ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT
(ADDENDUM)

PROPOSED ACTIVE PHARMACEUTICAL INGREDIENT MANUFACTURING FACILITY - EFFLUENT TREATMENT PLANT, SAGAMU, OGUN STATE

SUBMITTED TO

FEDERAL MINISTRY OF ENVIRONMENT, ABUJA

DOCUMENT REVIEW

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List of Abbreviation

AoI	Area of Influence
API	Active Pharmaceutical Ingredient
ESIA	Environmental and Social Impact Assessment
BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
EPC	Engineering, Procurement and Construction
EMP	Environmental Management Plan
ETP	Effluent Treatment Plant
FMEnv	Federal Ministry of Environment.
GMP	Good Manufacturing Practice
GPS	Geographical Positioning System
HACCP	Hazard Analysis and Critical Control Point
HVAC	Heating, Ventilation and Air Conditioning
HSE	Healthy Safety & Environment
HUB	Hydrocarbon Utilizing Bacteria
HUF	Hydrocarbon Utilizing Fungi
IFC	International Financial Cooperation
ITCZ	Inter Tropical Convergence Zone
LGA	Local Government Area
mg/l	Milligram Per Litre
mg/kg	Milligram per kilogram
ND	Not Detected
NAFDAC	National Agency for Food, Drug Administration and Control
NOx	Oxides of Nitrogen
NPC	Nigerian Population Commission
PAP	Project Affected Person
ppm	Parts Per Million
PMU	Project Management Unit
RAM	Risk Assessment Matrix
SPM	Suspended Particulate Matter
TDS	Total Dissolved Solid
TOC	Total Organic Content
TOR	Terms of Reference
THB	Total Heterotrophic Bacteria
THF	Total Heterotrophic Fungi
TPH	Total Petroleum Hydrocarbon
WHO	World Health Organization
VOC	Volatile Organic Compounds

EXECUTIVE SUMMARY

Background and Introduction

An active pharmaceutical ingredient (API) is the part of any drug that produces the intended effects which are responsible for its therapeutic effect. In Nigeria, nearly all of the local drug manufacturers rely heavily on the importation of active pharmaceutical ingredients (API) from overseas manufacturers, chiefly China and India to formulate the API's into finished drugs. This means that they are limited to purchasing drugs and repackaging them for use. Also, it is generally accepted that the main route for human pharmaceuticals to the aquatic environment is via sewage treatment plants receiving wastewater from households and hospitals. The release of pharmaceuticals from sewage effluents to rivers and lakes is an issue of growing concern. Drugs are frequently detected in effluents at levels from below 1 ng/L up to a few g/L. The pharmaceutical industry generates lots of waste water during the production or formulation of medicines. So, it is very important to convert the waste water into a useful water. Notwithstanding, there are manufacturing companies such as Emzor pharmaceuticals Industries Limited still actively involved in the manufacturing of drugs such as analgesics, antimalarial, antibiotics, antiretroviral and vitamins including tablets, capsules and syrups and they are committed to conduct their operations in compliance with good principles of environmental management and sustainable development.

Emzor Pharmaceutical Industries Limited, a private indigenous pharmaceutical manufacturing group in Nigeria with a mission to develop an API Manufacturing Plant and Effluent treatment plant (ETP) which will be used to locally manufacture and distribute APIs for the treatment and prevention of malaria and the ETP will be used to treat the waste water generated from the API plant. This Facility will be a world class infrastructure in Sub-Sahara Africa designed for the production of the following APIs:

- Artemether and Lumefantrine,
- Sulfadoxine and Pyrimethamine.

Emzor is committed to carrying out all its activities in line with established local and international health, safety and environmental best practices framework and regulations. On this basis Emzor had initially carried out an Environmental Impact Assessment (EIA) and received approval for the development of its pharmaceutical manufacturing plant in 2012. However, owing that the proposed API manufacturing plant and the Effluent Treatment plant (ETP) was not scoped as part of the 2012 EIA and also presents some important environmental and social aspects, there was the need to carry out additional impact assessment for the API & ETP Plant development. Thus, Emzor has commissioned an ESIA Addendum for the proposed API-ETP manufacturing plant.

AquaEarth Consulting a leading environment, sustainability, climate change and geosciences advisory firm has carried out the ESIA on behalf of Emzor Pharmaceutical Industries Limited. The assessment has been carried out in line with the following established Environmental best practices, frameworks and regulations:

- Environmental Impact Assessment Act 86 of 1992 now EIA CAP E12 LFN 2004
- European Investment Bank Environmental and Social Standard
- IFC Performance Standards on Environmental and Social Sustainability, 2012

This ESIA Addendum has provided access to the environmental and social impacts of the API-ETP manufacturing plants construction, operation, and future decommissioning on the surrounding environment. Overall, the findings of the impact assessment indicate that the project has no insurmountable impacts; however, the significant impacts identified have been adequately mitigated within the context of a comprehensive environmental and social management plan (ESMP) attached to this report as chapter seven.

Impact Summary

This section highlights some of the major impacts of the project on the environment. Though impacts related to soil disturbance, erosion, flora and fauna, ecosystems services, amongst others having been accessed in the main body of the report but are not deemed significant for inclusion in the summary provided below.

The mitigation, management and monitoring of these impacts have been fully covered in the standalone ESMP included as **section seven** of this report.

Air Quality and Noise

Air quality impacts as treated within the scope of this study are basically associated with the listed emissions below:

- Dust generated by heavy machinery and automobiles during site preparation and construction.
- VOC emissions from mixing, compounding, granulation, and formulation (using ethanol or isopropyl alcohol) involving solvents (granulation)
- There is an expected increase in noise level associated with heavy duty equipment (• During construction as well as continuous operations of manufacturing equipment such as compressed air, vacuum sources, and ventilation systems during operations.
- Fugitive emissions from reactor vents, tanks, pumps, and filtering systems used in the separation of chemical compounds and raw materials
- Incremental exhaust gas emissions caused by the combustion of cumulative 4MW gas generators, backup diesel generators, and installed turbines, boilers, compressors, pumps, and other power and heat generation engines
- Noise from generator sets and other machinery

Hazardous chemicals and Oil leaks and spills

- Oil spills might occur during storage of diesel within the generator house as a result of corrosion of the storage material/tanks, during maintenance activities of equipment, vehicles and generators.
- Generation of spent solvents, reactants, spent acids, bases, aqueous or solvent liquors, still bottoms, cyanides and metal wastes in liquid or slurry form, as well as filter cakes which may contain inorganic salts, organic by-products and metal complexes
- In addition, the storage and management of the active chemicals might present potential leakages and spills which might result in perturbation of soil and likely groundwater.

Solid Wastes

- Generation of residual waste especially during fermentation and natural extraction.

- Generation of domestic wastes e.g. food waste, paper, plastic etc. during operation and construction process
- Other sources of hazardous or potentially hazardous wastes include raw materials packaging waste, used air filter media, off-spec and expired products, laboratory wastes, sludge from the wastewater treatment process, and collected particulate from air pollution control systems

The handling, management and disposal of all solid waste generated during the project construction and operation is critical to reducing the potential impacts of solid wastes of the environment.

Liquid Waste

Emzor has simultaneously planned to construct an API-ETP (Effluent treatment plant) for the purpose of treating liquid waste within its facility while considering a dry process in long-term. Therefore, no discharge of waste water into the environment.

The main conventional pollutants of concern in these wastewater streams from primary manufacturing (e.g. fermentation, chemical synthesis, crystallization, purification, and biological / natural extraction. On this project,

Occupational Health and Safety

Heat

The use of large volumes of pressurized steam and hot water are typically associated with fermentation and with compounding operations representing potential for burns due to exposure to steam or direct contact with hot surfaces as well as heat exhaustion.

Chemicals

- Inhalation of VOC from recovery, Isolation and extraction activities.
- Exposure of workers airborne dusts during dispensing, drying, milling and mixing operations.

Fire and Explosions

- Fire and explosion hazards may arise during solvent extractions.
- Organic synthesis reactions have the potential to cause explosions and fire.

Accident

- Increased chances of fatal accidents may occur during excavation on site,
- Increased probability of accident on the highway due to increase in transit during construction, installation /operation of equipment.
- Accidental spillage from handling of chemicals
- Slips and trips from height during construction.

Community Health and Safety

The most significant community health and safety hazards associated with pharmaceutical and biotechnology manufacturing facilities occur during the operation phase and may include the threat from major accidents related to the aforementioned fires and explosions at the facility and potential accidental

releases of finished products during their transport outside of the processing facility.

- Significant exposures to workers and surrounding communities from handling and storage of solid, liquid, and gaseous substances.
- Additional risks of traffic congestion along community routes.
- Risks of vehicular knock down of community pedestrians leading to injuries and or fatalities along the Sagamu expressway

Socio-economic

At the time of the ESIA, approximately 30-50 people were engaged in the existing EMZOR facility for both skilled and unskilled operations.

- It is expected that once the API-ETP facility is operational, the percentage of skilled and unskilled workers will rise by 30%, creating job opportunities for Sagamu residents as well as attracting international skilled workers.
- Increased economic gains for investors and project owners, revenue for state and federal governments through taxes, and overall economic standing of host and affected communities as a result of installed infrastructure and facility operation
- A positive contribution to regional health and malaria epidemic control, which will be enhanced by the development and operation of the required active pharmaceutical ingredient manufacturing plant in Nigeria. As a result, we will be able to bridge the gap in our absolute reliance on imported APIs for local manufacturing of anti-malaria drugs.

Environmental and Social Management Plan

To manage and monitor the effectiveness of the mitigation measures proposed in response to the impacts associated with the development and operation of the API-ETP manufacturing plant, a robust ESMP has been developed. This ESMP can be used as a stand-alone document to manage the project's associated, residual, and cumulative impacts.

The key elements/scope of the ESMP are highlighted below
Environmental and social management Organogram

- Trainings and awareness
- Emergency preparedness and response
- Waste management plan
- Audits and monitoring
- Environmental and social action plan
- Budget
- Stakeholders engagement and grievance redress management
- Decommissioning and abandonment.

Conclusion and Recommendation

In summary, the project is expected to spur numerous positive impacts including creation of employment opportunities, advancement in the pharmaceutical manufacturing industry, increase in revenue for the project developers, state government and federal government amongst others. It is therefore inferred that the magnitude and significance of the project positive impacts outweigh the totality of the associated

adverse impacts that will be effectively managed under the ESMP.

Consequently, it is suggested that this ESIA is in accordance with established national and international guidelines on environmental and social management because it has adequately assessed and mitigated the environmental and social impacts associated with the proposed API-ETP manufacturing plant.

CHAPTER ONE
INTRODUCTION

1.0 Background

An active pharmaceutical ingredient (API) is the part of any drug that produces the intended effects which are responsible for its therapeutic effect. In Nigeria, nearly all of the local drug manufacturers rely heavily on the importation of active pharmaceutical ingredients (API) from overseas manufacturers, chiefly China and India to formulate the API's into finished drugs. This means that they are limited to purchasing drugs and repackaging them for use. Notwithstanding, there are manufacturing companies such as Emzor pharmaceuticals Industries Limited still actively involved in the manufacturing of drugs such as analgesics, antimalarial, antibiotics, antiretroviral and vitamins including tablets, capsules and syrups.

Also, it is generally accepted that the main route for human pharmaceuticals to the aquatic environment is via sewage treatment plants receiving wastewater from households and hospitals. The release of pharmaceuticals from sewage effluents to rivers and lakes is an issue of growing concern. Drugs are frequently detected in effluents at levels from below 1 ng/L up to a few g/L. The pharmaceutical industry generates lots of waste water during the production or formulation of medicines. So, it is very important to convert the waste water into a useful water. Notwithstanding, there are manufacturing companies such as Emzor pharmaceuticals Industries Limited still actively involved in the manufacturing of drugs such as analgesics, antimalarial, antibiotics, antiretroviral and vitamins including tablets, capsules and syrups and they are committed to conduct their operations in compliance with good principles of environmental management and sustainable development.

The challenge to fully navigate the difficulties and gap of accessing API's present a business, health and pharmaceutical sector growth opportunity. One of the major reason why Emzor Pharmaceutical Industries Limited, a private indigenous pharmaceutical manufacturing group in Nigeria with a mission to produced and provide quality and affordable healthcare has proposed to develop an API Manufacturing Plant and Effluent treatment plant (ETP) which will be used to locally manufacture and distribute APIs for the treatment and prevention of malaria and the ETP will be used to treat the waste water generated from the API . This Facility will be a world class infrastructure in Sub-Sahara Africa designed for the production of the following APIs:

- Artemether and Lumefantrine,
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AquaEarth Consulting a leading environment, sustainability, climate change and geosciences advisory firm has carried out the ESIA on behalf of Emzor Pharmaceutical Industries Limited. The assessment has been carried out in line with the following established frameworks and regulations:

- Environmental Impact Assessment Act 86 of 1992 now EIA CAP E12 LFN 2004
- European Investment Bank Environmental and Social Standard
- IFC Performance Standards on Environmental and social sustainability, 2012

1.1 Project Location

The facility is situated within the premises of Emzor Pharmaceuticals Industries Limited located at Sagamu/Benin expressway, Makun, Sagamu Local Government Area of Ogun State, Nigeria with geographic coordinates of N6.878733, E3.593607. The site lies on a relatively flat piece of land with an average elevation of 90m above the mean sea level.The total land area for the API facility is about 10 hectares. Access to the project site is through Lagos/Sagamu road, via Lagos-Ibadan expressway. The host community is Makun, Sagamu LGA

The site is a green field with no developments around it. There is no known critical habitat andprotected area within 5km radius of the development

Figure 1.1: Satellite Image of the Proposed API-ETP Facility

Figure 1.2 Aerial Drone View of the Proposed API-ETP Facility

1.2 ESIA Objectives

The main objectives of this ESIA are to identify the impacts and risks from the development and associated activities, ensure compliance with statutory environmental laws and regulations and the EIB Standards requirements, and recommend appropriate measures that will mitigate the potential negative impacts as well as enabling a rational decision to be made regarding the operations and management of the project.

The objectives of this EIA are as follows:

- Establish the existing biological, physical, social and economic conditions of theproject area
- Characterize the environment thereby identifying the resultant hazards (including Social) associated with the distribution line;
- Identify and predict the positive and or negative impacts likely to result from the project construction and operational phases;
- Proffer measures to enhance the positive impacts and minimize the unavoidablenegative impacts of the project on the entire ecosystem;
- Develop a feasible and cost-effective Environmental and Social Management Plan (ESMP) to
- manage and monitor the environmental parameters throughout the lifecycle of the project;

This ESIA study will further present ways to mitigate, prevent, minimize and/or manage potential significant negative impacts resulted from proposed development.

1.3 Proponent

Emzor pharmaceutical Limited is a private indigenous pharmaceutical manufacturing group and a Pan-African Distributor of world-class medicine, surgical equipment and medical supplies incorporated in Nigeria, in 1984. The company is committed to manufacturing pharmaceutical and healthcare products that always exceed the expectation of her stakeholders.

Emzor Pharmaceutical Industries Limited started pilot production in 1985. By 1988, it had become an

established pharmaceutical manufacturing company especially with the introduction of Emzor paracetamol. In April 1999, an extension to the Isolo (Lagos) factory was commissioned. From the humble beginning of four (4) production line in 1987, the company now manufactures over 140 high-quality pharmaceutical products and medical consumables including analgesics, vitamins, haematinics, anti-malarials, anti-tussives, antibiotics, anti-helmintics, anti-histamine, antacid, and cardio-protective drugs. With factories located at Ajao, Richfield, and Sagamu.

The company's corporate headquarters is located on plot 3c Block A, Aswani Market Road,oshodi/Isolo Expressway Lagos. The factory is registered with the Federal Ministry of Health. The proposed new project will produce high quality active pharmaceutical ingredients in drugs that will meet international standards at affordable and competitive prices.

1.4 Assessment Methodology

This section highlights the approach in conducting the environmental and social assessment. Using information gathered from field activities and supplemented with information provided by Emzor and also desktop research informed the development of an Environmental and Social Management Plan (ESMP) included in section seven. The scope of work involves the following:

Desktop Review

Desktop and onsite based reviews to verify information, and gaps related to the project. A technical information request sheet was sent out to the project proponents. The data used for developing this report can be categorized into primary and secondary data, below,

- Secondary data: -Published books, documents from Emzor, plans, reports, and documentation from members of the project team.
- Primary data: -Formal/informal interviews, pictures and field observation.

Site Reconnaissance Visit

Reconnaissance field visit was made to the proposed project location on 5th of July 2021 prior to field investigation. The E&S team conducted a walkthrough of the proposed API-ETP facility. During the visit, visual observations were made to identify and record important environmental features, while potable camera devices were used to capture ground level photographs within and around the proposed project locations, the information gathered during the visit was synthesized to design the field observation and sampling strategy.

Field Data Gathering

Field data for characteristics were collected on 6th of July 2022 at the proposed land for the API project at Sagamu, Ogun State. Field studies involved quantitative sampling as well as a recording of observations of the environmental components of the study area within the project's area of influence. The environmental components investigated included; noise, air quality, groundwater quality, soil, and land use while the socio aspect entails the socio economics, cultural background, heath survey, population, ethnicity, religion etc. of the host community. All sampling locations were geo-referenced using a handheld Global Positioning System (GPS).

Reporting

AquaEarth reviewed all documentation to close out any information gap identified with consideration to conformance with the requirements of the European Investment Bank ESS IFC Performance Standards and as well as other national standards and guidelines.

1.5 Project Description &Context

The proposed facility involves the development of an Active Pharmaceutical Ingredient (API) Facility for the production of antimalarial prototypes, the main raw material in the production of finished pharmaceutical products. The production of 4 antimalarial API (Artemether, Lumefantrine, Sulfadoxine, Pyrimethamine) will be done.

The API Facility will be located in the company's existing premises with total land area of about 10 hectares and its purpose will be to manufacture active ingredients from raw materials through both chemical and physical means. The facilities involved are

a) Main Plant Manufacturing Building,
b) Reception/security/canteen Building,
c) Quality Control Laboratory Building,
d) Utility/Engineering Building,
e) Warehouse Building,
f) Solvent Storage Tanks/Yard
g) Effluent Treatment Plant.

The major source of water supply for the construction of the facility will be borehole water (potable) & secondary treatment for purified water. A Zero Liquid Discharge (ZLD) ETP is planned with solid waste to be incinerated (dried from sludge). The number of employees during Construction phase will be about 30-35 of both skilled and unskilled labor, while during the Operations phase the number of employees will be at full capacity of 150-200 persons. The only source of power for the proposed facility will be an existing gas power plant with a capacity of 12MW (alongside an 800KVA diesel generator set as an emergency backup).

1.6 Applicable Statutory (Legal & Administrative) Framework

There are number of regulations that are pertinent to this project. A brief description of the policies is given below:

Table 1.1 Summary of Key Applicable National and State Regulations

Regulations/ Institutions	Summary Requirements/Provisions/Stipulations	Year
Federal Ministry of Environment (FMEnv) administers and enforces environmental laws in Nigeria. It took over this function in 1999 from Federal Environmental Protection Agency (FEPA) Act.	The following regulations were made pursuant to the FEPA: • National Environmental Protection (Effluent Limitation) Regulations: • National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Wastes) Regulations; and • National Environmental Protection (Management of Solid and Hazardous Wastes) Regulations.	1991
National Guidelines on Environmental Management Systems	Stipulates guidelines and procedures for establishing and implementing an environmental management system in Nigeria	1999

Federal Ministry of Environment EIA Act 86 of 1992 CAP E12 L.F.N. 2004	The policy states that it is mandatory for all new major public and private projects to carry out EIA before embarking on any project or activity. It generally seeks to promote good environmental practice through environmental awareness and education. Other objectives include: • consider the likely impacts, and the extent of these impacts on the environment before embarking on any project or activity; all laws and decision-making processes through which the goal of this Act may be realized and • encourage the development of procedures for 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 • promote the implementation of appropriate policy in all Federal Lands	2004
National Environmental Protection (Effluent Limitations) Regulations (5.1.8) of 1991	• This regulation makes it mandatory for industries generating wastes to install anti-pollution and pollution abatement equipment on site. The regulation is specific to each category of waste generating facility with respect to limitations of solid and liquid discharges or gaseous emissions into the ecosystems. Appropriate penalties for contravention are also specified in the regulation	1991
National Environmental Protection (Pollution Abatement in Industries Producing Waste) Regulation (5.1.9) of 1991	• The National Environmental protection (Pollution Abatement in Industries Producing Waste) Regulation of 1991 regulates the release of toxic substances, requirement for pollution monitoring unit, machinery for combating pollution and contingency plan by industries. It also provides that industries producing wastes should submit lists and detailsof chemicals used by such industries to FMENV as well as permissible limits of dischargeinto public drains.	1991
National Agency for Food and Drug Administration and Control Act Cap N.1 Lfn 2004	The Agency shall have the following functions, that is, to- • Regulate and control the importation, exportation, manufacture, advertisement, distribution, sale and use of food, drugs, cosmetics, medical devices, bottled water and chemicals; • Conduct appropriate tests and ensure compliance with standard specifications designated and approved by the Council for the effective control of the quality of food, drugs, cosmetics, medical devices, bottled water and chemicals and their raw materials as well as their production processes in factories and other establishments; • Undertake appropriate investigations into the production premises and raw materials for food, drugs, cosmetics, medical devices, bottled water and chemicals and establish relevant quality assurance systems, including certificates of the production sites and of the regulated products; • Compile standard specifications and guidelines for the production, importation, exportation, sale and distribution of food, drug, cosmetics, medical devices, bottled water and chemicals; undertake the registration of food, drugs, cosmetics, medical devices, bottled water and chemicals; • Undertake measures to ensure that the use of narcotic drugs and psychotropic substances are limited to medical and scientific purposes; • Grant authorization for the import and export of narcotic drugs and psycho- tropic substances as well as other controlled substances; • Collaborate with the National Drug Law Enforcement Agency in measures to eradicate drug abuse in Nigeria	2004

National Environmental (Chemicals, Pharmaceuticals, Soap and Detergent Manufacturing Industries) Regulations, S. I. No. 36, 2009.	• The aim of these Regulations is to avoid and limit pollution in the Nigerian environment from all operations and auxiliary activities in the Sector. • Ensure every facility shall plan and set up machinery for combating pollution hazards and maintain equipment in the event of an emergency. • Ensure the implementation of cleaner production processes and pollution prevention measures to yield economic, social and environmental benefits. • Ensure No Facility discharges effluent onto land, into a water-course or into a water body unless the facility ensures that the parameters of the effluent do not exceed the permissible regulatory limits.	
National Policy on Environment	• Restore, maintain and enhance the ecosystems and ecological process essential for the functioning of the biosphere to preserver biological diversity and to promote the principle of optimum sustainable yield in the use of their natural resources and ecosystem. • Raise public awareness and promote understanding of essential linkages between environment and development and to encourage individual and community participation in environmental improvement efforts.	1989
Ogun State Environmental Management (Miscellaneous) Provisions Law, 2004	This law was enacted and signed by the State's House of Assembly and the Governor respectively in the year 2004. Sections 3 and 4 of the law, states in clear terms, the functionand powers of the Ministry of Environment. According to the sections: • The Ministry shall be responsible for administering the provisions of this law and for ensuring within the State, the protection, maintenance and development of the environment, environmental technology and initiation of policy in relation to environmental research and technology; • The Ministry shall formulate and enforce policies, statutory rules, and regulations on waste collection and disposal, general environmental protection, control and regulationof 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; • Establish and take measures to ensure effective environmental structures in the in the State for flood and erosion control, solid and liquid waste collection and disposal, water and air pollution eradication, noise control and general sanitation; • Initiate appropriate policy action on the environment impact implications of environment related activities; • Initiate measures to ensure pollution free air, water and land throughout the State and take steps to obviate, mitigate or eliminate environmental discomfort to individual or groups, or danger to lives and properties; • Establish such environmental criteria, guidelines, specifications or standards for the protection land, water and air as may be necessary to protect to protect the health and welfare of the population from environmental degradation; • Establish such procedure for industrial or agricultural activities in order to minimize damage to the environment from such activities	2004

1.7 International Conventions, Guidelines and Protocol

For the purpose of this project, our key reference is the IFC performance and European Investment Bank Environmental and Social Standard. They are further presented in the table below:

Table 1.2: EMZOR API Project and EIA Alignment/Compliance to the European Investment Bank E&S Standards.

Performance Standard	Key Requirement	Project/ESIA Compliance to the Requirements
ESS 1-Environmental and Social Impact Assessment & Risks	Environmental and Social Impact Assessment and risks	EMZOR has commissioned this ESIA Addendum as a decision-making tool for assessing environmental and social impacts of the API project on the environment. This ESIA examines the environmental and social impacts and seek opportunities to enhance the positive impacts of the project. This is the Draft ESIA Addendum
	Stakeholders Engagement	During the field data gathering, there was a consultation with some of the host communities to take their opinion on the project. Stakeholders engagement is a continuous process, this will continue throughout the life span of the project.
	Environmental and social risks management	Environmental and social risks have been identified (Chapter 5) and mitigation measures have been recommended in (Chapter6). While Chapter 7 documents a comprehensive EMP that could be used as a stand-alone document to guide the project's life cycle implementation.
	Organization, Capacity and Competency	EMZOR has established organizational structure and assigned roles and responsibilities to personnel to implement the ESMS. The existing facility has HSE officers in place and a good management system that will be carried forward to the API facility.
ESS 2- Stakeholders Engagement	Engagement planning	During the field data gathering, there was a consultation with some of the host communities to take their opinion on the project. Stakeholders engagement is a continuous process, this will continue throughout the life span of the project
	Identification and Analysis of Stakeholders	The federal government, both state governments and the community that would be affected have been identified and consulted and this would continue throughout the lifecycle of the project The principle of free prior and informed consent (FPIC) amongst other tools was utilized for all round stakeholder's engagement.
ESS 3 – Pollution Prevention & Resource Efficiency	Pollution prevention and Management	The EIA has identified likely pollution sources (construction debris, workers camp domestic wastes, etc) in chapter 5 and also documented mitigation measures for pollution impacts in chapter 6 & 7. Furthermore, the waste management plan detailing pollution and waste sources has been detailed in this report
	Waste Management	A standalone Waste Management Plan has been affixed to this report in Appendix 2
ESS 4 – Biodiversity & Ecosystem	Modified Habitat	The associated and potential impacts on natural and modified habitats as well as biodiversity resources will be limited to vegetation clearing along of about 10 hectares only.
	Natural Habitat	N/A

	Critical Habitat	
ESS 5 – Climate Change	GHG Emissions	An evaluation of likely GHG emissions / aspects do not suggest that the expected GHG emissions associated with the project will be insignificant.
ESS 6 – Involuntary Resettlement	Project Design	The project design has considered ways to avoid physical or economic displacement
	Displacement/Resettlement	There will be no form of displacement either physical or economic e as the proposed site is situated inside the existing EMZOR facility
ESS 7 – Vulnerable groups	Stakeholders engagement	As at time of this exercise, all groups have been identified and engaged.
	Free, prior and informed consent	The principle of free prior and informed consent (FPIC) amongst other tools was utilized for all round stakeholder's engagement
ESS 8 – Labour Right	Child /Forced labour	Emzor has an existing labour management framework that covers all the existing project and this will be carried forward to the API-ETP facility. Also, EMZOR does not employ the use of child or forced labour on any of its facility.
	Migrant workers	
ESS 9 – Healthy, Safety and Security	Community exposure to disease and safety	This EIA has also documented key aspects of community health and labour conditions. It suggests the use of existing Emzor Environment and Social Management System are in line with community, health, safety and security policy. And an Appropriate HSSE plan will be developed before operation on the API-ETP plant commences.
	Emergency Preparedness and Response	Emergencies are expected especially during the construction and operation phase of the project. These emergencies may be related to worker's safety, health and security. As part of the impacts related to such emergencies the ESIA has recommended the development of a robust emergency preparedness and response plan by the EPC before construction and during operation by the HSE officer.
ESS.10.-. Cultural Heritage	Legally protected cultural heritage area	N/A
	Chance find procedure	
ESS 11 – Intermediate Finance	Micro finance	N/A
	Equity Funds	

Table 1.3: EMZOR API Project and EIA Alignment/Compliance to the International E&S Frameworks

