⁰C of pre-industrial levels.

1.7.4.9 World Bank Guidelines on Environmental Assessment:

The World Bank has over time given increasing attention to the assessment of the environmental impacts of its investment projects. **Operational Directive (OD) 4.0** obliges the Bank to carry out environmental assessments for its financed projects. In the late 1990s, the Bank began to convert Operational Directives which combined elements of policy, procedure and guidance into separate short statements of mandatory policy (Operational Policies – Ops), mandatory instructions for carrying out the policy (Bank Procedures – BPs) and advice on good practice.

OP 4.01 is a very important policy which states that the bank requires environmental assessment (EIA) of projects earmarked for Bank financing to help ensure that they are environmentally sound and sustainable in order to improve decision making. Additionally, the policy specifies that the Bank undertakes environmental screening of each proposed project to determine the appropriate extent and type of E.A. The Bank classifies projects into one of four categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts. Details of World Banks EIA procedures and guidelines are published in the banks **EA Source Books Vols. i – iii of 1991**. Potential issues considered for EIS in the oil and gas industry include:

- Biological Diversity
- Coastal and Marine Resource Management
- Hazardous and Toxic Materials
- Cultural Properties
- International Waterways

A summary of the relevant conventions is presented in **Table 1.2**

Table 1.2: Summary of Relevant International Conventions and Protocols

S/N	Regulation	Date of Adoption	Place of Adoption	Date of coming into force in Nigeria	Ratification/ Accession/ Signature
1	African Convention on the Conservation of Nature and Natural Resources	15/9/58	Algiers	16/6/69	7/5/74

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2	International Convention on Civil Liability for Oil Pollution Damage (CLC)	29/11/69	Brussels	5/8/81	7/5/81
3	International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (FUND)	18/12/71	Brussels	10/12/87	11/9/87
4	Convention Concerning the Protection of the World Cultural and National Heritage (World Heritage Convention)	16/11/72	Paris	17/12/75	23/10/74
5	Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES)	3/3/73	Washington DC	18/4/76	19/3/76
6	Protocol Relating to the International Convention for the Safety of life at Sea (SOLAS PROT)	17/2/78	London	13/2/85	13/11/84
7	Convention for Cooperation in the Protection and Development of the Marine and Coastal Environment of the West and Central Region	23/3/81	Abidjan	5/8/84	6/6/84
8	Protocol Concerning Cooperation in Combating Pollution in Cases of Emergency in the West and Central African Region	23/3/81	Abidjan	5/8/84	6/6/84
9	Convention for the Protection of the Ozone Layer	22/3/85	Vienna	29/1/89	31/10/88
10	Protocol on substances that deplete the Ozone Layer	16/9/87	Montreal	1/1/89	31/10/88
11	Convention on the Control of Trans-boundary Movements of Hazardous Waste and their disposal (Basel Convention)	22/3/89	Basel	5/5/92	13/3/91
12	International Convention on Oil Pollution Preparedness, Response and Cooperation	30/11/90	London	13/5/95	25/5/93
13	African Economic Community Treaty	3/6/91/	Abuja Nigeria	Not yet in force	6/3/91
14	Framework Convention on Climate change	9/5/92	New York	27/11/94	29/8/94
15	Convention on Biological Diversity	22/5/92	Nairobi	27/1/94	27/8/94

1.7.5 Century Power Generation Limited's Health Safety and Environment Policy

The operation of Century Power Generation Limited's CNG Mother/Daughter Station is subject to the Company's Policy Statements. By this Policy, CENTURY POWER is committed to Environmentally friendly project operations and fully accept the principle that

in addition to being a statutory requirement, sound Health, Safety and Environmental Protection practices play a considerable role in all successful management initiatives. Consequently, the Company has the primary objective to comply with all relevant legislations, standards or requirements and to ensure:

- Health and Safety of our employees and the people who could be directly impacted by our activities;
- Protection and Preservation of the Environment and the adoption of principles of Environmental Sustainability;
- Continuous improvement in Health, Safety and Environment performance through implementation of the HSE IMS (Integrated Management System) for all our projects and operational activities;
- Quality and control of all procedures;

To meet these objectives, the Company will operate in accordance with the following principles:

- Promote a culture inside the whole group in which all employees share HSE commitment and are fully involved in its implementation;
- Acting in compliance with all applicable laws and regulations, with the HSE, IMS, Century Power Generation Limited's Operational Standards, all agreements that are voluntarily subscribed by the Company and, where laws and regulations are not available, apply the recognized international standards;
- Establish accountability and responsibility for HSE within organizational line management;
- Identify and evaluate risks related to its operations in a documented manner, implementing all practicable measures to ensure healthy and safe working conditions;
- Implement programmes and appropriate protective measures to control risks and to respond quickly and effectively to any emergency resulting from its operations;
- Prevent accidents, injuries and occupational illness of workers, contractors and the people who may be directly impacted by its activities;
- Ensure that employees and contractors are adequately trained and aware of the importance of HSE aspects of their job;

- Establish selection and management processes for purchase, supply and contracting of goods and services, to ensure that suppliers and contractors' policies are in line with our Policies;
- Seek economically viable ways to minimize the environmental impact of its operations, reduce waste generation, conserve resources and respect biodiversity;
- Develop and maintain knowledge throughout the organization, by timely communication of information, education and training;
- Ensure quality and control of all operations and provide products that meet the specified quality requirements, which are consistent with contractual specifications and statutory requirements;
- Reviewing at appropriate intervals, the adequacy, suitability and effectiveness of the HSE EMS and its performance against the requirements of reference standards and other agreements, including strategic objectives targets and HSE Policy;
- If pollution or damage to the environment does occur, the policy of the Company is to promptly control, clean up, rehabilitate the polluted area and minimize the socio-economic effects through socially responsible and ethical community relations.

1.8 Declaration

Century Power Generation Limited the project proponent hereby declares her intention to abide by the existing international and national laws and regulations regarding environmental protection during the all the proposed project phases. The Company is committed to the implementation of the Environmental Management Plan (EMP) proposed for the project execution. The Company has prepared this EIA report using the best available expertise in personnel, equipment and internationally acceptable methods.

1.9 Terms of Reference

The detailed Terms of Reference as approved by the Federal Ministry of Environment are provided in Appendix.

1.10 Structure of Report

Executive Summary

Chapter One	Introduction presents an overview of the proposed project, the EIA objectives, the legal and administrative framework and Terms of Reference.
Chapter Two	Project Justifications describes the rational for the project, its value and the sustainability
Chapter Three	Project/Process Description discusses the technicalities of the project, the material input/output, process of operations and maintenance as well as the project schedule.
Chapter Four	Description of the Environment of the Study Area ; provide details of the baseline data of the project area as it relates to the physical, chemical, biological, social, and health aspects
Chapter Five	Potential and Associated Impacts , provides information on the impact prediction methodology and all the potential and associated impacts of the project
Chapter Six	Mitigation Measures ; highlights the measures proffered for the negative impacts
Chapter Seven	Environmental Management Plan ; provide the plans for the management of the environment
Chapter Eight	Remediation / Decommissioning Plan , presents an overview of remediation / decommissioning plan after Project closure.
Chapter Nine	Conclusion and Recommendation ;

CHAPTER TWO

2.0 PROJECT JUSTIFICATION

2.1 Preamble

The establishment of a Compressed Natural Gas (CNG) mother/daughter station in Warri, Delta State is justified by the region's strategic location within Nigeria's gas-rich corridor, the growing national transition toward cleaner fuels, and the need to expand affordable energy access. Warri's proximity to existing gas infrastructure enables efficient gas sourcing and distribution, while the mother/daughter configuration supports flexible supply to areas without pipeline connectivity.

2.2 Proposed Project Justification

The establishment of a Compressed Natural Gas (CNG) Mother/Daughter station network in Warri, Delta State, is a highly viable strategic project. The business and economic justification relies on four primary pillars:

- **Proximity to Feedstock and Existing Infrastructure:** Warri is a principal hub of Nigeria's oil and gas sector, a Mother Station built here directly taps into the existing domestic gas pipeline network, bypassing massive pipeline distribution costs. This allows for highly cost-efficient, high-volume gas compression at the source.
- **Virtual Pipeline Efficiency via Daughter Stations:** Due to the lack of vast secondary pipeline grids across Delta State, a Daughter Station model acts as a "virtual pipeline". The Mother Station compresses gas into mobile storage trucks, which then supply skid-mounted Daughter Stations in surrounding commercial areas and commuter corridors (e.g., Effurun, Uvwie, and along the East-West Road). This approach eliminates the exorbitant cost of building new physical pipelines and shorter construction timelines to meet pressing energy demands.
- **Immediate Commercial Demand:** Warri has a dense concentration of commercial transport fleets, tricycles, industrial logistics trucks, and marine vessels. High premium motor spirit (PMS) and diesel prices make local fleet operators eager to transition to cheaper fuel. With Delta State scaling up its CNG vehicle conversion hubs, a reliable supply network is required to service thousands of daily motorists.

- Direct Policy Alignment: The project perfectly aligns with the Federal Government's Presidential CNG Initiative (Pi-CNG) and Delta State's developmental "MORE Agenda". This synergy ensures strong regulatory backing, smoother environmental approvals through the Federal Ministry of Environment, Delta State Ministry of Environment, and potential fiscal incentives from the Midstream and Downstream Gas Infrastructure Fund (MDGIF).

2.3 Need for Project

The oil and gas industry plays an important role in the Nigerian economy and this CNG Mother/Daughter Station is one of such.

- The project will reduce dependence on PMS and diesel, lower greenhouse-gas and particulate emissions, This shift supports improved air quality and public health outcomes.
- stimulate local economic activity, and boost the living conditions
- enhance energy security in line with Nigeria's Decade of Gas policy.
- Improve the health of the society and environment
- Conservation of energy
- Provision of resource for industrial production at lower cost and increase productivity
- Creating employment opportunities for Nigerians
- Environmental impacts identified are manageable and can be mitigated through established engineering and operational controls, making the project both environmentally viable and socio-economically beneficial

2.4 Benefits of the Proposed Project

The proposed CNG mother/daughter station in Warri will deliver significant environmental, economic, and energy-security benefits.

- It will reduce greenhouse-gas and air-pollutant emissions by providing a cleaner alternative to petrol and diesel, thereby improving local air quality and supporting Nigeria's energy-transition goals.
- The project enhances regional energy security by supplying a stable, locally sourced fuel and extending gas access to areas without pipeline infrastructure.

- It will stimulate economic growth through job creation, lower fuel costs for transport and industrial users, and increased business activity.
- The station also aligns with national policies such as the Decade of Gas and the National Gas Expansion Programme, while promoting safer fuel handling and reduced spill risks compared to liquid fuels.:

2.5 Value for the Proposed Project

The value of the proposed project is highlighted by the desire to enhance local environment cleanliness and health in the oil and gas operational areas. The project estimated cost is ₦500m, to be independently funded. The project lifespan shall be 25-30years.

2.6 Envisaged Sustainability

The sustainability of the proposed project is categorised as follows:

2.6.1 Economic Sustainability

he project is economically sustainable as it leverages Nigeria's abundant natural gas resources to provide a cheaper and more stable alternative to petrol and diesel. The station will reduce fuel costs for transport operators, SMEs, and industrial users, thereby improving business competitiveness. It will generate direct and indirect employment during construction and operation, stimulate local supply chains, and support long-term economic diversification in Delta State. The mother/daughter model also ensures cost-effective distribution to areas without pipeline infrastructure, enhancing market reach and financial viability.

2.6.2 Technical Sustainability

The project is technically sustainable due to the use of proven CNG compression, storage, and transportation technologies widely adopted globally. The modular mother/daughter configuration allows phased expansion based on demand, reducing technical risk. Warri's proximity to existing gas infrastructure ensures reliable feedstock supply, while modern safety systems—pressure relief devices, gas detection, automated shutdowns—enhance operational reliability. The design complies with relevant engineering standards, ensuring long-term functionality and maintainability.

2.6.3 Environmental Sustainability

CNG is a cleaner-burning fuel that significantly reduces CO₂, NO_x, SO_x, and particulate emissions compared to conventional liquid fuels. The project will contribute to improved

air quality and reduced greenhouse-gas emissions in line with Nigeria's climate commitments. CNG poses minimal risk of soil or water contamination because it dissipates rapidly when released. Identified environmental impacts—noise, construction disturbance, waste generation—are limited in scale and can be effectively mitigated through standard environmental management practices, making the project environmentally viable.

2.6.4 Social Sustainability

The project supports social sustainability by creating employment opportunities, enhancing local skills, and improving access to affordable energy. Lower fuel costs will benefit transport operators and commuters, contributing to improved mobility and reduced cost of living. The project promotes safer fuel handling and reduces community exposure to pollutants associated with diesel and petrol. Engagement with host communities ensures inclusion, transparency, and alignment with local development priorities.

2.6.5 Legal/Legislative Sustainability

The project aligns with Nigeria's regulatory framework governing natural gas utilization, environmental protection, and industrial development. It complies with FMEnv EIA requirements, NESREA environmental standards, and NUPRC guidelines for gas handling and distribution. The project will operate under valid permits and licenses, adhere to national safety codes, and implement an Environmental Management Plan (EMP) consistent with statutory obligations. This ensures long-term legal compliance and regulatory sustainability.

2.6.7 Political Sustainability

The project is politically sustainable as it directly supports national policy priorities, including the Decade of Gas Initiative, the National Gas Expansion Programme (NGEP), and Nigeria's broader energy transition agenda. It aligns with government efforts to reduce dependence on imported refined fuels, promote cleaner energy, and stimulate gas-based industrialization. The project strengthens government credibility in delivering energy reforms and is likely to receive continued political support at federal and state levels.

2.7 Project Options

As required by law in Nigeria, some reasonable options and alternatives to the various elements of the proposed project shall be considered and examined. Accordingly, a

number of alternatives have been weighed up for the construction and operation of the proposed CNG Mother/Daughter Station using economic, technical and environmental considerations.

2.7.1 No- Project Option

The no-project option means the development of the planned CNG Station shall not take place. As a direct consequence, this would result in no effect on the environment in the area as this option would result in no change of environmental features. A key implication of this option is that the project area which is suitable for the CNG operations, will be under-utilized. Additionally, the waste generated at the oil operation terminals may likely be spilled into the host environment, thus creating pollution and health challenges in that local environment. The adoption of this option will mean, negative impact on the environment, society and nation's economy as well as loss of employment opportunities with the opportunity to improve the host local community.

This option also goes against the mandates of FMEnv, NMDPRA, PPMC, NNPC and even DAPPMA that gears toward addressing inadequate product availability through improvement in the efficiency in the petroleum product supply chain through private sector involvement. In addition, the site is currently under-utilized, and the economic stimulus the proposed development will have on the host community would not occur. Since no viable economic or technical reason supports this option despite not negatively impacting the environment, the option was deemed not feasible and is rejected.

2.7.2 Delayed Project

Delaying the project involves moving the project to a later date. This situation is unlikely, and can only be considered if existing circumstances are highly unfavourable or risky for the execution of the project. Conflicts, war, hostilities, communities deeply resentful of the project or unacceptable/unattractive economics are some of the reasons this option can be adopted. In contrast, the economics and the political environment favour the execution of the project. Moreover, delaying the project will have no net effect on significant environmental impacts that would arise from the project. Additionally, the project will create job opportunities for the host communities. thus, delaying the project will have dire consequences as all processes that have been set up for the project design and

implementation will be stopped. Furthermore, contractors will have to be demobilized, and when inflationary trends are taken into account, project costs could increase if the project is delayed and this leads to a decrease in the final profit and benefits accruable from the project. For these stated reasons, the delayed option is not considered.

2.7.3 “Go Ahead Project Option”

The justification of this project outweighs other negative variables, therefore the “go ahead” option is proposed for the project at the present location. It is therefore, recommended that the project be carried out as planned, since adequate mitigation measures shall be incorporated into the project plan to minimize or eliminate potential negative environmental and social impacts of the proposed project.

2.7.4 Alternate Site/ Locations

Alternative site locations were considered early on by the board of Century Power Generation Limited. Four location alternatives considered before deciding on the present location were Ugheli, Asaba, Ogoni and Warri, all in Delta State. The site best suited for the project Warri was selected. This location was considered as it's not within a dense community and promises lower environmental impacts during the project lifecycle.

The key advantage of this alternative from an environmental perspective is minimal on the host community. As a result, this is the preferred and selected site.

CHAPTER THREE

3.0 PROJECT AND OPERATIONS DESCRIPTION

3.1 Geographical Location

The proposed project site shall be located at Nest Oil JBL Yard, NPA Express Way, Warri, Delta State. The site lies between approximately between latitudes N5°33'37.68" - N5°33'37.23"; and longitudes E 5°43'44.12" – E 5°43'44.15" with an elevation of 474ft. The site is accessible via existing road networks, facilitating efficient movement of CNG transport modules. (**Plate 3.1**).



Plate 3.1: Project Location

3.2 Project/Process Description

The proposed project involves the establishment of a Compressed Natural Gas (CNG) Mother/Daughter Station in Warri, Delta State, designed to support Nigeria's growing demand for cleaner, more affordable alternative fuels. The facility will compress, store, and distribute natural gas to daughter stations and end-users. The project aligns with national gas-expansion policies and contributes to the transition toward low-carbon energy systems.

The process consists of the mother station receiving natural gas from the the Escravos–Lagos Pipeline, the gas is dried, compressed to high pressure - 250 bar(g), and loaded into cascade storage or transport modules. These modules are then hauled by trailers to daughter stations, which lack pipeline access and rely on the delivered CNG for dispensing. At the daughter station, the gas is pressure-regulated, metered, and dispensed to vehicles through standard CNG dispensers, with safety systems such as gas detection, emergency shutdowns, and venting integrated throughout the process to meet EIA and environmental compliance requirements.

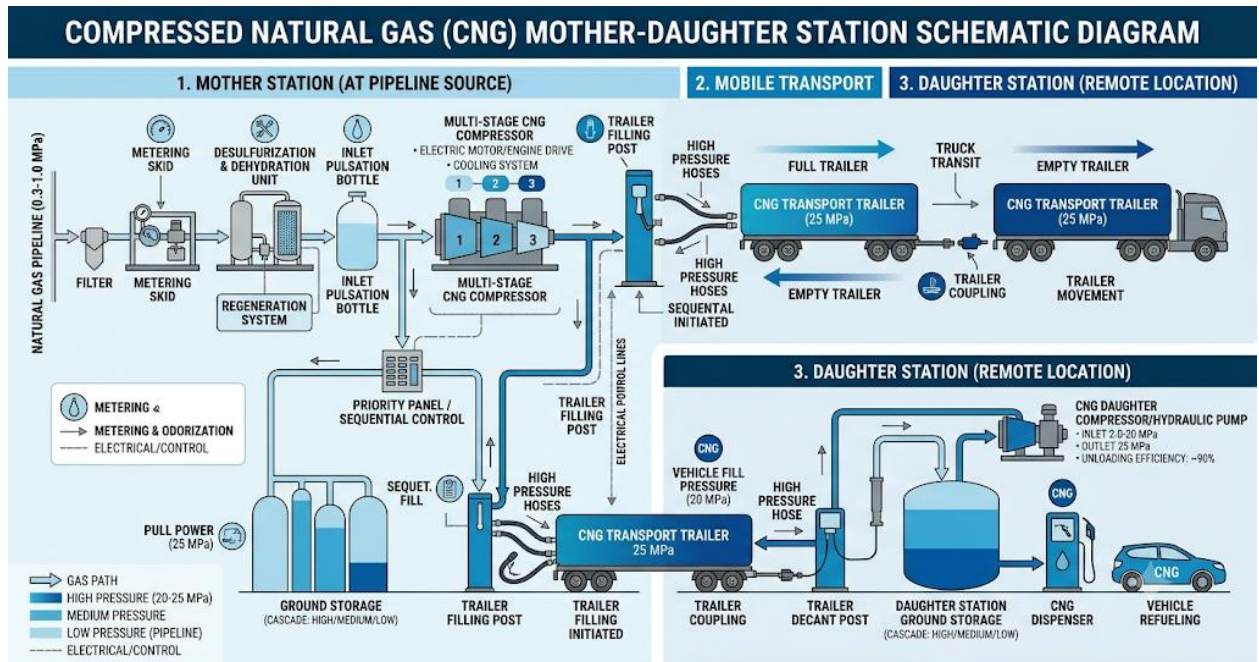


Fig 3.1: Process Flow Diagram for the CNG Mother/Daughter Operations

Table 3.1: Key Equipment

Mother Station	Daughter Station
Gas filter/separator	Trailer unloading manifold
Fiscal metering skid	Priority panel
Gas dryer	Storage cascade
High-pressure compressor	Pressure regulating system
Cascade storage banks	CNG dispensers
Tube trailer filling skid	Emergency shutdown system
CNG dispensers	CNG dispensers

3.3 Facilities Description

The proposed CNG Mother/Daughter Station is an industrial energy facility comprising two integrated zones: a Mother Station and the daughter Station.

- **Gas Receiving Unit (GRU):** Receives natural gas from an upstream pipeline or gas supplier.
- **Compression System:** High-pressure compressors that raise gas pressure to CNG standards (typically 200–250 bar).
- **Cascade Storage System:** High-pressure storage cylinders arranged in banks for efficient loading and unloading.
- **Dispenser Units:** For direct vehicle fueling (if applicable) and for loading CNG into daughter-station transport modules.
- **CNG Transport Modules (Daughter Trailers):** Mobile storage units used to deliver CNG to off-grid locations.
- **Control Room & SCADA System:** For monitoring pressure, flow, safety systems, and operational parameters.
- **Fire & Safety Infrastructure:** Fire-suppression systems, gas detectors, emergency shutdown systems, and safety signage.
- **Ancillary Facilities:** Administrative building, workshop, security post, internal roads, drainage, and utilities.

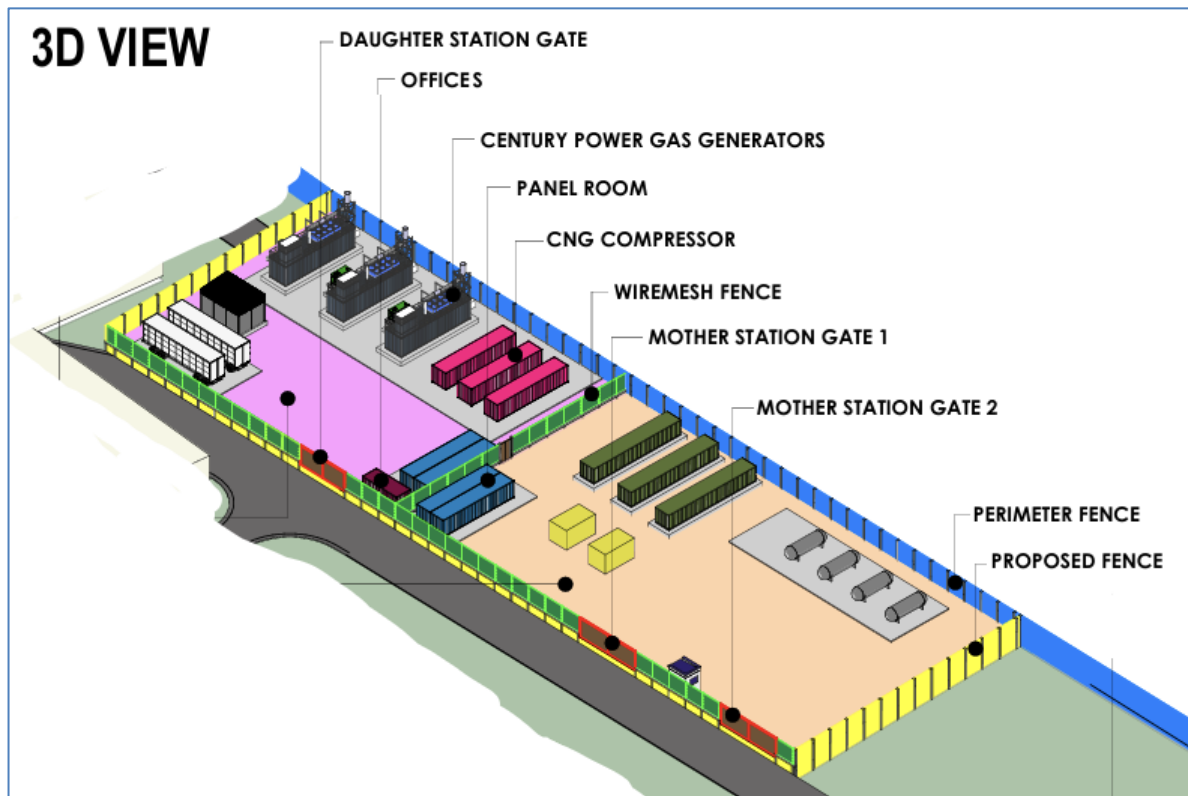


Fig 3.2: Facility Layout for the Proposed CNG Mother/Daughter Station

3.4 Operations Description

3.4.1 Pre-Construction Activities

The activities in the pre-construction stage shall primarily be made up of:

- Concept development,
- Feasibility studies
- Site acquisition
- Site survey and geotechnical investigations
- Front-End Engineering Design,
- Environmental baseline studies
- Community engagement and stakeholder consultations
- Procurement of permits and approvals

All activities in this phase of project shall take into account environmental, technical and economic considerations.

3.4.2 Construction Phase

The construction of the facility would involve:

- Topographic Surveys
- Soil Investigation Surveys
- Mobilization of equipment and labour
- Site clearing and grading
- Installation of facilities that shall be fitted within the storage terminal e.g., piping, valves, loading hoses/nozzles, and safety alarms.
- Construction and installation of an administrative block, etc.
- Installation of foundations, equipment, and storage systems
- Construction of buildings and utilities
- Provision of Parking spaces.
- Painting of facilities
- Erection of safety signs around the facility
- Designation of Muster Stations
- Testing and commissioning of mechanical and electrical systems

3.4.3 Operations Phase

The operational activities shall include the following:

- Continuous gas compression, storage, and distribution
- Routine maintenance of compressors, storage banks, and safety systems
- Monitoring of environmental and safety parameters
- Good housekeeping
- Engagement with host communities and regulatory agencies

3.4.4 Decommissioning Activities

- Removal of equipment and structures
- Site remediation and restoration
- Waste disposal in accordance with regulatory standards

Applying a contemporary view, it is expected that all operation streams shall be stopped and all facilities shall be put out of use and/ or dismantled. Furthermore, the facility shall most likely have to be utilized for a different purpose and the environment shall be restored to as close to its original state as possible, with the specific decommissioning plan to be drawn up following the prescribed decommissioning guidelines of by FMEnv.

3.5 Maintenance Activities

Periodic checks of the pipeline, valves, compressors and dispensers shall be carried out. All leaks and spills shall be reported to the safety personnel who shall recommend and take appropriate actions. In addition, security personnel shall man the facility round the clock. Informal inspections shall be done on a daily basis noting the overall facility condition however formal inspections shall be conducted on a monthly basis. Piping must be maintained in sound condition and hydrostatically tested yearly. Sagging and cracking pipes as well as rusting or rotten pipe supports shall be checked for routinely. Maintenance activities shall also include repainting pipes; and repairing and replacement of defective pipes and valves. The hydrant tanks shall be checked for peeling, blistering or chipping periodically. The storage tanks shall be emptied, cleaned and the inside examined for holes and corrosion. The nozzles shall be checked for any signs of leaks from the valves and they shall be checked to see if they can be completely turned on and turned off to stop product flow.

Record keeping is a key aspect of maintenance and this would be kept for inspections, maintenance activities, training and product inventory.

3.6 Health, Safety, Security and Environmental Issues

Construction Stage

- All personnel involved in the construction activities shall wear appropriate PPE's during work;
- Hearing protection devices shall be provided in areas of excessive noise pressures;
- Only authorized personnel shall be allowed into the construction site;
- Wastes shall be appropriately handled during the construction phase to protect the water resource and environment;
- The entire construction area shall be cordoned off using a tape that serves a dual purpose for security and safety;
- Strict access control shall be implemented at the facility;
- There shall be sufficient security to protect all workers as well as the site, with security agencies being deployed if necessary.
- A secondary security team made up of members of the community shall be used, if necessary, to foster a good relationship with the community and negate any form of local security threats.
- A competent security officer shall manage security affairs during construction and shall report directly to the Managing Director/ C.E.O of CENTURY POWER.

Operations Phase

- An HSE Officer shall be in charge of all HSE related matters.
- PPE's and safety signs shall be in place all over the facility.
- The facility shall be run with an integrated safety management system that shall cover health, safety, environment and quality. All the safety items and features required by the management system after Hazard identification and risk assessment shall be made available.
- Relevant industrial training for staff shall be carried out, including operational health, environmental awareness and basic safety training;
- Adequate attention shall be given to environmental pollution;
- The plan for security during facility operations shall include the use of a reputable security firm to provide a team of trained private security personnel;

- Security matters shall be implemented following an approved security plan. The plan shall include round the clock security, access control, surveillance, training, communication, community relationship, emergency response, drills, exercises etc. This plan shall be reviewed periodically for update.
- The Chief Security Officer shall be at the senior management level with direct line of reporting to the CEO.
- The facility shall be inspected regularly for general cleanliness
- The safety superintendent shall visually inspect generators feed tank, water reservoir valves, pipelines, flanges and loading arms for leaks, cracks, dents, corrosion, open/close position of valves and will record all observations appropriately.
- The fire hydrant system shall be inspected daily to ensure that it is ready for use. In addition, firefighting equipment shall be manned at all times by at least one well-trained fire staff.
- The Health and Safety department shall have a firefighting unit. The unit shall be made up of highly trained personnel. However, all work units within the facility shall have at least one staff trained in firefighting and designated "Unit Fire man" in addition to their primary duties. These men shall be effective in fire prevention efforts within their units, assisting the safety officers and act as first responders in the case of a fire within their work areas;
- Fire drills shall be carried out half yearly for the entire staff of the factory. Situations may however arise such as employment of new staff or introduction of new processes or equipment which may necessitate a fire drill before the set time;
- There shall be muster points for fire drills and safety signs also displayed at various locations of the facility to put all workers, contractors and visitors on alert.
- There shall be "no smoking" signs at smoking prohibited areas, in addition to danger and warning signs all around the facility

Decommissioning Stage

- All personnel involved in decommissioning activities shall wear appropriate PPE's during work
- Hearing protection devices shall be provided in areas of excessive noise pressures
- Only authorized personnel shall be allowed into the project area

- Wastes shall be appropriately handled by DSEPA during the decommissioning phase to protect the groundwater and the environment.

3.7 Emergency Response Procedures

Emergency Response Procedures during the project shall be in the areas of:

- Medical emergencies
- Fire Outbreaks
- Security
- Extended power losses
- Chemical/ Oil spills
- Water contamination

The response for medical emergencies shall be:

- Immediately contact emergency phone numbers of paramedics and health care facilities and notify them of the nature and location of the emergency;
- Not to move the victim unless absolutely necessary;
- Any trained personnel available will give CPR/ first aid to the victim/ injured personnel involved prior to the arrival of professional help. However, if no trained personnel are available, minor actions like stopping bleedings through the application of pressure on wounds as well as clearing victims' air passages can be initiated;
- In case of rendering assistance to personnel exposed to hazardous materials, the Material Safety Data Sheet (MSDS) will be consulted and appropriate personal protective equipment will be worn. In such cases, first aid will be attempted by ONLY trained and qualified personnel.

The response for fire outbreaks shall be:

- Activation of the nearest fire alarms;
- Notifying the Nigerian Fire Service/ Delta State Fire Service;
- Getting all personnel within the facility to the muster points through the designated escape routes, but in the case of very large fires evacuating all personnel from the facility;
- Ensuring all personnel have evacuated the affected area;

- Getting trained firefighting personnel to combat the fire while awaiting the Nigerian Fire Service;
- Using the appropriate fire extinguishers for the various fire classes (viz Multipurpose Dry Chemical for Classes A, B, C and Dry powder for Class D;
- Regularly servicing the extinguishers for optimal performance
- Shutting down any processes and isolation of any materials that will escalate the fire, if it is safe to do so; and
- Ensuring all personnel remain at their designated muster stations until the competent authority decides it is safe to re-enter the affected area when the fire is out.

The response for security incidents shall be:

- Notifying the relevant security agencies particularly the Nigerian Police on the nature of the threat;
- Getting all personnel to take shelter to any threat that may pose danger to personnel, with all exterior doors locked;
- Encourage personnel to flee the facility if the threat is within and they are close to an exit;
- Encourage personnel to hide, turn off phones and lights, if personnel are facing a clear and present danger within the facility;
- Keep all doors locked in the building until law enforcement or security officers issue an official “all clear”;
- Only the security personnel at the site will be allowed to combat the security threats.

The response for extended power losses shall be:

- Cease activities or operations that involve potentially hazardous conditions;
- Plug equipment needed during a prolonged power outage into emergency power outlets;
- Turn off equipment sensitive to power failure while unnecessary electrical equipment and appliances should be turned off in the event that power restoration would surge, causing damage to electronics and affecting sensitive equipment in the process;

- Use of alternative sources of lights like emergency lights or flashlights; but use of open flames will be avoided;
- Increasing natural lighting by opening windows to aid visibility;
- After power is restored, all equipment will be checked to make sure they have restarted properly; and
- Personal belongings must be secured.

The response to chemical/ oil spills shall be:

- Immediate notification of the designated personnel and safety coordinator;
- Containing the spill with available equipment (e.g. pads, booms, absorbent powder etc.);
- Securing the area and alerting other site personnel;
- Preventing personnel from attempting to clean-up the spill unless trained to do so;
- Attending to injured personnel and calling in the medical team;
- Calling the registered spill clean-up company; and
- Notifying the necessary Government regulatory body/ agency.

The response for water contamination shall be:

- Immediate notification of the designated personnel and safety coordinator;
- Notification of Local Authorities and the appropriate regulatory agencies;
- Notification of neighbouring communities and other water resource users;
- Providing alternative sources of water for use by personnel;
- Immediate removal of the source of contamination; and
- Conducting immediate water quality monitoring.

3.8 Waste Generation

According to the Basel Convention, wastes are substances or objects that are disposed or are intended to be disposed, or are required to be disposed by the provisions of national laws. Wastes include any items that people no longer have any use for, which they either intend to get rid of, or have already discarded. In addition, wastes also include such items which are required by law to be discarded, because of their hazardous properties.

In the light of this, Century Power Generation Limited recognize the implications of the ineffective handling and final disposal of generated wastes. It is CENTURY POWER's

intention to be practical, systematic and efficient in the handling of waste materials during the construction and operation phases at the petroleum products terminal.

As a result, a stand-alone Waste Management Plan will be developed to conform to the universal principles of minimize/reduce at source (waste generation); reuse (components); recycle (before disposal) and responsible disposal – the 4 Rs Principle. The general concept of waste management is illustrated in **Fig 3.3**.



Fig 3.3: General Concepts of Waste Management

The Waste Management Plan shall entail detailed strategies for conducting waste identification, waste collection/characterization, waste segregation, storage, tracking, treatment and disposal and the various strategies are highlighted in this section.

3.8.1 Waste Identification and Characterization

Various forms of wastes expected to be generated during the construction and operations phases have been identified. These wastes have been classified as solid, liquid and gaseous; they have also been categorized as hazardous and non-hazardous as well as biodegradable and non-biodegradable. The characterization of expected wastes from the project is shown in **Table 3.2**.

