ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

FOR

THE PROPOSED CONSTRUCTION AND INSTALLATION OF 2 X 7.5MVA, 132/33KV SUBSTATION PROJECT AT SANGO OTA IN ADO-ODO OTA LGA OF OGUN STATE

by

ADEFOLORUNSHO

TECH. VENTURES LIMITED

DRAFT REPORT

submitted to

THE FEDERAL MINISTRY OF ENVIRONMENT, ABUJA, NIGERIA

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TABLE OF CONTENT **PAGES**

CHAPTER SIX: MITIGATION MEASURES

CHAPTER SEVEN: ENVIRONMENTAL MANAGEMENT PLAN (EMP)

CHAPTER EIGHT: REMEDIATION PLAN AFTER DECOMMISSIONING/CLOSURE

CHAPTER NINE: CONCLUSION

LIST OF TABLES **PAGES**

LIST OF FIGURES **PAGES**

LIST OF PLATES **PAGES**

ACRONYMS AND ABBREVIATIONS

AAS	Atomic Absorption Spectrophotometer
AASHTO	American Association of State Highway and Transportation Officials
APHA	American Public Health Association
ASTM	American Society for Testing and Materials
ATVL	Adefolorunso Technical Ventures Limited
AVC	Auto Voltage Control
AWWA	American Water Works Association
BAT	Best Available Technology
BOD	Biochemical oxygen demand
CO	Carbon monoxide
DCP	Dry Chemical Powder
DCPT	Dutch Cone Penetrometer Test
DO	Dissolved Oxygen
EC	Emergency Coordinator
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EIS	Environmental Implication Study
EMP	Environmental Management Plan
EMS	Environmental Management System
FAT	Factory Acceptance Test
FEPA	Federal Environmental Protection Agency
FMEnv	Federal Ministry of Environment
FRSC	Federal Road Safety Corporation
GHG	Green House Gases
HSE	Health, Safety and Environment
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
ITCZ	Inter-Tropical Convergence Zone
Kg	Kilogram

KV	Kilovolts
LFN	Law of the Federation of Nigeria
LVAC	Low voltage alternate current
NA	Not Applicable
NERC	Nigerian Electricity Regulatory Commission
NESREA	National Environmental Standards and Regulations Enforcement Agency
NIMET	Nigerian Meteorological Agency
NMA	Nigerian Maritime Authority
NURTW	National Union of Road Transport Workers
OGEPA	Ogun State Environmental Protection Agency
OGMOE	Ogun State Ministry of Environment
OGSEMA	Ogun State Emergency Agency
OGWAMA	Ogun State Waste Management Agency
PHCN	Power Holding Company of Nigeria
PPE	Personal Protective Equipment
PSP	Private Sector Participation
QMS	Quality Management System
QA/QC	Quality assurance/quality control
ROW	Right of Way
Tc	Tropical Continental
TCN	Transmission Company of Nigeria
TDS	Total Dissolved Solids
Tm	Tropical Maritime
TSS	Total Suspended Solids
UNEP	United Nations Environment Programme
USEPA	United States Environmental Protection Agency
WB	World Bank
WEF	Water Environment Federation
WMP	Waste Management Plan

SYMBOLS

dB(A)	Decibel
g/cm^3	Gram per cube centimeter
Kg	Kilogram
KVA	Kilo-volt-amperes
L	Liters
m	Meter
g/kg	Gram per Kilogram
mg/kg	Microgram per kilogram
mm	Millimeter
ml	Milliliter
Mg/l	Milligram per liter
mg/m^3	Milligram per meter cube
%	Percentage
µm	Micrometer
µs/cm	Micro siemens per centimeter
µg/m^3	Microgram per meter cube
˚C	Degree Celsius
cm/s	Centimeter per second
cfu/ml	Colony-forming units per milliliter
ppm	Parts per million
ppt	Parts per trillion
Pt. Co	Platinum Cobalt
NTU	Nephelometric Turbidity *Unit*
cfu/g	Colony-forming units per gram

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Executive Summary

Background Information

This document presents the Environmental Impact Assessment (EIA) for the proposed construction and installation of 2 x 7.5MVA, 132/33KV Substation at Sango Ota, Ado - Odo Ota Local Government Area, Ogun State by Adefolorunsho Technical Ventures Limited. The project aims at generating steady electricity through the construction and installation of a substation, as the Compressed Natural Gas (CNG) being previously used seems not to be viable for its operations.

The EIA study has been carried out under the terms of the Federal Ministry of Environment's Environmental Impact Assessment Act Cap E12 LFN 2004, Sectoral guidelines and other extant laws in Nigeria and also in fulfillment of World Bank/ International Finance Corporation (IFC) requirements for financing projects of this magnitude.

The Proponent

Adefolorunsho Technical Ventures Limited (ATVL) is a world class Polyethylene Terephthalate (PET) preform (PET bottles and caps) manufacturer registered on 28th October 2015 in Nigeria. The company is located at KM 37, Lagos – Abeokuta expressway, opposite Alishiba bus stop, Sango Ota in Ado - Odo Ota Local Government Area, Ogun State.

Proponent's Intent

Adefolorunsho Technical Ventures Limited was previously using Compressed Natural Gas (CNG) for its operations. This gas was supplied by Green Liquefied Natural Gas (GNLG) but seem not to be viable which is why it intends to construct and install a 2x7.5MVA, 132/33KV Substation at Sango Ota in Ado - Odo Ota LGA of Ogun State. The company is currently running on a 415KV electricity transformer but now intends to tap electricity from a 132 KV national grid and step it down to 33 KV by running a 33 KV cable from the substation to its factory through a short distance. The proposed substation is in front of the national grid with the distance from substation to the factory being approximately 300m away. The proponent also intends to source fund from a GenCo (North South Power Generation Company) for the proposed project. A Power Purchase Agreement document has been signed in liaison with Transmission Company of Nigeria (TCN) with respect to this loan. About 95% of the equipment to be used for the substation project shall be sourced from India while the remaining 5% shall be acquired locally. Galvanised steel will be used for the substation equipment

Legal Framework for the EIA Process

The legal and regulatory framework for carrying out EIA of the proposed substation project are contained in relevant national statutes and international environmental conventions to which Nigeria is signatory. Specific policies, acts and guidelines enforced by FMEnv and relevant to this project are presented as follows:

- Federal Environmental Protection Agency Act No. 58/30 December 1988 (as amended by Act 59 of 1992 and further amended by Act 14 of 1999)
- Environmental Impact Assessment (EIA) Act Cap E12 LFN 2004
- National Environmental Protection (Management of Solid Hazardous Wastes Regulation (S.1.15) 1991
- EIA Sectoral Guidelines of the Federal Ministry of Environment (FMEnv)
- Pollution Abatement Regulation, S.1.9 of 1991 (No.42, Vol. 78, August, 1991)
- Electric Power Sector Reform Act *2005*
- Energy Commission of Nigeria 1988
- Nigerian Electricity Supply and Installation Standards Regulations 2015 REGULATION NO: NERC/Reg/1/2015
- The Electricity Act, Cap 106 of 1990
- Criminal Code Act (cap.*77*) Laws of the Federation of Nigeria (L.F.N),2004
- Land Use Act Cap L*5*, LFN 2004
- Harmful Waste Act the Harmful Waste (Special Criminal Provisions) Act Cap H1, LFN 2004
- National Environmental Standards and Regulations Enforcement Agency (NESREA) ACT of 2007
- NESREA, National Environmental (*Energy Sector*) *Regulations*, S. I. No 63, 2014.
- Public Health Law (L.N *47* of 1955, Cap 103)
- Factory Act CAP FI, LFN 2004
- The Nigerian Urban and Regional Planning ACT, CAP N138, LFN 2004
- Ogun State Policy on Environment (2013)
- Ogun State Ministry of Environment (OGMOE)
- Ogun State Environmental Protection Agency (OGEPA) Edict 1995
- Ogun State Emergency Agency (OGSEMA)
- International Standards, Treaties and Conventions and etc.

Project Alternatives

The examination of alternatives and development options considered for the proposed substation project were;

- Alternative Construction Materials and Technology
- Alternative Sources of Energy and
- Alternative Substation Site

Based on the above-mentioned suitability criteria and technical restrictions, ATVL has identified the site for the location of its proposed substation. The site was acquired on a willing seller and willing buyer and was selected after the considerations discussed. Relocation option to a different site is an option available for the project implementation. The project proponent can look for alternative land to accommodate the scale and size of the project. However, this will be a costly venture, which takes long without a guarantee that the land would be available.

Project Options

All available options were considered, these include the no-project option, the delayed project option, and the option to proceed with the ATVL proposed substation project. The option to proceed with the substation project was considered and adopted as the preferred option based on its numerous favorable factors as highlighted and explained in Chapter 2 of this report.

Project Location

Adefolorunsho Technical Ventures Limited proposed Substation site is located at Okon close, off Powerline road, off Matina road, Sango Ota, Ado - Odo Ota LGA, Ogun State. The site occupies a landmass of 1174.821m^2 on Latitude 06^0.42.759N and Longitude 003^0.14.175E, South East (SE) of Okon Crescent Powerline road, Latitude 06^0.42.749N and Longitude 003^0.14.177E, South West (SW) of Durojibagun close, Latitude 06^0.42.746N and Longitude 003^0.14.208E,North West (NW) of Shirish clinic with Latitude 06^0.42.751N and Longitude 003^0.14.210E, but North East (NE) of Jacob's Model school. The proposed project which is located in a built-up area and on a location previously housing a shopping complex is to be sited at Boluwatife which is the host community.

Environmental Baseline Data

This study was done on 30th June 2020 in the wet season. However, the company has been granted a waiver to carry out a one season Environmental Impact Assessment (EIA) using existing baseline data for of the Environmental Implication Study(EIS) of Adefolorunso Technical Ventures Limited(carried out in February 2018) submitted to Ogun State Ministry of Environment Abeokuta report as secondary data for the dry season.

Climate

The proposed project area is in the moderately hot, humid tropical climate zone of South-west, Nigeria. The climate in the area is tropical with alternating wet and dry seasons. The climate 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 rainfall pattern in the area is characterized by high rainfall in the months of April to October (wet season) while the lowest mean rainfall amount is recorded in December. Of the total amount (1342.05 mm), about 1180.68 mm was recorded during the wet season (April – October) while only 161.40 mm was recorded in the dry season (November to March).

The highest temperature value of about 34.77 ^{0}C occurs in the month of March and the lowest value of 21.34 ^{0}C in August. Data for Ogun State area from Nigerian Meteorological Agency (NIMET) indicate that humidity measured in the morning ranges between 68.11% in January and 87.33% in August while in the afternoon the value ranges from 41.26% [in February] to 76.78% [in August].

The monthly average wind speed in the study area ranges from 3.1m/s to 5.0m/s. The highest speed is recorded at the onset and offset of seasons when squalls, lightning and thunder accompany torrential rains. The wind direction was predominantly south west.

Air Quality

For the purpose of documenting the existing air quality of the project area, air quality monitoring was carried out at seven (7) different points including control within and around the proposed project site during the wet study period but eight (8) locations was sampled in the secondary data report.

During the wet season study period, SO_2, NO_2 and H_2S, NO, NH_3, CO, were not detected in all the sampled locations including the control point by the instrument used and were therefore within specified FMEnv limits. Similarly, SO_2, NO_2, CO and H_2S were not detected for the secondary data with only oxygen detected in all locations and were within limits

The concentration of total volatile organic compounds recorded ranged from 0.02ppm to 0.06ppm and a mean concentration value of 0.03ppm as compared to 0.01ppm obtained for the control point. There was no record of TVOC in the secondary data used.

The oxygen concentrations recorded within the project site were in line with the recommended FMEnv limit of 21.0% during the wet season. Also the value was 20.9% in all locations for the secondary data and also within FMEnv's limit for oxygen.

The mean concentration of carbon dioxide recorded was 265ppm and it ranged from 264ppm to 269ppm during the wet season study period. Carbon dioxide was not recorded for the secondary data.

The suspended particulate matter ($PM_{10.0}$) recorded for wet season was in the range 15. $\mu m/m^3$ – 23.3 $\mu m/m^3$ with a mean of 20 $\mu m/m^3$ while 47 $\mu m/m^3$ was obtained for the control location as compared to 250 $\mu m/m^3$ stipulated by FMEnv. The $PM_{2.5}$ ($\mu g/m^3$) for the wet season was in the range 29.4 $\mu m/m^3$ – 50.6 $\mu m/m^3$ and a mean of 39.78 $\mu m/m^3$ as compared to a control value of 26.6($\mu g/m^3$). However, a range of 150.2 -1083.8($\mu g/m^3$) was obtained for PM_{10} in the secondary data used with some of the locations exceeding the FMEnv's recommended limit of 250 $\mu m/m^3$.

The mean temperature at Adefolorunsho Technical Ventures limited Substation was 27.8°C. The temperature gradient recorded, ranged between 26.2°C at ANS 3 to 31.4°C at ANS Control. All sampled sections were in compliance with the **FMEnv** limit of **32.0°C** during the wet season. Similarly, for the secondary data used the range was 31°C – 33.4°C with the values exceeding the recommended FMEnv's limit of **32.0°C.**

Noise Level

Sampling took place at seven (7) monitoring stations strategically located in the site including control point while eight (8) locations were sampled in the secondary data report used for comparison. The mean noise level at Adefolorunsho Technical Ventures limited Substation was 56.4dB (A). The mean of minimum and maximum values ranged between 52.37dB(A) to 60.83dB(A). All sampled sections were in compliance with the **FMEnv** limit **90.0dB(A) and NESREA** limit **85.0dB(A)** for wet season. Moreover, a range of 66.4 – 89.6 dB(A) was recorded

for the secondary data with only the value at Beside compressor room exceeding both **FMEnv** limit of **90.0dB(A) and NESREA** limit of **85.0dB(A).**

Land Use

The project area is characterized by industrial and commercial activities; constituting approximately 50% of the total land use in the area. Notable industries around the substation are Food, Agro and Allied Industries Limited; Veepee Limited, Shongai Packaging Industries Ltd, Nigerian Breweries, Vetri Industries Ltd; Homus Industries Limited among many others. About 80% of the land within the 5km radius of the project site may be considered to be urban settlements.

Hydrogeology of the Study Area

The project area fall within the eastern Dahomey(or Benin) basin of southwestern Nigeria which stretches along the continental margin of the Gulf of Guinea. The stratigraphy of the basin has been grouped into Abeokuta, Imo, Oshosun, Ilaro and Benin formations. In general, the rocks are late Cretaceous to Early Tertiary in age. The Abeokuta Formation comprising the Araromi, Afowo and Ise Formations, has been exploited for industrial water supply in the area and at Itokin for rural water supply. Both the Ilaro and Ewekoro Formations may be considered effective regional aquitard/acquiclude unit, separating the underlying Abeokuta Formation aquifers from the overlaying Benin Formation aquifers. The Ewekoro Formation is known to be aquiferous only where limestone members are present. The Ewekoro Formation also bears similar aquifer characteristics, but the Akinbo Formation has been found to be a good source of groundwater exploration. The structural features that occur within the basement rocks are due to tectonic activities and they include: joints, faults and fractures. Though aquifers are known to exist in the other sedimentary formations present in the area, the Benin Formation is without doubt the most significant aquifer system, being the major source of groundwater for private and public water supply, including industrial and commercial water usage

The subsoil investigation which involved Penetrometer Testing using 2.5 tones Dutch Cone Penetrometer Testing (DCPT) Machine was carried out on July 11, 2020. Visual assessment of the site/description of subsoil encountered was also done. However, the test involved carrying out 3 Nos. of 2.5 tons Dutch Cone Penetrometer Test (DCPT) up to depth ranging between the existing ground level at -2.75m depth upon which the cone attained anchorage and one number of trial pit dug at -2.00m depth below the existing ground level.

Considering the proposed substation on this site and the subsoil conditions as revealed in the completed trial pit, DCPT results and Laboratory analysis of selected subsoil samples, it was suggested that Reinforced Shallow Foundation in form of Pad & Column could be adopted for the proposed building to a minimum depth of -1.50m below the existing ground level.

The result of the investigation gave a General Safe Bearing Pressure value of 121.50kN/m^2 for a rigid well reinforced Square/Circular footings placed at -1.50m as recommended above.
Moreover, ancillary structures such as gate house (if applicable) could be placed on Shallow Strip footings of up to 0.50 while the generator house could be placed on pad footing up to 0.75m below the existing ground level in view of the vibration it would induce on the ground

Water Quality

For this Environmental Impact Assessment report, two (2) groundwater and one control were collected within 1km radius of the project site while similar number of sampling points was analyzed in the report used as secondary data.
The pH values of the ground water samples were 6.2 and 6.4 with mean as 6.3. The pH value for the control sample was 6.4. All values recorded were lower than the **FMEnv LIMIT** of 6.5-8.5 during the wet season. For the secondary data, the pH values of the groundwater samples were 4.9, 6.6 and 4.6 respectively. The pH values for GWS1and GWC1were lesser than the FMEnv's Maximum Permissible Level while that of GWS2 complied. The pH values obtained from the analysis of the water samples (GWS1and GWC1) were observed to fall within the acidic mark; thus, showing slight acidity of the ground water samples.

For the wet season, the dissolved oxygen is a measure of the amount of oxygen dissolved in the ground water sample. The dissolved oxygen values of the ground water samples were 0.4mg/L and 0.3mg/L with mean as 0.35mg/L. while value for the control sample was 0.4mg/L. All values recorded were below the **FMEnv LIMIT** of 7.5mg/L.. For the secondary data, the dissolved oxygen values of the ground water samples were 4.0mg/L and 3.4mg/L and were below **FMEnv LIMIT** of 7.5mg/L.

The conductivity values of the ground water samples were 51.9µs/cm and 64.5µs/cm with mean as 58.2µs/cm. The conductivity value for the control sample was 190.4µs/cm for wet season. For the secondary data, the values were 76.2 µs/cm and 80.3 µs/cm with control value of 69.3 µs/cm. No limit was specified by FMEnv for this parameter.

The total dissolved solids of the ground water samples were 25.9mg/L and 29.4mg/L with mean as 27.7mg/L. The total dissolved solids for the control sample was 94.2mg/L. All values were within the FMEnv LIMIT of 500mg/L. during the wet season. Similarly, for the secondary data the values were 38.1 and 39.8 with control value of 34.7. All values were also within the FMEnv LIMIT of 500mg/L.

The BOD value of the ground water samples were 13.1mg/L and 15.1mg/L with mean as 14.1mg/L. The BOD value for the control sample was 5.3mg/L. All values were higher than the FMEnv LIMIT of 0mg/L. during the wet season period. There was no record for biochemical oxygen demand in the secondary data report.

The COD value of the ground water samples were 35.1mg/L and 40.7mg/L with mean as 37.9mg/L. The COD value for the control sample was 14.6mg/L. There was no record for Chemical Oxygen Demand in the secondary data report.

The magnesium concentration of the ground water samples were 1.45mg/L and 1.55mg/L with mean as 1.50mg/L. The magnesium concentration for the control sample was 1.98 for wet season.

The nitrate concentration of the ground water samples were 0.97mg/L and 0.61mg/L with mean as 0.79mg/L but the control sample value was 0.07 mg/L. All values are within the **FMEnv LIMIT** of **10mg/L**. during wet season.

For the wet season, the chloride concentration of the ground water samples were 17.5mg/L and 19.4mg/L with mean as 18.4mg/L with the control sample as 18.5. All values were within the **FMEnv LIMIT** of **250mg/L**. For the secondary data the values obtained were 23.27mg/L and 25.6mg/L with control value being 19.54mg/L and were also within **FMEnv LIMIT** of **250mg/L**.

The hardness concentration for the control sample was 21.6mg/L.. All values were within the **FMEnv LIMIT** of **200mg/L**. For the secondary data the values were 20.0 mg/L and 33.2 mg/L with a value of 28.0 mg/L obtained for the control location. All values were within the **FMEnv LIMIT** of **200mg/L.**

Heavy metals in the ground water samples such as manganese, chromium, lead, cadmium, arsenic and nickel were recorded below the detection limit of Atomic Absorption Spectrophotometer (AAS) used for the analysis during the wet season. Meanwhile, manganese, cadmium, arsenic and copper were not detected for values recorded in the secondary data report. All samples for both seasons were thus within specified limits.

The iron concentration of the ground water samples were 0.01mg/L and 0.03mg/L with mean as 0.02mg/L. The iron concentration for the control sample was 0.01mg/L. All values were within the **FMEnv LIMIT** of **1.0mg/L** for the wet season. For the secondary data recorded Iron values were 0.03mg/L and 0.02mg/L with a value of 0.05mg/L at the control point. All values were within the **FMEnv LIMIT** of **1.0mg/L.**

The copper concentration of the ground water samples were 0.004mg/L and 0.001mg/L with mean as 0.0025mg/L. The copper concentration for the control sample was 0.006mg/L. All values were within the **FMEnv LIMIT** of **0.1mg/L.**

The zinc concentration of the ground water samples were 0.004mg/L and 0.014mg/L with mean as 0.009mg/L. The zinc concentration for the control sample was 0.02mg/L. All values were within the **FMEnv LIMIT** of **5.0mg/L.** For the secondary data the values were 0.02mg/L and 0.04mg/L and a control value of 0.017mg/L. All values were within the **FMEnv LIMIT** of **5.0mg/L.**

The faecal coliform count of the ground water samples were 17cfu/100ml and 6cfu/100ml with mean as 12cfu/100ml and the control sample was 1cfu/100ml.
The total plate count of the ground water samples were 30cfu/100ml and 25cfu/100ml with mean as 28cfu/100ml and the control sample was 16cfu/100ml.
The total heterotrophic bacteria of the ground water samples were 1.0 X 10^1cfu/ml and 0.3 X 10^1cfu/ml with mean as 0.7 X 10^1cfu/ml. The total heterotrophic bacteria for the control sample were 1.4 X 10^1cfu/ml.
The total heterotrophic fungi of the ground water samples were 1.0 X 10^1cfu/ml and 1.6 X 10^1cfu/ml with mean as 1.3 X 10^1cfu/ml. The total heterotrophic fungi for the control sample was 0.1 X 10^1cfu/ml.
However, for the secondary data used, total plate bacteria were observed in GWS1 (1cfu/100ml) andGWC1 (2cfu/100ml).The Total Coliform Count for all the water samples was however lesser than the specified FMEnv Maximum Permissible Level of 10cfu/100ml.