Performance Standard	Key Requirement	Project / ESIA Compliance or Alignment to the Requirements
PS 1- Assessment and Management of Environmental and Social Risks and Impacts	Environmental and Social Impact Assessment and risks	EMZOR has commissioned this ESIA as a decision-making tool for assessing environmental and social impacts of the API project on the environment. This ESIA examines the environmental and social impacts and seek opportunities to enhance the positive impacts of the project.
	Management Program	A robust Environmental management plan addressing all residual impacts from the project activities phases have been documented for implementation as a standalone document in chapter 5 of this ESIA. More so, useful management frameworks to guide the execution of these proposed project have also been documented for implementation. The frameworks cover the necessary aspects of concern on the social and environmental receptors
	Organization, Capacity and Competency	EMZOR has established organizational structure and assigned roles and responsibilities to personnel to implement the ESMS. The existing facility has HSE officers in place and a good management system that will be carried forward to the API facility.
	Emergency Preparedness and Response	Emergencies are expected especially during the construction phase of the project. These emergencies may be related to worker's safety, health and security. As part of the impacts related to such emergencies the ESIA has recommended development of a robust emergency preparedness and response plan by the EPC before construction despite the typical emergency response procedure documented in chapter 6 of the ESIA report. It is expected that the EPRP developed by EPC will address both workers and communities, roles, procedures, drills and documentation for effective emergencies management.
	Monitoring and Reviews	This ESIA has recommended continuous monitoring and reviews of all plans and activities, mitigation measures implementation as documented in the EMP and management frameworks to ensure their effectiveness or need for fresh timely and appropriate corrections.
	Stakeholders Engagement	A stakeholder's engagement framework is being carried out for the project by AquaEarth Consulting, this has been attached as appendix as 4
PS 2 – Labour and Working Conditions	Working conditions and worker relationships	EMZOR shall commission the EPC who shall in turn document a comprehensive human resources manual as prescribed by this ESIA in the EMP. The manual alongside the Occupational Health and Safety (OHS) policy shall guide working conditions and workers' relations.
	Child Labour/ Forced labour	The conditions of service, code and conducts and other labour management hallmarks such as prohibition to child labour, prohibition to forced labour,

		gender-based violence and equal opportunities, wokers health and safety, workers health insurance and compensation etc. is in place at the existing facility and this will also be used by the new facility.
	Non-discrimination and equal opportunities Occupational Health and Safety	The documented Human resources manual and OHS policy shall clearly state the non-discrimination clause and allow equal opportunities for all workers on the project. The conditions of service, code and conducts and other labor management hallmarks such as prohibition to child labour, prohibition for forced labour, gender-based violence and equal opportunities, workers health and safety, workers health insurance and compensation etc. will be entrenched in an employee handbook or human resources manual etc.
	Supply chain	This ESIA has documented that the project owner EMZOR shall ensure total compliance to the Nigerian Labour Content in contracting for the project construction and installation as well as during its operations and maintenance phases. Emzor will ensure that contractor/third party will not engage in child labor or forced labor. The code of conduct will be given for them to sign
PS 3 – Resource Efficiency and Pollution Prevention	GHG Emissions	An evaluation of likely GHG emissions / aspects do not suggest that the expected GHG emissions associated with the project will be insignificant.
	Resource Efficiency	Preliminary information suggests that the average water consumption during construction works is estimated at about 7,000 liters per day and during water intensive works such as concrete mixing it will use about 14,000 liters. This volume of water is expected to be sourced from the existing borehole in the facility and is not expected to significantly impact the aquifer volume around the area. Other expected resources to be utilized by the project includes sand for making blocks. This material is in abundance quantities and it is not expected to affect the sustainability of the resources.
	Pollution Prevention	The ESIA has identified likely pollution sources (construction debris, workers camp domestic wastes, effluents, air emission etc.), Emzor has an existing waste management procedure and this procedure will be carry forward into the new project. We have documented a concise Mitigation measures for pollution impacts in chapter 5.
	Hazardous materials	A waste management plan detailing the inventory of potential waste streams, likely quantities, management of hazardous waste and types during

		site preparation and construction has been proposed to be developed for this facility.
PS 4 –Community Health, Safety and Security	Community exposure to disease and safety	This ESIA has also documented key aspects on community health and labour conditions. It suggests the Contractor develops and implement a robust OHS and Human resources manual to effectively manage labour and workers' health and safety issues that may arise during the course of the project life.
	Emergency Preparedness and Response	Emergencies are expected especially during the construction phase of the project. These emergencies may be related to worker's safety, health and security. As part of the impacts related to such emergencies the ESIA has recommended development of a robust emergency preparedness and response plan by the EPC before construction despite the typical emergency response procedure documented in chapter 6 of the ESIA report. It is expected that the EPRP developed by EPC will address both workers and communities, roles, procedures, drills and documentation for effective emergencies management.
	Ecosystem Services	The ecosystem services were assessed during biodiversity survey carried out as part of the ESIA baseline study through project area walk – through.it was observed that the project area is an industrialized area and based on IFC requirement the project is not situated around wetlands, mangroves or an upland forest.
	Hazardous materials	Emergencies are expected especially during the construction phase of the project. These emergencies may be related to worker's safety, health and security. As part of the impacts related to such emergencies the ESIA has recommended development of a robust emergency preparedness and response plan by the EPC before construction despite the typical emergency response procedure documented in chapter 7 of the ESIA report. It is expected that the EPRP developed by EPC will address both workers and communities, roles, procedures, drills and documentation for effective emergencies management.
PS – 5 Land Acquisition and Involuntary Resettlement	Project Design	EMZOR shall consider feasible alternative project designs to avoid or minimize physical and/or economic displacement, while balancing environmental, social, and financial costs and benefits, paying particular attention to impacts on the poor and vulnerable in the comprehensive ESIA Report

	Displacement Resettlement	There will be no form of displacement either physical or economic during the project lifecycle as the proposed and is situated inside the existing EMZOR facility
PS 6 –Biodiversity Conservation and Sustainable Management of Living Natural Resource	Modified Habitat	The associated and potential impacts on natural and modified habitats as well as biodiversity resources will be limited to vegetation clearing along of about 10 hectares only.
	Natural Habitat Critical Habitat	N/A
	Invasive Alien Species	N/A
	Legally protected area	There are no protected areas around the project area.

1.8 Report Structure

This report has been structured into the following chapters below:

Chapter	Title	Details
Peripherals		Cover page, Document control page, Table of Contents,
		Executive Summary
Chapter One	Introduction	This chapter introduces the project, its location and proponent. It also highlights the structure of the report. The policy, legal and administrative framework guiding the study and the Limitations
Chapter Two	Project Justification	This highlights the needs, benefit and sustainability of the project.
Chapter Three	Project Operations/Description	Overview of facility/project, facility design, facility management organogram, operations flow process and waste streams.
Chapter Four	Overview of Existing Environment	This chapter describes the existing biophysical and social Environment of the project area. The data for the baseline description have been sourced primarily from field sampling and literature review
Chapter Five	Environmental & Social Impact Assessment	This chapter assesses potential impacts of the API facility by evaluating the interaction of elements of project activities against existing environmental
Chapter Six	Mitigation Measures	
Chapter Seven	Environmental & Social Management Plan	The ameliorative (mitigation) and enhancement measures put in place for adverse and positive impacts of the project are contained in this section
Chapter Eight	Decommission	This chapter discusses overall justification for implementation of the project. Explanation of how, adverse effects have been Mitigated
Chapter Nine	Conclusion and Recommendations	
References		References made in the report and other supporting documents reviewed during the assessment are presented in the list of References.
Appendices		A comprehensive list of technical and non-technical annexes tothe report is affixed in this section.

CHAPTER TWO
PROJECT JUSTIFICATION

2.0 General

In Nigeria, nearly all of the local drug manufacturers rely heavily on the importation of active pharmaceutical ingredient from China and India to formulate the API's into finished drugs. This means that they are limited to purchasing drugs and repackaging them for use. Notwithstanding, there are manufacturing companies such as Emzor pharmaceuticals Industries Limited still actively involved in the manufacturing of drugs such as analgesics, antimalarial, antibiotics, antiretroviral and vitamins including tablets, capsules and syrups.

2.1 Need for project

Especially in a developing country like Nigeria which imports all its active pharmaceutical ingredients used in the manufacturing of medicinal drugs for quality healthcare. As a result of the restriction caused by the covid19 lockdown, and the restrain it created on the importation of medicinal drugs needed for healthcare. Emzor pharmaceutical decided to construct an API-ETP manufacturing facility, which will be used to locally manufacture and distribute APIs for the treatment and prevention of malaria in Nigeria and as an export commodity to other African nations. Which will also serve as a source of revenue for state and federal government

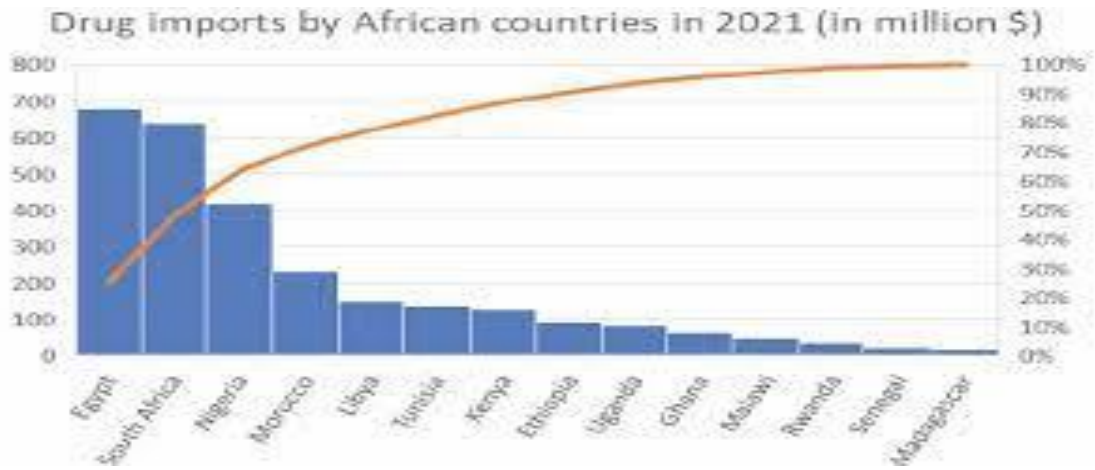

Figure 2.1 Drugs Importation to Nigeria

Source: The Punch Nigeria

2.2 Benefits of the project

The proposed project benefits include improved efficiency of healthcare services provided within the state and the nation. It also brings about an opportunity for growth both in terms of building skilled human capital, profit for the proponent and as a source of revenue by remitting income tax to the government.

2.2.1 Optimization of the Project Site

Emzor has an existing facility situated within the Ogun State business park acquisition, 200 meters away from Shagamu/Benin expressway, Makun, Shagamu Local Government Area of Ogun State, Nigeria with geographic coordinates of N6.878733, E3.593607. The proposed API / ETP facility is

to be located within the existing facility. The total land area for the proposed API / ETP facility is about 10 hectares. Access to the project site is through Lagos/Shagamu road, via Lagos-Ibadan expressway. And its proximity to Lagos the market hub of Nigeria and the most populated state in Africa is also an added advantage, so this project can help meets the increasing demand of API by industrial users and antimalarial drugs by domestic users in the nation and sub-Saharan African nations.

2.2.2 Source of Revenue

The construction and operation of the project will be an added source of income to all levels of government from the pre-construction stage, construction, operation & maintenance, and decommissioning stage. Revenue in the forms of permits, license, levies, and taxes will be remitted to local, state and federal governments. Generally, as a result of the proposed development, there shall be sections for skills transfer from the implementation of training programmes for all staff. The project will foster economic development within the proposed project area in the supply of materials and goods for construction, opportunities for the creation of new associated businesses, promotion of small and medium business opportunities, employment, and access to public services. This shall translate to increase in internal revenue generation for the country through payment of income tax.

2.2.3 Return on Investment (ROI)

The acquisition and utilization of the project shall bring about returns on investment for the proponent. The proposed development as conceived by the proponent will capitalize on the size of the acquired land, its location, the importance and value of the project (the first developed API manufacturing plant in sub-Saharan Africa.) which will inevitably bring high return on investments.

2.3 Envisaged sustainability of the proposed project

The conceived sustainability of the proposed project is categorized as follows**:**

2.3.1 Socio-economic sustainability

The proposed project is expected to create employment in both the construction and operational phases of the project development. Hereby gainfully employing the host community' members and developing the required manpower skill by contributing to their wellbeing. Emzor shall ensure a MOU (Memorandum of Understanding) is signed in agreement with the host community and stakeholders to promote socio-economic sustainability of the project and thus stimulate economic activities as long as the facilities is operating.

2.3.2 Technical Sustainability

Highly skilled personnel both local and international are sourced for this project. The process safety considerations are also available as local and international skills exist for process hazard analysis and installation of safety instrumented system, which is also guaranteed by international and local codes & standards for the design of the facility.

2.3.3 Environmental sustainability

The construction of the proposed project is guided by the National and sectorial guidelines. In this regard, the best environmentally acceptable techniques / methods would be employed to ensure minimum negative impacts on the environment. The incorporation of findings and recommendations from the EIA at the various stages of the project activity, and adherence to the EMP (Environmental Management Plan) would ensure environmental sustainability. In conducting this study, the requirements of the Federal, State and Local Authorities on environmental management practices were considered.

2.3.4 Economic/ Investment Sustainability

Nigeria with the population of 200 million people, it is Africa's most populous nation. With an increasing demand for antimalarial drugs especially during the wet season where there is a high rise of malarial sickness. So, the development of API-ETP manufacturing facility opens up ample opportunities for institutional investors in the pharmaceutical industry and further more create employment. API availability will increase to further satisfy national consumption of antimalarial drugs and growing demand to export to other African nations. The API-ETP project will, in the long run, contribute substantially to Nigeria's revenue from pharmaceuticals' product

2.4 Project Development Options

An analysis of the project options represents an opportunity for a full examination on the project development especially elements that could potentially impact the environment whilst proffering measures to mitigate to the barest minimum the negative impacts and also enhancing the positive impacts. This is important to provide a framework for sound decision making based on the principles of sustainable development and the proposed options as outlined below were considered on the basis of environmental sustainability, health and safety concern, regulatory requirement and compliance with international best practice.

Table 2.1: Project Development Options

Alternatives	Advantages	Disadvantages	Remarks
No Project	• No capital expenditure • No new risks • No further impact on the environment	• No socio- economic contribution to the host community, Western Nigerian region and Federal Government • No increase in the availability of much needed API for drug manufacturing and distribution to other local pharmaceutical industries, • Increase in environmental footprint. • This alternative should not be adapted as there is need to encourage development as long as it is on a sustainable basis.	Not adopted for implementation

Alternatives	Advantages	Disadvantages	Remarks
Delayed Project Option	• No further impact on the environment • Improved methods/processes could be observed for implementation	• All plans and processes put in place for the project design and execution and contractors already mobilized will be demobilized. • Will set back Emzor pharmaceuticals, stakeholders and the Federal Government on socio-economic development and benefits associated with the project	Not adopted for implementation
Construct a new API-ETP Facility	• Increase in socio-economic development in the proposed project location • Economic contribution to host communities and to Federal Government • Increased capacity for supply of API to meet market demand and reduce our reliance on importation of these API • Reduced environmental foot print.	• High capital will be required for expenditure; • Consumption of natural resources e.g. water; • New environmental footprint and minimal loss of biodiversity.	Adopted for implementation

The considerations in the overall development of the project were identified and evaluated using a number of screening criteria. Non-viable options were rejected at an early stage and potentially viable options were submitted for further consideration.

An objective ranking process against key alternatives was used for the most viable options against the following criteria:

- Health, Safety, and Environment (HSE);
- Design and technical issues;
- Project execution;
- Operational aspects; and
- Political / socio-economic issues.

The objective ranking aided the adoption of the most viable concepts against environmental and social criteria. The criteria and weighting scale used for the evaluation of key development options are described briefly in **Table 2.2 below**

Table 2.2 Environmental and Social Risk Criteria

	Low (0-1)	Medium (2-3)	High (4-5)
Environmental and Social Risk	• Zero to negligible changes or alterations in ambient, local, and or regional conditions of soil, water, air quality, noise quality, biodiversity, and other biophysical features. • Zero to negligible perturbation and or changes to socio-cultural profiles • Zero to negligible effects/risk exposure in community and occupational health and safety	• Medium/moderate changes or alterations in ambient, local, and or regional conditions of soil, water, air quality, noise quality, biodiversity, and other biophysical features. • Medium/moderate perturbation and or changes to socio-cultural profiles • Medium/moderate effects/risk exposure in community and occupational health and safety	• Major/highly significant changes or alterations in ambient, local, and or regional conditions of soil, water, air quality, noise quality, biodiversity, and other biophysical features. • Major/highly significant perturbation and or changes to socio-cultural profiles • Major/highly significant effects/risk exposure in community and occupational health and safety

CHAPTER THREE
PROJECT DESCRIPTION

3.0 Introduction

This chapter is a description of the proposed API Facility development sequence from site preparation to construction as well as operational processes It also includes the project design basis Depending on the complexity of the molecule required, synthesis of APIs might need multi-step complex chemistry utilizing a range of processing technologies.

3.1 Project Overview

The proponent has proposed to develop a facility for the production of Active Pharmaceutical Ingredient. This will involve the production of 4 antimalarial API's (Artemether, Lumefantrine, Sulfadoxine, Pyrimethamine). The API Plant will be located in the company's existing premises with total land area of about 10 hectares along Lagos/Benin expressway Sagamu, Ogun State and its purpose will be to manufacture active ingredients from raw materials through both chemical and physical means in drugs.

The site is a green field with no development adjacent the site. The site is already under possession of Emzor Pharmaceutical Limited. There is no wild life sanctuary present within the project site.
The major component of the facility includes:

- Main Plant Manufacturing Building
- Administrative building
- Security Building
- canteen Building
- Quality Control Laboratory Building
- Utility/Engineering Building
- Warehouse Building
- Solvent Storage Tanks/Yard
- Effluent Treatment Plant

3.2 Project Design Basis

The design objective of this project was planned and carried out to develop an Active Pharmaceutical Ingredient Plant that satisfies applicable regulations, industry standards, andcodes. The project design objectives can be summarized as follows:

- **Safety and security** – Accidents/ incidents prevention during project planning and execution. These are the project's highest priorities and everyone's responsibility;
- **Quality -**quality is the foundation of safe, operable & reliable facilities;
- **Business Conduct and Controls** – maintain integrity in the conduct of business;
- **Environment/ Regulatory / Permitting** – project design and work are performed in a manner that meets regulatory requirements, high-performance expectations of Nigeria;
- **Community Relations** – foster an effective, productive relationship with communities;
- **Operability & Reliability** - ensure facilities meet business objectives to ensure safe, environmentally sound, and cost-effective operations;

- **Energy Efficiency** – ensure the designed facility is efficient and has an optimum powerusage effectiveness (PUE);1
- **Nigerian Content** – foster continued development of Nigerian – based industry to meet Federal Ministry of Environment (FMEnv) requirements;
- **Stakeholder Engagement** – continuous engagement with identified stakeholders is necessary for project success;
- **Commercial Agreements** – execute commercial agreements and secure fiscal terms toachieve project schedule.

The project shall be designed and implemented per the following:

- Nigerian building codes
- Design and engineering practice safety manual,
- Industry Codes and Standards
- Contractors Codes and Working Standards
- EHS guidelines for Pharmaceutical and Biotechnology Manufacturing
- National Fire Protection Association (NFPA)

The development comprises:

- Main plant building,
- Utility engineering building,
- QC Laboratory R&D building,
- ETP, Solvent Tanks/ Yards,
- Warehouse
- Administrative building which will include reception, security and canteen.

The total land area is 10 hectares the design overview and layout of the facility is below

Figure 3.1 Design Overview and Layout of the Facility

Construction Work scope

This shall include the construction of the following:

a) An office building which shall contain the security office, the canteen and the reception/waiting lounge
b) The plant manufacturing building which shall contain the main API plant where manufacturing shall take place.
c) The quality control laboratory building which shall house the laboratory, wheretesting/analysis of the product will be carried out.
d) The warehouse building shall contain the finished goods and raw materials.
e) Utility/Engineering building shall contain the tools and workshop, the compressed air equipment, boiler equipment and pumps, panels, chillers and a protected balcony.
f) The Solvent Storage Tanks.
g) The Effluent Treatment Plant (ETP)
h) The chemical storage building.

The facility will be powered by the an already existing onsite power plant (up to six (6) 1000KVA gas generators) and will require about 400–600kW of power. In addition, an emergency backup diesel generator with an output of 800 kVA will be constructed as an emergency backup to the gas plant's supply. Excavated material used during construction will be used to level the surrounding ground. Unused/waste Aluminum, nails etc will be sold to scrap collectors for melting and re-use (recycling). Wood used for site construction will be sold out. Other construction materials such as scaffoldings, paint bucket, cement sack will be sold to collector for re-use.

3.2.1 Operation and Maintenance

The facility shall be operated in accordance with established Good Manufacturing Processes (GMP). The API-ETP facility will be managed by a fully trained and competent personnel and must align to established rules and regulations guiding the Pharmaceutical industry including Emzor Pharmaceutical Industries Limited's HSE policy guidelines.

The main activities of the API Plant facility are receipt of raw materials/solvents, manufacturing of Active Pharmaceutical Ingredients (which includes oxidation, neutralization, acidification, chlorination and physical operations like filtration, extraction, sieving and drying, distillation etc.), storage and product distribution.

During operation the Key starting Materials (KSM) which will be used in the API production will be sourced from India and Solvents could be sourced locally if the high levels of purities required can be guaranteed. The list of API products and their KSM are presented in table 3.1

Raw Material Requirement

Various raw materials will be required for the manufacturing of proposed products.

Handling

All raw materials and finished products will be handled as per Good Manufacturing Practice in a closed system. Finished product handling will be in an isolated system. Also, all the pipes and equipment will be kept cleaned to avoid any blockage and unexpected side reactions. Pressure tests (leak tests) will be carried out before every startup. Hydro test of tank/ systems will be carried out periodically.

All the process and storage equipment's used for the handling of these chemicals will be maintained properly to avoid any leakage or spillage of the chemical. Also, all storage tanks, transfer lines, valves, fittings and every joint will be inspected by third party periodically. Drum trolley will be used for safe handling and transfer of hazardous chemicals drums from one place to another place in the plant area.

Storage

Provision of adequate and proper storage facilities for all the raw materials and finished products. All the raw materials will be stored in an isolated storage area, in a tightly closed container/tank.

Transportation

Most of the raw materials required for the proposed products will be sourced internationally and locally if the purities of the chemical are guaranteed. Finished products will be sold to domestic / international market by convenient mode of transportation.

Table 3.1 API Products to be Manufactured

API Product	**Key Starting Materials (KSM)**
ARTEMETHER	Artemisinin
LUMEFANTRINE	Dibenzylideneacetone (DBA)
SULFADOXINE	Sulfanilamide
	4,6-Dicholoro-5MethoxyPyrimidine
PYRIMETHAMINE	Ethyl Propionate
	Para toluene Sulphonic Acid
	Guanidine

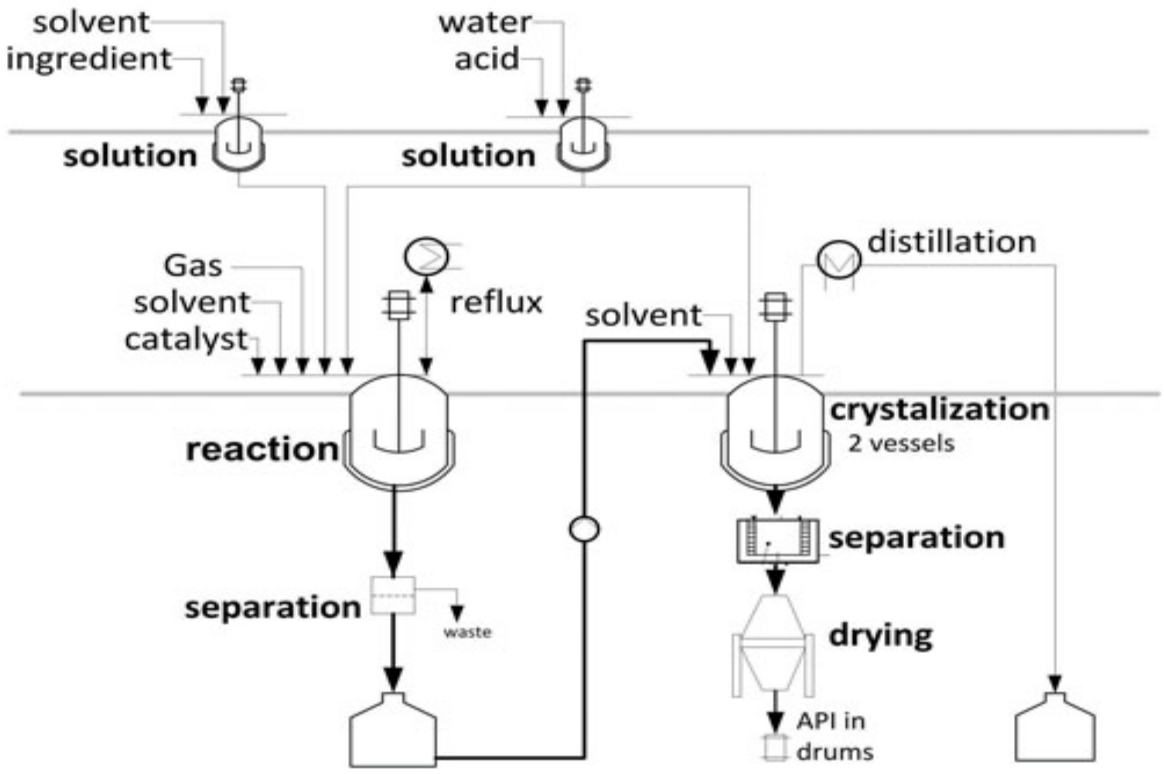

Figure 3.2 Schematic Diagram of an API Manufacturing Process

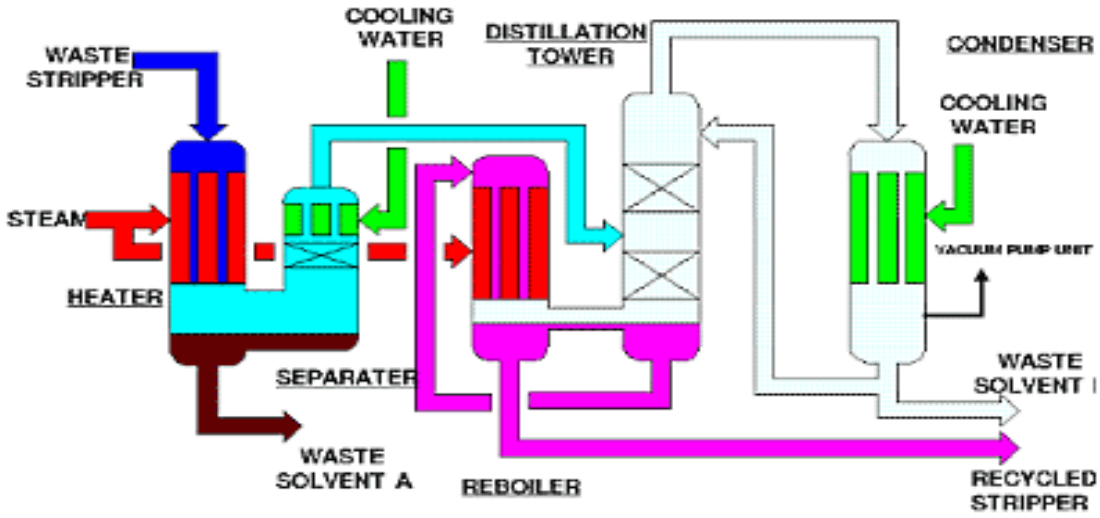

Figure 3.3: Schematic Diagram of Solvent Recovery System

Dispensary/Weighing

This is the first stage in tablet production to confirm that the various raw materials (Active Pharmaceutical Ingredients) after formulation are weighed out in their correct proportion with the aid of a *Metler* Toledo Digital Weighing by the Quality Control/Quality Assurance Department before proceeding to granulation.

Chemical Reaction/Granulation

This generally involves the process of mixing/blending powdered compounds together in a solvent to create bonds between them.

Wet Granulation:

The powder mixture (consisting of the active ingredients. filler. disintegration agent, etc) is mixed with a binder dissolved in a solvent, then blended until it attains the correct density in the granulator. Next the damp mass of mixture is dried in the Fluid bed- dryer, after they might have been screened into pellets or granules. Finally, dried granules are passed through a screen of smaller size than the one used for the wet mass of mixtures to select granules of uniform size.

Dry Granulation

This process is same as that of wet granulation except that product from dry granulation are heat sensitive and this is done by usings slugging tooling or on a roller compacter commonly referred to as a Chilsonator. For both types of granulations, a Lubricant, anti-adherent and glidant of fixed quantities are added to granule mixture during blending in order to enhance compression process.

Purification

The preferred methods for removing residual metal catalysts are distillation, crystallization and precipitation. A distillation process collects the pure API as a distillate, leaving the non-volatile compounds in the residue.

Crystallization

while crystallization and precipitation steps both generate solid material that can be physically removed by selecting a filtration step for a more effective quality of products a double crystallization process is implemented.

Separation

This process involves both chromatography and activated carbon powder treatments are used for exploit charge and adsorptive technologies for impurity removal using a centrifugal or filtration process.