Table 3.2: Expected Wastes, Sources and Characterization of Wastes in the Various Project Phases

S/N	Wastes	Source(s)	Solid/ Liquid/ Gaseous	Hazardous/ Non- Hazardous	Biodegradable/ Non- Biodegradable	Project Phases Associated with Wastes	
						Construction Stage	Operations Stage
1	Earth Fill	Excavation	Solid	Non- Hazardous	Non- Biodegradable	X	
2	Vegetation ((Trees, tree stumps and thick branches)	Excavation and Site Clearing	Solid	Non- Hazardous	Biodegradable	X	
3	Construction Wastes/ Rubble	Unused and Broken aggregates, cement powder, concrete, grout, bricks and tiles	Solid	Non- Hazardous	Non- Biodegradable	X	
4	Steel Rods	Off-cuts of steel rods, steel plates	Solid	Non- Hazardous	Non- Biodegradable	X	
5	Scrap metal	Metal off-cuts, metal drums, rusted scaffolds and fabrication	Solid	Non- Hazardous	Non- Biodegradable	X	
6	Untreated Wood	Support boards, wood chippings and cuts, boxes and crates	Solid	Non- Hazardous	Biodegradable	X	
7	Gaseous Emissions	Generator diesel engines, heavy duty engines, storage tank vents, flash emissions, vehicular emissions	Gaseous	Hazardous	Non- Biodegradable	X	X
8	Dust	Excavation, site clearing, Dust present in the ambient air	Solid	Non- Hazardous	Non- Biodegradable	X	
9	Spent/ Spilled hydraulic and lubricating Oil	Generators, BRV's, pumps	Liquid	Hazardous	Non- Biodegradable	X	X
10	Used/ Spent Oil	Generators, machinery and Big Road Vehicles (BRV's)	Liquid	Hazardous	Non- Biodegradable	X	X
11	Oil Spills	Pipeline leakages;	Liquid	Hazardous	Biodegradable		X
12	Oil Filters	Maintenance of Engines and pumps	Solid	Hazardous	Non- Biodegradable		X
13	Oily Rags/ Absorbents	Clean up of oily surfaces and equipment	Solid	Hazardous/ Non- Hazardous	Non- Biodegradable	X	X
14	Lead –Acid Batteries	Used Lead-acid batteries	Solid	Hazardous	Non- Biodegradable		X
15	Run-off Water	Precipitation into drainage channels and indiscriminate surface run-off during construction	Liquid	Hazardous/ Non- Hazardous	Non- Biodegradable	X	X

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16	Paints	Spilled or residual paints in containers	Liquid	Hazardous/ Non-Hazardous	Non-Biodegradable	X	X
17	Nails	Unwanted or damaged nails	Solid	Non-Hazardous	Non-Biodegradable	X	
18	Bulbs/ tubes	Damaged or destroyed bulbs from illuminated areas	Solid	Hazardous	Non-Biodegradable	X	X
19	Treated Wood	Unused, Damaged or destroyed finished wood products such as office furniture etc.	Solid	Hazardous/ Non-Hazardous	Biodegradable		X
20	Plastic	Packaging materials, damaged plastic materials and containers, PVC pipes and plumbing fittings	Solid	Non-Hazardous	Non-Biodegradable	X	X
21	Glass	Bottles and jars, ceramics, broken windows	Solid	Non-Hazardous	Non-Biodegradable	X	X
22	Paper and cardboard	Packaging, newspapers, computer prints, domestic sources, office documents,	Solid	Non-Hazardous	Non-Biodegradable	X	X
23	Metal drums and tins	Packaging for chemicals, paints, varnishes etc	Solid	Hazardous/ Non-Hazardous	Non-Biodegradable	X	X
24	Food and Beverage	Personnel food consumption	Solid/ Liquid	Non-Hazardous	Biodegradable	X	X
25	Sanitary Wastes/ Sewage	Urinals, Water Closet, sinks, showers and laundry	Solid/ Liquid	Non-Hazardous	Biodegradable		X
26	Agricultural/ Plant Waste	Pruning of plants, Excavated plant/ agricultural material or dead or decayed plant material	Solid	Non-Hazardous	Biodegradable	X	
27	Electrical Waste and E-Waste	Unused or damaged electric wires; off cuts of electric wires, Old computer systems, flash drives, CD's, Digital scanning equipment	Solid	Hazardous	Non-Biodegradable	X	X

3.8.1.1 Construction Wastes

During construction, the main type of wastes are rubble, concrete-based masonry, blocks and tiles. Others envisaged wastes include earth fill, tree and tree stumps, wooden planks, packaging material, waste oils, spent diesel, oily rags, steel rods, plastic, glass, plumbing off-cuts and electric wiring. Dust and gaseous emissions shall be released into the ambient air. Exposure to dust in construction sites shall come from material stockpiles and unpaved surfaces or excavation operations, while sources of gaseous emissions shall be from earth moving equipment and diesel generators.

Reusable wastes shall be recycled on-site, so as to reduce the collection, transportation and disposal and any associated charges from handling.

3.8.1.2 Operations Waste

Operational wastes shall include: packaging materials, paper and plastic materials accumulated from consumables and deliveries. The primary sources of such materials shall be mainly from maintenance works during operations.

Wastes shall be accumulated in suitable receptacles which shall be placed in appropriate areas throughout the facilities where these wastes are generated.

Metals and plastic containers shall be used for a wide range of lubricants and chemicals, while drums and containers shall inevitably contain variable quantities of residues. These wastes and other solid wastes shall be cleared, properly packaged and disposed of at designated disposal locations. CENTURY POWER shall also seek opportunity for waste minimization through the use of the “reduce, reuse and recycle / recover” philosophy.

Treated wood waste shall be generated from office furniture that are no longer used or needed and they shall be sold for reuse at other locations or sent to an offsite facility for treatment (if hazardous) prior to final disposal.

Oily rags are envisaged to be generated from cleaning oily surfaces (lubricating oils), fuels, paints or other solvents. Oily rags used in cleaning hazardous substances (if any) shall be stored in air-tight, non-combustible containers and sent to DSEPA or any FMEnv/NMDPRA approved disposal facility.

Lead-acid batteries from generators and automobiles shall be replaced regularly during the operational phase of the project. Lead-acid batteries contain large quantities of lead and sulphuric acid. Once the lead plates begin to wear and the acid weakens,

they will need to be changed and disposed-of, and these wastes shall then be sent for recycling for its valuable components or to a lead-acid battery vendor.

3.8.1.3 Decommissioning Waste

A broad range of wastes shall be generated during decommissioning. These could range from demolition waste/ rubble from any structures that shall be brought down, earth fill and plant wastes that would be generated from any excavations being carried out, in addition to scrap metals, wood, plastic, glass, metal drums, paper and bulbs. Steel plates from the storage tanks and other structures shall be removed and re-used/ recycled if practical. Spent oil/fuel could be generated from the earth moving equipment used during decommissioning operations. Dust and gaseous emissions is envisaged to be generated from the earth moving equipment used.

3.8.2 Waste Segregation

An integral part of the Waste Management Programme is waste segregation which prevents the disposal of hazardous waste with non-hazardous wastes, and also ensures re-use of recyclable wastes. During construction, wastes shall be segregated as inert construction waste, non-inert construction waste, chemical waste and general refuse; while during operations, the wastes shall be further segregated into general wastes, food waste, effluents, oil/ chemical spills, glass, paper, plastic waste, tins and drums, e-waste and electrical wastes etc. and stored in separate colour coded bins.

3.8.3 Waste Storage

All wastes shall be handled and stored in a manner which ensures they are held securely without loss or leakage to minimize the potential pollution. Portable containers shall be used to accumulate and hold solid wastes prior to disposal by appropriate vendors. While, sanitary wastes shall be routed to a septic tank, and be removed by accredited waste managers.

3.8.4 Waste Tracking

To ensure that all wastes collected from the proposed CNG Mother/Daughter Station are disposed of appropriately, a Waste Consignment Note (WCN) shall accompany all waste transfers.

The WCN shall contain the description and the quantity of waste, as well as the disposal facility. The materials handler shall prepare a WCN for each transport, and shall include the Materials Safety Data Sheet (MSDS) for any hazardous wastes.

3.8.5 Waste Disposal

The individual waste streams collected from the proposed project across all project phases shall be managed or disposed of in varying manners, with the frequency of disposal individually tailored to the characteristics of each individual waste stream. For example, general refuse generated on-site during construction shall be disposed-off by a waste vendor on a daily or every other day, to minimize potential odour impacts; minimize the presence of pests and other scavengers, and prevent unsightly accumulation of waste.

Due to the nature and scale of activities associated with the proposed project, CENTURY POWER shall engage a waste vendor for handling the facilities waste streams to ensure a more effective and sustainable management of generated wastes. **Tables 3.3 and 3.4** shows the waste disposal, treatment and management options for the project.

Table 3.3: Construction Waste Streams

Wastes	Disposal/ Treatment
Earth Fill	• Reuse a portion on-site as backfill material for foundations as well as for landscaping • Any good quality fill can be transported for reuse at other locations • Surplus material to be collected and transported to an off-site disposal facility
Vegetation (Trees, tree stumps and thick branches)	• Trees and tree stumps to be cut into logs and sold for timber for various uses including fuel/ charcoal • Leaves and small branches to be transported for composting at an off-site facility
Construction Wastes/ Rubble	• Wastes to be reduced by purchase control of construction materials and prevention of excessive concrete mixing • Proper storage will minimize the damage or contamination of construction materials • Construction rubble will be reused as much as possible within the project • Waste that cannot be reused will be collected and transported to landfill
Steel Rods/ Steep Plates	• Waste volumes will be reduced by purchase control of steel materials • As much steel as possible will be reused on-site • Unused steel materials will be collected and reused offsite • Damaged/ broken steel rods/ plates will be gathered and sent to a metal scrap yard for recycling
Scrap metal	• Waste volumes to be reduced by purchase control of metals/ metal containing materials • Scrap metal will be collected and sent for recycling
Wood	• Wood will be reused if practical • Unused wood waste will be collected and transported to recycling or disposal facility
Gaseous Emissions	• Emissions will be minimized through strict equipment maintenance programs • Total hours of operation of equipment will be optimized • Low sulphur, clean burning diesel will be used

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Spent/ Spilled hydraulic and lubricating Oil	- Planning and good housekeeping practices to be employed to minimize surplus and contamination - Surplus chemicals may be usable in other locations or returned to vendors, if possible
Used/ Spilt Diesel or Fuel	- Fuel wastes generated will be reduced through purchase control of fuels - Spills and leakage to be avoided by improved housekeeping, maintenance and transport procedures (like use of secondary containment and proper decanting system for petrol/diesel from damaged drums or vessels.)
Oily Rags	- The potency for fires will be reduced by storing in air-tight containers - Used oil rags employed to clean hazardous substances will be collected and transported to waste disposal facility
Run-off Water	- Contamination of the runoff water to be avoided as much as possible as the groundwater is prone to contamination in the construction phase. - Thought will be given to the segregation of drainage from oil, fuel and chemical storage areas from the rest of the site.
Paints	- Residual Paints will be reused where it is feasible - Old and poor-quality paints will be hardened and disposed to landfill (with the exception of oil paints) - Residual oil paints will be collected and transport to disposal facility - Unused paints to be returned to vendors
Nails, screws, bolts and nuts	- Waste quantities to be reduced through purchase control - Nails, screws bolts and nuts to be reused if practical - Damaged nails will be collected for recycling at a metal scrap yard
Bulbs/ tubes	Damaged bulbs to be collected and transported to disposal facility
Plastic	- Plastic containers or bottles to be reused for various purposes if safe to do so - Plastic containers/ plastic materials no longer needed, will be collected and sent for recycling
Glass	Waste glass will be collected and transported to a disposal facility
Paper and Cardboard	Will be collected and sent for recycling
Metal drums and tins	- Bulk transport and storage for high volume consumption items to reduce the number of waste drums and tins generated. - These containers will be refilled and reused where possible - Non-refillable containers will be returned to vendors for reuse or to a company specializing in container refurbishment.
Food and Beverage	- Food wastes to be used as animal feed - Food and beverage wastes to be collected by a waste disposal vendor
Sanitary Wastes/ Sewage	Sanitary waste to be collected and treated in a septic tank
Agricultural/ Plant Waste	To be collected for composting
Electrical Waste	Electrical wastes will be collected and transported for recycling to recover valuable materials including copper/ other conducting metal as well as rubber.

Table 3.4: Operations Waste Streams

Wastes	Disposal/ Treatment
Scrap metal	Scrap metal to be gathered and sent for recycling at a metal scrap yard
Wood	Wood waste will be collected and transported to recycling or disposal facility

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Gaseous Emissions	- Emissions will be minimized through strict equipment maintenance programs - Total hours of operation of equipment will be optimized - Low sulphur clean burning diesel will be used
Spent/ Spilled hydraulic and lubricating Oil	Planning and good housekeeping practices to be employed to minimize surplus and contamination
Used/ Spent Oil	- Fuel wastes generated will be reduced through purchase control of fuels - Spills and leakage to be avoided by improved housekeeping, maintenance and transport procedures (like use of secondary containment and proper decanting system for petrol/diesel from damaged drums or vessels.) - Spent oil to be discharged into sump pit and recycled
Oil Spills	- Planning and good housekeeping practices to be employed to minimize oil spills - Absorbed where possible, booms will also be used (if on water), absorbent, and then collected before injecting into a waiting vessel for reprocessing
Oil Filters	Old oil filters to be collected and transported to disposal facility to recover used oil and steel components for recycling
Oily Rags	- The potency for fires will be reduced by storing in air-tight containers - Rags containing oil and grease will be laundered, dried and reused - Used oil rags employed to clean hazardous substances will be collected and transported to disposal facility
Lead-Acid Batteries	Batteries to be collected and transported and sent to a recycling facility or lead acid battery vendors
Run-off Water	- Contamination of the surface drainage water to be avoided as this is considerably easier than any subsequent treatment. - Thought will be given to the segregation of drainage from oil, fuel and chemical storage areas; loading/unloading areas; and production operations areas from the rest of the facility.
Paints	- Any leftover paints will be reused when required - Old and poor-quality paints will be hardened and disposed to landfill (with the exception of oil paints) - Residual oil paints will be collected and transported to disposal facility
Nails, screws, bolts and nuts	- Waste quantities to be reduced through purchase control - Nails, screws bolts and nuts to be stored for reuse during maintenance - Damaged nails will be collected for recycling at a metal scrap yard
Bulbs/ tubes	- Wastes can be reduced by purchasing LED/ energy saving bulbs as substitutes - Old bulbs to be collected and transported to disposal facility
Treated Wood	- Will be collected to be reused at another facility or recycled - Wasted treated wood will be collected and transported for treatment and disposal
Plastic	- Plastic containers or bottles for various purposes will be reused if safe to do so - Plastic containers/ plastic materials no longer needed will be collected and sent for recycling
Glass	Waste glass will be collected and transported to a disposal facility
Paper and Cardboard	Will be collected and sent for recycling
Metal drums and tins	- Bulk transport and storage will be used for high volume consumption items. - Containers will be refilled and reused where possible, - Non-refillable containers will be returned to the vendor for reuse or to a company specializing in container refurbishment.
Food and Beverage	Food wastes to be used as animal feed

	• Food and beverage wastes to be collected by a waste disposal vendor
Sanitary Wastes/ Sewage	• Sanitary waste to be collected and treated in a septic tank
Agricultural/ Plant Waste	• To be collected for composting
Electrical Waste and E-waste	• Electrical and E-wastes will be collected and transported for recycling to recover valuable materials including copper/ other conducting metal as well as rubber/ plastics
Process Wastewater/ Effluent	• Treated in skimmer pit before disposal

3.9 Traffic Management

CENTURY POWER's Traffic Management Plan is essential for maintaining optimal traffic flow and taking into account worst-case scenarios especially during operations. The plan contains the mandatory minimum requirements for traffic management during the various project phases and separate Traffic Management Plans shall be designed for the construction and operations phases. Accidents carry a risk of loss of life, property, money; products; or damage to equipment. The traffic management plan shall aim to:

- Identify, assess and control the risks associated with traffic hazards
- Eliminate traffic hazards where reasonably practical;
- Adopt adequate traffic management planning where operations/ work force causes changes to the flow of either pedestrian, vehicular or mobile plant traffic

The key features of the Traffic Management Plan include:

- Vehicle Routes
- Signage
- Facility Protection
- Safe Crossings and Pedestrian Zones
- Training and Review

3.9.1 Vehicle Routes

Vehicle routes shall be designated within the premises during the different project phases and there shall be specified vehicle lanes for road tankers and smaller vehicles during project operations. Parking areas will be provided separately for trailers and cars, and these will be clearly marked. Stopping and non-stopping areas shall also be specified in addition to haul and loading/ unloading routes for supplies and materials. In a bid to keep optimal traffic flow, there shall be separate entry and exit points especially in the operational phase where the route surface will be made of well-drained material such as bitumen or concrete in order increase grip and prevent slippage.

The route surfaces shall always be kept free of hazards such as oil, slippery substances, potholes or other surface damage as these hazards affect stopping

distances, maximum speeds and cause vehicle wear. Excessively steep gradients shall be avoided as much as possible, as they will create instability in vehicular movements within the facility.

The lane widths are crucial and shall have buffer zones slightly larger than the widest load of the largest vehicles thus reducing the risk of accidents and collisions. The roads widths shall be designed to permit easy maneuvering of vehicles, with corner radii to suit the turning circle of the largest vehicle expected (i.e., fire trucks, road tankers or any specialist vehicles carrying special loads).

3.9.2 Signage

Signage is an integral part of the Traffic Management Plan as it guides drivers and pedestrians on appropriate movement around the facility. Reflective markers and lines and easy to read signs will alert all vehicles and pedestrian users to things of importance. It will be ensured that all signs will need to be legible at maximum speeds and they will be placed far above eye level. Clear signage will be used to alert drivers to:

- exclusion zones
- parking/no parking zones
- speed limits
- pedestrian crossings
- vehicle crossings
- blind corners
- steep gradients
- overhead hazards (e.g., powerlines) specifying maximum vehicle clearance heights
- Poor or changed traffic conditions
- Sharp or blind corners
- other known hazards

3.9.3 Facility Protection

Areas within the proposed facility having vulnerability and susceptible to wear will be subject to protection. Protective items like bollards will be useful in protecting important parts of the facility and to also alert pedestrians to dangerous zones and prevent them from walking into oncoming traffic. In addition to bollards, guardrails will be used in certain areas to protect pedestrians from traffic.

To reduce wear on the structural features of the facility, bump rails or rub rails, may be used to extend the life of key facility structures. These protective measures will extend the life of the facility and they will be put in place to minimize the possibility of accidents.

3.9.4 Safe Crossings and Pedestrian Zones

Pedestrian zones shall be clearly demarcated and physically separated so that vehicles cannot encroach. Where it is not possible to physically separate pedestrian and vehicle zones, alternative options such as vision panels in doors, mirrors for pedestrian and vehicle use will be applied. Natural pedestrian routes and clearly marked footpaths will be made obvious to both the people walking them and the vehicles.

Barriers will be used not just to stop traffic but also to remind pedestrians of entrances and exits when moving around the facility. Should pedestrians need to cross vehicle routes, protection through the use of physical barriers with inward opening gates, gates with warning devices and the use of traffic light systems will all be contemplated. These control measures will also be combined with clearly visible ground markings, lights and signs.

3.9.5 Training and Review

Every person who enters the facility shall be made to understand the Traffic Management Plan. They will be made aware of designated safe routes, no-go zones and speed limits which will be done through an induction process. A supervisor will be provided for visitors to ensure their safety and protection when navigating around the facility. Training is a critical element and many types of vehicles require operators to have high risk work licences.

A review of the Traffic management Plan will be done periodically to assess whether all strategies have been effective and how they could be improved. This will ensure that the Traffic Management Plan keeps up with the advancements offered by new technology, new procedures and staff experience.

3.10 Spill Prevention, Control and Countermeasures Plan (SPCC)

The Spill Prevention Control and Countermeasures plan strives to prevent oil from entering navigable waters through the prevention, control, and mitigation of oil spills. The objectives of the Spill Prevention, Control, and Countermeasure (SPCC) Plan for CENTURY POWER's proposed CNG Mother/Daughter Station include:

- Providing standards for the transfer/movement of the products within the plant.

- Establishing standard procedures, methods, and equipment or other requirements to prevent the discharge of chemical/oil into the navigable waters of Nigeria.

The contents of Century Power Generation Limited's SPCC is discussed in subsequent sections

3.10.1 Organizational Structure for Oil Spill Response

The organization structure of oil spill response is predicated on Tier-1 oil spills defined as small operational oil spills of up to 25 barrels or 1,050 gallons, in inland waters, and not more than 250 barrels on land or coastal water but with an in-built provision for escalation of response to Tier-2 and Tier-3 oil spills which are beyond CENTURY POWER's in-house capability.

Tier-1 oil spills will be contained and cleaned up by the facility spill response personnel who have been adequately trained to provide emergency response services. No outside assistance will be required. **Fig 3.4** shows the organizational structure for oil spill response at CENTURY POWER's terminal.

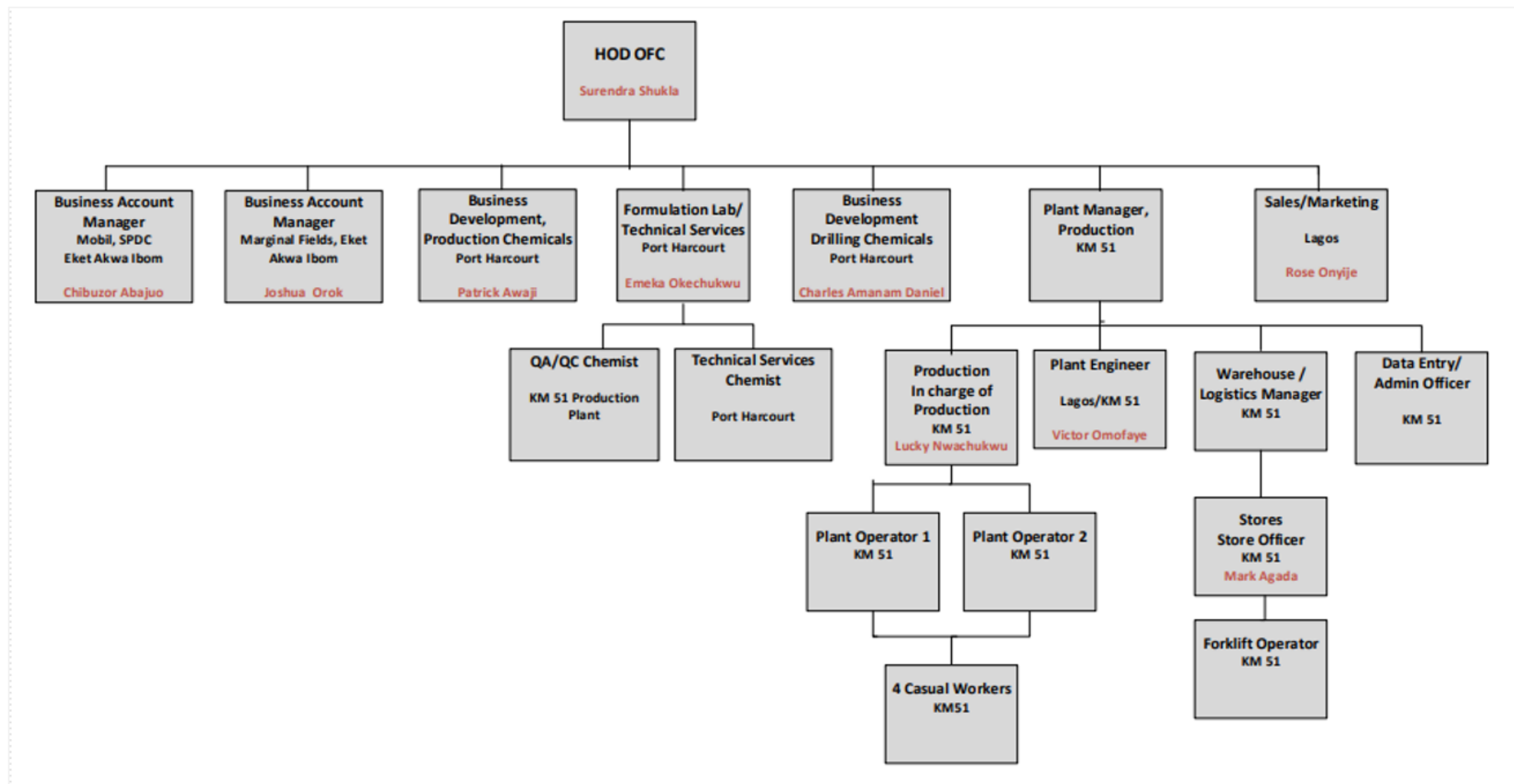


Fig 3.4: Organizational Structure for Oil Spill Response

3.10.2 Responsibilities and Duties

The CEO of CENTURY POWER is ultimately responsible for all safety, health and environmental issues in the company, including the provision of adequate human and material resources for effective implementation of the company's Spill Prevention and Countermeasures plan. The general manager (operations) has the overall authority and responsibility in the management of all activities related to control, and effective combating of any oil spill in the company's operations. The commercial manager's primary responsibility is to ensure that the Facility/ Plant Manager and the Marine Manager are fully equipped to handle emergency situations in their respective business units; while the HSE Manager ensures that oil spill response operations are carried out in accordance with company HSE Policy and Procedures, relevant laws and regulations.

The Facility Manager shall be the on-scene commander in the event of an oil spill occurring at the proposed CNG Mother/Daughter Station.

The transportation or logistics manager shall be responsible for providing facilities, services and materials in sufficient quantities to support oil spill incident response; with the clean-up coordinator being responsible for co-ordinating oil spill clean-up on land by determining resource needs; mobilizing clean-up personnel for oil spill response in addition to delegating various assignments as deemed fit to the response team/personnel assigned to deal with any oil spill incident.

3.10.3 Oil Spill Risk Analysis

The proposed project will be evaluated to determine where there is reasonable potential for equipment failure, which would result in a potential release of oil to the environment. This will involve the predetermination of potential sources of oil spillages, analysis of oil spill scenarios, resources at risk and potential damage to the resources. Oil spill risk analysis based on knowledge of the facility operations shows that the major risks are associated with:

- (i) Pipeline corrosion/rupture
- (ii) Malfunctioning of valves/nozzles
- (iii) Loading Failure
- (iv) Road Tankers accident/overflow
- (v) Fire/Explosion.

3.10.4 Spill Prevention Mechanisms

The proposed CNG Mother/Daughter Station shall contain the following at vulnerable areas:

- bund walls around storage tanks that are sufficiently impervious to contain spilled oil;
- Curbing; culverts, gutters or other drainage systems;
- Storage sheds with built-in containment
- Weirs, booms or other barriers;
- Spill diversion ponds;
- Retention ponds;
- Sorbent materials.

3.10.5 Equipment and Materials for Oil Spill Response and Clean-up

The equipment and materials that will be stockpiled at the facility for Tier-1 oil spill response include:

Response Equipment

- Response vehicle fitted with spark arresters.
- Waste oil storage tanks and drums of various capacities
- Caution signals and Reflecting Tapes
- Pick-up trucks with spark arresters.

Clean-up Equipment

- Hot water cleaner
- Sorbent Pillows
- Sorbent sheets
- Non-spark Shovels/Rakes
- Sorbent booms
- Vacuum truck and hoses
- Containment boom
- Storage containers of various sizes.
- Buckets
- Fire mains water portable air pumps
- Sand

Personnel Protective Equipment

- Rubber boots
- Rubber Gloves
- Face Visors/goggles
- Waterproof suits/coveralls
- Respirators
- Hazardous Vapour defector
- Stock of soap detergent for degreasing/deoiling of concreted areas, vessel/decks and general cleaning purposes.
- Hard hats

3.10.6 Contact Persons and Agencies

Spills at the proposed facility shall be under the jurisdiction of the Delta State Ministry of Environment and the National Oil Spill Detection and Response Agency (NOSDRA). In addition, some key personnel of Century Power Generation Limited will be designated as being responsible for oil spill prevention at the facility. Their names, roles and responsibility and contacts will be contained in the Spill Prevention, Control and Countermeasures plan at the start of operations.

CHAPTER FOUR

4.0 DESCRIPTION OF THE ENVIRONMENT IN THE STUDY AREA.

4.1 Study Approach/ Methodology

A one-season sampling was approved for this project therefore the dry season sampling was carried out on 18th March 2026 to determine the existing environmental status and a ten (10) years meteorological data was obtained from the Nigerian Meteorological Agency.

This report was based on:

- a. Literature review and desktop studies
- b. Preliminary survey/site reconnaissance visit
- c. Scope of Work (SoW) and Terms of Reference (ToR) for the environmental baseline and site verification exercise by FMEnv; Abuja and Delta State.
- d. Field data gathering and Laboratory analyses for biophysical samples collected using standard international (APHA, ASTM, and AWMA) and FMEnv. approved methods.
- e. Compilation of comprehensive environmental baseline data to fully describe the environmental conditions.

4.1.1 Literature Reviewed

Extensive literature search relevant to the study area was conducted in order to acquire background information on the current state of the project environment. Literature review also included information from previous studies around the project area, and of areas with similar environmental characteristics. The project review and data acquisition exercise commenced with the project proponent, and included bibliographic and spatial data, detailed project description diagrams, site inventory records, maps, facility manual and baseline information on the physical, chemical and biological attributes of the environment, associated development activities and community related issues.

Literature reviewed included:

- a. Topographic maps obtained from Federal Surveys: Nigeria.
- b. Climate and meteorological conditions of Delta State for ten years obtained from the Nigerian Meteorological Agency, (NIMET), and online.
- c. The relevant institutional, legal and regulatory guidelines and standards obtained from the Federal Ministry of Environment, (FMEnv), Delta State Ministry of Environment (DSMOE), and its Delta State Environmental Protecting Agency (DSEPA).

- d. Textbooks and journal articles on the biophysical natural resources and biodiversity in the study area.
- e. The relevant institutional, legal and regulatory framework was obtained from publications by the regulatory agencies and ministries.

4.1.2 Preliminary Site Survey/Reconnaissance Visit

The site reconnaissance team consisting of representatives of CENTURY POWER, FMEnv, DSMOE and CHEMTEK (the environmental consultant). The following were achieved/accomplished after the site survey:

- i. Identification of and familiarization with the proposed project area, human settlements and some land-use pattern in the project area.
- ii. Field surveillance and inspection to obtain a bird's eye view of the project site and its environment
- iii. The approximate geographical co-ordinates of the project area.
- iv. Photographs of some sections of the site to show its vegetation cover and built-up environment
- v. The general topography of the area
- vi. Ascertaining the security situation on ground and logistics for field data gathering.

4.1.3 Field Data Gathering

➤ Fieldwork/Period of Fieldwork

In order to establish the existing environmental conditions around the proposed facility, field sampling of the various biophysical components (air quality and noise, soil and groundwater) was carried out. The dry season field data collection took place on 18th of March, 2026.

➤ Sampling Design for Biophysical Data Acquisition

Field work for collection of biophysical data was carried out in accordance with standard ecological methods. Each sampling location was geo-referenced on a Global Positioning System (GPS) using a hand-held GPS meter GARMIN Gpsmap 78. The following environmental media were sampled; air quality and noise, soil, groundwater and vegetation.

The collected samples were labelled and transported to SearchGate Laboratory, Lagos State (an FMEnv accredited laboratory) for analysis. Table 4.1. below gives the referenced (with a GPS) geographic co-ordinates of all sampled locations.

Table 4.1: Sampling Co-ordinates

CODE	LATITUDE	LONGITUDE	ENVIRONMENTAL COMPONENTS
CP 1	05° 33'34.10"	005°43'45.29"	Air, Noise, Soil
CP 2	05° 33'34.23"	005°43'43.68"	Air, Noise, Soil
CP 3	05° 33'34.82"	005°43'44.43"	Air, Noise, Soil
CP 4	05° 33'35.24"	005°43'43.63"	Air, Noise, Soil
CP 5C	05° 33'35.09"	005°43'47.88"	Air, Noise, Soil (Control)
CP 6	05° 33'35.47"	005°43'43.45"	Ground water
CP 7C1	05° 33'34.30"	005°43'45.53"	Ground water (Control 1)
CP 7C2	05° 33'29.19"	005°43'43.04"	Ground water (Control 2)

➤ **Equipment and Materials Check**

The equipment and materials deployed for the data collection include PPEs, sampling tools, containers, handheld devices, preservatives, first aid box etc. Equipment was checked for their suitability, maintenance and calibrations status and field readiness and their uses are listed on Table 4.2.

Table 4.2: Field Sampling Equipment's and Materials

S/N	Item	Objective	Qty
Materials			
1.	1 litre plastic water bottles	groundwater physico-chem & heavy metals	2
2.	500ml glass bottles	groundwater/ Organics (THC, etc.)	2
3.	250ml amber bottles	groundwater BOD ₅	2
4.	machate bottles	Groundwater/soil MIC	12
5.	1 pack of Ziploc bag	Soil samples	1
6.	Paper masking tapes	Labels	2
7.	Markers/ disposable gloves	Labels	2
8.	Coolers and ice packs	samples preservation/transport	1
9.	HNO ₃ and H ₂ SO ₄	Heavy metal and THC preservation	1
10.	Pipette	collecting preservatives	2
11.	Pairs of bowl and spoons	Soil/sub-sampling	2
12.	Pairs of Rainboots	Foot wear PPE	4
13.	Chain of custody forms	Samples logging and tracking	3
14.	Daily Work sheets	Show work achieved and targets	2
15.	Attendance sheet	Records	2
16.	In-situ Sheets	Fast changing parameters	3
Equipment			
17.	Hand Auger	For Soil Sampling	1
18.	Camera	Still photos	1
19.	Air Quality Meter	Air quality pollutant gases: Nox, Sox, VOC, CH ₄ , H ₂ S, CO	1
20.	Noise meter	Noise level measurement	1
21.	Intelligent Air-Detector Meter	Suspended particulates matter	1
22.	In-situ meters	DO, temp, conductivity and pH	1
23.	GPS	Sampling stations positioning	1
24.	Field note book	For in-situ records and notes	1

➤ **Field Sampling Methodologies**

A. Air Quality and Noise Level

Four (4) locations in project site and 1 control (5 locations) were sampled using hand-held air quality meters and results recorded on-site.

Parameters and Equipment Employed:

- A hand-held air quality detector of IGERESS WP69305 Model was to monitor temperature, HCHO, TVOC, PM_{2.5/1.0/10}.
 - Multi- Gas Detector a hand-held meter FORENSICS FD-4S model was used to monitor CO, H₂S, O₂.
 - Gas Detector of BOSEAN BH-4S model was used to monitor NO₂, SO₂, CH₄.
 - Noise level was monitored using Digital Sound Level Meter of TENMARS TM-103 model.
 - A hand-held meter of GARMIN Gpsmap 78 Model was used to mark the coordinates.
- The values of the atmospheric concentrations of each gaseous pollutant were read off directly from the equipment screen and the ambient noise level was measured with the aid of a Noise Meter. The meter was placed at arm's length on a tripod and positioned to take readings. The values were read off directly from the meter after a few seconds.

B. Climate and Meteorology:

The climate and meteorological conditions of the project area were obtained from the Nigerian Meteorological Agency, (NIMET), online; and with a hand-held meter for the microclimate.

C. Groundwater

Groundwater was collected in glass wares from a borehole within the project site and two (2) control stations.

D. Soil Samples

Soil samples were collected at each land location with the aid of a 90 mm diameter soil auger at 0 cm to 15 cm for topsoils and 15 cm to 30 cm for subsoils.

Samples for organics analysis were stored in aluminum foil and those for microbiology in sterilized McCartney tubes/bottles. All the samples were stored in field ice-packed cooler, and transported to the laboratory for analysis.

E. Terrestrial Biodiversity

- Vegetation Cover

Sample quadrats (2m by 2m for herbs and shrubs and 1m x 1m for grasses) were measured in the sampling locations which were randomly selected, taking into account plant species diversity or rarity, density and dominance.

In each quadrat, plant species were identified and the vegetation type described. Unidentified plant species and species whose identification were doubted were collected, given sample location coded numbers and pressed for identification and/or confirmation of identification in a herbarium. Plant species were identified with the aid of:

Plant album: and plant snap (plant app). The leaves of plant species at each location were examined for symptoms of diseases and nutrient element deficiency.

- Fauna:

(i) Invertebrate Fauna

At a sampling location, the invertebrate fauna within a quadrat of 5m by 5m were identified on sighting. Invertebrate fauna that could not be immediately identified to species level were captured and put into a labeled and coded specimen container. Insects and spiders were captured with an insect sweep net or by hand picking. Casts of earthworms indicated their presence.

(ii) Wildlife/Vertebrate Fauna

Wildlife within the project area and surroundings was explored for direct sighting and identification (amphibians, reptiles, birds and mammals). The wildlife was ascertained from photographs.

➤ Handling of Biophysical Samples and Storage

Sampling locations were coded and numbered serially per location. At each location, specimen containers were appropriately labeled using permanent marker showing code and number of the sampling location. One litre kegs, amber bottles (for BOD₅) and glass wares for water collection were similarly coded and labeled. Different sizes of polythene bags for topsoil (TS) and subsoil (SS); pre-sterilized bottles for soil and water microbiological analysis were each coded and labeled as per number of the sampling location and preserved in an ice-pack cooler.

➤ Sample Preservation

Each sample was properly labelled, arranged, and preserved in accordance with the sample QAQC procedures. Table 4.3 below gives the sample preservation matrix.