Soil Study

Five (5) soil sampling points including control point away from the site was established for the assessment of the soil quality. Topsoil (0 – 15 cm) and subsoil (15 – 30 cm) samples were collected using Soil Auger.

The mean pH values of the top soil and sub soil samples were 6.7 and 6.9. The pH value of the top soil samples ranged from 6.5-7.3 and 7.2 for control. The pH value of the sub soil samples ranged from 6.5-7.5 with 7.4 at the control point during the wet season. However, for the secondary data the pH values was in the range 7.6 - 8.1, sub soil was in the range 7.5 – 7.8 with control points having a range of top soil 7.2 – 7.3 and sub soil 7.4 – 7.5.

During wet season, the mean permeability values of the top soil and sub soil samples were 0.035cm/s and 0.221cm/s. The permeability value of the top soil samples ranged from 0.028cm/s-0.048cm/s and control of 0.048cm/s while that of the sub soil samples ranged from 0.028cm/s-0.790cm/s and control value of 0.049cm/s.

The mean porosity values of the top soil and sub soil samples during the wet season were 32.1% and 32.9%. The porosity value of the top soil samples ranged from 22.2% - 44.0% and 33.1%. at the control. The porosity value of the subsoil samples ranged from 23.6% – 40.3% and 32.0% at the control. There was no record for porosity in the secondary data.

The mean moisture content values of the top soil and sub soil samples were 8.54% and 8.89%. The moisture content value of the top soil samples ranged from 8.0% - 8.9% and control of 10.4% but the sub soil samples ranged from 8.56% – 9.16% with a control of 10.8%. The secondary data had moisture content value of the top soil samples range from 6.4% - 7.5%.. The moisture content value of the sub soil samples range from 2.6– 2.8% with a control range of 4.8% – 5.0% at the topsoil and 2.5% – 3.5% at the subsoil.

The mean bulk density values of the top soil and sub soil samples were 1.46% and 1.43%. The bulk density value of the top soil samples ranged from 1.24% - 1.68% with control value of 1.35% while the sub soil samples ranged from 1.26% – 1.52% and control of 1.32%. Nothing was recorded for bulk density in the secondary data report.

Heavy metals in the soil sample such as cadmium, chromium, nickel and lead were recorded below the detection limit of Atomic Absorption Spectrophotometer (AAS) used for the analysis for the wet season analysis results while only cadmium and Nickel was not detected at all the sampling points in the secondary data report.

The mean copper values of the top soil and sub soil samples were 0.234mg/kg and 0.257mg/kg. The copper value of the top soil samples ranged from 0.199mg/kg – 0.298mg/kg and 0.172mg/kg at control. The value of the sub soil samples ranged from 0.222mg/kg – 0.309mg/kg and 0.250mg/kg at control for wet season data. Moreover, the secondary data had top soil samples ranged from 5.08mg/kg – 6.22mg/kg. The value of the sub soil samples

ranged from 7.09mg/kg – 9.01mg/kg with the control range of 3.66 mg/kg – 4.55 mg/kg for topsoil and range of 2.82 mg/kg – 3.85 mg/kg.

The mean zinc values of the top soil and sub soil samples were 1.338mg/kg and 1.338mg/kg. The zinc value of the top soil samples ranged from 1.199mg/kg – 1.398mg/kg and control of 1.290mg/kg. The zinc value of the sub soil samples ranged from 1.303mg/kg – 0.369mg/kg with control of 1.297mg/kg for wet season. The zinc value of the top soil samples ranged from 24.53mg/kg – 33.5mg/kg. The zinc value of the sub soil samples ranged from 20.62mg/kg – 28.3mg/kg with control range of 6.92 mg/kg – 9.25 mg/kg for topsoil and 8.19 mg/kg – 11.2 mg/kg for subsoil in the secondary data report. All the values in both seasons were within 421mg/kg as stipulated by FMEnv.

For wet season, the mean iron values of the top soil and sub soil samples were 42.7mg/kg and 39.4mg/kg. The iron value of the top soil samples ranged from 23.0mg/kg – 85.5mg/kg and control of 22.5mg/kg. The iron value of the sub soil samples ranged from 28.56mg/kg – 50.5mg/kg and control of 20.5mg/kg. In the secondary data, the iron value of the top soil samples ranged from 66.57mg/kg – 70.5mg/kg. The iron value of the sub soil samples ranged from 109.04mg/kg – 118.5mg/kg and control range was 207.50mg/kg - 222.5 mg/kg for topsoil and 128.56 mg/kg - 201.5 mg/kg for subsoil.

For the soil sample during the wet season, the mean faecal coliform count of the top soil and sub soil samples were 4cfu/g and 3cfu/g. The faecal coliform count of the top soil samples ranged from 1cfu/g – 7cfu/g while control sample was 2cfu/g. The faecal coliform count of the sub soil samples ranged from 1cfu/g – 6cfu/g and control sample was 3cfu/g.

The mean total heterotrophic bacteria counts of the top soil and sub soil samples were 2.9 x 10^1cfu/g and 2.8 x 10^1cfu/g. The total heterotrophic bacteria count of the top soil samples ranged from 2.0 x 10^1cfu/g – 5.2 x 10^1cfu/g and control sample was 1.1 x 10^1cfu/g. The total heterotrophic bacteria count of the sub soil samples ranged from 1.7 x 10^1cfu/g – 4.7 x 10^1cfu/g but control sample was 1.3 x 10^1cfu/g.

The mean total heterotrophic fungi counts of the top soil and sub soil samples were 2.3 x 10^1cfu/g and 2.1 x 10^1cfu/g. The total heterotrophic fungi count of the top soil samples ranged from 1.5 x 10^1cfu/g – 4.0 x 10^1cfu/g with control sample 1.4 x 10^1cfu/g. The total heterotrophic fungi count of the sub soil samples ranged from 1.3 x 10^1cfu/g – 3.3 x 10^1cfu/g and control sample was1.4 x 10^1cfu/g.

No microbiology result was recorded for the secondary data.

Vegetation Study

The flora observed in the Adefolorunso Technical Ventures Limited (ATVL) EIA Substation project area observed during the wet season include the following; *Stenotaphrum secundatum, Abelmoschus esculentus, Manihot esculenta, Aspilia Africana, Stenotaphrum secundatum, Cynodon dactylon, Cynodon dactylon and Mangifera indica* as compared to *Stenotaphrum secundatum* and *Heliotropicum steudneri* recorded in the secondary data.

Wildlife Study

The avifauna dominates the fauna species in the area due to lack of habitat for terrestrial animals as a result of urban development and industrialization of the area. *Agama agamas* were seen at the project site both during the wet season and secondary data used.

Socio Economic Assessment

The methods adopted in the collection and analysis of information from the field and data bank includes but not limited to the following: Sources of data; Research Design and Sampling Techniques and sample size. The questionnaires were administered within 5km radius of the project area predominated by both commercial and residential buildings.

The estimated population size, at 95% Confidence Level and margin of error of 5%, the ideal sample size for the study was 83 respondents. However, only 30 people were interviewed due to unavailability of many inhabitants from the project area. The low number of people interviewed was due to unavailability of many residents who usually return from work to their residences late.

Ado-Odo/Ota Local Government Area had a total Population figure of about 527,242 people with a landmass of 878km^2 according to 2006 census. After 10 years, the estimated population of people living in Ado-Odo/Ota was about 733,400 people showing a growth rate of 39.10%. Using the estimated 733,400 population based on official growth rate, it is estimated that the present population density of the study area is approximately 835 people per square kilometer.

The Ado-Odo/Ota Local Government Area is one of the 20 Local Government Areas of Ogun State, Nigeria. It came into existence on May 19, 1989, following the merging of Ota, part of the defunct Ifo/Ota Local Government with Ado-Odo/Igbesa Areas of the Yewa South Local Government. Ado-Odo/Ota borders on metropolitan Lagos. The Local Government Area is the second largest in Ogun State and it is headquartered at Ota (or Ota.

The Political Administrative seat of Ado-Odo/Ota Local Government Area is located in Ado-Odo-Ota LG Secretariat, Ota, Ogun State. By all standards, Ado-Odo/Ota Local Government Area is an urban settlement given the available evidence of physical, human, economic development and social infrastructure forming part of the familiar landscaping of the Local Government Area.

The project area is locally ruled by a crowned Oba, called the Olota of Ota; whose ruling privilege came from the Yoruba traditional home of Ile-Ife. There are currently Ten (10) other Traditional Obaship institutions in the Local Government Area.

Male respondents across the communities within the spatial boundary constitute 53.3% of the total number of people interviewed while 46.7% of the respondents were female.

The study shows that the majority of the respondents (30.0%) are of youthful age (20 to 39) comprising of 24.0% male and 6.0% female. The respondents within the age bracket of 40 to 59 are 30% male and 5% female. People above 60 years, who are less active in terms of occupation and general economic activities, are 15% male and 5% female.

Of the total respondents, 55% were married, while 25% were single but 20% of the respondents were divorced, separated or widowed.

The collated data indicate that most of the respondents have stayed in the study area for more than 10 years (10%). Some 30% of the respondents had stayed in the area for between <1year while 50% had lived in the area for 3-5 years, however, 10% had resided in the proposed project area for more than 20 years. From this information, it is assumed that out-migration is minimal.

Majority of the respondents in the project area are Yoruba's, constituting 80% of the total respondents. Igbo people, Edo, Delta, and other non-Yoruba respondents living or working in the area constitute the remaining 20%.

The two dominant religions in the area are Christianity and Islam. A small proportion of the people still practice traditional religion. According to the survey, 60% of respondents claimed to practice Islam while 40% were Christians. None of the people interviewed claimed to be a traditional worshipper.

Occupation of population in the project area is dominated by Traders, Artisans and employees in private sector around the project area constituting 55%, 20% and 15% respectively. Student population pursuing first degree and other post-secondary education was 6% while 4% claimed to be civil servants at various local and state government establishments of the respondents interviewed in the area.

The interviewed respondents who claimed to be earning <N10, 000 per month were less than 35%, and were mostly students and petty traders in the project area. Majority of the respondents (60%) claimed to be above N10, 000 to a maximum monthly income limit of N99, 000. 5% of the respondents earn monthly income between N100, 000 and N250, 000

The residents of the project area depend solely on public power supply and use of privately-owned power generating sets, candles and lantern as source of lighting. Besides, some make use of rechargeable lamps in the absence of the two major sources of lighting. Most of the respondents (45%) claimed to be using only liquefied natural gas as source of fuel for cooking. 30% claimed to be using electric stove for cooking while 25% use Kerosene and firewood as source of fuel for cooking.

The project area Ado Odo/ Ota and neighboring communities make use of hand-dug wells and boreholes as their main source of water supply. None of the respondents interviewed have access to public water supply system. They all depend on boreholes and wells as sources of water for domestic purposes. People in the area make use of road transport system to move from place to place.

The settlement type is mostly metropolitan but has a mix of old and modern building. Concrete houses had the highest percentage especially Bungalow while water closet system is the most commonly used toilet facilities among the respondents. Blocks of flats constitute 9.0% of the total housing units of respondents

Health Impact Study

From responses of the people interviewed across the community, private hospital is the preferred option in terms of seeking medical assistance for ailments. Most of the respondents claimed to prefer visiting government hospitals and healthcare clinics for treatment and medical consultation for major health challenges but are faced with financial instability.65% of the respondents use combine herbs with orthodox medicine for treatment, while 35% usually resort to self-medication (without prescription) by purchasing drugs from pharmacy store to treat malaria or body ache.

Waste Disposal and Sanitation

The Ogun State Government in collaboration with Private Investors is responsible for solid waste disposal within the State. Licensed operators are responsible for the collection and evacuation of solid waste from flash points and designated bin sites within major towns in the State to the final dumpsite. The level of awareness of waste collection services and waste management regulations are relatively low in the project area, there are still a number of people in the State who use other indiscriminate solid waste disposal methods like open dumping, open burning, and dumping

in drainages. Residents of the project area dispose their domestic solid waste through PSP and Ogun state accredited waste managers.

Project Perception & Support

Major stakeholders, especially residents and workers around the project site in Sango/Ota were interviewed about the project and their opinions were sought. There was no disapproval on siting the proposed substation project in the area with promised support for the project due to the potential benefits the project will bring to the area through increased production of the factory. Substantial number of the respondents requested for help with the repair of the dilapidated road to serve people working and living in the area.

Impact Identification and Mitigation

The following basic steps were adopted for identification and evaluation of impacts in adherence to general regulatory guidelines: Impact identification; Impact qualification; Impact rating and Impact description.

Site Acquisition

For the proposed substation project, an average landmass of 1174.821m^2 was acquired. Some of the project areas are already built up and mostly consist of both residential and commercial land use. The areas are already largely devoid of their original vegetation, therefore, the sensitivity of the project area is adjudged minor. With this low sensitivity of the impact receptors, the Impact will not be visible. This impact is classified as an adverse impact of medium significance.

Construction Impact

The environmental impact during construction will be localized and short-term with no changes in use of the surrounding land as compared to the current conditions. Impacts will primarily relate to the civil works period, and less intensive impact is expected during erection of the equipment

Impact on Air/Noise Quality

These emissions will not emanate continuously there will be short term depending upon season of construction and meteorological conditions. The magnitude of the impact will be minor because the project is restricted to the substation site. The duration of the impact will be minor. Construction activities are expected to continue for not more than two months. The frequency of the impact will be minor as the impact will occur intermittently only during construction activities. Noise and air emissions will only take place within the immediate vicinity of the project area. The project area is

already mostly heavily built up and consists of both residential and commercial land use, therefore noise levels are not expected to significantly exceed prescribed regulatory limits as set by FMEnv. This impact is classified as an adverse impact of minor significance

Impact on Transportation

The magnitude of the impact will be minor since the substation related transportation will be for designated hours of the day and will not be a major issue, the cumulative effect of these on transportation will be minor. The duration of the impact will be minor. Construction activities are expected to continue for not more than 2 months. The frequency of the impact will be minor, as the impact will occur intermittently only during the construction period. The extent of the impact will be minor. Because prior to the project commencement there was presence of vehicular traffic prevalent in the area, the sensitivity of the receptor is adjudged minor. Impact on transportation as a result of actions leading to the construction activity will be minimal and short-termed. Therefore, the project has a Minor significance with regards to transportation Impact.

Impact on Income

Given the level of commercial activities currently around the project area, casual workers exist in the area and are willing to work for daily pay. It is obvious that there will be a positive impact for them in this regard, as they stand to gain employment, even if temporary, during project construction. This is a positive impact. Similarly, a significant proportion of the materials to be used for the project can be obtained locally such as cement, blocks etc. Therefore, project proponent will acquire many of these things within the local market. This means that there will be financial injections into the economy. This is a positive impact. Food vendors and other small-scale retailers will record a relative boom during the construction period, as project workers will rely on nearby food sellers for sustenance during construction. This will equally result in increased monetary inflows for local inhabitants.

Impact on Health and Safety:

Major concerns include long-term health effects, such as hearing impairment. Similarly, workers could be exposed to harmful levels of emissions from the various equipment and machinery that will be used for the project. In addition, they could sustain falls, which could lead to permanent disabilities or even death, depending on the height from which they fall, and/or, how they land.

The project construction activities will only last for a short while. Similarly, the likelihood of major accidents happening during the construction activities is low. Also, adequate hearing protection

will be provided for all workers and other relevant Personal Protective equipments (PPEs). Therefore, the project is deemed to have a minor impact, with regards to health and safety issues.

Impact on Waste Management

Based on the relatively small volume of wastes that will be generated at the substation site, majority would be reused for backfilling and the fact that most locations around the substation are already built up, sensitivity of the project environment is rated as major. Impacts of wastes from the project activities during construction are deemed to have negative impact. Therefore Adefolorunso Technical Ventures Limited in close consultation with Ogun State Environmental Protection Agency (Ogepa) shall secure the services of a registered waste contractor to handle all streams of wastes from cradle to grave with the regulator's supervision.

Operation Impact on Air Quality and Noise Level

The magnitude of the impact will be minor because the emissions will be from only a few pieces of equipment and vehicles at a time, thus, total emissions will be minimal. The duration of the impact will be short term. The substation is expected to have lifespan of not less than 30 years and during the period; emissions will be taking place all along. The frequency of the impact will be major, as the impact will occur continuously throughout the operational life of the project. Areal extent of the impact will be minor. The Impact of emissions and noise levels will be most acute within the immediate vicinity of the project site and would be significantly attenuated at distances beyond 100m from the project area. The sensitivity of the project environment is minor because mixing and dispersion of air emissions and noise are expected. The fact that the impact has a high likelihood of occurring continuously over the project life, this impact is rated as negative of medium significance.

Impact on Ground Water Quality

There is very little likelihood of such spills at any point in time. The areal extent of the impact will be minor. Since the groundwater provides domestic and industrial water for many of the inhabitants, the sensitivity of the receptor is adjudged to be moderate. Impact on ground water quality from the operation of the substation will be minimal, based on the various extrapolations done earlier. There is no surface water close to the proposed substation site. Therefore the impact is rated as of minor significance

Impact on Local Economy

The Impacts of the proposed substation project on the National and local economy are largely positive. For instance, jobs will be created for unskilled workers at the project area, either as artisans or casual workers. Also, the availability of the substation will boost steady power supply to ATVL factory and thus improve its productivity and lead to increased sales of products and thus, sellers will record increased turnover.

Operation Impact on Waste management

A number of waste types shall be produced during the operational phases of the project. These include metal scraps from maintenance, burnt capacitors, lubricant filters and domestic waste from the control room personal of the substation. Improper waste disposal would lead to loss of aesthetics, risk of accidents by sharp objects/scrap piles, and contamination of soil and water bodies (through run-offs). The effects of improper waste disposal are significant but can be reversed following strictly the waste management plan of Adefolorunso Technical Ventures Limited.

Decommissioning Phase

The substation being a permanent electricity infrastructure, it is not envisaged that the transmission power line will be decommissioned in the foreseeable future. However, after operational design lifespan of about 30years, a reassessment of the current status of the transmission line in the substation shall be carried out.

Environmental Management Plan (EMP)

An EMP has been developed to satisfy long-term objectives of managing and monitoring the environment, health, safety, security and socio-economic impact of the proposed project. This plan has been designed to achieve, enhance and demonstrate good environmental performance, in accordance with National and International standards and regulations. The EMP covers an environmental audit, waste handling, waste segregation and waste minimization guidelines.

Conclusion

The proposed ATVL substation project has been designed in line with the principle of sustainable development and international operational standards as blueprint to ensure its sustainability. This document described the nature of the proposed project in Chapter 3 and the baseline environmental, social and health conditions as detailed in Chapter 4 of this report. The overriding objective of the study is to ensure that potential environmental impacts, however minor and transient, are recognized and addressed.

The impacts of the proposed project are related to traffic accidents during construction, air quality impairment from dust generation at clearing and site preparation stages, increase in noise level, waste generation, surrounding water siltation, groundwater exploitation, among others. ATVL shall ensure a successful execution of the proposed substation project in an environmentally sustainable manner through proper management of processes/activities at may bring about disturbances to the environment.

ACKNOWLEDGEMENT

Adefolorunso Technical Ventures Limited (ATVL) hereby wishes to acknowledge all the regulators for their patience, cooperation and support during the preparation of this Environmental Impact Assessment (EIA) report for the proposed construction and installation of 2 x 7.5MVA, 132/33KV Substation at Sango Ota, Ado - Odo Ota Local Government Area, Ogun State.

We also express our profound gratitude to the management and staff of Azmarineberg Limited (Environmental Consultant) for their commitment towards the successful preparation of this Environmental Impact Assessment report. The study has been carried out to the highest level of precision and in line with local and international qualified standards.

CHAPTER ONE

INTRODUCTION

1.1 Background Information

This document presents the Environmental Impact Assessment (EIA) for the proposed construction and installation of 2 x 7.5MVA, 132/33KV Substation at Sango Ota, Ado - Odo Ota Local Government Area, Ogun State by Adefolorunsho Technical Ventures Limited. The project aims at generating steady electricity, as the Compressed Natural Gas (CNG) being previously used seems not to be viable for its operations.

The EIA study has been carried out under the terms of the Federal Ministry of Environment's Environmental Impact Assessment Act Cap E12 LFN 2004, Sectoral guidelines and other extant laws in Nigeria and also in fulfillment of World Bank/ International Finance Corporation (IFC) requirements for financing projects of this magnitude.

The Electricity sector in Nigeria generates, transmits and distributes megawatts of electric power that is significantly less than what is needed to meet basic household and industrial needs. (Adedeji, Adesina Akanji 2016). In 2012, the industry labored to distribute 5,000 megawatts, very much less than the 40,000 megawatts needed to sustain the basic needs of the population. This deficit is also exacerbated by load shedding, partial and total system collapse and power failure (Adedeji, Adesina Akanji 2016). To meet demand, many households and businesses resort to purchasing generating sets to power their properties, hence the significance of this type of project.

1.2 Project Proponent

Adefolorunsho Technical Ventures Limited (ATVL) is a world class Polyethylene Terephthalate (PET) preform (PET bottles and caps) manufacturer registered on 28th October 2015 in Nigeria. The company is located at KM 37, Lagos – Abeokuta expressway, opposite Alishiba bus stop, Sango Ota in Ado - Odo Ota Local Government Area, Ogun State. The company is proposing to construct and install a 2x7.5MVA, 132/33KV Substation at Sango Ota in Ado - Odo Ota LGA of Ogun State. The proposed project is expected to give a steady power supply and in case of a breakdown which is very rare except there is complete outage in the whole of Nigeria the

company plans to install two (2) 7.5 MVA transformers and use one of the 2 x 7.5 MVA as Redundancy (i.e. redundancy is the duplication of critical components or functions of a system with the intention of increasing reliability of the system, usually in the form of a backup or fail-safe, or to improve actual system performance) till power is again restored for their production. The company currently has a Memorandum of Agreement with Greenfield Liquefied Natural Gas that supplies natural gas as feedstock to power its operations that is renewed annually.