Drying/Compression:

Granule batch that pass quality control test are fed into the compression machine via Hopper. Granulated materials flow into the punch via the feeder from where the materials are compressed /dried into powder Each batch of dried compressed powdered is further sent to Quality Control /Quality Assurance for quality verification status before packaging.

Packaging

The final API products after being released by Quality Control are packed in air tight/ isolated containers/tanks. Final packs are labelled appropriately and put into shippers (cartons).

3.3 Waste Water Management

Effluent Treatment Plan: Wastewater Management Strategy (ETP).

Wastewater, or more accurately, industrial effluent, is an inescapable by-product of any wet manufacturing operation. As a result, Emzor decided to develop an appropriate design upgrade, treatment methodology, and wastewater management, and an understanding of the physical, chemical, and biological characteristics of the effluent is deemed important. As a result, waste water samples will be collected and analysed to determine its characteristics.

Apart from being coloured, wastewater may have high values for Turbidity and Total Suspended Solids, indicating the presence of settable solids in the effluent. As a result, the proposed ETP will have an efficient unit operations facility to remove these contaminants. Organic and nutrient matters may also be present in the wastewater, as indicated by the values obtained for Nitrate, Phosphate, COD, and BOD; these will require a chemical and/or biological treatment process to remove.

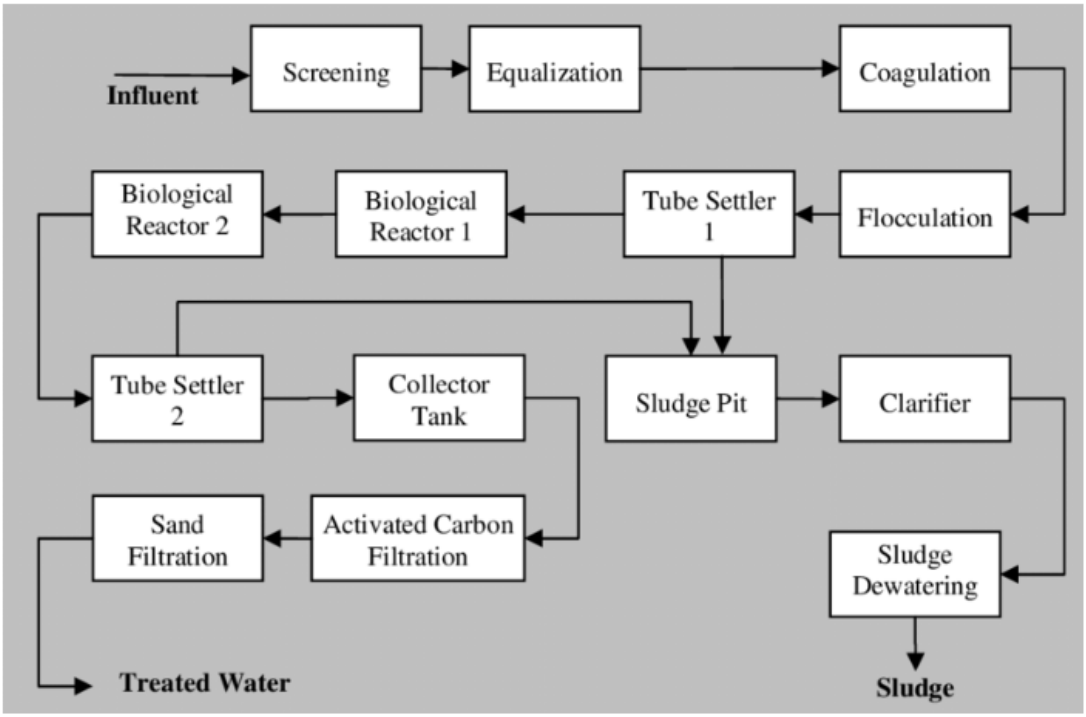

Figure 3.4. Model Effluent Treatment Plant Block Diagram (ETP)

Laboratory analyses of such collected wastewater samples may also reveal that certain constituents of concern in the effluent contain the parameters above. the recommended discharge limits, emphasizing the importance of the factory having a facility to treat the effluent before it is evacuated or discharged into a public drain or canal.

Furthermore, sludge generated from the effluent treatment plant overtime would be tested and dumped in a government approved landfill after dewatering/treatment. Sludge generated can be utilized in brick and ceramic production; Sludges are can also serve as soil conditioners for they contain chemical compound required for plant growth. various the wastewater qualification exercise will be adequately carried out in operation to determine the volume and flow rate of the factory's processed wastewater as a fundamental step in improving the conceptual process design of the proposed API plant.

Maintenance:

The facilities at the present site of the company are well maintained. The equipment is maintained based on the design of the machines. The management of the company carries out a preventive maintenance schedule for some of their equipment. This is necessary considering the nature of activities being carried out in the factory.

Therefore, a daily, weekly. quarterly and annual clean up and maintenance of the all the equipment on the facility in line with HVAC requirements complying with specific GMP guidelines and may vary for different synthesis steps

Health, Security, Safety and Environment (HSSE) Requirements

Emzor shall adopt approved HSE requirements for the API-ETP facility due to the risks/sensitivity involved with the manufacturing of the API, using volatile organic compounds.in operations as well as maintenance to prevent explosion and the benefits to be gained from developing sound environmental and health protection practices in pursuing the goal of a zero-incident. To this end, the contractor shall comply with a comprehensive emergency response/contingency plan in the event of accidents.

The work plan identifies actions necessary in the event of accidents including communication network, individual responsibilities of key personnel, and the procedures for reporting to the authorities as well as arranging logistics for extra labor need forimmediate response and in case of any emergencies.

CHAPTER FOUR
EXISTING ENVIRONMENTAL BASELINE CONDITION

4.0 General

This chapter provides a description of the existing environmental and socio-economic conditions of the Project area against which the potential and associated impacts of the proposed Project have been assessed. The establishment of a comprehensive environmental baseline condition of the project area is required as part of the ESIA process, to provide information on the characteristics and features of the project environment.

In addition, it also provides the background/scientific basis for predicting, evaluating and mitigating the impacts of the project activities on the environment, monitoring environmental changes in the area, as well as support the decision- making management and decommissioning.

The components described include the:

- **Physico-chemical environment** (meteorology, geology, soil type and distribution, surface/groundwater characteristics);
- **Biological environment** (location and distribution of flora and fauna characteristics);
- **Socio-economic and health conditions** describing the demographic structure, culture, social and health status of the affected communities and social environment, including outcomes of consultations held and stakeholders' engagement.

The change(s) caused by any project will have both positive and negative impacts to residents in the area and in particular the biophysical surrounding. Thus, the characterization of the environment presented in this ESIA has been based on information acquired from the site visit to the project area and complimented with other literature.

4.1 Baseline Characterization Approach

The various methods employed in collecting and documenting environmental baseline condition of the project area are highlighted below. The baseline condition of the proposed location was established through literature research, and a one-season (wet) field data gathering followed by laboratory analyses of field samples. A multi- disciplinary team of environmental scientists and engineers conducted the studies.

Both literature research and field sampling were conducted within the framework of FMEnv and international standards and best practices. Elements of this approach include:

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

4.1.1 Literature review/ Previous Environmental Reports

Review of literature on International (especially those of the European Bank standards and IFC) and national regulations applicable to environmental safeguards conducted. A number of relevant literatures on to similar project and environment available in the public domain were also reviewed.

Information was sourced from the reports of previous environmental studies conducted in the Project area. These include;

- Environmental Impact Assessment Report for Emzor Pharmaceuticals Limited, Sagamu, Ogun state (2012),
- Abbreviated ESIA Report for Emzor Pharmaceuticals Limited, Sagamu, Ogun state (2021) and;
- Environmental Impact Assessment For "Setup of Proposed API's & Intermediates Product Manufacturing Unit" Taluka- Mohol, District - Solapur, Maharashtra and

4.2 Field sampling

Field data for characterization was collected on 6th of July 2022 in Sagamu, Ogun State. Field studies involved quantitative sampling as well as a recording of observations of the environmental components of the study area within the project's area of influence. The environmental components investigated included; noise, air quality, groundwater quality, soil, vegetation. All sampling locations were geo-referenced using a handheld Global Positioning System (GPS).

Table 4.1: Sampling locations and coordinates

Sample Code	Longitude	Latitude	Media
AQ/N 1	6.874677	3.582002	Air and Noise
AQ/N 2	6.873536	3.581440	Air and Noise
AQ/N 3	6.874776	3.581134	Air and Noise
AQ/N 4	6.8741667	3.580556	Air and Noise
AQ/N.5	6,875936	3.580925	Air and Noise
AQ/N CTRL 1	6.876312	3.581235	Air and Noise
AQ/N CTRL 2	6.878469	3.582715	Air and Noise
SS 1	6. 874677	3. 582002	Soil
SS 2	6.8741667	3.580556	Soil
SS CTRL	6.876312	3.581235	Soil
GW 1	6.876048	3.580944	Water
GW. CTRL	6.875557	3.580745	Water

Table 4.2: Environmental Component and Method of Sample Collection

Environmental Component	Method of collection
Air Quality and Noise	Electronic gas monitors, Particulate matter counter/ monitor. Telegram photoionization Gas analyzer (Viper), Noise meter
Soil/Land use	Dutch stainless-steel hand auger, digger and spade for profile pit study, Core samplers, Interviews, and Direct observation
Vegetation	Transects, Key Informant Interviews, Use of Binoculars, Direct Observation and sample collection
Wildlife	Direct Observation, Key Informant Interviews, and indirect countmethod
Socio-economics / health	Interviews, questionnaires, focus group discussions, publications

4.3 Desktop Research and Secondary Public Data

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

Secondary Public Data

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

- National Population Census, 2006
- Nigeria Demographic and Health Survey, 2018
- National Bureau of Statistics, 2020
- Nigerian Meteorological Agency (NIMET) 1991 – 2020.

Field Sampling Design

This sub-section of the report briefly describes the data gathering processes conducted. For air quality and noise measurement, soil sampling, groundwater sampling, and socio-economics.

Study Team

The study scientific team comprised of AquaEarth's multidisciplinary team, representatives from FMEnv and the QAQC personnel. Kindly refer to **Appendix 1B** for attendance sheet.

4.4 Field Survey Activities

The following activities were carried out during the preceding and succeeding the field exercise.

Pre-mobilization Checks

The following were pre-planned prior to the wet season field data gathering:

Health Safety and Security Plan and Field Activities Plan

A detailed Health, Safety and Security Plan and Field Activities Plan were prepared prior to field mobilization by AquaEarth. These plans covered likely risks associated with the fieldwork and preventive measures to be adhered to in relation to the various activities that will be carried out during the field data gathering exercise.

Equipment and Materials Checklist

The equipment and materials deployed for the data collection included Personal Protective Equipment (PPE), sampling tools, containers, handheld devices, hand auger, preservatives, first aid box, etc., which were checked for their adequacy, maintenance, calibrations status and field readiness. The equipment deployed and their uses are listed in **Table 4.3 below**.

Table 4.3: Field Sampling Equipment and Materials

S/N	Item	Objective	Qty
Materials			
1	0.5 litre plastic water bottles	groundwater heavy metals	2
2	1 litre plastic water bottles	groundwater physico-chem	2
3	500ml glass bottles	groundwater THC	2
4	250ml amber bottles	Groundwater MCB	2
7	Ziploc bag	Sediment samples	6
8	Paper masking tapes	Labels	1
9	Markers / disposable gloves	Labels	2
10	Plaid bags	Samples and materials	1
11	Coolers and ice packs	Samples preservation/transport	1
12	HNO_3 and H_2SO_4	Heavy metal and THC preservation	1
14	Pipette	collecting preservatives	2
15	Pairs of bowl and spoons	Soil/sediment mixing/sub-sampling	2
16	Pairs of Rain boots	Foot wear PPE	2
17	Chain of custody forms	Samples logging and tracking	6
18	Daily Work sheets	Show work achieved and targets	2
19	Attendance sheet	Records	4
20	In-situ Sheets	Fast changing parameters	4

Equipment			
1	Hand Auger	For soil sampling	1
2	Camera	Still photos	1
3	Air quality multi-meter 1	Air pollutant gases: Nox, Sox, CH_4, H_2S, CO	1
4	Air quality multi-meter 2	Air pollutant gases: $SPM_{2.5}$, SPM_{10}, CO, NH_3	1
5	Air quality multi-meter 3	VOC	1
6	Noise meter	Noise level measurement	1
7	In-situ meter	Salinity measurement in water	1
8	In-situ meters	Temperature, total dissolved solids, conductivity and pH	1
9	Bailers/Cups	ground water sample collection	1
10	GPS	Sampling stations positioning	1
11	Field notebook	For in-situ records and notes	1

Mobilization

Prior to set-out, certain checks were carried out to confirm that the equipment and materials were suitable for intended purpose. These checks comprised of the following:

- Inspecting instrument for physical damage;
- Checking the battery condition of the GPS, camera, air and noise meters, etc.;
- Appropriate storage of equipment to avoid exposure to extreme temperature and moisture conditions;
- Review alternative movement routes; and
- Appraise security updates.

Samples Handling

The following sample collection and handling were carried out in accordance with FMEV Guidelines and Standards.

- All sampling equipment was maintained in excellent condition, calibrated against international standards and adequate steps were taken to ensure that they function normally.
- Only new and thoroughly washed, rinsed and sterilized sampling containers were used.
- For heavy metal determination, sampling bottles were used and were rinsed with a solution of one part nitric acid to four parts water, followed by copious amounts of distilled water.
- Water samples for BOD determination were collected in amber oxygen bottles and kept away from light source.
- All air parameters were measured in situ on the field.
- Soil and ground water samples were preserved as soon as they were collected.
- Heavy metal samples were acidified to a pH of about 2 with concentrated H2SO4 respectively.
- All samples were adequately labeled to preserve their identity. Label included project title, sample code number, source, sampling date, etc.

- All samples were safely packed and transported to the laboratory for analysis.

Sample Storage

All samples were packaged, clearly labelled and stored carefully to avoid any disturbance during transport to the laboratory. To compensate potential damage and loss of samples during the transportation, spare samples were taken for each analysis.

Sample Preservations

Following sampling, each sample was properly labelled, arranged, and preserved in accordance with AquaEarth sample QAQC procedures.

4.5 Laboratory Analysis

Laboratory Description and Accreditations

Laboratory analyses for the environmental samples collected were analyzed and processed in Jennobly Environmental Laboratories Limited, Lagos state. Analyses were generally in line with international American Society for Testing and Material (ASTM) and American Public Health Association (APHA) as well as FMEnv Standard protocols. Other QA/QC measures adopted are:

- Use of trained personnel at all phases of the study;
- Written analytical standard operating procedures were followed during analyses; and
- Outline auditing and checking of analyses results, including control solutions and mid-point standards, were introduced into every batch or ten samples as applicable, and analyses for which deviation of these quality control/mid–point standards are outside 90 to 110% of expected value were repeated.

Quality Assurance / Quality Control

The samples collection, analyses and reporting for the existing environment baseline were subject to recommended quality assurance standards in accordance with the stipulated regulatory bodies in Nigeria.

4.5.1 Climate and Meteorology

Climate controls the natural forces that act on virtually all the components of the ecosystem. In addition to determining the components of the environment, it also modifies the structural differences between them in the process of maintaining equilibrium. Ogun State is located in the moderately hot, humid tropical climate zone of South-west, Nigeria.

The climate of the area is tropical with alternating wet and dry seasons. It is strongly influenced by Inter-Tropical Convergence Zone (ITCZ) weather patterns. Maritime tropical air masses, characterized by warm, humid south-westerly winds and the continental air mass, characterized by hot, dry north-easterly winds, converge in the ITCZ. The alternating wet season and dry season phenomenon is determined by the north-south oscillation of air masses in the ITCZ. Movement of these air masses results in two main seasons; a wet season from April to October, and a dry season from November to March. During the dry season there are periods when the harmattan (a period characterized by dry dusty winds and relatively low temperatures) is experienced. This typically occurs during the months

of December and January. **Table 4.4** summarizes the monthly mean climatic characteristics of the Project area in Ogun State from 1990 to 2019.

Table 4.4: Monthly Mean Climatic Characteristics of the Project Area in Ogun State (1990-2019)

MONTH	Temperature (^{0}C)		Rainfall (mm)	Humidity (%)		Sunshine Hours	Wind speed (m/s)
	Min	Max	Mean	9:00Hr	15:00Hr		
January	24.29	31.12	23.86	77.72	69.76	5.54	3.5
February	26.07	32.27	36.61	79.48	71.96	5,40	3.7
March	26.61	32.48	64.96	79.76	73.92	5.24	4.1
April	26.37	32.26	139.22	80.84	75.32	5.74	4.1
May	25.64	31.53	216.86	82.40	76.80	5.65	3.9
June	24.37	29.72	413.06	87.12	81.12	4.27	3.7
July	23.96	28.34	232.13	87.88	82.92	3.01	4.9
August	23.88	28.16	115.24	87.68	82.00	2.59	5.1
September	24.18	28.76	232.13	87.92	82.80	3.10	4.7
October	24.62	29.99	192.31	84.72	79.64	4.84	4.1
November	25.80	30.14	52.31	81.76	75.84	6.18	3.8
December	25.36	31.56	13.70	80.44	71.36	5.74	3.7
Total			1,732.99			57.3	

Source: NiMet 2020

4.5.2 Ambient Temperature

Temperature is relatively high all the year round in view of the location of the study area around the tropic. Temperature and thermal characteristics of the area depend on the apparent movement of the sun, the wind regime and the distance of the area to the Atlantic Ocean. Two peaks (Major and minor) characterize the annual temperature cycle. The major peak occurs in February –March and the variation in the annual temperature range is about 5^0C.

The temperature is usually higher is usually higher during the rainy season but lower during the harmattan. The temperature was measured using a thermometer. The changes in temperature invariably affect the rate of evaporation of the surface water in the area, and so the higher the temperature the higher the rate of evaporation. However, the rate of evaporation is found to be high during the dry season than in the wet season.

The maximum temperature of the area is between 27.7ºC. and 37.8ºC while the minimum temperature varies between 22.5 and 26.3ºC. The months August and September are the coolest with temperature of about 22oC while the months of January to March are usually the hottest with a mean temperature of 36.5ºC.

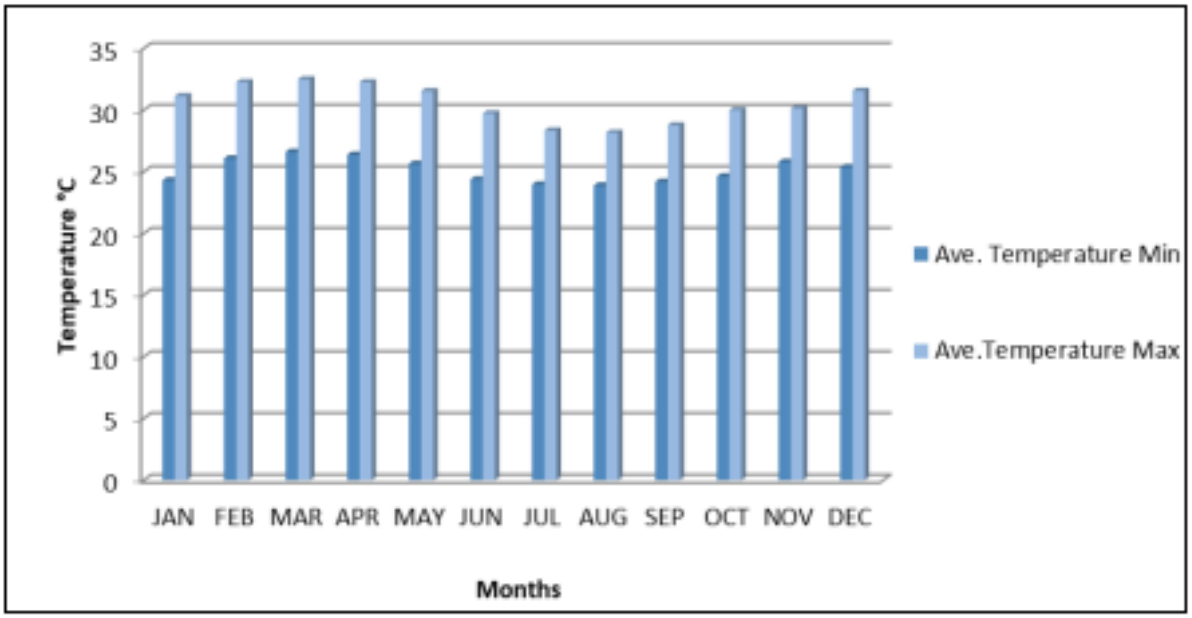

Figure 4.1: Monthly Mean Temperature Characteristics of the Project Area (1990-2019)
Source: NiMet 2020

4.5.3 Relative Humidity

Ogun State has an average annual relative humidity of 71 % which is highest during the rainy season, when it rises to about 86% at 9.00 hrs. High relative humidity is experienced in the area as a result of the prevailing Tropical Maritime (Tm) air mass that blows over the environment almost all the year round. Data for Ogun State indicates that humidity measured in the morning ranges between 77.72 % in January and 87.92 % in September while at night the value ranges from 69.76 % (in January) to 82.92% (in July) as shown in **Figure 4.2**

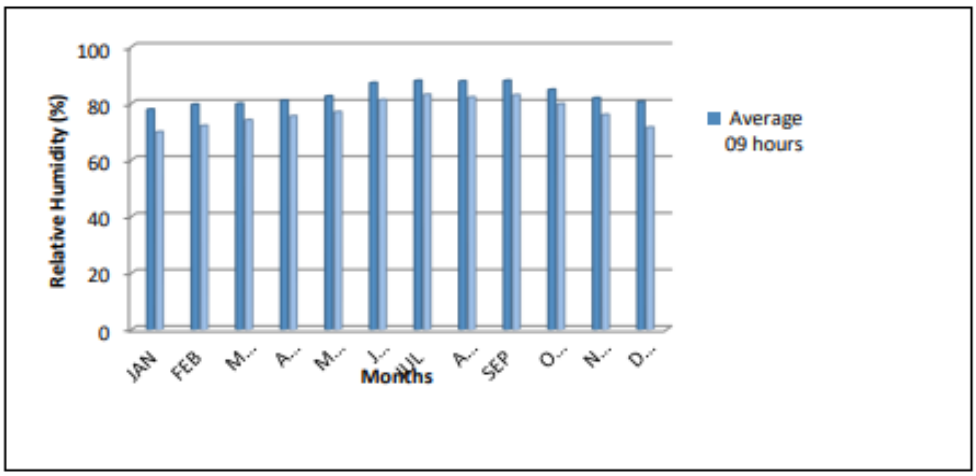

Figure 4.2: Relative Humidity taken at 0900hrs and 1500hrs

4.5.4 Rainfall

Rainfall distribution in Ogun State, as in all part of Nigeria, is bimodal with peaks in June and July and a two-week break in August. Mean Rainfall Pattern for the period of 2000-2015 is presented **Figure 4.3.** The rainy season begins in (March) - April, when there is significant precipitation, andlast till October or early November. From April to May, there are violent storms whichdestroy crops and houses. Rainfall is often at its maximum at night and during the earlymorning hours. It rains all year round even in the dry season. However, variations occurin rainfall amount from year to year. The total annual rainfall is about 1,732.99 mm, out of this amount about 1,541.55 mm is recorded during the wet season (April – October) while only 191.44mm is recorded in the dry season (November to March) as shown in Figure 4.3 below

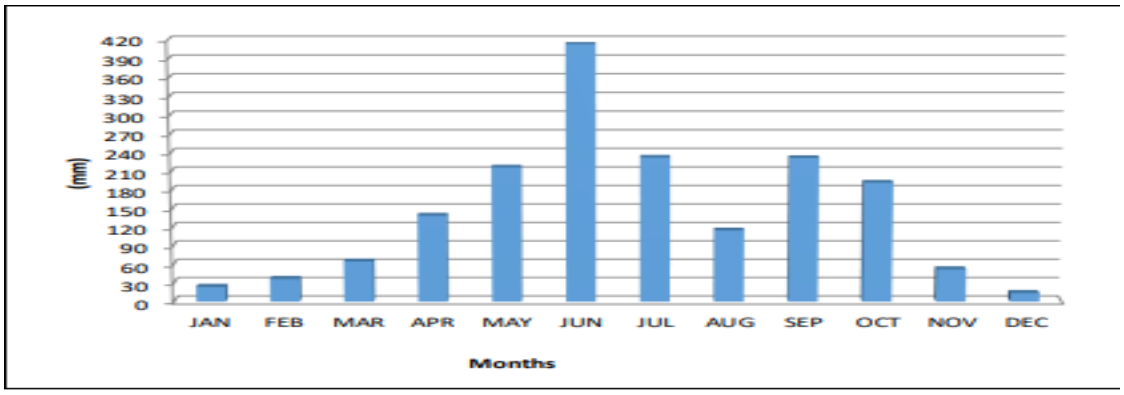

Figure 4.3: Average rainfall characteristics of the Project area (1990- 2019)
Source: NiMet 2020

4.5.5 Wind Direction and Speed

Wind Direction and Speed Wind follows the distinctive pattern of the Tropical continental, (Tc) (Northeast) and Tropical maritime, Tm (Southwest) directions depending on the apparent location of the sun and the dominant of the two. The moisture laden and rain bearing South-westerly from the Atlantic predominates during the wet season. It is calmer due to its higher moisture load. The Tc is of less intensity and prevails between December and March. The two major wind patterns are however modified marginally by warm Benguela Current and the North-East Harmattan winds.

The monthly average wind speed in the Project area ranges from 3.5 m/s to 5.1 m/s (Figure 4.4), while the dominant wind direction is towards the south west (Figure 4.5),

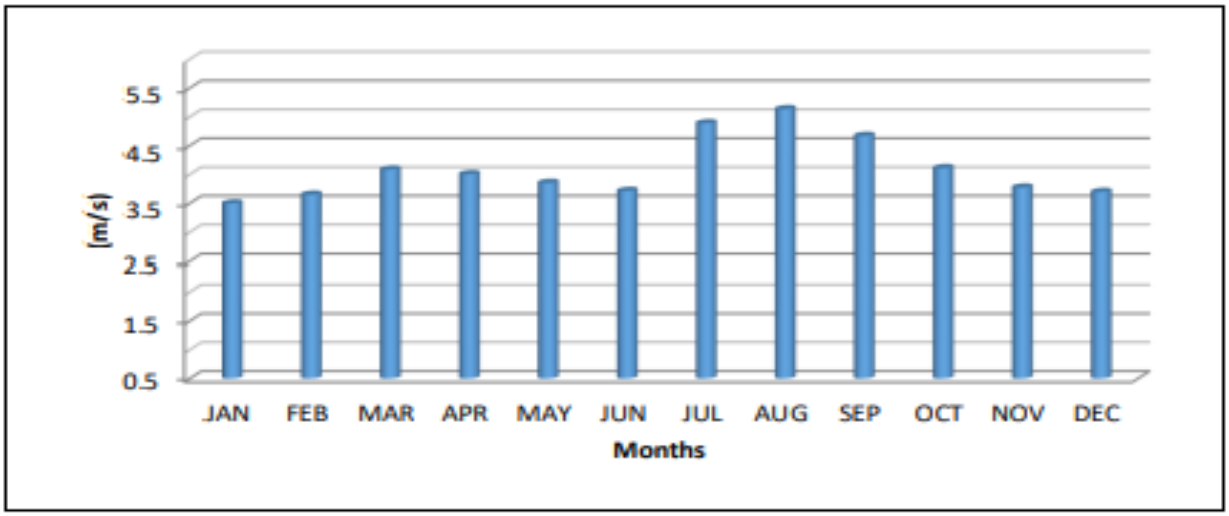

Figure 4.4: Monthly Average Wind Speeds of the Project Area (1990- 2019)

Source: NiMet 2020

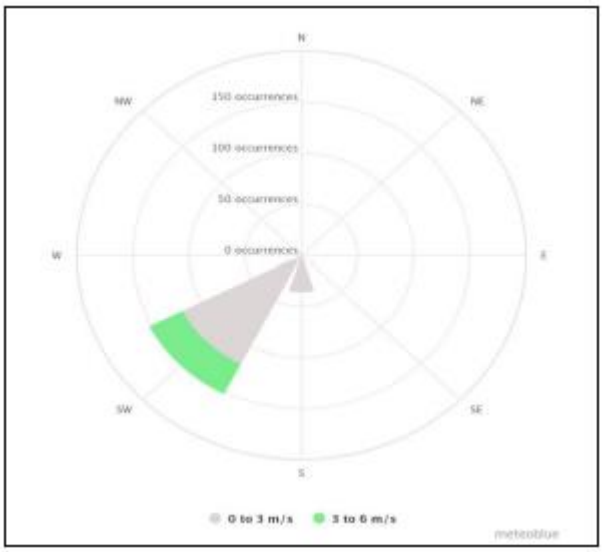

Figure 4.5: Windrose of the Project Area

Source: www.meteoblue.com

4.5.6 Air Quality and Noise Level Measurement

Air generally contains water vapour, gases, and particulate matter in small but very variable quantities. Air pollution is the presence in the atmosphere of one or more contaminants in such quantities, characteristics, duration as to make them actually or potentially injurious to human, plant, or animal life or to property, or which unreasonably interfere with the comfortable enjoyment of life and property.