Table 4.3: Sample Preservation Matrix

Soil				
Parameter	Minimum Sample Volume	Container	Preservative	Container Pre-treatment
General Appearance, Colour, Odour, Depth,	Record observation on site in a note book using relevant charts	-	-	-
Metals (Cu, Zn, Ag, Pb, Ni, Cd, Mg, K, Na, Ba, Mn, Fe, , Cr, Co, Ca, , As, Hg, V)	1.0L	Plastic	Ice below 0°C	Rinsed with HNO ₃
Physico-chemical (%TOC, pH, Sulphate, Conductivity, Particle size, Nitrate, redox potential, EC, Moisture content)	1.0L	Plastic	Cool below 0°C	Rinsed with distilled water
Organics TPH, THC, etc.	200ml	Glass	Cool below 0°C	Rinsed with distilled water
Microbiology (HUB, HUF, THF, THB)	250ml	Amber	Cool below 0°C	Sterilized
Water Samples				
Parameter	Minimum Sample Volume	Container	Preservative	Container Pre-Treatment
DO, salinity, Turbidity, Conductivity, Temperature, TDS, Ph, BOD chloride	Insitu Measurements	-	-	-
Metals (Mn, Fe, Cu, Zn, Ag, Pb, Ni, Cd, Cr, Co, Ca, Mg, K, Na)	1.0L	Plastic	Add 2ml conc. HNO ₃ & cool, 4°C ± 2°C	Rinsed with 1+1HNO ₃
TPH	500ml	Glass bottle	Add 2ml conc. H ₂ SO ₄ & Cool, 4°C ± 2°C	Rinsed with distilled water
BOD ₅	250ml	Amber	Cool below 0°C	Rinsed with distilled water
Microbiology (HUB, HUF, THF, THB)	250ml	Amber glass bottles	Cool, 4°C ± 2°C	Sterilized

➤ **Quality Assurance and Quality Control (QA/QC) for Field Data Gathering**

Data collections were carried out with adequate quality control and assurance (QC/QA) to the standard and procedure recommended for field data gathering ASTM and APHA.

- All instruments were cleaned and calibrated before and after use
- Several water chemistry parameters such as pH, temperature, salinity, conductivity and dissolved oxygen were determined on-site

- Water samples collected for heavy metals were acidified with 1 ml concentrated HNO_3 per litre to enhance preservation and prevent precipitation of metal ions. Fresh glass bottles with stoppers were used for collection.
- For collection of samples for petroleum hydrocarbon determination, fresh 500ml glass bottles were used, with glass stoppers. These were wrapped with aluminum foil.
- Fresh 2L plastic kegs were used for water samples for determination of other physico-chemical characteristics.
- The kegs were preserved in ice-pack coolers in the field, refrigerated to 4°C in the laboratory and analysed within 24 hours.
- Soil samples were put in fresh polyethylene bags and immediately preserved in ice-pack coolers in the field and at 4°C in the laboratory.
- All samples and specimen containers were adequately and properly labeled, coded and numbered per sampling location.
- Pre-sterilized McCartney tubes/bottles were employed for collection of water, sediment and soil samples for microbiological analysis.

➤ **Chain of samples custody procedure**

The principal documents used to identify samples and to document possession were Chain of Custody (COC) records, field log books, and field tracking forms. COC procedures were used for all samples throughout the collection, transport, and analytical process, and for all data and data documentation, whether in hard copy or electronic format. COC procedures were initiated during sample collection.

Each person who had custody of the samples signed the form and ensured that the samples were not left unattended unless properly secured. Minimum documentation of sample handling and custody included the following:

- Sample collection date and time
- Any special notations on sample characteristics
- Initials of the person collecting the sample
- Date the sample was sent to the laboratory
- Location the samples were collected

The completed COC form alongside the samples were transfer to the laboratory.

The laboratory also initiated their own chain of custody and there is a Master register for all samples brought into the laboratory. Following registration of the samples, a sample

data sheet containing pertinent information on the sample was opened for each sample.

The information includes:

- sample reference number,
- nature or type of sample,
- site of collection,
- date and time of collection,
- mode of preservation (depends on nature of material) and analytical data from the field and results of laboratory analysis of representative samples.

Upon receiving and confirming that the samples were in good condition, the laboratory representative and the field officer, both sign the coc form.

➤ **Laboratory Analysis**

The samples were analyzed at SearchGateLaboratories Limited, a Federal Ministry of Environment (FMEEnv) accredited laboratory in Lagos. A summary of analytical methods employed for the analysis are shown in Table 4.4

Table 4.4: Laboratory Analytical Methods

Parameter	Method
Water Physiochemical Characteristics	
pH	APHA 4500H ⁺ B
Temperature	APHA 2550B
Electrical Conductivity	APHA 2510B
Salinity (ppt)	APHA 2520B
DO (mg/L)	APHA 4500-OG
Turbidity (NTU)	APHA 2130B
Redox Potential	APHA 2580A
TDS (mg/L)	APHA 2540A
TSS (mg/L)	APHA 2540D
BOD5 (mg/L)	APHA 5210B
COD (mg/L)	APHA 5220D
Total Hardness (mg/L)	APHA 2340C
Oil & Grease (mg/L)	APHA 5520D
Chloride (mg/L)	APHA 4500 Cl ⁻ B
Nitrate (mg/L)	APHA 4500 NO ₃
Sulphate (mg/L)	APHA 4500-SO ₄ E
Magnesium (mg/L)	APHA 3500-Mg B
Potassium (mg/L)	APHA 3111B
Sodium (mg/L)	APHA 3111B
Calcium (mg/L)	APHA 3500-Ca B
Cadmium (mg/L)	APHA 3111B
Total Chromium (mg/L)	APHA 3111B
Copper (mg/L)	APHA 3111B
Total Iron(mg/L)	APHA 3111B
Lead (mg/L)	APHA 3111B
Nickel (mg/L)	APHA 3111B
Zinc (mg/L)	APHA 3111B

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Silver (Mg/L)	APHA 3111B
Manganese (mg/L)	APHA 3111B
Mercury (mg/L)	APHA 3112B
Vanadium (mg/L)	APHA 3111D
Parameter	Method
Soil Physiochemical Characteristics	
pH (Soil to Water) @25° C	EPA 9045D
Electrical Conductivity (µS/cm)	APHA 2510A
TOC (%)	Walkey-Black method
THS (mg/L)	EPA 1664A
Redox Potential (mV)	EPA 9045D
PSD	ASTM D 422
Clay (1%)	
Silt (%)	
Sand (%)	
Nitrate (mg/kg)	APHA 4500-NO
Extractable Phosphate (mg/kg)	APHA 4500 SO ₄ ²⁻ E
Magnesium (mg/kg)	Olsen/ APHA 4500 PE
Potassium (mg/kg)	USEPA 3050B
Sodium (mg/kg)	USEPA 3050B
Calcium (mg/kg)	USEPA 3050B
Cadmium (mg/kg)	USEPA 3050B
Total Chromium (mg/kg)	USEPA 3050B
Copper (mg/kg)	USEPA 3050B
Total Iron (mg/kg)	USEPA 3050B
Lead (mg/kg)	USEPA 3050B
Nickel (mg/kg)	USEPA 3050B
Zinc (mg/kg)	USEPA 3050B
Barium (mg/kg)	USEPA 3050B
Silver (mg/kg)	USEPA 3050B
Manganese (mg/kg)	USEPA 3050B
Mercury (mg/kg)	USEPA 3050B
Vanadium (mg/kg)	USEPA 3050B
Parameter (cfu/g)	Method
Soil Microbiological Characteristics	
Total Heterophobic Bacteria	Spread Plate Method APHA 9215C
Hydrocarbon Utilizing Fungi (Vapour phase Transfer)	
Total Heterophobic Fungi	
Hydrocarbon Utilizing Fungi (Vapour phase)	

➤ **Quality Assurance/Quality Control for Laboratory Analysis of Samples**

Glassware and other containers used for each analysis were thoroughly cleansed as appropriate for each parameter. All glassware used for oil and grease determination were pre-rinsed with Analar grade xylene. Glassware for determination of metals were pre-soaked in dilute nitric acid and then rinsed well with distilled water. All reagents and chemicals of high purity (mostly Analar grade) were used. Freshly distilled water prepared in the laboratory was used for all dilutions.

The various instruments and equipment for measuring physico-chemical parameters were used while in good working condition. Periodic control checks were usually carried out on such instruments/equipment and the performance record maintained. The pH meters were calibrated using HACH commercial buffer standards. Using appropriate colour standards of diluted potassium dichromate or potassium permanganate solutions frequently checked the wavelength settings and sensitivities of the absorption spectrophotometer.

For analytical determination requiring the use of calibration curves, such curves were plotted using standard solution prepared from analytical grade reagents. Records of such calibration curves were maintained and frequent re-calibration checks were carried out. Analytical blanks were incorporated per specific batches of samples to compensate for the sample preparation and determination steps. All the analyses were replicated and the means reported.

4.2 The Biophysical Environment of the Study Area

Climate determines the biophysical make up of a region by acting on all the components of the ecosystem. In addition to this, it also aims at maintaining the natural equilibrium between environmental components. This section of the report discusses the seasonal variability of the dominant climatic elements and factors in the area.

The data used for this study were sourced, primarily from existing literature, Nigerian Meteorological Agency climatic data and World Weather Data from the past 10 years, and previous environmental studies. Supplementary measures and checks were carried out during the fieldwork using the relevant literature materials on the theme and study. The data sets were collated, analysed and have been presented using appropriate tools.

The study area falls in a humid tropical environment, within the Nigerian coastal region where high precipitation and relative humidity (%RH) are regular throughout the year. The most dominant wind systems in the study area are the South-Westerly winds and the North-Easterly Trade winds. The South-Westerly winds are responsible for rainfall (wet season) while the North-Easterly Trade winds are responsible for harmattan conditions experienced in the dry season.

4.2.1 Climate and Meteorology

The climate of the study area can be described as the sub-equatorial south system. The most dominant wind systems in the study area are the South-Westerly winds. The

seasonal patterns are; rainy season, from March–October predominantly occasioned by southwest to west-southwest winds, driven by monsoon flow. The dry season / Harmattan starts from November–February driven by northeasterly trade winds, but the effect is weaker in coastal Delta State compared to inland regions.

The climatic information is discussed in subsequent subsections.

4.2.1.1 Rainfall

The study area which is situated in the tropics has two distinct seasons. These are the wet season and the dry season. The wet season usually runs from early April till October with a double maxima rainfall peak. and it is characterized by south-westerly winds that bring heavy downpours to the southern portion of Nigeria. The first peak period is experienced in the month of July (467 mm) while the second period is experienced in the month of September (427 mm). On the average, there are usually about 185 rainy days per year. The annual rainfall of the study area is higher than 2000 mm (Figure 4.1,).

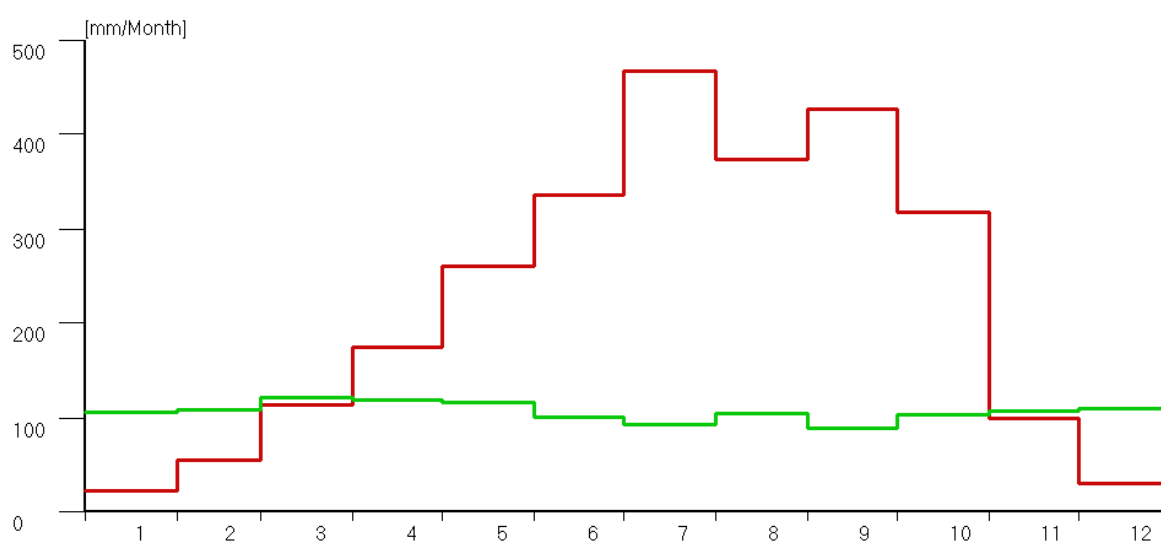


Fig 4.1: Mean Rainfall Distribution in the Study Area

4.2.1.2 Sunshine and Insolation

The amount of insolation and net radiation is related to rainfall, cloud cover and temperature. The amount of sunshine hours affects most forms of biological activities resulting in diurnal rhythms of terrestrial flora and fauna. The general pattern is that the amount of sunshine hours is lowest in the wet season compared with the dry season. This lower amount of sunshine is related to the greater cloud cover and rainfall that characterize wet tropical areas.

The mean minimum fraction of sunshine per day occurs in September (19%) while the maximum occurs in November (51%). The mean sunshine hours per month are influenced by the amount of rainfall such that a low sunshine hour is recorded in September at the peak of rainy season, while high values are recorded in November. An observation of the sunshine hour in the study area revealed an average of four hour of sunshine period per day and a monthly sunshine of between 68-75 hours. The brightest month is November with an average sunshine period of 186 hours and an average of 6.02hours per day.

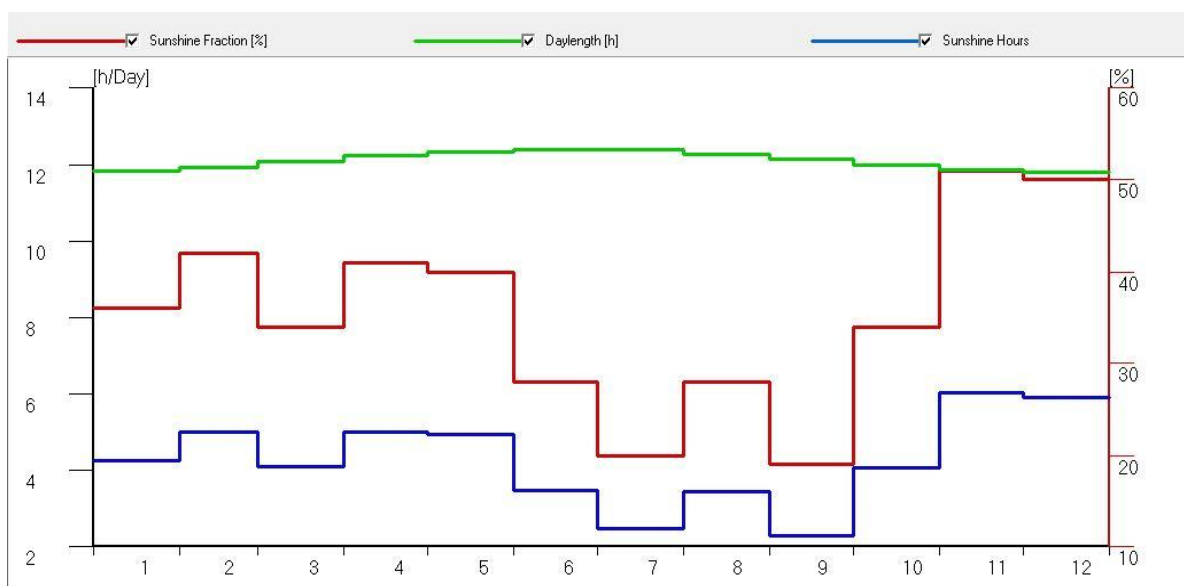


Fig 4.2: Sunrise and Sunset Patterns in the Study Area

4.2.1.3 Air Temperatures

A hand-held Air Quality Detector Meter (IGERESS WP69305 Model) was used to determine the micro temperature of the study area. Overall, the study area has a constant high temperature with mean annual minimum and maximum temperatures of about 21.62°C and 30.61°C respectively. The mean annual range of temperature is 3.8°C. The hottest months coincide roughly with the passage of the overhead sun over Nigeria. The sun passes over Nigeria twice on its way to and from the Tropic of Cancer. Due to this phenomenon, the study area is also characterized by two maxima and minima each in the annual temperature cycle (Figure 4.3).

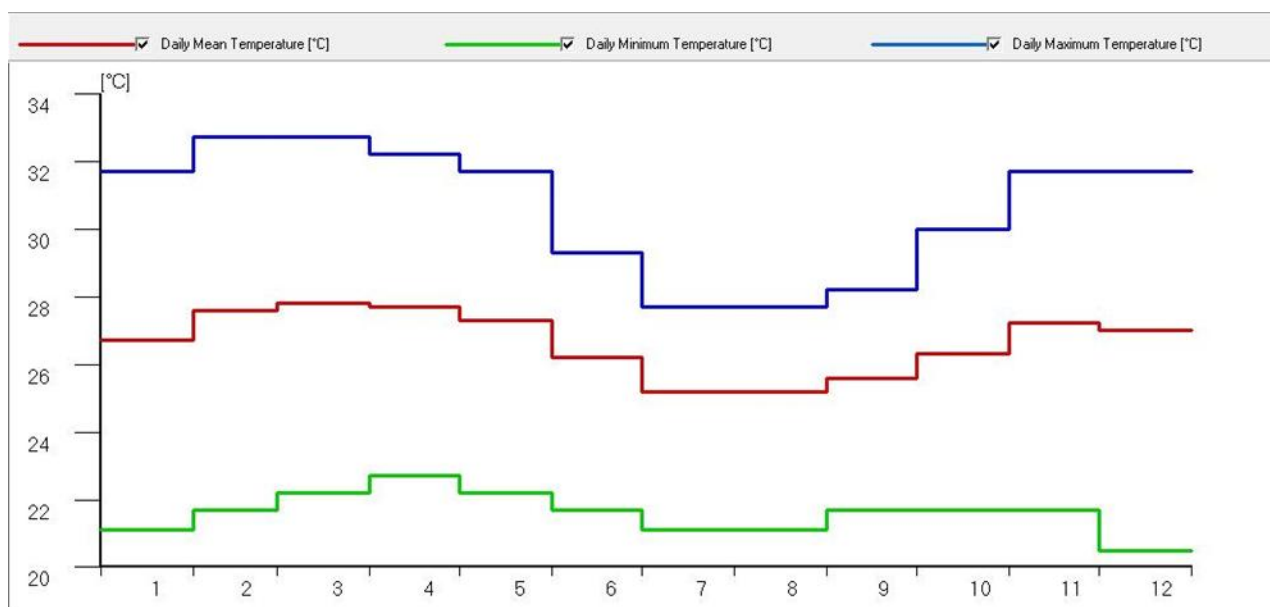


Fig 4.3: Air Temperatures in the Study Area

4.2.1.4 Relative Humidity

The relative humidity is high throughout the year. According to Iloeje 2001, the sub-equatorial south in which the study area falls experience over 90% relative humidity in the early morning, but fall to between 60 and 80% in the afternoon. Relative humidity is higher in the wet season than the dry season. Relative humidity is important not only for its impact on human comfort. In areas of low relative humidity, rates of evapotranspiration are much higher, allowing water to escape back into the atmosphere much faster.

4.2.1.5 Wind Speed and Water Vapour Pressure

The prevailing winds along the project area are the persistent south-westerly monsoon modified by land and sea breezes throughout the year. The mean monthly wind speed is fairly constant with an average speed of 2.16 km/h from January-September. The wind speed drops to an average speed of 1.8km/h during the months of October-November which marks the end of the wet season. The water vapour pressure of the study area is highest in March/April with 26.1hpa and lowest in August with 24hpa

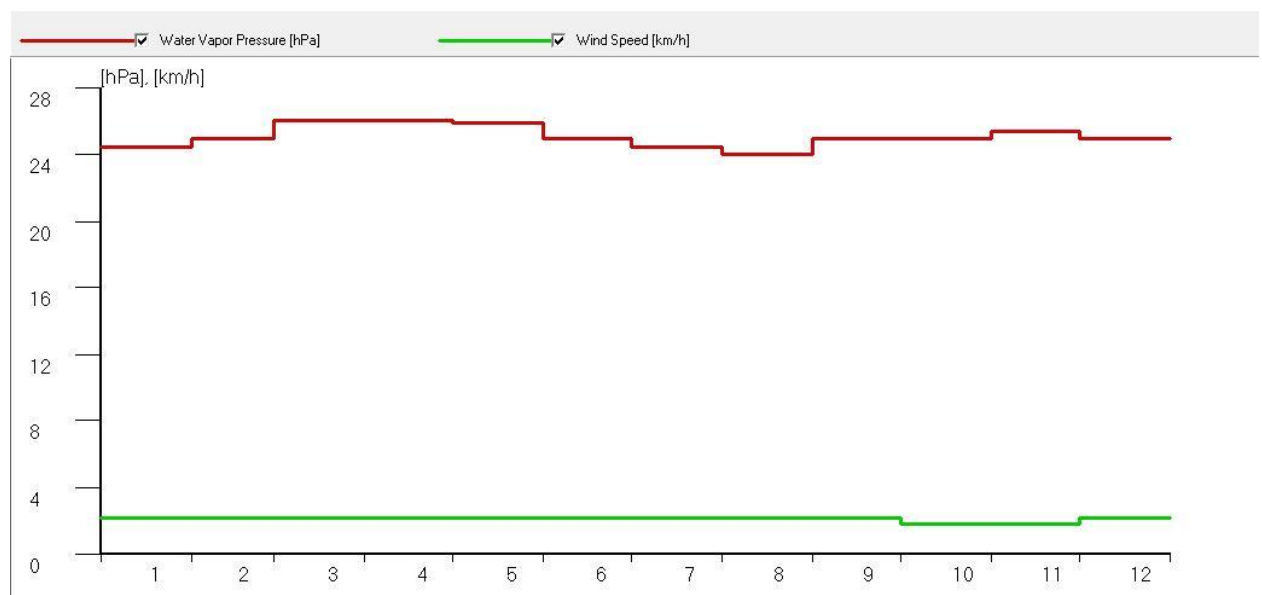


Fig 4.4: Mean Wind Speed Variation in the Study Area

4.2.2 Air Quality and Noise Characteristics

4.2.3.1 Air Quality

Air pollution is the presence of one or more contaminants in the atmosphere in quantities, characteristics or duration that become potentially injurious to human, plant, or animal life or to property, or which unreasonably interfere with the comfortable enjoyment of life and property. The Nigerian government, through the Federal Ministry of Environment and the NMDPRA has put up interim regulatory Standards for particulates and gaseous emissions



in ambient air quality. Thus, the air quality parameters measured in the study area were compared with the interim national standards.

Plate 4.1: Air Quality Data Gathering within the Study Area

Four (4) air quality/noise samples and one (1) control were taken from the proposed project site. Digital portable hand-held air quality detector meters (Igeress WP69305, Forensics FD-4S and Bosean BH-4S Models) were used to measure the air quality and digital sound level meter (Tenmars TM-103 Model) for sound/noise level. Nigerian Ambient Air and Quality Standard is presented in Table 4.5 and the Noise Exposure Limit in Table 4.6. The results of the air quality parameters monitored in the study are presented in **Table 4.7** and these results are discussed in this section.

Table 4.5: Nigerian Ambient Air and Quality Standard

Pollutants	Time Average	Limit
Suspended Particulates	Daily average of daily values 1 hour	50 µg/mg ³
Sulphur Oxides (Sulphur dioxide)	Daily average of hourly values 1 hour	0.01 ppm (26 µg/mg ³) 0.1 ppm (260 µg/mg ³)
Non -Methane Hydrocarbon	Daily Average of 3 Hourly Values	160ppm
Carbon Monoxide	Daily average of hourly values 8 - hourly average	0 ppm (11.4 µg/mg ³) 20 ppm (22.8 µg/mg ³)
Nitrogen oxides (Nitrogen Dioxide)	Daily average of hourly values (range)	0.04 ppm – 0.06 ppm (75 µg/mg ³ – 113 µg/mg ³)
Photochemical oxidant	Hourly values.	0.06 ppm

Source: FEPA (1991); EGASPIN (2018)

Table 4.6: Noise Exposure Limits for Nigeria

Duration Per, Hour	Permissible Exposure Limit dB(A)
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25 or less	115

Source: FEPA (1991);

Table 4.7: Air Quality Dry Season Results

PARAMETERS		A1 N5°33'34.10 E5°43'45.29	A2 N5°33'34.23 E5°43'43.68	A3 N5°33'34.82 E5°43'44.45	A4 N5°33'35.24 E5°43'43.63	A5 Control N5°33'35.09 E5°43'47.88
Temperature °C		41.0	50.0	45.0	41.0	40.0
Relative Humidity (%)		43.0	27.0	24.0	30.0	33.0
Wind Direction		NW	SW	SW	NW	SW
Wind speed(m/s)		2.4	0.7	0.8	1.2	0.8
Noise levels (dBA)	Min	36.8	32.4	35.0	33.2	34.6
	Max	42.4	38.6	39.7	37.0	38.0
Carbon monoxide(ppm)		0.0	0.0	0.0	0.0	0.0

Sulphur dioxide (ppm)	0.0	0.0	0.0	0.0	0.0
Nitrogen dioxide (ppm)	0.0	0.0	0.0	0.0	0.0
Carbon dioxide (ppm)	0.0	0.0	0.0	0.0	0.0
Hydrogen sulphide (ppm)	0.0	0.0	0.0	0.0	0.0
VOC/LEL (ppm)	0.0	0.0	0.0	0.0	0.0
SPM	2.5 ($\mu\text{g}/\text{dm}^3$)	008	008	006	020
	5.0 ($\mu\text{g}/\text{dm}^3$)	006	006	004	015
	10.0 ($\mu\text{g}/\text{dm}^3$)	009	010	006	023

Suspended Particulate Matter (SPM)

Suspended particulate matter (SPM) is an important environmental indicator for geomorphological change, pollution and climate change. This consists of fine solids and liquid droplets of 0.01 microns to over 100 microns in diameter, suspended in ambient air, other than clean water that are dispersed in air. They originate from both natural and anthropogenic factors. Anthropogenic sources include but not limited to fumes from combustion processes, for instance; tobacco smoke, power plants, moving vehicles/car exhaust, wood stoves, oil burners as well as other heating systems.

High concentrations of suspended particulate matter (SPM) are known to irritate the mucous membranes and may initiate a variety of respiratory diseases (bronchitis, emphysema and cardiovascular diseases). Also, fine particulates may cause cancer and aggravate morbidity and mortality from respiratory dysfunctions (CCDI, 2001).

The SPM values occurred in trace amounts within the proposed project site, while the control point SPM shows higher values. The project site can currently be classified as a low-dust environment.

Carbon Monoxide

Carbon monoxide is produced by the incomplete combustion of fossil fuels, incinerators, terminals, motor vehicles etc. It can impair the oxygen carrying capacity of the blood when inhaled in excessive quantities. Carbon monoxide (CO) is a colourless, odourless and tasteless gas produced by the incomplete combustion of carbonaceous materials or fossil fuels – gas, oil, coal and wood. It is the most common air pollutant, whose adverse health effect has been observed as induces fatigue, impaired alertness, inhibited foetal development and aggravated cardiovascular diseases.

Carbon Monoxide was not detected in all the stations and control.

Nitrogen Dioxide

NO_x is a generic term for mono-nitrogen oxides NO and NO₂ (nitric oxide and nitrogen dioxide). They are produced from the reaction of nitrogen and oxygen gases in the air during combustion, especially at high temperatures. NO_x gases are formed everywhere where there is combustion – like in gas flares. NO_x react to form smog and acid rain. NO_x are also central to the formation of tropospheric ozone. In atmospheric chemistry, the term means the total concentration of NO and NO₂. NO₂ is the component of greatest interest and the indicator for the larger group of nitrogen oxides. NO₂ forms quickly from emissions from cars, trucks and buses, power plants, and off-road equipment. In addition to contributing to the formation of ground-level ozone, and fine particle pollution, NO₂ is linked with a number of adverse effects on the respiratory system.

The NO_x concentrations in the study area and control were.

Sulphur Dioxide

SO_x refer to all sulphur oxides (Lower sulfur oxides (S_nO, S₇O₂ and S₆O₂); Sulfur monoxide (SO); Sulfur dioxide (SO₂); Sulfur trioxide (SO₃) and Higher sulfur oxides (SO_{3+x} where 0<x≤1)), the two major ones being sulphur dioxide (SO₂) and sulphur trioxide (SO₃). Sulphur dioxide is a colourless gas with a pungent, irritating odour and taste. It is highly soluble in water forming weakly acidic sulphurous acid. When sulphur dioxide combines with the oxygen (O₂) in the air some sulphur trioxide is slowly formed. Sulphur trioxide rapidly combines with water to produce sulphuric acid. The lifespan of sulphur oxides in the atmosphere is from 4 to 10 days. Man-made sources of sulphur dioxide include sour gas processing, coal combustion, ore refining, chemical manufacturing and other fossil fuel processing and burning. Sulphur dioxide can harm crops and trees, textiles, building materials, animals, and people either as a result of exposure to long-term low concentrations or short-term high concentrations. It turns leaves yellow and decreases the growth rate of crops. Sulphur dioxide corrodes metal and causes building materials and textiles to deteriorate and weaken. Sulphur dioxide irritates the throat and lungs and, if there are fine dust particles in the air, can damage a person's respiratory system. Sulphur oxides combine with other substances in the air to produce a haze that reduces visibility. Sulphur dioxide is a major contributor to acid deposition (Acid Rain). SO_x were not detected in all the sampled points and control.

Hydrogen Sulphide

Hydrogen sulfide (H_2S) is an extremely hazardous, toxic compound. It is a colourless, flammable gas that can be identified in relatively low concentrations, by a characteristic **rotten egg** odor. Naturally occurs in coal pits, sulfur springs, gas wells, and as a product of decaying sulfur-containing organic matter, particularly under low oxygen conditions. Industrial sources of hydrogen sulfide include petroleum and natural gas extraction and refining, pulp and paper manufacturing, chemical manufacturing etc. This gas is classed as a **chemical asphyxiant**, similar to carbon monoxide and cyanide gases. It inhibits cellular respiration and uptake of oxygen, causing biochemical suffocation. Prolonged exposures at lower levels can lead to bronchitis, pneumonia, migraine headaches, pulmonary edema, and loss of motor coordination (Safety Directory, 2004)

Hydrogen Sulphide (H_2S) was not detected in all stations monitored for both the study area and control.

Volatile Organic Compounds

Volatile organic compounds (VOCs) are produced naturally through biological mechanisms such as metabolism. Industrial use of fossil fuels produces VOCs either directly as products (gasoline) or indirectly as by products like automobile exhaust. In addition to their indirect impacts through photochemical ozone formation, some VOCs directly affect human senses through their odour; some others exert a narcotic effect while certain species are toxic with particular concern on cancer induction.

VOC was not detected for both the project area and control.

Noise

The lowest noise floor was caught at Point 2 (32 dB(A)), while Point 1 experienced the loudest transient spike (42dB(A)). All values fall well within standard daytime limits for residential, commercial, or rural zones (usually capped between 45 to 55 dB(A)) by FME_{env}, NMDPRA and International Standards like the IFC/World Bank or WHO). The environment is currently quiet

4.2.3 Geology of the Study Area

4.2.3.1 Regional Geology

The study area Warri, is located in Delta State. It worthy to note that Delta State lies within the Niger Delta Basin (also known as the Niger Delta Province), one of the largest Cenozoic regressive deltas and most prolific hydrocarbon provinces in the world.

The regional geology of Delta State can be succinctly summarized into three major components: its tectonic origin, its subsurface stratigraphy, and its superficial quaternary geology.

1. Tectonic Origin and Framework

The basin formed at the site of a Cretaceous rift triple junction during the separation of the African and South American plates. True delta progradation began in the Late Paleocene to Eocene, moving southward onto thinned continental and oceanic crust. The structural framework of the region is highly dictated by gravity-driven, syn-depositional **listric normal faults (growth faults)** and rollover anticlines, which act as the primary traps for oil and gas.

2. Lithostratigraphy (The Three Main Formations)

The subsurface geology of Delta State consists of a thick clastic wedge (up to 12 km deep) composed of three diachronous, upward-coarsening formations. From oldest to youngest (deepest to shallowest), they are:

- *Akata Formation (Paleocene to Recent)*: The basal layer consisting of thick, open-marine under-compacted shales, silts, and minor turbidite sands. It is over-pressured, acts as the primary hydrocarbon source rock, and exhibits shale diapirism.
- *Agbada Formation (Eocene to Recent)*: The middle layer characterized by alternating paralic sandstones, siltstones, and shales. It serves as the primary hydrocarbon reservoir unit across Delta State, where the sandstones hold commercial quantities of oil and gas and the interbedded shales provide seals.
- *Benin Formation (Oligocene to Recent)*: The topmost subsurface layer, up to 2,000 meters thick, consisting predominantly of high-porosity, continental, and alluvial sands and gravels. It contains negligible hydrocarbons but serves as the region's major freshwater aquifer.

3. Surface and Quaternary Geology

The surface geology across Delta State varies geographically depending on the geomorphic sub-environment:

- *Upland and Inland Areas (North/Northeast)*: Dominated by the Tertiary Ogwashi-Asaba Formation (and Coastal Plain Sands), consisting of continental sands, clays, and notable lignite (brown coal) seams.

- *Lowland Deltaic Plains and Coastal Belts (South/West):* Dominated by Recent Quaternary alluvial deposits. These consist of highly heterogeneous mixtures of soft beach-ridge sands, organic-rich mangrove swamp silts/clays ("chicoco" mud), and freshwater swamp flood-plain deposits, which present challenging, highly compressible geotechnical engineering conditions.

4.2.3.2: Hydrogeology

➤ Hydrogeological Framework and Aquifer Architecture

The project site in Warri is underlain by the Benin Formation (Coastal Plain Sands), which constitutes the regional aquifer system. In the Warri area, this aquifer behaves as a unconfined to semi-confined system.

- *Lithology:* The aquifer matrix consists predominantly of coarse to medium-grained, poorly sorted continental sands and gravels, occasionally intercalated with thin, discontinuous lenses of low-permeability clays and silts.
- *Aquifer Properties:* Due to the coarse nature of the Benin sands, the aquifer exhibits exceptionally high porosity (typically 30–40%) and high hydraulic conductivity ($K \approx 10^{-2}$ to 10^{-4} m/s, rendering it a highly prolific source of groundwater.

➤ Groundwater Depth and Flow Dynamics

- *Water Table Elevation:* Warri features a characteristically shallow static water table, typically fluctuating between 0.5 meters to 3.0 meters below ground level (bgl) depending on micro-topography. During the peak of the wet season, the water table frequently rises to the ground surface, resulting in localized waterlogging and surface ponding.
- *Flow Direction:* The local groundwater flow gradient is generally low, mimicking the regional topography by moving in a south-southwesterly direction toward local hydraulic sinks, specifically the Warri River and its network of distributary creeks.

➤ Baseline Groundwater Quality and Vulnerability

- *Physicochemical Status:* Naturally occurring groundwater in the upper sandy layers of Warri is generally acidic to sub-acidic (pH ranging from 4.5 to 6.2) due to organic matter decomposition in the overlying swamps and low buffering capacity of the silica sands. It is characterized by low Total Dissolved Solids (TDS) but frequently exhibits naturally elevated concentrations of dissolved iron (Fe^{2+}).

- **Vulnerability Rating:** Utilizing the DRASTIC index approach, the Warri shallow aquifer is classified as having Extremely High Vulnerability. The combination of a very shallow water table, high aquifer permeability, and the absence of a continuous, thick, overlying clay confining layer means that surface-derived pollutants face virtually no geological barrier before infiltrating the groundwater table.

Summarily, the Benin Formation serves as the study area's primary prolific freshwater aquifer. Because it consists of highly porous and permeable continental sands and gravels, it has high hydraulic conductivity. This makes the groundwater highly vulnerable to surface contamination (e.g., chemical spills, fuel leaks, or poorly managed waste from construction/operations).

4.2.4 Soil Studies

The project site soil samples and control samples) were collected and analysed to establish baseline soil quality conditions within the project area. The assessment covers physico-chemical characteristics, nutrient levels, heavy-metal concentrations, and microbiological activity. These parameters help determine whether the project site shows evidence of contamination, anthropogenic influence, or ecological disturbance.



Plate 4.2: Soil Sampling at the Project Site

Soil Physical Parameters

Four (4) soil samples and one (1) control were taken from the proposed project site with a soil auger for; the topsoil (0-15cm) and subsoil (15-30cm). The soils in the study area are predominantly silty and brownish with a high cohesion value. The Particle Size Distribution

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(PSD) and United Soil Classification System (USCS) indicated that the soil bearing capacity of the proposed project site is suitable for the intended project structure.

The soil characteristics, physico-chemical properties, heavy metals and microbiology are shown in Tables 4.8 below.