1.3 Proponent's Intent

Adefolorunsho Technical Ventures Limited was previously using Compressed Natural Gas (CNG) for its operations. This gas was supplied by Green Liquefied Natural Gas (GNLG) but seem not to be viable which is why it intends to construct and install a 2x7.5MVA, 132/33KV Substation at Sango Ota in Ado - Odo Ota LGA of Ogun State. The company is currently running on a 415KV electricity transformer but now intends to tap electricity from a 132 KV national grid and step it down to 33 KV by running a 33 KV cable from the substation to its factory through a short distance. The proposed substation is in front of the national grid with the distance from substation to the factory being approximately 300m away. The proponent also intends to source fund from a GenCo (North South Power Generation Company) for the proposed project. A Power Purchase Agreement document has been signed in liaison with Transmission Company of Nigeria (TCN) with respect to this loan.

This document is the EIA report of the proposed substation project. It has been prepared in line with the EIA Act Cap E12 LFN 2004 of the Federal Ministry of Environment (FMEnv), Sectoral Guidelines for Infrastructures (Power Transmission Line) projects and the World Bank/International Finance Corporation (IFC) guidelines. The EIA is also necessary to acquire permits required to operate the substation. Azmarineberg Limited was commissioned to prepare this report on behalf of ATVL.

1.4 EIA Terms of Reference

In line with the EIA procedural guidelines (FEPA, 1995), a Terms of Reference (ToR) for the proposed project was developed at the early stages of the study based on an initial assessment of the environmental issues relating to the proposed project.

The specific objectives of the ToR were to:

- Describe the relevant framework of legal and administrative requirements for EIA of the proposed project;
- Summarize the general scope of the EIA study including the overall data requirements on the proposed project and affected environment; and.
- Classify the procedures and protocols for identification and assessment of associated and potential impacts and also for selecting appropriate prevention, reduction and control as well as enhancement measures for such impacts; and eventually developing an effective Environmental Management Plan (EMP) for the project.

A copy of the ToR submitted to Federal Ministry of Environment (FMEnv) by ATVL is provided in the Appendix of this report.

1.5 Objectives of the EIA

In line with statutory requirements for environmental protection in Nigeria, the proposed EIA study objectives are as follows:

- Establish control and cost effective strategies, procedures and practices to be followed during design, construction and operation of the substation to ensure the environmental sustainability of the project;
- Ensure all environmental components (baseline) from the project site are established and documented for developing an Environmental Impact Assessment (EIA) report for the proposed project;
- Satisfy regulations from federal, state, local authorities as well as international best practices on environmental matters, by showing that proactive environmental actions shall be incorporated in ATVL substation project design, installation, construction and operation phases of the project;
- Identification of all communities within the project area and other Stakeholders for effective consultation
- Identify all environmental aspects of the proposed project that may interact positively or negatively with the environment and evaluate the associated and potential impacts of the proposed project on the ecological and socio-economic communities within the study area;

- Develop an Environmental Management Plan (EMP) for effective and proactive environmental management of the environment throughout the project life cycle and
- Provide information and evidence needed for development and the preparation of Environmental Impact Statement (EIS) for the proposed substation Project

1.6 Scope of the EIA study

The scope of study includes the following:

- Project registration, screening and site visit
- Preparation of Terms of Reference (ToR) in accordance with regulatory guidelines;
- Review national and international regulations guiding the activities to be carried out as well as consultations with regulators and other relevant stakeholders concerned with the proposed project;
- Carry out a comprehensive literature review to adequately describe the background of the area;
- Carry out a one-season field data gathering exercise and survey of the area in line with best practices to establish environmental baseline information specific to the study area; However, secondary data will be sourced from a recently approved EIA within the project zone of influence to compliment the primary data
- Collate field data collected and analyzed for effective characterization of the area as well as Impact identification, prediction, interpretation and evaluation from project activities;
- Development of an effective mitigation/ ameliorative measures and monitoring programmes for significant impacts;
- Development of comprehensive Environmental Management Plan covering the project life cycle; and
- Preparation of an EIA reporting following Federal Ministry of Environment (FMEnv) guidelines and procedures

1.7 EIA Methodology

The approach adopted in conducting the study is shown in Figure 1.1 below. This technique ensures that the EIA process was in compliance with the FMEnv's guidelines and standards. This EIA report has been compiled in accordance with the flow scheme below.

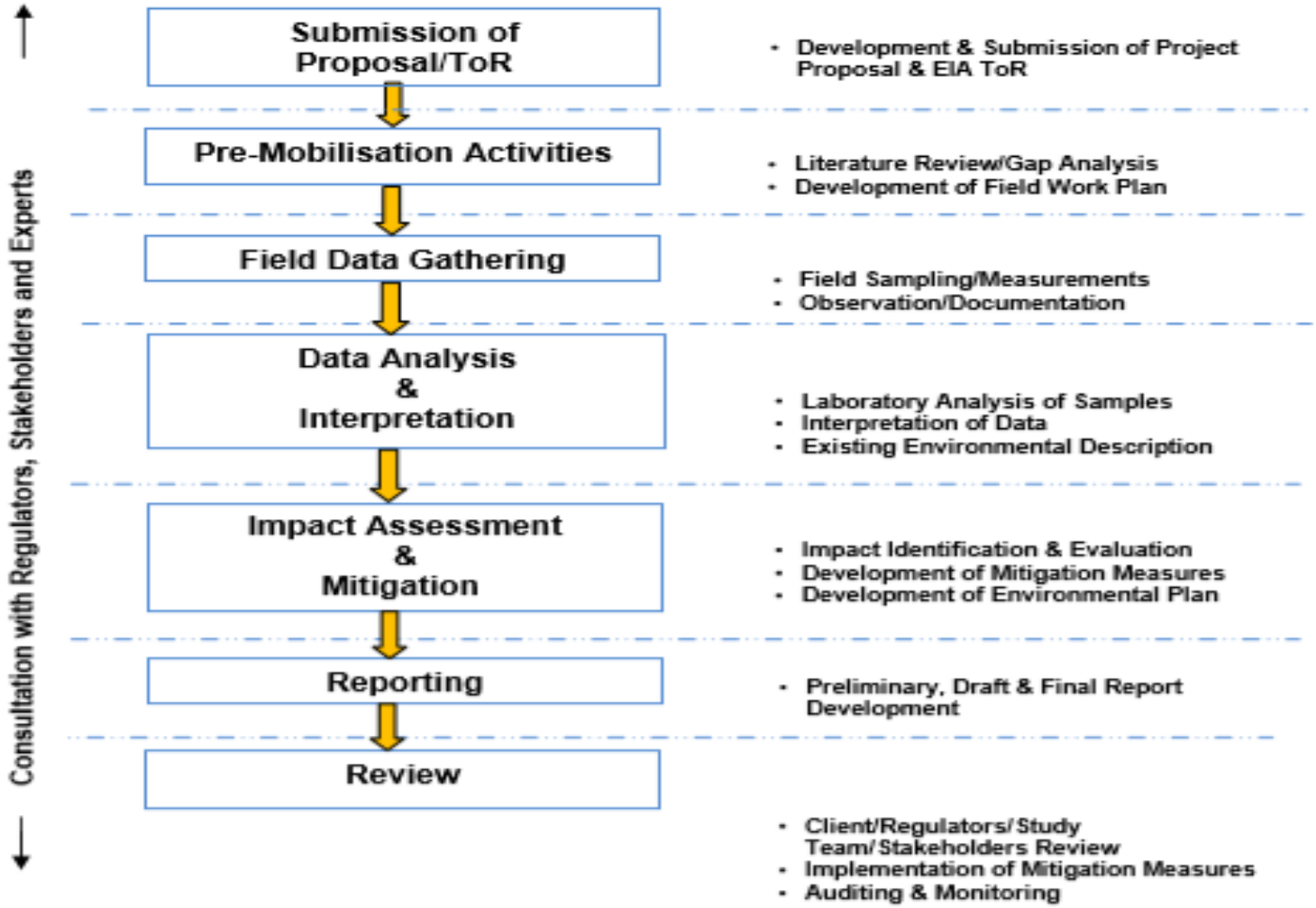

Figure 1.1: EIA Methodology Flowchart

1.8 Legal Framework For The EIA Process

The legal and regulatory framework for carrying out EIA of the proposed substation project are contained in relevant national statutes and international environmental conventions to which Nigeria is signatory. Specific policies, acts and guidelines enforced by FMEnv and relevant to this project are presented as follows:

1.8.1 National Regulations

1.8.1.1 The Federal Ministry of Environment

The defunct Federal Environmental Protection Agency (FEPA) was created by Decree No. 58 of 1988 as a parastatal of the Federal Ministry of Works and Housing. In 1992, the Agency's authority was strengthened through Decree 59 of 1992 by which the defunct FEPA was transferred to the Presidency. FEPA's goals were to improve and maintain the quality of the Nation's environment, manage its resources and physical characteristics, prepare ecological Master Plan to guide the use of coastal areas rift with diverse and often conflicting economic and social activities.

In same year, Nigeria took a giant step towards the sustainable management of its environment by formulating a decree of Environmental Impact Assessment (EIA). This has become globally accepted as an environmental management tool. June (1999), Nigeria formed a bigger body, "The Federal Ministry of Environment" which include the defunct FEPA and other departments from different Federal Ministries and Parastatal. The Federal Ministry of Environment is charged with the responsibility of all matters concerning the nation's environment and its biodiversity.

It has developed instruments of intervention to halt environmental degradation in form of policies, standards, guidelines and regulations and programmes. With the initiation of these instruments, enforcement by FMEnv has become the most effective tool to bring industries and regulated community into compliance through compliance promotions. The relevant policies, guidelines and regulations of the ministry are outlined below:

National Policy on the Environment In 1989, the Federal Government of Nigeria through the Federal Environmental Protection Agency established a National Policy on Environment (NPE) with the goal of achieving sustainable development.

Environmental management in Nigeria is based on the NPE, as revised in 1999. The goal of this policy is to achieve sustainable development, to:

- Securing a quality of environment adequate for good health and well-being;
- Promoting sustainable use of natural resources and the restoration and maintenance of the biological diversity of ecosystems;
- Promoting an understanding of the essential linkages between the environment and economic development and encouraging individual and community participation in environmental improvement initiatives;
- Raising public awareness and engendering a national culture of environmental preservation; and
- Partnership among all stakeholders including government at all levels, international institutions and governments, non-governmental agencies and communities on environmental matters.

The action plans to achieve the policy objective include the following:

a) that environmental aspects are considered in major economic decision making processes;
b) that an integrated environmental management approach is built into major development projects;
c) that economic instruments and environmental reporting are employed in the management of natural resources;
d) that the best practicable environmental technology is applied in major economic activities;
e) that environmental impact assessment (EIA) is mandatory before any major development project is embarked upon; and
f) that environmental monitoring and auditing is routinely carried out in major economic activities.

All environmental regulation in Nigeria is intended to align with the NPE. Based on this policy, the National Guidelines and Standards for Environmental Pollution Control in Nigeria were published.

1.8.1.1.2 National Guidelines and Standards for Environmental Pollution Control.

This guideline and standard was initiated in March 1991 sequel to the promulgation of the National Environmental Policy in 1989. This document is a basic instrument for monitoring and

controlling industrial and urban pollution. The guidelines and standards relate to these areas of concern, thus:

- Effluent limitations;
- Water quality or industrial water uses at point of intake;
- Industrial emission limitations;
- Noise exposure limitations;
- Management of solid and hazardous wastes, and
- Pollution abatement in industries.

1.8.1.1.2.1 National Effluent Limitation Regulation, S.1.8 of 1991 (No. 42, Vol. 78, August, 1991)

The National Effluent Limitation Regulation, S.I.8 of 1991, makes it mandatory for industries as waste generating facilities to install anti-pollution and pollution abatement equipment on site. The regulation is specific for each category of waste generating facility with respect to limitations of solid and liquid discharges or gaseous emissions into the ecosystem. Appropriate penalties for contravention are also prescribed.

1.8.1.1.2.2 Pollution Abatement Regulation, S.1.9 of 1991 (No.42, Vol. 78, August, 1991)

The Pollution Abatement in Industries and Facilities Generating Wastes Regulations, S.I.9 of 1991, imposes restrictions on the release of toxic substances and stipulates requirements for pollution monitoring units, machinery for combating pollution and contingency plan by industries; submission of lists and details of chemicals used by industries to Federal Ministry of Environment (FMEnv); requirement of permit by industries for the storage and transportation of harmful or toxic waste; the generator's liability; strategies for waste reduction; permissible limits of discharge into public drains; protection of workers and safety requirements; environmental audit (or environmental impact assessment for new industries) and penalty for contravention.

1.8.1.1.2.3 Management of hazardous and Solid Waste Regulation, S.1.15 of 1991 (No.102, Vol. 78, August, 1991)

The Management of Hazardous and Solid Waste Regulation, S.I.15 of 1991, defines the requirements for groundwater protection, surface impoundment, land treatment, waste piles, landfills, incinerators etc. It also describes the hazardous substances tracking programme with a

comprehensive list of acutely hazardous chemical products and dangerous waste constituent. It also states the requirements and procedure for inspection, enforcement and penalty.

1.8.1.1.3 Environmental Impact Assessment Act Cap E12 LFN, 2004

The Environmental Impact Assessment EIA Act Cap E12 2004 requires that for all new major public and private projects in Nigeria, where the extent, nature or location of a proposed project or activity is such that it is likely to significantly affect the environment, its EIA is undertaken in accordance with the provision of the Act. The EIA Act sets out to:

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

The Act gives specific powers to the FMEnv to facilitate environmental assessment of projects. In 1995, the then Federal Environmental Protection Agency (FEPA, now FMEnv) published EIA Procedural Guidelines. The guideline is intended to assist in the proper and detailed execution of EIA studies in Nigeria

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1.8.1.1.4 Factory Act CAP FI, LFN 2004

The Factories Factory Act CAP FI, LFN 2004 is the primary law regulating the health, safety and welfare of workers in the country's factories. The law holds management and staff personally responsible for violations of the provisions in the Act.

With respect to safety, there are general provisions as to the securing, fixing, usage, maintenance and storage of prime movers, transmission machinery, other machinery, unfenced machinery, dangerous liquids, automated machines, hoists and lifts, chains, ropes and lifting tackle, cranes and other lifting machines, steam boilers, steam receivers and containers, and air receivers. There

are, in addition to these, standards set for the training and supervision of inexperienced workers, safe access to any work place, first aid boxes, prevention of fire, and safety arrangements in case of fire.

The law requires that all accidents and industrial diseases be notified to the nearest inspector of factories and be investigated. The Act also prohibits the owner or occupier of a factory from making any deductions from the wages of any employee in respect of anything to be done or provided in pursuance of the FA.

1.8.1.1.5 Land use Act of 1978

The Land Use Act of 1978 states that "it is public interest that the rights of all Nigerians to use and enjoy land in Nigeria and the natural fruits thereof in sufficient quality to enable them to provide for the sustenance of themselves and their families be assured, protected and preserved".

1.8.1.1.6 Electric Power Sector Reform Act 2005

The Nigeria Electric Power Sector over the years witnessed a slow and steady decline leading to a near complete failure of the system. The Government therefore, as a matter of dire necessity embarked on an Electric Power Sector Reform Program, which led to the establishment of the Nigerian Electricity Regulatory Commission (NERC) in 2005 and the Sector Reform Act.

This Act provides for the formation of initial and successor companies for the transfer of assets and liability of the National Electric Power Authority (NEPA), development of a competitive electricity market, establishment, functions and powers of the Nigerian Electricity Regulatory Commission (NERC), licenses and tariffs, acquisitions of land and access rights, consumer protection and licensee performance standards, completion and market power, the power consumer assistance fund, etc. for the regulation and control of electrical installations, and the generation, supply and use of electrical energy in Nigeria

1.8.1.1.7 Energy Commission of Nigeria 1988

The Energy Commission of Nigeria (ECN) was established in 1988 with the statutory mandate for strategic planning and coordination of national policies in the field of energy. It was established in line with the declaration of the Heads of the Economic Community of West African States in 1982 for the establishment of an Agency in each member state charged with the responsibility of

coordinating and supervising all energy functions and activities. The functions of the ECN include, but are not limited to, the following:

- serve as a centre for gathering and dissemination of information relating to national policy in the field of energy;
- inquire into and advise the Government of the Federation or the State on adequate funding of the energy sector including research and development, production and distribution;
- monitor the performance of the Energy sector in the execution of government policies on energy; and
- serve as a centre for providing solutions to inter-related technical problems that may arise in the implementation of any policy relating to the field of energy.

1.8.1.1.8 Nigerian Electricity Supply and Installation Standards Regulations 2015 REGULATION NO: NERC/Reg/1/2015

In exercise of the powers to develop Standards and make Regulations conferred by Sections 81 and 96(1) of the Electric Power Sector Reform Act 2005 (Act No. 6 of 2005) respectively, and all other powers enabling it in that behalf, the Nigerian Electricity Regulatory Commission makes several Regulations for Engineering Designs, Installations, Commissioning and Maintenance of electric power systems in the Nigerian Electricity Supply Industry

1.8.1.1.9 National Electricity Regulatory Commission.

This is an independent regulation agency for electricity in the form of a regulatory commission. It has many functions some of which include: electricity regulation for grid connected services, Issuing of licenses to the companies operating in the Nigeria Electricity Supply Industry

1.8.1.1.10 The Electricity Act, Cap 106 of 1990

This contains regulations pertaining to permit for electrical installations, placement of overhead lines, construction of substations and switching stations, penalties for breaches of licenses and regulations etc.

1.8.1.1.11 Criminal Code Act (cap.77) Laws of the Federation of Nigeria (L.F.N),2004

The Nigerian Criminal Code makes it an offence punishable with up to 6 month's imprisonment for any person who:

- Violates the atmosphere in any place so as to make it noxious to the health of persons in general dwelling or carrying on business in the neighborhood or passing along a public way.

1.8.1.1.12 Nigerian Urban and Regional Planning Act Cap N138, LFN 2004

- Section 30 (3) requires a building plan to be drawn by a registered architect or town planner.
- Section 39 (7) establishes that an application for land development will be rejected if such development will harm the environment or constitute a nuisance to the community.
- Section 59 makes it an offence to disobey a stop-work order. The punishment under this section, is a fine not exceeding N10, 000 (Ten thousand naira) and in the case of a company, a fine not exceeding N50, 000.
- Section 72 provides for the preservation and planting of trees for environmental conservation

1.8.1.1.13 Harmful Waste Act the Harmful Waste (Special Criminal Provisions) Act Cap H1, LFN *2004*

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

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

1.8.1.1.14 National Environmental Standards and Regulations Enforcement Agency (NESREA) ACT of 2007

NESREA Act Administered by the Ministry of Environment, the National Environment Standards and Regulation Enforcement Agency (NESREA) Act of 2007 replaced the Federal Environmental Protection Agency (FEPA) Act. It is the embodiment of laws and regulations focused on the protection and sustainable development of the environment and its natural resources.

1.8.1.1.14.1 National Environmental* (Energy Sector) Regulations, *S. I. No 63, 2014. These Regulations are to ensure that our national development agenda is not at variance with the carrying capacity of our fragile environment.

1.8.1.1.14.2 National Environmental (Surface and Groundwater Quality Control) Regulations, S. I. No. 22 of 2011

The purpose of this Regulation is to restore, enhance and preserve the physical, chemical and biological integrity of the nation's surface waters, and to maintain existing water uses.

1.8.1.1.14.3 National Environmental (Permitting and Licensing System) Regulations 2009

This addresses the need to obtain permits from the agency to cover various environmental licenses to operate as regards the safety and care of the environment. Such permits include: Effluent discharge permit, Air quality permit, Waste and toxic substance permits.

1.8.1.1.14.4 National Environmental (Soil Erosion and Flood Control) Regulations, S. I. No. 12 of 2011

The objective of these Regulations is to control all earth-disturbing activities, practices or developments for non-agricultural, commercial, industrial and residential purposes.

1.8.1.1.14.5 National Environmental (Control of Vehicular Emissions from Petrol and Diesel Engines) Regulations, S. I. No. 20 of 2011

These Regulations are aimed at safeguarding the Nigerian environment against pollutants from emissions of engines powered by fossil fuel.

1.8.1.1.14.6 National Environmental (Sanitation and Wastes Control) Regulations, S. I. No. 28 of 2009: The purpose of these Regulations is to provide the legal framework for the adoption of sustainable and environment friendly practices in environmental sanitation and waste management to minimize pollution.

1.8.1.1.14.7 National Environnemental (Noise Standards and Control) Regulations, S. I. No. 35 of 2009

The main objective of the provisions of these Regulations is to ensure serenity of the human environment or surrounding and their psychological well-being by regulating noise level.

1.8.2 State Environmental Legislations

The Ogun State regulations guiding Environmental management includes but not limited to the following:

1.8.2.1 Ogun State Policy on Environment (2013)

Ogun State Policy on environment aims at:

i) Preventative activities to reduce the negative impact of social and economic development on the environment;

ii) Broad strategies to tackle environmental problems and promote sustainable environmental protection and management of systematic and sub-systematic levels;

iii) Ensuring consistent assessment of the impacts of developmental projects on the state of the environment.

1.8.2.2 Ogun State Ministry of Environment (OGMOE)

The Ministry was established in July 2003 with the aim of creating better living and conducive environment for the entire people of Ogun State. The mandate of Environmental Impact Studies (EIS) lies with the Department of Planning Research & Statistics which includes managing Environmental Impact Assessment (EIA) and review of major projects in Ogun State in conjunction with Federal Ministry of Environment in line with EIA Act.