Noise is a periodic fluctuation of air pressure. Apart from causing disturbance to the affairs of man, long term exposure to excessive noise can damage health and have psychological effects (SIEP, 1995). The noise level in the study area ranged from 54.9 - 68.8 dB(A) for the wet season survey.

Air quality and ambient noise studies were conducted at 5 designated stations plus two (2) control within and outside the facility using the Bosean portable multiple gas detector. The relative concentrations of ambient air pollutants Suspended particulate matter (SPM), Nitrogen oxides (NOx), Sulphur oxides (SOx) and Formaldehyde (CH_2O) etc. were within tolerable limits in the atmosphere. Also, Extech digital sound level meter was used for noise measurement of the project area. Noise measurement was taken in dB (A). The mean concentrations of the air pollutant gases and noise levels measured in-situ during the period within the study area are presented in **Table 4.5** below

Figure 4.6: Air quality and Noise Measurements

Table 4.5: Air Quality and Noise Result

Parameters	AQ1	AQ2	AQ3	AQ4	AQ5	AQ CTRIAQ CTI		Regulatory Limits		
								FMEnv	WHO	EIB
NOISE (db)	68.8	60.8	64.2	65.2	65.4	64.1	54.4	95	85	85
CH2O(ppm)	4	4	6	5	6	4	1			
SO2 (ppm)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.026	0.02	0.125
NO2 (ppm)	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.075-0.113	0.04	0.15
NH3(ppm)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-
SPM 2.5 (ppm)	1.03	0.97	1.45	1.19	1.33	1.04	0.85	0.010 - 0.025	0.025	
SPM 10 (ppm)	1.12	1.11	0.99	0.66	1.01	1.04	0.99	0.025	0.050	
E Field(v/m)	0	0	0	0	0	57	0.0	-	10kvm	15kvm
H Field (µT)	0.30	0.86	0.19	0.79	1.43	0.86	0.33	-	600	500

Source: Field Survey 2022., AQ = Air Quality

Minimum Detection Limit of Multimeter Gas Monitor=<0.1ppm

Suspended Particulates Matters

Suspended Particulate Matter (SPM) constitute the sum of all solid and liquid particles suspended in air, ranging in size from 0.1 micrometer to about 30 micrometer in diameter, many of which are hazardous. This complex mixture contains for instance dust, pollen, soot, smoke, and liquid droplets.

Ambient particulate matter is responsible for harmful effects on health, even in the absence of other air pollutants. Both fine and coarse particles have been shown to affect health, in particular the respiratory system. Fine particles are more dangerous than coarse particles. Apart from the size of the particles, other specific physical, chemical, and biological characteristics that can influence harmful health effects include the presence of metals, PAHs, other organic components, or certain toxins.

Particulates were detected in all the locations sampled. The measured concentrations were in the range of 002-005 µg/m3; 002-004 µg/m3; and 003-006 µg/m3 respectively for SPM 2.5. SPM 1.0 and SPM 10 for the wet season. These ranges were well within regulatory limits, indicating the receiving atmospheric environment had not been compromised by the project.

Sulphur Dioxide (SO2)

SO2 is a colourless gas which has long been recognized as a pollutant because of its role, along with particulate matter, in forming smog. Sulphur iv oxide in the air results primarily from activities associated with the burning of fossil fuels (coal, oil). Exposure occurs from breathing and it affects the lungs and at high levels may result in burning of the nose and throat, breathing difficulties, and severe airway obstructions (ATSDR, 1999). Sulphur iv oxide is known to be a harsh irritant, and is capable of aggravating asthma, bronchitis and emphysema and promoting impaired functions in the human system (CCDI, 2001).

SO2 was detected at all the sampling points, with concentration level ranging from 0 to 0.1.4 µg/m3 for wet season. These values were less than the recommended limit of both FMEnv and WHO.

Nitrogen Dioxide (NO2)

Many chemical species of nitrogen oxides (NOx) exist, but the air pollutant species of most interest from the point of view of human health is nitrogen dioxide (NO2), Nitrous Oxide, N2O being a major contributor to global atmospheric warming potential. On a global scale, emissions of nitrogen oxides from natural sources far outweigh those generated by human activities. Natural sources include intrusion of stratospheric nitrogen oxides, bacterial and volcanic action, and lightning. Because natural emissions are distributed over the entire surface of the earth, however, the resulting background atmospheric concentrations are very small. The major source of anthropogenic emissions of nitrogen oxides into the atmosphere is the combustion of fossil fuels in stationary sources, (gas flares, heating, power generation) and in motor vehicles (internal combustion engines). The result obtained showed that the values were within regulatory limits.

Volatile Organic Compound

Volatile organic compounds (VOCs) are a large group of organic chemicals that include any compound of carbon (excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate). VOCs are of interest in part because they participate in atmospheric photochemical reactions that contribute to ozone formation, they play a role in formation of secondary organic aerosols, which are found in airborne particulate matter, and because many individual VOCs are known to be harmful to human health. VOCs are emitted from a variety of sources, including motor vehicles, chemical manufacturing facilities, refineries, factories, consumer and commercial products, and natural (biogenic) sources (mainly trees), and health effects vary by pollutant (EPA, 2018). VOC was detected at all sapling points with values ranging from 0.001-0.055 µg/m3.

Noise

Noise is a pressure variation (wave) that travels through air, producing excessive or unwanted sound which potentially results in annoyance and/or hearing loss. Physical manifestation of noise is a pressure wave which is caused by vibrating surfaces Patrick and Peter (2006). Apart from causing disturbance to the affairs of man, long term exposure to excessive noise can damage health and have psychological effects (SIEP, 1995; Oguntoke et al., 2015; Oguntoke et al.,2019). The effects of noise on residents generally relate to the annoyance/nuisance caused by the short- and long-term high noise levels. Also,

disturbance to wildlife is significant especially during breeding seasons and/or when rare species are present.

The noise levels recorded in the project's area for the wet season study ranged from 54.9 to 68.8 dB (A). However, noise due to construction activities are expected to rise. The noise measurements recorded at all sampling stations were within FMEnv and EIB regulatory limit as stated in **Table 4.5** above.

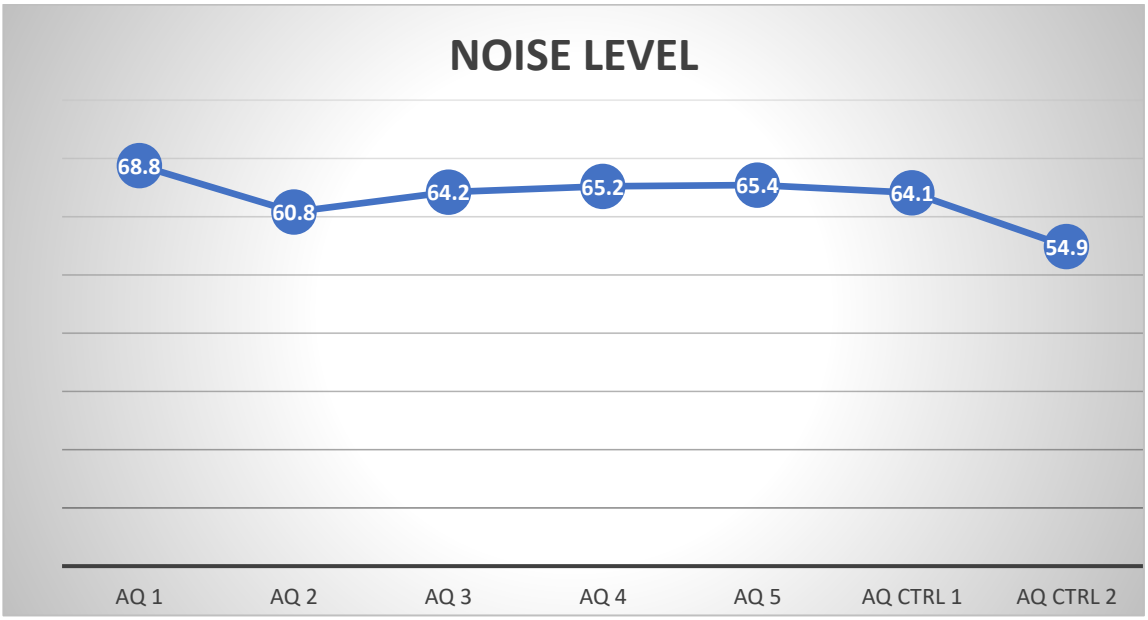

Figure 4.7: Noise Monitoring Within Emzor's Facility

4.5.7 Geology and Hydrogeology

The geology of Ogun State comprises sedimentary and basement complex rocks. The rocks are soft and brittle, but in some places, cemented by iron and silicon containing materials. The basement complex is essentially non-porous and water can only be contained in the crevices of the complex. This basement complex primarily underlies the sedimentary layers which consist of Cretaceous, Tertiary and Quaternary sediments deposited in the coastal basin. The sedimentary rock of Ogun State consists of the Abeokuta formation, which lies directly above the basement complex and is in turn overlain by the Ewekoro, Oshosun and Ilaro formations. The proposed project site is located on the Ewekoro formation (Figure 4.8).

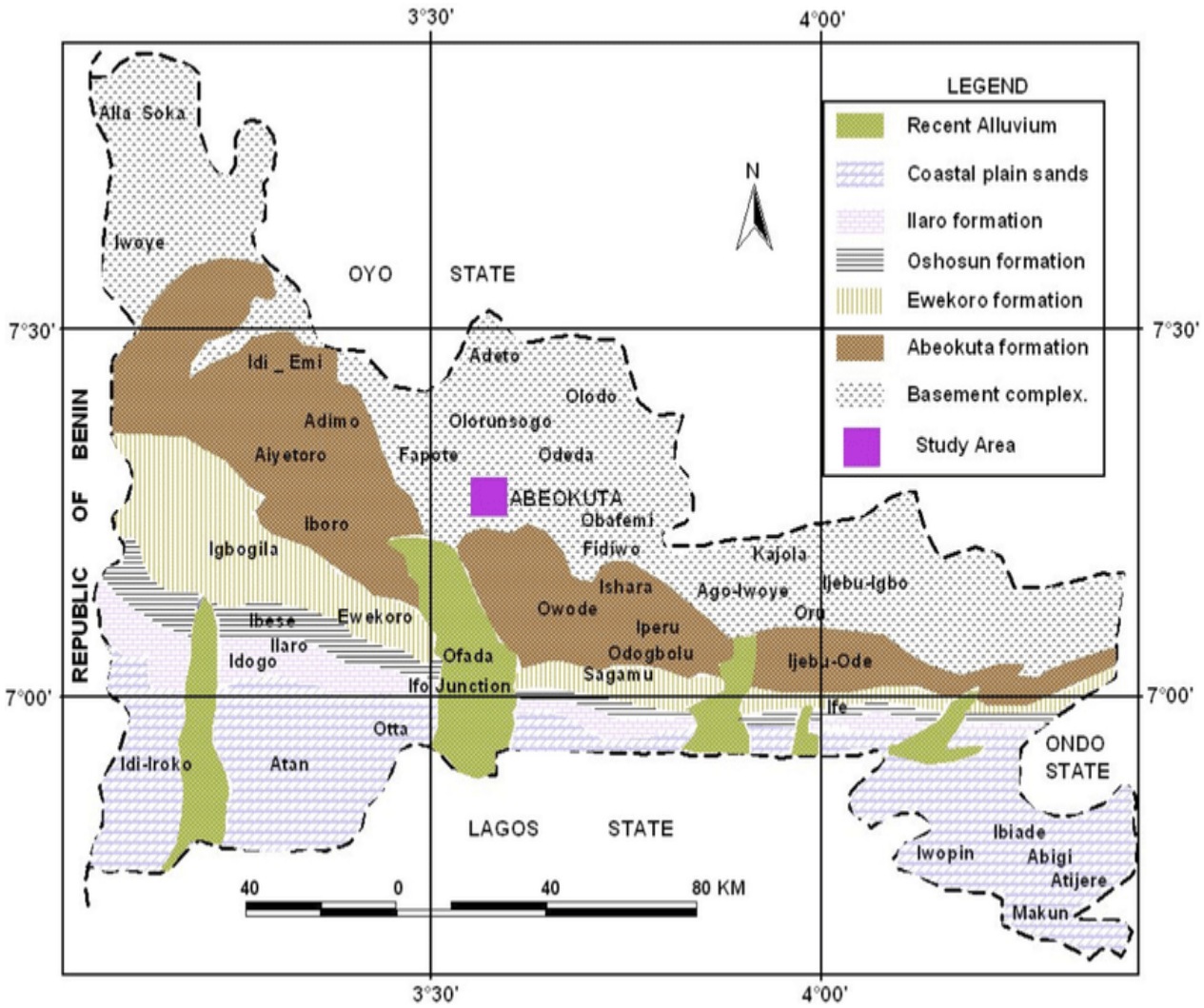

Figure 4.8: Geological map of Ogun State showing the Study area

Source: Olurin et al., 2015

The relief of Ogun State has a wide area of undulating lowlands belonging to the coastal sedimentary rocks of western Nigeria. There are scattered hills that are interfluves between the different river valleys. Some remnants of a large planation in the state include the out-crop inselbergs found at Abeokuta the Olumo Rock at the southern edge of the Western uplands. The relief of the project area is characterized by gentle undulations as presented in Figure 4.9

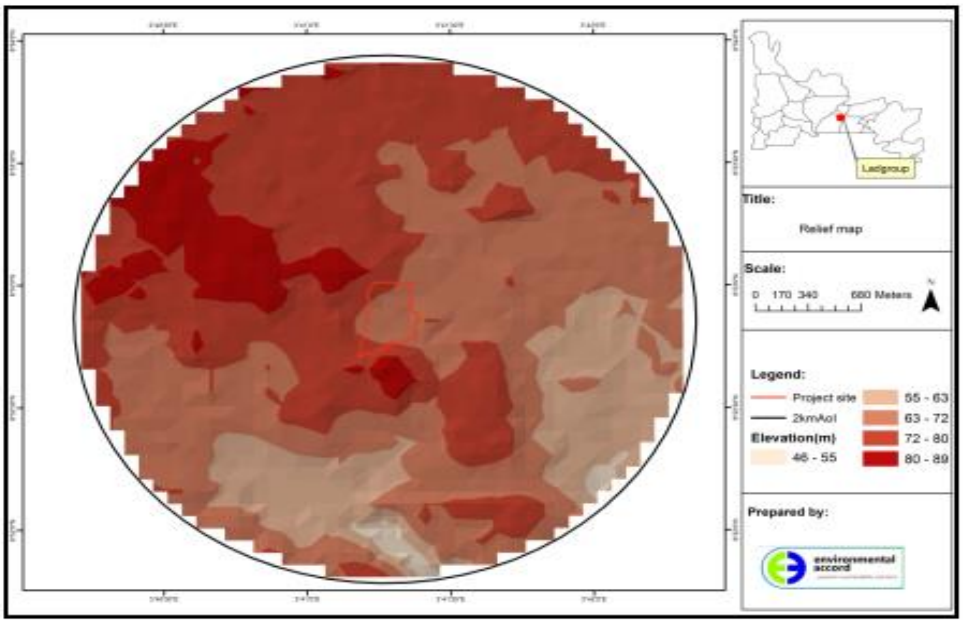

Figure 4.9: Relief map of project area

Source: Adapted from https://earthexplorer.usgs.gov/

Ogun State is traversed by many rivers which flow southward either as tributaries or main rivers into the coastal lagoons and the Atlantic Ocean. These include Ogun, Osun, Yewa, Yemoji, Ona, Sasa, Oni, Ohu, Ohia, Abafon, Oyan, lju and others. Most of the state is well-drained by these streams and rivers, much of which dry up during the dry season. There are no water bodies around the project AoI, however the project area is well drained, the local natural drainage indicates that surface runoff for the project area drains towards the south/south east (figure 4:10)

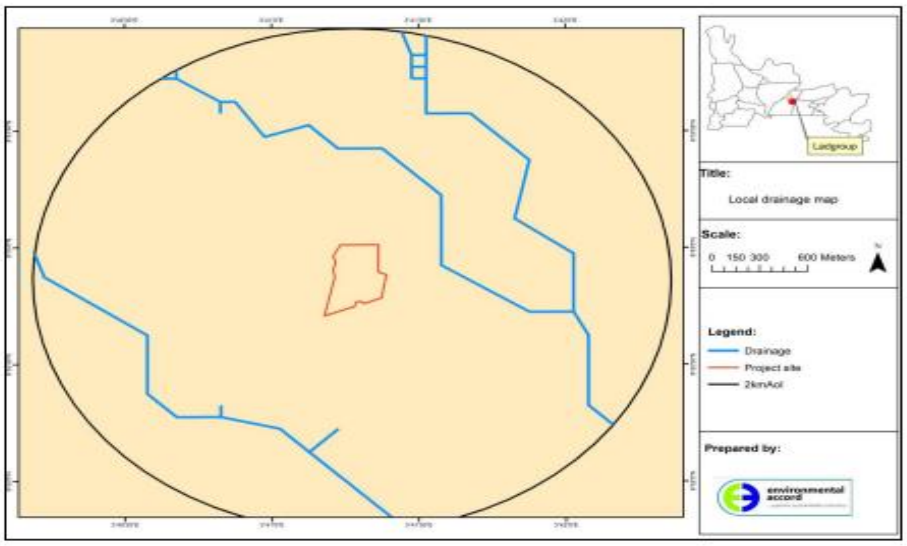

Figure 4.10: Natural drainage network

Source: Adapted from https://earthexplorer.usgs.gov/

4.5.8 Soil Characteristics

Soil is an important component of the ecosystem that serves a footprint of impacts. Therefore, it is imperative that soil environmental conditions are one of the baselines upon which potential impacts of an activity can be measured. The bio-statistical results of the physicochemical characteristics of soils in the project area as presented in subsections below were obtained from the field sampling on 6th July 2022. The detailed laboratory results are contained as part of the Appendices.

Composite soil samples were collected at two depths: 0-15cm (topsoil) and 15-30cm (subsoil) using a Dutch stainless-steel hand auger from two (2) site stations at different locations within the proposed project area and one (1) control site outside the project area. A total of three (3) soil composite samples were collected. The soil samples were collected in duplicate; those for physical and chemical analysis were packed in zip lock polythene bags, while those for microbial and oil and grease/hydrocarbon analysis were packed in a vial bottle. The samples were neatly labeled, preserved, and transported to the laboratory for analysis.

Figure 4.11: Soil Sampling of Study Area

Source: Emzor Baseline Study, 2022

Soil Physico-chemical Characteristics

A summary of the physico-chemical characteristics of soils in the project area as presented in **Table 4.6** below as obtained during the field sampling of the study area. The detailed laboratory results are contained as part of **Appendices**

Table 4.6: Physico-chemical Characteristics of Soil within the Study Area

Parameters (Units)	Project Influence Zone (Wet Season)2022						Project Influence Zone (Dry Season)2021						NESREA Limits
	Topsoil (0-15cm)			Subsoil (15-30cm)			Topsoil (0-15cm)			Subsoil (15-30cm)			
	Mean	Range	Ctrl	Mean	Range	Ctrl	Mean	Range	Ctrl	Mean	Range	Ctrl	
PHYSICO-CHEMISTRY													
pH	6.70	6.64-6.76	6.79	6.695	6.61—6.78	6.81	6.5	6.4-6.5	6.4	6.6	6.4-6.7	6.3	4.8 - 9.5
Temperature (C)	25.22	25.19-25.25	25.30	25.17	25.14-25.20	255.35							
E. Conductivity (µs/cm	66.50	61-72	51	64	58-70	52	21.2	20.9-21.5	28.0	21.6	18.2-25.0	33.4	-
Total Organic Carbon	1.305	1.29-1.32	0.60	1.30	1.27-1.33	0.53	1.6	1.4-1.9	1.6	1.1	0.9-1.3	1.2	-
EXCHANGEABLE CATIONS													
Sodium(mg/kg)	19.23	16.48-21.98	54.93	13.715	10.95-16.48	54.93	31.0	30.8-31.1	28.8	23.5	22.5-24.6	19.5	
Potassium(mg/kg)	1.97	1.923-2.024	4.869	1.616	1.357-1.874	5.014	0.9	0.9-1.0	1.0	0.7	0.7-0.8	0.6	
Calcium (mg/kg)	80.15	60.09-100.2	70.10	70.12	50.07-90.16	75.15	163.3	110.2-216.4	124.2	157.4	134.3-180.4	166.3	
CEC (mg/kg)	149.5	120.4-179.1	172.2	127.76	98.65-156.9	180.4							-
Ammonia Nitrogen (m	36.54	32.08-40.99	45.93	36.79	30.55-43.03	47.27	11.2	9.5-13.0	13.5	6.2-20.0	9.8	36.54	-
EXCHANGEABLE ANION-													
Nitrate (mm/kg)	22.73	22.45-23.01	22.47	21.565	20.74-22.39	21.54	203.3	177.5-229.0	414.5	479.3	203.0-755.5	148.02-	-
Nitrite (mm/kg)	0.685	0.598-0.772	0.463	0.644	0.552-0.736	0.409							-
Phosphate (mg/kg)	15.33	12.68-17.98	2.207	15.75	11.90-19.60	1.823	1.4	1.0-1.9	0.8	1.9	1.5-2.3	0.8	-
Total Nitrogen(mg/kg)	318.75	316.6-320.9	148.4	303.4	280-326.8	146.5							-
HEAVY METALS													
Iron (mm/kg)	145.15	142.2-148.1	150.4	147	143.8-150.2	151.6	27.3	7.5-47.0	8.8	17.5	3.0-32.0	15.5	450
Zinc (mm/kg)	3.571	2.086-2.970	1.027	3.0595	3.044-3.075	1.114	1.6	0.6-2.6	1.4	1.1		0.9	421
Copper (mm/kg)	0.636	0.531-0.741	0.944	0.7395	0.636-0.843	1.047	0.4	0.3-0.5	0.7	0.2	0.2-0.3	0.5	100
Lead (mm/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	1.0	0.9-1.1	1.6	0.7	0.6-0.9	1.3	164
Cadmium (mm/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.2	0.2-0.2	0.3	0.1	0.1-0.1	0.2	-
Barium (mm/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.1	0.1-0.1	0.2	0.1	0.1-0.1	0.2	-
Chromium (mm/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	1.0	0.8-1.2	1.1	0.9	0.7-1.1	1.1	100
Arsenic (mm/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001							
ORGANICS													
TPH (mg/kg)	0.0435	0.039-0.048	0.464	0.0475	0.039-0.048	0.432							
Oil & Grease (mg/kg)	5.2235	2.673-7.774	9.109	4.827	2.788-6.866	8.772							
Phenols (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001							
MICROBIOLOGY													
THB	3.625	3.00-4.25	7.30	2.05	2.00-2.10	4.50	1.3050.0	12400.0-1370(	14500.0	12200.0	11800.0-12600.0	13300.0	-
THF	2.36	2.00-2.72	3.50	1.35	1.20-1.50	2.65	3800.0	3100.0-4500.0	2000.0	3000.0	2700.0-3300	1400.0	-
HUB	ND	ND	ND	ND	ND	ND	7550.0	7000.0-8100.0	5400.0	5650.0	4800.0-6500.0	7550.0	
HUF	ND	ND	ND	ND	ND	ND	2550.0	2400.0-2700.0	ND	1600.0	1300.0-1900.0	2550	

Sources: Emzor Field Survey, 2022

Table 4.7: Physico-chemical Characteristics of Soil within the Study Area

Parameters (Units)	Project Influence Zone (Wet Season)2012						Project Influence Zone (Dry Season)2012						NESRE Limits
	Topsoil (0-15cm)			Subsoil (15-30cm)			Topsoil (0-15cm)			Subsoil (15-30cm)			
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	
PHYSICO-CHEMISTRY													
Colour	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	
Temp	23.68	22.60	24.60	23.48	22.90	24.10	23.59	22.40	25.2	23.48	22.2	25.0	
Ph	7.39	6.22	6.22	7.36	6.23	8.50	7.52	6.11	8.22	7.49	5.94	8.20	4.8-9.5
Moisture	9.91	8.00	8.00	16.36	12.30	19.00	11.01	7.06	16.99	15.13	11.04	20.00	
Cr (mg/kg)	0.09	0.01	0.01	0.08	0.03	0.14	0.07	0.01	0.12	0.06	0.01	0.11	100
Cd (mg/kg)	ND	0.00	0.00	ND	0.00	0.00	ND	0.00	0.00	ND	0,00	0.00	
Pb (mg/kg)	0.11	0.06	0.06	0.11	0.09	0.14	0.06	0.01	0.12	0.08	0.03	0.20	
Zn (mg/kg)	2.46	1.16	1.16	2.34	1.24	3.28	2.44	1.04	4.12	2.16	0.216	3.80	221
Fe (mg/kg)	11.18	6.71	6.71	10.88	7.12	14.27	9.65	6.92	15.1	9.75	7.94	13.29	450
Ni (mg/kg)	15.21	0.67	0.67	8.21	0.71	102.00	1.13	0.60	2.05	1.15	0.59	1.99	
Mn (mg/kg)	3.56	1.29	1.29	3.63	2.00	4.99	3.31	1.33	5.92	3.30	1.11	5.11	
Sulphate (mg/l)	2.87	2.14	2.13	2.82	2.13	3.20	3.42	2.14	5.20	3.86	2.22	5.60	
Phosphate (mg/l)	0.06	0.02	0.02	0.06	0.02	0.17	0.09	0.02	0.3	0.11	0.02	0.42	
Nitrite (mg/l)	0.13	0.08	0.08	0.15	0.09	0.30	0.23	0.12	0.38	0.23	0.09	0.42	
Toc %	1.32	1.01	1.01	1.33	1.03	1.61	1.59	1.04	2.11	1.54	1.10	2.01	
Sand	81.57	76.00	76.00	79.86	76.00	85.00	80.00	75.00	84.00	79.81	76.00	84.00	
Silt	10.62	7.00	7.00	11.29	9.00	17.00	11.14	9.00	13.00	11.37	8.50	14.00	
Clay	13.08	5.00	5.00	19.64	6.00	90.00	8.86	6.00	12.00	8.91	6.00	11.00	
MICROBIOLOGY													
Total Heterotrophic Bacteria Count	1.490	1.028	2.110	1.425	1.031	2.010	1.548	1.040	2.250	1.265	1.050	1.940	
Total Heterotrophic Fungi Count	8.100	6.000	12.000	8.571	3.000	14.000	9214	6.000	13.000	7.786	3.000	11.000	
Total Conforms	ND	0.000	0	ND	0.000	0.000	ND	0.000	0.000	ND	0.000	0.000	
Total Hydrocarbon Utilizing Bacteria Count	19.857	10.000	38	18.214	12.000	30.000	25.643	16.000	38.000	14.571	8.000	22.000	
Total Hydrocarbon Utilizing Fungi Counts	3.857	2.000	8	4.5	2.000	8.000	3.857	2.000	6.000	3.143	1.000	5.000	
Hydrocarbon Utilizers %	0.014	0.012	0.019	0.013	0.012	0.019	0.015	0.012	0.019	0.015	0.010	0.019	

Source Emzor ESIA 2012

Physiochemical

pH

pH is a most commonly measured soil quality parameter. It shows the acidity, neutrality or alkalinity of a particular soil, indicating the availability of exchangeable cations (e.g., Ca^{2+},Mg^{2+}, K^{+} etc.). The pH of the soil samples collected from the study area for wet season sampling had a pH range of 6.64-6.76 for topsoil and 6.61-6.78 for subsoil, which falls within the acidic range.

Colour

The colors of various soil types collected from the field for analysis were, brown, darkbrown and reddish brown.

Nutrients

Extractable Nitrate

Nitrate concentration in the soil samples for wet season sampling ranges from 22.45-23.01 mg/kg (topsoil) and 20.74-22.39 mg/kg (subsoil)

Extractable Phosphate

Phosphate concentration analyzed and recorded for wet season ranges from 12.68-17.98 mg/kg (topsoil) and 11,90-19.60 kg/mg (subsoil). Phosphate in soil is usually from fertilizer application.

Extractable Total Nitrogen

Total Nitrogen concentrations analyzed in the soil samples from this study ranges from 316.6-320.9mg/kg (topsoil) and 280-326.8 mg/kg (subsoil).

Heavy Metals

Heavy metal refers to any metallic chemical element that has a relatively high density and is toxic or poisonous at low concentrations. Heavy metals analyzed in this study include; Iron (Fe), Copper (Cu), Cadmium (Cd), Lead (Pb), Zinc (Zn), Barium (Ba) and Arsenic (As). Heavy metals are natural components of the earth's crust. Traces of heavy metals as well as others are present in most soil but their minerals are relatively rare.