Table 4.8: Physico-chemical Parameters for Soil Samples Dry Season

Sample ID/ Parameter	Units	CPG SS1 (0-15cm)	CPG SS1 (15- 30cm)	CPG SS2 (0-15cm)	CPG SS2 (15- 30cm)	CPG SS3 (0- 15cm)	CPGS S3 (15- 30cm)	CPG SS4 (0- 15cm)	CPG SS4 (15- 30cm)	CPG SSC (0- 15cm)	CPG SSC (15- 30cm)
Physico-Chemical											
Appearance		Brown	Brown	Pale Cream	Pale Cream	Brown	Brown	Brown	Brown	Brown	Brown
Sand	%	30.0	30.0	20.0	20.0	10.0	15.0	20.0	30.0	20.0	30.0
Silt	%	70.0	70.0	80.0	80.0	90.0	85.0	80.0	70.0	80.0	70.0
Clay	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bulk density (	g/cm ³	1.41	1.41	1.52	1.46	1.26	1.33	1.47	1.40	1.45	1.43
Porosity	%	47.19	46.82	43.07	45.32	52.81	50.19	44.94	47.56	45.69	46.44
pH		5.42	5.35	5.51	5.22	5.59	5.63	5.47	5.06	4.91	5.22
Conductivity	µs/cm	164.0	146.0	102.0	84.0	132.0	164.0	90.0	132.0	54.0	140.0
Redox potential	mV	+77.4	+83.3	+81.8	+85.2	+55.6	+42.5	+68.2	+72.3	+40.5	+40.2
Salinity	ppt	0.082	0.073	0.051	0.042	0.066	0.082	0.045	0.066	0.027	0.070
Nitrate	mg/ kg	10.70	26.71	11.12	9.08	15.30	8.95	22.12	26.34	13.38	10.70
Ammonium N	mg/ kg	0.024	0.041	0.011	0.008	0.012	0.022	0.007	0.027	0.013	0.011
Potassium	mg/ kg	13.05	11.66	8.97	9.99	1.95	12.93	11.91	11.89	6.23	6.71
Calcium	mg/ kg	28.86	37.26	40.86	38.46	34.86	51.72	36.06	30.06	12.00	18.06
Magnesium	mg/ kg	13.74	17.76	19.44	18.30	16.62	24.63	17.17	14.31	5.70	8.58
Sodium	mg/ kg	503.0	466.5	358.9	358.1	430.50	466.40	433.10	251.20	252.0	394.8
Chloride	mg/kg	53.40	68.40	47.40	74.40	89.40	65.40	62.40	50.40	80.40	71.40
Carbonate	%	1.368	1.440	1.548	1.080	1.404	2.016	1.764	1.260	0.756	0.540
Total Organic Carbon (TOC)	%	0.37	0.43	0.12	0.21	0.25	0.22	0.15	0.65	0.16	0.25
Sulphate	mg/kg	96.1	88.4	68.0	69.5	83.40	90.90	83.40	85.00	48.7	47.6
Phosphate	mg/kg	42.55	35.38	55.56	38.51	55.44	104.51	106.23	55.55	48.7	47.6
Heavy Metals											
Iron	mg/ kg	325.81	626.74	400.42	255.05	325.72	700.31	450.31	601.88	275.43	375.48
Zinc	mg/ kg	11.25	17.55	5.23	8.79	15.27	10.16	11.26	12.49	11.23	11.39
Manganese	mg/ kg	15.11	18.76	17.50	21.23	11.25	10.10	16.26	16.30	13.75	15.14
Chromium	mg/ kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lead	mg/ kg	0.19	0.31	0.37	0.17	0.22	0.28	0.12	0.17	0.22	0.18
Copper	mg/ kg	0.19	0.31	0.37	0.17	0.22	0.28	0.12	0.17	5.12	3.77
Cadmium	mg/ kg	0.07	0.16	0.22	0.26	0.31	0.07	0.06	0.10	0.07	0.08
Mercury	mg/ kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Barium	mg/ kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Nikel	mg/kg	7.75	10.38	8.75	7.38	8.88	12.25	7.76	11.51	4.13	11.63
Organics											
TPH	mg/ kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
O&G	mg/kg	0.14	0.10	0.08	0.14	0.10	0.12	0.10	0.12	0.10	0.06
PAH	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BTEX	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
THC	mg/kg	10.0	11.1	9.30	5.50	6.20	6.40	3.40	23.70	3.20	6.20
Microbiology											
THB	cfu/g x10 ³	0.31	0.44	0.35	0.21	0.38	0.47	0.29	0.36	0.51	0.30
THF	sfu/g x10 ²	1.25	1.33	1.40	1.15	1.26	1.31	0.94	1.22	1.38	0.87

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THUB	cfu/g x10 ²	0.45	0.28	0.30	0.22	0.20	0.40	0.55	0.82	0.91	0.43
THUF	sfu/g x10 ⁵	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Coliform	cfu/g x10 ²	0.65	0.36	0.29	0.12	ND	0.08	ND	0.10	ND	ND

Source: EIA Fieldwork 2026

Inorganic constituents

Texture: The soil texture was dominated by silt (70–90%), with negligible clay content. Bulk density values (1.26–1.52 g/cm³) and porosity (43–53%) fall within normal ranges for silt rich soils, suggesting good structural integrity and moderate water holding capacity.

pH levels: The soils across all sampling points exhibited brown to pale cream coloration, typical of undisturbed tropical soils. Soil pH ranged from 4.91 to 5.63, indicating moderately acidic conditions consistent with natural lateritic soils in humid regions. No sample showed alkalinity or extreme acidity that would suggest chemical contamination.

Nutrient Concentration: Nutrient indicators such as nitrate, sulphate, phosphate, and total organic carbon varied moderately between locations but remained within expected natural ranges. Total organic carbon was generally low across all samples (0.12–0.65%), which is typical for sandy-silt soils with low organic matter retention.

Electrical conductivity values (54–164 µS/cm) were low, reflecting minimal soluble salt content and confirming the absence of salinization. Redox potentials were positive across all locations, indicating well aerated soils with no reducing (anaerobic) conditions.

Organics in the Soil: Total Hydrocarbon Content (THC) ranged from 3.20 to 11.1 mg/kg, with all values far below regulatory concern thresholds (typically >50 mg/kg). This confirms no petroleum hydrocarbon contamination. TPH, PAH and BTEX were not detected.

Heavy Metals in the Soil

Heavy-metal concentrations were evaluated to determine potential contamination from industrial or anthropogenic sources. The results shows that Iron levels (255–700 mg/kg) were elevated but consistent with natural iron rich lateritic soils common in the region. Lead ranged between 0.12–0.37mg/kg, well below international soil-quality concern thresholds. Copper, zinc, manganese, and nickel showed moderate variation between test and control sites but remained within natural background ranges for tropical soils. Cadmium, chromium, and mercury were not detected, indicating no toxic metal contamination. The results suggested that the study area is free of heavy metal pollution.

Soil Microbiology

Microbial counts (THB, THF, THUB) were low to moderate across all samples, consistent with healthy, biologically active soils. Total coliforms were either absent or present at very low levels, indicating no faecal contamination. The absence of pathogenic indicators and the presence of normal soil microflora confirm that the soils are ecologically stable and not impacted by biological pollutants.

Overall, the soil quality assessment indicates that the project area is characterized by natural, slightly acidic, silt dominated soils with no evidence of chemical, hydrocarbon, or heavy metal contamination. The similarity between project site and control samples demonstrates that no site-specific pollution sources are influencing soil conditions.

All measured parameters fall within regulatory requirement, and the soils within the project area are uncontaminated, chemically stable, and ecologically healthy. The findings provide a reliable baseline for future monitoring and confirm that current site conditions pose no environmental or public health risks

4.2.5 Groundwater Studies

Groundwater samples (GW1 and control samples GW-C1 and GW-C2) were analysed to evaluate baseline water quality conditions within the project area. The analytical results provide insight into the physico-chemical, heavy-metal, and microbiological characteristics of the groundwater system.

Table 4.9 summarizes the physico-chemical properties of the groundwater from the proposed project site and control stations for the dry season field data gathering.

Table 4.9: Groundwater Quality Dry Season

Parameters	Units	DRY SEASON		
		GW1	GW (Control 1)	GW (Control 2)
	Physico-Chemical			
Appearance		Clear	Clear	Clear
Colour (pt.co)		3.0	2.0	3.0
Odour		Unobjectionable	Unobjectionable	Unobjectionable
Temperature	°C	27.9	28.4	28.7
pH @ 25°C		6.32	5.48	5.92
Conductivity	(uS/cm)	100.0	40.0	40.0
Salinity	ppt	0.05	0.02	0.02
TOC	mg/L	<0.01	<0.01	<0.01
Turbidity	NTU	0.2	0.1	0.2
BOD	mg/L	0.414	2.070	1.070
COD	mg/L	25.60	25.60	25.60
DO	mg/L	5.50	5.33	5.44
TDS	mg/L	50.0	21.0	18.0
TSS	mg/L	7.0	7.0	7.0

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Total Hardness	(mg CaCO ₃ /l)	34.0	15.0	10.0
Alkalinity	mg/L	62.0	27.0	43.0
Chloride	mg/L	15.90	9.90	8.92
Nitrate	mg/L	1.37	1.78	0.53
Phosphate	mg/L	3.93	4.36	4.44
Sulphate	mg/L	3.40	2.00	1.40
Sodium	mg/L	17.11	10.72	7.23
Potassium	mg/L	0.44	0.27	0.18
Calcium	mg/L	6.81	3.01	2.00
Magnesium	mg/L	3.29	1.45	0.97
Iron	mg/L	0.202	0.041	0.039
Lead	mg/L	<0.001	<0.001	<0.001
Copper	mg/L	0.244	0.285	0.204
Cadmium	mg/L	<0.001	<0.001	<0.001
Chromium	mg/L	<0.001	<0.001	<0.001
Manganese	mg/L	0.089	0.024	0.015
Mercury	mg/L	<0.001	<0.001	<0.001
Nickel	mg/L	0.076	0.076	0.076
Vanadium	mg/L	ND	ND	ND
Barium	mg/L	ND	ND	ND
Organics				
TPH	mg/L	ND	ND	
Oil & Grease	mg/L	<0.01	<0.01	<0.01
PAH	mg/L	ND	ND	
BTEX	mg/L	ND	ND	
Microbiology				
HUB	cfu/ml (x10 ³)	3.5 X 10 ³	1.2 X 10 ²	2.2 X 10 ²
THB	cfu/ml (x10 ³)	0.10 x 10 ²	0.11 x 10 ²	0.09 x 10 ²
THUB	cfu/ml (x10 ²)	2 X 10 ²	ND	ND
HUF	cfu/ml (x10 ²)	ND	2 X 10 ²	ND
THUF	cfu/ml (x10 ²)	ND	ND	ND
Faecal Coliform	cfu/ml	ND	ND	ND
E.Coil		ND	ND	ND

NB: CFU – Colony Forming Unit; ND: Not Detected

pH

The pH is a measure of the hydrogen ion concentration in water. In the aquatic ecosystem, pH influences the solubility of toxic metals which can have a negative effect on aquatic living organisms and human health.

The pH values ranged from 5.48 to 6.32, reflecting slightly acidic groundwater typical of many tropical aquifers influenced by natural soil–water interactions. The values obtained for both locations are within the regulatory permissible levels.

Conductivity

Conductivity, hardness, and alkalinity values were all low and well within regulatory limits, confirming that the groundwater is soft, lightly mineralized, and free from salinity intrusion.

Biochemical Oxygen Demand

Biochemical Oxygen Demand is a measure of the quantity of oxygen used by microorganisms (e.g., aerobic bacteria) in the oxidation of organic matter.

The groundwater BOD concentrations obtained for the site sample was 0.41mg/l with a control mean value of 1.57mg/l. These values are low, suggesting that the groundwater quality is good and free of microbial pollution. There is no significant difference between the values obtained in both locations. The values are within the regulatory limits.

Total Dissolved Solids

The TDS value for the site sample was 50.0mg/l while the control value ranged between 18.0-21.0mg/l. The values obtained indicated that the groundwater has low contamination of dissolves solid minerals. All the vales obtained are within the regulatory limits.

Exchangeable Anions

The anion composition of the groundwater samples (GW1, GW C1, GW C2) reflects clean, low-salinity, and minimally impacted groundwater. Key anions—including chloride (Cl^-), nitrate (NO_3^-), sulphate (SO_4^{2-}), phosphate (PO_4^{3-}), and bicarbonate (HCO_3^-). The values obtained for nitrates, sulphate chloride, and phosphate were 1.37mg/l, 3.40mg/l, 15.90mg/l and 3.93 mg/l respectively for the project site; while the control mean values were 1.15mg/l, 1.70mg/l, 9.40mg/l and 4.40mg/l respectively.

Chloride levels are low, indicating no influence from saline intrusion, sewage, or industrial effluents. Nitrate concentrations are minimal, showing no evidence of agricultural runoff or faecal contamination. Sulphate and phosphate values are low, consistent with natural background levels and absence of chemical pollution. Bicarbonate levels are modest, supporting the classification of the water as soft and weakly buffered.

The anion profile shows no signatures of anthropogenic contamination. The low concentrations across all measured anions confirm that the groundwater system is chemically stable, unpolluted, and suitable as a baseline environmental condition for the EIA.

Exchangeable Cations

Major cations—including calcium (Ca^{2+}), magnesium (Mg^{2+}), sodium (Na^+), and potassium (K^+)—occur at low concentrations, indicating low mineralization and no evidence of contamination consistent with naturally soft groundwater. These values fall well within

acceptable environmental and drinking-water guideline limits. The cation composition reflects unpolluted baseline groundwater conditions, with no indicators of saline intrusion, industrial discharge, or metal contamination. The results support a favourable hydrochemical status for the project area and provide a reliable baseline for Environmental Impact Assessment documentation.

Organics

Oil & grease, TPH, PAH and BTEX were not detected.

Heavy Metals

Heavy metal concentrations in all samples were generally low. Iron, copper, manganese, and zinc were detected at concentrations far below FMEnv, NMDPRA WHO and NSDWQ thresholds. Toxic metals such as lead, cadmium, chromium, and mercury were not detected, indicating the absence of industrial or anthropogenic contamination.

Microbiological Characteristics

Microbiological analysis showed no detection of Total Coliforms or E. coli in any of the samples. Total heterotrophic bacteria (THB) counts were very low, confirming that the groundwater is microbiologically safe and free from faecal contamination.

4.2.6 Vegetation and Wildlife

4.2.6.1 Vegetation

Vegetation refers to the ground cover provided by plants in project area. Vegetation is one of the most important expressions of the health of an environment as it epitomizes climatic and edaphic conditions. Vegetation further reflects the level of human interference with nature and its state in many situations reflects the level of human well-being. Humans rely on vegetation for sustenance, deriving food, medicines and cultural objects from plants. The vegetation of the influence area assumes importance not only as indicator of the status of the environment but especially as the human inhabitants of the localities, based on their level of economic development, depend on plants for various aspects of their daily lives.

❖ Methodology

The project area supports a rich biodiversity (i.e. flora and fauna), although the selective exploitation of forests for economic or social reasons is common. In most cases, major losses have been recorded in vegetation diversity, and germplasm (quality). Furthermore, the representative vegetation plots were studied to:

- a) Provide data on the floristic composition and structure of the vegetation.
- b) Determine the population density of the key economic plant species.
- c) Evaluate the health of the vegetation.
- d) Provide information on the composition and coverage of aquatic macrophytes.
- e) Determine the existence of any unique, invasive or endangered species for nature conservation.

Flora

Information on species composition and structure were obtained using 50-meter long transects. Study plots (100m² quadrants) were established at each site for the determination of population density of the key economic plants. The number of strata in the vegetation was noted and the dominant species recorded. Where counting of individuals was not possible as in situations where there are creeping plants, cover was measured using the Braun-Blanquet scale (Sutherland, 2006). Plant identification was carried out using the Flora of West Tropical Africa and Trees of Nigeria (Keay, 1989). The floristic compositions for the wet and dry season were essentially the same. Table 4.10 gives the floral composition typical of the project area.

Table 4.10: Observed Flora Species in the Project Area

S/N	Common Name	Botanical Name	Kingdom	Family	Growth Habitat	IUCN category
1	Oil Palm/ African Oil Palm	<i>Elaeis guineensis</i>	Plantae	<i>Arecaceae</i>	Tree	LC
2	Harebell	<i>Dianella ensifolia</i>	Plantae	Asphodelaceae	Flowering Plant	LC
3	Mango	<i>Mangifera Indica</i>	plantae	Anacardiaceae	Tree	LC
4	Cassava	<i>Manihot esculenta</i>	Plantae	Euphorbiaceae	Plant	LC
5	Caterpillar	<i>Holocerina angulata</i>	Insecta	Saturniidae	Insect	LC
6	Banana	Musa	plantae	Musaceae	Flowering Plant	LC
7	Fishbone Fern	<i>Nephrolepis cordifolia</i>	Plantae	Nephrolepidaceae	Plant	LC
8	Wild Tomato	<i>Phylus Angulat</i>	Plantae	Angular winter cherry Physalis angulate	plant	LC
9	Dotted Hawthorn	<i>Crataegus punctata</i>	Plantae	Rose	Tree	LC
10	Bamboo	<i>Thyrsostachys</i>	Plantae	Poaceae	Tree	LC
11	Governor Plum	<i>Sterculia dawei Sprague</i>	Plantae	Sterculiaceae	Tree	LC
12	karatas	<i>Bromelia plumier</i>	Plantae	Bromoliaceae	Plant	LC
13	Plantain	<i>Musa × paradisiaca</i>	Plantae	Plantaginacea	Plant	LC
14	Wild Pineapple	<i>Bromelia pinguin</i>	Plantae	Broeliaceae	Plant	LC

15	cocoyam	<i>Colocasia esculenta</i>	Plantae	Araceae	Plant	LC
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4.2.6.2: Fauna

➤ Terrestrial Invertebrates

Terrestrial and soil invertebrate fauna of the project site and control were observed. The dense undergrowth and fertile soils harboured millipedes, centipedes, spiders, mites and ticks, woodlice, butterflies and moths, short horn and long horn grasshoppers, bees, aphids, longicorn and ground beetles, leaf and ladybird beetles, leaf hoppers, dragon and damselflies, ants, midge, housefly, blowfly, black fly, deer fly, mayfly, stick insect, crickets, mantids, various bugs, wasps, hornets and termites.

➤ Wildlife

The wildlife composition includes Mammalian, Aves, Reptilia, Amphibians and Insects. The summary of the wildlife composition of the study area are presented below:

❖ Mammalia

The mammalian fauna within the study area was dominated by African civet (*Civettictis civetta*), Potto (*Perodicticus potto*), Striped ground squirrel (*Euxerus erythropus*), Multimammate rat (*Rattus natalensi Crictomyinae*), Marsh mongoose (*Atilax paludinosus*) and Tree hyraxes (*Dendrohyrax dorsalis*).

❖ Aves

Dominant avian species identified in the study area include African Black Kite (*Milvus migrans*), Pied Hornbill (*Tockus fasciatus*), Little Green bulbul (*Andropadus virens*), Tambourine Dove (*Turtur tympanistria*), Grey - headed sparrow (*Passer griseus*), Pin-tailed whydah (*Vidua macroura*), Grey - Crowded negrofinch (*Nigrita canicapilla*), Orange - cheeked waxbill (*Estrilda melpoda*), and Woodland kingfisher (*Halcyon senegalensis*).

❖ Reptilia

Members of the family *Viperidae*, *Scincidae*, *Elapidae*, *Trichedidae* and *Colubridae* were the most dominant reptiles observed during the sampling survey. Also, evidence of hissing sounds and burrows of snakes were observed around the study area.

❖ Insects

The area was found to hold a wide variety of insect fauna. The *epidopterans* (butterflies and moth) occurred in large numbers while the *Orthopterans* (Grasshoppers), *Coleoptera*

(beetles), and *Hemiptera* (bugs) dominated the insect fauna along the rainforest and settlements. Ants appeared to be uniformly distributed throughout the area.

4.3 Socioeconomic and Health Assessment

The socio-economic and health studies were conducted for the immediate surrounding local communities of the project area.

➤ Methodology and Work Scope

The study was conducting using both secondary and primary data sources. Questionnaire were administered in data collection and Focus Group meeting was held. The meetings produce a consensus of opinion from different groups in the community.

➤ Questionnaire Administration

The questionnaire was administered randomly to respondents in the community. Both direct observation and household survey methods were applied in the study approach. Secondary data were used to determine the sample size in each community. The questionnaire focused on the age, gender, education status, marital status, ethnicity, religion. Occupation and average income per month.

4.3.1 The Socio-economic Environment

History, Background and Organization

Warri's history is deeply tied to the Itsekiri Kingdom, although there are two other major communities Ijaw, and Urhobo, each with distinct histories and territorial claims. The Itsekiri monarchy (Olu of Warri) remains a central cultural institution. Warri traces its origins to the Kingdom of Warri (Iwere Kingdom), founded around 1480 by Prince Ginuwa, the eldest son of Oba Olua of Benin. Ginuwa migrated with Benin chiefs and established a new monarchy at Ode-Itsekiri, which remains the ancestral capital. Warri became a British Protectorate in 1884, later incorporated into the Southern Nigeria Protectorate (1900) and then colonial Nigeria (1914). It served as the capital of the colonial Warri Province in the early 1900s. The name "Warri" is derived from the Itsekiri word Iwere, mispronounced by early European visitors as Awerri, Owere, Warre, eventually standardized as Warri by the British.

Administration

Warri's governance structure blends traditional monarchy, modern local government, and regional political systems. The Olu of Warri is the traditional monarch of the Itsekiri people,

currently Ogiame Atuwatse III. The kingdom maintains a council of chiefs, including the Ologbotsere (chief advisor).

Warri is divided into three Local Government Areas (LGAs); Warri South LGA, Warri South-West LGA, and Warri North LGA. The LGA oversees local administration, public services, markets, environmental sanitation, and community relations. This runs parallel to highly influential traditional administrative structures (e.g., the Palace of the Olu of Warri, and Urhobo/Ijaw traditional councils).

Occupation

The livelihoods and economy of the people is dominated by oil and gas extraction, refining (Warri Refining and Petrochemical Company), marine logistics, and public service. However, in the immediate catchment areas and riverine fringes, traditional livelihoods include artisanal fishing, aquaculture, and cassava/palm oil farming. Also, a massive percentage of the local population relies on informal trading, small-scale artisan crafts, transport services (Keke/Okada operations), and urban agriculture.

Religious Affiliations

The religious landscape of Warri can be broken down into three primary categories: Christianity, African Traditional Religion and Islam. The vast majority of the population in Warri are Christians, accounting for approximately 90–95% of the population. Pentecostalism / evangelicalism is the most visible and influential religious force in urban Warri (such as Word of Life Bible Church, founded by Ayo Oritsejafor). Pentecostal churches have significant socioeconomic influence and serve as key communication channels for community outreach. There is also a strong, historical representation from the Anglican Church (Church of Nigeria) and the Baptist Convention, particularly among older generations and established families. Catholicism under the Roman Catholic Diocese of Warri, which has numerous schools and hospitals across the metropolitan area operates in the area.

Small proportions of residents practice African Traditional Religions (about 3–10%). Traditional worship is tied to ancestral veneration and deities associated with natural geography, such as the water spirits ("Mami Wata" or "Oru" in Ijaw culture) and land deities. While Islam represents a very minor share (around 2% or less), practiced predominantly by the transient economic migrant population and traders from Northern Nigeria (Hausa-Fulani communities). They are largely concentrated in specific commercial quarters and markets within the urban center.

This religious distribution reflects the ethnic makeup of the area, especially the Itsekiri majority, who are historically and culturally Christian.

Education

Compared to national averages in Nigeria, the Warri metropolitan area exhibits a relatively high adult literacy rate, hovering between 80% and 85%. This is driven by the presence of tertiary institutions like Federal University of Petroleum Resources, Effurun (FUPRE), Petroleum Training Institute (PTI), Effurun and College of Education, Warri. Also the area features a dense mix of public schools (managed by the Delta State Post Primary Education Board) and a highly saturated network of private primary and secondary institutions.

Age-Sex Distribution and Age Dependency Ratio

The demographic structure of Warri mirrors a classic expansive population pyramid typical of a rapidly growing urban center in Sub-Saharan Africa. It is characterized by a very broad base (high youth population) and a narrow apex (low life expectancy among the elderly).

Warri exhibits a youthful demographic profile, with children (0–14 years) forming 38% of the population and older persons (65+) accounting for 2.4%. The working-age population (15–64 years) represents 58.5%. However, because Warri is a dominant industrial, oil-refining, and port hub, its mid-section is heavily influenced by in-migration. This brings a disproportionately high number of working-age males from other regions of Nigeria into the urban core.

The overall sex ratio stands at approximately 102 to 105 males per 100 females. This male-skewed ratio is driven by transient laborers, engineers, and artisanal contractors migrating for the petroleum and maritime sectors. In the rural fringes and remote riverine host communities (e.g., portions of Warri South-West), the local ratio shifts slightly toward females (~48% male to 52% female) as young adult males migrate toward urban centers in search of wage labour.

Table 4.11 Structural Cohort Distribution

Demographic Cohort	Age Bracket	% Distribution (Est.)	Socio-Economic & Project Implications
Infants & Children	0 – 4 years	14.5%	High vulnerability to water-borne diseases (cholera, typhoid) and malaria. Dictates rigorous corporate social responsibility (CSR) maternal health planning.

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School-Age Youth	5 – 14 years	25.5%	Strict requirement for community pedestrian safety and traffic management plans around project corridors to shield local schools.
Young Working Age	15 – 24 years	21.0%	Core demographic for volatile youth agitations, pipeline vandalism, and "kpo-fire" (illegal artisanal refining). Primary target for unskilled construction labor and vocational CSR training.
Prime Working Age	25 – 64 years	35.8%	Readily available pool for semi-skilled and skilled workforce integration. Saturated with local secondary and tertiary technical graduates.
Elderly / Aged	65+ years	3.2%	Smallest demographic cohort. High cultural leverage as community elders, custodians of shrines, and key stakeholders in traditional governance structures.

The Age Dependency Ratio measures the pressure exerted by the non-working-age population (dependents aged <15 and >64) on the productive, working-age population (ages 15–64).

The age-dependency ratio is calculated as:

$$\text{Dependency Ratio} = \frac{(0-14) + (65 +)}{15-64} \times 100$$

The age-dependency ratio is approximately 69%, reflecting a high proportion of dependents relative to the labour force.

Household Composition and Size

Households in Warri typically consist of 5–6 persons, with extended family structures being common. Nuclear households account for about half of all households, while extended households make up 40–45%. Female-headed households represent 10–15% of the total. Warri South, being more riverine, exhibits slightly larger household sizes and a higher prevalence of extended-family living arrangements. The demographic structure results in a high dependency burden, especially among child populations.

Marital Status of Population

The population of Warri town and Warri South is predominantly married, accounting for approximately half of all adults. A significant proportion (about 40%) is single, reflecting the youthful demographic structure. Widowed and divorced/separated individuals together make up less than 10% of the population. These patterns are typical of Niger Delta urban

and semi-urban communities and influence household composition, dependency levels, and social support systems.

Housing Characteristics

Warri metropolis contains a mix of urban, peri-urban, and riverine housing forms. The dominant housing types include: cement block houses (bungalows & storey buildings), flats/apartments, traditional mud/cement-plastered houses, stilt houses (on wooden or concrete piles) and mixed-material structures.

Roofing is mainly corrugated zinc sheets, and flooring is largely cement screed. Access to water, sanitation, and electricity varies significantly, with urban Warri better served than riverine communities. Tenure is a mix of owner-occupied and rented housing, with owner-occupation more common in =jjjjjjjjjjjjjjjjjjnk . Settlement patterns reflect both high-density urban clusters and linear riverine settlements.

Land Use and Environmental Problems

Land use in the project area is dominated by residential, commercial, and industrial activities. Decades of oil-driven economic growth have triggered rapid, uncoordinated urbanization. Land cover data shows a severe decline in natural vegetation and high demand for space has driven structural development into wetlands, floodplains, and river channels, reducing the natural drainage capacity of the Warri River catchment.. Due to weak zoning enforcement, sensitive industrial operations (such as refineries, depots, and fabrication yards) operate directly adjacent to high-density residential areas, increasing community exposure risks.

Key environmental problems include flooding, erosion, oil pollution, waste management challenges, air and water pollution, mangrove loss, and land degradation. These issues are driven by rapid urbanization, oil and gas operations, inadequate infrastructure, and pressure on natural ecosystems.

4.3.2 Health Assessment

The health profile of Warri is characterized by a high burden of communicable diseases, especially malaria, respiratory infections, and water-borne illnesses. Non-communicable diseases such as hypertension and diabetes are increasing. Health infrastructure is better developed in urban Warri, while riverine communities in Warri North face significant access challenges. Environmental factors—including oil pollution, poor sanitation, flooding, and air

pollution—contribute substantially to health risks. Maternal and child health indicators remain moderate to low, particularly in hard-to-reach areas.

Morbidity and Mortality Profile

- *Respiratory Tract Infections:* Due to high ambient air pollution from gas flaring, refinery emissions, and heavy traffic, Acute Respiratory Infections (ARIs), chronic bronchitis, and asthma are highly prevalent across all age demographics in Warri.
- *Waterborne and Vector-Borne Diseases:* Poor municipal drainage and frequent urban flooding create massive stagnant water pools. This drives high endemic rates of Malaria, while groundwater contamination fuels frequent outbreaks of Typhoid fever, Cholera, and Diarrheal diseases.
- *Dermatological Conditions:* Contact with chemically contaminated surface waters and heavy-metal-laden urban runoff results in high incidences of contact dermatitis, skin rashes, and water-induced lesions among vulnerable groups.

Environmental Health Determinants

- *Hydrocarbon and Heavy Metal Exposure:* Industrial pollution and incidences of oil spills/leakages frequently show elevated levels of heavy metals (such as Lead, Cadmium, and Chromium) and Polycyclic Aromatic Hydrocarbons (PAHs) in local food sources (e.g., seafood from the Warri River) and shallow drinking wells, increasing long-term carcinogenic risks.
- *Noise and Vibration Stress:* Proximity to heavy industrial plants, marine vessels, and heavy-duty logistics trucks as well as continual development projects, subjects residential communities to continuous high-decibel noise, leading to sleep deprivation, hypertension, and elevated psychological stress.

Healthcare Infrastructure and Capacity

- *Healthcare Facility Distribution:* Warri possesses a relatively robust mix of public and private healthcare facilities, including the Central Hospital Warri and numerous private clinics funded by the oil and gas sector
- *System Strain:* Despite the availability of facilities, the public health system operates under severe strain due to rapid population influxes, a shortage of specialized healthcare professionals, and frequent power supply disruptions.

Vulnerable Sub-Populations

- *Children and the Elderly:* Children under five show higher susceptibility to diarrheal diseases and ARIs, while the elderly exhibit exacerbated cardiovascular and chronic respiratory symptoms due to poor air quality.
- *Low-Income Settlements:* Inhabitants of dense, informal settlements along the riverbanks and swampy fringes face the highest health risks due to the absolute lack of sanitary waste disposal and rely heavily on polluted surface waters.

4.3.3 Community Perceptions and Concerns

In Warri, host communities are highly sensitive to industrial projects due to decades of oil and gas exploration.

The common perception among residents around the project area is that the proposed project provide, them benefits; particularly employment opportunities, energy and other amenities.

The primary concern and fears include; explosion and fire outbreaks: because CNG is stored at extremely high pressures (up to 200–250 bar), traffic congestion and gridlock as the CNG Mother/Daughter station setup will attract heavy-duty virtual pipeline trucks and long commercial queues, and likely to paralyzing local transit.

The general perception toward CNG technology among the educated stakeholders and formal business owners CNG as a highly welcome cushion against high PMS prices and a breath of fresh air for reducing the city's heavy particulate air emissions.

CHAPTER FIVE

5.0 ASSOCIATED AND POTENTIAL IMPACTS

5.1 Overview

The Impact Assessment aims at assessing the effects the project will have on the biophysical, social and health components of the project environment. Precise prediction and assessment of impacts is imperative as it ensures that adequate mitigation measures are proffered for the anticipated negative impacts in addition to putting measures in place for enhancing the positive (beneficial) effects.

As a result, the envisaged impact has been identified through interactions between the project activities and environmental sensitivities, and evaluated on the strengths of the likelihood of occurrence as well as the rating of their magnitude and significance. The impact prediction methodology used in this study is described and explained in subsequent sections.

Overall, the project will have in-depth positive impact by providing solutions to waste management challenges of the oil and gas sector and boost the socio-economic needs of the host community.

5.2 Methodology for Impact Prediction

Potential impact evaluation was carried out using a modified method of Leopold Interaction Matrix (Leopold *et al*; 1971). In this system, project activities are in columns while environmental components are in rows (Table 5.1).

➤ Impact Indicators

To further guide the identification and screening of impacts using potential impact screening matrix, established environmental impact indicators or indices are developed for each of the environmental interaction categories. Impact indicators are the observable or measurable parameters of each environmental component that can be directly or indirectly linked to changes in environmental conditions.

Table 5.1. Environmental Components and their Impact Indicators

Environmental Components/Receptors	Potential Impact Indicators
	Biophysical
Soil	Changes to physical and chemical properties and soil ecology
	Changes to geology, geomorphology, topography

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Flora	Changes to vegetation population, health, species abundance and diversity and impact on endangered and economic species
Wildlife	Changes to wildlife assemblages, threat to endangered/endemic/medicinal/economic species, food chain effects
Groundwater	Contamination of shallow or deep groundwater resources, depletion of ground water resources.
Air	NO _x , NO _x , SPM, CO, VOC, Greenhouse Gases (GHG), Ozone
	Measured increases in noise or vibration levels
	Socio-Economics
Communities/Host Population	Changes in population indices – Total population, gender ratio, age distribution
	Infrastructure: Improvement or pressure on existing urban/rural infrastructure including water supply and waste handling facilities
	Aesthetics: Physical deterioration, landscape, etc
	Social and Cultural structure: Impact on local authority and governance structure, increase in negative social vices (prostitution, crime), intra and interethnic clashes
	Cultural and archaeological resources: Impact on shrines, burial grounds; loss of archaeological resources
	Transportation: Effects of increase or decrease in different types of transportation
	Macro and micro economy: Improvement or negative impact on macro and micro economy, employment, standard of living, occupation changes.
	Health Determinants
	Pollution related health problems/diseases: Increase in concentration of air pollutants of concern (NO _x , SO _x , VOC, CO, PM, Greenhouse gases) beyond regulatory limits. Contamination of surface waters and potable ground water, increased vibration and noise beyond regulatory limits, increased night time light beyond acceptable limits.
	Communicable and non-communicable diseases inventory: Increase in communicable and non-communicable diseases or disease-causing factors.
	Nutritional status: Changes to nutritional status, malnutrition starvation and high fat diets
	Health/Recreational facilities: Changes in availability of and access to health care and recreational facilities
	Psychosocial factors: Drug use/abuse, communal violence, crime, suicide, depression and prostitution
	Fertility: Changes to fertility levels, changes in birth rates
	Morbidity and Mortality: Improvement or impairment of health of workers and of general public, increased security risk.
	Accidents/fires/Explosions: Changes to rate of occurrence and severity of accidents/fire/explosions.

5.3 Preliminary Impact Identification and Screening

5.3.1 Sources of Material Used in Screening and Identification of Impacts

The rationale for assessing the likely impacts of the proposed project is based on the following considerations.

- i. Knowledge of the project activities, equipment types, construction methods and operational procedures.
- ii. Results of literature search on the baseline condition of the project area
- iii. Findings of other EIA studies conducted around the project area
- iv. Reference to FMEEnv/NMDPRA/UNEP/WHO/WB guidelines and standards
- v. Experts group discussions and presentations
- vi. Previous experience on other projects

Impact identification is based on the definition of an impact as “having both spatial and temporal components and can be described as the change in an environmental parameter over a specified period within a defined area, resulting from a particular activity compared with the situation which would have occurred had the activity not been initiated”.

5.4 Impact Qualification and Categorization

5.4.1 Criteria and Weighting Scale Used in Evaluating Significance of Impacts

The identified impacts were qualified and quantified. The Impact qualification classified the impacts as direct (D) or indirect (ID), adverse (-) or beneficial (+), local (Lo) or widespread (W), short term (S) or long term (L), reversible (R) or irreversible (I).

- Adverse impacts are those, which impact negatively on the environment.
- Beneficial impacts are those, which enhance the quality of the biophysical, health and social environments.
- Local impacts are limited to the immediate surroundings while the widespread impacts go far beyond the immediate area the impact is occurring.
- Short term means a period of time less than three months while any period greater than three months is considered long term.
- Reversible/irreversible is meant whether the impact can either be reverted to previous conditions or remains permanent once the activity causing the impact is terminated.