1.8.2.3 Ogun State Environmental Protection Agency (OGEPA) Edict 1995

Ogun State Environmental Protection Agency (OGEPA) is an agency charged with protecting the environment in the State. Specifically, to coordinate the waste management aspect of the environment, domestic and industrial pollution control and ensures Environmental Compliance to environmental laws in the State

1.8.2.4 Ogun State Emergency Agency (OGSEMA)

Ogun State Emergency Agency (SEMA) was enacted in 1991, with a mandate to coordinate efficient and effective disaster prevention, preparedness, mitigation and response in Ogun State. The activities of the Agency include:

- disaster risk reduction, search and rescue, policy and strategy, advocacy, and education;
- financial and material assistance to several victims of disaster in the state in a fast and coordinated manner;
- hazard monitoring and disaster prevention activities in the State

1.8.3 International laws

International Policies, Guidelines and Conventions in addition to the national laws/regulations which Nigeria is signatory or party to that support the use of EIA as the key tool for achieving sustainable development include but not limited to the following:

1.8.3.1 World Bank Group Environmental, Health and Safety Guidelines

The World Bank Group Environmental, Health and Safety Standards emphasize the importance of managing social and environmental performance throughout the life of a project (any business activity that is subject to assessment and management). It provides operational procedures for a project's social and environmental management system as a dynamic, continuous process initiated by management and involving communication between the client, its workers, and the local communities directly affected by the project (the affected communities). The standard therefore applies to projects with social or environmental risks and impacts that should be managed, in the early stages of project development, and on an ongoing basis.

In addition, the World Bank has developed specific safeguard operational policies that identify various aspects of the environment that a developmental project may likely impact.

1.8.3.2 IFC Environment, Health and Safety Guidelines

The 2007 version of this guideline provides general technical approach towards achieving Good International Industry Practice (GIIP) in the implementation of environmental, health and safety risk potential projects. The guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities / projects by existing technology at reasonable cost.

1.8.3.3 The Rio Declaration on Environment and Development

The UN Conference on Environment and Development met at Rio de Janeiro in June 1992, at which time it reaffirmed the 1972 declaration on the Human Environment, and sought to build upon it. This is with the goal of establishing a new and equitable global partnership through the creation of new levels of cooperation among States, key sectors of societies and people. It is also to aid work towards international agreements, which respect the interests of all, protect the integrity of the global environmental developmental system, and recognize the integral and interdependent nature of the earth.

1.8.3.4 World Heritage Convention

The World Heritage Convention (1978), which seeks to set aside areas of cultural and natural heritage, the latter defined as areas with outstanding universal value from the aesthetic, scientific and conservation points of view.

Other Conventions to Which Nigeria is Signatory includes but not limited to:

- 1985 Vienna Convention on the Protection of the Ozone Layer;
- 1987 Montreal Protocol on Substances that deplete the Ozone Layer
- 1972 United Nations Guiding Principles on the Human Environment
- 1996 International Union for Conservation of nature and Natural Resources (IUCN) Guidelines
- 1989 Basel Convention on the Control of Tran boundary Movements of Hazardous Wastes and their disposal; • 1996 Protocol on the 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter
- 1992 Convention on Biological Diversity; and the
- 1992 United Nations' Convention on Climate Change

1.8.4 Environment and Community relation Policy of Adefolorunsho Technical Ventures Nigeria Limited

The Company's policy seeks to preserve at all times the health of its employees and sub-contractors through high degree of personal hygiene and implementation of work procedures that are free from any health risk. Health Hazard Analysis would be carried out and control put in place. The Company retains the services of good clinics to take care of the workers and much emphasis is placed on the promotion of the total health and protection of the worker. Staff would be advised to stay away from excessive noise and encouraged to wear ear defenders where noise is unavoidable. Regular medical examination would be encouraged. New staff would be medically examined before joining the company and inducted on the hazards inherent in their assigned responsibilities.

1.9 Declaration

Adefolorunsho Technical Ventures Limited declares that this report has been prepared by **AZMARINEBERG,** using the best resources and methods available, and therefore takes responsibility for the implementation of the approved Environmental Management Plan drawn up in the report.

1.10 FMEnv's EIA Approval Process in Nigeria

The Federal Ministry of Environment (FMEnv) is statutorily responsible for the processing and approval of EIA reports. The EIA Act stipulates that no major project shall be undertaken without prior consideration, at early stages, of their environmental effects. Appropriate mitigation measures for potential significant impacts shall be stated before the commencement of the project.

The formal approval process for the project would follow the normal procedures, which will involve the following steps:

- Project Conceptualization (the act or process of forming the idea)
- EIA Registration and ToR Submission;
- Site Verification Visit;
- EIA Scoping;
- Conduct baseline and environmental impact studies;
- Proponent's informs host communities about the extent and processes of the project;
- Proponent submits required copies of the EIA report to FMEnv for assessment;
- FMEnv publicly displays the EIA report in designated areas to enable any interested members of the public to read and comment upon;
- FMEnv places advertisement in some National Dailies to inform the public about the display of EIA report;
- FMEnv appoints an independent review panel, comprising academicians and professionals to review the EIA report;
- FMEnv distribute the EIA report to the review panel members;
- FMEnv convenes a public hearing including site visit after the display of the EIA reports, backed by statewide radio announcement;

- Proponent gives a presentation to the public panel at the review session giving details about the project and its environmental management, followed by a questions and answers session;
- The review panel members, and representatives present their comments on the presentation and the EIA report;
- Proponent responds to all comments and takes note of the public and panel member's observations for incorporation into the final EIA report;
- Upon fulfillment of the environmental requirements, recommendation for provisional approval will be made by the review panel members; and
- FMEnv will communicate the granting of a provisional approval to proponent and requests the incorporation of the panel's comments into the final EIA report before a final approval of the EIA report. After that the permit is granted.

The steps mentioned above are presented in Figure 1.2 below.

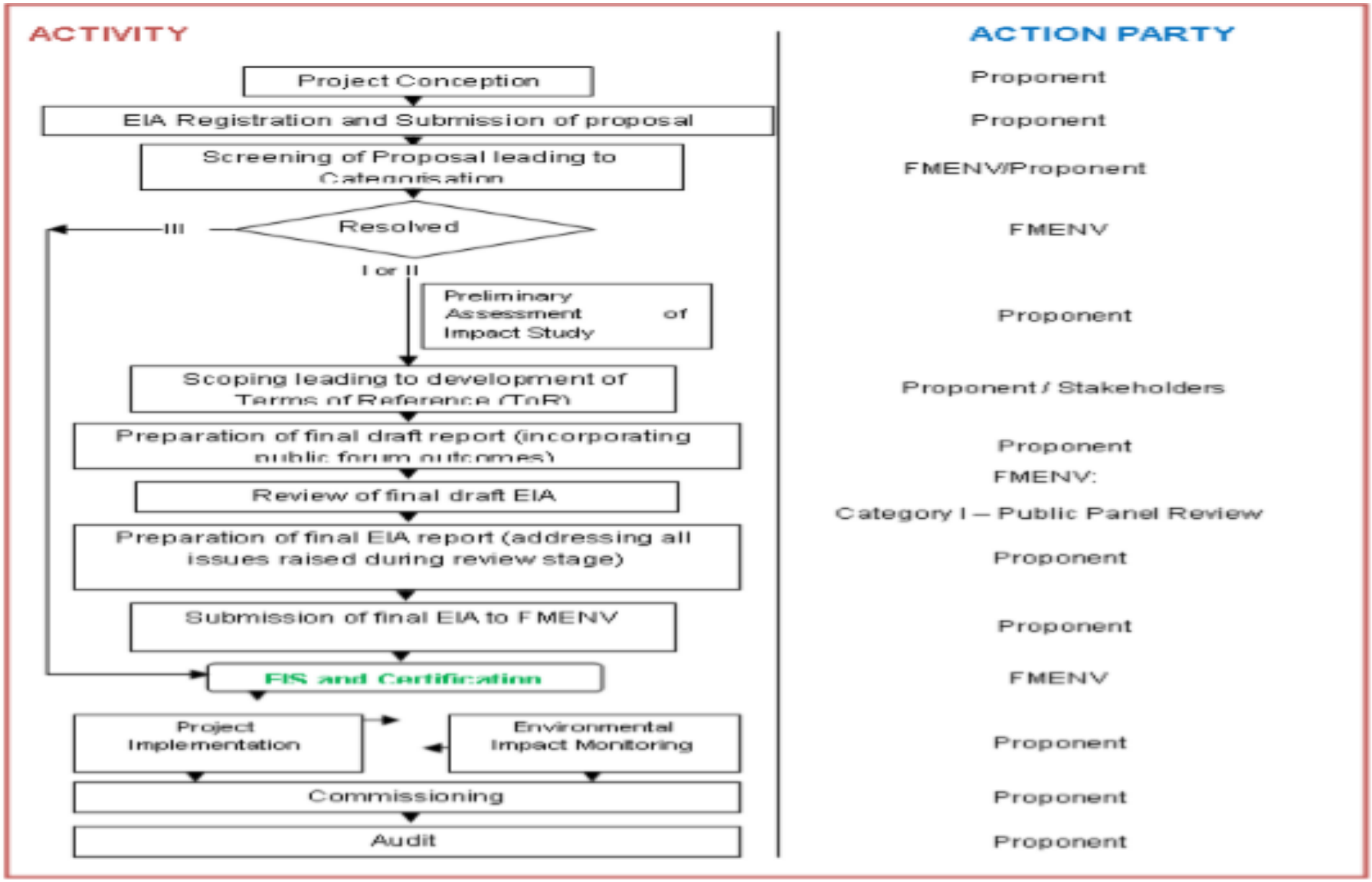

Figure 1.2: FMEnv EIA Process

1.11 EIA Report Structure

This EIA report is presented in Nine (9) chapters preceded by an executive summary as follows:

- Chapter one - contains the introductory part: project background, and outlines the objectives, scope and EIA methodology, and legal framework / data sources.
- Chapter two - discusses the project setting, and presents the need / benefits, sustainability as well as the project alternatives and options.
- Chapter three - describes the technical elements, components and processes of the proposed Transmission Line activities from design through construction and operation as well as scheduling.
- Chapter four - describes the existing ecological (climatic, bio-physical and biological) and Socio-economic baseline condition of the area.
- Chapter five - describes the associated and potential environmental, social and health impacts of the proposed project on the environment.
- Chapter six - documents the mitigation measures accrued to the identified potential and associated impacts of the project on the environment.
- Chapter seven - presents the environmental management plan to be adopted throughout the project life cycle. It also recommends the environmental monitoring program and the waste management plan.
- Chapter Eight - is about remediation plan after decommissioning and
- Chapter Nine - concludes the EIA report with the key findings of the study presented therein.

CHAPTER TWO

PROJECT JUSTIFICATION

2.1 Need for the Project

Electricity plays a very important role in the socio-economic and technological development of every nation. The electricity demand in Nigeria far outstrips the supply. The absence of reliable electricity supply and constant blackout causes severe economic stagnation and damage. For years the substation has been overlooked, as old technology and insufficient metering control still seemed to cause problems.

However, over the years, Ota has been experiencing erratic supply of electricity and of poor quality, which has made many industries to fold up in the area. Similarly, due to accelerated growth and industrial development in Ota and the attendant increase in load demand, there is need for more transmission station connected to the grid in Ota. Ota transmission substation has two incoming transmission lines coming from Ayobo in Ikeja West area of Lagos state namely Ikeja west line 1 and 2. The power transformer in the substation is 100 MVA rated capacity comprising 60 MVA and 40 MVA. It has six numbers of outgoing feeders namely; Idiroko, Winner, Odigbo, Sango, FSM and Amje. The electrical substation's various equipment would include Circuit Breaker, Current Transformer (C.T), Potential Transformer (P.T), Isolators, Earth Break Switch (A.B.S), Air Circuit Breaker (A.C.B) and some others which will be installed under the open sky.

The Sub-stations have two major roles to play. One is to Step down the Very High voltages (normally in KVs) generated at the Generating station to intermediate /low voltages (depending upon the location of sub-station and the actual users) and the other is to distribute the intermediate high voltage/low voltage to actual users. Substations are also used to boost up the line voltages when the distances between Generating station and end users are very large and there is considerable drop in transmission voltage due to it. Substations take the load from large distribution systems and distribute it to smaller distribution networks. They also fix any changes in phase that may have occurred during transmission and step the voltage to the correct level for the smaller network. In networked systems the substations can connect to each other and manage the load better or route around outages.

Adefolorunsho Technical Ventures Limited was previously using Compressed Natural Gas (CNG) for its operations. This gas was supplied by Green Liquefied Natural Gas (GNLG) but seem not to be viable which is why it intends to construct and install a 2x7.5MVA, 132/33KV Substation at Sango Ota in Ado Odo Ota LGA of Ogun State. The company is currently running on a 415KV electricity transformer but now intends to tap electricity from a 132 KV national grid and step it down to 33 KV by running a 33 KV cable from the substation to its factory through a short distance. The proposed substation is in front of the national grid with the distance from substation to the factory being approximately 300m away.

The company currently has a Memorandum of Agreement with Greenfield Liquefied Natural Gas that is renewed annually.

2.2 Benefits of the Proposed Project

The most significant benefit from the proposed substation project is the expected improvement in power generation and supply. Moreover, the project is expected to yield the following benefits:

- Provide reliable power supply to assist in reducing current generation deficit in the country with the aim of alleviating the current power crisis;
- Source of income to the government through royalties and tax generation and increased revenue/ derivations to Local and State Governments as well as other mandated agencies/ commissions;
- Promote indigenous Nigerian investor-led independent power production by shifting the burden of investment capital for power generation from the central government to the private sector;
- Promote secondary social development and services such as service delivery, manufacturing etc.;
- Provide direct and indirect employment opportunities;
- Support technology development through technical assistance and training for Nigerians as part of overall strategy of institutionalising local content in Nigeria's Energy Sector;
- Reduce environmental emissions associated with privately powered generators; and reduce pressure on the diesel/ petrol supply chain.

2.3 Value of the Project

The value of the project is estimated to be **Five Hundred Million naira (500,000,000).** This will cover the cost of all activities to be carried out during the construction to the operation phase of the proposed ATVL substation project. Introduction of such huge fund into the economy will have lots of direct and indirect economic benefits to the local and national economy.

2.4 Envisaged Project Sustainability

Various factors are important for far reaching project sustainability. They are related to practical aspects, economic profitability, technical resources, and all, with an efficient management. Moreover, with the growth in electricity demand that has occurred over the last decades, adequate and reliable energy supplies are important for economic development. Additional energy resources, including electricity generation and share, as well as infrastructure improvements, are important.

2.4.1 Technical Sustainability

Design of the substation would be carried out using latest technology, which would facilitate simple operation and maintenance system. Also, the proposed project would be technically sustained in view of adherence to international and nationally accepted engineering practices to be adopted at all stages of the development. Again,

- The main construction work needed would be much smaller and with less quantity of buildings or infrastructure (control room).
- Insulation cost for switchgear and other electrical equipment would be very low.
- Adequate space between separate adjoining equipments would be provided in the substation which can reduce the possibility of any kind of fault.
- Erection and Commissioning for the substation can be completed within a short period.
- All equipment can be viewed and it can help to find the fault location easily.
- Future extension of the scheme would be easier whenever needed.
- In compliance with one of the guidelines mandating all power distribution companies and the TCN to fence all substations the proposed substation is sited in a fenced location.

2.4.2 Economic Sustainability

The proposed substation project shall be economically sustainable because the proponent is seeking to finance the project through a loan from a GenCo (North South Power Generation Company). A Power Purchase Agreement document has already been signed in liaison with Transmission Company of Nigeria (TCN). The project actualization is expected to engage some unemployed Nigerians. Employment opportunities shall also be created during all phases of the project especially the operation. Opportunities that will be created include unskilled, semi skilled to skilled jobs. These will involve security personnel, and staff to man the substation. Others service providers include fire alarm and first aid box service providers. The project is being constructed in order to boost power supply. During the operational phase, ATVL factory shall benefit from reliable and quality power supply. Frequent blackouts shall be a thing of the past and the increased power demands of the company shall be met. The area close to the substation will benefit from reduced impacts of lightening due to installation of lightening arrestors. The proposed project is expected to give a steady power supply and in case of a breakdown which is very rare except there is complete outage in the whole of Nigeria the company plans to install two transformers with a capacity of 7.5 MVA each (i.e. 15MVA) using one of the transformers as Redundancy.

2.4.3 Social Sustainability

Stakeholder consultation process would be implemented throughout the EIA process to assist in ensuring that all stakeholders can provide input into the project planning process. This would go a long way in ensuring better relationship with stakeholders throughout the lifecycle of the project. There are two basic criteria in the adoption of a 'green' substation approach. Firstly, the design of the substation and the equipment it accommodates shall allow economic efficiency and technical effectiveness over its service lifespan. Secondly, the substation shall be built in an environmentally friendly manner. The substation project shall involve programmes that will benefit the local community. These programmes would comprise projects aimed at improving the health, education and infrastructures of the inhabitants of the host community. The specific form and extent of these programmes would ultimately be guided by the company's Community Social Responsibility Policy (which will have input from all stakeholders including the Company's employees.

2.4.4 Environmental Sustainability

The substation project will be environmentally sustained by incorporating into the project design, mitigation measures or controls suggested during this EIA study. Also by implementing the environmental monitoring and management programmes as recommended in the Environmental Management Plan (EMP). By implementing these actions ATVL would also ensure that the project meets and/or exceeds the requirements of the FMEnv, State Environmental Protection Agency and World Bank/ IFC regarding minimizing the environmental and social impacts.

The project would eventually lead to reduced footprint of air pollutant emissions from individual and corporate owned power generators. It will also reduce/ eliminate noise generation associated with these generators.

2.5 Project Alternatives

The examination of alternatives and development options considered for the proposed substation project is presented in the paragraphs below and the considered process alternatives were;

2.5.1 Analysis of Alternative Construction Materials and Technology

It was designed that the proposed substation will be constructed using modern, locally and internationally accepted materials to achieve public health, safety, security and environmental aesthetic requirements. Equipment that guarantees efficient use of locally available materials shall be encouraged to ensure reliability in supply with minimum power loss and efficiency in power distribution.

Previously, support structures in substations were wooden. However, ATVL shall use steel for the construction works. Steel has been chosen because of its durability, strength and therefore all support structures shall be steel. A perimeter stone wall shall be constructed instead of using wooden poles and wire mesh. A perimeter wall is chosen because it is more durable and offers better protection and security. Basically, use of steel poles and construction of a perimeter wall shall require negligible maintenance costs. The projects design shall be chosen paying attention to efficiency in installation and maintenance. The final designs shall be approved by relevant authorities before construction begins. The proposed project shall not conflict with the existing and perhaps future developments in the area.

2.5.2 Alternative Sources of Energy

The project objective is to boost power supply for the factory use. Alternative sources of energy other than relying on the national grid were analyzed. Some of the possible options included relying on diesel generators which would lead to increased noise and emission of green house gases. Other alternatives would be use of Solar Power and Compressed Natural Gas (CNG) which is green energy. Compressed Natural Gas (CNG) is currently being used by the company but seems not to be viable for its operations.

2.5.3 Alternative Substation Site

The potential substation sites identified during the initial site search was assessed in terms of various suitability criteria and technical restrictions such as the following;

- Size – this is key because a potential site must be sufficient for the average size of a substation and associated incoming and outgoing power lines. The project land has sufficient ground area to accommodate substation equipments and control room etc.
- Hydrology – consideration was given to the proximity of proposed site to adjacent water courses and wetlands where there may be potential impacts in terms of erosion and siltation of water courses, as well as implications associated with storm-water control at the substation. There is no surface water close to the location of the substation.
- Topography – gently sloping topography is preferred for siting a substation especially in flood prone areas. A gentle slope facilitates surface drainage and movement of vehicles and people on-site during construction. A steep slope requires costly leveling (cut and fill) for the construction of the substation. In addition, a steep slope inhibits movement, makes vehicle access problematic and increases the potential for environmental impacts during construction as well as operation e.g. steeper slopes have higher surface water flow rates and therefore higher erosive potential. The site is gently sloping. Set back distances shall be observed as per the regulations in force and the proposed project site does not have water logging problem.
- Geology and soils – consideration is given to the soil type present within the site whereby stable soil and founding conditions are preferable. Less stable soils, i.e. shallow, dispersive soils and soils with poor drainage, present an erosion hazard if not managed correctly, and also require the installment of additional, costly foundation infrastructure;

- Flora and fauna – the proposed site is devoid of heavy flora and fauna as there are adjourning structures in the vicinity and thus not a site with high ecological value.
- Visibility – highly visible sites i.e. on a ridge / elevated terrain are considered less favorable in that they have a high visual impact on the surrounding landscape. The site is not on a hill and will not cause visual intrusion as there are other buildings near the site.
- Access – it is preferable that potential sites are located in close proximity to existing provincial roads so as to avoid the need for construction of new access roads of considerable length. Access is also important particularly as it relates to the transportation of the substation transformer to the site, which weighs approximately 38 tons and requires the use of a low-bed vehicle. As such, long access routes with sharp bends are to be avoided and the site should not be located in an area that has excessively steep inclines or declines that could hinder access, particularly during periods of heavy rainfall. The site is accessible as it has an accessible road beside it.
- Distance to site – The proposed site is strategically located close to the National grid and about 300m from the factory site where electricity is needed.
- Adjacent land use – The land surrounding the substation is relatively clear of obstructions that might otherwise inhibit / obstruct the path of the power lines in and out of the substation. The site is near the National grid. In addition the lines shall be micro tunneled along the side of the road to the factory which is about 300m away from the site with minimum distractions.
- Public acceptability – The location of the proposed substation shall pose no possible adverse impact on public health, safety, access to natural resources and local land and property values.

Based on the above-mentioned suitability criteria and technical restrictions, ATVL has identified the site for the location of its proposed substation. The site was acquired on a willing seller and willing buyer and was selected after the considerations discussed. Relocation option to a different site is an option available for the project implementation. The project proponent can look for alternative land to accommodate the scale and size of the project. However, this will be a costly venture, which takes long without a guarantee that the land would be available.