Concern over the presence of heavy metals in an environment arises from the fact that they cannot be broken down to non-toxic forms. Thus, once they get into natural ecosystems they cannot be degraded or destroyed. To a small extent they enter our bodies via food, drinking water and air. As trace elements, some heavy metals (e.g. copper and zinc) are essential to maintain the metabolism of the human body. However, at higher concentrations they can lead to poisoning.

The recorded levels of heavy metals (As, Ba, Cu, Cd, Zn and Fe) concentration across soils within the study area were found to be within reported values for similar environment and compliant to levels required for optimal functioning of the ecosystem.

Iron

Iron is a major component of most soils. The predominant iron minerals are the oxides but iron is also present in many other minerals (notably carbonates, micas, amphibolite and clays). Although widely distributed, iron deficiencies can occur due to its low solubility in alkaline (calcareous) soils and also in phosphate fixation.

Iron concentrations in the soil samples for wet season sampling ranges from 142.2-148.1 mg/kg (topsoil) and 143.8-150.2 mg/kg (subsoil).

Copper

Copper is generally higher in soils derived from igneous rocks and tends to be lower in extreme acid and alkaline soils. The soil availability levels are similar to that of zinc although its requirements by plants are generally lower. It activates certain enzyme systems in plants, especially those linked with oxidation processes. It is essential for animals. However, copper in excess can be harmful and pollution occurs in areas where copper ores are found.

Copper concentrations in this study ranges from 0.531-0.741 mg/kg (topsoil) and 0 636-0.843 mg/kg (subsoil) Any of the identified sources of copper in the study area could be responsible and they include; domestic waste water, combustion of fossil fuels, phosphate fertilizer application, decaying vegetation etc.

Lead

Lead is toxic to many plant species although a few are relatively tolerant. It is a poison when accumulated in mammals. Waste products from certain industries result in polluted soils and high levels of lead are associated in drainage systems. More widespread is the discharge of lead into the atmosphere from car exhaust fumes due to the use of tetraethyl lead as antilock ingredient. Plants and soils on roadside verges are consequently high in lead. Lead is also widely distributed through its use in batteries, pigments, dyeing and glass. It is used in combination with arsenic as lead arsenate in sprays.

Lead concentrations in the soil samples of this study ranges below <0.001mg/kg (topsoil) and from <0.001mg/kg (subsoil). Lead usually enters soil from anthropogenic sources which include; lead pipe presence, lead additives in vehicles, lead- based paint etc.

Zinc

Zinc occurs naturally in air, water and soil, but zinc concentrations are rising unnaturally, due to addition of zinc through human activities. Zinc is usually added to the environment during industrial activities, such as mining, coal and waste combustion and steel processing. When it finds its way into waterways, it can increase the acidity of waters. Some fish can accumulate zinc in their bodies. When zinc enters the bodies of these fish it is able to bio-magnify (where by these minerals becomes more concentrated) up the food chain. Zinc concentrations in the current studies ranged between 2.086-2.970 mg/kg (topsoil) and between 3.044-3.075 mg/kg (subsoil).

Other metals analyzed during the current studies are Chromium (Cr) and Cadmium (Cd).

4.5.9 Ground Water Characteristics

Naturally, groundwater contains mineral ions. These ions slowly dissolve from soil particles, sediments and rocks as the water travels along mineral surfaces in the pores or fractures of the unsaturated zone and the aquifer. They are referred to as dissolved solids or suspended solids as the case may be. Some dissolved solids may have originated in the precipitation water or river water that recharges the aquifer.

Except for natural organic matter originating from topsoil, all of these naturally occurring dissolved solids are inorganic constituents: minerals, nutrients, and trace elements, including trace metals. In most cases, trace elements occur in such low concentrations that they are not a threat to human health. However, high concentrations of trace metals can be found in ground water near contaminated sources, posing serious health threats.

Two borehole water was sampled within the existing EMZOR facility. Ground water in-situ measurement was carried out and result obtained. The detailed laboratory results are contained below.

Figure 4.12 Groundwater Sampling

Table 4.8: Summary of Ground-Water In-Situ Measurement

Parameters	**Emzor ESIA Wet Season**	
	GW	**GW Ctrl**
Temperature(°C)	31^0C	30.1^0C
pH @ 25^0C	5.15	6.20
Conductivity(µs/cm)	47	97
TDS (mg/L)	101	122
Salinity (ppt)	0.02	0.05

Temperatures of 31 to 30°C were measured in situ from the project sampled borehole and the borehole outside the facility

The borehole pH was acidic (5.15), whereas the control's pH was also acidic at (6.9). Total dissolved solids levels ranged from 101ppm to 122ppm, with salinity levels ranging from 0.02 to 0.05ppt. During in-situ measurements, all parameters were within acceptable limits. Other parameters analysed in the laboratory are presented and discussed below (**Table 4.8**).

Table 4.9: Analysis of Ground Water Physico-chemistry Characteristics

PARAMETERS	GW1	GW Ctrl	WHO Limits
PHYSICIO-CHEMICAL			
Appearance	Slightly colored	Clear	Clear
Odour	Non	Non	Unobjectionable
pH @ 250C	7.56	7.70	6.5-8.5
Color	1	1	
Temperature (0C)	26.78	26.33	Ambient
E. Conductivity (µs/cm)	47	97	1000
BOD(µs/cm)	1.80	1.92	-
Salinity (ppt)	0.06	0.08	-
COD (mg/L)	8	16	-
DO (mg/L)	3.45	3.54	-
Turbidity (mg/L)	0.0	0.0	5.0
TSS (mg/L)	ND	ND	-
TDS (mg/L)	55	79	500
Alkalinity (mg/L)	35	50	-
EXCHANGEABLE CATIONS			
Magnesium(mg/L)	4.84	5.45	50
Ammonium (mg/L)	0.267	0.080	-
Calcium (mg/L)	8.02	9.02	75
Sodium(mg/L)	13.19	1.109	
Potassium(mg/L)	1.109	1.230	
EXCHANGEABLE ANIONS			
Nitrate (mg/L)	0.05	0.92	50
Nitrite (mg/L)	0.016	0.012	
Sulphate (mg/L)	7.50	8.76	500
Phosphate (mg/L)	0.158	0.006	-
Chloride (mg/L)	20.24	23.63	500
Silicate(mg/L)	9.608	10.85	
ORGANICS/OIL&GREASE			
TPH (mg/L)	<0.001	<0.001	
THC (mg/L)	0.092	ND	
HEAVY METALS			
Iron (mg/L)	5.538	1.846	0.3
Lead (mg/L)	<0.001	<0.001	0.01
Cadmium (mg/L)	<0.001	<0.001	-
Chromium(mg/L)	<0.001	<0.001	3
Manganese(mg/L)	0.011	0.057	0.4

Vanadium(mg/L)	<0.001	<0.001	-
Barium (mg/L)	<0.001	<0.001	-
Mercury(mg/L)	<0.001	<0.001	0.006
Nickel(mg/L)	<0.001	<0.001	0.07
Zinc(mg/L)	0.117	0.172	3.0
MICROBIAL			
THB	1.00	1.30	100
THF	ND	1.50	-
HUB	ND	ND	-
HUF	ND	ND	-
Total Coliform	3.7	<1.8	

Physiochemical

pH

pH of water determines the solubility of chemical constituents such as nutrients (phosphorus, nitrogen, and carbon) and heavy metals. pH is therefore an index of groundwater pollution. Although pH has no direct health implication on humans, high pH encrusts water pipes and water using appliances with deposits; and depresses the effectiveness of groundwater disinfectants. pH 9.2 would markedly impair the portability of drinking water (WHO 2011). The pH concentration of the groundwater samples from are7.56mg/L and 7.70mg/L respectively and they are within FMEnv acceptable limits.

Turbidity

Turbidity is a measure of the degree to which water loses its transparency due to the presence of suspended particulates. The more suspended solids in the water, the murkier it is and the higher the turbidity. Turbidity is considered a good measure of the quality of water. The recorded turbidity level is 0.0 for both ground water samples collected.

Dissolved Oxygen

Dissolved Oxygen (DO) is a measure of the amount of gaseous oxygen dissolved in the water sample. It is an indicator of biological activity in a water body and is essentially for aerobic respiration. The DO concentration of the groundwater samples was 4.26 and 4.15 mg/L and is within WHO permissible limits (6.5-8 mg/L).

Total Suspended Solids (TSS)

The values from all water samples revealed a very low presence of contaminants in the water within the facility and high values in the control. The water in the facility is within WHO permissible limits (≤ 30 mg/L).

Electrical Conductivity

Electrical conductivity gives an indication of the amount of total dissolved substitution in water. Pure water containing less or no organic salt is an excellent insulator which cannot conduct electricity, hence any water with EC concentration above WHO/FMEnv limits is said to be polluted (IFC EHS 2007). The EC of the groundwater sample from were 192.0µs/cm and 330µs/cm and are with WHO regulatory limit.

Nutrients (Nitrate, Sulphate and Phosphate)

Nutrients are essential for the growth of micro-organisms in groundwater. Excessive concentrations of nutrients in drinking water, however, promote bacterial growth, as well as imparting bitter taste (WHO 2011). High level of nutrients in groundwater is attributed to failing septic systems, excessive use of agriculture fertilizers, leachable from refuse dumps and industrial discharges. Nutrients level above the maximum permissible limits in drinking water, indicates pollution, and thus poses some health challenges (WHO 2011). Nitrate recorded concentrations of 2.0mg/L and 7.30mg/L, Sulphate recorded 3.0mg/L and 11.0mg/L while Phosphate recorded 0.03mg/L and 00g mg/L respectively in groundwater samples in dry Season. All parameters wee within acceptable regulatory limits.

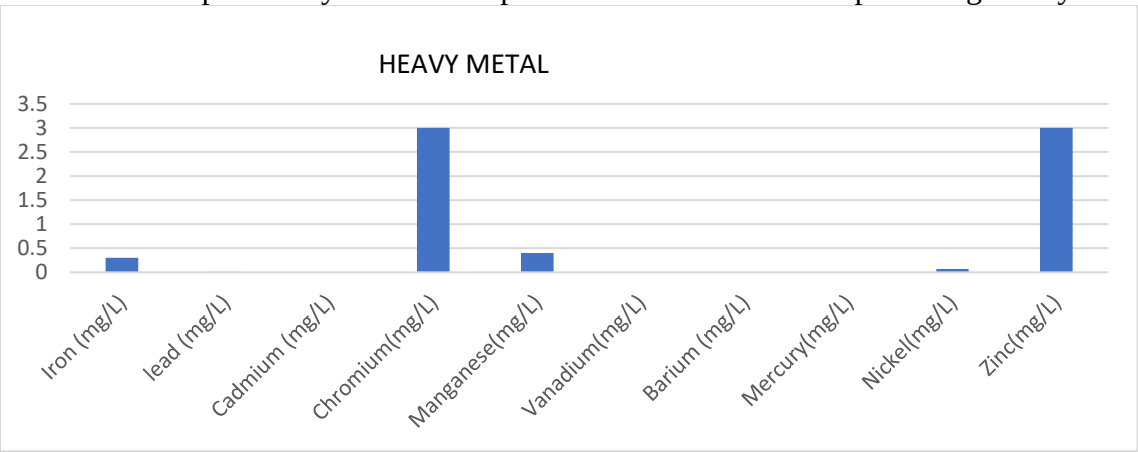

Figure 4.13: Heavy Metals in Groundwater

Ground Water Microbiology

More than 95 percent of the world's available fresh water (excluding ice caps and glaciers) is groundwater. This ground water is valuable as a source of drinking water for most communities in the world, especially small ones. The groundwater in a drinking-water well may contain a wide variety of microbes without presenting a public health risk. However, groundwater in some areas becomes contaminated by the faecal material of humans and other animals.

This is a cause for concern because faecal material may contain pathogenic (disease-causing) microbes that can infect the intestinal tract of humans. Faecal pathogens may be bacterial, viral, or protozoan. Water containing faecal material may seep into the groundwater from the land surface or from underground sources of contamination. Major surface sources include, wastewater and bio solids from sewage treatment facilities that have been applied to land as a soil conditioner; seepage from shallow artificial ponds (lagoons) used for processing sewage; seepage from contaminated lakes and other surface-water bodies; urban runoff; faeces from cattle and other livestock operations; and improperly constructed sanitary landfills where trash and garbage are disposed. Faecal contamination also can reach the groundwater from underground sources, such as improperly functioning septic tank systems, underground reservoirs for liquid household sewage (cesspools), or leaking underground sewer lines.

4.5.10 Biodiversity / Ecological Characteristics

Flora

The immediate API/ETP project site has been cleared and devoid of vegetation as facility is brownfield. The surrounding environment consist of mainly secondary rainforest on hillside and valley. The highland range from 300-600m in height and soil is reddish to ferruginous type.

Due to the nature of the land mass, which is designated for industrial use, the project area has little to no flora and fauna diversity. The development was built around a Kapok tree (Ceiba pentandra) that had been left behind after a significant amount of the land had been cleared. Furthermore, none of the recognized species in the area are of conservation value. major Flora observed are majorly weeds like ***Ipomoea asarifolia***, some developing plantations of Pawpaw (Carica papaya) were also available on the site, *Cynodondactylon* etc

Figure 4.14 Kapok Tree

Fauna

Fauna species within the project site is limited has site is devoid of vegetation. However, fauna characteristic of the surrounding areas from previous ESIA and interview with the community representative on sighted and dominant species found within the area include; small invertebrates such as earthworms, ants, grasshoppers, butterflies and spiders and vertebrates like lizards (Agama agama) and birds. Other species mentioned are as presented in **Table 4.9** below;

Table 4.10: Fauna Abundance in the Study Area

COMMON NAME	SPECIES	ORDER	FAMILY	CLASS	IUCN CLASSIFICATION	PHYLUM
Earthworms	*Eudrilus euginae*	Lumbriculida	Eudrillidae	Oligocheata	Not evaluated	**Annelida**
Toad	*Sclerophrys regularis*	Anura	Bufonidae	Amphibia	Least concern	**Chordata**
Dove	*Columba livia*	Columbiformes	Columbidae		Least concern	
Agama Lizards	*Agama mucosoensis*	Squamata	Agamidae	Reptilia	Least concern	
	Agama africana				Least concern	
	Agama boensis				Least concern	
Spider	*Alfenus chrysophaeus*	Araneida	Salticidae	Archanida	Not evaluated	**Anthropoda**
	Hiratoscirtus torquatus				Not evaluated	
Beetles	*Stephanocrates spp*	Coleoptera		Insecta	Not evaluated	
Housefly	*Musca domestica*	Diptera	Muscidae		Not evaluated	
Mosquitoes	*Anopheles spp*				Not evaluated	
Termite	*Macrotermes spp*	Isoptera			Not evaluated	
Grasshoppers	*Conocephalus spp*	Orthoptera	Pyrgomorphidae		Least concern	
Cricket	*Gryllus bimaculatus*		Gryllidae		Least concern	
	Brachytrupesportentosu				Not evaluated	
Praying mantis	*Sphodromantis viridis*	Mantodea			Least concern	
Butterflies	*Aslauga camerunica*	Lepidotera			Not evaluated	
Moths	*Acantharctia metaleuca*				Not evaluated	
Centipedes	*Lithobius spp*	Chilopoda			Not evaluated	

IUCN Red list 2019, EN = Endangered, VU = Vulnerable, LC = Least Concern, DD = Data Deficient, NE = Not Evaluated.

Economic Importance

The local community identified some fauna species of economic importance to the livelihood. The Antelope, Grass-cutter, Sheep, Goats, were identified as source of food, and source of income when sold in trade. The prices for games hunted in the forest ranged from ₦3000 to ₦5000 depending on the size and value attached.

Protected Areas

At the time when studies were carried-out, there were no recorded protected area within the project area of influence of about 1km.

4.5.11 Socio-economic and Health Profile of Host Community

The ESIA involved socio-economic and health studies which outlines baseline socio-economic, health, environment and infrastructure indices of the study area and communities surrounding it. It also provides data on the cultural heritage and lifestyle in study area, while the consultation process elicited responses on stakeholder's concern and action as regard the API project in Makun and its surrounding community in Sagamu.

Study Methodology, Design and Strategy

The study was designed to obtain important socio-economic and health data from the community, LGA and State. To this end a strategy was adopted which entailed:

- Conducting literature searches and reviews
- Conducting field visits, holding interviews and discussions, and administering questionnaire
- Collation and analysis of data obtained from all the sources
- Report preparation

The socio-economic and health study covered:

- Population distribution and demographic conditions in the community and LGA;
- Social characteristics including ethnic composition and marital status of the population;
- Adult literacy rate, school enrolment and education attainment.
- Lifestyle and Social Vices
- Environmental Health
- Consultations and Stakeholders Engagement

Also included were the:

- Local economy;
- Land use and resource harvesting, involving examination of natural resource endowment and their exploitation for sustenance;
- Indicators of the quality of life of residents including quality of housing, access to potable water, availability of functional infrastructural amenities;
- Health conditions, livelihood activities and income levels were studied.

Additionally, the study discussed the perceptions, concerns and expectations of members and residents of the community, in order to determine the proposed project's potential impacts, impact enhancement and mitigation measures.

Study Methodology, Design and Strategy

The study was designed to obtain all relevant socio-economic and health data from the community, LGA and State. To this end a strategy was adopted which entailed:

- Conducting literature searches and reviews.
- Design and pre-testing of structured questionnaire used in the study.
- Conducting field visits, holding interviews and discussions, and administering questionnaire.
- Collation and analysis of data obtained from all the sources.
- Report preparation.

Data Collection

This study employed both primary and secondary data sources. The primary sources of data included the, key informants, general group discussions, interviews and direct observations made during field visits while secondary data were sourced from published and unpublished documents obtained from the previous study carried out within the site and other academic sources. All the published documents are referenced in the bibliography at the end of this report.

4.6 Outcome of Stakeholders Consultation and Integration in Studies

Consultation is a major feature of the socio- economic component of the EIA process and remains continuous for any project and which in this case incorporated all individuals in the communities that may be directly or indirectly affected by the API-ETP project. Field consultations and discussions were held with community members and residents, women and youth. This was part of an integration programme consisting of interactions and consultations with community residents and stakeholders, project disclosure and advocacy.

Project disclosure and advocacy serves as a tool to inform and secure permission and co-operation for the study all attempted to record the major concerns and views of all stakeholders. It shall also help to minimise the potential conflicts that could arise during project implementation while the meetings served to elicit information from residents as a major source of primary data for the study. Other stakeholders like the Federal Ministry of Environment (FMEnv), Ogun State Ministry of Environment (OGMEnv) participated in overseeing the primary data gathering processes.

Several means of collecting data such as Focus Group Discussions (FGD), questionnaire, interview etc were used during the consultation meetings and to gather community data relating to baseline conditions, socio-economic and health impacts (direct and indirect, beneficial and adverse, short and long term) and also to obtain stakeholders' concerns and expectations from the proposed project. The activities included discussions and interviews.

Discussions included local traditional administrative institutions, historical background of the community, its heritage, and migration patterns. Socio-cultural resources, social structures, vices and conflict management procedures were discussed. Similarly, land ownership and tenure, housing conditions, employment situation, livelihoods, incomes and expenditure patterns, infrastructural network and development prospects were discussed. Other issues discussed included availability and utilization of health facilities, staffing of facilities and prevalent disease conditions. Community health issues, environmental health, personal hygiene and nutrition, maternal health, child birth and immunization were among issues discussed. Perceptions and concerns of community members and residents about proposed project; and community needs and expectations were discussed.

The integration programme provided benefits including determination of potential socio-economic and health impacts of the proposed project and impact enhancement and mitigation measures associated with it. It also potentially exposed areas in which Emzor Pharmaceutical Limited Non-Governmental Organizations (NGOs) and government agencies could assist in sustainable development efforts in Makun/Iwelepe communities. Consultation activities in the community is a continuous effort and thus provides useful feedback to ensure community integration and sustainable development during all phases of the life of the project.

The project activities involved extensive consultation with authorities and the community involved. It should be noted that Consultation is a major requirement in all Emzor's projects and it is a continuous process that spans through the life cycle of the project through Stakeholders engagement at various phases of the EIA process (fieldwork, laboratory analysis, open forum, etc.).

4.6.1 Objectives of Consultation

The main objectives for carrying out consultation for the Emzor's Project include:

- Sustaining consultation with stakeholders via people's parliament with explanation on key issues associated with the project and their effects on the people.
- Assuring full commitment to implement mutually accepted sustainable community development Projects.
- Facilitating communication and understanding between the various stakeholders and Emzor (the project proponent).
- Gaining support and buy-in from all relevant stakeholders.
- Comply with mandatory statutory requirements.
- Identifying issues relevant to the project which are likely to cause impact.
- Providing a link between the communities and Emzor in order to obtain early notification of any changes in the environment as a result of the project.
- Being aware of stakeholders' views of the project with respect to the present environmental conditions in the area and any changes thereof in the future.

- Considering effective participation of the host community in maintaining and sustaining the beneficial impact of the project.
- Maintaining continuous interaction with the host community to obtain early warning information on the physical, chemical, biological, health, and social components of the environment to tackle detrimental consequences during the construction and operational phases of the project.

Relevant Stakeholders

- Stakeholders are those affected to varying degrees by the impact of the proposed API-ETP project. Primarily, the stake holders are the inhabitants of the host communities alongside all other institutional stakeholders like the Ogun State Ministry of Environment and all other relevant governing bodies (FMEnv). The identified stakeholders for this project is the host community known as Makun community.

4.6.2 Stakeholder Engagement Sessions

The stakeholder engagement with the governing council of the community took place on 5th November 2021 in view of the proposed API-ETP project and subsequent meeting on 6th July 2022 to register the concerns of residents and business owners within the area of Influence (AoI) and have a social license to operate within the community.

Regulatory agencies such as the FMEnv, OGMEnv were informed through the project proposal and letter of notification were well represented during the session. The proposed API-ETP project description and activities was well explained and spelt out to all stakeholders during this exercise. It is expected that this stakeholder's engagement and consultation will be on a continuous basis specifically through all phases of the project. The following images depict interactions between community stakeholders, the consultant, the State Ministry of Environment, and the Federal Ministry of Environment.

Figure 4.15: Stakeholder Consultation with the Community Youth, Business Owner, Project Proponent and E & S Consultant

4.6.3 Community Perception of the Impact of the Project

Members of the respective host communities who were interviewed during this study were positively disposed to the proposed project.

However, a few of them expressed their thoughts and opinions on the project's activities. They emphasized the project's awareness and its benefit to them by utilizing local labour for construction. They also expressed concern about storm water discharge from the facility, which will be addressed as a result of the API-ETP project currently in progress within the Emzor facility, which will handle the recycling and reuse of effluent waste water with a zero discharge from the entire process.

They all gave good remarks about the Emzor CSR activities and support since the company's establishment in the community.

Identification of Potential Impacts with Stakeholders

During these consultations, the following question format was used as a guide to identify potential impacts and mitigative measures:

Question A: What is the issue/impact?

Question B: What aspect of the project will cause the impact and when /where is it likely to occur?

Question C: What are the sensitive or vulnerable resources/ receptors that could be impacted?

Question D Who are those impacts likely to affect?

Question E: What information do you need to predict the magnitude of (b) on (c)? Question F: Is the potential impact significant (both positive and negative impact)? Question G. What potential measures would you propose to enhance or eliminate or reduce the impact?

Future Consultations

Emzor Pharmaceutical Limited will continue to consult with all the relevant parties concerned with or likely to be affected by the project at all stages of the project development.

4.7 Demographic Studies

Population Size

Nigeria's towns and cities have grown phenomenally with the rate of urban growth consistently above 2 per cent per annum (UNDESA, 2019). In 2017, the urban population for Nigeria was 51.0 per cent of the total population. Over the last 50 years, the urban population of Nigeria has grown substantially from 17.3 to 49.4 per cent rising at an increasing annual rate that reached a maximum of 3.19 per cent in 1981 and then decreased to 1.66 per cent in 2017 (Knoema Nigeria, 2018).

Nigeria has a land area of 909,890 square kilometres (sq. km), NBS. ABS, 2012; and its current population density are 218.2 per sq. km. Similarly, Ogun state covers a total of 618,367-kilometre square land area and shares boundaries with Ondo in the East, Oyo to the North, Lagos and the Atlantic Ocean to the South and to the West Republic of Benin.

As at 2006 Population Census, Sagamu Local Government Area has a total Population figure of about 253,421 people. The estimated population of people living in Sagamu as at 2021 was about 355,900 people showing a growth rate of 4 %. By virtue of the level of industrial, economic development and population concentration, the Local Government is urban in status. Invariably, over 60% of the populations of the Local Government Area are found within the confines of the urban centers.

Religion, Cultural/Archaeological Properties, Custom Belief System and Values

Inhabitants of the project affected communities are predominantly Christian by religion; on the average, there was an 80% per cent profession of Christianity, 5% Islam and 10% traditional religion by the respondents across the surveyed communities. However, there is no Religion, Cultural/Archaeological Properties within the study area.

Cultural Festivals

The study communities have a cultural festival which are celebrated annually during the month of June or July. In Makun the Oro Festival is a known nocturnal (night time) festival celebrated strictly by males in the community while the females are forbidden from participating.

Economic Characteristics and Livelihood

The study communities are rural and agrarian, and production activities are primary and small scale. Various economic activities are carried out namely farming (including livestock and collection of forest products like fruits and firewood), commercial activities, food processing (especially fish smoking, processing cassava into garri and fufu, processing palm oil), hunting, lumbering, handicraft, traditional herbalist and petty trading

A small number of residents of these communities, especially, work as civil/public servants in the local government office or as contractors. Most residents combine economic activities in various forms since production and income levels are low. Residents of Makun are mainly farmers and petty traders.

Language and Communication

The Local Government is populated by all tribes in Nigeria, and the languages spoken are Yoruba (language of the predominant majority), and English (official language). The languages spoken by major ethnic groups bear the names of groups so also the dialects bear that of the sub-ethnic sub divisions. However, Remo dialect of Yoruba language is the main local language for they are predominantly in Sagamu and its environs.

Household Composition, Structure and Size

In the study area, the typical household has a head and several members. In most cases, the father is the head, and members include his wife, children, and wards. Wards could be children of relatives or friends who are fed and otherwise cared for using household resources. The household could also be made up of members who are not related but have agreed to live together under one roof. In the study area, this latter type of household group is uncommon. There is no documented household size for the South Western Region because there are significant variations between individual states, Local Government Areas, and senatorial districts.

Household sizes in rural communities are typically large (8 people per household), despite the fact that several socioeconomic surveys of some urban communities in the South West have revealed even larger, if not larger, households (average size ranges from 6-14) Larger household size is a common phenomenon in most rural Nigeria, which is heavily influenced by polygamy culture.

Health Care Facilities

Makun has a public health center, within the community where all health cases are being catered for. It also has some practitioners of traditional medicine. The dispersion of drug stores (chemists) is uneven. In many cases, herbal care advice is given on herbs and roots found in the environment that are believed to provide relief for certain ailments by local traditional practitioners.

Land Tenure and Use

The land is a very important and key asset in economies that are rural and agrarian like those of the study communities. The ownership and use of land are very significant issues. Lands in these communities are not owned and managed by individuals. They are owned by families (extended families) and assigned or leased to individuals.

Individuals however, exercise some ownership rights over the piece of land on which they have built their residences. The land ownership practices make it imperative for negotiation to lease or acquire any land to be done through the community.

Traditionally, lands have been put to use for economic, housing, development and cultural purpose. The most significant economic purpose is use as farmlands. Some lands have been used for residential purposes and citing of social amenities.

When lands are leased, they are for a specific period or duration but most land on which residences are developed had been handed down by ancestors. Such are held on a freehold basis and both male and female exercise equal rights on land ownership within these communities. Community lands are used for development of infrastructure and common facilities.

CHAPTER FIVE
ASSOCIATED AND POTENTIAL IMPACT ASSESSMENT

5.0 General

This chapter evaluates and identifies the biophysical, health, and socioeconomic implications of all phases (pre-construction, construction, operation and decommissioning). The findings from the overall assessment of the potential and associated environmental impacts of the proposed API-ETP project to be installed and operated in the Makun community area of Ogun State were also presented. It takes into account the potential effects of abnormal occurrences in addition to those that may result from normal operations.

The impacts are expressed as threats or opportunities to the wellbeing of humans and the environment. Project activities / environmental interfaces generally encompass a broad range of concerns such as air and water pollution, effects on employment and land use change, etc. These issues have been considered in arriving at the potential and associated impacts of the proposed project on the environmental receptors. This section describes the overall approach for the impact assessment and mitigation.