The criteria and weighting scale used in evaluating significant impacts are as follows adopted from The International Organization for Standardization ISO 14001. The risk factor and frequency of occurrence of impact are based on the Risk Assessment Matrix, RAM

- i. Legal/regulatory (L)

- ii. Risk factor (R)
- iii. Frequency of occurrence of impact (F)
- iv. Importance of impact on an affected environmental component (I) and
- v. Public perception/interest (P).

These criteria and ratings are as follows:

- a. Legal/Regulatory Requirements (L) – Is there a legal/regulatory requirement or a permit required?
 - 0 = There is no legal/regulatory requirement
 - 3 = There is legal/regulatory requirement
 - 5 = There is a legal/regulatory requirement and permit required
- b. Risk Factor (R) – What is the risk/hazard rating based on the Risk Assessment Matrix?
 - 1 = Low risk
 - 3 = Intermediate risk
 - 5 = High risk
- c. Frequency of Impact (F) – What is the frequency rating of impact based on the Risk Assessment Matrix?
 - 1 = Low frequency (rare)
 - 3 = Intermediate frequency (likely)
 - 5 = High frequency (very likely)
- d. Importance of affected environmental components and impacts (I) – What is the rating of importance based on consensus of opinions?
 - 1 = Low importance
 - 3 = Medium/ intermediate importance
 - 5 = High importance
- e. Public interest/perception (P) – What is the rating of public perception and interest in proposed project and impacts based on consultation with stakeholders?
 - 1 = Low interest/perception
 - 3 = Intermediate interest/perception
 - 5 = High interest/perception

This approach was adopted considering its interactive and descriptive analysis of the relationship between the proposed project activities and the ecosystem components. It combines the following factors in assessing the overall impact rating of the project on the environment:

- The sensitivity/vulnerability of the ecosystem components;
- The productivity evaluation/rating of the ecosystem components;
- Knowledge of the possible interactions between the proposed project and the environment;
- Envisaged sustainability of the project environment;
- The economic value of the proposed project; and
- Projected duration of the impact of each project activity on various environmental components.

The nature and level of health, safety and environmental risks associated with each impact were determined using the Risk Assessment Matrix (Table 5.3) in conjunction with the evaluation of impact significance presented above. The importance of affected environmental component was determined through consultation and consensus of opinions. The manner in which the host communities and the general public would perceive each potential impact and its effects were again determined through consultation with the host communities and consensus of opinions of environmental professionals and stakeholders.

For this study, the Frequency (F), the Importance (I) and Public (P) perception were judged to be superior indicators of the impacts hence the significant impacts were based on the sum of F+I+P. The maximum possible point from this sum is 15. Impacts whose sum of F+I+P was less than or equal to 5 were rated as low. These impacts were judged not to require mitigation. Those whose sum of F+I+P was between >5 and <10 was rated as having medium significance while those whose sum of F+I+P was >10 were rated as having high significance (Table 5.2). For this study, medium and high significant impacts were judged to require mitigation, while low impacts would be mitigated through standard practice i.e. Risk Assessment Matrix. The positive impacts of the proposed project on all valued environmental components shall be rated as beneficial; hence amelioration measures shall not be applicable.

Table 5.2: Environmental Impact Significance Rankings

Ranking (F+I+P)	Significance
≤5	Low
6 -≤10	Medium
>10	High

Table 5.3: Risk Assessment Matrix for Environmental Consequences

CONSEQUENCES					INCREASING LIKELIHOOD				
					A	B	C	D	E
Severity	People	Assets	Environment	Reputation	Never heard of in the industry	Heard of in the industry	Has happened in the Organisation or more than once per year in the industry	Has happened at the location or more than once per year in the Organisation	Has happened more than once per year at the Location
0	No injury or health effect	No damage	No effect	No impact					
1	Slight injury or health effect	Slight damage	Slight effect	Slight impact		Low			
2	Minor Injury or health effect	Minor damage	Minor effect	Minor Impact		Risk			
3	Major Injury or health effect	Moderate damage	Moderate effect	Moderate impact			Medium		
4	PTD or up to 3 fatalities	Major damage	Major effect	Major Impact			Risk	High	
5	More than 3 fatalities	Massive damage	Massive effect	Massive impact				Risk	

Table 5.4: Evaluation of Associated and Potential Impacts of the Proposed CNG Mother/Daughter Station

	Activities	Receptors	Potential Impact: Negative/Positive	Impact quantification	Significance			Overall Significance
					F	I	P	
Pre-Construction	Site selection and land acquisition	Community and youth concern	Land-use change and possible displacement (-); Agitation	D; (-); Local; S/L; R	1	5	3	9
	Environmental and engineering surveys	Soil, vegetation, community	Minor disturbance from survey activities (-)	D, -, Lo, S, R	1	1	1	3
	Stakeholder engagement and permitting	Local communities	Improved stakeholder participation and project acceptance (+)	ID, +, Lo, L, R	2	2	2	6
	Material and equipment supply	Air quality	Vehicular emission from vehicles uses in conveying construction equipment (pollutant and greenhouse gases with possible health hazards)	D; (-); Local; S; R	5	1	1	7
		Noise	Noise generated from vehicles conveying construction equipment	D; (-); Local; S; R	3	3	1	7
	Construction	Mobilization of workforce	Population in the vicinity of activity	Social and cultural interaction issues; Health and security issues; Noise and dust.	D; (-); Local; S; R	3	3	3
Community infrastructure and utilities			Increase demands on services in local communities	D; (-); Local; S; R	3	3	3	9
Community and youth concern			How to be gainfully employed	D; (+); Local; S; R	5	3	5	13

		Transport	Increase in the demand of public transport	D; (-); Local; S; R	3	3	3	9
		Vector related	Vector such as bed bug etc. can be an issue	D; (-); Local; S; R	1	3	3	7
		Sexually transmitted infection HIV/AIDS	Sexual relationship	D; (-); Local/Wide; S/L; R/I	3	5	3	11
		Nuisance exposure	Noise and dust exposure	D; (-); Local; S; R	3	3	1	7
	Base camp construction, ground clearance and grading	Air quality	Reduction in air quality due to an increase in airborne particulate matter	D; (-); Local; S; R	5	1	3	9
		Noise	Noise generated from activities	D; (-); Local; S; R	5	1	3	9
		Soil quality	Disruption of the topography of the soil	D; (-); Local; S; R	5	1	3	9
		Nuisance exposure	Noise and dust exposure	D; (-); Local; S; R	3	3	1	7
	Excavation and construction of site facilities	Air quality	Reduction in air quality due to dust and emissions from equipment	D; (-); Local; S; R	5	1	3	9
		Noise level	Increase in ambient noise level due to operation of equipment and machinery	D; (-); Local; S; R	5	1	3	9
		Ground water quality	Contamination of groundwater aquifers	D; (-); Local; S; R	1	1	5	7
	Construction traffic	Road users	Traffic congestion and accident risk (-)	D, -, Local, S, R	2	2	2	6
	Construction activities	Local economy	Employment and business opportunities (+)	ID, +, Local, S, R	2	5	2	9
	Fuel/lubricant storage	Soil and groundwater	Spill-related contamination (-)	D, -, Local, L, R	2	5	2	9

	Equipment installation and commissioning	Workers	Occupational health and safety risks (-)	D, -, Local, S, R	2	5	2	9
Operation Phase	Natural gas compression	Ambient air	Methane leaks and greenhouse gas emissions (-)	D, -, Local, L, R	2	5	2	9
	Compressor operation	Local community	Continuous operational noise (-)	D, -, Local, L, R	2	2	2	6
	CNG dispensing operations	Vehicle owners	Access to cleaner transportation fuel (+)	D, +, Local, L, R	5	5	5	15
	CNG use replacing conventional fuels	Air quality	Reduced particulate matter and NOx emissions (+)	ID, +, W, L, R	5	5	5	15
	CNG station operations	Economy	Reduced fuel costs and increased energy availability (+)	ID, +, W, L, R	5	5	2	12
	High-pressure gas storage	Workers and public	Fire and explosion hazards (-)	D, -, Local, S, I	1	5	5	11
	Mother station trailer loading	Workers	High-pressure gas handling hazards (-)	D, -, Local, S, I	2	5	5	12
	Transportation of CNG trailers	Communities, road users	Road accidents and gas release incidents (-)	ID, -, W, S, I	2	5	5	12
	Daughter station unloading	Workers	Gas leakage during unloading operations (-)	D, -, Local, S, I	2	5	5	12
	Routine maintenance	Workers	Exposure to operational hazards (-)	D, -, Local, S, R	2	5	2	9

	Operations and maintenance	Workforce	Long-term employment generation (+)	ID, +, Local, L, R	5	2	2	9
	National gas utilization	Energy sector	Enhanced energy security and domestic gas utilization (+)	ID, +, W, L, R	5	5	2	12
	Emergency situations: fire/explosion	Workers, public, infrastructure	Injury, fatality and asset damage (-)	D, -, Local, S, I	1	5	5	11
Accidental Events	Work related injuries	Accidents and injuries	Can be as severe as loss of live	D; (-); Local; S/L; R/I	1	5	5	11
		Health services infrastructure and capacity	Additional stress on the available healthcare infrastructure and manpower	D; (-); Local; S; R	1	3	5	9
	Facility operation and utility	Air quality	Reduction in air quality due to emissions from the machines and equipment exhaust	D; (-); Local; L; R	5	1	3	9
		Soil quality	Waste generation and discharge on land	D; (-); Local; L; R	3	3	3	9
		Population in the vicinity of activity	Social and cultural interaction issues; health and security issues.	D; (-); Local; L; R	3	3	5	11
		Community and youth concern	Business and employment opportunity	D; (+); Local; L; R	3	5	5	13
		Transport	Increase in the use of access route	D; (-); Local; L; R	3	1	3	7
		Sexually transmitted	Sexual relationship	D; (-); Local/Wide; S/L; R/I	3	5	5	13

		infection HIV/AIDS						
		Nuisance exposure	Exposure to noise and emissions	D; (-); Local; L; R	5	5	3	13
Decommission and Abandonment	Facility Decommission	Employees	Loss of employment opportunities (-)	ID, -, Lo, L, R	2	2	2	6
		Air quality	Dust/pollutants generated from equipment removal/building remodeling	D; (-); Local; S; R	5	1	3	9
		Noise level	Noise generated from activities	D; (-); Local; S; R	5	1	3	9
		STDs/Infections; HIV/AIDS	Sexual relationship	D; (-); Local; S; R	3	5	5	13
		Community and youth concern	Agitation	D; (-); Local; S; R	1	5	5	11
		Accidents and injuries	Resultant injuries from work activities Can be as severe as loss of live	D; (-); Local; S/L; R/I	1	5	5	11
		Environment/Aesthetics	Change in aesthetic value of the area	D; (-); Local; S/L; R/I	1	3	3	7
		Community	Increased opportunity for business	D; (+); Local; S/L; R/I	1	3	1	5
	Work-related injuries	Health services infrastructure and capacity	Additional stress on the available healthcare infrastructure and manpower	D; (-); Local; S; R	1	3	5	9

5.5 Description of Qualitative Impacts

5.5.1 Preliminaries

➤ Land Acquisition

CENTURY POWER has acquired portions of land in Warri and have made all the requisite payment as agree on an MoU. The activity has increased awareness of the project.

➤ Survey Line Cutting

Survey line cutting consists primarily of very little of vegetation clearing, as the area is already built-up, for survey activities on a temporary land area. The potential impacts of this activity are direct, negative, short-term, local and rated minor. This activity also has socio-economic benefit as it is income and employment generating and shall impact positively on community relations.

➤ Permitting

Permitting is the process of obtaining permission of relevant government agencies and other stakeholders on issues related to the project. All required permits are being processed, at both the local, state and federal levels; this EIA Studies is one of such permits. Prior to commencement of the project, extensive stakeholder consultations have been carried out with host community, State and Local Government agencies and other interest groups to enlist their support, cooperation and participation in the project. The occurrence of this is rated as high and the impact is positive.

5.5.2 Site Preparation and Pre-Construction Phase

The site preparation activity for the project shall consist primarily of mobilization of personnel, heavy machinery, equipment and materials to the project camp-site. The activities shall include; clearing to remove vegetation at the site with the use of bulldozers and hydraulic excavator and soil spoils disposal and levelling of cleared area; this requires motor scrappers and grader. The potential impacts of these procedures are;

➤ Contracts/Tenders Award

Contracts shall be awarded at this phase of the project site preparation. This shall have a positive/beneficial impact on the socio-economic environment only as it leads to employment and income generation for many people and higher output or productivity. The impact shall be direct, positive, short-term, local and rated major.

➤ **Vegetation Clearing**

The proposed project site at Nest Oil Yard is already built-up, so natural vegetation is very little if any. This impact is direct, negative, short-term, local, reversible and rated minor.

Secondary impacts include increase in ambient noise, prevalence of particulate matter suspension in the atmosphere. These might further put any wildlife in the immediate vicinity of the plot migrate.

➤ **Soil Testing**

Before construction phase begins the soils in the site shall be tested by soil civil engineers to enable determination of type of foundation to be made for the different categories of buildings to be constructed and equipment to be installed. Soil profiles to depths of more than 10m shall be determined. Soil testing involves soil samples collection at regular depths per site and laboratory tests, for certain soil properties. It is income and employment generating, the impact shall be direct, positive, short term, limited to project site and rated moderate.

➤ **Bulldozing, Grading and Compaction of Soil**

Assemblage and use of heavy equipment and machines such as bulldozers, graders and rollers into the cleared site temporarily cause noise. People will be employed and receive income. Bulldozers shall remove weeds and stumps of trees. The soil surface shall be leveled and compacted with the aid of graders and rollers. Evaporation from bare exposed soil shall be high, affecting local climate. These activities shall generate minor increase in air-borne particulates. This impact shall be direct, negative, short term, local and minor in magnitude.

➤ **Excavated Soil Spoils and their Disposal**

Soil spoils shall have to be adequately disposed of so as not to pose solid waste problem on the project area. Heaps of soil spoils shall become substrate for many unwanted organisms and obstruct flow of stormwater runoff. The soil spoils can be used in the facility and road grading. These impacts shall be direct, negative, short term, local and rated low to moderate in magnitude, and shall be limited to project site.

5.5.3. Activities at Construction Phase

a Camp Site Establishment

A camp site for the construction workers shall be within the project site. A moderate quantity of solid waste, refuse and sanitary waste shall be generated during the period of

construction activities. These shall have to be adequately disposed of. There are possibilities of relationship between the male and female workers on-and off-site. Therefore, there are likelihood of HIV/AIDS and other sexually transmitted diseases (STDs) with their adverse impacts. The solid wastes/refuse are likely to blight the landscape and dirty the environment and water-and air-borne diseases may emanate from sanitary wastes and sold unhygienic food.

b. Building/Civil Works

Increase in Vehicular Traffic

The construction phase of the project will lead to the vehicular transport volume increase around the project vicinity. This impact is described as direct, negative, short-term, local, reversible and is rated moderate.

Air Quality

Construction activities shall result in localized high level of dust/particulate matter, noise and vehicular emissions. The dust rising from earthwork and vehicular movement could be significant particularly during dry season and can cause disturbances to the nearby communities. Potential impacts from dust emissions on site shall be significantly reduced by careful management and the implementation of mitigation measures to reduce dust generation.

Other sources of air pollutants include:

- ✓ Internal combustion engines of construction machinery;
- ✓ Welding and drying equipment on construction site;
- ✓ Unloading and storage of inert materials (crushed stoned, sand)
- ✓ Dust from the ground surface disturbed by earthmoving operations during dry season.

Emissions from welding activity and construction machinery/vehicular exhaust, shall consist of numerous gaseous components divided into several groups based on similar impact on environment and human health. These include:

- ✓ Carbon monoxide, the presence of which in large amounts (up to 12%) is characteristic of exhaust gas from internal combustion engines using gasoline;
- ✓ Nitrogen oxides;
- ✓ Hydrocarbons, aromatic compounds including carcinogen;
- ✓ Non-toxic substances such as nitrogen, hydrogen, carbon dioxide and water vapour,
- ✓ Spent gas components.

The emissions are short-termed and localized to the immediate project site area; though the likelihood of occurrence is high, the consequence is rated a negligible negative. Thus, the overall impact risk level is expected to be low.

Noise

The heavy equipment used in site excavation and construction works, diesel powered generators used for on-site power generation, vehicular movement on-site for shuttling of material and men shall have an adverse impact on ambient noise levels.

With respect to the ambient noise levels, since noise is attenuated by distance (typically noise levels drop by about 40dBA at 100m distance from source) the activities on-site are unlikely to adversely affect receptors at a significant distance. However, during the night-time when the ambient noise levels are low, the level of perception to noise by communities may be more acute. Noise from transport vehicles shall be only transient for a given location and can be considered as a nuisance during night-time.

The permissible noise level of 90 dBA for an 8-hour exposure is not envisaged to be exceeded. Hearing impairment could occur from prolonged exposure to high noise level. However, it is envisaged that the site shall be demarcated and an exclusion zone created. Thus, it is unlikely that villagers will be exposed to harmful noise level. The noise impact is rated short-termed and localized to the immediate site area; with a high likelihood of occurrence, the overall impact is low, reversible and rated minor.

Behavioural Modifications from Wildlife

The noise and physical presence of equipment and personnel being conveyed to the site will lead to behavioural modifications from wildlife around the site. The forms of behavioural modifications will vary but may include interrupted breeding and feeding patterns; unusual burrowing patterns; mother-calf separation; movement away from the area; obstruction of normal movement patterns; amongst others. This impact is described as direct, negative, short term, local, reversible and is rated moderate.

Hydrogeology

Groundwater flow in the area is not expected to be disturbed as a consequence of the construction/civil works of the facility, as only the topmost layer of earth materials would be involved during the construction. The only possibility of impact on the groundwater is expected to occur in the remote case of percolation of construction materials and wastes if not properly stored. This possibility is remote considering the management plan that shall

be put in place. Thus, impact is considered negligible negative with negligible likelihood. Thus, overall rating is low risk.

Geology

Only minimal geological impacts are expected in the construction phase of the project, as there shall not be significant topographic or geological changes due to the construction of the facility. Soil erosion, which could be another potential impact to geology of the area, is not envisaged as adequate erosion control measures shall be put in place. Impact consequence from the construction activities is rated a negligible negative, while the likelihood of its occurrence is low, thus, the overall risk is low i.e. of a low priority.

Labour Requirement/Recruitment of Workforce:

During the construction/civil works the project could offer employment for the indigenes at various stages. This could improve income. The impact was described as direct, long term, local/widespread and reversible. It was rated positive

Migrant labour could be attracted to the project area. This increase in population of the area could put pressure on the already deficient infrastructure. This could lead to overcrowding with potential for increase in communicable diseases like malaria, respiratory tract infections and skin diseases. The impact was direct, negative, short term, local and reversible. It was rated moderate.

The increase in financial flow could lead to social vices such as violence, alcoholism, attraction of commercial sex workers (CSW), substances abuse, and teenage pregnancies. This could lead to increase in sexually transmissible diseases (HIV/AIDS, syphilis among others), injuries, and loss of life or properties. This impact is rated as direct, negative, short term, local, reversible and major.

Conflicts/ Third party agitations over employment issues

Labour issues are always a source of friction between companies and communities and among community members, this is the current situation particularly, in oil bearing zones of the country. The agitation could be either due to requests for a certain number of labour that could not be met or sharing the labour slots in the community. However, such conflicts/agitations are most unlikely to occur, due to the existing understanding between the project proponent and the host community. The impact was described as direct, negative, short term, local and reversible. It was rated minor.

Health Issues: Increased level of disease vectors (mosquitoes, flies, etc.)

Improper disposal of wastes generated from construction activities can be a breeding site for disease vectors such as mosquitoes, rats, cockroaches, flies, etc. The impact is direct, negative, short term, local and reversible with a moderate rating.

Consequent on disposal of wastes without proper adherence to sanitary guidelines, discharge of sewage on-land, will attract the preponderance of disease vectors leading to widespread increase in diarrhea diseases. The impact was direct, negative, short term, local and reversible. The rating is moderate.

Burns/ Injuries from Welding Sparks

The sparks generated during welding activities could result in fires or injuries on soft tissues of the body. Adherence to the project management plan will forestall such occurrences. This impact is described as direct, negative, short term, local, reversible and is rated moderate.

Waste Generation/Handling:

Wastes are envisaged to be generated during the construction/civil works. All wastes generated shall be properly handled and disposed of. The impact was direct, negative, short term, local and reversible. The rating is moderate

5.5.5 Operation and Maintenance Phase Activities

The operational activities of the proposed project are envisaged to impact on the ambient air, noise, hydrogeology, geology, and soil quality. These are discussed thus:

Increase in Vehicular Traffic

The operation of project will make for an increase the vehicular transport volume to the project area. Vehicles conveying the staff, customers to and from the project area. This will lead to increase of noise, gaseous and particulate load of the ambient environment. This impact is described as direct, negative, long-term, local, reversible and is rated moderate.

Air Quality:

The facility shall have gaseous emissions from the operational machinery. The envisaged gaseous emissions include heat, particulates, CO, SO_x, NO_x, NH₃, sulphides and mercaptans. Some of which may contribute to global warming, respiratory problems, scorching of vegetation. The impact is high risk, of long-term duration and very significant.

Noise

Noise shall arise from the continuously and intermittently operating sources such as machines, generators, mobile equipment, trucks etc. The estimated maximum sound level shall be 65.5dB (A). Noise emissions shall also occur due to equipment faults, inappropriate operation, and damage to equipment supports and fixtures, etc.

The design considerations and installation of mufflers, are expected to reduce noise level to generally low values, within regulatory limit. The likelihood of occurrence is high, the effect of the noise shall be local, the noise level reduces with distance and the impact is expected to be moderate.

Soil

The potential causes for land contamination are the discharge of liquid effluents (wastewater), disposal of solid and hazardous wastes on land and accidental spillages of hazardous material. The likelihood is low and significance of the impact is high.

The comprehensive environmental procedures prepared for the project shall ensure that any potential impact(s) are adequately mitigated. Thus, impact level is minor negative consequence, with low likelihood of occurrence; overall risk level is low and acceptable.

Geology

The study area lies in a very geologically (tectonic and seismic) stable zone with no recorded cases of earthquakes or tremors. Furthermore, no major or minor faults are known to transverse the area. Therefore, the possibility of any geo-hazards occurring in the area is negligible. Overall impact risk is low.

Hydrogeology

During operational phase, groundwater resources could be negatively impacted through leaked chemicals, oil or accidental spills that could infiltrate resources. The management plan that shall be in place shall make this a very rare occurrence. Hence the overall rating of impact is seen as low with low likelihood of occurrence and medium negative impact.

Wastes Disposal

A number of waste types shall be produced during the operational phase of the project. These include wastewater, lubricant filters, office waste. Improper waste disposal would lead to a loss of aesthetics, risk of contamination of soil, groundwater through seepage and water bodies (through run-offs). The effects of improper waste disposal can be reversed and are of long-term.

However, waste handling could create opportunities for employment and services by waste management vendors associated with project operations resulting in increased income levels. This impact is described as direct, short/ long term, local, reversible and is rated positive.

Sanitary Waste Discharges and stormwater Run-offs

Sanitary wastes shall be properly handled. Consequent on disposal of wastes without proper adherence to sanitary guidelines, could lead to widespread health challenges. The impact is considered direct, negative, short-term, local and reversible. The rating is moderate.

Water Demand and Use

Water intake shall be from borehole dogged within the facility. Water abstraction shall be low, as the wastewater shall be treated and re-used. The water demand shall have minimal impact on water quantity of the project area. The impact is considered direct, long-term, local and reversible. The rating is low.

Product Spill Incidents

Operational accidents can result in product spills due to equipment failure and human errors. The spilled product could contaminate soil, groundwater and any nearby surface water bodies within the project vicinity. The product spills will have a devastating impact on the flora and fauna in the area if not contained. This impact is described as direct, negative, short/long term, Local/widespread, reversible/ irreversible and is rated major.

Fire Outbreaks during Operations

Fire outbreaks can occur during the project operations; and as the product being handled is flammable. A worst-case scenario will involve a fire outbreak accompanying a spillage/leakage leading to loss of assets, properties and life; including that of the third parties. This impact is described as direct, negative, long term, local/ widespread, irreversible and is rated major.

5.5.5 Decommissioning and Abandonment Phase Activities

The potential impacts from the decommissioning and abandonment phase include the following:

Job/Services Opportunity and Income

The decommissioning phase of the project could offer assets and temporal job opportunities for the indigenes and this would improve income for a final time. Contract services will also be given to specialized companies to handle special components of the decommissioning program. The impact is described as direct, short term, local, reversible and is rated positive.

Air Quality Impairment and Noise

During decommissioning, pollutants from heavy machinery and diesel generators will impair the air quality with noxious gases such as VOC's, CO, NOx SOx as well as other pollutants into the ambient air in addition to generation of noise. This impact is described as direct, negative, short term, local, reversible and is rated moderate.

Community Agitation over Environmental Damage and Loss of Benefits

Any form of environmental damage that occurred in the host communities over the lifespan of the proposed plant can lead to conflicts during the decommissioning phase as the community could make demands which may not be met by the operators of the project. In addition, the loss of benefits that the host community regularly enjoyed, can lead to community agitations as they could possibly make some final demands before facility closure. The impact is described as direct, short-term, local, reversible and is rated moderate.

5.5.6 Significant Positive Impacts of the Project

The proposed project will result in a number of positive impacts for the community. Most of the positive impacts will be in the area of macro-economics. The envisaged positive impacts of the project are further discussed below.

Income from site clearing and other site preparation activities

During the early stages of the project there will be need to clear the land. The communities surrounding the project site will benefit financially from contracts and employment opportunities relating to land clearing and site preparation.

Income during construction and operation of the proposed project

Direct employment opportunities shall be created for the local populace because of the personnel requirement for the construction and operation of the project. Indirect employment opportunities will be created from support services and retail sales given that some construction materials and personnel needs would be locally sourced; this would

increase financial flow in the local economy. During the construction phase, local spending will increase, economically benefiting the area.

Increase in income from transportation

During all the project phases, there will be transportation of workers, equipment and supplies to and from the project site. Some contractors involved in this project will hire vehicle owners who may live in the communities around the proposed project area.

Income from involvement in waste handling activities

Solid wastes will be generated at each phase of the project, but will peak during the construction and decommissioning phases. Most of the wastes associated with this project will be handled by, accredited waste handling and disposal companies; and this will generate income for the vendors engaged.

Income from dismantling of structures and site restoration

Direct and indirectly related job opportunities would be created for the local populace during the decommissioning phase of the project which will include the dismantling of structures, site remediation/restoration, and demobilization of equipment and men from site. Logistics, transportation, waste management and site restoration activities will create job opportunities that will impact the macroeconomics of the communities positively.

CHAPTER SIX

6.0 MITIGATION MEASURES

6.1 Introduction

This chapter proffers mitigation measures for the impacts from the proposed CNG Mother/Daughter Stations identified in **Chapter 5**. Some major negative impacts were identified though impacts mainly fell between moderate and minor. Mitigation measures have been provided for the impacts rated as major and moderate, while recommendations have been made for enhancing the positive impacts. Continuous improvement and standard practices would address minor and negligible impacts as shown in the HEMP process that is contained in the Environmental Management Plan (**Chapter 7**) in this report.

The mitigation measures for the proposed project plays the dual role of reducing the levels of the identified negative impacts to As Low as Reasonably Practical (ALARP) as well as enhancing the positive (beneficial) effects of the different phases of the project (pre-construction, construction, operations and decommissioning). The residual impacts that could arise despite the mitigation measures have also been assessed and information on these residual impacts as well as the plan for monitoring compliance and effectiveness of mitigation measures are provided in the Environmental Management Plan (**Chapter 7**).

In proffering mitigation measures, the primary objectives were:

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

The mitigation measures proffered for the predicted environmental impacts from the project took cognizance of:

- Environmental laws in Nigeria, with emphasis on permissible limits for wastestreams {FEPA (1991) now FMEnv, EGASPIN (2018)};
- Best Available Technology for sustainable development;

- Feasibility of application of the measures in Nigeria;
- Social well-being, etc.
- Professional Judgement

Century Power Generation Limited is committed to ensuring the implementation of mitigation measures for the various phases of the project which are shown in **Table 6.1**.

Table 6.1: Mitigation Measures

	Activities	Receptors	Description of Potential Impact: Negative/Positive	Impact Rating	Mitigation	Residual Impact
Pre-Construction	Land acquisition and tenure	Liability/ reputation	Litigation	9	Ensure that all relevant stakeholders/ issues are identified, discussed and resolved properly prior to mobilization	Low
		Community and youth concern	Agitation	9	- Implement regular consultations with the local community and other stakeholders (Govt., Community, NGOs, CBOs etc.) for effective communication and social license; - Support traditional conflict resolution structures in the project communities	Low
	Environmental and engineering surveys	Soil, vegetation, community	Minor disturbance from survey activities (-)	3	- Restrict survey footprint; restore disturbed areas after surveys	Negligible
	Material and equipment supply	Air quality	Vehicular emission from vehicles conveying workers and construction equipment (pollutant and greenhouse gases with possible health hazards)	9	- Engine to comply with international standards for exhaust gases; - Maintenance of engines and exhaust gas check; - Adoption of engine off policy at construction site. - Regular inspection, servicing and maintenance of plant and equipment will be scheduled and carried out to ensure good performance and reduced emissions.	Medium

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		Noise	Noise generated from vehicles conveying construction equipment	9	- Adoption of engine off policy at construction site; when not in use - schedule activities to day time only; - use of noise muffs	Low
	Mobilization of workforce	Population in the vicinity of activity	Social and cultural interaction issues; Health and security issues; Noise and dust.	9	Effective and open complaints procedure; while other impacts are treated in the relevant column	Medium
		Community infrastructure and utilities	Increase demands on services in local communities	9	Proponent to provide all utilities for the facility; therefore, the community infrastructure and utilities will not be overstressed.	Low
		Community and youth concern	How to be gainfully employed	13	- Company to provide appropriate job opportunities for skilled and unskilled labour for the communities - Cooperative and open working relations shall be established early with local communities and maintained throughout the life of the project; commitments with respect to local and national content of workforce;	High (+)
		Transport	Increase in the demand of public transport	9	- Develop a Transport Management Plan specifying routes, speeds, times of travel and key roads in terms of local services; - Consideration shall be given to avoid reliance on public transport and contractors shall be required to use private buses/vehicle	Low
		Vector related	Vector such as bed bug etc. can be an issue	7	- Provide employee induction, awareness and training aimed at building a culture of environmental awareness;	Low

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	Mobilization of workforce				- Provide support to district health vector-related control programs to provide long lasting Insecticide at reduced costs.	
		Sexually transmitted infection HIV/AIDS	Sexual relationship	13	- HIV/AIDS, and other sexually transmitted disease (STD) awareness information, including means of preventing contraction of such diseases, shall be included in induction training and toolbox talks of workers. - workers will be informed of the health risks of illicit sex and that prostitution is illegal and - information on the health risks of prostitution will also be provided; - Information on sexually transmitted diseases and the risks of prostitution shall also be provided.	Low
	Base camp construction, ground clearance and grading	Air quality	Reduction in air quality due to an increase in airborne particulate matter	9	- Good maintenance of machineries to generate minimal levels of pollutants; - Regular visual monitoring to identify equipment producing excessive visible emissions. Equipment observed to be creating excessive air quality emissions will be replaced or serviced within 48 hours - Use of the most suitable site equipment that can carry out the required tasks with the most efficient fuel consumption rates	Medium

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		Noise	Noise generated from activities	9	- Use of mufflers on diesel equipments; - Adoption of engine off policy at construction site; - schedule activities during day time	Low
		Soil quality	Disruption of the topography of the soil	9	- Best available technology shall be used; - Area of disruption shall be kept as minimal as possible	Low
	Excavation and construction of facility	Air quality	Reduction in air quality due to emissions from equipment	9	- Regular visual monitoring to identify areas generating visible dust emissions from the site. Where visible dust emissions from the site are observed, feasible and reasonable dust mitigation measures will be identified and implemented e.g. Implementation of a dust suppression system such as regularly spraying surfaces with water to reduce dust levels; (especially during the Dry Season). - All plant / equipment operators will be appropriately trained and certified - Monitoring of PM 2.5 and PM 10 in line with FMEEnv. guidelines for air quality in the Dry Season	Low
		Noise level	Increased noise and vibration level from construction plant and equipment	9	- Mufflers shall be installed on all combustion engine plant, such as generators and compressors, and they will be checked to ensure they produce minimal noise. - Best industry practice will be employed.	Low

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	Excavation and construction of facility				- All plant / equipment operators will be appropriately trained and certified - Construction plant, equipment and vehicles will be modern and well maintained in accordance with written procedures that are based upon the manufacturers guidelines, applicable industry code, or engineering standards to ensure efficient and reliable operation - Noisy operations will be scheduled at the same time to take account of the fact that combined levels may not be significantly higher than the level if the operations were performed separately. The perceived percentage usage for the noisiest activities will therefore be lower at receptors - Provide employee induction, awareness and training aimed at building a culture of environmental awareness	
		Ground water quality	Contamination of groundwater aquifers	7	- Best available technology shall be used; - Avoid digging to the bottom aquifer	Low
		Soil quality	Change in topography	7	- Green areas to be planted with native plants	Low
	Construction		Loss of terrestrial habitat	7	- Excavation shall be limited to areas clearly marked out for the facility - Limit clearing and earthworks - Vegetation will be replanted as part of the landscaping works	Low

					- Where practical utilize previously cleared areas	
Construction	Construction traffic	Road users, local communities	Increased traffic congestion and accident risk (-)	6	- Implement traffic management plan; - provide signage; train drivers; - schedule deliveries appropriately	Low
	Construction activities	Local economy	Increased employment and business opportunities (+)	9	- Maximize local workforce participation and - local sourcing	Medium (Positive)
	Fuel and lubricant storage/handling	Soil and groundwater	Contamination from accidental spills and leaks (-)	9	- Store fuels in bunded areas; - maintain spill kits; - train personnel; - implement spill response procedures	Low

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	Equipment installation and commissioning	Workers	Occupational injuries and accidents (-)	9	- Enforce HSE procedures; - provide PPE; - conduct toolbox talks and - safety training	Low
Accidental Events	Work related injuries	Accidents and injuries	Can be as severe as loss of life	11	- Site specific induction and continual safety training for all staff; - continual drills in emergency procedures; - ensure that appropriate safety and rescue equipment is available and employee trained in its use	Low
		Health services infrastructure and capacity	Additional stress on the available healthcare infrastructure and manpower	9	- Rescue ambulance should be available; - Assist the local hospital/clinic in areas of short comings	Low
Operations	Natural gas compression operations	Ambient air	Methane emissions and greenhouse gas releases (-)	9	- Conduct routine leak detection and repair (LDAR); - install gas monitoring systems; maintain compressors	Low
	Compressor operations	Nearby neighbours/communities	Noise from compressors and associated equipment (-)	9	- Install acoustic enclosures; - maintain equipment; - establish noise buffer zones	Low

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	CNG dispensing operations	Vehicle owners and transport sector	Improved access to cleaner fuel (+)	15	- Ensure reliable supply and safe operation of dispensing systems	High (Positive)
	Substitution of conventional fuels with CNG	Air quality, public health	Reduction in particulate matter, SOx and NOx emissions (+)	15	- Promote adoption of CNG-powered vehicles - maintain fuel quality standards	High (Positive)
	Operation of CNG station	Consumers and businesses	Reduced fuel costs and improved energy access (+)	12	- Maintain operational efficiency and uninterrupted supply	High (Positive)
	High-pressure gas storage	Workers, public, infrastructure	Fire and explosion hazards (-)	11	- Install emergency shutdown systems; - gas detection systems; fire protection systems; - comply with applicable design codes; - conduct emergency drills	Medium
	Tube trailer loading (Mother Station)	Workers	Exposure to high-pressure gas handling risks (-)	12	- Develop loading SOPs; - use pressure relief devices; - conduct competency training; - implement permit-to-work system	Medium
	Transportation of CNG trailers	Communities, road users	Traffic accidents and gas release incidents (-)	12	- Use certified transport vehicles; - implement journey management plans; - train drivers; perform vehicle inspections	Medium

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Operations	Trailer unloading (Daughter Station)	Workers	Gas leakage during unloading operations (-)	12	- Use standardized unloading procedures; - install emergency isolation valves; - conduct operator training	Medium
	Routine maintenance activities	Workers	Exposure to operational and maintenance hazards (-)	9	- Implement lockout/tagout procedures; - provide PPE; - conduct regular safety audits	Low
	Routine operations and maintenance	Workforce	Long-term employment opportunities (+)	9	- Maintain fair employment practices and workforce development programs	Medium (Positive)
	Emergency situations (fire/explosion)	Workers, communities, infrastructure	Injury, fatality, and property damage (-)	11	- Emergency response plan; - firefighting systems; - emergency drills; - mutual aid agreements; - adequate separation distances	Medium
	National gas utilization	Energy sector	Enhanced energy security and domestic gas utilization (+)	12	- Ensure sustainability of the facility and its operations	High (Positive)