The substation site is reasonably central to the distribution area to be served (factory) and is secure from intrusion by passers-by, both to protect people from injury by electric shock or arc discharge, and to protect the electrical system from disoperation due to vandalism. The site offers the least disruption to both human and natural environment; its closeness to the National grid and being about 300m from ATVL's factory made the substation location preferable. It is recommended that the proponent be allowed to install the project at the already available site.

2.6 Project Options

There are few development options which have been considered and discussed under various sub-categories as follow.

2.6.1 No Project Option

The 'No Project Option' implies that the proposed project should not be constructed, and the human development index, which is closely related to industrialization, will remain poor. It further implies there is no need to carry out the EIA study. This option though is environmentally favorable; it is economically unviable as no economic returns shall accrue to Nigerian Government through taxes and other revenues.

2.6.2 Delayed Project

The prevailing condition in the project location does not necessitate delaying the project further. In the course of stakeholders' engagement, the people were favorably disposed to implementation of the proposed substation project as it is considered to further enhance the socioeconomic status of the project area. Therefore, delayed option is considered unviable for the project.

2.6.3 Implement or Do Project Option

The potential benefits of the proposed project, if permitted to go ahead as planned, are of diverse economic benefits to ATVL in particular and various organs of government in Nigeria. Thus, the preferred option for the proponent, which is to go ahead as planned, has immense project benefits and potential positive impacts which outweigh adverse impacts. As a result, going ahead with the project as an option outweighs the other options of no project and delay as earlier discussed.

CHAPTER THREE

PROJECT AND/OR PROCESS DESCRIPTION

3.1 Project Type

The growing demand for electrical power is rapidly on the rise, and this can be satisfied by the construction and installation of power generating substations. A substation is an electrical system with high-voltage capacity and can be used to control apparatus, generators, electrical circuits, etc. Substations are mainly used to convert AC (alternating current) to DC (direct current). Some types of substations are tiny in size with an inbuilt transformer as well as related switches. Other types of substations are very huge with different types of transformers, equipment, circuit breakers, and switches. The different types of substations mainly include Step-up Substation, Step-down Transformer, Distribution, Underground Distribution, Switchyard, Customer Substation, and System Station.

The substation for the proposed project shall work as the major source of power supply for ATVL specific business operations. Here power shall be tapped from the National grid to be utilized in an industrial facility where the voltage has to be stepped-down to additional distribution. The company is proposing to construct and install a 2x7.5MVA, 132/33KV Substation at Sango Ota in Ado Odo - Ota LGA of Ogun State. The proposed project is expected to give a steady power supply and in case of a breakdown which is very rare except there is complete outage in the whole of Nigeria, the company plans to install two (2) 7.5 MVA transformers and use one of the 2 x 7.5 MVA as Redundancy (i.e. redundancy is the duplication of critical components or functions of a system with the intention of increasing reliability of the system, usually in the form of a backup or fail-safe, or to improve actual system performance) till power is again restored for their production.

Basically, the company intends to tap electricity from a 132 KV national grid and step it down to 33 KV by running a 33 KV cable from the substation to its factory through a short distance. The proposed substation is in front of the national grid with the distance from substation to the ATVL factory site being approximately 300m away. About 95% of the equipment to be used for the substation project shall be sourced from India while the remaining 5% shall be acquired locally. Galvanised steel will be used for the substation equipment.

The proponent ATVL shall ensure that a Factory Acceptance Test inspection is carried out by officials of the Power Holding Company of Nigeria (PHCN) before equipment purchase and during the operational phase of the project. The Factory Acceptance Test (**FAT**) is a process that evaluates the equipment during and after the assembly process by verifying that it is built and operating in accordance with design specifications.

3.2 Project Location

Adefolorunsho Technical Ventures Limited proposed Substation site is located at Okon close, off Powerline road, off Matina road, Sango Ota, Ado - Odo Ota LGA, Ogun State. The site occupies a landmass of 1174.821m^2 on Latitude 06^0.42.759N and Longitude 003^0.14.175E, SE of Okon Crescent Powerline road, Latitude 06^0.42.749N and Longitude 003^0.14.177E, SW of Durojibagun close, Latitude 06^0.42.746N and Longitude 003^0.14.208E, NW of Shirish clinic with Latitude 06^0.42.751N and Longitude 003^0.14.210E, but NE of Jacob's Model school. The proposed project which is located in a built up area and on a location previously housing a shopping complex is to be sited at Boluwatife which is the host community.

Figure 3.1 below is the map of Nigeria showing the project location (Ogun state) while figure 3.2 show the Map of Ogun state depicting the twenty LGAs and Ado Odo Ota LGA where the proposed project is sited. Others are figure 3.3 showing Ado – Odo Ota LGA, Figure 3.4 (Aerial view of AVTL) and figures 3.5a and 3.5b(project line diagram layout of the project area).

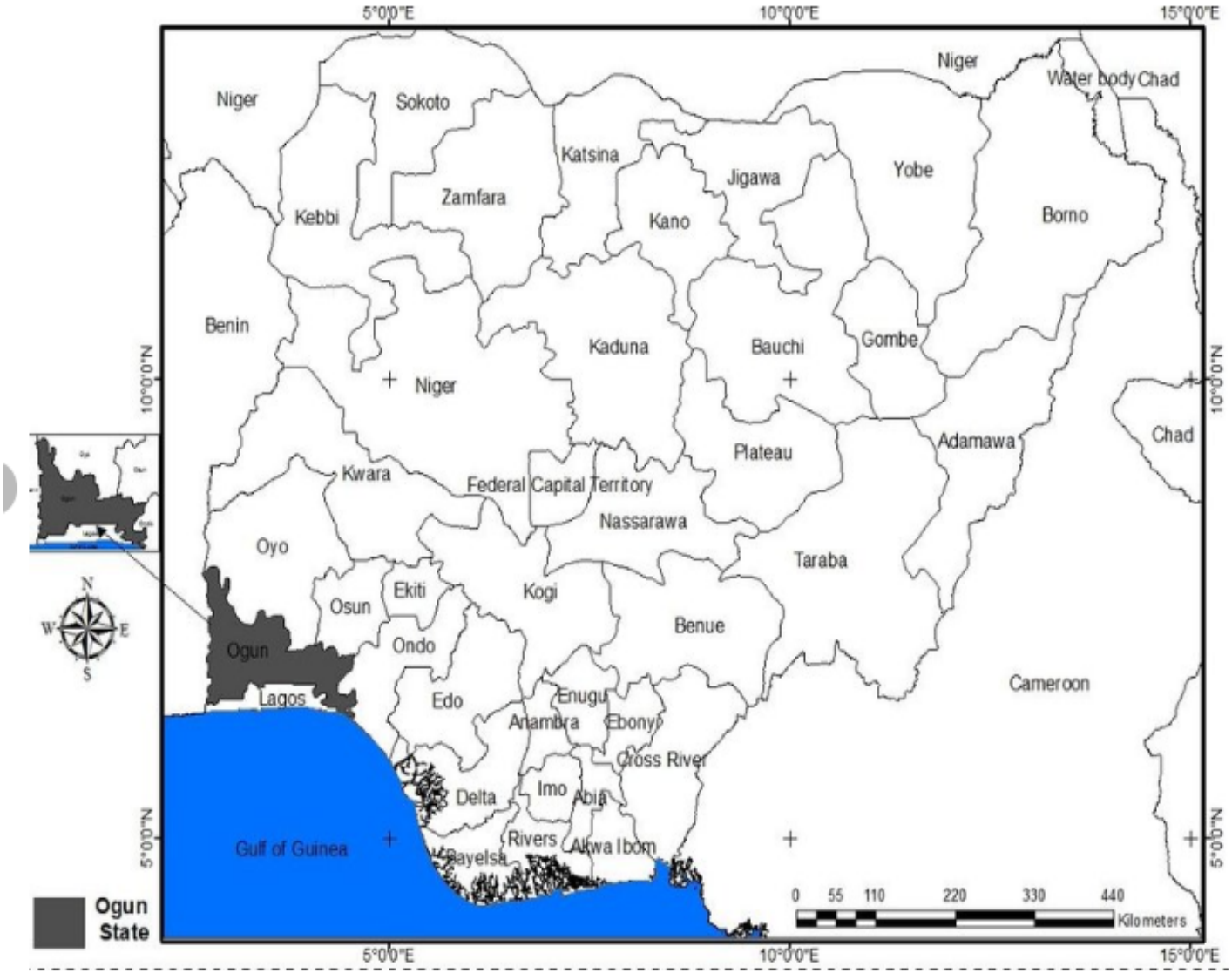

Figure 3.1: Map of Nigeria with Ogun state highlighted

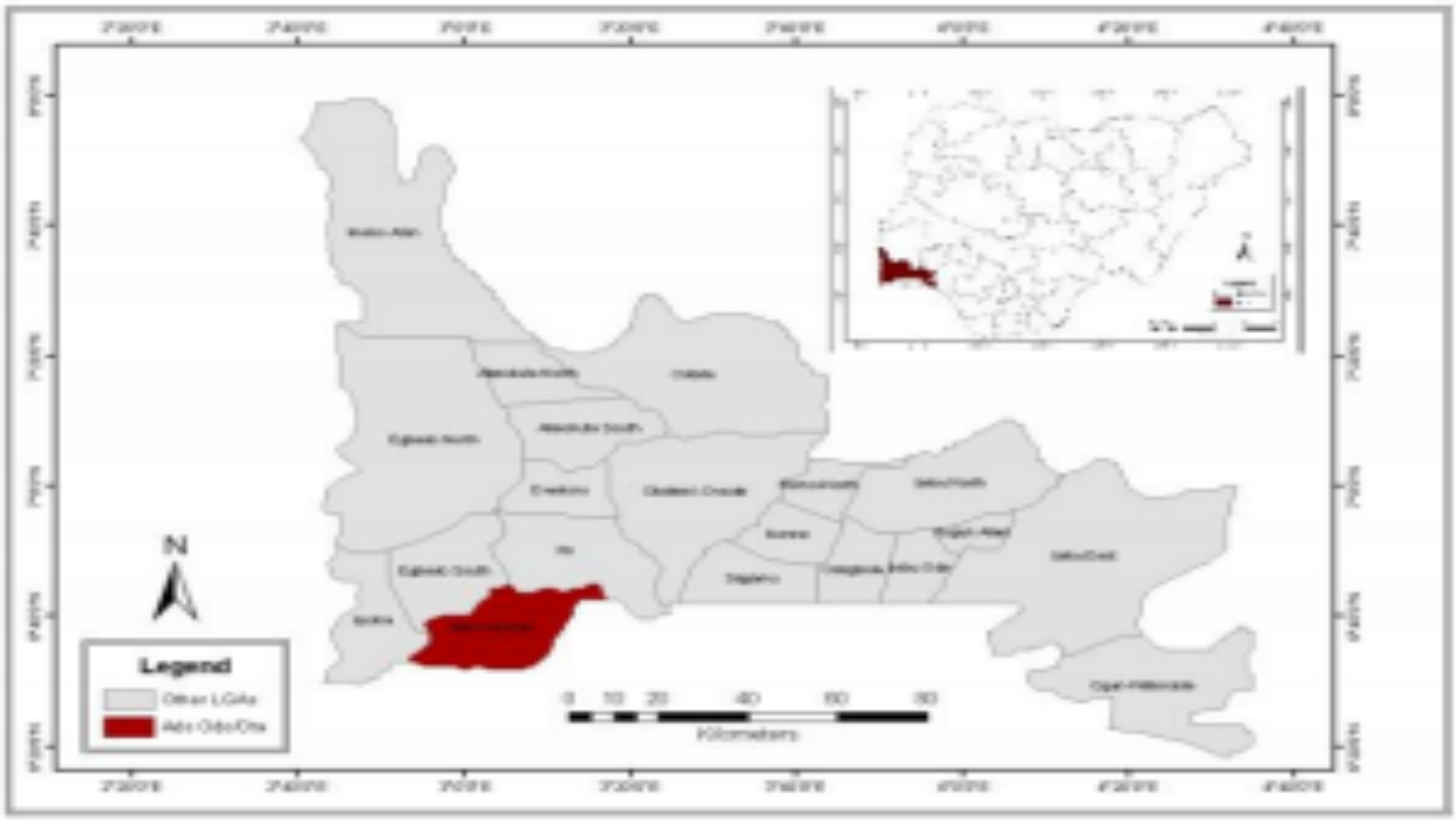

Figure 3.2: Map of Ogun state showing the LGAs with Ado Odo Ota LGA in red

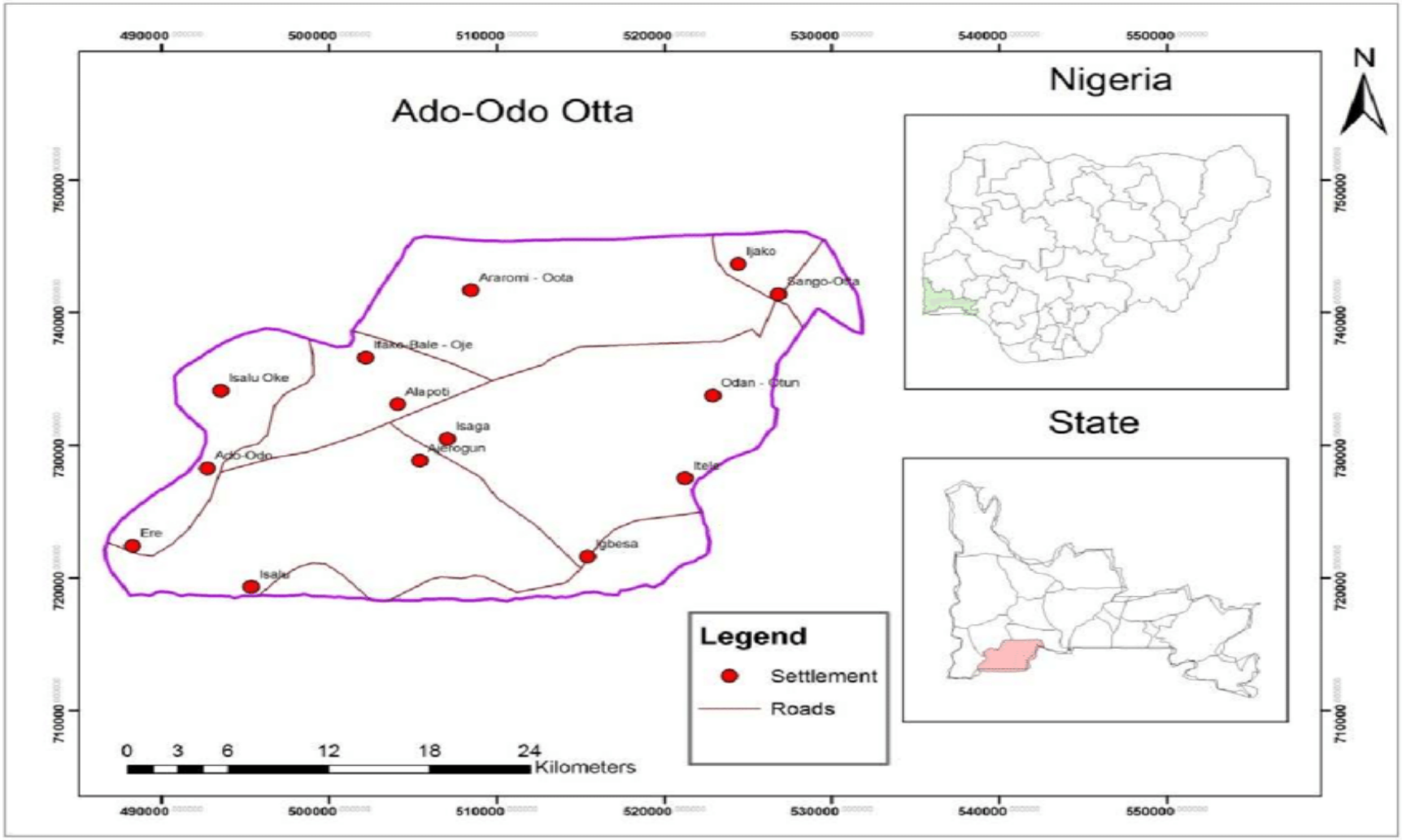

Figure 3.3: Map of Ado-Odo Ota Local Government Area

Figure 3.4: Aerial view of Adefolorunsho Technical Ventures Limited's proposed substation
Note: ATVL – Adefolorunsho Technical Ventures Limited.

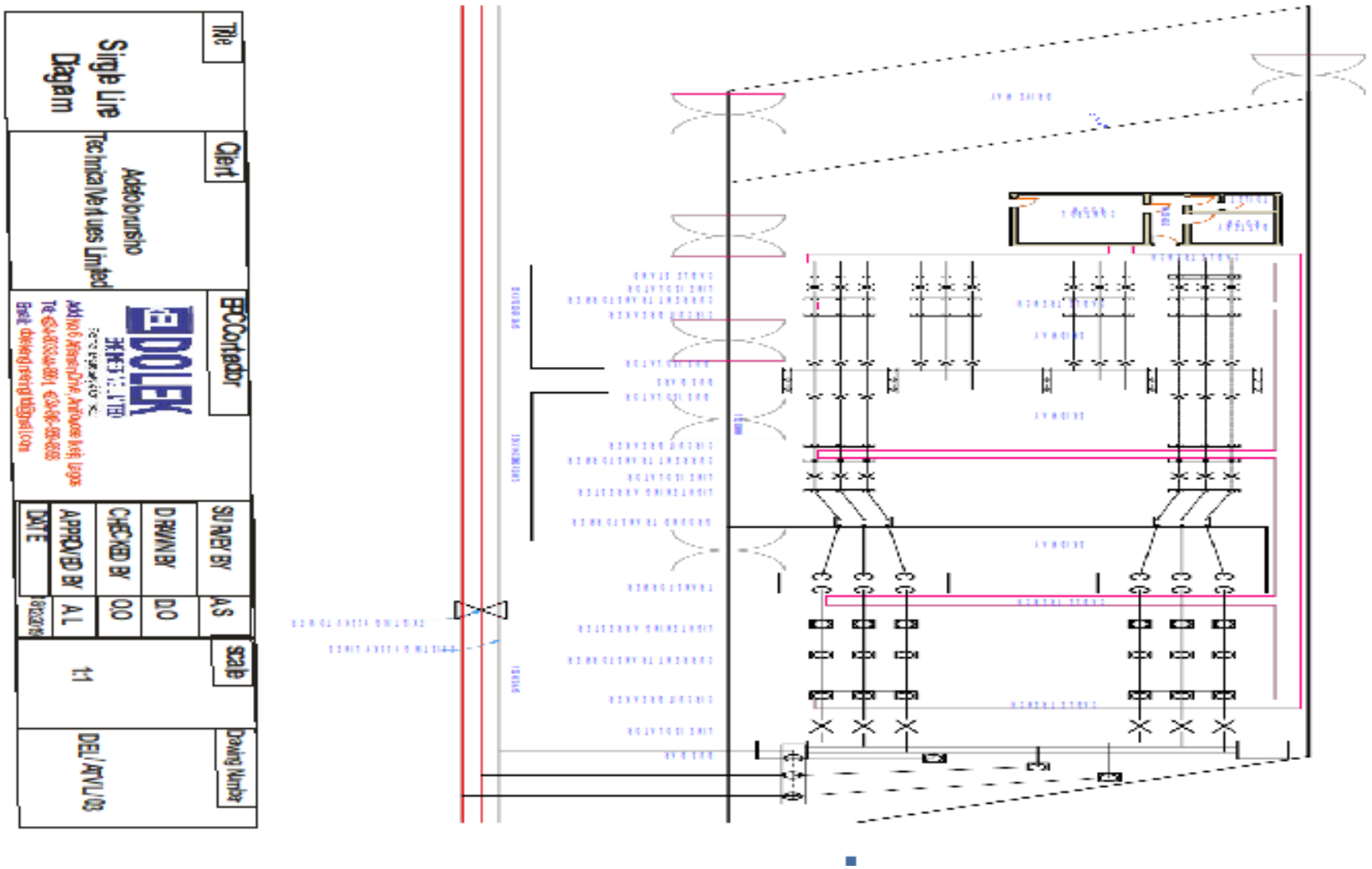

Figure 3.5a: Proposed project line diagram layout of Adefolorunsho Technical Ventures Limited

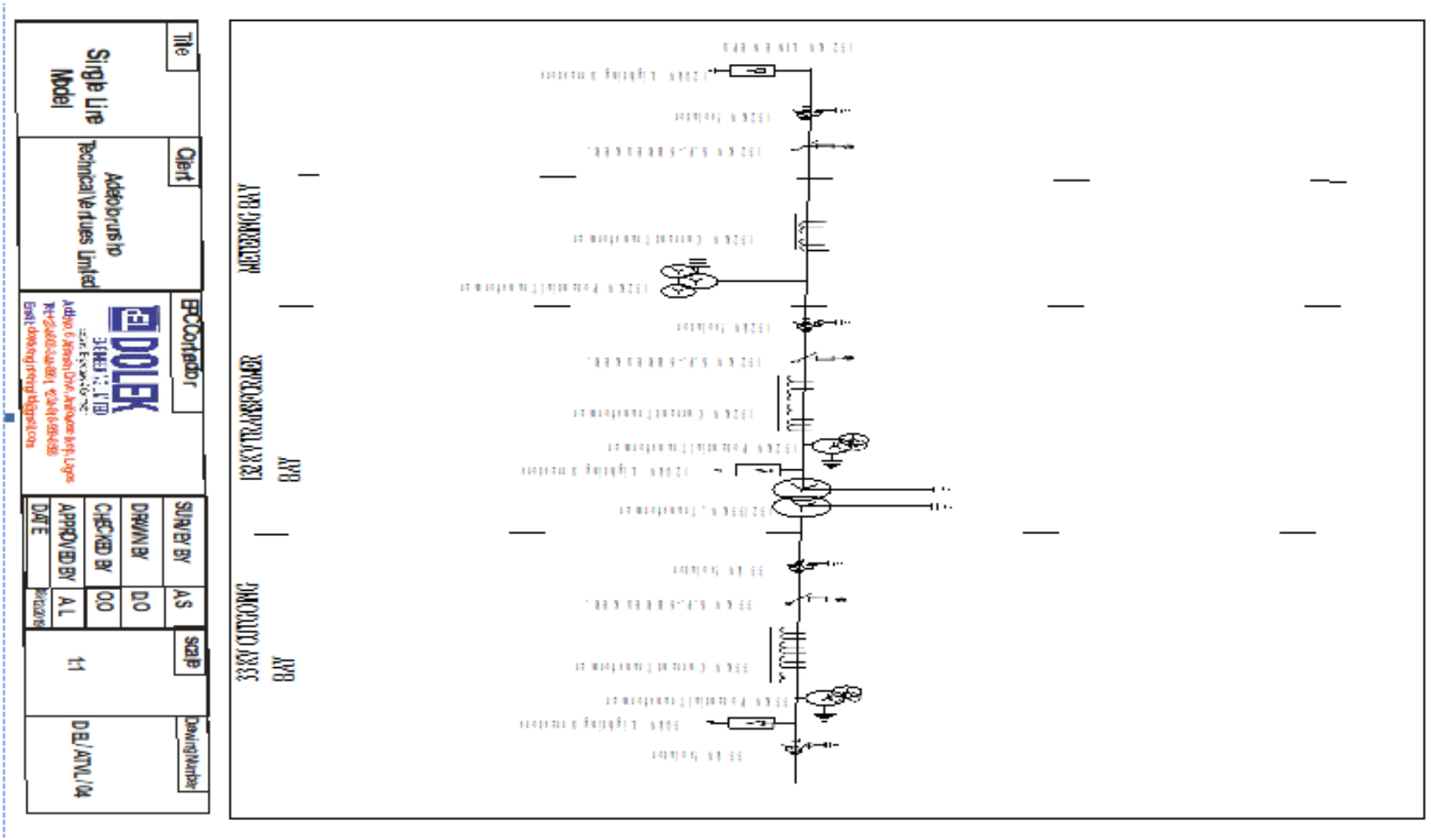

Figure 3.5b: Proposed project line diagram layout of Adefolorunsho Technical Ventures Limited

3.3 Project Components

The following are major electrical components of the proposed substation;

- Instrument transformer
- Current transformer
- Potential transformer
- Conductors
- Insulators
- Busbars
- Lightening arresters
- Circuit breakers
- Relays
- Capacity banks
- Batteries
- Wave trapper
- Switch yard
- Metering and indication Instruments
- Equipment for carrier current
- Prevention from surge voltage
- The outgoing feeders
- Control Room
- Security fence
- Primary power lines
- Ground wire etc.