The rationale used in this impact evaluation is drawn from FMEnv sectoral guidelines. The assessment process is shown below:

- Identification of the various potential impacts using interaction matrix to show the relationship/ interaction between the project environmental components and planned project activities.
- A screening of potential impacts associated with each phase of the project is performed using a Risk Assessment Matrix; and
- A detailed evaluation of the individual impact producing factors that comprise each aspect of the project phases is then performed. The significances of the potential impacts are quantified using the same rationale as for the screening.

In general, the assessment approach involved matching the various activities of the proposed project's various stages (as described in section three of this report) with the components of the existing environment described in section four. As a result, the potential changes (and extent of changes) in the environment as a result of the interactions have been identified/evaluated, and mitigation measures to reduce, offset, or ameliorate such changes have been proposed.

At this stage of the EIA, the potential/associated negative and positive impacts of the proposed API-ETP project on the existing environment were identified. Among other references, the EIA Procedural Guidelines, the ISO 14001 approach, and the Hazard and Effect Management Process (HEMP) were used in the identification process.

The Risk Assessment Matrix (RAM) has been employed in determining risks posed by the identified potential/associated impacts of the project in order to proffer appropriate mitigation measures. In predicting impacts, the experiential/practical 'worst case scenario' approach has been applied to determine the extreme effects of project activities on environmental components, while 'consensus of opinions' has been made use of to determine the importance of affected environmental components. The impact evaluation results make up the pedestal for developing the EIA of the proposed project.

The identified impacts were evaluated and compared using specific criteria such as legal/regulatory requirements, magnitude of impact, risk posed by impact, public perception of affected environmental component, and importance of affected environmental component. This section of the report presents the findings of the identification and evaluation processes.

5.1 Impact Assessment Techniques.

Figure 5.1 below depicts the steps taken in identifying, assessing, and evaluating the potential and associated impacts of the proposed project.

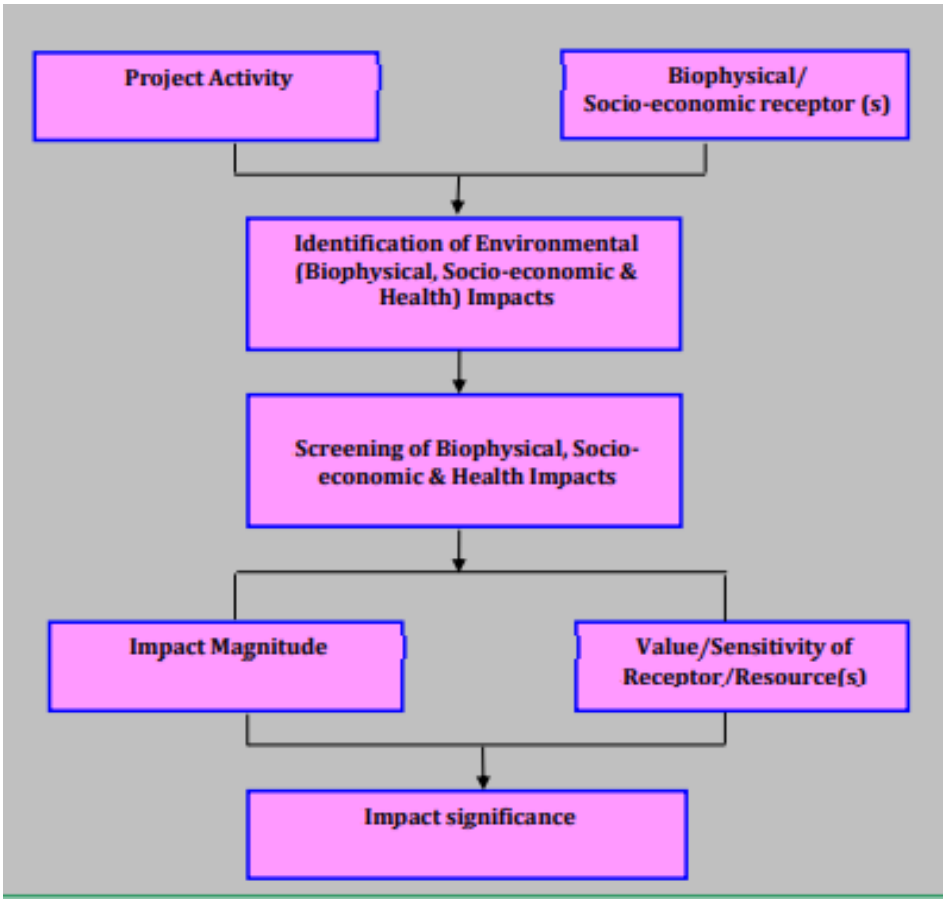

Figure 5.1: Impact Assessment Process Overview

5.2 Environmental and Social Indicators

The API-ETP development project activities discussed in section three of this EIA will interact with environmental components, and their impact indicators will be tracked to determine the level of impact. The following are the environmental components and impact indicators:

- Noise and vibrations impact indicator: Noise levels measured in decibels (dB).
- Ecological impacts indicators: Floral (edible plants and weeds) and Fauna (Small reptiles and insects) abundance and diversity.
- Air quality impact indicators: SPM, NOx, SO, CO, VOCs, NH3, H2S, CH4, O_2
- Hydrology and water quality – Surface water and Groundwater (boreholes) impact indicators: Dissolved and suspended solids, pH, BOD, COD, turbidity, toxicity, heavy metals and microbial loads.
- Soil impact indicator: Soil type, soil physicochemical compositions, microbial composition; particle size description.
- Socio-economic and health impact indicators: Needs and concern of host communities and third-party concerns; community population and ethnicity; community relations; livelihood activities; opportunities for employment; income level; health facilities and risks; waste streams and sanitation (handling, treatment and disposal); land-use; access to electricity; infrastructure (access to household water, roads, transport, electricity); and climate change factors.

5.3 Impact Identification and Characterization Technique

Impact identification is a procedure that ensures all potentially significant impacts are identified and taken into account during project design and implementation. The identified impacts were classified into two types: positive and negative impacts. The impacts were assessed at various stages of the project's life cycle, including mobilization/construction, operation, and decommissioning.

In order to make an overall significance assessment for the impact, the techniques adopted considers the nature, type, and degree of reversibility on the impact, the magnitude of the change, and the current status and sensitivity of the resource/receptor. (Figure 5.2).

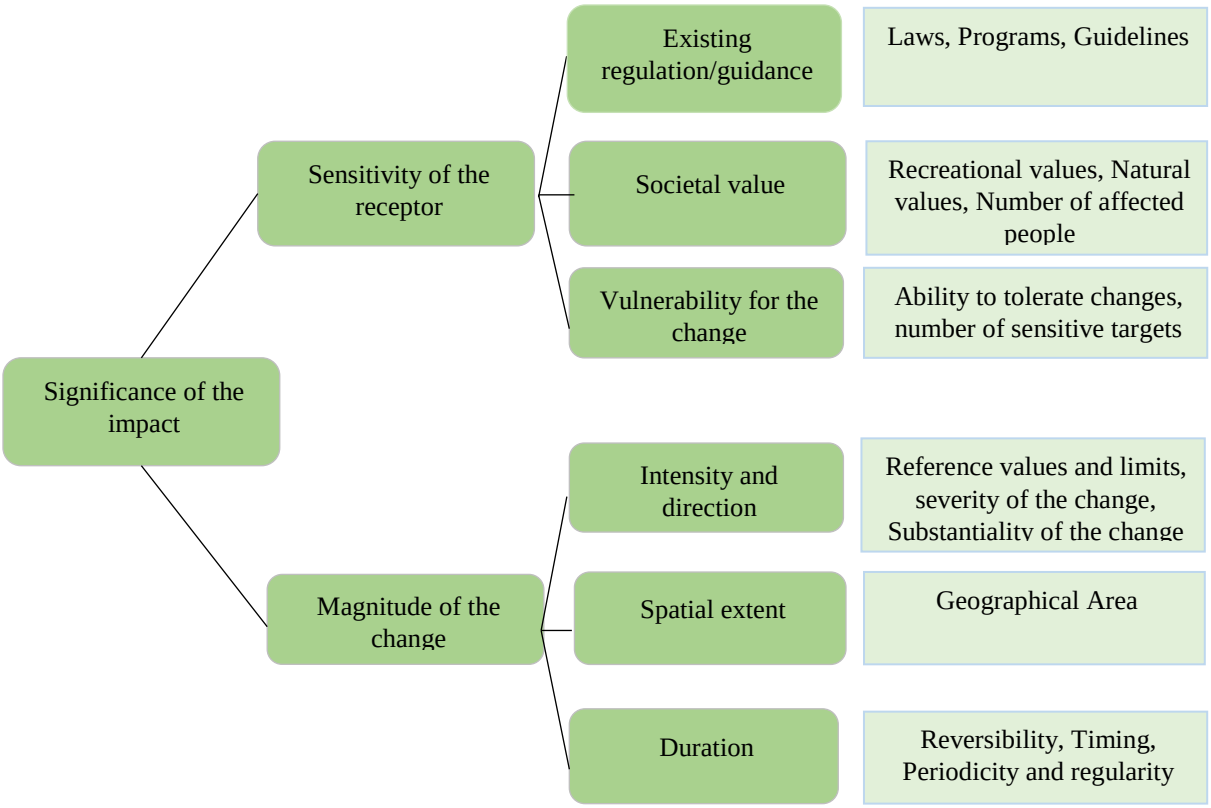

Figure 5.2: Impact Characterization

This entails identifying the existing baseline environmental, social, and project subcomponents that are likely to be impacted by the proposed project. The identified impacts have also been classified as reversible or irreversible, direct or indirect, short or long term, permanent or temporary, and cumulative, among other things.

Table 5.1 Impact Descriptions

NATURE OF IMPACTS	
Positive Impacts	These are significant benefits that result from an improvement to the baseline or the inclusion o new, desirable factor.
Negative Impacts	These are negative consequences caused by an antagonistic change from the baseline or introduction of a new, undesirable factor.
Direct Impacts	These are inevitable consequences that are directly related to the project's proposed activities.
Indirect Impacts	These are the changes that are less obvious or impacts are further away from the impact source.
Cumulative Impacts	Impacts resulting from the interaction of project components or activities with other activities in past, concurrently, or in the future.
Residual Impacts	These are the effects that persist even after mitigation measures have been implemented.
REVERSIBILITY / IRREVERSIBILITY	
Reversible Impacts	These are impacts that do not cause permanent change to the components of the environment.
Irreversible Impacts	These impacts cause permanent impairment to the environmental component of the area.

DURATION OF IMPACTS	
Long Term	Impacts that will continue for the life of the Project, but cease when the project stops operating
Short term	Short term impacts are predicted to last only for a limited period or as a result of mitigation measu and natural recovery
On-site	These are limited to the project site

5.3.1 Project Associated Activities

The associated activities to be carried-out across the phases of the API-ETP project are highlighted below.

Preconstruction Phase

- Preliminary site surveys and investigation works
- Mobilization of personnel and equipment for site preparation activities
- Stakeholders' engagement
- Site preparation activities including fencing, vegetation removal, excavations, earth works.

Construction Phase

- Installation of safety signages, markings and cordoning-off
- foundations work and construction,
- Concrete works
- Construction of buildings (offices, laboratory, ETP plant)
- Commissioning

Operation Phase

- Operation of the API-ETP Facility
- Use of water for domestic activities and industrial activities.
- Power generation and servicing (installation of electric pole to obtain electricity from an already existing power plant)
- Routine maintenance of installed facilities,
- Recruitment of workers
- Waste generation

Decommissioning Phase

- Shutdown of activities,
- Removal of electrical cables and wires
- Demolition of buildings for land retrieval,
- Demobilization of decommissioned equipment,
- Waste generation and management
- Site Restoration activities – clean-up of site and landscaping

Table 5.2: API-ETP Project - Environmental Interaction Matrix

Associated Project Activities	*Air Quality*	*Noise / Vibration*	*Ecology and Ecosystem Services*	*Soil and Topography*	*Hydrology and hydrogeology*	*Socio-economic and Health*
Pre-construction Phase • Preliminary site surveys and investigation works • Mobilization of personnel and equipment for site preparation activities • Stakeholders engagement • Site preparation activities including fencing, vegetation removal, excavations, earth works.	**X**	**X**	**X**	**X**		**X**
Construction and Installation Phase • Mobilization of construction personnel and equipment's • Installation of safety signages, markings and cordoning-off • foundations work and construction, • Construction of buildings (offices, laboratory, ETP plant). • Commissioning	**X**	**X**	**X**	**X**	**X**	**X**
Operation Phase • Operation of the API-ETP Facility • Use of water for domestic activities and industrial activities. • Power generation and servicing (installation of electric pole to obtain electricity from an already existing power plant) • Routine maintenance of installed facilities, • Emergence of large-scale enterprise	**X**	**X**	**X**	**X**	**X**	**X**

• Recruitment of workers • Waste generation						
Decommissioning Phase • Shutdown of activities, • Removal of electrical cables and wires • Demolition of buildings for land retrieval, • Demobilization of decommissioned equipment, • Waste generation and management • Site Restoration activities – clean-up of site and landscape	**X**	**X**	**X**	**X**		**X**

Key: X – identified interaction

5.3.2 Project Phases and Associated/Potential Impacts

Impacts identified for Pre-Construction stages include;

Environmental

Positive

- Stakeholder consultation and engagement is carried out with the goal of informing identified stakeholders about project activities and providing them with an opportunity to contribute to project development.
- The EPC contractors will be sensitized and trained on the ESMP implementation and monitoring which will be beneficial.
- Job opportunities resulting from the hiring of unskilled labour for vegetation clearing, labourers, and security.

Negative

- Loss of biodiversity and vegetation of about 10 hectares of land within the site through site clearing, however, the site will not be cleared at the same time but in batches and a green area will be set aside as buffer zone:
- Air quality pollution as a result of excavation of the land
- Influx of people (migrant workers, sub-contractors and suppliers) and increased pressure on existing social infrastructure.
- Pre-construction operations which include grading, filling, excavation, earthwork and movement of vehicles and heavy construction equipment will disrupt top soil. The disruption of soil profile- mostly loss of top soil, will increase the erosion potential at the project site, however the facility is not prone to flooding, there are drainages available
- Increased noise levels and vibrations within the project area from movement of heavy-duty equipment
- Generation of solid waste (scrap metal, wood, sand, concrete, iron rods, paper)

Occupational Health –

Positive

- During the pre-construction phase, Occupational Health and Safety (OHS) awareness will be conducted. Awareness programs will benefit primarily, PMU (Project Management Unit) and third-party contractors, Guidelines on safe practices and safe behaviours will be given.

Negative

- Increased traffic during mobilization with risk of accidents leading to injury/death and loss of asset;
- Trips, falls, dust inhalation and injuries from open excavations and working at heights.

Socio-economic –

Positive

- The project will conduct socioeconomic stakeholder consultations to educate the residents of the host communities about the project's social safeguard components. The public consultations process is viewed positively because it will serve as a foundation for project concept, decision-making, and implementation.
- Generation of jobs (skilled and unskilled) during site preparation
- Increased demand for goods and services from retail vendors and canteens as a result of job opportunities made available for host community, locals especially the youths.
- Increased revenue for suppliers as some materials will be sourced locally.

Negative

- Stock piling and dust from materials and vehicular activity may affect the facility's visual aesthetics for personnel and visitors.
- Conflicts over employment issues
- Population impacts, as there would be a minor increase in the host communities as a result of the preparation efforts;

Impacts Identified for Construction and Installation stages include;

Environmental –

Positive

- Employment opportunities for people within the host communities for both skilled and unskilled workers
- Installation of ETP will avoid the disposal of waste water generated to the nearest water body, the waste water will be reused to in -house for domestic purpose;
- Increased livelihood from employment opportunities among host communities, locals, youth, increasing demand for goods and services from retail vendors
- Increase in market availability of therapeutic drugs (Anti-Malaria)
- Reduce the footprint on drug importation
- Provision of electricity from the already existing power plant within the facility with a backup generator of 800KVA, which will result in less emission.

Negative

- Emissions generated from vehicle exhaust, dust and machinery engine emissions could potentially pollute air.
- Introduction of invasive species through negligence in the management of imported equipment.
- Site runoff resulting from dust suppression sprays, cement works, oils, grease from machinery and vehicles

- Soil / groundwater contamination resulting from accidental leakages and spills from heavy duty trucks
- Construction activities will alter and lead to loss of the existing fauna and flora habitat (landscaped area with trees) and diversity around the facility.

Occupational Health

Negative

Issues relating to health and safety include:

- Increased dust in the ambient air in working zones;
- Heat stress from increased exposure of construction workers to the sun;
- Work site accident and injuries, trips, falls and burns;
- Increased risk of infections and spread of communicable diseases due to influx of people.
- Increased noise and vibration levels;

Socio-economic

Positive

- Recruitment of skilled, semi-skilled and unskilled labour will be done locally, as much as practically possible, and any foreign workers would mostly be hired if there are no locals to fill the job post.
- Improved livelihood from job opportunities for locals especially the youths. There will also be an exponential increase in demand for goods and services from retail vendors and canteens around the project area.
- This phase will encourage the conduct of safety frameworks such as Occupational Health Risk Assessment (OHRA), Job Hazard Analysis (JHA),Hazard Identification (HAZID), Hazard Communication Programs (HAZCOM), Occupational Health Safety (OHS) trainings and other proactive safety strategies which will fulfil the social and fiscal imperatives and this will help reduce the occurrence of onsite accidents and curb the direct or indirect associated financial costs.
- OHS efforts will be intensified during this phase as traffic signs, warning and hazard signs will inform the people working in the area and others about the on-going construction works in the area.

Negative

- Construction activities may also bring about noise pollution, thus, being a nuisance to neighbours near-by, and others.
- There will be traffic congestions especially along the road as a result of heavy-duty vehicles conveying construction materials to site.
- Possibility of conflict between contractor and working personnel.
- Increased traffic and road accidents from increased vehicle movement.

Impacts Identified for Operations and Maintenance Stages include:

Environmental –

Positive

- Creation of substantial pharmaceutical infrastructure within the state and nation.
- The API-ETP project is of great importance because it handles the treatment of the waste water generated during the manufacturing process, hereby mitigating the effect of the such effluent in the environment.
- Operation of the ETP will avoid the disposal of waste water generated to the nearest water body, the treated waste water will be reused in-house for domestic purpose;
- Increased livelihood from employment opportunities among host communities, locals, youth, increasing demand for goods and services from retail vendors
- Increase in market availability of therapeutic drugs (Anti-Malaria)
- Reduce the footprint on drug importation

Negative

- Air Pollution by volatile and gaseous emission (CO, $CHCO_2$, NOx, etc.) from diesel generators and other pollutant emissions from industrial activities in the API-ETP.
- The operations of the generators and power plants, and industrial operations will generate noise pollution.
- Water and Soil contamination in the event of an accidental oil spill, or contaminants from serviced generators and vehicles can seep into ground and groundwater, which may contaminate the aquifer.
- Pollution of surface waterbodies by wastewater generated from industrial waste discharge, domestic waste, E-waste etc.
- Traffic congestion along the route leading to the API-ETP.
- Generation and handling of waste materials (paper, domestic wastes, E-waste, etc).

Occupational Health –

Negative

- Work place accidents/incidents resulting from slips, trips and fall from height, cuts and bruises during operation and maintenance.
- Accidental fire outbreak with resultant smoke and soot from the facility

Socio-economic –

Positive

- Offers graduates employment opportunities as well as a channel for knowledge transfer to help skill up the workforce.
- Improve tertiary institution educational curriculum as partnerships will be formed with corporates and local/international academic institutions to improvement tertiary institution educational curriculum and, sensitization programs in universities to change perception and

promote innovation and technology among potential graduates with the aim of increasing talent supply.

- Promote Research and development for innovation
- Improved Aesthetics for the host community.
- An expansion of e-governance and public procurement in the country
- Promotion of employment opportunities and poverty reduction: the project will attract employment during construction and operation. The employment will increase income to local communities as most of the casual laborers and some skilled workforce will be sourced from the project sites
- Bridge of gender gap. Participation and mainstreaming different groups (women, boys, girls and men's) will have impact in minimizing disparity among vulnerable parts of the community (elders, women, children and youth). Livelihood will be more diversified and will improve income of households, diversified livelihood and income cumulatively builds the capacity of households for resilience to sector shocks.
- The attendant rehabilitation /Construction of support infrastructure such as feeder roads in the new institution sites will enhance market and information access for the local communities.
- Digital skills program to increase the talent pipeline in the country
- Increase entrepreneurial culture and a young labour force in the country
- Economic boost for Ogun state and generation of revenue for the state and the Nation;
- it will attract foreign investors to the state, there increasing revenue for the state.

Negative

- Influx of people into the host community, thereby putting pressure on the existing infrastructure and available resources.
- Increased traffic and road accidents from increased vehicle transit.

Decommissioning and Abandonment include;

Environmental –

Positive

- Regrowth of new vegetation and return of species that have migrated away from the area.
- Restoration of the project land to the state close to its original state

Negative

- Disturbance to soil profile, and potential contamination from surface runoff during abandonment.
- Ground water contamination from Site runoff resulting from dust suppression sprays, oils and grease from machinery and vehicles as well as waste water from dismantling works.
- Pollution resulting from improper management of waste
- Air quality pollution as a result of dust and heavy equipment dismantling movement
- Increased noise levels within community during dismantling activities.

Socio-economic –

Negative

- Loss of business/employment/source of income and means of livelihood due to API-ETP Project activity closure. Thus, indirectly impeding other small business activities banking on the project activities.
- Social vices like theft and vandalism as a result of job loss by host community youths
- Increased traffic impact while moving demobilized equipment and personnel

Occupational Health

Negative

- Air quality pollution resulting in illnesses such as swollen eye, difficulty in breathing, catarrh and bronchitis (respiratory tract infections).
- On-site traffic congestion and risk of accident during dismantling of the API-ETP facilities

Table 5.3: Impact Significance Evaluation

Criteria	Rating	Condition
Legal/Regulatory Requirements (L) Status of compliance with relevant Nigerian legislation, policies and plans and any relevant Nigerian or industry policies, standards or guidelines. Requirements have been identified from laws/guidelines reviewed in chapter one.	Low (1)	No legal/regulatory requirement for carrying out project activity
	Medium (3)	Legal/regulatory requirement exist for carrying out activity
	High (5)	A permit is required prior to carrying out project activity which may result in impact on the environment
Magnitude (M) The magnitude (including scale and duration) of the change to the natural or socio-economic environment, expressed, wherever practicable, in quantitative and/or qualitative terms. Magnitude is viewed from perspective of environmental/social receptors affected by considering likely perceived importance as understood through stakeholder engagement and similar project experience	Low (1)	This means that no further mitigation may be required
	Medium (3)	This means that the impact can be mitigated with additional controls and modifications
	High (5)	This means that the impact requires avoidance or major control/mitigation
Frequency of Impacts Occurrence (F) Evaluation of the frequency was based on the historical records of periodicity of occurrences of accidents, spills, fires, social strive, etc. Information of such is obtained through stakeholder sessions, experts experience and professional judgment.	Low (1)	Low frequency of impact (occur in just about one occasion during the project execution period)
	Medium (3)	Intermittent frequency of impact (occur in only a few occasions during the project execution period)
	High (5)	High frequency of impact (occur continuously and almost throughout the project execution period)
Importance and Sensitivity (I) The importance, nature and sensitivity of the impact receptor (physical, biological, or human). Where the receptor is physical, the assessment considers quality, sensitivity to change and importance of the receptor. For a human receptor, the sensitivity of the household, community or wider societal group is considered	Low (1)	Alteration in value, function or service of impacted resource that are not obvious. E.g. non-detectable impact (e.g., emissions from automobile equipment)
	Medium (3)	Measurable reduction or disruption in value, function or service of impacted

		resource. E.g., loss time injury from minor burns
	High (5)	Major reduction or disruption in value, function or service of impacted resource. E.g., impairment of endangered, protected habitat, species
Public Interest/Perception (P) The perceptions of stakeholders, expressed as opinions around certain issues, can be as important as actual impacts. Consequently, the concept of perception is explicitly brought into the evaluation of significance after an impact is evaluated. When an impact is of significant stakeholder concern, this may be cause to raise the significance rating. This prompts the formulation of appropriate mitigation measures which focus on the source of the impact and also address stakeholder perceptions. The risk of not addressing stakeholder perceptions is that reputational damage could arise, resulting in the loss of a 'social licence to operate'..	Low (1)	Unlikely adverse perception among stakeholders / public
	Medium (3)	Possibility of adverse perception among the public and other stakeholders
	High (5)	Pose major public concern among population in the project region Major reduction in social, cultural, economic value
Likelihood / Consequence The likelihood (probability) that the identified impact shall occur. This is estimated based upon experience and/or evidence that such an outcome has previously occurred. Furthermore, in the event an impact has occurred, there is a consequence. Therefore, a likelihood/consequence matrix has been developed as additional criteria for significance rating.	See **Table 5.4**, **Table 5.5** and **Figure 5.2** below.	

5.4 Evaluation of the Consequence / Likelihood of Occurrence

Although appropriate best practices and planned control measures are considered to be in place, impacts are to be assigned levels that represent the magnitude of the consequence that could arise in the absence of control and/or mitigation measures. Table 5.4 below shows the definitions of likelihood and consequence ratings.

Table 5.4: Consequence Ratings

Category	Ranking	Definition
Severe	**5**	Trans-boundary and/or national scale impact resulting in: Long term and profound change and/or damage to the natural environment and its ecological processes; and/or Increase in threat for rare and endangered species of fauna and flora identified in national and global listings. Natural habitat restoration time greater than 10 years and requiring large-scale and long-term intervention. Breach of statutory environmental regulations and/or company policy and/or greater than 200% exceedance of international, national, industry and/or operator standard for an emission parameter. Negative widespread national and international media coverage.

Category	Ranking	Definition
		Significant long-term financial loss.
Major	**4**	Regional to national scale impact resulting in: Medium term change and/or damage to the natural environment and its ecological processes; Reduction in regional habitat and species diversity; and/or Direct loss of habitat for endemic, rare and endangered species of fauna and/or flora and for species' continued persistence and viability. Natural habitat restoration time 5 to 10 years and requiring substantial intervention. Breach of environmental regulations and company policy and/or 100 to 200% exceedance of international, national, industry and/or operator standard for an emission parameter. Sustained adverse national media attention Significant medium-term financial loss
Moderate	**3**	Local to regional scale impact resulting in: Short term change and/or damage to the natural environment and its ecological processes; Direct loss of habitat crucial for species' (including listed species) continued persistence and viability. Introduction of exotic species of fauna or invasive floral species replacing resident 'natural communities' within the project area; Environmental stress lowering reproductive rates of species within the project area. Natural restoration time 2 to 5 years and requiring intervention. Potential breach of environmental regulations and company policy and/or 50 to 100% exceedance of international, national, industry and/or operator standard for an emission parameter Complaints from the public, authorities and possible local media attention Medium term financial loss
Minor	**2**	Local scale impact resulting in: Short term change and/or damage to the local natural environment and its ecological processes; Short-term decrease in species diversity in selected biotopes/areas within the project area; and/or increased mortality of fauna species due to direct impact from project activities. Natural restoration within 2 years requiring minimal or no intervention. 10 to 50% exceedance of international, national, industry and/or operator standard for an emission parameter. Public perception/concern Short term financial loss
Negligible	**1**	Impact largely not discernible on a local scale being absorbed by the natural environment; areas adjacent to disturbed areas absorb exodus of species able to disperse Restoration within 6 months without intervention. Up to 10% exceedance of international, national, industry and/or operator standard for an emission parameter. Public perception/concern. Minimal financial loss.

Table 5.5: Likelihood Ratings

Likelihood / Probability Rating	Attribute – Environmental / Socioeconomic (workers/public)
A	No known occurrence in API-ETP development projects in over 1,000 years)
B	Has occurred in API-ETP development projects between 100 – 1,000 years)
C	Incident has occurred in API-ETP development projects between (10 – 100 years)
D	Happens several times/years in API-ETP development projects between (1 - 10 years)
E	Happens several times/year in API-ETP development projects (10 - 1 year)

These consequence ratings (Table 5.4) combined with likelihood ratings (Table 5.5) are put in the matrix below.

			Likelihood of Occurrence				
			A	**B**	**C**	**D**	**E**
			No known occurrence in API-ETP development project in over 1,000 years	Has occurred in API-ETP development project between 100 – 1,000 years	Incident has occurred in API-ETP development project between 10 – 100 years	Happens several times/year in API-ETP development project between 1 - 10 years	Happens several times/year in API-ETP development project between 10– 100 years
Severity	1	Negligible	**1A**	**1B**	**1C**	**1D**	**1E**
	2	Minor	**2A**	**2B**	**2C**	**2D**	**2E**
	3	Moderate	**3A**	**3B**	**3C**	**3D**	**3E**
	4	Major	**4A**	**4B**	**4C**	**4D**	**4E**
	5	Severe	**5A**	**5B**	**5C**	**5D**	**5E**

Figure 5.2 Consequence/Likelihood Risk Assessment Matrix

Low Risk	Medium Risk	High Risk

5.5. Impact Significance Categories Definition

The overall significance of the proposed project's potential impacts (taking into account the evaluation criteria as well as the product of likelihood and consequence) is described below.