Operations	Facility operation and utility	Air quality	Reduction in air quality due to emissions from the machines and equipment	9	- Use of mechanical seals, vapour recovery, sealing glands by oil pressure, and maintenance - Engine to comply with international standards for exhaust gases; - Maintenance of engines and use of gas filters on exhaust to minimize emission; - Adoption of engine off policy at docking premises. - Regular inspection, servicing and maintenance of plant / equipment will be scheduled and carried out to ensure good performance and reduced emissions. - Equipment will be subject to periodic performance reviews - the scope of which includes environmental performance indicators - Where practical machines will be operated at low speed or power and will be switched off when not being used.	Low
	Facility operation and utility	Transport	Interference with public transport	5	- Operational activities shall not interfere with the public transport or cause road jams; - however, consult with stakeholders on nature and timing of activities which may likely cause interference	Low
		Soil quality	Contamination of soil	7	- Good housekeeping to minimize leaks and spills	Low

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			Waste generation	11	- All generated wastes shall be placed in appropriate containers prior to disposal - Provide consistent, clear direction on waste and resource handling, storage, stockpiling, use and re-use management measures - Waste collection and storage areas shall be established and maintained - Waste will be segregated at source, stored and transported to disposal sites by appropriate third-party contactor - Sludge, and effluent waste shall be placed in sealed containers, before disposal	Low
		Noise	Noise generated from activities	11	- Silencers / mufflers shall be used on equipment where possible - Operations will be conducted such that noise generation will be managed within regulatory requirements - Continuous noise emitting machinery, such as generators will be housed in a suitable acoustic enclosure	Low
		Health and safety	Exposure of the work force	11	- Emergency response plan and procedures are in place - Ensure that an adequate number of trained first aiders are available at work sites - Create awareness on handling of electrical appliances amongst the staff.	Low

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	Facility operation and utility				- Ensure that appropriate PPE are provided and correctly used - Job hazard identification and analysis is conducted - Perform regular workplace inspections. Hazards identified must be addressed immediately, or as soon as reasonably possible - Risk assess activities involving hazardous substances - Safety signage is provided at strategic locations - Toolbox talks shall be held before any site work commences - Use best practice procedures to ensure safe operations	
		Community infrastructure and utilities	Increase demands on services in local communities	11	- Overstressed utilities can be addressed by community assistance grant, loans, construction of need facilities, etc.	Low
		Community and youth concern	Community health and employment	13	- Give concessions to indigenes in employment, award of contracts, scholarships and training schemes. - Cooperative and open working relations shall be established early with local communities and maintained throughout the life of the project; - commitments with respect to local and national content of workforce and - job opportunities for local skilled and unskilled labour;	Low

	Facility operation and utility				- Encourage communities to identify impacts that may be of particular concern to them and have a voice in appropriate mitigation measures.	
		Sexually transmitted infection HIV/AIDS	Sexual relationship	13	- HIV/AIDS, and other sexually transmitted disease (STD) awareness information, including means of preventing contraction of such diseases, shall be included in induction training and toolbox talks of workers. - Induction for workers on health risks of illicit sex and communicable diseases. - workers will be informed that prostitution is illegal and information on the health risks of prostitution will also be provided; - Information on sexually transmitted diseases and the risks of prostitution shall also be provided.	Medium
Operation	Power generation	Air quality	SPM and other gaseous pollutants from power generating plant	9	- The open end of the exhaust of generator should be at least 2.5meters above the ground level. It should also be pointing skywards. - This will minimize pollutant gases concentration at level close to workers. - This also enhances wind dispersion effect on the pollutant gases; - Systematic inspection and maintenance of generators to minimize air emission	Low

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Accidental Events/ Non-routine Activities		Noise	Noise from power generator	9	- Mufflers on power generators; - Systematic inspection and maintenance of generators to minimize noise emission	Low
		Soil quality	Contamination of soil from generator fuel	7	- Good housekeeping to minimize leaks and spills	Low
		Population in the vicinity of activity	Health issues.	11	Effective and open complaints procedure; while other impacts are treated in the relevant column	Medium
	Fire/explosion	Air quality	Resultant air emission from fire/explosion	11	- Ensure and enforce the implementation of fire prevention & protection devices are incorporated into the daily operations; - Ensure the implementation of emergency response plan for the location; - Firefighting material should be available on location at all times; - Material safety data sheets (MSDS) should be available for all chemicals and hazardous substances to be used on location; - Staff handling hazardous substances/materials must be aware of their potential impact and take appropriate safety measures; - Carry out HAZID/HAZOP of the facility; Permit to work system (PTW) should be enforced; restoration of biophysical environment	Medium
		Soil quality	Resultant contamination of soil from fire/explosion	11		Medium
		Vegetation	Resultant vegetation destruction from fire/explosion	11		Medium
		Wildlife	Habitat destruction and wildlife kill from fire/explosion	11		Medium
		Population in the vicinity of activity	Health issues	11		Medium

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		Community infrastructure and utilities	In case of fire outbreak, localized infrastructure and utilities shall be damaged	9	- Reduction of activities leading to explosion and fire outbreak - Good housekeeping	Low
		Community and youth concern	Avoidance of such catastrophe	11	- Encourage communities to have a voice in appropriate mitigation measures	Low
		Liability/ reputation	Litigation and damaged reputation	11	- Prompt compensation for damage property and utilities	Low
		Accidents and injuries	Resultant injuries from fire/explosion	11	- Emergency responses should also cover the injured victims	Medium
	Work-related injuries	Accidents and injuries	Can be as severe as loss of live	11	- Periodic training and continual safety drills for all staff; - activation of emergency procedures; - ensure that appropriate safety and rescue equipment is available and employee trained in its use	Low
		Health services infrastructure and capacity	Additional stress on the available healthcare infrastructure and manpower	9	- Rescue ambulance should be available; - Assist the local hospital/clinic in areas of short comings	Low
Decommissioning	Facility shutdown and decommissioning	Employees	Job losses and reduced economic activity (-)	6	- Develop workforce transition plan; - provide notice and retraining opportunities	Low

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Decommissioning	Equipment dismantling and demolition	Workers	Occupational health and safety risks (-)	9	- Prepare decommissioning HSE plan; - use trained contractors; - enforce PPE requirements	Low
	Demolition activities	Nearby communities	Dust, noise and vibration generation (-)	9	- Water suppression; noise control measures; - controlled demolition practices	Low
	Removal of pipelines and storage vessels	Soil and groundwater	Residual contamination from hydrocarbons or chemicals (-)	9	- Conduct contamination assessment; - remove contaminated soils; - implement remediation measures	Low
	Scrap metal recovery and recycling	Environment	Resource recovery and waste minimization (+)	9	- Maximize recycling and reuse of materials through licensed recyclers	Medium (+)
	Site restoration and revegetation	Soil, biodiversity, landscape	Restoration of ecological and aesthetic value (+)	12	- Implement site rehabilitation plan; - revegetate with native species; - monitor restoration success	High (+)

Decommissioning	Decommissioning and Abandonment	Air quality impairment and noise	Resultant air emission and noise from decommissioning activities.	9	- Protective masks will be worn by personnel in areas having excessive emissions as well as dust prone areas. - Operators of equipment will be mandated to wear PPE (ear plugs, noise mask, coverall etc, - Vehicles and machinery to be used during decommissioning, will be fitted with filters and muffs to minimize emissions and noise levels	Low
		Community and youth concern	Community agitations over environmental damage and loss of oil benefits	9	- Identification and resolution with relevant stakeholders' issues will be ensured. - Regular consultation will be made with stakeholders (Govt., Community, NGOs, CBOs etc.) to understand community perceptions, issues and concerns. - Effective liaison/ communication channels with communities (via Community interface coordinators/ community relations officers [CIC/CROs]) will be maintained - There will be inclusion of decommissioning issues in the Terms of Reference for the MOU	Low
		Community and youth concern	Creation of business/job opportunity	13	- Indigenous contractors/ personnel and qualified resource persons shall be engaged in the decommissioning activity. - There will be a strict Compliance with CENTURY POWER procedures /criteria for indigenous labour sourcing /employment.	High (+)

CHAPTER SEVEN

7.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

7.1 Overview and scope

This chapter contains the Environmental and Social Management Plan (ESMP) drawn up for the Century Power Generation Limited's CNG Mother/Daughter Station at Warri, Delta State.

This Environmental and Social Management Plan (ESMP) will enable CENTURY POWER to realize its Health, Safety and Environment (HSE) regulatory compliance objectives, carry out its institutional responsibilities (Federal Ministry of Environment/NMDPRA regulations and Delta State Ministry of Environment guidelines), and other associated obligations connected to the development and operation of the Plant. An ESMP for the facility is a major feature of CENTURY POWER's overall Environment Management System (EMS), as it addresses environmental, social, and health performances.

This ESMP has been designed for the following purposes:

- 1.) It lays down the procedures and measures that will be incorporated into the development and operations of the plant to verify and regularly monitor compliance effectiveness, of the mitigation and enhancement measures that Century Power Generation Limited has chosen to implement during this project.
- 2.) The ESMP will be used to ensure strict compliance with statutory requirements and CENTURY POWER's corporate policies on safety and the environment.
- 3.) This ESMP will establish any relationship between each significant impact (major or moderate significance); the relevant mitigation measures; and the monitoring approach of all significant impacts that have so far been identified in the study.

Also, through this ESMP, significant impacts are referenced to:

- Appropriate regulatory requirements, institutional responsibilities and other obligations;
- Relevant Century Power Generation Limited operational controls (e.g., management best practices, construction and operation specifications, procedures, and work instructions); and
- Mitigation and regulatory monitoring of institutional roles

This EMP applies to all sub activities of the operation of the project.

7.2 Policies

Century Power Generation Limited has established an HSE Policy and a sustainability commitment that mutually defines the company's resolve in carrying out operations in a socially responsible and ethical manner, at the same time considering the protection of health, safety and the environment. Century Power Generation Limited is fully committed to the implementation of the policy and guidance as presented in **Chapter 1** of this report. Environmental aspects will be embarked upon using the following process identification of environmental sensitivities:

- Identification of potential significant impacts,
- Implementation of design measures or operational procedures that minimize impacts to satisfactory levels,
- Establishment of emergency and contingency plans
- Monitoring the effectiveness of environmental protection, and
- Auditing the success of the overall strategy.

The negative impacts associated with the development and operations at the Stations and measures drawn up to mitigate them have previously been examined. But the long-term process of managing HSE issues relating to development and operations at the Plant requires management of residual impacts, as well as monitoring and follow-up.

The guidelines employed by Century Power Generation Limited in its operations include:

- Control and minimization of all solid and non-solid wastes,
- Prevention of release of petroleum products to the environment,
- Reducing gaseous emissions and noise in the ambient air.

7.3 Environmental and Social Management Plan

This Environmental and Social Management Plan has been set up to serve as a guide for the regulators, Century Power Generation Limited's managers and any other suppliers/contractors that would be involved in the project, as well as other personnel tasked with the implementation of the plan. The EMP integrates features of the larger CENTURY POWER EMS, modelled for all of the Company's operations. The HSE-MS blueprint has been drawn up to identify, plan for, and subsequently minimize potential HSE and socio- economic impacts.

Table 7.1: Environmental and Social Management and Monitoring Plan for CENTURY POWER CNG Mother/Daughter Stations

Project Phase and Activities	Description of Impacts	Impact Rating before Mitigation	Mitigation Measures	Residual Rating	Action Party	Timing	Parameters for Monitoring	Monitoring Frequency	Responsible Party
Land Acquisition	Loss of means of Livelihood of land owners who previously use the acquired land for farming.	Moderate	Adequate compensation shall be paid to those whose livelihoods are affected as a result of the project	Minor	Admin/Community Relations Depts.	Pre-Mobilization	Site inspection Report	Once Prior to site preparation activities	Admin Manager
Site Preparation/ Site Clearing	Vegetation removal and loss; to make room for the construction of the proposed Plant.	Moderate	Vegetation clearing shall be limited to the areas within the site needed for the Project. Use of herbicides for clearing shall be avoided	Minor	Project contractor and HSE Dept.	Pre-Mobilization	Site inspection Report	Daily throughout site preparation activities	HSE Manager
			Cleared trees shall be replanted within the project site or elsewhere	Minor	Project contractor and HSE Dept.	Pre-Mobilization	Site inspection Report	Daily throughout site preparation activities	HSE Manager
	Removal of the topsoil in preparation for the project construction.	Moderate	Removal of the topsoil and vegetation shall be restricted to the construction area Measures should be employed to restrict silt removal	Minor	Project contractor and HSE Dept.	Pre-Mobilization	Site inspection Report	Daily throughout site preparation activities	HSE Manager
	Noise and Vibrations from site preparation equipment and machines.	Moderate	Machinery with noise levels within acceptable limits shall be used	Minor	Project contractor and HSE Dept.	Pre-Construction	Monitoring of noise levels	Weekly throughout site preparation activities	HSE Manager
			All engines of all heavy equipment and automobiles will be switched off when not in use	Minor	Project contractor and HSE Dept.	Pre-Construction	Monitoring of noise levels	Weekly throughout site preparation activities	HSE Manager
			Time management will ensure that the site preparation activities	Minor	Project contractor	Pre-Construction	Monitoring of noise levels	Weekly throughout site	HSE Manager

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			will be done within the shortest possible time		and HSE Dept.			preparation activities	
			Acoustic mufflers shall be provided for heavy engines with noise levels above acceptable limits	Minor	Project contractor and HSE Dept.	Pre-Construction	Monitoring of noise levels	Weekly throughout site preparation activities	HSE Manager
			Noise generating energy equipment shall be enclosed in noise insulators	Minor	Project contractor and HSE Dept.	Pre-Construction	Monitoring of noise levels	Weekly throughout site preparation activities	HSE Manager
			Workers with existing hearing impairments shall not be deployed to site.	Minor	HSE Dept.	Pre-Construction	Records of medical checks	Prior to mobilization of personnel	HSE Manager
	Impairment of Air Quality from site clearing and preparation activities.	Moderate	Protective masks will be worn by personnel in areas having excessive emissions as well as dust prone areas	Minor	Project contractor and HSE Dept.	Pre-Construction	SPM, NOx, VOC, O ₃ , CO, H ₂ S, CH ₄ , dust levels etc.	Weekly throughout site preparation activities	HSE Manager
			All heavy equipment that will be used in the site preparation will be mandated to regularly maintain and service their vehicles to minimize the emissions levels from their exhausts	Minor	Project contractor and HSE Dept.	Pre-Construction	SPM, NOx, VOC, O ₃ , CO, H ₂ S, CH ₄ , dust levels etc. and equipment servicing records	Weekly throughout site preparation activities	HSE Manager
	Loss of Wildlife and Habitat due to the site clearing and construction preparation.	Moderate	The site clearing is minimal as such the destruction of habitats of various microfauna and macrofauna species will not be carried out beyond the required project area	Minore	Project Contractor	Pre-Construction	Site Inspection Reports	Weekly	HSE Manager
			The use of herbicides will be avoided	Moderate	Project Contractor	Pre-Construction	Project Progress Reports	Weekly	HSE Manager
	Social Management Plan								
	Exposure of workers to poisonous animals	Moderate	Workers shall be provided with PPE (coveralls, jungle boots,	Minor	Project Contractor	Pre-Construction	Site inspection Report	Weekly throughout	HSE Manager

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	and plants as a result of site clearing and preparation.		hard hat and gloves) and their usage enforced					site preparation activities	
			Awareness shall be created among personnel on the likelihood of exposure to poisonous wildlife and plants and the immediate measures to be taken if it occurs	Minor	HSE Dept	Pre-Construction	Minutes of Project Kick off meetings	Prior to site preparation activities	HSE Manager
			First aid measures and Medevac procedures shall be put in place in the event of an incident.	Minor	Project Contractor and HSE Dept	Pre-Construction	Site inspection Report	Weekly throughout site preparation activities	HSE Manager
			Anti-venom injections shall be provided on site.	Minor	Project Contractor	Pre-Construction	Site inspection Report	Weekly throughout site preparation activities	HSE Manager
	Opportunities for employment	Positive	Indigenous contractors and qualified resource persons shall be employed.	Positive	Project Contractor	Pre-Construction	Interview Records and Personnel CV's	Once prior to confirmation of employment	Human Resources (HR) Manager
			CENTURY POWER shall develop procedures/ criteria for indigenous labour sourcing/ employment.	Positive	HR Dept and Community Relations Department	Pre-Construction	Contract documents	Prior to site preparation activities	Human Resources Manager
	Injuries resulting from clearing of vegetation.	Moderate	Workers shall be provided with PPE (coveralls, jungle boots, hard hat and gloves) and their usage will be thoroughly enforced	Minor	Project Contractor	Prior to all Construction activities	Project safety reports	Weekly throughout site preparation activities	HSE Manager.
			Toolbox meetings will be conducted before commencing site clearing activities.	Minor	Project Contractor	Prior to the start of Construction activities	Minutes of Toolbox meetings	Daily throughout site preparation activities	HSE Manager.

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			First aid /medical facilities shall be provided on site, with critical cases transferred to CENTURY POWER approved or other appropriate health facilities (Medevac).	Minor	Project contractor and HSE Dept	Throughout Pre-Construction	Project safety reports Incident Reports	Weekly throughout site preparation activities	HSE Manager.
Recruitment of Workers	Increased employment/ services opportunities for the host community, and potential increase in income and better livelihoods.	Positive	Engagement of indigenous contractors and qualified resource persons	Positive	HR Dept	All Project Phases	Contractor Portfolio, Interview Records and Personnel CV's	Once prior to signing contract/ confirmation of employment	Human Resources (HR) Manager
			Application of existing CENTURY POWER procedures/ criteria for indigenous labour sourcing and employment.	Moderate	HR Dept and Community Relations Department	All Project Phases	Contract Documents and Employment Letters	Prior to site preparation activities	Human Resources Manager
	Increase in social vices (violence, drug/alcohol abuse, Teenage pregnancies, prostitution etc)	Moderate	Awareness campaigns shall be carried out to enlighten the communities/ workers on the implications of drug and alcohol abuse, unprotected sex, prostitution and the need to sustain cultural values.	Moderate	HSE and Community Relations Depts.	Pre-Construction	Consultation Sessions Records	Prior to site preparation activities	HSE and Community Relations Managers.
			Condom use shall be encouraged	Moderate	HSE Dept.	Pre-Construction	Consultation Sessions Records	Prior to site preparation activities	HSE Manager.
			Alcohol and drug sales will be prohibited around the Plant at all project phases	Moderate	HSE Dept.	All Project Phases	Site Inspection Reports	Weekly	HSE Manager.
			Alcohol consumption and drug use shall be prohibited on the facility in line with CENTURY POWER's Drug and Alcohol policy.	Moderate	HSE Dept.	All Project Phases	Incident Reports	Weekly	HSE Manager.
			Efforts will be made to enlighten the host communities to existing	Moderate	HSE Dept.	Pre-Construction	Consultation Sessions Records	Prior to site preparation	HSE Manager.

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			government control programs for HIV/AIDS					activities	
	Third party agitation (over employment issues)	Moderate	Identification and resolution of relevant stakeholders' issues will be ensured	Minor	Community Relations Dept	Prior to Construction	Project Registration Documents, Consultation Records and MOU with the host community	Prior to site preparation activities	Community Relations Manager
			Regular consultation will be made with stakeholders (Govt., Community, NGOs, CBOs etc.) to understand community perceptions, issues and concerns.	Minor	Community Relations Dept	Prior to Construction	Consultation Sessions Records	Weekly	Community Relations Manager
			Effective liaison/communication channels with communities (via Community interface coordinators/ community relations officers [CIC/CROs]) will be maintained	Minor	Community Relations Dept	Prior to Construction	MOU with the host community	Prior to site preparation activities	Community Relations Manager
			There will be inclusion of community employment issues in the Terms of Reference for the MOU	Minor	Community Relations Dept	Prior to Construction	MOU with the host community	Prior to site preparation activities	Community Relations Manager
Mobilization	Environmental Management Plan								
Transportation of Personnel and Equipment	Noise and Vibration	Moderate	Personnel will be car pooled as much as possible to reduce the number of vehicles that will be used to convey personnel to site thus reducing cumulative noise	Minor	Project contractor and HSE Dept.	Pre-Construction	Contractors Work Execution Plan and Noise level monitoring	Weekly throughout site preparation activities	HSE Manager
			Machinery with noise levels within acceptable limits shall be used	Minor	Project contractor and HSE Dept.	Pre-Construction	Monitoring of noise levels	Weekly throughout site preparation activities	HSE Manager

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			All engines of all heavy equipment and automobiles will be switched off when not in use	Minor	Project contractor and HSE Dept.	Pre-Construction	Monitoring of noise levels	Weekly throughout site preparation activities	HSE Manager
			Time management will ensure that the movement and transportation of personnel shall be done within the shortest possible time	Minor	Project contractor and HSE Dept.	Pre-Construction	Monitoring of noise levels	Weekly throughout site preparation activities	HSE Manager
	Emissions and dust from vehicles	Moderate	Protective masks will be worn by personnel in areas having excessive emissions as well as dust prone areas.	Minor	Project contractor and HSE Dept.	Pre-Construction	SPM, NOx, VOC, O ₃ , CO, H ₂ S, CH ₄ , dust levels etc.	Weekly throughout site preparation activities	HSE Manager
			All heavy equipment that will be deployed to site will be mandated to regularly maintain and service their vehicles to minimize the emission levels from their exhausts	Minor	Project contractor and HSE Dept.	Pre-Construction	SPM, NOx, VOC, O ₃ , CO, H ₂ S, CH ₄ , dust levels etc. and equipment servicing records	Weekly throughout site preparation activities	HSE Manager
	Social Management Plan								
	Injuries and accidents to workers during loading and off loading construction materials.	Moderate	Adequate PPE shall be provided especially gloves, safety shoes, and hard hats to workers shall be ensured. It is mandatory that all employees on site shall wear the appropriate PPE whilst performing their duties.	Minor	Project contractor and HSE Dept	Pre-Construction	Work Execution Plan	Weekly throughout site preparation activities	HSE Manager
Increased vehicular movement and traffic and possibilities for road accident	Moderate	A journey management plan shall be developed and workers shall be pooled. Use of signages	Minor	Project contractor and HSE Dept	Pre-Construction	Work Execution Plan Journey Management Plan	Weekly throughout site preparation activities	HSE Manager	
Behavioural modifications from wildlife	Moderate	Personnel will be car pooled as much as possible to reduce the number of vehicles that will be	Moderate	Project contractor	Pre-Construction	Contractors Work Execution Plan	Weekly throughout site	HSE Manager	

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			used to convey personnel to site thus reducing cumulative noise and behavioural modifications by wildlife		and HSE Dept.		and Noise level monitoring	preparation activities	
			All engines of all heavy equipment and automobiles will be switched off when not in use	Minor	Project contractor and HSE Dept.	Pre-Construction	Monitoring of noise levels	Weekly throughout site preparation activities	HSE Manager
			Time management will ensure that the movement and transportation of personnel shall be done within the shortest possible time	Moderate	Project contractor and HSE Dept.	Pre-Construction	Monitoring of noise levels	Weekly throughout site preparation activities	HSE Manager
Construction	Environmental Management Plan								
Construction of the Plant and Ancillary Facilities	Noise/ Vibration	Moderate	Engines of any equipment not in use shall be switched off	Minor	Project contractor	During Construction	Monitoring of noise levels	Weekly During Construction	HSE Manager
			Time management will ensure that the construction of the Plant shall be executed within the shortest possible time	Minor	Project contractor	During Construction	Monitoring of noise levels	Weekly During Construction	HSE Manager
			Acoustic mufflers shall be provided for equipment if noise levels are above acceptable limits	Minor	Project contractor	During Construction	Monitoring of noise levels	Weekly During Construction	HSE Manager
			CENTURY POWER's HSE policy of wearing ear muffs/ plugs shall be applied in areas of high noise pressures	Minor	Project contractor	During Construction	Site Safety Reports	Weekly During Construction	HSE Manager
			Sufficient separation distances shall be provided for sources of high energy sound to reduce noise levels	Minor	Project contractor	During Construction	Monitoring of noise levels	Weekly During Construction	HSE Manager
			Warning signs shall be provided at noise prone areas and will be designated "Ear Muff Area".	Minor	Project contractor	During Construction	Site Safety Reports	Weekly During Construction	HSE Manager

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			Workers with existing hearing impairments shall not be deployed to site.	Minor	Project Contractor and HSE Dept.	Pre-Construction	Records of medical checks	Prior to Construction	HR Manager
Impairment of Air Quality	Moderate		Protective masks will be worn by personnel in areas having excessive emissions as well as dust prone areas.	Minor	Project contractor	During Construction	SPM, NOx, VOC, O ₃ , CO, H ₂ S, CH ₄ , dust levels etc.	Weekly	HSE Manager
			Operators of emission generating equipment/ vehicles that will be used in construction will be mandated to regularly maintain and service their engines to minimize the emission levels generated	Minor	Project contractor	During Construction	SPM, NOx, VOC, O ₃ , CO, H ₂ S, CH ₄ , dust levels etc. and Equipment Service Records	Weekly	HSE Manager
			Operators of power generators will regularly maintain them	Minor	Project contractor	During Construction	SPM, NOx, VOC, O ₃ , CO, H ₂ S, CH ₄ , dust levels etc. and Equipment Service Records	Weekly	HSE Manager
Increase in vehicular traffic	Moderate		Movement of any supply vehicles will be limited to off-peak times to reduce traffic congestion	Moderate	Project contractor	During Construction	Traffic Management Plan and Traffic Density	Monthly	HSE Manager
			Journey Management Plans that reduce pressure on the existing road networks shall be implemented	Moderate	Project contractor	During Construction	Traffic Count and Traffic Density	Monthly	HSE Manager
			There will be a strict adherence to the Construction Traffic Management Plan	Moderate	HSE Dept.	During Construction	Traffic Count and Traffic Density	Monthly	HSE Manager
			Contractors will be encouraged to use buses to convey personnel to reduce traffic congestion	Moderate	Project contractor	During Construction	Traffic Count and Traffic Density	Monthly	HSE Manager
Interruption of drainage pattern	Moderate		Health awareness training shall be conducted prior to	Minor	Project Contractor	During Construction	Minutes of toolbox	Weekly	HSE Manager

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			commencement of activities.		and HSE Dept.		eetings/ safety briefings.		
			Engineered drainage channels will be constructed taking into cognizance the topography and natural drainage of the area	Minor	Project Contractor	During Construction	Project Progress Reports	Monthly	HSE Manager
			The engineered drainage system will be designed in such a way as to prevent soil erosion in surrounding areas with vegetative cover being one of the key components of the altered drainage channels	Minor	Project Contractor	During Construction	Project Progress Reports and Site Inspection Reports	Monthly	HSE Manager
	Social Management Plan								
	Burns/ injuries from welding sparks and other construction activities	Moderate	Awareness sessions on health risks and safety precautions of welding operations shall be carried out for workers.	Minor	Project contractor	During Construction	Minutes of toolbox meetings/ safety briefings.	Weekly	HSE Manager
			Pre-employment medical certification shall be carried out for the welders.	Minor	Project contractor	During Construction	Records of medical checks	Once, Prior to start of construction	HSE Manager
			CENTURY POWER shall enforce the use of welder's mask, goggles, earmuffs, jacket, gloves, boots and coveralls, by welders during welding.	Minor	Project contractor and HSE Dept	During Construction	Safety Reports	Weekly	HSE Manager
			A medical facility/ first aid delivery service Plant shall be arranged for personnel use	Minor	Project contractor	During Construction	Incident Reports	Weekly	HSE Manager
	Exposure to radioactive emission during radiography.	Moderate	Health awareness training shall be conducted prior to commencement of activities.	Minor	Project Contractor and HSE Dept.	During Construction	Minutes of toolbox meetings/ safety briefings.	Weekly	HSE Manager
			Staff shall undergo routine medical check-ups for radiation exposure.	Minor	Project Contractor and HSE Dept.	During Construction	Records of medical checks and Results of	Weekly	HSE Manager

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							radiation tag monitoring		
			Radiation monitors shall be provided to monitor radiation levels above threshold.	Minor	Project Contractor and HSE Dept.	During Construction	Radiation levels	Daily	HSE Manager
			The use of radiography aprons to protect the body from radiation shall be enforced.	Minor	Project Contractor	During Construction	Radiation levels	Weekly	HSE Manager
			Warning signs shall be provided during actual activities.	Minor	Project Contractor	During Construction	Site Inspection Report	Weekly	HSE Manager
			The activity shall be carried out in accordance with standard specifications	Minor	Project Contractor and HSE Dept.	During Construction	Safety Reports	Weekly	HSE Manager
	GBV (sexual harassment, intimate partner violence, poor working conditions)	Moderate	The EEP GBV Action Plan shall be implemented for the Project	Minor	Project Contractor and HSE Dept	During Construction	Health and Safety Report	Weekly	HSE Manager
	Sexual transmitted diseases with influx of people.	Moderate	Labour management plan shall be developed Sensitization programme shall be conducted for the construction workers as well as a Code of Conduct.	Minor	Project Contractor and HSE Dept	During Construction	Health and Safety Report	Weekly	HSE Manager
	Employment opportunities	Positive	Engagement of indigenous contractors and qualified resource persons will be done	Positive	Project Contractor	Prior to Construction	Employment Records and Personnel CV's	Once, Prior to construction	HR Manager
			Application of existing CENTURY POWER procedures/ criteria for indigenous labour sourcing and employment.	Positive	Project Contractor and HR Dept	Prior to Construction	Contract documents	Once, Prior to Construction	HR Manager
Operations	Environmental Management Plan								
Operations and Maintenance	Noise and vibration	Moderate	Acoustic treatment by enclosure of equipment or soundproofing buildings that hold loud equipment and/ or units that	Minor	HSE Dept	During Operations	Noise level monitoring	Weekly	HSE Manager

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			operate at significant noise levels						
			Machinery with noise levels within acceptable limits shall be used	Minor	HSE Dept	During Operations	Noise level monitoring	Weekly	HSE Manager
			Noise generating equipment/ machinery/ generators shall be switched off if not in use	Minor	HSE Dept	During Operations	Noise level monitoring	Weekly	HSE Manager
			Acoustic mufflers shall be provided for heavy engines with noise level above acceptable limits	Minor	HSE Dept	During Operations	Noise level monitoring	Weekly	HSE Manager
			Noise generating energy equipment shall be enclosed in noise insulators in line with CENTURY POWER's policy	Minor	HSE Dept	During Operations	Noise level monitoring	Weekly	HSE Manager
			CENTURY POWER's HSE policy of wearing ear muffs/ plugs shall be applied in areas of excessive noise pressures	Minor	HSE Dept	During Operations	Noise level monitoring	Weekly	HSE Manager
			Sufficient separation distances shall be provided for sources of high energy sound to reduce cumulative noise levels	Minor	HSE Dept	During Operations	Site Inspection Reports	Weekly	HSE Manager
			Workers with existing hearing impairments shall not be deployed to site	Minor	HSE Dept	During Operations	Medical checks	Annually	HSE Manager
	Impairment of Air Quality	Moderate	Protective masks will be worn by personnel in areas having excessive emissions as well as dust prone areas.	Minor	HSE Dept	During Operations	Safety Reports	Weekly	HSE Manager
			All tanker vessels, generators and vehicles will be regularly maintained and serviced to minimize emission levels	Minor	HSE Dept	During Operations	Equipment Service Records	Quarterly	HSE Manager
			Monitoring of indicator air quality parameters like NOx, CO, SPM, SOx and VOCs, will be undertaken regularly	Minor	HSE Dept	During Operations	Radiation, SPM, NOx, VOC, O ₃ , CO,	Weekly	HSE Manager

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							H ₂ S, CH ₄ , dust levels etc.		
			Power generators will be maintained/ serviced regularly	Minor	HSE Dept	During Operations	Generator Service Records	Quarterly	HSE Manager
			Generators, road tankers and road vehicles must be switched off when not in use	Minor	HSE Dept	During Operations	Site Inspection Reports	Weekly	HSE Manager
	Changes in Soil and Groundwater Quality	Major	The soil and groundwater quality in the vicinity of the terminal shall be periodically monitored in line with regulatory requirements.	Moderate	HSE Dept	During Operations	pH, THC, PAH, TOC, BOD, COD, Conductivity, heavy metals, phenols, etc	Monthly	HSE Manager
			Any spill that is noticed will be promptly cleaned up to prevent pollution of soil and groundwater.	Moderate	HSE Dept	During Operations	pH, THC, PAH, TOC, BOD, COD, Conductivity, heavy metals, phenols, etc	Monthly	HSE Manager
	Oil spill incidents	Major	CENTURY POWER will have a full functional Oil Spill Contingency Plan in place to control and recover oil from incidents	Moderate	HSE Dept	During Operations	Oil Spill Contingency Plan	Annually	HSE Manager
			ESI maps will be used to minimize environmental impacts in the event of a spill.	Moderate	HSE Dept	During Operations	Oil Spill Contingency Plan	Annually	HSE Manager
			Majority of chemicals will be controlled in accordance with the OSPAR HOCNS and the CHARM model, which ensure that all chemicals are not toxic to the environment at the quantities released.	Moderate	HSE Dept	During Operations	Chemicals MSDS	Monthly	HSE Manager
			Oil spill cleanup materials (e.g. absorbent pads, booms, skimmers etc) will be stockpiled to contain and collect spills.	Moderate	HSE Dept	During Operations	Materials Inventory, OSCP	Monthly	HSE Manager

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			CENTURY POWER personnel will be trained in use of such materials and contingency measures will be implemented for even the smallest of spills.						
	Fire Outbreaks during operations	Major	Fire protection facilities (detection, fighting and control) shall be provided at the Plant and will be regularly inspected with regular drills carried out.	Moderate	HSE Dept	During Operations	Site Inspection Report and Emergency Response Plan	Monthly	HSE Dept
			CENTURY POWER's Emergency Response Procedures shall be implemented, including measures to quickly seek third-party assistance when necessary.	Moderate	HSE Dept	During Operations	Emergency Response Plan	Monthly	HSE Dept
			Adequate compensation shall be paid to affected parties in the event of third-party damage to lives and property.	Moderate	HSE Dept	During Operations	Incident Reports and CENTURY POWER's Compensation Records	After every event	HSE Dept
	Electric shock, injuries to personnel during maintenance	Moderate	Ensure that worker wear appropriate PPE at work Strict compliance to the SOP	Minor	HSE Dept	During Operations	Inspection Report	Monthly	HSE Dept
	Social Management Plan								
	Pressure on Existing Infrastructure	Moderate	Proper waste management procedures will be followed to reduce pressure on existing waste management facilities with the key focus being placed mainly on reduction and recycling	Moderate	HSE Dept	During Operations	Waste Consignment Notes	Weekly	HSE Dept
			CENTURY POWER shall liaise with other companies on the need to jointly use/ develop key infrastructure to avoid pressures on the existing infrastructure that	Minor	Admin Dept	During Operations	Minutes of Meetings and General Correspondence	Quarterly	Admin Manager

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			the public utilizes.						
	Increase in vehicular traffic	Moderate	The movement of supply vehicles shall be limited to off-peak times to reduce traffic congestion	Minor	Admin Dept	During Operations	Traffic Management Plan and Traffic Density	Monthly	HSE Manager
			All personnel will be encouraged to adapt to Journey Management Plans to reduce pressure on the existing road networks	Minor	HSE Dept.	During Operations	Traffic Count and Traffic Density	Monthly	HSE Manager
			There will be strict adherence to the facilities Traffic Management Plan	Minor	HSE Dept.	During Operations	Traffic Count and Traffic Density	Monthly	HSE Manager
			Road tankers will be mandated to use designated parking areas to prevent traffic congestion on the major roads	Minor	HSE Dept.	During Operations	Traffic Count and Traffic Density	Monthly	HSE Manager
	Increase in local Population	Moderate	Any arbitrary micro-economic developments springing up as a result of the Plant's operations will be located as far away as possible from the facility.	Moderate	Admin Dept	During Operations	Site Inspection Reports	Weekly	Admin Manager
	GBV (sexual harassment, intimate partner violence, poor working conditions)	Moderate	The EEP GBV Action Plan shall be implemented for the Project	Minor	Project Contractor and HSE Dept	During Construction	Health and Safety Report	Weekly	HSE Manager
	Susceptibility to Pollution Related Diseases	Moderate	Monitoring of indicator air quality parameters like NO _x , CO, SPM, SO _x and VOCs will be carried out regularly to ensure that they are within recommended levels	Minor	HSE Dept	During Operations	Radiation, SPM, NO _x , VOC, O ₃ , CO, H ₂ S, CH ₄ , dust levels etc.	Weekly	HSE Manager
			There will regular monitoring of groundwater quality for pollution to ensure that the groundwater complies to drinking water standards	Minor	HSE Dept	During Operations	pH, THC, PAH, BOD, COD, DO, Turbidity, TSS, heavy metals, phenols, etc	Monthly	HSE Manager