3.3.1 The Instrument Transformer

The instrument transformer is a static device utilized for reduction of higher currents and voltages for safe and practical usage which are measurable with traditional instruments such as digital multi-meter etc. The value range is from 1A to 5A and voltages such as 110V etc. The transformers shall also be used for actuation of AC protective relay through supporting voltage and current. Instrument transformers are shown in Plate 3.1 below.

Plate 3.1: Picture of Instrument transformer to be used in the substation

3.3.2 Current Transformer

A current transformer is a gadget utilized for the transformation of higher value currents into lower values. It is utilized in an analogous manner to that of AC instruments, control apparatus, and meters. These are having lower current ratings and shall be used for maintenance and installation of current relays for protection purpose in the proposed substation. Current Transformers used for instrumentation and protection of power system equipment shall conform to the following Standards: NIS/IEC60186, 60694 and 60947- 1. Current transformers are shown in Plate 3.2 below.

Plate 3.2: Picture of current transformer used in the substation

3.3.3 Potential Transformer

The potential transformers are similar in characteristics as current transformers but are utilized for converting high voltages to lower voltages for protection of relay system and for lower rating metering of voltage measurements. Transformers shall be of rating 30 MVA and above with On Load Tap Changer (OLTC) with +4x1.25/ -12x1.25% range. Vector group shall be YNd11. Potential transformer is shown in Plate 3.3 below.

Plate 3.3: Picture of Potential transformer

3.3.4 Conductors

Conductors are the materials which permit flow of electrons through it. The best conductors are copper and aluminum etc. The conductors shall be utilized for transmission of energy from the substation.

3.3.5 Insulators

The insulators are the materials which do not permit flow of electrons through it. Insulators are resisting electric property. There are numerous types of insulators such as shackle, strain type, suspension type, and stray type etc. Insulators shall be used in the substation for avoiding contact with humans or short circuit. Insulator is shown in Plate 3.4 below.

Plate 3.4: Picture of Insulator

3.3.6 Isolators

The isolators in substations are mechanical switches which are deployed for isolation of circuits when there is an interruption of current. These are also known with the name of disconnected switches operation under no-load conditions and are not fortified with arc-quenching devices. These switches have no specific current breaking value neither do they have current making value. These are mechanically operated switches. Isolator is shown in Plate 3.5 below.

Plate 3.5: Picture of Isolator

3.3.7 Busbars

The busbar is among the most important elements of the proposed ATVL substation and is a conductor which carries current to a point having numerous connections with it. The busbar is a kind of electrical junction which has outgoing and incoming current paths. Whenever a fault occurs in the busbar, entire components connected to that specific section shall be tripped to allow thorough isolation in a small time. Busbars are of different types such as ring bus, double bus, and single bus etc. Support structure for plant and equipment including bus-bars shall be constructed from galvanized steel. Structures shall be designed to accommodate all normal vertical and horizontal loads plus additional loadings associated with wind and electrical fault conditions. A simple bus bar is shown in Plate 3.6 below.

Plate 3.6: Picture of a typical busbar in a substation

3.3.8 The Lightning Arresters

The lightning arresters can be considered as the first ever components of a substation. These have a function of protecting equipment of substation from high voltages and also limit the amplitude and duration of the current's flow. These shall be connected at the proposed substation amid earth and line i.e. connected in line with equipment in the substation. The lightening arresters are

meant for diversion of current to earth if any current surge appears hence by protecting insulation as well as conductor from damages. They are of various types and are distinguished based on duties. The lightning arresters to be installed at the substation shall be fitted with pressure relief devices and diverting ports suitable for preventing shattering of porcelain housing providing path for the flow of rated currents in the event of failure of surge arrester. A leakage current monitor with surge counter shall be provided with each lightning arrester. All such Surge Arresters to be deployed in the substation for ATVL shall comply with the provisions of IEC 60099-4 on Surge Arresters. The design and dimensions of the surge arresters shall put into consideration the energization of the different lines as well as the lightning protection of the substation equipment. Lightning arresters are shown in Plate 3.7 below

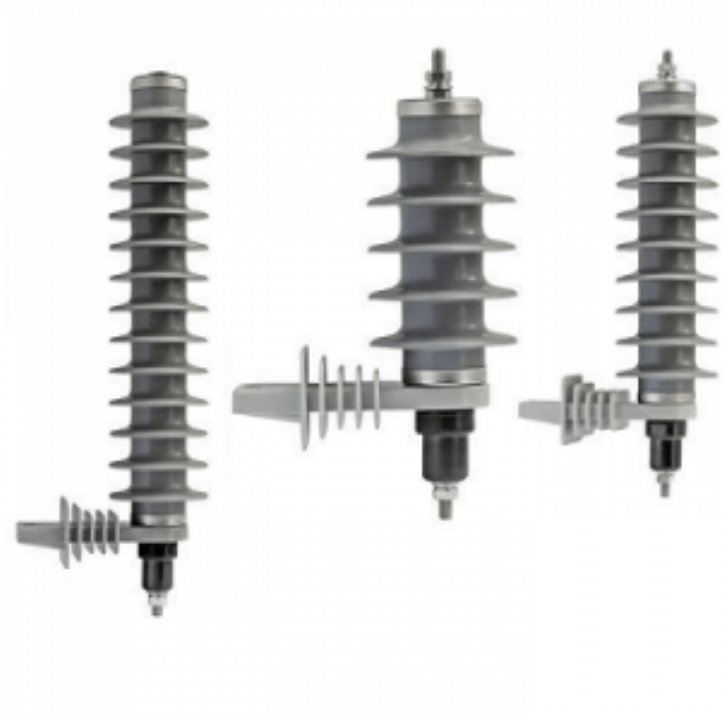

Plate 3.7: Picture of Lightning arresters

3.3.9 Circuit Breakers

The circuit breakers are switches used for closing or opening circuits when a fault occurs within the system. The circuit breaker has 2 mobile contacts which are in OFF condition in normal situations. At the time when any fault occurs in the system, a relay is sending the tripped command to the circuit breaker which moves the contacts apart, hence avoiding any damage to the circuitry. Circuit breaker is shown in Plate 3.8 below

Plate 3.8: Picture of circuit breaker in a substation

For the proposed project, Interrupting medium of circuit breakers shall be SF6. Circuit breakers of 132kV voltage class with a breaking time of 100ms (where ms is milliseconds) shall be suitable both for single phase and three phases auto reclosing. Each circuit breaker shall be provided with two trip coils. Two sets of trip circuits shall be connected to separate fuse or Miniature Circuit Breaker (MCB) controlled DC supplies for greater reliability. The circuit breaker shall have the provision for local manual trip, which shall be placed in a position easily accessible to the operating person. The circuit breaker specifications shall be in accordance with the following IEC60056, 60947-1, 60694, and 60815 standards.

3.3.10 Relays

Relays are committed components of electrical substation equipment for the protection of system against abnormal situations e.g. faults. Relays are basically sensing gadgets which are devoted for sensing faults and determine its location as well as sending interruption message of tripped command to the specific point of the circuit. A circuit breaker falls apart its contacts after getting the command from relays. This protects the equipment from other damages such as fire, risk to human life, and removal of fault from a particular section of the substation. The relays to be installed at the proposed substation shall take into consideration the expected types of failure that will be experienced and the characteristics of the failure; with the ultimate aim of causing the

defective apparatus or lines to be disconnected and minimize damage and maintain service continuity to the rest of the system in accordance with IEC 60255. Picture of relays in a substation are shown in Plate 3.9 below

Plate 3.9: Picture of relays in a substation

3.3.11 Capacitor Banks

The capacitor bank is a set of numerous identical capacitors which are connected either in parallel or series inside an enclosure and are utilized for the correction of power factor as well as protection of circuitry of the substation. These act like the source of reactive power and thus reduce phase difference along with current and voltage. They increase the capacity of ripple current supply and avoid unwanted power generated which is not used in the substation system. The use of capacitor banks is an economical technique for power factor maintenance and for correction of problems related to power lag. Picture of capacity banks in a substation are shown in Plate 3.10 below

Plate 3.10: Picture of capacitor banks in a substation

3.3.12 Batteries

Some of the important substation parts such as emergency lighting, relay system, and automated control circuitry are operated through batteries. The size of the battery bank depends on the voltage required for operation of the DC circuit respectively. The storage batteries are of various basic types namely acid-alkaline batteries, Lithium batteries and lead-acid batteries. The lead acid batteries are the commonest type used in substations as these provide high voltages and are cheaper. However, Lithium batteries shall be used for the proposed substation project. Picture of batteries in a substation are shown in Plate 3.11 below.

Plate 3.11: Picture of batteries in a substation

3.3.13 Wave Trapper

The wave trapper is a substation component placed on incoming lines for trapping high-frequency waves. The high-frequency waves which may be coming from other localities could disturb the current and voltages, thus need for trapping. Diagram of wave trapper in a substation is shown in Plate 3.12 below

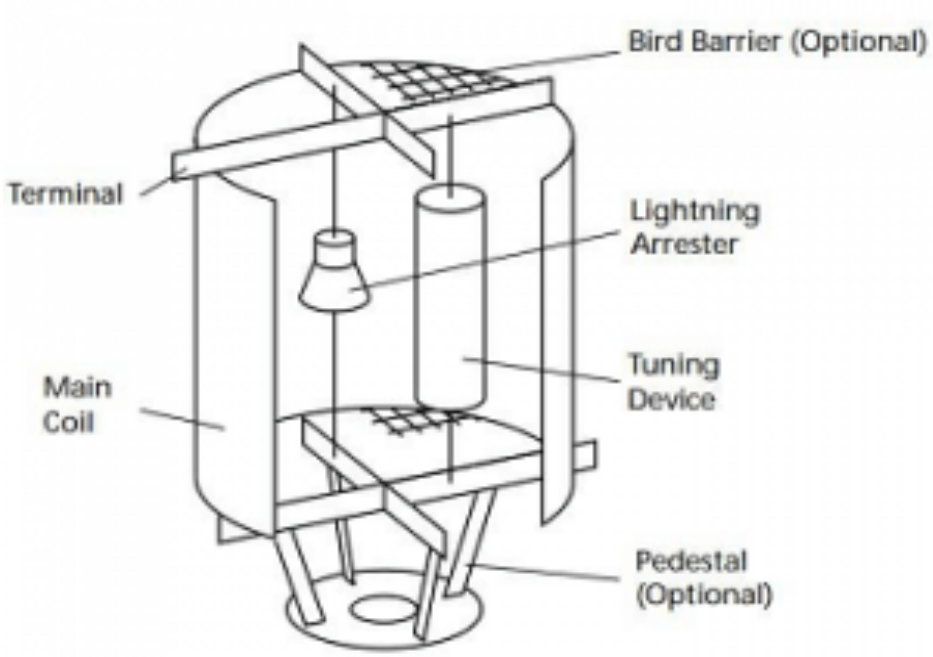

Plate 3.12: Diagram of wave trapper in a substation

3.3.14 Switchyard

The switchyards, switches, circuit breakers and transformers are used for the connection and disconnection of transformers and circuit breakers. These components also have lighting arrestors to protect the substation from strokes of natural lighting. Picture of switchyard in a substation is shown in Plate 3.13 below

Plate 3.13: Picture of switchyard in a substation

3.3.15 Metering and Indication Instruments

There are instruments that would be used for metering and indication in the substation such as watt-meters, voltmeters, ammeters, power factor meters, Kilowatt hour (kWh) meters, volt-ampere meters and kilo volt amperes reactive hours (KVARH) meters etc. These instruments would be installed at different places within the substation for controlling and maintaining values of current and voltages.

3.3.16 Equipment for Carrier Current

The equipment for carrier current shall be installed in the substation for the purpose of communication, supervisory control, telemetry, and/or relaying etc. This equipment shall be mounted in a carrier room and connected across the power circuit of high voltages.

3.3.17 Prevention from Surge Voltage

The transient of overvoltages in a substation system is because of inherent characteristics. There are several reasons for overvoltages which may be caused due to a sudden alteration in condition of the system e.g. load rejection, faults, switching operations or lighting etc. There are two types of overvoltages namely; switching generated or lightning generated. However, the scale of overvoltages could be over maximum allowable voltage levels, hence these are required to be protected and reduced to avoid damage to instruments, equipment, and lines to enhance the performance of the substation.

3.3.18 Outgoing Feeders

There are numerous outgoing feeders which are connected to a substation. Basically, the connection is with a bus of the substation for carrying power to service points. The feeders can hug overhead streets, underground, underneath streets, and are carrying electrical power to that of distribution transformers at near or farther premises. The isolator and breaker of the feeder are typically of metal-clad. Whenever a fault is occurring in the feeder, the protection is detecting and the circuit breaker is opened. After detection of fault through manual or automatic way, there is more than one attempt for re-energizing the feeder.

3.3.19 Control Room

The control room shall be designed to accommodate the following equipment;

- Transformer relay and AVC panels (including space for future units where appropriate)
- Telecontrol panel and outstation
- Mimic board (Human Machine Interface)
- Substation battery
- Telecontrol battery
- Switchgear local control panel
- Feeder and bus section relay panels as required
- LVAC board (Low voltage alternate current)
- Intruder alarm panel
- Telephone
- Drawer filing cabinet
- Safety notice board
- Key cabinet / key safe
- Fire point with extinguishers
- Door mat –standard surface mat with non-slip backing.
- Equipment shall be positioned so that there is adequate clearance for installation, inspection, maintenance and future replacement. Specific minimum distances shall be provided to the front and rear of control and relay panels,
- The height of the control room shall be about 1000mm above the relay / control panels.

- ATVL shall make suitable provision for personnel and equipment access and exit. A door shall be installed with the access door clearly marked, as this shall be the substation building entry point providing access to the intruder alarm panel.
- Floors of control rooms shall be of removable floor panels supported on pedestals on a concrete sub-floor. Floor panels shall have an antistatic sheet vinyl finish. A suitable skirting shall be provided around the room perimeter.
- Provision of Mobile toilet on site

The control panels, including the frames to which they are attached, shall be made of fireproof material. All types of boxes, cabinets etc. shall generally conform to and be tested in accordance with IEC 60439 standards, as applicable. All Control cabinets, junction boxes, Marshalling box & terminal blocks shall be dust, water & vermin proof.

3.3.20 Equipment Plinth

The substation foundation preparation shall include an evaluation of soil characteristics and concrete work with foundation constructed of reinforced, air-entrained concrete thick with symmetric sloping edges on top of the base and footings. A civil Engineer shall be contacted to know if the proposed area is susceptible to seismic activities and the stability of the unit with respect to turning over shall be evaluated, whether placed outside or in a building.

3.4 Type of substation

3.4.1 Step-down Substation:

The step-down substations are linked with load centers as there is a requirement of different voltage levels for various loads. The step-down substations are capable of changing the voltage levels of transmission. The lines of the substation serve as a source to that of the distribution substation. Moreover, some of the power is tapped from the substation line to be used for industrial purposes. ATVL is currently running on a 415KV electricity transformer but now intends to tap electricity from a 132 KV national grid and step it down to 33 KV by running a 33 KV cable from the substation to its factory through a short distance of about 300m. Picture of a step – down substation is shown in Plate 3.14 below

Plate 3.14: Picture of a Step-down Substation

3.5 Setback Consideration

In Nigeria the Power Holding Company of Nigeria (PHCN) guidelines stipulate a minimum horizontal distance of 4.5 meters between a building and 11kv cable, and minimum horizontal distances of 7.5 meters, 30 meters, and 60 meters are recommended for a building between 33kv cable, 132kv cable, and 330kv cable respectively (Federal Government of Nigeria, 1996). However, Ogun state's Urban and regional planning regulation is slightly different from that of PHCN. Section 35(1d) of the Ogun State Urban and Regional Planning Law 2005 also states that: "an application for a development permit may be rejected if the proposed development falls within the setback of road, National Electric Power Authority High Tension power line, drainage channel, land of water body. Part 1, section 4 of the Ogun State Building Plan Regulation further stipulates that the minimum distance from a building to the center of overhead power line shall be 50 meters for 333kv less than 132 kv wires; and 10 meters, 8 meters and 12 meters for 132kv less or equal to 33kv wires, 11kv less or equal to 0.415kv wires, and a substation, respectively (Ogun State Government, 2005). The proposed site is located close to the National grid in a built-up area. Necessary safety precautions shall be made available and enforced at the proposed site.

3.6 Water Management

The use of water during construction and operation of the substation shall comply with the provisions of the National Guidelines and Standards for Water Quality in Nigeria (2002) and current extant laws on water quality, which provides for the proper management of water (either marine or interstate fresh water) to maintain its quality. Water supply shall be designed to meet the total water requirement of the substation, facilities and emergency reserve for complete performance of the works.

3.7 Emission and Effluent Limitations

The National Guidelines and Standards for Environmental Control impose among other restrictions, the release of toxic substances during the construction and operation of power plants. It also stipulates requirements for monitoring of pollution to ensure that permissible limits are not exceeded. The Statutory Guidelines provide limits for the emissions of Green House Gases (GHGs), pollutants and particulates. The proposed substation construction shall comply with the provisions of the Nigerian Electricity Health and Safety Code (2018) and other relevant extant laws and authorities.

3.8 Design of Drainage

For the design of drainage, the rainfall data for the project area shall be obtained and the storm water drainage system including culvert, drains, and slope to accommodate the most intense rainfall that is likely to occur over the catchment area in one hour period based on an average over a period of 10 years. Invert level of drainage system at outfall point shall be decided in such a way that any water over flow from water harvesting recharge shafts can easily be discharged outside the substation boundary wall.

3.9 Cable Trench

Cable trenches within enclosures housing Indoor Equipment shall have continuous reinforced concrete bottoms and reinforced concrete or filled masonry sides. Moreover, landscaping treatment around the substation shall be carefully designed so as not to create potential security problems in the area.

3.10 Site Health and Safety Plan

Contractors undertaking work in the electric substations shall prepare a site Health and Safety Plan for each contract specific to the risk that shall or may be encountered during the execution of the project.