- **Positive impacts**. e.g. economic benefits or opportunities for employment;
- **Negligible or insignificant impact (Gray)** - impacts for which (L+M+F+I+P) is ≤5 with a consequence/likelihood rating of: 1A, 1B, 1C, 1D, 1E;
- **Minor significance (Blue)** - impacts for which (L+M+F+I+P) is ≤6-9 with a consequence/likelihood rating of: 1A, 1B, 1C, 1D, 1E, 2A, 2B, 2C, 3A, 3B, 4A;
- **Medium significance (Orange)**- impacts for which (L+M+F+I+P) is between 10 - 14 with a consequence/likelihood rating of: 2D, 2E, 3C, 3D, 4B, 4C, 5A, 5B;
- **Major significance (Dark red)**- impacts for which (L+M+F+I+P) is ≥15 with a consequence/likelihood rating of: 3E, 4D, 4E, 5C, 5D and 5E.

Table 5.6 presents the significance rating of the potential and associated impacts of the proposed API-ETP project.

Table 5.6a: Significance Ranking of Identified Impacts for the API-ETP Project During Pre-Construction								
	Impacts Summary	**L**	**M**	**F**	**I**	**P**	**Likelihood**	**Impact Rating**
	Environmental							
	• Loss of designated green area within the site through site clearing,	Med (3)	Med (3)	Med (3)	Med (3)	Med (3)	4D	Medium
	• Air quality pollution as a result of fugitive emissions from dust generated and equipment usage although, only while the pre-construction activities are going on,	Low (1)	w (1)	ow (1)	Med (3)	Low (1)	1C	Minor
• Preliminary site surveys and investigation works • Mobilization of personnel and equipment for site preparation activities • Site preparation activities including fencing, vegetation removal, excavations, earth works.	• Pre-construction operations which include grading, filling, excavation, earthwork and movement of vehicles and heavy construction equipment will disrupt top soil. The disruption of soil profile-mostly loss of top soil, will increase the erosion potential at the project site,	Low (1)	Med (3)	High (5)	Med (3)	Med (3)	3E	Major
	• Increased noise levels and vibrations within the project area,	Med (3)	Med (3)	Med (3)	Low (1)	Low (1)	2D	Medium
	Social							
	• Stock piling and dust from materials and vehicular movement, may impair the visual aesthetics of the facility to the employees and visitors of the facility and raise grievances from neighbours respectively.	Low (1	Low (1)	Low (1)	Low (1)	Low (1)	1B	Negligible
	• Impact on population as there would be a slight increase in the host communities due to the preparatory activities.	Med (3)	Med (3)	Med (3)	Low (1)	Low (1)	2D	Medium

	• Impact on land use as available land for community use and expansion will be affected since a vast portion of land has been acquired for other use by Emzor Pharmaceutical Limited. Hence, potential agricultural land is also lost.	Med (3)	Med (3)	Med (3)	Med (3)	Med (3)	4D	Major
	Occupational Health and Safety							
	• Increase in vehicular movement and traffic around the project site leading to potential road accidents. Trips, falls and injuries from open excavations and working at heights	Med (3)	Med (3)	Med (3)	Med (3)	Med (3)	4D	Major

Table 5.6b: Significance Ranking of Identified Impacts for the API-ETP Project During Construction and Installations

	Impacts Summary	L	M	F	I	P	Likelihood	Impacts Rating
• Mobilization of personnel and equipment • Installation of signage, markings and cordoning-off • Soil excavation, foundations and building construction. • Generation of Solid waste and waste removal • Commissioning	**Environmental**							
	• Introduction of invasive species through negligence in the management of imported equipment from port.	Low (1)	Med (3)	Med (3)	Low (1)	Low (1)	2D	Medium
	• Emissions generated from vehicle exhaust, dust and machinery engine emissions could potentially pollute air,	Med (3)	Med (3)	Med (3)	Med (3)	Med (3)	4D	Major
	• Increased noise levels within the project site during the use of heavy equipment such as excavator, bull dozer, cement trucks and vehicular transit.	Med (3)	Med (3)	Med (3)	Med (3)	Med (3)	4D	Major
	• Site runoff resulting from dust suppression sprays, cement works, oils, grease from machinery and	Med (3)	Med (3)	Med (3)	Low (1)	Low (1)	2D	Medium

	vehicles as well as waste water from erosion of temporary stockpile.							
	• Increased use of natural resources such as water for operational activities in the API-ETP facility for domestic cleaning purposes, and other high industrial water demands.	Med (3)	Med (3)	Med (3)	Low (1)	Low (1)	2D	Medium
	• Generation of potential non-hazardous wastes such as metal scraps, and plastics, hazardous materials such as paints and maintenance fluids for equipment (i.e. spent oils, spent lube, waste oil filters etc.) and non- hazardous wastes in the form of sanitary and domestic wastes	Med (3)	Med (3)	Med (3)	Med (3)	Med (3)	4D	Major
	• Construction activities will alter and lead to loss of the existing fauna and flora habitat (landscaped area with trees) and diversity around the facility.	Med (3)	Med (3)	Med (3)	Med (3)	Med (3)	4D	Medium
	Social							
	• Construction activities will also induce noise pollution, thus, being a nuisance to neighbours nearby and passers-by.	Med (3)	Med (3)	Low (1)	Med (3)	Med (3)	3C	Medium
	• There will be traffic congestions especially along the road as a result of heavy-duty vehicles conveying construction materials to site.	Med (3)	Med (3)	Low (1)	Med (3)	Med (3)	3C	Medium
	• Possibility of conflict between contractor personnel.	Low (1)	Med (3)	Low (1)	Med (3)	Low (1)	1C	Minor
	• Increased traffic and road accidents from increased vehicle transit.	Low (1)	Med (3)	Med (3)	Low (1)	Med (3)	3C	Medium
	Occupational Health and Safety							
	• Increased dust in the ambient air in working zones;	Med (3)	Med (3)	Med (3)	Med (3)	Low (1)	2B	Medium

	• Heat stress from increased exposure of construction workers to the sun;	Med (3)	Med (3)	Med (3)	Med (3)	Low (1)	2B	Medium
	• Work site accident and injuries, trips, falls and burns;	Med (3)	Med (3)	Med (3)	Med (3)	Low (1)	2B	Medium
	• Increased risk of infections and spread of communicable diseases due to influx of people.	Med (3)	Med (3)	Med (3)	Med (3)	Low (1)	2B	Medium
	• Increased noise and vibration levels;	Med (3)	Med (3)	Med (3)	Med (3)	Low (1)	2B	Medium

Table 5.6c: Significance Ranking of Identified Impacts for the API-ETP Project During Operations

	Impacts Summary	L	M	F	I	P	Likelihood	Impacts Rating
• Operation of the API-ETP facility • Use of water for domestic activities, industrial activities and other activities, • Power generation and servicing (Installation of electric poles and cables to secure electricity from the already existing power plant within the Emzor premises) • Routine maintenance of installed facilities, • Generation and maintenance of industrial waste, domestic waste, E-waste, etc. • Recruitment of workers	**Environmental**							
	• Air Pollution by gaseous emission (CO, COx, NOx, etc.) from diesel generators and other pollutant emissions from industrial activities in the facility.	Med (3)	Med (3)	Med (3)	Med (3)	Med (3)	3E	Major
	• The operations of the generators and power plants, and industrial operations will generate noise pollution.	Low (1)	Low (1)	Low (1)	Low (1)	Low (1)	1C	Negligible
	• Water and Soil contamination in the event of an accidental oil spill, or contaminants from serviced generators and vehicles can seep into ground and groundwater, which may contaminate the aquifer.	Med (3)	Med (3)	Med (3)	Med (3)	Med (3)	3E	Major
	• Increased use of natural resources such as water for industrial operational activities in the facility	Med (3)	Med (3)	Low (1)	Med (3)	Med (3)	2D	Medium
	• Non -Pollution of surface waterbodies by treated wastewater generated from industrial waste discharge, domestic waste, E-waste etc.	ow (1)	Low (1)	Low (1)	Low (1)	Low (1)	1C	Negligible
	• Generation and handling of waste materials (paper, domestic wastes, E-waste, etc).	ed (3)	Med (3)	Med (3)	Med (3)	Med (3)	3E	Major
	Occupational and Community Health							

	• Work place accidents/incidents resulting from slips, trips and fall from height, cuts and bruises during operation and maintenance.	Med (3)	Med (3)	Low (1)	Med (3)	Med (3)	2D	Medium
	Social							
	• influx of people into the host community, thereby putting pressure on the existing infrastructure and available resources.	Med (3)	Med (3)	Med (3)	Med (3)	Low (1)	2D	Medium
	• Potential impact from spread of sexually transmitted diseases due to influx of people to project area	Med (3)	Med (3)	Med (3)	Med (3)	Med (3)	3E	Major
	• Increased traffic and road accidents from increased vehicle movement.	Low (1)	Med (3)	Low (1)	Med (3)	Low (1)	C	Minor

Table 5.6d: Significance Ranking of Identified Impacts for the API-ETP Project During Decommissioning & Abandonment

	Impacts Summary	**L**	**M**	**F**	**I**	**P**	**Likelihood**	**Impacts Rating**
	Environmental							
• Shutdown of activities, • Removal of electrical accessories and wires • Demolition of building structures, • Demobilization of decommissioned equipment, • Waste generation and management • Site Restoration activities – clean-up of site and landscaping	• Disturbance to soil profile, and potential contamination from surface runoff during abandonment.	Med (3)	Low (1)	Med (3)	Low (1)	Med (3)	C	Minor
	• Surface water (adjoining rivers) contamination from runoff resulting from dust suppression sprays, oils and grease from machinery and vehicles used for dismantling works.	Med (3)	Med (3)	Low (1)	Low (1)	Low (1)	C	Minor
	• Improper management and disposal of waste	Low (1)	Med (3)	Low (1)	Med (3)	Med (3)	C	Medium
	• Air pollution as a result of dust and fumes from heavy equipment movement during dismantling	Low (1)	Med (3)	Low (1)	Med (3)	Med (3)	C	Medium
	• Increased noise levels within community during dismantling activities.	Low (1)	Med (3)	Low (1)	Med (3)	Med (3)	C	Medium
	Occupational and Community Health							

	• Air pollution resulting in illnesses such as swollen eye, difficulty in breathing, catarrh and bronchitis (respiratory tract infections).	Med (3)	Med (3)	Low (1)	Low (1)	Med (3)	3C	Medium
	• On-site traffic congestion and risk of road traffic accidents during dismantling and movement of equipment from the API-ETP Facility.	Low (1)	Low (1)	Low (1)	Med (3)	Med (3)	2C	Minor
	• Trips, slips and falls of workers during dismantling of equipment and machinery	Med (3)	Med (3)	Low (1)	Med (3)	Med (3)	2D	Medium
	Social							
	• Loss of business /employment/means of livelihood due to API-ETP Facility shutdown. Also, impeding indirect business activities such as the nearby canteens, stalls and supermarkets.	Med (3)	Low (1)	Low (1)	Med (3)	Med (3)	2D	Medium
	• Social vices like theft and vandalism as a result of job loss by youths of host communities.	Low (1)	Low (1)	Low (1)	Med (3)	Med (3)	2C	Minor

5.6 Cumulative Impact Assessment

The above associated and potential impacts of the proposed API-ETP facility were not assessed in isolation. Several existing and planned projects around the project and within the communities with substantial or minimal environmental implications were also evaluated.

The cumulative impacts assessment focused on incremental impacts associated with;

- **Existing projects** around the study area- e.g. Sagamu Independent power plant, Nestle Plc, Coleman cables, Eternal oil depot etc.
- **Future projects** – construction of Lagos Sagamu Road

Cumulative impacts and effects are those that arise as a result of an impact and effect from the Project interacting with those from another activity to create an additional impact and effect. These are termed cumulative impacts and effects.

Cumulative impact to Air Quality and Noise Levels:

Though the proposed API-ETP construction timelines might not be in sync with that of the timeline for the construction of existing project, it is expected that the combined emissions during site preparation and construction activities from these existing projects will be incremental and adversely significant to the general ambient air quality within the cumulative AoI.

The operations of the mentioned existing organization mentioned above have zero to very limited interactions with air quality as no construction's activities are ongoing as they already existing.

Cumulative impact to Surface water and groundwater:

Due to the regional aquifer characteristics of this proposed project area and nearby waterbodies surrounding the site, the aquifer's sensitivity to water availability is considered medium; however, the impact is slightly significant as a natural resource. Many residents of the host communities rely on groundwater for their daily needs.

In addition, there are also risk associated on the larger cumulative foot print of the mentioned existing projects from accidental spills, leakages and discharges from hazardous material storage and transportation fuel storage facilities to point of use and finding their way into nearby surface water streams.

5.7 Climate and Disaster Risk Screening

This project has been screened against climate change impacts such as extreme rainfall, temperature rise and likely bush fires. Climate change impacts such as sea level rise was screened out as potential due to geographic location of the project not being within such impact zone. The result of the screening suggest that impacts are moderate (rainfall), Moderate (flooding), high (temperature) and low (bush fires). The World Bank Climate Change IBRD-IDA screening tool was used. The table below provides a summary of the project's exposure from historical to current and future time frames.

Table 5.7: Summary of Project Exposure to Climate and Geophysical Hazard

Hazard	Time frame	Description	Probable exposure
Extreme Temperature	Current	The highest monthly average maximum daily temperature is 30℃.	High
	Future	Annual average temperature is expected to increase by 1 – 2.8℃ by 2060 relative to current conditions.	High
Storms and Strong winds.	Current	The project area and RoW has not suffered serious winds in the past few years. Maximum average wind speed is still at 1.92knot	Low
	Future	The wind speed is projected to increase but estimates are highly uncertain.	Low
Landslide	Current	There are no records of landslide in the past few years.	Negligible
	Future	Landslide is not expected	Negligible
Wildfire	Current	There is no available information of wildfires within the area.	Low
	Future	Wildfire is not expected	Low

CHAPTER SIX
IMPACT MITIGATION MEASURES

6.0 Introduction

The acceptability or suitability of a project is set on several considerations, among which is the reduction of negative environmental and social impacts to tolerable levels. Impact significance reduction is usually achieved by introducing mitigation/amelioration measures to cater for the negative impacts identified.

This chapter proffers appropriate and cost-effective mitigation measures to avoid, reduce, control, remedy or compensate for negative adverse impacts and enhance positive benefits of the proposed Emzor Project.

The measures are aimed at reducing these impacts to As Low as Reasonably Practicable (ALARP). The residual impacts that could arise despite these mitigation measures were also noted. The next chapter (chapter seven) shall thereafter document management plans to manage and monitor the mitigation measures through an effective Environmental and Social Management Plan (ESMP).

6.1 Mitigation Objectives and Hierarchy

The need for mitigation measures has the primary objectives of prevention, reduction and possible control of impacts. For clarity, we define the following thus;

- **Avoidance** – methods aimed at preventing the occurrence of negative impacts, and/or impeding such occurrence from having harmful environmental/social outcomes;
- **Minimization** – limiting or reducing the degree, extent, magnitude, or duration of adverse impacts. Reduction can be achieved by scaling down, relocating, or redesigning elements of a project;
- **Control** – ensuring that occurring impacts are reduced to a level as low as reasonably practicable;
- **Compensation** - recompense for residual impacts through offsets.

There is a standard impact mitigation hierarchy adopted for all identified impacts and this is as shown in Figure 6.1 below.

Figure 6.1: Impact Mitigation Hierarchy

6.2 Proffered Mitigation Measures

This section proposes mitigation/adjustment measures for the project's identified potential and associated impacts. Enhancement measures to positive impacts have also been proposed where appropriate. Furthermore, the residual effects of mitigation measures have been assessed. This section, however, focuses solely on the significant impacts of project activities and their residual ratings.

Based on overall significance ratings (Major, Medium or Minor) in **chapter five**, the expected residual rankings after mitigation are classified as "***Negligible, Low and Moderate***".

The mitigation measures as presented in **Table 6.1** below have been proffered with reference to the following considerations

- National and international guidelines and regulatory requirements;
- Best industry practices and best available technologies;
- Available resources and competencies;
- On-site conditions; and public concerns.

Table 6.1a: Mitigation Measures for Proposed API-ETP Facility during Operation and Maintenance

Environmental Aspects	Associated and Potential Impact	Impact Category	Mitigation Measures	Residual Ranking
Operations and Maintenance				
• **Waste generation and handling** • **Loading, unloading and storage of chemicals** • **API-ETP maintenance service**	**Geology/Hydrogeology**			
	Seepage from waste affecting surface and groundwater quality Wastewater effluent discharge to streams, affecting water quality for downstream users	**Major**	• Reduce the risk of soil and water pollution by constructing diversion channels or holding structures such as drains, and cut-off drains to divert surface runoff. • Effluent treatment plant installation to treat the waste water generated from the API facility and such waters to be reused for domestic purposes. • Monitor water quality to ensure its not polluted • A waste management plan shall be developed and implemented • Wastes shall be well and properly managed to limit the incidence of seepage • Environmental monitoring and audits	**Moderate**
	Air Quality/Noise			
	As engines are working efficiently, they will be Fugitive emissions (VOC) generated from reactor vents, filtering systems in the separation process. And other equipment's (centrifuges) • VOC emissions generated from mixing, compounding, granulation, and formulation (use of ethanol or isopropyl alcohol) involving the use of solvents (granulation). • Exhaust emission from trucks during transportation of product • Particulates consisting of manufactured or in-process product can be emitted from bulk e.g. fermentation and secondary manufacturing. • Exhaust gas emissions produced by the combustion of gas or diesel in turbines, boilers, compressors, pumps and other engines for power and heat generation. • Odour emissions from fermentation activities	**Medium**	Gaseous emission reduction measures will be implemented. These include: - • Reducing or substituting the use of solvents and other materials which have a high VOC content • Implementation of VOC leak prevention and control strategies from operating equipment's • For drying operations, adoption of closed circuits under a nitrogen atmosphere • Use of closed loop liquid and gas collection equipment for cleaning of reactors and other equipment. • Maintenance of trucks at regular intervals • Environmental monitoring of the air quality and noise levels quarterly • Use of appropriate PPE (earmuffs) during operations • Installation of dedicated filtration system in granulation equipment.	**Moderate**

	• High noise levels generated from manufacturing equipment's and utilities e.g. compressed air, vacuum sources, and ventilation systems.		• Installation of high efficiency particulate air (HEPA) filters in the heating, ventilating and air conditioning (HVAC) systems to control particulate matter emissions internally and externally as well as to prevent indoor cross contamination.	
	Resource and Waste			
	Environmental pollution as a result of sanitary wastewater from public and employee services Stormwater runoff may include pollutants associated with leaks and spills of diesel, during operation and maintenance of ground service vehicles, and volatile organic compounds (chemicals) during handling, manufacturing and storage activities.	**Minor**	• Appropriate site landscaping to be employed • Have a proper drainage to channel the surface run off • Process modifications (e.g. continuous rather than batch operations to reduce spillage and other material losses); • Spent solvent recycling and reuse, through distillation, evaporation, decantation, centrifugation and filtration;	**Negligible**
	Generation and handling of waste (municipal waste, lavatory waste, deplaned waste biodegradable and non-biodegradable waste)	**Major**	• Ensure various wastes streams generated are segregated and containerized in colour-coded bins. • Maintain inventory of daily waste generated. • Liquid waste such as oil & grease, chemicals spill should be immediately cleaned and disposed of appropriately in designated site. • Register with Ogun state waste management board for proper waste treatment and disposal	**Moderate**
	Socioeconomics			
	Risk of a fire outbreak affecting life and property due to technical malfunction or a severe weather phenomenon	**Major**	• Implementation of an Emergency Response Plan to manage major fire incidents if they should occur. • Good maintenance of all control systems and emergency response vehicles and equipment.	**Moderate**
	Community/Occupational, Health, Safety and Security			
	• Incremental risks of traffic congestion along distribution routes / communities • Risks of vehicular knock down of community pedestrians leading to injuries and or fatalities along the Sagamu expressway	**Medium**	• Emergency response plan considering community, health and safety should be put in place with trained personnel and adequate equipment. • Trainings of truck drivers on road safety • Good traffic management should be put in place.	**Moderate**

Table 6.1c: Mitigation Measures for Proposed API-ETP Facility during Decommissioning / Abandonment

Environmental Aspects	Associated and Potential Impact	Impact Category	Mitigation Measures	Residual Ranking
Decommissioning				
• **Dismantling of buildings/removal of equipment's** • **Demobilisation of project personnel** • **Land Rehabilitation**	**Geology/Hydrogeology**			
	Chemical contamination of ground water resulting from accidental spills during transportation and handling, and seepage from waste	**Medium**	• There shall be the equipping of all trucks and equipment carrying fuels or oil with spill response materials and train personnel in the use of such materials • Oil & silt traps shall be used to remove these types of contaminants from stormwater, and use designated areas for equipment servicing • Where contaminants are transported, emergency contaminant and mitigation measures shall be developed to minimize impacts should accidental spillages occur along the transport routes • All potential sources of contamination shall be stored in secure facilities with appropriate Storm Water management systems in place to ensure that contaminants are not released to the water resource through Storm Water runoff	**Low**
	Disturbance to soil profile, and potential contamination from surface runoff during abandonment.	**Minor**	• Backfill excavated areas with soils or overburden that is free of foreign material that could pollute groundwater and soil. • Carry out internal environmental assessment to check activities and status of construction activities while in process. • Manage and dispose of waste from erosion through building drainage channels connecting to the treatment plant.	**Negligible**
	Contamination of groundwater resulting from seepage from hazardous materials and waste	**Moderate**	• Restrict runoff to site by constructing diversion channels or holding structures such as banks, drains, dams, etc., to reduce the potential of soil erosion and water pollution and cut-off drains to divert surface runoff from exposed soils or construction areas.	**Moderate**

			• Wash water from washing out of equipment shall not be discharged into water courses or road drains. • Ensure equipment used are designed to cause less disturbance and harm to the aquatic ecology when cutting through existing river. • Employ good site management practices as outlined in NESREA regulation 2011 for Construction sector. • All drainage and effluent from storage areas, workshops and camp sites shall be captured and treated before being discharged into the drainage system in line with applicable government water pollution control regulations. • To the extent practicable, reinstate natural drainage patterns where they have been altered or impaired. • Provide absorbent materials and other containment equipment on site for quick response to any form of spill.	
	Air Quality/Noise			
	Air quality pollution as a result of dust and heavy equipment dismantling movement	**Minor**	• Workers should be provided with masks for protection against the inhalation of dust; • Protect stockpiles of friable material subject to wind through wetting. • Cover loads with of friable material during transportation. • Restrict speed on loose surface roads to 30Km/hr during dry or dusty conditions	**Low**
	Increased noise levels within community during dismantling activities.		• Proper sound management during work hours. • Monitor sound levels throughout the dismantling and abandonment stage. • Procure equipment and machines that are climate friendly and sound proof. • Maintain, equipment and other transport automobiles to optimal functioning levels. • Machinery, vehicles and instruments that emit high levels of noise are used on a phased basis to reduce the overall impact.	

			• Ensure noise generated are within the permissible limits as prescribed u der the NESREA regulation 2009 for Noise standards and control as specified in S.I No 35. • Workers, especially those working with machines, vehicles and instruments that emit high levels of noise/vibrations are supplied with ear plugs and ear muffs to reduce the risk of hearing impairment. • Safety trainings and toolbox/briefing at mobilization and demobilization.	
	Socioeconomics			
	Loss of business/employment/means of livelihood due to road construction activity closure impeding indirect business activities	**High**	• Ensure public awareness on road decommissioning and abandonment are placed on Radio. • Consult with business corporate associations affected by airport abandonment. • Subsidize new business locations and assist affected persons to restart businesses.	**Moderate**
	Social vices like theft and vandalism as a result of job loss by host community youths	**Medium**	• Empower disengaged workers and recommend some to other construction contractors for hire. • Ensure prompt payment and motivation of staff. • Warn off unauthorized persons with appropriate signs. • Secure the area with security personnel from the communities.	**Low**
	Community/Occupational, Health, Safety and Security			
	On-site traffic congestion and risk of accident during the dismantling and demobilization of the API-ETP facility	**Medium**	• Proper diversion and signage shall be provided • Traffic management plan will be prepared and implemented • Prohibit trucks from parking along the access roads	**Moderate**
	Risk of heavy machinery collision, incidents (incidents resulting from being hit, slips, trips and fall, cuts and bruises) or accidents with a lot of mortality and morbidity if proper signs are not strategically positioned.	**High**	• First aid kits on site and registration with nearby health centre in host community. • All staff are properly trained and certified in their relevant activity. • established that safe working procedures are adhered to	**Moderate**

			• Provide adequate lighting for night works if night time works are necessary. • Ensure all staff wear appropriate PPEs. • Develop and implement occupational health and safety plans. • Implement health awareness programme. • Ensure safety signage are on display at strategic locations.	

CHAPTER SEVEN
ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

7.0 INTRODUCTION

An Environmental and Social Management Plan (ESMP) is a standalone tool used to monitor the effectiveness of the mitigation measures and project commitments in the ESIA. The ESMP is incorporated into the project implementation process to minimize or eliminate adverse impacts, assess compliance with environmental regulatory standards and corporate HSE policies.

The ESMP highlights the commitments of Emzor to implement the mitigation measures built into project design as well as the additional mitigations recommended in this ESIA, and the roles and responsibilities of other stakeholders. The ESMP also emphasizes all the biophysical and social environmental attributes that should be monitored by Emzor throughout the lifecycle of the proposed project. This is to curtail associated negative, residual and cumulative impacts and expose other impacts that have not been identified and elucidated in this ESIA report arising from the implementation of the proposed project.

7.1 Background and Scope

The ESMP has been developed to meet required standards and regulations on environmental and social management performance. Also, it is aligned with general guidelines provided by the ISO 14001: - Environmental Management System (EMS). It shall therefore be incorporated into the EMS or HSE-MS of Emzor which shall be developed before the API-ETP Facility reaches operation phase.

The scope of the ESMP covers the entire project activities from pre-construction, construction / installation, operation / maintenance and decommissioning phases and shallbe subject to reviews and updates by Emzor and regulatory stakeholders prior to commencement of activities to ensure completeness.

Emzor Pharmaceutical Industries Limited shall have primary responsibility for all measures outlined in the ESMP, but may delegate responsibility to its construction contractors, where appropriate.

7.2 Objectives of the ESMP

The main objective of the ESMP is to successfully implement the project's environmental and social performance by providing a systematic approach to bringing environmental and social considerations into daily decision making towards the assurance that environmental risks and liabilities are managed in all phases of the project throughout its lifecycle. Hence, it provides a working document that shall be continually developed for tracking, evaluating and communicating environmental and social performance.

The objectives of the ESMP contained in this section are as follows:

- to monitor compliance with all the mitigation measures and commitments as discussed in this ESIA report during the implementation of the proposed project;
- to ensure best practices management as a commitment for continuous improvement in environmental performance;
- ensure that all workers, sub-contractors and others involved in the project meet legal, administrative and other requirements with regard to environmental management;
- incorporate environmental management into project design and operating and maintenance procedures;
- to monitor compliance with legal standards and limits for wastes discharges;
- to provide early warning signals on potential environmental degradation for appropriate actions to be taken so as to prevent or minimize environmental consequences
- Achieve, enhance and demonstrate sound environmental performance built around the principle of continuous improvement
- In the event that damage or harm is caused, take action to repair and return to condition comparable to pre-impact condition;
- Implement a system to maintain communication with the community and raise awareness of proposed construction activities and the potential impacts that they may represent.