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	Increased opportunities for employment and business	Positive	CENTURY POWER will engage indigenous contractors/ personnel and qualified resource persons	Positive	HR Dept	Prior to Operations	Employment Records and Personnel CV's	Once, Prior to Operations	HR Manager
			There will be a strict Compliance with CENTURY POWERS procedures /criteria for indigenous labour sourcing /employment.	Positive	HR Dept	Prior to Operations	Contract documents	Once, Prior to Operations	HR Manager
	Conflicts arising from Project Operations	Moderate	Identification and resolution of relevant stakeholders' issues will be ensured.	Minor	Community Relations Dept	During Operations	Project Registration Documents, Consultation Records and MOU with the host community	Continuously	Community Relations Manager
			Regular consultation will be made with stakeholders (Govt., Community, NGOs, CBOs etc.) to understand community perceptions, issues and concerns.	Minor	Community Relations Dept	During Operations	Consultation Sessions Records	Quarterly	Community Relations Manager
			Effective liaison/communication channels with communities via Community interface coordinators/ community relations officers [CIC/CROs] will be maintained	Minor	Community Relations Dept	During Operations	MOU with the host community	Continuously	Community Relations Manager
			There will be an inclusion of community employment issues in the Terms of Reference for the MOU with the community	Minor	Community Relations Dept	During Operations	MOU with the host community	Once Prior to Start of operations	Community Relations Manager
Waste Generation (solids/liquid/ gaseous)	Contamination of soil, surface water and ground water	Moderate	Solid wastes that cannot be recycled must be treated appropriately before final disposal	Minor	Waste Contractors and HSE Dept	During All project phases	Waste Inventory	Weekly	HSE Manager
			For waste that are to be treated at third party facilities,	Minor	Waste Contractors	During All project phases	Waste Management Plan	Quarterly	HSE Manager

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			appropriate storage areas will be designated on site		and HSE Dept				
			The choice of appropriate treatment of wastes will comply with the waste classification schemes from FMEnv, NMDPRA	Minor	Waste Contractors and HSE Dept	During All project phases	Waste Management Procedural Document	Continuously	HSE Manager
	E-waste generation and Disposal	Moderate	Training of workers on the handling of generated e-waste	Minor	Waste Contractors and HSE	During All project phases	Training/ Waste Management	Continuously	HSE Manager
	Social Management Plan								
	Increased opportunities for employment and business	Positive	CENTURY POWER will engage indigenous contractors/ personnel and qualified resource persons	Positive	HR Dept	During All project phases	Employment Records and Personnel CV's	Continuously	HR Manager
			There will be a strict Compliance with CENTURY POWER's procedures /criteria for indigenous labour sourcing /employment.	Positive	HR Dept	During All project phases	Contract documents	Continuously	HR Manager
D&A	Environmental Management Plan								
Decommissioning and Abandonment.	Air Quality Impairment and noise	Moderate	Protective masks will be worn by personnel in areas having excessive emissions as well as dust prone areas.	Minor	HSE Dept	During Decommissioning	Safety Reports	Weekly	HSE Manager
			Operators of equipment, vehicles and machinery that will be involved during decommissioning, will be mandated to regularly maintain and service them to minimize emissions levels	Minor	HSE Dept	During Decommissioning	Equipment Service Records	Quarterly	HSE Manager
			Monitoring of indicator air quality parameters like NOx, CO, SPM, SOx and VOCs, will be undertaken during and after decommissioning	Minor	HSE Dept	During Decommissioning	Radiation, SPM, NOx, VOC, O ₃ , CO, H ₂ S, CH ₄ , dust levels etc.	Weekly	HSE Manager
			Machinery with noise levels within acceptable limits shall be used	Minor	HSE Dept	During Decommissioning	Noise level monitoring	Weekly	HSE Manager

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			Noise generating equipment/ machinery/ generators shall be switched off if not in use	Minor	HSE Dept	During Decommissioning	Noise level monitoring	Weekly	HSE Manager
			Acoustic mufflers shall be provided for machines/ engines with noise levels above acceptable limits	Minor	HSE Dept	During Decommissioning	Noise level monitoring	Weekly	HSE Manager
			CENTURY POWER's HSE policy of wearing ear muffs/ plugs shall be applied in areas of excessive noise pressures	Minor	HSE Dept	During Decommissioning	Noise level monitoring	Weekly	HSE Manager
			Workers with existing hearing impairments shall not be deployed to site.	Minor	HSE Dept	During Decommissioning	Medical checks	Annually	HSE Manager
	Social Management Plan								
	Increased opportunity for business and employment	Positive	CENTURY POWER will engage indigenous contractors/ personnel and qualified resource persons	Positive	HR Dept	During Decommissioning	Employment Records and Personnel CV's	Continuously	HR Manager
			There will be a strict Compliance with CENTURY POWER's procedures /criteria for indigenous labour sourcing /employment.	Positive	HR Dept	During Decommissioning	Contract documents	Continuously	HR Manager
	Community agitations over environmental damage and loss of oil benefits	Major	Identification and resolution of relevant stakeholders' issues will be ensured.	Minor	Community Relations Dept	During Decommissioning	Consultation Sessions Records, Regulatory Approvals and MOU with the host community	Once, prior to Decommissioning	Community Relations Manager
			Regular consultation will be made with stakeholders (Govt., Community, NGOs, CBOs etc.) to understand community perceptions, issues and concerns.	Minor	Community Relations Dept	During Decommissioning	Consultation Records	Throughout decommissioning	Community Relations Manager

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			Effective liaison/ communication channels with communities (via Community interface coordinators/ community relations officers [CIC/CROs]) will be maintained	Minor	Community Relations Dept	During Decommissioning	MOU between all Parties	Throughout decommissioning	Community Relations Manager
			There will be inclusion of decommissioning issues in the Terms of Reference for the MOU	Minor	Community Relations Dept	During Decommissioning	MOU with community and Community Complaints Register	Before Commencement of Project	Community Relations Manager

The HSE-MS methodology has been designed to ensure that each potentially critical HSE impact recognized in this EIA will have suitable operational controls that indicate appropriate procedures, work instructions, EMPs, roles, responsibilities, authorities, monitoring, measurement, and record keeping that avoid or reduce impacts. Other CENTURY POWER's operating procedures will be appraised and, where appropriate, tailored to contain information for planning and minimizing HSE impacts, or in any case, reference relevant documents that address HSE impact avoidance and mitigation.

Century Power Generation Limited plans to put into operation its HSE-MS throughout the lifetime of project activities to ensure compliance with applicable HSE regulations and other requirements to which CENTURY POWER pledges, and to mitigate substantial adverse impacts.

The HSE-MS is modelled after and is also compliant with the International Organization for Standardization 14001: 1996 Technical Specification Guidance for Use (ISO 14001) and the draft standard ISO 18001.

7.3.1 HSE Management Plan

CENTURY POWER plans to employ an official, documented HSE Management System (HSE-MS) for all its undertakings. Highlights of the HSE-MS are briefly discussed below.

Policy and Strategic Objectives

The Century Power Generation Limited HSE-MS initiates the direction and objectives of HSE management within the company and makes them applicable to all of the Company's activities. Several daughter policies addressing specific HSE issues complement this HSE policy. The policies relating to the environment include guidelines on:

- Spills,
- Environmental assessment,
- Use of chemicals
- Materials and energy use and
- Waste management.

Managers and supervisors are authorized to give the detailed content of the HSE Policy and applicable daughter policies to all personnel and contractors, concentrating on individual roles and responsibilities required of them.

Organization, Responsibilities, Resources, Standards and Documentation

Responsibilities for HSE are outlined in the CENTURY POWER's HSE-MS, and are described in detail in various supporting documents.

HSE Management is a line responsibility in CENTURY POWER, assisted by a team of specialist HSE advisers and consultants. Contractor organizations will perform some of the activities associated with the operation of the Plant and are required to satisfy defined standards in HSE management before they can carry out any CENTURY POWER's operations. Contractors' HSE performance will be screened and reviewed during project execution.

Century Power Generation Limited is committed to comply with applicable legislations and other requirements, including:

- Nigerian Legislations,
- International conventions and agreements to which Nigeria is a signatory,
- Century Power Generation Limited HSE Standards, and
- International oil industry standards and practices.

The development and operational activities at the Plant have been drawn up to comply with these standards and all areas of interest will focus on complying with applicable legal and regulatory requirements.

7.3.2 Implementation

Environmental matters are tackled across all levels in CENTURY POWER's planning activities, these include:

- Century Power Generation Limited's Business Plans, containing critical issues for HSE with set goals aimed at improvement and associated performance indicators,
- Emergency and contingency planning (e.g., the oil spill contingency and response plan),
- Asset HSE Plans,
- Department HSE Plans, and
- Contractor HSE Plans.

Actions from this EMP will be integrated into this planning framework.

CENTURY POWER maintains a hierarchy of written standards, procedures and work instructions. These include standards on waste management and chemicals management.

The environmental performance of the Stations operations will be monitored in line with relevant regulatory and CENTURY POWER requirements.

Monitoring

Monitoring activities during the development and operational phases of the Plant are described in **Section 7.5**. Results obtained from the monitoring programme will be reported regularly to the FMEnv and other regulatory authorities and to the CENTURY POWER HSE Manager.

Audit

Century Power Generation Limited will prepare a programme of internal and external audits that evaluates the effectiveness of business controls, including the usefulness of the HSE-MS. The audit shall include the development and operations of the Plant.

Management Review

Century Power Generation Limited management appraises the efficiency of the HSE-MS from time to time to meet the business requirements set out by the organization and its stakeholders. Activities and operations at the Stations are included in this review, incorporating the results of the environmental monitoring.

7.4 Operational Controls

Century Power Generation Limited's HS-EMS, employs comprehensive operational controls to guarantee that all CENTURY POWER operations are environmentally sustainable. Those operational controls that are applicable to the proposed project are discussed below.

7.4.1 Oil/Chemical Management

To limit the potential for oil/chemical to accidentally enter the environment and to make sure that the impacts of those substances whose entry to the environment cannot be avoided are minimized, a thorough selection and management procedure is being put into operation.

This procedure highlights the requirements for the evaluation, selection, supply, transport, storage, use and handling of such oil/chemical and other hazardous substances. A comparable process will be used in the Plant's operations.

Also incorporated into the plan is the requirement that adequate spill response materials will be made available at all locations where oil /chemicals are handled, stored or used. In

the unlikely event that a an accidentally released, the toxicity and recommended spill management procedures used in CNETURY POWER's operations will be detailed in a standard manual for managing such wastes.

7.4.2 Waste Management

Separate fit-for-purpose Waste Management Plans have been drawn up for the entire lifecycle of the proposed Stations. The waste management strategy implemented in these plans focuses on the standard waste handling hierarchy, including avoidance, tracking, minimization, reuse, recycling and finally responsible disposal.

7.4.3 Oil Spill Management

Century Power Generation Limited's strategy for oil spills and emergency response are contained in Company's Oil Spill Contingency Plan and Spill Prevention and Countermeasures Plan.

The potential sources and impacts of oil spills from the operations in the proposed Plant have been dealt with in **Chapter 5**. Spills that are contained in the facility will be managed in line with the laid down procedures, with all contaminated clean-up materials placed in appropriate bags or skips and disposed in accordance with CENTURY POWER Waste Management Plan and regulatory requirements.

Tiers of Response

Century Power Generation Limited's oil spills response has been placed into three tiers classified on the basis of its magnitude, nature of the spill and the amount of resources required to manage the incident. These are described below.

Level 1 Response (TIER - 1)

Level 1 response capability takes care of minor spills whose containment, recovery, clean-up and disposal can be performed by CENTURY POWER equipment and workforce stationed on site. The "onsite" equipment is set up in a way where the deployment and response operations will be initiated promptly by the on-scene response team after the initial detection of an oil spill.

Spill < 250 bbls is in this category

Level 2 Response (TIER- 2)

Level 2 response capability would be required when containment of the spill is outside the capabilities of CENTURY POWER's local resources. The level 2 response capability which is classified under medium spills would be provided by the OPTS Mutual Assistance Plan (MAP) and the Clean Nigeria Associates (CNA), as necessary.

MAP – Individual oil companies provide support services and materials, which can be used during an oil spill incident.

CNA – Is an OPTS co-operative assistance scheme and is the level 2 oil spill response established to maintain a capability to combat spills additional to any such capability maintained by any individual member.

Any spill between 250 – 2500bbls is in this category

Level 3 Response (TIER – 3)

Level 3 response would be required when the spill is beyond capabilities of combined CENTURY POWER, OPTS Mutual Assistance Plan and CNA. A level 3 response would require mobilization of external resources such as Oil Spill Response Limited (OSRL) located at Southampton, England which has the capability for responding to high seas oil spills. A Level 3 response is usually required for major oil spills.

Any spill > 2500 bbls is in this category.

Oil Spill Tracking

In the improbable event of an oil spill in the adjacent waterways, the spill must be tracked until it has evaporated or broken up, dispersed or recovered as appropriate.

7.5 Environmental Monitoring Programme

Monitoring will be carried out to ensure compliance with regulatory requirements and as a way of evaluating the effectiveness of Century Power Generation Limited's operational controls and other measures intended to mitigate potential impacts associated with development and operations at the proposed Plant.

With regard to the significant impacts identified in this EIA Report, Century Power Generation Limited has mapped out a programme to monitor the effectiveness of the mitigation measures (**Table 7.1**). The programme describes the effect to be measured and the frequency.

Together with monitoring of the efficiency of specific mitigation measures, CENTURY POWER has designed a programme to monitor for compliance with relevant regulatory standards. This programme also ensures that contractors keep their contractual obligations relating to work practices and design requirements. Monitoring will be done by CENTURY POWER's HSE department and/or by contractors pursuant to their contractual obligations. The parameters to be measured during the course of operations at the proposed Plant are provided in **Table 7.1**.

Table 7.2: Environmental Monitoring Plan for Century Power Generation Limited's CNG Mother/Daughter Stations

Environmental Components/ Matrix	Sampling Locations	Sampling Method	Environmental/ Social Parameters to be monitored	Compliance Requirement	Frequency of Monitoring	Responsible Party	Project Development Phase	Estimated Cost (₦)
Atmosphere (Air Quality & Noise)	Site boundary, nearest receptor, compressor area	Air Quality Monitoring Equipment Sound level meter	PM _{2.5} , PM ₁₀ , NO _x , SO ₂ , CO, CH ₄ , VOCs TSP, CO, , Noise Level (dBA)	FMEnv/ NESREA WHO/ AfDB	Monthly monitoring; Monthly reporting	HSE Officer / Accredited Consultant, EPC Contractor	Construction & Operation Phase	500,000.00
Fugitive Gas Emissions	Compressor area, storage cascades, loading/unloading points	Portable gas detector and leak survey	Methane (CH ₄), natural gas leaks	NMDPRA Requirements, IFC EHS Guidelines	Monthly	Operations Supervisor / HSE Officer	Operation	150,000/month
Noise Levels	Site boundary, compressor house, nearest residence	Sound level meter	Daytime and nighttime noise levels (dB(A))	NESREA Noise Standards	Quarterly	HSE Officer	Construction & Operation	250,000/event
Groundwater Quality	Monitoring boreholes, nearby wells within the project site	Water samples collected in sampling containers and analysed in accredited laboratory. In-situ parameters checked	Temperature, pH, salinity, TDS, conductivity, DO, BOD, TOC, COD, NO ₃ , PO ₄ , Chloride, sulphate, Microbiology, Heavy metals, TSS and Turbidity	FMEnv/ WHO/ Nigerian Drinking Water Standards	Quarterly monitoring; Monthly reporting	EPC Contractor Environmental Consultant	Construction & /Operations Phases	250,000.00
Soil Quality	Fuel storage area, compressor area, loading/unloading bays	Soil samples collected at various points at the Plant for laboratory analysis.	pH, Moisture, TOC, THC, TPH, NO ₃ , PO ₄ , Chloride, sulphate, Microbiology, Heavy metals.	FMEnv, NESREA/ NMDPAR/ AfDB	Quarterly monitoring and reporting	EPC Contractor & Environmental Consultant	Construction /Operations Phases	250,000.00
Solid Waste	Waste storage areas	Waste shall be collected in designated bins. Monitor the handling and disposal of solid wastes generated onsite; waste tracking documentation.	Waste types, quantities generated, disposal records Operational solid wastes including used packaging waste.	FMEnv/ NESREA/ NMDPRA/ AfDB	Monthly monitoring; Quarterly reporting	HSE Officer EPC Contractor	Construction, Operation & Decommissioning phases	300,000.00

Environmental Impact Assessment (EIA) Report for the Proposed Century Power CNG Stations, Warri, Warri South LGA, Delta State

Hazardous Waste	Waste storage facility	Inspection and manifest review	Used oils, filters, contaminated materials	Hazardous Waste Regulations	Monthly	HSE Officer	Construction & Operation	300,000/month
Occupational Health and Safety	Workers and Operational areas	Observe compliance to PPE and unsafe working conditions, Safety inspections and record review	Health and Safety Plan, Lost Time Injury Frequency Rate (LTIFR), near misses, incidents, PPE compliance	FMEV/ NESREA/ AfDB/Factory Act, NMDPRA HSE Requirements	Daily monitoring; Quarterly reporting	EPC Contractor	Pre-construction, Construction /Operations & Decommissioning Phase	250,000.00
Fire and Explosion Risk	Compressor area, storage cascade, dispensers	Inspection and testing	Functionality of fire extinguishers, gas detectors, ESD systems	NMDPRA, NFPA Standards	Monthly	HSE Officer	Operation	200,000/month
Emergency Preparedness	Entire facility	Drill evaluation and audit	Emergency response time, drill performance	Emergency Response Plan	Bi-annually	HSE Manager	Operation	500,000/drill
Training	Workers	Observe compliance with existing training plan	Training plan and records	FMEV/ NESREA/ NMDPRA/ AfDB	Quarterly monitoring and reporting	EPC Contractor	Construction /Operations Phase	500,000.00
General Housekeeping	Construction sheds and operational areas	Observe cleanliness and aesthetics of Plant	Cleanliness and aesthetics of Plant	FMEV/ NMDPRA/ NESREA/ AfDB	Daily monitoring; Quarterly reporting	EPC Contractor	Construction /Operations Phase	200,000.00
Stakeholder Engagement	Local community Regulatory Agencies	Observe evidence of stakeholder consultations	Stakeholder Engagement Plan	FMEV/ NMDPRA/ NESREA/ AfDB	Quarterly monitoring and reporting	EPC Contractor	Construction /Operations Phase	200,000.00

7.6 Internal and External Auditing

Apart from the scheduled inspections and monitoring activities, audits shall be carried out internally by CENTURY POWER to ensure compliance with regulatory requirements as well as in-house HSE standards and policies. Audits to be conducted shall also cover the contractor HSE department's self-reported monitoring and inspection activities. The audit shall be carried out by qualified personnel and the results shall be reported to the HSE Manager.

The audit shall include a review of compliance with the requirements of the EIA and of this ESMP and include, but not limited to, the following:

- Completeness of HSE documentation, together with planning documents and inspection records;
- Conformance with monitoring requirements;
- Efficacy of activities to address any non-conformance with monitoring requirements; and
- Training activities and record keeping.

7.6.1 Corrective Action

Identifying impacts and dealing with associated risks before an incident occurs is an integral part of the CENTURY POWER HSE management approach. Investigating a "near miss" or actual incident after it occurs can be used to acquire valuable information. Lessons learned can be used to prevent similar or more severe episodes in the future.

CENTURY POWER shall implement a formal corrective action procedure to manage the actions of its employees and contractors. The HSE Manager shall be tasked with keeping custody of records of corrective actions and for overseeing the revision of environmental, social, or health procedures and/or training programmes to avoid repetition of non-conformances and non-compliances.

7.7 Training, Awareness and Capacity Building

Personnel training needs shall be identified and appropriate training conducted especially for staff whose work may have a significant adverse impact upon the environmental or social conditions of the project. Competent personnel shall be engaged at each phase of the project. All staff employed will be trained in basic fire safety, oil spill contingency plan, occupational health and safety, environmental/social management and general operation of the plant.

New employees and visitors to the Plant shall be put through induction. There shall be periodic refresher courses and job specific specialized training. Some of the specific training is presented in Table 7.3 below.

Table 7.3: Training Programme

S/N	Training Content	Participants	Mode	Cost (₦)
1.	Environmental and Social Management	HSE officers, Environmental & Social Safeguard Officer	In-house and External Consultant	200,000.00
2.	ESMP Implementation: mitigation, roles and responsibilities	Admin, HSE and Project Team	Accredited Consultants	250,000.00
3.	ESMP mitigation measures, Code of Conduct, OHS requirements	Contractors	External Accredited Consultants	100,000.00
4.	Contractor drivers, fleet management, traffic control	Drivers, Contractors and Safety Officers	External Accredited Consultants	250,000.00
5.	GBV/SEA/SH Prevention and Response Mechanisms	HSE Officers/Project team, Environmental & Safeguard Officer	External Accredited Consultants	250,000.00
6.	Grievance Redress Mechanism	Admin, Grievance Redress Committees: Project Level and Management Level	External Accredited Consultants	250,000.00
7.	Minimum Industry Safety Training for Downstream Operations (MISTDO) Training	HSE Officers/Project team, Environmental & Safeguard Officer	External NMDPRA Accredited Consultants	200,000.00

7.8 Regulatory Oversight

Regulatory requirements relevant to the operations at the proposed project and the associated governmental agencies have been described in **Chapter 1**.

Communications between the HSE personnel and government regulatory bodies throughout the project lifecycle will occur through various means, including written reports and memos, as well as informal and formal meetings. Most of the regular meetings will be scheduled, though additional meetings will be called on an as the need arises. Such meetings will be required to discuss scheduling/ planning issues, current areas of concern and emerging HSE and socio-economic issues.

At the management level, formal meetings do occur, but on a less frequent basis. Informal meetings and communications will also occur if there is a pressing need. During formal meetings, the HSE Manager will meet with government regulatory agency representatives to review HSE and socio-economic performance, based on the analysis of internal HSE-MS audits. These meetings can be expected to include discussion of future work plans and coordinating issues and resolution of problems.

7.8.1 Reporting

Century Power Generation Limited shall ensure that regulatory officials are frequently updated with the project progress with respect to HSE matters via written status reports and face-to-face meetings. Official notification shall be made for any of the following:

- Significant modifications to this ESMP or the EIA;
- Significant design, routing or implementation changes;
- Results of empirical monitoring;
- HSE incidents such as:
 - Security incidents for potential or actual personnel-at-risk, sabotage attempts, asset losses and fraud/extortion;
 - Emergency medical situations (evacuations, hospitalization, etc.);
 - Fires;
 - Hazardous material and hazardous waste releases or spills;
 - Results from internal audits
 - Results from third-party independent audits;

CENTURY POWER shall make appropriate documentation of HSE-related activities, including internal inspection records, training records and reports easily accessible, or to be provided on request.

7.9 Financial Resources

The costs associated with each of the mitigation measures and the related training and monitoring activities identified shall be included in the operational budget of the proposed project. It is fair to say that these costs shall be refined to reflect reality at the time of implementation. Century Power Generation Limited is committed to providing the necessary resources to fully implement the requirements of the EIA and this ESMP.

CHAPTER EIGHT

8.0 REMEDIATION / DECOMMISSIONING PLAN

8.1 Introduction

At the end of the project life, it shall be abandoned and/or decommissioned. CENTURY POWER shall therefore draw an abandonment plan meets national regulatory requirements (FMEnv & NMDPRA) and international standards. The expected life span shall be 25-30years. A general approach will be to commence detailed planning of decommissioning and abandonment activities about five years in advance. This would ensure a safe, environmentally friendly, and efficient decommissioning/abandonment programme.

CENTURY POWER, the project proponent on behalf of itself and partners shall follow the widely accepted decommissioning/abandonment process for onshore facilities as illustrated in the Figure 8.1.

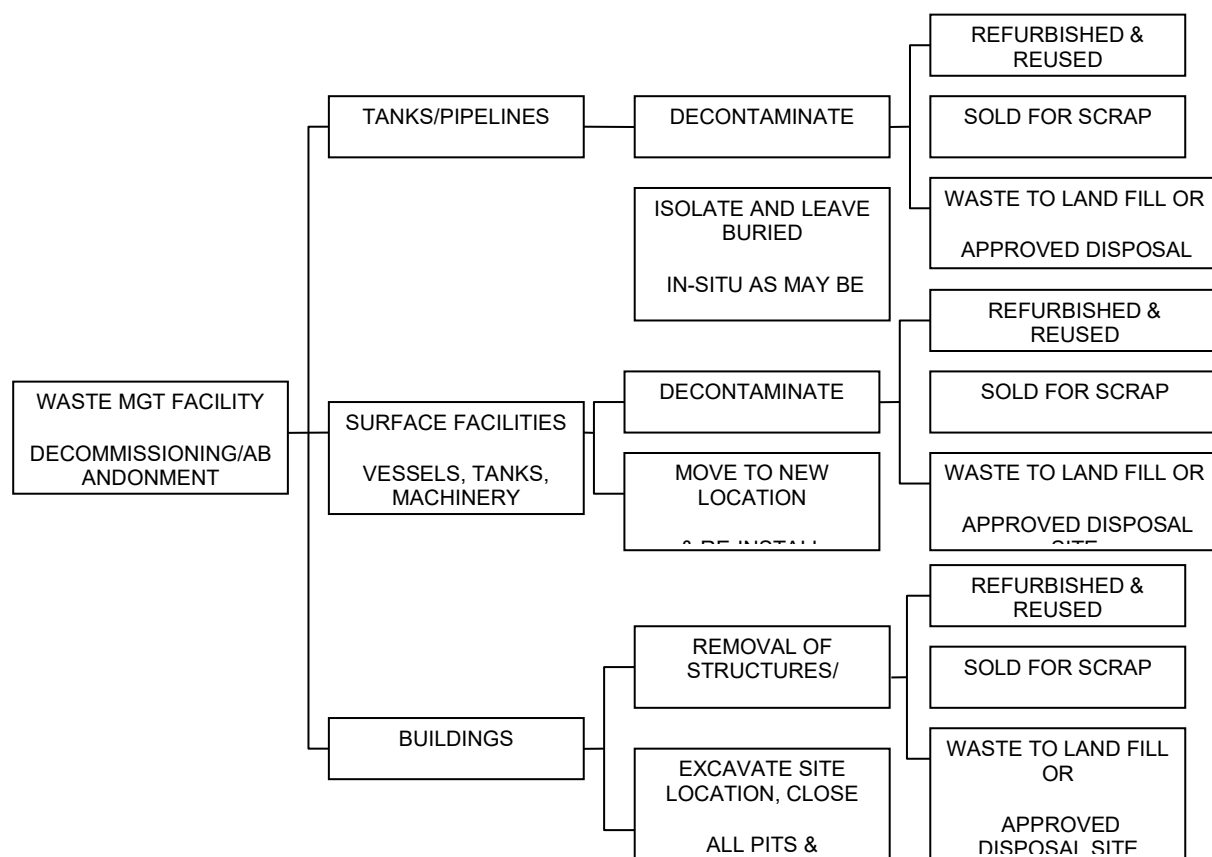


Figure 8.1: Decommissioning and Remediation Decision Tree

Prior to abandonment, a decommissioning plan shall be developed for:

- Facilities to be abandoned or removed.
- Environmental aspects of the decommissioning activity.
- Methods for facility re-use, recycling, disposal, removal or abandonment.
- Proper consultation with all stakeholders (communities, other land users and regulators).
- Efforts to mitigate negative environmental impacts and appropriately rehabilitate the site.
- Programmes for restoring the environment in accordance with national (FMEnv and NMDPRA) and international best-practices and regulatory requirements.
- Scope of work to assess possible residual impacts of the plant on the environment; specifically, any future restrictions on other activities.

8.2 Planned Remediation /Closure Programme

CENTURY POWER shall develop a comprehensive Abandonment, Decommissioning and Closure Plan, to include necessary restoration efforts. The content of the plan will take into consideration the extent of the decommissioning (temporary or permanent, partial or complete shutdown), plans for future use of the site, and the condition of the site and environment at the time of decommissioning.

A detailed post-operational study of the impact of the project on the environment shall be conducted to determine appropriate restoration and remedial measures. The Decommissioning Plan shall be submitted and approved by the regulatory authorities prior to scheduled abandonment and decommissioning.

The Plant facilities shall be decommissioned as follows:

- Tanks, pipelines, etc shall be drained using a standard process for draining and entering of tanks, etc. As much liquid as possible would be pumped from the tanks and the remainder removed by vaporization.
- Interconnecting pipelines would be isolated and purged.
- The power supply for all motors and instrumentation locked out.
- All installed facilities on project sites will be adequately dismantled and removed to allow for proper remediation of the project site.

- CENTURY POWER's Safety Health and Environmental (HSE) Management System will be implemented to ensure the health and safety of its personnel and the public during decommissioning as well as minimise negative environmental impacts. Particular attention will be paid to the following:
 - Protection from air pollutant emissions
 - Protection from noise
 - Waste handling
 - Spill containment and management

8.2.1 Soil Remedial Measures

- Draining and cleaning of all pipes and removal of solid wastes;
- Demolition of project equipment, pipe racks, and related facilities, etc;
- Removal of any impacted soil; and
- Backfilling with clean soil/sand and re-vegetation of area with native plants.

8.2.2 Groundwater Remedial Measures

- Groundwater remediation, if needed to remove contaminants.

Once the facility has been properly and safely decommissioned,

- Water and power supply lines would be disconnected and removed.
- All surface buildings and structures would be dismantled and removed from the site.
- Disturbed areas on the plant site will be identified and restored using appropriate plant species.

8.2.3 Re-Use/Recycling of Equipment

- All facility components that can be used or recycled will be identified and quantified.
- Buildings will either be sold or converted to other uses. Alternatively, the buildings may be donated to host communities.
- Vehicles and other facilities will be scrapped and/or moved to other locations.
- Cleared locations will be re-vegetated using fast growing native species.
- Contaminated environmental component attributable to project activities shall be restored.

8.2.4 Other Issues to be Considered

In addition, the following general items will be addressed:

- Possible decommissioning alternatives other than restoration of site (e.g. Re-use for industrial purposes);
- Conformance with applicable laws, ordinances, regulations, and standards and with local and regional land-use plans; and
- Provision of 24-hour security for the facility, until decommissioning activities is completed.

To accomplish the above, the Decommissioning and Abandonment Programme shall be managed by a team of competent personnel, including the HSE personnel of CENTURY POWER. The methodology shall be in accordance with the provisions of FMEnv and NMDPRA.

8.3 Re-Use/Recycling of Equipment

All facility components that can be used or recycled shall be identified and quantified. Buildings shall either be sold or converted to other uses. Alternatively, the buildings may be donated to host communities. Vehicles and other facilities shall be scrapped and/or moved to other locations. Cleared locations shall be re-vegetated using fast growing native species. Contaminated environmental component attributable to project activities shall be restored.

8.4 Reporting

As required by regulations, a post decommissioning report (PDR) shall be prepared and submitted to the FMEnv and NMDPRA. The PDR shall provide the following details:

- Overview of decommissioned facilities.
- Details of methods used for decommissioning.
- Nature of decommissioning (partial or whole).
- Record of consultation meetings.
- Details of recyclable/reusable materials/facility components.
- Decontaminated facilities.
- Decommissioning Schedule.
- State of the surrounding environment.
- Waste Management Plan.
- Plans for restoration/remediation where necessary.

CHAPTER NINE

9.0 CONCLUSION AND RECOMMENDATION

9.1 Conclusions

The aim of this chapter is to highlight the major finding and recommendation of the study. This will ensure an environmentally friendly development of the CNG Mother/Daughter Station. This report was carried out in accordance with the regulatory requirements established by the Federal Ministry of Environment (FMEnv.) and international standards.

This Environmental and Social Impact Assessment (ESIA) evaluated the potential environmental and social impacts associated with the proposed Century Power Generation Limited's Compressed Natural Gas (CNG) Mother/Daughter Station during the pre-construction, construction, operation, and decommissioning phases. The assessment identified a range of potential impacts, including: air emissions, noise generation, occupational health and safety risks, traffic-related impacts, and potential fire and explosion hazards associated with the handling and storage of high-pressure natural gas.

The assessment also identified significant positive impacts, including increased access to cleaner transportation fuel, reduction in greenhouse gas and particulate emissions relative to conventional petroleum fuels, employment generation, economic development, and enhanced energy security.

Based on the findings of the study, the majority of adverse impacts are localized, temporary, and manageable through the implementation of appropriate mitigation measures and industry best practices. The adoption of a comprehensive Environmental and Social Management Plan (ESMP), Emergency Response Plan (ERP), Occupational Health and Safety Management System, and Environmental Monitoring Plan will further reduce potential impacts to acceptable levels.

Consequently, it is concluded that the proposed CNG Mother/Daughter Station is environmentally and socially viable and can proceed, provided that all recommended mitigation, monitoring, and management measures are effectively implemented throughout the project lifecycle.

9.2 Recommendations

Details of recommendations proffered to mitigate identified/potential impacts are contained in Chapter Six. Nevertheless, the following specific recommendations are re-emphasized.

- 1) Implement all mitigation measures identified in the Environmental and Social Management Plan (ESMP) throughout the project lifecycle.
- 2) Ensure full compliance with applicable national environmental, health, safety, and petroleum industry regulations, standards, and permit requirements.
- 3) Establish and maintain a robust Occupational Health, Safety, Security, and Environment (HSSE) Management System for all project phases.
- 4) Install and regularly maintain gas detection systems, emergency shutdown systems, fire protection equipment, and other safety-critical infrastructure at both Mother and Daughter Stations.
- 5) Conduct routine leak detection and preventive maintenance programs to minimize fugitive methane emissions and operational risks.
- 6) Implement a comprehensive Emergency Response Plan (ERP), including regular emergency drills, personnel training, and coordination with relevant emergency response agencies.
- 7) Maintain effective stakeholder engagement and grievance management mechanisms to address community concerns promptly and transparently. CENTURY POWER should endeavour to engage in Corporate Social Responsibility to enhance the relationship with the host community so as to check-mate agitation and restiveness.
- 8) Undertake periodic environmental monitoring of air quality, noise, soil, groundwater, waste management practices, and occupational health and safety performance in accordance with the approved monitoring plan.
- 9) Prioritize local employment and procurement opportunities where practicable to enhance socio-economic benefits to host communities.
- 10) Develop and implement a Decommissioning and Site Restoration Plan to ensure safe facility closure, waste management, and rehabilitation of disturbed areas at the end of the project life.
- 11) Environmental-auditing of the project shall be conducted as recommended by FEMnv. An accredited consultant should be commission to handle this exercise
- 12) . The waste management plan should be implemented as recommended.

With the application implementation of these recommendations, the proposed CENTURY POWER CNG Mother/Daughter Station is expected to deliver substantial environmental and socio-economic benefits, and shall be constructed, operated and decommissioned with negligible adverse impacts on the environment. The approval of this report is therefore solicited.

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APPENDIX

Appendix I

RC 931502



CORPORATE AFFAIRS COMMISSION
FEDERAL REPUBLIC OF NIGERIA

Certificate of Incorporation

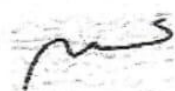
I hereby certify that

CENTURY POWER GENERATION LIMITED

*is this day incorporated under the COMPANIES AND ALLIED MATTERS
ACT 1990 and that the Company is Limited By Shares.*

*Given under my hand at Abuja this Twenty-First day of
January, 2011*




BELLO MAHMUD

Registrar - General

400142

10/25

Appendix II

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

TERMS OF REFERENCE/SCOPE OF WORK (TOR/SOW)

FOR

**THE PROPOSED
CENTURY POWER GENERATION LTD
CNG MOTHER/DAUGHTER STATION
WARRI, WARRI SOUTH LGA
DELTA STATE**

**SUBMITTED BY:
CENTURY POWER GENERATION LIMITED
NEST OIL JBL YARD, WARRI,
DELTA STATE**

**SUBMITTED TO:
FEDERAL MINISTRY OF ENVIRONMENT
ENVIRONMENT HOUSE (BROWN BUILDING)
AIRPORT ROAD, CENTRAL BUSINESS DISTRICT
ABUJA**

February 2026

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Term of Reference (TOR)

Environmental Impact Assessment (EIA) Studies for the Proposed Century Power Generation Limited, CNG Station, Nest Oil JBL Yard, Warri, Delta State

1.0 Introduction

Century Power Generation Limited, (hereafter referred to as CPG, Century or The Company) is an indigenous company, with the drive to make natural gas readily available for power generation to industries and residential areas across Nigeria. CENTURY seeks to set up a Natural Gas Compression (CNG) Mother / Daughter Station with a capacity of 3 MMSCFD at Nest Oil JBL Yard, NPA Express Way, Warri, Delta State. Upon completion, the facility will receive natural gas via the Escravos–Lagos Pipeline, compress it to a pressure of 250 bar(g), and convert it into CNG for distribution to designated off-takers.