3.11 Project Waste Management Plan

A project specific waste management plan (WMP) shall be developed for the substation project which is discussed under the WMP section in chapter seven of this report. Waste streams during construction phase will include; Asphalt, Soil, Concrete, Rock, Plastic, Wood, Paper products, Metals, Packing materials and Non-hazardous construction debris. These and other waste streams with their management methods are as indicated in table 3.1 below;

Table 3.1: Expected waste streams at the proposed substation site

S/N	MATERIAL	MANAGEMENT METHOD
1	Batteries – Lithium, Lithium Ion, NICAD, NiMH, Small Sealed Lead-Acid, and other rechargeable batteries	Coordinate with National Electricity Regulations Company (NERC) Environmental Department; manage in accordance with extant Waste Rules especially those related to e-waste
2	Oil-filled electrical equipment (full and drained)	Coordinate with National Electricity Regulations Company (NERC) Environmental Department on proper recycling/disposal facility
3	Wooden Insulator Crates	Recycle or carted through an accredited vendor to an approved landfill, transfer station, or incinerator
4	Paper and Cardboard	Recyclable, waste material to be processed at a recycling facility and converted into usable products
5	Scrap Cable	Recyclable, waste material to be processed at a recycling facility like a metal recycling facility and converted into usable products
6	Aluminium	Recyclable, waste material to be processed at a recycling facility like a metal recycling facility and converted into usable product
7	Concrete Debris	To be used as road sub-base, reused for flooring at the existing factory site or shall be used in existing concrete pads and foundations
8	Waste Aerosol Cans	Coordinate with National Electricity Regulations Company (NERC) Environmental Department on proper disposal methods
9	Paint Waste	Coordinate with National Electricity Regulations Company (NERC) Environmental Department on proper disposal options

The substation project during the project's lifespan will involve the use of some hazardous materials as indicated in table 3.2 below

Table 3.2: List of Hazardous materials to be used during the lifespan of the proposed substation

Hazardous Materials	Use/Product	Project Phase
Fire extinguisher	Extinguish or control small fires	Operation phase
Acetylene gas	Oxyacetylene gas welding	Construction phase
Air tool oil	Construction equipment repair	Construction phase
Ammonium hydroxide	Battery maintenance	Operation phase
Antifreeze (ethylene glycol), new and used	Construction equipment and vehicles	Construction phase
Automatic transmission fluid	Construction equipment and vehicles	Construction phase
Battery acid (in vehicles, small electronics, and in the meter house of the substation)	Self-contained batteries	Operation phase
Bottled oxygen	Welding	Construction phase
Brake fluid	Construction equipment and vehicles	Construction phase
Canned spray paint, new and used	Mark utilities and survey lath	Construction phase
Connector grease (penotox)	Mark utilities and survey lath	Construction phase
Connector grease (penotox)	Electrical connecter installation	Construction phase
Contact cleaner 2000	Electrical equipment installation and maintenance	Construction phase/ Operation phase
Diesel de-icer	Construction equipment and vehicles	Construction phase
Diesel fuel	Construction equipment and crew trucks	Construction phase
Diesel fuel additive	Construction equipment	Construction phase
Drilling fluids and residue	Waste resulting from foundation construction	Construction phase
Dust suppressants and tackifiers	Dust control and soil stabilization	Construction phase
Gasoline	Construction vehicles and portable generators	Construction phase
Hot stick cleaner (cloth treated with polydimethylsiloxane)	Hot stick maintenance	Operation phase
Hydraulic fluid	Construction equipment	Construction phase
Impacted soil and cleanup debris	Soil impacted by a hazardous product and materials used to clean up the soil and product	Construction phase
Insulating oil (inhibited, non-PCB)	Transformers and other electrical equipment	Operation phase
Lubricating grease	Construction equipment	Construction phase
Mastic coating	Waterproofing	Construction phase
Methyl alcohol	Electrical equipment installation and maintenance	Construction phase/ Operation phase
Motor oils, new and used	Construction equipment and vehicles	Construction phase

Paint thinner	Construction and maintenance	Construction phase/ Operation phase
Propane	Equipment installation and maintenance	Construction phase/ Operation phase
Safety fuses	Electrical equipment protection	Operation phase
Starter fluid	Small engine maintenance	Operation phase
Sulfur hexafluoride (within the circuit breakers in the substations)	Insulator gas for high-voltage substation equipment	Operation phase
Two-cycle oil (contains distillates and hydrotreated heavy paraffinic)	Lubricating oil for small gasoline operated equipment	Operation phase
WD-40	Maintenance of tools and equipment	Operation phase
ZEP (safety solvent)	Degreaser for tools and equipment	Operation phase

Good practice including segregation of waste shall be adhered to during the construction and operational phases of the substation project. Sufficient space shall be provided for segregation of construction and excavation wastes. Irrespective of the waste stream, the following good practices shall be followed:

- Planning ahead for waste quantities. Contractor and ATVL shall estimate waste quantity across the site and provide suitable bin capacity;
- Provision of recycling sites with the use of recycling bins to discourage the disposal of potentially recyclable items in general waste bins; e.g. containers for paper, plastic, glass, cans and card shall be provided
- Signage- Waste storage receptacles/areas shall be clearly marked to promote source segregation and inhibit contamination. A waste stream color coding system shall be employed to aid the successful segregation of waste at source particularly during the construction phase.
- Provision of necessary information like; types and quantities of waste produced, types and quantities of waste that have been reused/ recycled/ recovered/ landfilled or otherwise disposed of on or off site, identity of the person removing the wastes etc.

3.12 Project Description

3.12.1 Establish the work zone

Substations have many functions for controlling power flows. For example, they play a key role in dividing long lines into smaller sections. This helps to minimize any disruption to the continuity of

service when a section is not functional, during a fault or maintenance period. Before carrying out any work, the work zone shall be established and fenced off to ensure the safety of the access points. Then, notices of work and site tags shall be installed to keep citizens informed throughout the construction period.

3.12.2. Prepare the substation site

The proposed project area is already leveled as purchased with no structures on the site and earthwork shall be carried out on the site. The construction team shall prepare the work site by carefully setting aside the topsoil, which would be reused.

3.12.3 Excavate and lay the foundation

The workers shall then excavate the site, build the formwork, install the reinforcements and pour the concrete. In addition to laying the foundation, all the underground concrete structures, such as the recovery basin shall be built.

3.12.4 Install the grounding grid

The grounding grid shall at this stage be installed to ensure the safety of people and the equipment at the project site. The grid shall be buried underground to ensure that the grid redirects the fault current. This stage shall also involve the laying of the 33KV cable through a distance of 300m to the factory.

3.12.5 Build the control Room

The control room which shall be the only shelter structure on the site where the operator would be, houses the control and protection equipment since the substation shall be maintained by a mobile team.

3.12.6. Backfill the foundations and substation yard

Furthermore, once the foundation has been laid, it shall be backfilled and the yard leveled with granular material (sand, gravel, rock, etc.) that is adapted to the site.

3.12.7 Assemble the steel structures

Once the concrete is set, steel structures shall be assembled to support the electrical equipment. Moreover, other structures shall also support the control room.

3.12.8 Install the electrical equipment

Again, once the framework is built, the equipment such as the voltage transformers, current transformers, power transformers, surge arresters, circuit breakers, switches etc. shall be installed on the foundation and steel structures. Then each piece of equipment shall be connected to the control room, which is under construction. The new installations shall be permanently fenced off at this stage to ensure everyone's safety on site. The site Engineers and technicians shall now test the equipment before the installations are connected to the National power grid. Finally, the substation shall be commissioned and flow of electricity to the factory is ensured.

3.12.9 Landscape and final inspection

The project ends with landscaping around the project site, create mounds of earth, do earthwork, demobilize the site and carry out the final inspection to wrap up the substation project. Only the operating equipment shall be left at the substation after the construction phase which is envisaged to use about ten (10) to eleven (11) workers. Figure 3.5 below is a simple flowchart of a typical substation. The line diagram for the proposed construction and installation of a 2x7.5MVA, 132/33KV substation at Sango Ota in Ado - Odo Ota LGA of Ogun State is shown in figures 3.5a and 3.5b above.

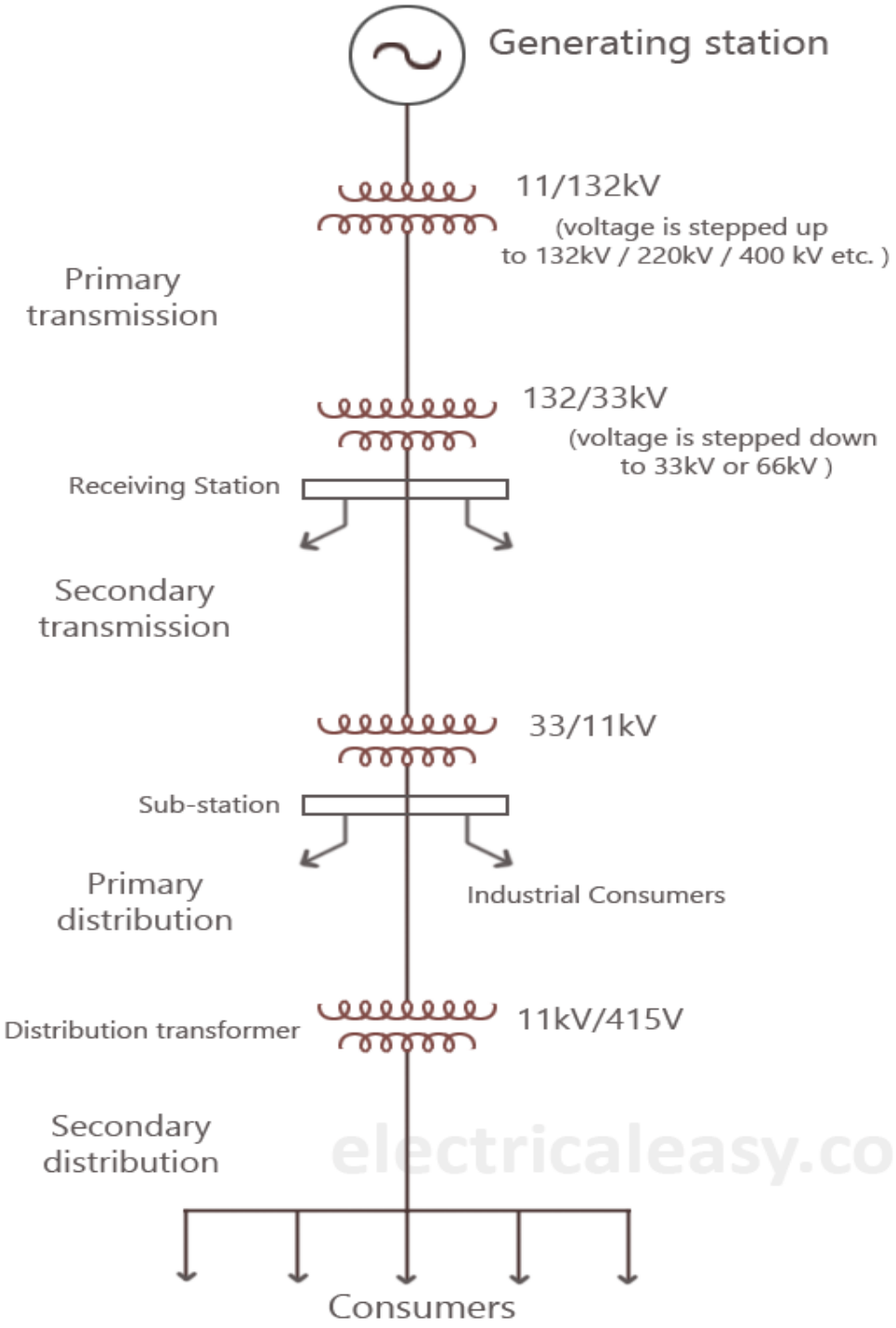

Figure 3.6: Simple flowchart for a typical flow station

3.13 Project Activities

The proposed project activities for the Adefolorunso substation project can be grouped into 4 phases namely:

i. Pre- construction
ii. Construction
iii. Post-construction
iv. Site Closure

3.13.1 *Pre-construction Phase*

The phase will involve obtaining the different permits for the project, including the conduct of the EIA for the project. The phase also involves site preparation, setting the various components of the facility that will require piling/diggings so as to make the area fit for purpose. The substation will have a perimeter wall, security lights and a guard throughout all the phases. This is because a substation is a high voltage area with potential health hazards if safety regulations and rules are not observed. The substation will be lit at night, and danger signs will be put to warn the public from accessing the substation.

3.13.2 *Construction Phase*

The construction activities at the Adefolorunso substation project site in this phase will consist of the following;

- Site investigations necessary for design and construction on a sound engineering basis.
- Holding of the site with iron sheet and a stone perimeter wall will be constructed
- Groundbreaking and removal of vegetation
- Leveling the ground.
- Civil works on site including digging foundations and concrete works
- Compaction and filling with gravel of the areas to form foundations
- Delivery of civil work construction materials, transformer, tools, electrical equipment to project site.
- Storm water drainage construction
- Construction of bund walls to hold transformer in case of accidental oil leakage
- Installation of transformers and erecting of the steel poles to support the incoming and outgoing feeders.

- Post construction clean–up, restoration and landscaping of site
- Connection of power from the existing 132kv National grid to the substation
- Connection of power to outgoing 33kV feeders.
- Load testing
- Remedying of defects after functional tests.

During construction, ATVL contractor shall ensure and observe safety by erecting warning signs to warn on any potential hazards, ensure proper and efficient use of Personal Protective Equipment (PPE) for all workers on site and observe safe work procedures. Clearing of the short shrubs will be done prior to ground breaking which will involve excavation of top soil to pave way for the construction. Soil excavation process shall be done with utmost care to ensure that the excavated soil is not improperly heaped or carried away by any surface flows to surface waters by rain causing siltation.

The excavated soil will be used to backfill on site and in the existing company premise while any remainder shall be disposed appropriately in accordance with the environmental management plan. Company safety and environmental policy as well as other extant National and local environmental protection regulations/standards shall be adhered to. This will include safety wear at all times with the use enforced by a safety officer on site during all construction activities.

However, during construction phase ATVL's contractor shall do their best to achieve the following:

- Motorized equipment are checked to ensure that they are in good working condition, safe to use and produce minimal noise levels and reduced smoke emission.
- Workers use personal protective equipment (such as hand gloves, hard hats, safety shoes, ear muffs, overalls and dust coats) at all times.
- Proper disposal of waste material and toilet facilities are provided for construction workers
- Provision of first aid kit and firefighting equipment (portable cylinders) and placement at strategic positions for access
- Emergency response procedures are in place and all workers are trained in effecting them.

- Any work involving deep excavations, elevated heights and lifting heavy loads, poses a number of risks to personnel. ATVL's contractor shall make sure their personnel are equipped with the correct protective clothing and equipment and are ready to work safely while also safeguarding the environment.

The contractor shall adhere to all requirements set by the proponent, Nigerian Electricity Regulatory Commission (NERC) and any other applicable legislation regarding environmental and socio – economic impacts.

3.13.3 Operation *Phase*

Operation phase of the project will involve transmission of power from the substation to ATVL's factory. Therefore no unauthorized person shall be allowed to access the substation. This is in line with company policy to ensure safety of staff and the public. Activities undertaken in the substation during the operational phase shall include;

- Switching
- Periodical maintenance works by authorized staff
- Internal and external environmental and safety audits

The operation phase of AVTL substation shall transform voltage received from the nearby National grid from high to low. AVTL shall tap electricity from a 132 KV national grid and step it down to 33 KV by running a 33 KV cable from the substation to its factory through a short distance of about 300m.

3.13.4 Decommissioning *Phase*

At the decommissioning/demolition phase, the following activities will take place;

- Removal of transformers and associated switching equipments
- Demolish and carefully handle components that contain oil like the transformer
- Removal of electrical fittings, bus bars and steel poles/structures
- Ensure proper handling of the demolished materials by an accredited Ogepa vendor to an authorized dumpsite ensuring guided transportation and disposal away from human settlement, water bodies and wildlife conservation area
- Demolish and remove all the concrete works

During this phase, the proponent shall restore the host environment close to its original state. All demolition work shall be undertaken in accordance with Nigerian Electricity Regulatory Commission (NERC) and Nigerian Electricity Supply and Installation Standards Regulations 2015 guidelines. The proponent shall submit a decommissioning plan to NERC in good time prior to decommissioning. The decommissioning plan shall include a restoration plan.

The site shall be rehabilitated and restored to its former state through:

- Appropriate landscaping.
- Removal of any soils that may have been impacted by oils or fuels for offsite disposal (away from the project area) and remediation.

3.14 Equipment Maintenance

Maintenance of equipment at the AVTL substation project site shall be classified in two categories as follows:

i) Breakdown or Corrective Maintenance

ii) Preventive maintenance

- The breakdown or corrective maintenance activities shall be undertaken after failure of equipment. Such maintenance results in outage of circuit and supply. In general, it consists of locating the trouble, repair and re-commissioning. A performance record of each critical component shall be maintained and basic decisions on the service life of the component and the total service it has put in. Repairs or replacements shall be made to ensure that no breakdown occurs at any time during the service.

- The preventive maintenance shall be undertaken to ensure smooth and efficient working of the system, equipment. Preventive maintenance shall be undertaken as per schedule before breakdown of the system or machine takes place.

  Preventive maintenance shall be carried out in planned manner. Breakdown maintenance shall be carried out as at when necessary. For switchgear and protective equipment, preventive maintenance is recommended because failure of switchgear cannot be permitted.

Maintenance covers a wide range of activities aimed at keeping the equipment in perfect working condition for performing its function regarding assigned duties. The choice of activities such as Inspection, Servicing, Examination and Overhaul as well as schedule shall depend upon extant laws and requirements.

3.15 Project Schedule

The proposed substation construction and installation shall be completed within a period of 6 to 7 months after receiving necessary approvals to commence. A Gantt chart showing a schedule of activities for the project is shown in Figure 3.3 below.

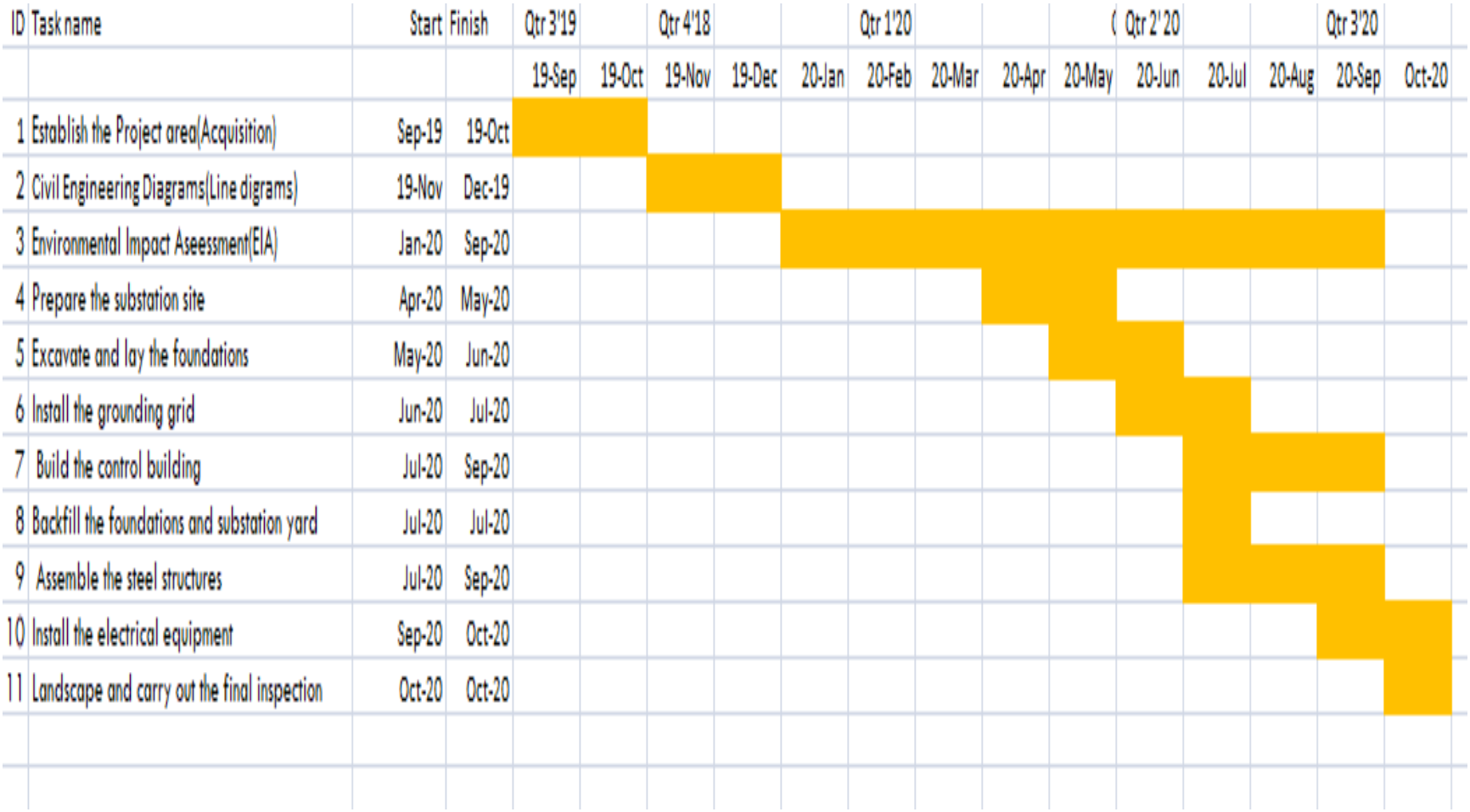

Figure 3.7: Gantt chart of the proposed project schedule

CHAPTER FOUR

DESCRIPTION OF THE ENVIRONMENT

The existing environmental conditions of the study area where the proposed construction and installation of 2 x 7.5MVA, 132/33KV Substation at Sango Ota, Ado - Odo Ota Local Government Area, Ogun State by Adefolorunsho Technical Ventures Limited would be sited, as well as the socio-economic and health profile of Boluwatife the host community is presented in this chapter. The main environmental components considered in the environmental baseline study include;

- Physico-chemical environment such as meteorology, land use, geology, sediment, soil type and distribution, surface water and groundwater characteristics
- Biological environment including benthos, plankton, fisheries, flora and fauna characteristics; and
- Socio-economic conditions describing; demographic structure, culture, social and health status of the host community.

Baseline conditions presented is based on information sourced from literature as well as findings from a season field sampling survey as the company was granted a waiver to carry out a one season Environmental Impact Assessment (EIA) using existing baseline data for Environmental Implication Study(EIS) of Adefolorunso Technical Ventures Limited Ogun State, Nigeria(February 2018) report as secondary data. However, laboratory analyses and interpretation of samples obtained is also reported in this chapter. Information acquired during this EIA will be used in further environmental management decisions and future monitoring of changes, if any, in the environmental components.

The field work activity for wet season was done on 30th June 2020 and was carried out in accordance with the FMEnv, National Environmental Standards and Regulations Enforcement Agency (NESREA), Ogun State Environmental Protection Agency (Ogepa), World Bank (WB) and other international standards and guidelines. Similarly, Consultations and meetings with State environmental regulators and host communities will be a continuous process throughout the project lifespan.

4.1 Baseline Data Acquisition Methods

4.2.1 Literature Research

This was carried out prior to field data gathering to obtain relevant background information on the study area, as well as during report preparation. Further research was conducted at the end of the field study to compare literature information with generated field data and for additional information on the study area. Generally, literature research involved consulting relevant textbooks, journals and articles.