7.3 Components of the ESMP

This ESIA, having identified the key environmental and socioeconomic aspects, potential impacts and mitigation measures for adverse impacts associated with the project, will serve as a basis for the Environmental and Social Management Plan (ESMP). Based on ISO 14001 standards, the ESMP consists of the following elements

- Training and Awareness
- Documentation
- Emergency Preparedness and Response
- Uncertainty and Change Management
- Environmental and Social Management Actions;
- Guidelines for Waste Management;
- Guidelines for Audit and Monitoring;
- Occupational Health and Safety Management
- Supplementary Management Plans; and
- Labour Influx
- Measures for Legal Compliance

7.3.1 ESMP ROLES AND RESPONSIBILITIES

Emzor Project Champion

- Overall responsibility for all project phases and activities (pre-construction, construction, operation and decommissioning);

- Ensure availability of funds to properly implement all agreed environmental and social safeguards measures;
- Ensure that the project, complies with the provisions of IFC and EIB's standards;
- Ensure that Project complies with federal and state environmental laws and regulations;
- Ensure that tender and contract documents for civil works include all relevant parts of the environmental and social assessment and project agreements;
- Promote institutional cooperation to enforce compliance with labour laws, including occupational, health and safety rules

Project Management Team

- The API-ETP project manager's main duties include the planning, directing, and coordinating of the operations, construction, and maintenance of all airport facilities
- Implement ESMP provisions to mitigate environmental and social impacts to acceptable levels;
- Ensure compliance with EIB and IFC standards and government laws and regulations;
- Engage and retain within PMT an Independent Environmental Consultant (IEC)
- Monitor site activities on a daily basis for compliance;
- Conduct internal audits of the construction site against the EMP;
- Confine the construction site to the demarcated area
- Ensure issues related to sexual harassment and gender-based violence between workers and with communities are effectively managed according to applicable laws and rules;
- Ensure that environmental and social protection and mitigation measures in the ESIA and ESMP are incorporated into the detailed design including climate change adaptation measures;
- Ensure that requisite measures from the ESIA and ESMP are incorporated into the bid and contract documents;
- Undertake environmental and social management capacity building activities, orientation and awareness training for contractors and community members;
- Ensure the necessary environmental license(s) have been obtained prior to award of civil works contracts;
- Undertake monitoring of the implementation of the ESMP (mitigation and monitoring measures);
- Prepare quarterly or semi-annual environmental and social monitoring reports for submission to financiers;
- Based on the results of ESMP monitoring, identify environmentally corrective actions and prepare a corrective action plan to financiers as necessary.

Project Contractor/EPC contractor (Civil Engineering Construction Company)

- Participate in the PMT's induction training on ESMP provisions and requirements.
- Ensure that the ESMP is followed at all times during the project's phases.
- Prior to the commencement of civil works contracts, relevant environmental license(s) for

linked facilities such as project works, asphalt mixing plants, and so on should be obtained;

- Ensure that all workers, site agents, including site supervisors and management participate in training sessions delivered by PMT.
- Maintain a record of training and conduct of awareness sessions for staff to ensure compliance with environmental and safety statutory and contractual obligations including the approved CESMP;
- Maintain an environmental register with records of all incidents that occurred on the site during construction. These incidents include:
- Public involvement / complaints
- Health and safety incidents
- Incidents involving Hazardous materials stored on site
- Noncompliance incidents
- Centered around the results of the ESMP monitoring, contractor along with the PMT will put into effect environmental and social remedial measures and corrective motion plans, as necessary;
- Prompt and efficient response to requests and guidelines from PMT for environmental and social corrective actions and put into effect additional environmental and social mitigation measures, as necessary;
- Provide enough funding and human resources for the ideal and timely implementation of required mitigation measures in the Environmental and Social Management Plan.

Project HSE Officer

- The Project HSE Officer is saddled with the responsibility to implement the ESMP during the construction phase, as well as liaison and reporting to the Developer, Contractor, Landowners and Authorities. The following tasks will fall within the responsibilities of the HSE officer:
- Be cognizant of the findings and conclusions of the Environmental Impact Assessment and the conditions stated within the EIA License;
- Be familiar with the recommendations and mitigation measures of this EMP;
- Conduct weekly/monthly audits of the construction site according to the EMP and EIA License conditions;
- Educate the construction team about the management measures of the EMP and EIA License conditions;
- Regularly liaise with the construction team and the project manager;
- Recommend corrective action for any environmental non-compliance incidents on the construction site; and
- Compile a regular report highlighting any non-compliance issues as well as good compliance with the ESMP.

Independent Environmental Auditor

An independent Environmental Auditor should be commissioned for the project. The IEC's responsibility will include:

- Ensuring that the ESMP requirements are met;
- Conducting audits/inspections of working methods and facilities (including site works, storage compounds, and so on) in accordance with the requirements of site-specific management plans;
- Examining audit/inspection reports generated by the Contractor's environmental staff;
- Submit audit reports to the Project HSE Officer and, if necessary, the appropriate authority.
- Contractors are given guidance and assistance on environmental management processes and mitigation measures.

Federal Ministry of Environment

- Review and approve environmental and social assessment reports as required by the Government;
- Issue, and renew environmental licenses/permits as necessary throughout the lifecycle of the Project;
- Monitor the project's environmental performance in accordance with their mandate.

7.3.2 Stakeholders Communication

Emzor Pharmaceutical Industries Limited shall welcome suggestions and information fromrelevant stakeholders, contractors, visitors and the general public, which shall help improve its activities in order to minimize impact on the environment and workers health and safety.

The Facility Manager shall be open to the general public for complaints and suggestions.

All complaints received from the public shall be documented and follow-ups made to ensure that such grievances are addressed accordingly and in line with the established grievance redress mechanism.

Emzor Pharmaceutical Industries limited shall maintain a formal procedure for communication with the regulatory authorities and communities. The HSE Manager is responsible for communication of HSE issues to and from regulatory authorities wheneverrequired.

7.3.3 Training and Awareness

Training needs for personnel whose work may have a significant adverse impact upon the environment or social conditions shall be reviewed by Emzor Pharmaceutical Industries Limited management and a training plan developed for the purpose. To a minimum, duringconstruction phase of the project, the following environmental awareness and trainings programs shall be conducted:

Induction Briefing

An induction briefing shall be a required for every construction worker engaged in the project and shall be provided by the contractors. The briefing shall include:

- detailed job description for new workers
- safe work procedures

- use of personal protective equipment
- emergency responses and warning notices;
- personal hygiene and site/work station sanitation issues;
- environmental protection; and
- Hazard recognition and incident reporting.

Weekly HSE Forum

There shall be a weekly environmental and safety awareness forum for operational workers during the construction activities at the project site. Emzor Pharmaceutical Industries Limited shall be responsible for coordinating these meetings

The HSE personnel is responsible for coordinating training, maintaining employee-training records, and ensuring that these are monitored and reviewed on a regular basis. They shallalso periodically verify that staff is performing competently through discussion and observation.

Emzor Pharmaceutical Industries Limited and the principal contractor shall ensure that allpersons responsible for undertaking work during the life of the project must be trained onthe contents of this EMP. All staff of Emzor Pharmaceutical Industries Limited and all members of the workforce for the API Plant shall be made aware of their environmental responsibilities through induction and training courses. All site personnel must have a basic level of environmental awareness training.

The training shall also include the following:

- Safety induction course,
- Emergency and spill response drill,
- Social responsibility during construction (Community interaction and relations),
- Fire Prevention and use of firefighting equipment,
- Basic First aid for first aiders and more in-depth training for selected personnel,
- Permit to Work System,
- Good Housekeeping.

The awareness program shall help develop environmental awareness and sensitivity amongst the personnel and shall be reviewed periodically. Safety awareness campaigns shall also be conducted for the host community and general public with the aim of sensitizing them to the potential impacts and hazards associated with the Emzor Pharmaceutical Industries Limited project and the appropriate response to accidents/incidents.

7.3.4 Documentation

The Manager HSE is responsible for maintaining a master list of applicable HSE documents and making sure that this list is communicated to the appropriate parties.

Documents shall include management plans; associated procedures; and checklists, forms and reports. These documents shall be controlled for distribution to regulators, and other responsible parties. Archives in soft and hard copies shall also be documented.

7.3.5 Emergency Preparedness and Response

Emzor Pharmaceutical Industries shall prepare plans and procedures for potential and response to, environmental accidents and health and safety emergency situations and for preventing and mitigating potentially adverse environmental and social impacts that may be associated with them. The plan shall incorporate emergencies such as fire, chemicals/oil spill, security, etc.

Prior to a detailed Emergency Response Plan (ERP) which shall be effective during actual construction, Emzor Pharmaceutical Industries Limited shall ensure the following is in place during the construction phase:

- Emergency training shall be conducted by the HSE Manager to enhance workers preparedness to respond appropriately to emergencies. Such training shall include fire, chemical spill, as well as first aid emergencies.
- A fire protection guideline shall be developed by Emzor Pharmaceutical Industries Limited immediately after construction phase before commencement of operational activities

7.3.6 Uncertainty and Change Management

An EMP is to address uncertainty through collecting information, additional assessment and, where necessary, the development of further mitigation and management measures.

There may be changes in the project which may occur due to unforeseen or unplanned situations. These adaptive changes may also occur during the course of final design, or during construction or even decommissioning. The project shall therefore implement a formal procedure to manage all changes in the project that through the entire project activities / phases.

The procedure for change management shall ensure that:

- proposed changes have a sound technical, safety, environmental, and commercialjustification;
- all changes are reviewed by competent personnel and the impact of changes is reflectedin documentation, including operating procedures and drawings;
- hazards resulting from the changes that alter the conditions assessed in the ESIA have been identified and assessed and the impact(s) of the changes do not adversely affect themanagement of health, safety or the environment;
- the changes are communicated to personnel who are provided with the necessary skills,through training, to effectively implement these changes; and the appropriate personnel accept the responsibility for the change.

7.4 Environmental and Social Management Action

The management action plan for residual potential and associated impacts documented in section 4 of this report are discussed in this section. The plan is a framework / guide to managing residual impacts of the project throughout its life span. The outline includes monitoring requirements, timing/frequencies, estimated cost of implementation and responsible parties.

Table 7.1 Environmental and Social Management Plan

Environmental Aspects	Associated and Potential Impact	Mitigation Measures	Residual Ranking	Monitoring Requirements	KPI's	Schedule	Cost Estimate	Action Parties
Pre-construction								
• Site survey and workforce Engagement and EPC contracting • Site preparation activities • Mobilization of personnel, equipment	• Strain on public infrastructure, e.g. roads, etc. • Traffic disruption / congestion on exiting Sagamu road	• Effective journey management plan and Safety inductions shall be conducted for all truck drivers • Traffic Management plan shall be prepared for the facility	Low	• Traffic Management Plan			X	• Management • HSE Manager
Construction								
• Earthwork comprising of excavation, grading, trenching • Transportation of construction	• Work place accidents / incidents resulting from trips and falls, objects at height, burns, cuts and bruises from excavation, cement and	Emzor Pharmaceutical Industries Limited shall ensure: • all staff are properly trained and certified in their relevant activity. • Fully equipped first aid kits shall be provided on site.	Moderate	• Workplace Inspections • Trainings on safe work practice and SOP	• Incidents and accidents Records • Hazards identific	Daily during construction		EMZOR HSE Manager/ EPC Contractor HSE manager

Environmental Aspects	Associated and Potential Impact	Mitigation Measures	Residual Ranking	Monitoring Requirements	KPI's	Schedule	Cost Estimate	Action Parties
materials • Civil work • Mechanical erection • Employment • Construction / Installation of API facilities • Non-destructive testing • Commissioning	welding activities.	• Ensure established safe working procedures are adhered to. • Ensure all staff wear appropriate PPEs. • Record, review and improve on HSE KPI's throughout construction project. • Tool box meetings every day before the start of work • Emzor shall initiate and develop effective Emergency Response Plans-ERPs • Emzor shall implement health awareness programme i.e COVID 19 measures		• Toolbox meetings	ation form			
Operation								
• Raw material & product storage, • Unloading of raw materials	• Deterioration of ambient air quality due to fugitive emission during handling and storage	• Reducing or substituting the use of solvents and other materials which have a high VOC content • Implementation of VOC leak prevention and control strategies from operating equipment's	Minor	Air quality monitoring	Results of Air quality .	• Quarterly	X	• HSE Manager / • Consultant

Environmental Aspects	Associated and Potential Impact	Mitigation Measures	Residual Ranking	Monitoring Requirements	KPI's	Schedule	Cost Estimate	Action Parties
• Storage of raw materials & products • Loading of products • Handling and transportation • Manufacturing process & utility operations (consumption of resources & emission of liquid effluent, flue & process gas) • Generation of	vehicles	• Reduction of equipment operating temperatures where possible						
	Accidental release of stored or handled API product due to leaks from storage tanks during product receipt and storage	• For drying operations, adoption of closed circuits under a nitrogen atmosphere • Use of closed loop liquid and gas Collection equipment for cleaning of reactors of reactors and other equipment. • Maintenance of trucks at regular intervals • Environmental monitoring of the air quality quarterly	Minor	• Maintenance of trucks • Air quality monitoring	Results of Air quality.	• Quarterly	X	• HSE Manager /
	• Contamination of soil due to leakages / spillage chemicals	• Proper handling of chemicals • Concretization of floor to prevent seepage • Bund wall around chemical storage area to contain spillage • Emergency response plan considering community, health and safety should be put in place with trained personnel and adequate equipment	Minor	• Trainings of staff on handling of chemicals • Supervision • Soil, and ground water monitoring around the project site	• Compliance Monitoring Report • Drills records	• Monthly during operations		HSE Manager

Environmental Aspects	Associated and Potential Impact	Mitigation Measures	Residual Ranking	Monitoring Requirements	KPI's	Schedule	Cost Estimate	Action Parties
solid/hazardous waste	• Accidents involving workers	• Trainings should be given to all skilled and unskilled workers • Providing specific worker training in handling of flammable materials, and in fire prevention or suppression • First aid kits on site and registration with nearby health primary health Centre in Sagamu • Provision of PPE	Moderate	• Trainings for all staff • First Aid kits and HMO	• Training Records • Incidents and Accidents records	• quarterly		HSE Manager
	• Contamination of groundwater sources due to improper handling of chemicals	• Proper handling of chemicals • Concretization of floor to prevent seepage • Bund wall around chemical storage area to contain spillage • Emergency response plan considering community, health and safety should be put in place with trained personnel and adequate equipment.	Moderate	• Trainings of staff on handling of chemicals • ERP document	• Compliance Monitoring Report • Drills records	• Monthly	X	• Emzor Pharmaceuticals Limited HSE Manager
	• Noise generation due to plant operations	• Environmental monitoring of the air quality and noise levels quarterly • Use of appropriate PPE (earmuffs) during operations.	Low	• Status of PPE of all staff • Air quality and Noise measurement	• Monitoring Report • PPE records	• Quarterly	X	HSE Manager

Environmental Aspects	Associated and Potential Impact	Mitigation Measures	Residual Ranking	Monitoring Requirements	KPI's	Schedule	Cost Estimate	Action Parties
	• Odour emissions from fermentation activities	• Install air humidifier/ air extractor	Low	• Through the use of human-sensory and analytical methodologies	•	• Daily	X	
Decommissioning								
• Cleaning and dismantling of equipment • Personnel, equipment and material demobilization • Site Reclamation and Restoration	• Work place accidents / incidents resulting from slips, trips and fall from height, objects at height, cuts and bruises during dismantling of equipment.	• First aid kits on site and registration with nearby health primary health center in Sagamu- • Ensure established safe working procedures are adhered to • Ensure all staff wear appropriate PPEs • Record, review and improve on HSE KPI's throughout construction project	Minor	• Provision of trainings • Safe working procedures • Tool box meetings	Trainings records	• Daily tool box meetings	X	• HSE Manager.

7.5 Guidelines for Auditing and Monitoring

Checking includes audit (inspections) and monitoring activities to confirm proper implementation of checking systems as well as effectiveness of mitigations. Corrective actions include response to out-of-control situations, non-compliances, and non-conformances. Actions also include those intended to improve performance

Audits

Environmental auditing assures an adequate, up to date environmental database for internal management awareness and decision in making in relation to plant's modification, new plans etc. it increases employee's awareness of the company's environmental policies andresponsibilities.

Environmental auditing ensures that cost effective systems of environmental protection management is in use at the factory and the standard of the environment protection management is sufficient to meet the present regulatory demands, future regulatory demand as well as the company's policy requirement and promoted good relation with local, national and international communities and also promote the image of the company. It alsohelps to reduce exposure to litigation and regulatory risks of penalties.

The scope of the audit shall include the following:

- Compliance with all necessary codes, standards and procedures
- Examination of line management systems, operations, monitoring practices etc.
- Identification of current and potential environmental problems especially during the operational phase of the project
- Checking the predictions in ESIA and assure implementations and application of recommended practices and procedures
- Make recommendation for the improvement of the management system of the operation

Finally, review of this ESMP shall be carried out during and after construction to determine its adequacy/ suitability for continuous use during development construction

Monitoring

Monitoring shall be conducted to ensure compliance with regulatory requirements as wellas to evaluate the effectiveness of operational controls and other measures intended to mitigate potential impacts. Further requirements prior to environmental monitoring duringproject implementation phase shall be agreed between Emzor Pharmaceutical Industries limited and regulators.

Emzor Pharmaceutical Industries limited and Contractors shall undertake periodic monitoring to confirm the measures identified in Management Plans are implemented. These include:

- Dust, emission and noise
- Effluents and storm water
- Solid wastes

The overall objective of (performance) monitoring shall be to identify any unanticipated changes to the biophysical, health and social environment brought about by the retail station facility. This ESIA has been formulated with the aim of ensuring that all the identified significant impacts from

the project are mitigated to as low as reasonably possible and thatkey performance indicators are monitored periodically to track how effectively mitigationmeasures are implemented. It specifies the mitigation measures, monitoring requirements,duration and frequency of the monitoring, and the action parties to manage the biophysical,social and health environment at the various phases of the project.

ESIA guidelines have been developed to cover all activities of the Emzor Pharmaceutical Industries limited facility. These include pre-construction activities (mobilizations, site preparation activities, etc.), construction activities and Operations.

7.6 Guidelines for Waste Management

Waste management guidelines and disposal options is very necessary for the running of a plant. The continuous use of the principle of waste reduction, recycling, recovery and reusewill make the company to be more environmentally friendly.

Waste Handling

For proper handling and disposal, wastes shall be well defined at source and the definition transmitted along with the waste to the final disposal points. The required basic information that would be provided, as a minimum, for adequate definition of wastes include:

a) waste type identification;
b) proper waste categorization;
c) waste segregation information;
d) location of generation, and
e) Recommended management practices.

Table 7.2 Waste Stream Management Guideline

Waste / Emissions Streams	Category	Origin	Disposal Option(s)
Domestic waste			
Empty food containers, food waste, aluminium or iron cans, cartons, papers, plastic bags, office wastes	Non-hazardous (combustible, biodegradable)	Production staffs, workers and visitor's consumption	• Manually sort plastics and metals for recycling • Segregate waste appropriately and contain for evacuation to approved sites for composting • Papers should be shredded, collected and stored for recycling by certified contractors
Vegetation cuttings and Trees	Hazardous (organic contaminant)	Preconstruction activities such as site preparation and earthworks	Remove and reuse (ensile) as organic manure on farmlands or transport offsite by an approved waste management contractor for further use or disposal
Industrial waste			
Waste water and sludge	Hazardous	By- product or volatile organic compounds from API pharmaceutical process (HCl, H_2 SO2) and Effluent treatment plant (sludge)	• Waste water is treated in the effluent treatment plant on site and reused for domestic purpose. • Sludge generated overtime will be treated properly before disposal at designated approved landfills.by state regulators or they can be recycled/reused in bricks manufacturing
Cardboard and Paper	Hazardous (combustible)	Paper recovered from construction materials	• Paper can easily be packed and recycled properly.
Plastic Polyethylene terephthalate (PET)	Hazardous (combustible)	Packaging from construction materials, tools. Plastic components from demolition (plastic piping, Cable ducking).	• Collect in properly labelled plastic drums placed at designated strategic locations. • Store in sealed, properly labelled plastic drums placed in a closed container located within the designated hazardous waste storage area for evacuation to incineration facilities
Metal / Wood scraps	Hazardous	Construction waste segregated in skids	• Re-use, Recycle or sale to other end users
Concrete and Rocks	Non-hazardous (Non-combustible)	Remains of Rocks and concrete	• Rock and cement pieces are crushed, screened, and separated to produce useful aggregates of various dimensions
Gravel, aggregate and fines	Hazardous (non-combustible)	Gravel, small stones, concrete chips	• concrete chips and similar materials can be shredded and converted into building materials
Vehicles and machineries fuel spill/leaks	Hazardous (combustible)	Fuel tanks, leaking pipes, equipment, etc.	• Quickly mop up and store in sealed drums for recycling.
Contaminated topsoil affected by grease and oily spills/leak	Hazardous (combustible)	Topsoil removed from spill/leak site	• Safely contained in sealed designated containers subsequent thermal desorption at approved FMEnv facility.
Clinical Waste	Hazardous	Clinic (Medic)	• Collect and dispose using approved government medical waste collectors.

Waste Minimization

Waste minimization involves reduction as low as practicably possible volume or toxicityof waste materials. The four principles of waste minimization process; recycle, reduce; reuse and recovery shall be adopted as applicable. During site preparation a large proportion of earth material shall be used for filling or otherworks on site.

During construction various wastes are always generated as part of the construction process, regardless of the type. Some of these are non-hazardous whereas others are likelyto be hazardous i.e. the construction fluids, cuttings, chemicals, etc. Other typical wastes include sanitary wastes, spent lubricant oils, domestic wastes, etc. The company shall adopt, as applicable, the principle of waste minimization process namely: reduction,recycling, reuse and recovery.

Waste Disposal

Emzor Pharmaceutical Industries Limited shall adhere strictly to the instructions on the material safety handling sheet and this shall form the basis for the disposal of waste related to such product. Before final disposal, adequate treatment will be carried out, where applicable, for all waste.

Measure for Legal Compliance

All appointed agents, contractors, and suppliers, as well as the PMU, shall confirm and ensure compliance with all applicable national and state environmental, health, and safety legislative requirements. It is recommended that a legal register be developed and compliance against the requirements be audited as part of the environmental, health and safety management system.

All applicable standards and guidelines relating to environmental, health and safety must be considered during the development of environmental legal register. All applicable international legalisation and guidelines for Good International Industry Practice (where practically possible) must be identified and included in the register

CHAPTER EIGHT
DECOMMISSIONING

8.0 PRELIMINARY DECOMMISSIONING FRAMEWORK

This chapter describes the major activities that will be performed during the decommissioning phase. The actual sequence of the work may differ from the order presented here and does not present detailed procedures for each activity.

The preliminary decommissioning plan provides the API-ETP management approach for the suspension, decommissioning, dismantling, and/or abandonment of the proposed API-ETP project at the end of its lifecycle. Decommissioning may proceed all the way to "greenfield" status

Ogun State Government, as part of its decommissioning plan for the proposed project shall properly treat all solid wastes. Excavated areas shall be backfilled and graded. Furthermore, all solid waste excluding scraps shall be disposed in an environmentally sound manner while scraps shall be recycled as much as possible. The State Government shall also restore the site as much as possible and all surfaces shall be stabilized and protected to control landslides/subsidence, erosion, water pollution and human hazards.

If the area is not decommissioned properly, degradation could occur and potentially present an environmental hazard in the future. Abandoning or leaving the project facilities after ceasing operations is not considered to be an acceptable alternative to decommissioning thus the reason for this chapter.

The plan is to aid as a guide for the decommissioning activities to assure an effective and environmentally sustainable process, compatible with intended future land use on health-related concerns and environmental impacts.

8.1 Objective

Ogun State Government have a legal and social responsibility to decommission the API-ETP facilities. Therefore, a decommissioning plan/framework is to serve as a guide to the process. It is necessary to satisfy legal obligations. This plan also complements the primary ESMS put in place for the project's sustainability.

This decommissioning plan is a set of guidelines and actions developed to ensure that decommissioning activities are implemented in a manner that reduces the socio-economic, environmental, health and safety risks.

The overview of the strategy is to ensure the delivery of a timely and cost-effective program while maintaining high standards of safety, security, and environmental protection.
Specifically, this plan aims to achieve the following:

- To comply with legal and regulatory requirements and Ogun State Government's project approvals.

- To meet stakeholders' expectations.
- To ensure safe, stable, and non-polluting land area which will be compatible with post-closure land use.
- To provide for the retention and beneficial reuse of constructed infrastructures.

8.2 Scope and Requirement

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

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

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

8.3 Requirements, Roles and Responsibilities

A description of the plans for the decommissioning of the API-ETP project is to include:

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

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

8.4 General Decommissioning Process

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

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

Decommissioning during Construction (Abandonment of Project)

In case of abandonment of project during construction, the same decommissioning procedures as for Decommissioning after Ceasing Operation will be undertaken and the same decommissioning and restoration program will be honoured, in as far as construction proceeded before abandonment. The facility will be dismantled, materials removed and recycled, the soil that was removed will be graded and the site returned to its preconstruction state

Decommissioning after Ceasing Operation

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

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

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

Should the project be decommissioned following the expected normal operational phase of 30 years or more, then decommissioning will be conducted accordance with the approach described herein, but under consideration of regulations and technology at the time.

8.5 Rehabilitation Process

The land that will be rehabilitated is the land on which the project components and associated infrastructure will be situated. All structures built on the site would have been dismantled and demolished before rehabilitation would commence. Once demolition is completed, the damaged site shall be restored to its original or near-original condition. The following items must be included in site rehabilitation:

- Filling of all depression including trenches that could have been done for the project.
- Levelling and appropriate landscaping of the entire site.
- Removal of all debris and scrap from site
- Carrying soil tests and analysis from various site locations where different structures and activities were being undertaken to ensure that any site soil contamination is handled appropriately and required soil amendments and treatments are done to ensure the result soil in that site supports the required vegetation that will later be planted. Soil amendments that may be done may include physical removal of affected soils and replacement with desired soil or phytoremediation.
- Planting of appropriate species of trees, shrubs and grasses to undertaken taking consideration of local ecological requirements.

8.6 Closure Outcomes/Completion Criteria

The expected closure outcomes for all site components are as follows:

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

These are the completion criteria:

- Government acceptance of project completion report which demonstrates achievement of all completion criteria.
- Audit shows if any remaining project infrastructure is left in a safe and secure manner, and discourages public access.
- Landscape and vegetation report undertaken and reported to show function is resilient, self-sustaining and comparable to the surrounding environment.
- Site contamination survey (conducted to relevant Nigerian standards) demonstrates no elevated level of selected contaminant.

Table 8.1: Decommissioning Outcome

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

8.6.1 Post Closure Monitoring

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

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

- Surface water quality and stream sediment quality.

Schedule

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

8.7 Decommissioning Procedures as per Environmental, Social and Health Aspects

General Site Safety

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

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

Traffic Safety

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

Labour Demobilization

For labour demobilization, the following shall be implemented;

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

Handling of the Host Community

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

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

Residual Wastes Handling

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

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

- Conduct a waste audit to determine the amount of waste that will be generated during the dismantling process; prepare an audit report in writing;
- Create a work plan for waste reduction and,
- Implement measures to ensure that all other workers at the dismantling site are aware of the plan.

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

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

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

8.8 Other Considerations

Emergency Response Plan

This is an important plan that shall be implemented through all the phases of the project in event of any emergencies. The potential emergency situations during decommissioning are the same as those identified during construction and operation.

The purpose of the plan is to establish and maintain emergency procedures required for effectively responding to accidents and other emergency situations, and for minimizing associated losses. Potential emergency scenarios which could occur during the decommissioning phase include fire, personal injury and spills. All operating staff will be trained in the following emergency response and communications procedures.

Communication Notification

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

Project updates due stakeholders shall include legally required notices as well as any information that EPC contractor considers relevant to inform the public and ensure safety

CHAPTER NINE
CONCLUSION AND RECOMMENDATION

9.1 Conclusion

This EIA report has provided a review of the legal, administrative, and institutional frameworks guiding the project and environment (**Chapter One**), evaluated the need for the project, its sustainability, and alternative concepts in **Chapter Two**. The report also presents the proposed project and process description in **Chapter Three**.

The report also provides baseline information on the existing environment and natural resources that were characterized through desktop search as well as a two season-based field sampling exercise. A detailed description of this is in **Chapter Four**. Furthermore, the EIA also provided a basis and methodology against which the potential and associated impacts of the project were assessed in **Chapter Five**. Identified potential impacts of the proposed project were then provided with mitigation measures (**Chapter Six**) to help avoid or mitigate adverse impacts. **Chapter Seven**, documents the project development activities' residual impacts alongside cumulative impacts, mitigation measures, monitoring requirements in an ESMP. A preliminary decommissioning plan has also been outlined in this EIA for the project as seen in **Chapter Eight** of this report.

Based on the findings of the ESIA study the following conclusions can be made:

- With the proposed Mitigation Measures in Chapter Six, the facility project associated potential impacts will be reduced on the general environment which is in line with the outcry from governments of most nations in the world for global environmental sustainability.
- The results from the assessment of the baseline ambient air, soil and water quality as well as noise level of the immediate environment of the proposed project conforms to the regulatory standard limits for healthy living condition.

9.2 Recommendation

Having sufficiently assessed and mitigated the proposed facility's environmental and social impacts. The following recommendations are made:

- The ESMP implementation and monitoring program shall be adhered to by the Contractors, under the supervision of the Ogun State Government as well as environmental and social expert throughout the project cycle.
- Emzor shall ensure collaboration and liaise with the other institutions/ enforcement agencies and all relevant stakeholders to ensure effective implementation of the ESMP both at national and local levels.

AquaEarth Consulting on behalf of Emzor Pharmaceutical Industries Limited, having provided this draft ESIA report.

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