The Company has acquired a virgin land for the proposed CNG Mother Station at Warri Delta State, for which an Environmental Impact Assessment (EIA) is required. The geographic co-ordinates of the site are approximately between N5°33'37.68" - N5°33'37.23" and E 5°43'44.12" – E 5°43'44.15".



Fig 1.1: Land acquired for the proposed project



Fig 1.2: Satellite imagery of the proposed project location

The construction/operational activities of the project are likely to impact on the soil, air, water and socio-economic status of the host environment. Thus, requiring an EIA to be conducted on the project location prior to the commencement of the station, in order to incorporate the outcome of the study into the project plan, programmes and policies.

Statutorily, the Federal Ministry of Environment (FMEnv.), requires that impact assessment studies be conducted on such projects so as to determine pollution levels (if any) at project locations and the immediate environment, in orders to map out remediation strategies from project inception.

This study shall follow the statutory requirement of Federal Ministry of Environemnt.

2.0 Objectives of Study

The objectives of this study are to establish the baseline data of existing environment prior to the commencement of the construction and operation of the CNG Mother station. This is with the view of incorporating into the project plan, activities and policies the outcome of the studies so as to ensure, that the environment is not adversely affected by the project. The objectives of this EIA studies, among others include: -

- i. to conduct a baseline survey of the ecosystem structure of the project site, to establish the existing environmental parameters.

- ii. to ascertain the socio-economic activities in and around the project area.
- iii. to identify and assess the likely positive and negative impacts of the project on the existing ecological and socio-economic conditions of the project areas.
- iv. to predict impact magnitude, determine appropriate mitigation measures and establish the environmental sustainability of the entire project and facilities.
- v. to incorporate the contributions of the EIA to the decision-making process of the project.

3.0 Project Description

The proposed project is for the construction of a CNG Mother Station and Daughter Station; comprising of two (2nos) compressors with a capacity of 2800Nm³/h each, a dryer to cool the gas and four (4nos) dispensers. Other utilities include an administrative office, generator house, security house and a parking area. The station shall be operating at 100% capacity on a 20 hours/day, based on 8-hour shifts.

The product shall be conveyed to the proposed facility via Escravos–Lagos Pipeline.

The major area of Environmental concern includes:

- Dispensing area
- Generator house area
- Parking/Admin area

4.0: ADMINISTRATIVE AND LEGAL FRAMEWORK

Various national statutory regulations and international standards that relate to and govern the assessment of environmental impacts for construction and development of an oil facility are highlighted in the Tables 1.1 and 1.2

Table 1.1: Relevant National Regulations Relating to Environmental Protection (by the Oil and Gas Industry) in Nigeria

S/No.	Regulation	Year Adopted
1.	Environmental Impact Assessment Act (Decree No. 86)	1992
2.	Federal Environmental Protection Agency Act 1988, Cap. 131, Vol IX P.6303	1988
3.	National Environmental Protection (Management of Solid Hazardous Wastes) Regulations 1991:	1991

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4.	National Environmental Protection (Pollution and Abatement in Industries in Facilities Producing Waste) Regulations. 1991:	1991
5.	National Environmental Protection (Effluent Limitation) Regulations	1991
6.	Midstream and Downstream Petroleum Environmental Regulations, 2023	2023
7.	Environmental Guidelines & Standards for the Petroleum Industry I Nigeria 1991. Revised 1999, Revised 2018	2018
8.	Guidelines for the Establishment and Operations of Gas Storage and Utilization Facilities in Nigeria – 2020	2020
9.	Petroleum (Drilling and Production) Act 1969 (Cap 350 Vol. XIX P.12644)	1969
10.	Mineral Oils (Safety) Regulations (Cap 350 Vol. XIX P.112667)	1963
11.	Petroleum (Drilling and Production) Act 1969 (Cap 350 Vol. XIX P.12768)	1969
12.	Oil Pipelines Act, 1956, (Cap 338 Vol. XIX P.12363)	1956
13.	Oil in Navigable Waters Act 1968, (Cap 337 Vol. XIX P.12327 Act)	1968
14.	The Mineral Oils (Safety) Regulations (Revised 1995)	1995
15.	Oil Terminal Dues Act 1969, (Cap 339 Vol. XIX P.12385)	1969
16.	Oil and Pipelines Regulations	1995
17.	Associated Gas Re-injection Act 1979, (Cap 26 Vol. XIX P.519)	1979
18.	Explosives Regulations, Cap 117, LFN	1949
19.	Petroleum Refining Regulations	1974
20.	National Inland Water-Ways Authority Decree	1997
21.	Guidelines and Standards for Environmental Pollution Control in Nigeria	1991
22.	DPR Procedure Guide for the Construction and Maintenance of Fixed Offshore Platforms	1992

Table 1.2: International Regulations and Conventions Relating to Environmental Protection in Nigeria.

S/No.	Regulation/Convention	Year Adopted
1	International Convention for the Prevention of Pollution of the Sea by Oil (OILPOL). Note: Superseated on 2 October 1983 by the MARPOL treaty 1973/78 to which Nigeria is not party	1954
2	Convention of the High Seas	1958
3	Convention on the Territorial Sea and Contiguous Zone	1958
4	Convention on the Continental Shelf (SCS)	1958
5	African Convention on the Conservation of nature and Natural Resources	1968
6	International Convention on Civil Liability for Oil Pollution Damage	1969

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7	International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (FUND)	1971
8	Convention on the International Regulations for Preventing Collisions at Sea (COLREG)	1972
9	Convention Concerning the Protection by Dumping of Wastes and Other Matter.	1972
10	Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter. Note: The Convention was amended in 1992	1972
11	International Convention on Standards of Training Certification and Watch-keeping for Seafarer (STCW)	1978
12	International Convention for the Safety of Life at Sea (SOLAS)	1974
13	Protocol Relating to the International Convention for the Safety of life at Sea (SOLAS PROT)	1978
14	Convention for Co-operation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region.	1981
15	Protocol Concerning Cooperation in Combating Pollution in Cases of Emergency in the West and Central African Region.	1981
16	UN Convention on the Law of the Sea.	1982
17	Convention for the Protection of the Ozone Layer.	1985
18	Protocol on Substances that Deplete the Ozone Layer: Note: The protocol was amended for the first time on 29 June 1990 in London. A second set of amendments was adopted in Copenhagen in November 1992; these entered into force on 1994.	1987
19	Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal of 1989 (Basel Convention).	1989
20	International Convention on Oil Pollution Preparedness, Response and Co operation	1990
21	Convention on Facilitation of International Maritime Traffic	1965
22	United Nations Framework Convention on Climate Change (UNFCCC)	1992
23	Convention on Biological Diversity.	1994
24	World Bank Environmental Assessment Source Books	1998

5.0 ENVIRONMENTAL SCREENING

Screening and scoping are the first tier of project evaluation that reviews the environmental effects of the project. The interaction matrix analysis after Luna Leopold was used to identify areas of potential environmental effects and establish cause-effect relationships between the specific project activities/actions and potential impacts.

5.1 Basis for Screening

In assessing the impacts of the different phases of the Plant on the receiving environment, the major areas of concern are the logistics and the socio-economic modification of the

environment. The basis for screening the likely impacts of the proposed project derives from the following:

- (a) Project type/category as provided in EIA Guidelines.
- (b) Project location and sensitivity of environmental components to project activities.
- (c) Knowledge of the construction procedure, equipment types and layout of the project facilities.

The criteria applied to the screening of the various activities are:

- (i) Magnitude - probable severity
- (ii) Prevalence - likely extent of the impact
- (iii) Duration and Frequency - (long-term, short-term or intermittent)
- (iv) Risks - probability of serious and permanent adverse impacts
- (v) Importance - economic, social and cultural values attached to the undisturbed project environment.

5.2 Rational for Screening

The ranking of the magnitude of impacts on the scale of 1-10, is to be interpreted as follows:

- 1-2 - low or insignificant
- 3-4 - medium/low
- 5-6 - medium
- 7-8 - medium high or adverse impact
- 9-10 - high or very adverse impact

The scale of importance of impact is structured similarly, 1-10, as follows:

- 1-2 - Not important
- 3-4 - Very little important
- 5-6 - Little importance
- 7-8 - Important
- 9-10 - Very important

The interaction matrix is derived by displaying environmental parameters with proposed activity so that a quantitative estimate of the potential magnitude of the environmental impacts can be derived.

5.3 Potential Project Impact on the Environment

Table 1.3 shows the interaction matrix for this project. The quantitative measurement of the severity of environmental impact for any given parameter is derived by multiplying the environmental impact scale and the importance scale; and then adding the products to obtain the severity. The existing environmental components are listed in the columns, whilst the proposed project activities/actions are listed in rows of the matrix.

The activities of the project that would generate environmental impacts has been grouped into three phases:

- Site investigation and acquisition
- Construction operations
- Operational phase.

Each of these phases of the development would impact the environmental components/characteristics of the project area, such as:

- Climate
- Air Quality
- Soil/Land Use
- Ecology
- Water Quality
- Hydrogeology
- Archaeology
- Socio-economics
- Wildlife

5.4 Mitigation/Amelioration Measures

The essence of conducting an EIA while the project is at the design and planning stages is to identify and evaluate the potential project impact, and thus effect a mitigation measure at that stage, and then feedback into the final design/planning as to promote a sustainable development. Mitigation has been defined as follows:

- Avoiding the impact altogether by not taking a certain action or part of an action.
- Minimizing the impact by repairing, rehabilitating or restoring the affected environment.

- Reducing or eliminating the impact over time by preservation and maintenance operation during the life of the project action
- Compensating for the impact by replacing or providing substitute resources or environments.

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TABLE 1.3: SCREENING MATRIX FOR ENVIRONMENTAL IMPACT ASSESSMENT OF THE PROJECT

	SITE PREPARATION			CONSTRUCTION STAGE			OPERATIONAL PHASE						
	Site Acquisition	Site Clearing	Site Grading and Resurfacing	Excavation / Foundation	Civil Works/ Building Proper	Equipment receipt Installation & Finishings	Oil Spill/Leaks	Accidents (Fire)	Refuse Disposal	Sanitary Wastes	Waste Treatment	Gaseous/Liquid Emissions	Noise
ECOLOGY													
Fisheries							2/6		1/6				
Plankton							2/6		1/6				
Benthos							1/5		1/4				
Birds		1/2						2/5					1/4
Insects								2/5					
Trees		3/7						1/5					
Shrubs								1/5					
Grass													
crops													
Mico flora													
Aquatic Plants													
Endangered species							1/6	1/6					2/4
HYDROLOGY													
Hydrologic balance													
Groundwater regime													
Waves and Tides													
Drainage/channel/Pattern													
Flooding													
Nutrients													
Toxic substances						2/6					1/6		
CLIMATE & AIR QUALITY													
Temperature		3/4											
Wind direction/speed													
Relative Humidity		2/4											
Storms and fronts													
Hydrocarbons	4/6	2/6			2/5		4/7						
Particulates		5/7	5/6		2/4	2/4							
Carbon monoxide		3/4			3/7								
Sulphur dioxide		3/4											
Odour					2/3				2/4	2/4	2/4		
GEOLOGY													
Subsidence													
Landslides													
Geophysical condition													
Grain size distribution													
LAND USE													
Agriculture		3/6		2/5			2/6	1/6					
Forestry				1/4			2/4	1/3					
Estuarine							1/2						
Coastal zone							1/2						
Residential	3/6	4/6											
Commercial													
Oil													3/4
Transportation		2/5				3/6							
SOCIO-ECONOMICS													
Health and safety		1/4			1/5						1/4		
Quality of life		2/4											
Housing													
Employment opportunities												4/6	
Industrial Growth													
ARCHEOLOGY													
Juju shrine/Groves													
burial grounds													
Monuments													

6.0 SCOPE OF WORK

The scope of work intended for this EIA study shall include but not be limited to the following:

- ✓ Literature review and desktop studies,
- ✓ Field sampling and compilation of comprehensive environmental baseline;
- ✓ Laboratory analyses of samples taken from the proposed project site;
- ✓ Description of the proposed project facilities and analysis of proposed operational activities and impacts;
- ✓ Recommendations and review on remediation and mitigation measures;
- ✓ Development of cost-effective environmental management programme which includes monitoring; and
- ✓ Preparation of detailed EIA Report to meet the requirements of regulatory agencies.

6.1 Literature Review

Biophysical

Review relevant FMEnv. approved EIA Reports (if any) and previous baseline studies for the proposed project region, as well as other available literature on the ecology of the project area. The review should focus on;

- I. Defining the spatial boundaries of the study area.
- II. Identifying the data gaps, if any, in the previous environmental studies, in order to enable proper characterization of the environmental components.
- III. Establishing the biodiversity and conservation status of the area and its relationship to any protected areas around the proposed project area.
- IV. Obtaining relevant secondary data on environmental features from local and national agencies such as the Nigerian Meteorological Agency.

Socioeconomics and Health

- a. Identify and obtain all relevant data from secondary sources such as Government agencies (National Population Commission, National Bureau of Statistics, National Archives etc.), Regulators, Reports, Journals, etc.
- b. Establish baseline data on the people, history, culture, tradition, governance structures, natural resource management, socio-economic conditions, demographic trends, geographical area, social infrastructure, archaeological and religious

artefacts, air and road traffic analyses around the project area (if any) and their potential impacts of the project.

- c. Identify all stakeholders including National and International authorities, Non-Governmental Organizations (NGOs), Community-Based Organizations (CBOs), Local/State government authorities, regulators, community leaders and groups that could be involved in the project (if any) and state the basis of their involvement.
- d. Identify and obtain all relevant data on the health conditions of the communities around the project area (if any) for a period of 5 to 10 years from the Ministry of Health, Hospitals Management Board, Local Government Primary Health Care Departments and Private clinics in the study area.
- e. Determine the population and disease trend for a period of 5 to 10 years in the study communities (where applicable) from the National Population Commission, State Ministry of Health, National Bureau of Statistics, etc.
- f. Acquire information on health budget, local health of the people from the Ministry of Health (Public Health Department).
- g. Identify necessary minimum health requirements and standards.

6.2 Field Data Acquisition

Biophysical Sampling

The framework shall involve the collection of relevant samples using standard methodologies taking cognizance of quality control/quality assurance measures. The environmental components and indices shall be evaluated for establishing the baseline conditions, from primary data and complimentary secondary information. Sampling activities shall be carried out in a manner that is consistent with existing FMEnv and NMDPRA standards. Based on our vast knowledge and work experience around the Project area, we have designed a sampling strategy that will ensure adequate coverage of the study area, in terms of data collection (see Table 1.4 and sampling plan).

Table 1.4. Environmental Components and Indices for Baseline Assessment (Biophysical Aspect)

Environmental	Environmental Aspect	Data Acquisition	Potential Environmental Impact Indicator
Component Climate/ Meteorology	Microclimate/Local Climate features	<i>In situ</i> measurement, Secondary data	Ambient Temperature, Rainfall, Atmospheric Pressure, Relative humidity, Wind direction and speed.
Air Quality	Site and Local	<i>In situ</i> laboratory analysis	Particulate, NO _x , So _x , Co, VOC, H ₂ S, NH ₃
Noise	Site/Local	<i>In situ</i> measurement	Ambient noise level dB (A)
Ground water Characteristics	Physicochemical Features	<i>In situ</i> laboratory analysis	Appearance, Chloride, alkalinity, TDS, TSS, Turbidity, EC, THC, DO, pH, BOD5, COD, NH ₄ ⁺ , NO ₃ , PO ₄ , SO ₄ , Na K, Ca, Mn, Mg. Heavy metals (Fe, Cd, Cr, Ni, V, Pb, Zn)
	Microbiology	Composite samples for laboratory analysis	Total heterotropic bacteria, fungi, Total hydrocarbon utilizing bacteria and fungi, total and coliforms.
Geology	Local and Regional	Secondary data, laboratory analysis	Regional geology, Stratigraphic/Lithologic properties etc.

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Soil	Physical characteristics	<i>In situ</i> / composite auger samples for lab analysis, Soil profile pits	Permeability, porosity, bulk density, texture (grain size), colour,
	Chemical characteristics	Composite samples for laboratory analysis	pH, TOC, Anions, Cations and cation exchange capacity (CEC), THC, heavy metals.
Land Use/Cover	Soil microbiology	Composite samples for laboratory analysis	Total heterotrophic bacteria, fungi, Total hydrocarbon bacteria and fungi.
	Satellite Imagery of land use and/Land cover	Secondary data sources	Land Use types: Recreational, agricultural, forestry, industrial, residential, institutional, commercial, Trends and time lapse mapping.
	Wildlife Vegetation	Transect, direct observation, interviews, secondary data sources Transect, herbarium studies, tissue analysis	Species composition/identification/distribution (vegetation map of locality), seasonality, exploitation methods/level (kill rates/month/year, estimates of wildlife population etc.). IUCN categorization. Habitat status, floral composition, species identification, density and distribution, vegetation structure, plant pathology.
Biodiversity Status & issues relevant to biodiversity	Conservation	<i>In situ observation, interviews, secondary data</i>	Conservation status (rare, threatened and endangered species), conservation areas (forest reserves etc.), environmentally sensitive areas – wetlands and swamps), local conservation practices.

N:B. All the samples collected during the fieldwork shall be analyzed for the different parameters as provided in Table 1.5,

Table 1.5: Sampling Specifications and Parameters for Data Analysis for Biophysical Samples

S/n	Sample	Sample Type	Analysis	Parameters
1	Soil	Surface (0-15cm)		pH, THC, TOC, Available PO ₄ -P, Total-N, NO ₂ , Na, K, Ca and Mg, cation exchange capacity, (CEC), conductivity, oil & grease, heavy metals (Fe, Cd, Cr, Pb, Cu, Ni, V and Zn)
			Soil characterization/ classification	Texture grain size analysis, porosity, permeability, bulk density.
		Subsurface (15-30cm)	Microbiology	Total heterotrophic bacteria and fungi, Total hydrocarbon utilizing bacteria and fungi
2.	Ground water	Liquid	Physico-chemical	Temperature, pH, salinity, EC, DO, Turbidity, THC, anions and cations, heavy metals (Fe, Cd, Cr, Pb, Cu, Ni, V and Zn)
			Microbiology	Total heterotrophic bacteria and fungi, Total hydrocarbon utilizing bacteria and fungi; total and faecal coliforms
3.	Vegetation	**Transect area	<i>In situ</i> study	Vegetation types, floral composition
			Herbarium studies	Sampled/field unidentifiable plant species
			Plants and crops Pathological studies	Identification of health conditions, insect pests, fungi, bacterial and viral disease of crops around the field and associated villages, farmlands or plantations, plant tissue analysis
4.	Wildlife	Transect/ Visual observation	Mammals, reptiles, birds, amphibians and invertebrates	Diversity, distribution, density, conservation status, formal/traditional conservation practices, wildlife exploitation methods.
5.	Air Quality		Physico-chemical	SO _x , NO _x , VOC, Particulates, CO, NH ₃ , H ₂ S, Noise level.

Socioeconomics and Health Studies

The fieldwork shall involve administration of well-structured questionnaires to help determine the social, cultural and health situations, conditions and outcomes in the surrounding urban communities. The fieldwork data gathering approach shall be used:

Oral Interviews

Focus group discussion (FGD)

Administration of questionnaires

The following Socioeconomics and Health data as detailed in the Tables below shall be acquired.

Table 1.6: Socioeconomics Data Needs

S/N	Social Features	Variables
1	Demography	Population size and distribution (age, gender, ethnic groupings, population density, dependency and sex ratio), marital status, educational attainment, primary and secondary school dropout rates, history and trend of migration, net enrolment ratios for primary and secondary schools, etc.
2	Livelihood	Income distribution and consumption patterns, employment status, occupation, occupational mobility and adjustment, poverty profile, land use and tenure system, and other economic activities.
3	Social Infrastructure	Major means of transportation; educational institutions, water supply, electricity, communication, recreational facilities, waste management facilities, housing (type, pattern and quality) etc,
4	Cultural Properties	Value system, social norms, location and spatial distribution of historical sites, archaeological artefacts, shrines, sacred forests/scenic areas; religion, plants/animal species of cultural value, festivals, marriage practices, cultural calendar, etc.
5	Natural Resources and Land Use	Values and use of natural resources including rights over private, rental, common ownership and access of resources – especially with respect to women; local conservation practices (closed seasons/closed locations) etc.
6	Perception of the project	Perception of associated project risks and impacts of quality of life, rating of relationship with the CLIENT, pleasure/displeasure with proposed project, expectations etc.
7	The role of women and children	Rights and privileges, contribution to socio-economic development; activity systems and political organization, women trafficking, child labour etc.
8	Physically Challenged	Rights and privileges, contribution to socio-economic development; activity systems, social exclusion etc.
9	Social Structure and Organization	Settlement history, ethnic groups, social organization and traditional governance – power and authority structure; history of conflicts and their resolution including the role of women.
10	Sex Trade	Population, Frequency, Nature, types, origin and socioeconomic aspects etc.

Table 1.7: Health Data Needs

S/N	Health Parameters	Data Requirements
1	Demographic profile of the Communities	Population, age-sex distribution, migration pattern, occupation, religion, marital status, educational attainment, fertility rate, crude birth rate (CBR), life expectancy.
2	Morbidity/Mortality Patterns	Pattern of morbidity and mortality in the area; computation of crude death rate (CDR); age-specific death rate (infant mortality rate, under 5 years mortality rate, maternal mortality ratio), etc.
3	Healthcare facilities	Inventory of existing healthcare facilities and the types/quality of services rendered; health programs available and their providers etc. Qualifications, experience and competence of local health professionals; availability of Medical Emergency Response Facilities (MEDEVAC)
4	Nutritional Status of Under-fives and the general population	Feeding habits, weight, height, mid-upper arm circumference (MUAC), and clinical examinations for signs of malnutrition.
5	Maternal and Child Health	Maternal mortality ratio; Under-5 mortality rate; Immunization Status; number, distribution and patronage of traditional birth attendants.
6	Knowledge, Attitude Practice and Behaviour (KAPB)	Knowledge of causes of common disease and methods of preventing them. Behaviour/Lifestyle that could influence Health (e.g Substance abuse, reproductive health behavior; health care seeking behavior (traditional medicine utilization, spiritual healing, etc.), Key household practices e.g. personal hygiene, intake of proteinous food like fish, egg, meat, etc. by children etc.
7	Environmental health fabrics	Water supply, sanitation, housing, waste management practices (disposal of human and domestic wastes), noise levels, air quality (indoor and outdoor) and levels of radioactivity, pest/vector control

7.0 EVALUATION AND PREDICTION OF POTENTIAL IMPACTS

- ❖ All present, potential and associated impacts shall be identified taking into cognizance the various interactions between the environmental components (i.e. biophysical, social and health components) and specific project activities.
- ❖ The evaluation of impacts shall distinguish between positive and negative impacts, direct/indirect, immediate, short and long-term impacts, which are unavoidable and irreversible. As much as possible, impacts shall be described quantitatively in terms of environmental costs and benefits explaining any uncertainties and deficiencies associated with impact predictions.
- ❖ Quantification, evaluation and prediction of the significance of the identified impacts using appropriate models and indicators (Air Dispersion Models, Human Development Index (HDI), Human Poverty Index (HPI), Gender Empowerment Measure (GEM) etc.).
- ❖ Comprehensive risk analysis covering all aspects of project activity on environmental components – biophysical, socio-economic and health status of project area.
- ❖ Evaluation and prediction of the cumulative impacts of project activities on the environment.

8.0 DETERMINATION OF APPROPRIATE MITIGATION MEASURES

The Appropriate remediation and mitigation measures shall be made to ameliorate all negative environmental impacts that have been identified to occur as a result of the project activities and must be Specific, Measurable, Achievable, Realistic and Time-based (SMART).

Recommendations should give consideration to:

- ✚ avoidance
- ✚ preservation
- ✚ minimization
- ✚ rehabilitation
- ✚ restoration
- ✚ replacement
- ✚ improvement
- ✚ development and
- ✚ diversification

Basically, remediation measures that will be recommended should be cost-effective, simple to implement, and easily available. Also, the remediation measures shall be set to achieve the following:

- ✚ Rehabilitation of impaired features
- ✚ Enhancement of beneficial impacts or any other measures considered appropriate for the identified impacts.
- ✚ Preventive measures.
- ✚ The use of 'environment friendly', inexpensive but effective methods
- ✚ Inexpensive but effective monitoring schemes for any proposed rehabilitation and restoration activities.

9.0 ENVIRONMENTAL MANAGEMENT PLAN

The Environmental Management Plan (EMP) should be prepared and reported as a stand-alone Chapter. The EMP should cover all the phases of the project activities, and should be organized using the following recommended sub-headings:

- ❖ Project activities and their impacts
- ❖ Proposed mitigation measures
- ❖ Rating before and after mitigation
- ❖ Scope of monitoring
- ❖ Parameters to be monitored and frequency of monitoring
- ❖ Monitoring schedule
- ❖ Responsible and action parties.

10.0 SAMPLING PLAN

The sampling point shall cover the entire projects site and adjoining points to serve as control. Details are as contained in the attached map/survey. The coordinates for the proposed sampling regions of the different environmental components to be sampled are presented in table 1.8 below.

Table 1.8 Sampling Co-ordinates

CODE	LATITUDE	LONGITUDE	ENVIRONMENTAL COMPONENTS
CP1	5°33'37.61"	5°43'44.17"	Air, Noise, Soil
CP 2	5°33'37.35"	5°43'44.14"	Air, Noise, Soil
CP3	5°33'37.24"	5°43'44.19"	Air, Noise, Soil
CP 4	5°33'37.16"	5°43'44.11"	Air, Noise, Soil
CP 5C	5°33'37.44"	5°43'44.41"	Air, Noise, Soil (Control)
CP 6	5°33'37.81"	5°43'44.12"	Ground water
CP 7C	5°33'37.12"	5°43'44.26"	Ground water (Control)

11.0 REPORTING

The report to be prepared and submitted in the course of the project should include the following:

- ✚ Draft EIA Report; and
- ✚ Final EIA Report

These Reports shall be prepared in line with the FMEnv. requirements and its format and content should be as follows:

The contents and structure of the EIA will be as follows;

- ✚ List of Tables
- ✚ List of Figures
- ✚ List of Plates
- ✚ Acronyms and Abbreviations
- ✚ EIA Preparers
- ✚ Acknowledgement
- ✚ Executive Summary
- ✚ Chapter One: Introduction
- ✚ Chapter Two: Project Justification and Alternatives
- ✚ Chapter Three: Project and Process Description
- ✚ Chapter Four: Description of the Environment
- ✚ Chapter Five: Associated and Potential Impacts
- ✚ Chapter Six: Mitigation Measures
- ✚ Chapter Seven: Environmental Management Plan
- ✚ Chapter Eight: Decommission and Abandonment Plans
- ✚ Chapter Nine: Recommendation and Conclusion
- ✚ References
- ✚ Appendices

12.0 DELIVERABLES

-  Programme for Field Studies
-  Environmental Management Plan (EMP) that can be integrated within HSE-MS and ISO 14001
-  Draft EIA Report
-  Final EIA Report

13.0 CONSULTING TEAM

This EIA Study is being executed by CHEMTEK ASSOCIATES LIMITED. The Project Team is made up of competent and experienced consultants, with many years of expertise in their various field of expertise.

14.0 PROJECT TEAM

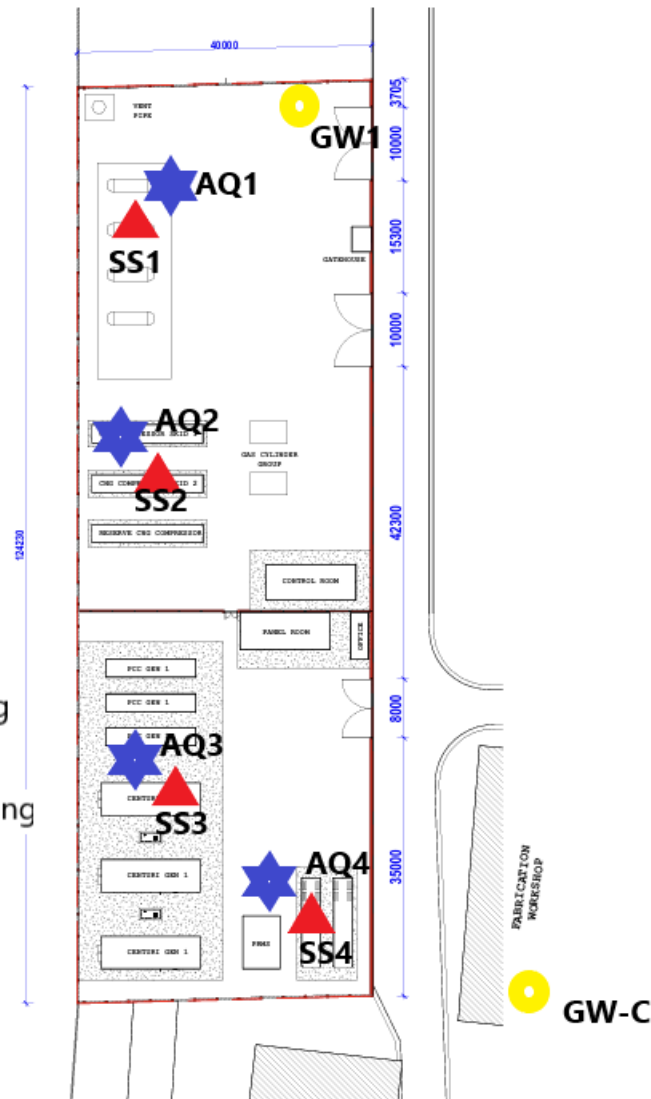
Project Team Members and their Roles

Project Co-ordinator	Chizoba Chinweze
Project Manager: Soil & Ecology	Chibuzo Uzoma
Air Quality, Noise, Climate and Meteorology	Samson Bello
Vegetation and Wildlife Ecology	Matthew Omoboriowo
Ground Water Studies & Microbiology	Jeremaih Ufot
Socioeconomic and Health Studies	Ejimovo Jideani

15.0 SAMPLING MAP



-  = Soil Sampling Pts
-  = Air Quality Sampling Points
-  = Groundwater Sampling Points

[illegible]

Appendix III

SOCIOECONOMIC IMPACT ASSESSMENT

COMMUNITY QUESTIONNAIRE

1. Enumerator: Date:

SECTION A: SETTLEMENT AND CHARACTERISTICS

2. Settlement Name: Community: LGA :

3. Ward: Constituency: Easting:E Northing: N

4. Date of Establishment:

5. Origin of Inhabitants (i.e. Clan Headquarters):

6. Rationale for Establishment :
.....

7. Estimated Population of Settlement:

8. Major Occupation of Inhabitants:

Occupation	Proportion
Fishing	
Farming	
Hunting	
Company Works	
Civil Service	

Occupation	Proportion
Services (Artisanship)	
Forestry	
Unemployed	

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9. Characteristics of Other Sister Communities

S/N	Settlement	Location/LGA	Population	2 Main Occupations

10. Traditional Administrative & Political Organisation and Structure (*w.s.r.t* age, sex, status, etc)

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SECTION B: ECONOMY

11. Industries / Companies in the Community

Company Name	Year Established	Ownership Structure	Nature of Activities	Staff Capacity	%age if Indigenes Employed

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12. Number of People Employed by the Industries / Companies

Category of Staff	Number		Category of Staff	Number		Category of Staff	Number
Labourers/Casual			Contractors				
Drivers			Lumberers				
Guards/Security			Senior Staffers				

13. Amenities provided by the Companies to the Community and Year

S/N	Amenities	Year of Provision	Current Status

14. Banking, Insurance and other financial Institutions in the Community, names and ownership

Institution	Year Provided	Ownership Structure	Nature of Activities	Current Status	Remark

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15. Average Income per annum from Major Occupation of Inhabitants :

Occupation	Income
Farming	
Hunting	
Company Works	
Civil Service	

Occupation	Income
Forestry	
Services (Artisans)	
Unemployed	

16. Nearest Markets

Name/ Location	Year Established	Marketing Duration	Articles sold by Inhabitants	Articles Bought by Inhabitants

SECTION C: HEALTH

17. Main Health Problems in the Community and Probable Causes

S/N	Health Problem	Average Number of Cases (1960-70, 70-80, 80-90, 90- 2000, 2000-Date)	Cause(s)	Remedial Action

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18. Health facilities in the Community, names and ownership structure

Facility	Year Provided	Ownership Structure	Nature of Activities	Current Status	Remark

19. Major means of Treating rampant Health Problems:

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20. Educational Institutions in the Community, names and ownership structure

Institution	Year Provided	Ownership Structure	Nature of Activities	Current Status	Remark

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21. Water Facilities in the Community, names and ownership structure

Facility	Year Provided	Ownership Structure	Nature of Activities	Current Status	Remark

22. Source of Energy/Electricity in the Community (Year Provided, Ownership Structure and Current Status)

23. Number of Residents having: Lorries () Cars () Motorcycles ()
 Bicycles () Generators () Radio () TV Sets ()

24. Proportion of People getting news from these sources

Media	%age		Media	%age		Media	%age
Newspapers/Magazine			Neighbours			Town Criers	
Radio			TV Set			Community Hall	
Churches/Mosques			Others (Spiritual)				

25. Rampant Criminal activities around and number of cases

Criminal Activity	1970 - 80	1980- 90	1990 - 2000	200 - 2005	Perceived Cause(s)	Remedial Action(s)

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26. Major Checks on the Criminal Activities

27. Major Traditional Heritage (e.g. Shrines, groves, festivals, gods/ goddesses, etc)

S/N	Name	Location	Significance	Follow- ership	Duration of Worship	Facilities for Worship

28. Had any of the cultural heritages been disturbed in recent times by operations (especially industry)? If yes, give details and the remedial actions taken

29. List of Associations / Clubs in the Community (e.g. social, occupational, etc)

S/N	Name	Location	Significance	Follow- ership	Duration of Worship	Facilities for Worship

30. What are your perceived positive impacts of the project in the area?

- (a)
- (b).....
- (c).....
- (d).....
- (e).....

31. What are your perceived negative impacts of the project in the area?

- (a)
- (b).....
- (c).....
- (d).....
- (e).....
- (f).....

32. Suggestions on how to abate the perceived impacts of the proposed project activities

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34. Free comments on the activities and impacts of neighbours and the Project in the area.

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35. Community requirements from the proponent for a sustainable implementation of the project . .

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36. Promises by the community to the proponent for a sustainable implementation of the project

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37. Any other information on the project

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APPENDIX 5: HOUSEHOLD SURVEY QUESTIONNAIRE

Household Name: _____ **Head of Household: Male () Female ()**

1. Sex: Male() Female()
2. Age of Respondent: ----- Years
3. Marital Status: (a) Single() (b) Married() (c) Widow/ Widower() (d) Divorcee()
4. Educational Status: (a) No formal education() (b) Less than Primary () (c) Primary School () (d) School Secondary() (e) Quranic School() (f) Others () (specify-----)
5. How long have you stayed in this Village? -----years
6. If not since birth, from where did you emigrate? -----
7. If not since birth, why did you immigrate? -----
8. Which Occupational Association do you belong to? -----
9. Which Social Association do you belong to? -----10.

Monthly income **N**-----

11. Sources of Income: (a) Primary ----- (b) Secondary ----- (c) Tertiary -----
12. Religion (a) Islam () (b) Christianity () (c) Others ()
13. Age Range of children

	< 5 yrs	5-15 yrs	16-25 yrs	> 25 yrs
Male				
Female				

14. Number of Children in school

	Primary	Secondary	Tertiary
Male			
Female			

15. What are your main occupations in order of significance?
- (a) Primary -----
- (b) Secondary -----
- (c) Tertiary -----
16. If married, tick the three main occupations of spouse (a) Primary -----
- (b) Secondary ----- (c) Tertiary -----
17. If you are engaged in any other occupation previously, what was the occupation? --

18. When did you leave the occupation? -----
19. Why did you change the occupation -----?
20. How many of the following have you
- (a) Number of Wives for male only () (b) Children () Houses ()
- Number Bicycles () Cars () Lorries () Canoes ()
- Number of Sheep () Goats ()
21. What percentage of household income is provided by:
- Father (%) Mother (%) Others (%)
22. Free comments on the observed impacts of the projects in this area and how to ameliorate them.