4.2.2 Reconnaissance Survey

A reconnaissance survey was undertaken to familiarize the EIA team with the proposed project area. This assisted in the concept design for field research execution.

4.2.3 Stakeholder Engagement Activities

Representatives of the host communities were consulted on issues regarding the potential ecological and socio-economic impact of the proposed project. Similarly, Regulatory bodies were well consulted to ensure cooperation during the project execution.

Plate 4.1: Opening meeting involving regulators from FMEnv during site verification exercise

Plate 4.2: Managing Director of ATVL explaining some salient points during the site verification visit

Plate 4.3: Team of experts at the substation site during the FMEnv's site verification visit

Plate 4.4: Team of regulators from FMEnv, MD of ATVL and Azmarineberg personnel during site verification visit

4.2.4 Field Sampling

To effectively characterize the study area, comprehensive Field investigations were carried out for baseline data gathering for wet season on 30th June 2020 since the company was granted one season sampling using an approved baseline data in the terrain for second season (dry season). The Environmental Implication Study (EIS) of Adefolorunso Technical Ventures Limited Ogun State report was used as secondary baseline data. All sampling and observation points were geo-referenced using the Garmin Global Positioning System (GPS) receiver (Garmin eTrex 10). Quality control/Quality assurance was ensured in all aspects including sample collection, handling, laboratory analysis, data coding/manipulation, statistical analysis, presentation and communication.

Fieldwork activities/Laboratory analyses were carried out to complement secondary data gathered from literature and to collect new and additional primary data to fill information gaps.

The activities were carried out in accordance with FMEnv and recommended international methods.

The systematic incorporation of expert opinions were used to identify potential environmental impacts and to predict their magnitudes and significance (empirical worst case scenario) using the data gathered from the field investigation. Experts in the relevant fields (as listed in the list of report preparers) were consulted for their opinions on issues relating to the potential ecological impacts of the proposed project.

Impact Assessment Methodologies involved impact identification, prediction and evaluation. Impact evaluation was carried out using Leopold Matrix and Rau matrix methodologies, specific and quantifiable, while the overall assessment was carried out through the use of the 'Strength of Relationship Matrix Approach' method. This method defines, numerically, the degree of interdependence of the various environmental parameters that were considered.
The 1 - 5 ratings were assigned to characterize the inter-relationship by the panel of experts. The impact evaluation results obtained formed the basis for development of the Environmental Management Plan (EMP) for the proposed project. This was carried out in an interactive manner.

4.2.5 Data Collection and Laboratory Analysis

Baseline data acquisition includes review of existing relevant literatures on the environment of the project site and design of field sampling strategies to meet the scope of the EIA and regulatory requirements. In addition, field equipment was pre-tested and calibrated prior to baseline data gathering exercise. Environmental samples were collected, properly preserved and stored before transfer to Azmarineberg Limited Laboratory Plot 242a Ganiyu Alimi Crescent Gbagada Phase 2, Lagos, Nigeria for analysis. Standard Quality Assurance and Quality Control Procedures was applied in carrying out the study, to eliminate ambiguous data, improve interpretation and ensure conferment of data validity and reliability during sample collection, preservation, storage, transportation, laboratory analysis and data generation and presentation.

The method, guideline and standards used are those acceptable to American Society for Testing and Materials (ASTM), American Public Health Association (APHA), United States Environmental Protection Agency (USEPA), International Organization for Standardization (ISO), World bank (WB) and Federal Ministry of Environment (FMEnv).

The quality control of laboratory analysis was in accordance with ASTM and APHA recommended methods and included blank analyses to establish analytic level, duplicate analysis to establish analytical precision, spiked and blank sample analyses to determine analytical accuracy. Meanwhile, In-situ measurement of unstable physico-chemical parameter like pH was carried out using calibrated portable meters during the study. This is to ensure reliability and accuracy of the analysis.

4.3 Study Area

The study area is the proposed site for Adefolorunsho Technical ventures Limited Substation. The site includes few industrial buildings, residential buildings, health care centre, Schools and communities, within 1km radius from the project site on which the project may have influence. The study area falls within the jurisdiction of Sango-Ota, Ado-Odo Ota LGA, Ogun State. Table 4.1 presents the geographical coordinates, of sampling points and figure 4.1, Map of Ogun showing Ado-Odo Ota LGA.

Table 4.1: Geographical Coordinates of Sampling Locations at ATVL Substation

LOCATION	ENVIRONMENTAL COMPONENT	LATITUDE	LONGITUDE	ELEVATION	WIND SPEED
AN 1	Air and Noise	06°42.754N	003°14.180E	83m	1.3
AN 2	Air and Noise	06°42.749N	003°14.184E	84m	1.4
AN 3	Air and Noise	06°42.755N	003°14.192E	83m	1.7
AN 4	Air and Noise	06°42.747N	003°14.192E	82m	0.6
AN 5	Air and Noise	06°42.751N	003°14.207E	82m	1.7
AN 6	Air and Noise	06°42.747N	003°14.208E	82m	0.9
AN Control	Air and Noise	06°42.742N	003°14.252E	88m	1.6
SS I	Soil Sampling	06°42.754N	003°14.180E	83m	1.3
SS 2	Soil Sampling	06°42.749N	003°14.184E	84m	1.4
SS 3	Soil Sampling	06°42.755N	003°14.192E	83m	1.7
SS 4	Soil Sampling	06°42.747N	003°14.204E	87m	0.5
SS Control	Soil Sampling	06°42.742N	003°14.252E	88m	1.6
GW 1	Ground Water	06°42.741N	003°14.200E	84m	0.9
GW 2	Ground Water	06°42.752N	003°14.218E	84m	1.2
GW Control	Ground Water	06°42.681N	003°14.072E	84m	1.6

Source: Azmarineberg Limited, 2020

4.3.1 Environmental Setting of the Study Area

The distribution of sampling points for air, water and soil quality were within the proposed project site as well as other key study locations, in relation to the proposed project site and the immediate communities

4.4 Geographical Location

Adefolorunsho Technical Ventures Limited proposed Substation site is located at Okon close, off Powerline road, off Matina road, Sango Ota, Ado - Odo Ota LGA, Ogun State. The site occupies a landmass of 1174.821m^2 on Latitude 06^0.42.759N and Longitude 003^0.14.175E, SE of Okon Crescent Powerline road, Latitude 06^0.42.749N and Longitude 003^0.14.177E, SW of Durojibagun close, Latitude 06^0.42.746N and Longitude 003^0.14.208E, NW of Shirish clinic with Latitude 06^0.42.751N and Longitude 003^0.14.210E, but NE of Jacob's Model school. The proposed project which is located in a built up area and on a location previously housing a shopping complex is to be sited at Boluwatife which is the host community.

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Figure 4.1: Map of Ogun showing Ado-Odo Ota LGA

4.5 Ogun State Regional Geology

The geology of Ogun state comprises mainly of Basement complex and sedimentary rocks, which underlie the remaining surface of the state. The sedimentary rocks of the study area consist of Abeokuta, Ewekoro, Oshosun and Ilaro formations which are then in turn overlain by the coastal plain sands.

Ogun state falls within the Dahomey sedimentary basin, a basin known to have resulted from events associated with the break-up of Gondwana and subsequent opening of the southern Atlantic. Deposition was in a fault-controlled depression, bounded by faults and other tectonic structures of the Romanche Fault Zone on the west, and by the Benin Hinge Line, also a major fault structure, on the east. Sediment thickness in the basin, which extends from Accra/Ghana to the Okitipupa Ridge, where it is separated from the Niger Delta, increases from north to south and from east to west within Nigeria.

Detailed studies among others indicate a stratigraphic succession that began with the mostly marine Cretaceous Abeokuta Formation at its base, lying on the Precambrian Basement Complex. The Paleocene Ewekoro Formation is deposited conformably on the Abeokuta Formation and is succeeded by the Eocene Ilaro Formation, which signifies the close of Mesozoic sedimentation in the basin area. The mostly continental Oligo-Plieistocene sediments of the Benin Formation also known as "Coastal Plain Sands" overlie the Ilaro Formation. The formation consist of loose, poor to moderately sorted sands, clays, pebbles, sandy clays and clayey sands, and rarely thin lignite beds. The youngest sedimentation in the area is of Quaternary alluvial deposits of unconsolidated and unsorted sands, clays and silts.

Ayoade (2003) described hydrogeology as the scientific study of groundwater with emphasis on the geology and its occurrence, movement and chemical characteristics of groundwater. According to Houston (1995) the bedrock over much of Africa is of Precambrian formations, which are dominated by relatively impermeable crystalline rocks such as granites, schist, gneiss and quartzite. It was often necessary to drill 60 - 80 m deep, with wells often yielding less than 2 m 3 /day (Dijon, 1981). Selby (1985) reported that rocks often break down quickly, producing a zone of weathered materials of saprolite or laterite and the surface soils are often underlain by red-brown silty clay, which does not function as a good aquifer.

According to Farquharson and Bullock (1992), the basement aquifers occur within the weathered residue overburden (the regolith) and the fractured bedrock. Development of the regolith components is by wells and shallow boreholes, which are liable to be drilled by lightweight

percussion rigs. Viable aquifers wholly within the fractured bedrock are of occurrence because of the typically low strativity of fracture systems that is less than < 1%. In order to be effective, development of bedrock components requires interaction with storage available in overlying adjacent saturated regolith or other suitable formations such as alluvium.

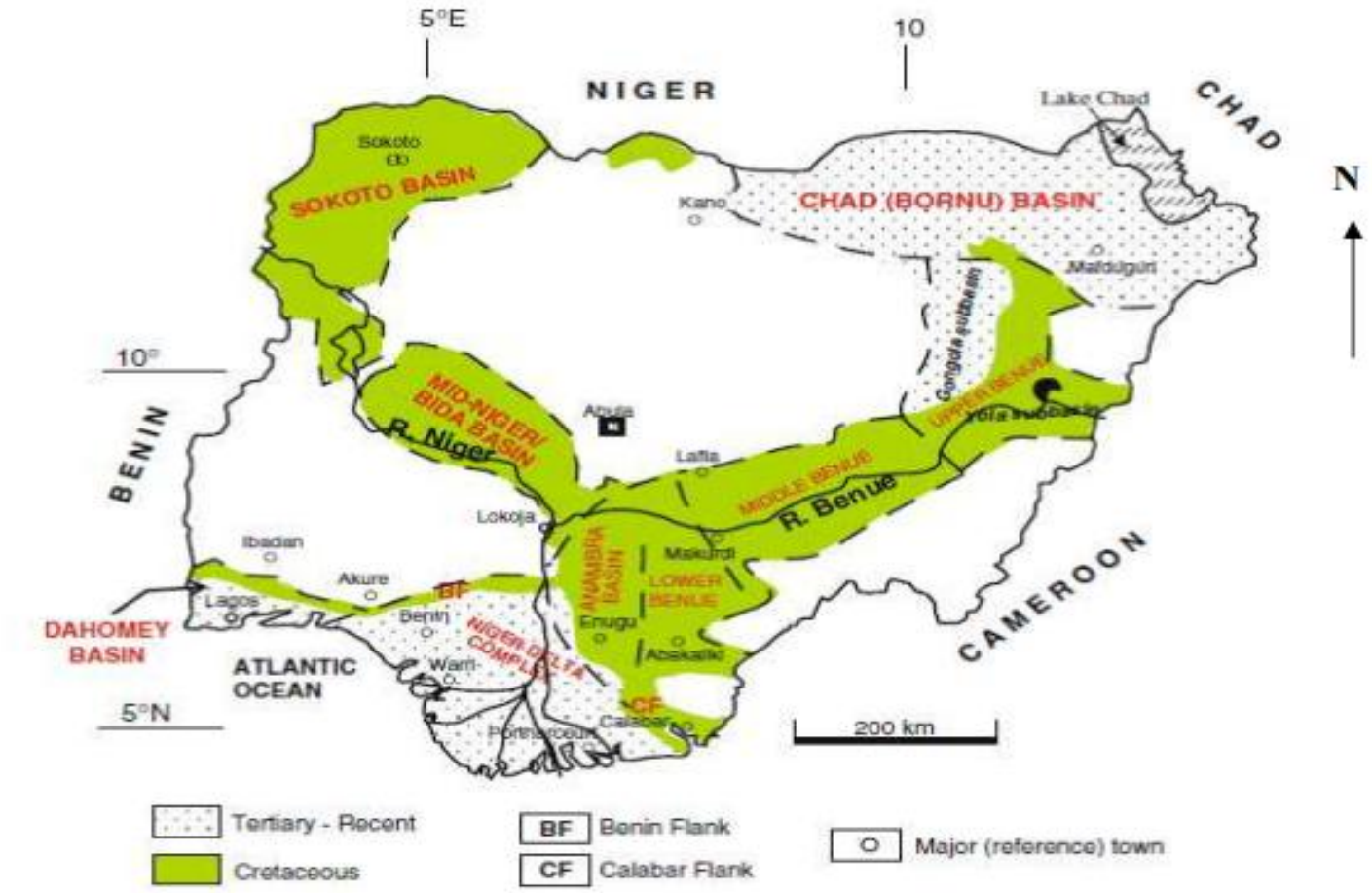


Figure 4.2: Sedimentary Map of Nigeria

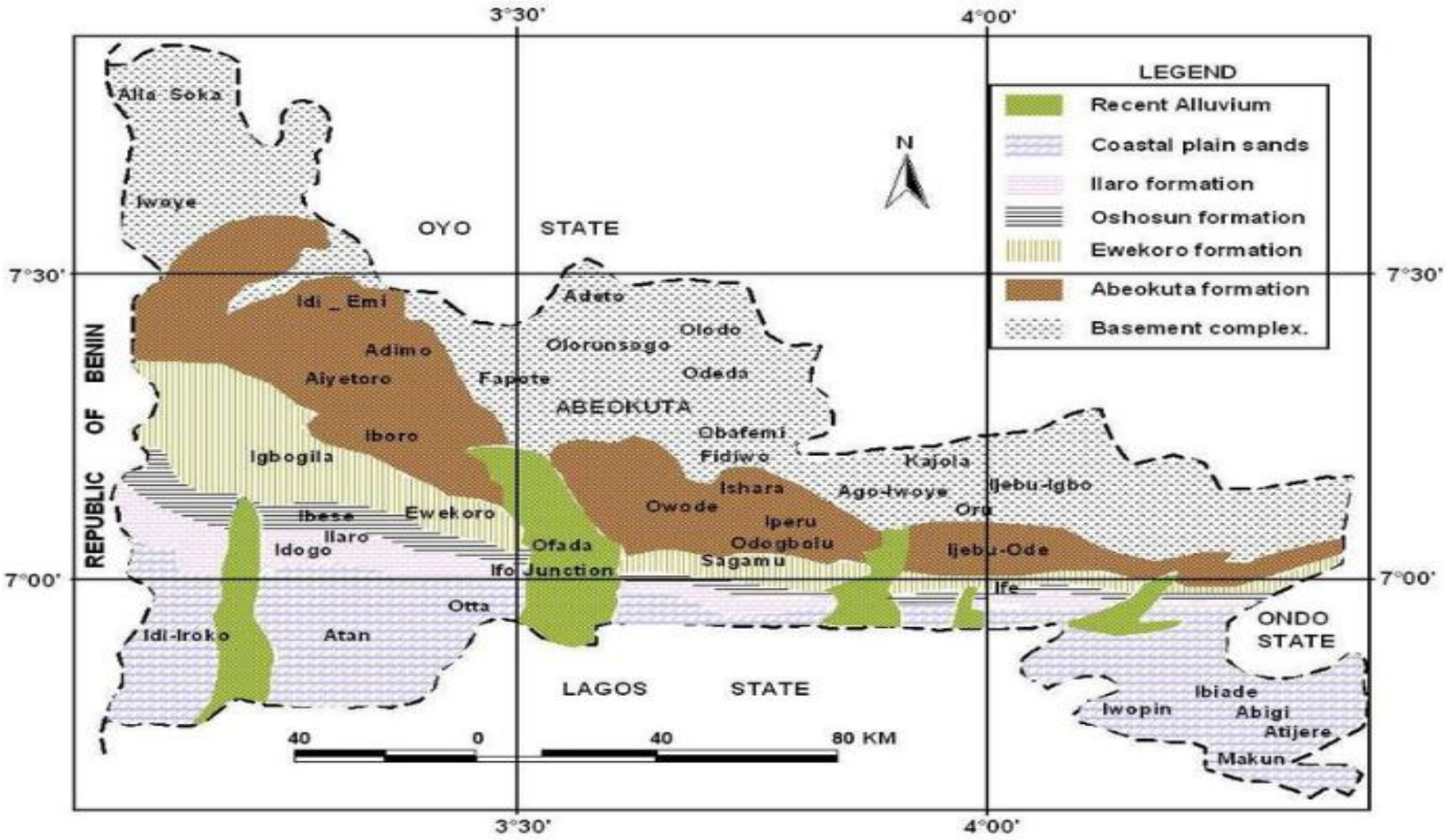


Figure 4.3: Geological map of Ogun state showing the study area

Table 4.2: Strategic Succession in the Basin Area

S/N	Age	Jones & Hockey 1964	Adegoke(in Kogbe,1976)
1	Recent	Alluvium	Alluvium
2	Oligo- Plieistocene	Benin Formation	Benin Formation
3	Eocene	Ilaro Formation	Ilaro Formation, Oshosun Formation
4	Paleocene-Lower Eocene	Ewekoro Formation	Akinbo Formation
5	Cretaceous	Abeokuta Formation	Araromi Formation, Afowo Formation, Ise Formation
6	Pre Cambrian	Basement Complex	Basement Complex

Source: Kogbe 1976

4.6 Ogun State Regional Hydrogeology

The Abeokuta Formation

The Abeokuta Formation comprising the Araromi, Afowo and Ise Formations, has been exploited for industrial water supply in the area and at Itokin for rural water supply. Aquifers of the Abeokuta Formation are essentially confined and artesian conditions have been encountered in boreholes at Itokin and Igbonla with a free flow head of about 15m at the Itokin borehole. The sandy Abeokuta Group is underlain by the basement complex and harbours aquifer zone which is unattractive since it cannot be considered as good prospect for groundwater exploration because of the impending low yield capacity.

The Ilaro and Ewekoro Formations

Both the Ilaro and Ewekoro Formations may be considered effective regional aquitard/acquiclude unit, separating the underlying Abeokuta Formation aquifers from the overlaying Benin Formation aquifers. A borehole screened in a thin band of sandy gravel of the Ilaro Formation yielded a transmissivity of 2.3m^2/d. The Ewekoro Formation is known to be aquiferous only where limestone members are present. The Ewekoro Formation also bears similar aquifer characteristics and but the Akinbo Formation has been found to be a good source of

groundwater exploration. The structural features that occur within the basement rocks are due to tectonic activities and they include: joints, faults and fractures.

The Coastal Plain Sands (Benin Formation)

Though aquifers are known to exist in the other sedimentary formations present in the area, the Benin Formation is without doubt the most significant aquifer system, being the major source of groundwater for private and public water supply, including industrial and commercial water usage. The Benin Formation which constitutes the most significant and productive regional aquifer system in southwestern part of Nigeria, outcropping over an area close to 25,000km^2 and dipping below the recent swamp deposits of the coastal areas. Its thickness is estimated at between 30m to 60m, has been confirmed in several boreholes at different locations.

The Benin Formation becomes thicker and increasingly sandy southwards from its outcrop area in the north and is also characterized by water quality variations. The formation is essentially plastic, being made up of loose red earth overlying unconsolidated, very poorly sorted clayey sands, gravelly sands and sandy clays, intercalated with grey clays and peat. The sands are generally friable, but become increasingly compacted with depth.

Recent Sediments

Locally significant aquifer may be found in the alluvial deposits along major streams in Ogun state. The unconsolidated deposits may constitute significant lithologic units, either as conduits for the passage of contaminants, as filter for removal of harmful chemicals and pathogens or as local aquifers for rural water supply. Due to their widely varying lithology that ranges from clay through silt, fine-coarse sand and gravel, there is a broad variation in their hydraulic properties too, especially permeability which is particularly significant in water supply considerations and pollution control. Table 4.5 below is a summary of hydrological units of the study area.

Table 4.3: Summary of hydrological units of the study area

Age	Formation	Lithology	Depositional Environment	Hydrogeological Significance
Recent	Alluvium	Sands, clays, mud, pebbles	Continental	Aquiferous
Oligo-Plieistocene	Benin Formation	Sands, clays, silts, sandy clays, gravel	Continental	Aquiferous
Eocene	Ilaro Formation	Predominantly shale, clays	Marine/Lacustrine	Non Aquiferous
Paleocene	Ewekoro Formation	Limestone, shale, clay	Marine	Aquiferous
Cretaceous	Araromi Formation Afowo Formation, Ise Formation	Shale fine/medium sands, Coarse/medium sand-stone, shale, silt-stone, sands, grits, sandstone	Marine/continental marine Continental	Aquiferous Artesian

Source (Goh et al, 2002)

4.61: Subsoil Investigation at ATVL Substation site

The subsoil investigation which involved Penetrometer Testing using 2.5 tones Dutch Cone Penetrometer Testing (DCPT) Machine was carried out on July 11, 2020. Visual assessment of the site/description of subsoil encountered was also done. However, the test involved carrying out 3 Nos. of 2.5 tons Dutch Cone Penetrometer Test (DCPT) up to depth ranging between the existing ground level at -2.75m depth upon which the cone attained anchorage and one number of trial pit dug at -2.00m depth below the existing ground level.

Table 4.4: Summary of the field work carried out

Test	Termination depth (m)
Trial pit	-2.00
Cone Penetrometer Test 1	-2.25
Cone Penetrometer Test 2 & 3	-2.75

4.6.2 The Dutch Cone Penetrometer Test (DCPT)

The Dutch Cone Penetrometer test (DCPT) consists of forcing a hardened steel cone consistently into the ground and measuring its resistance to penetration. The standard cone used had an apex angle of 60^0 and a base area of $10cm^2$. The penetrometer machine consists of a steel frame carrying a driving head which houses a hydraulic pressure capsule. The driving head could be raised or lowered by a manually operated winch or a motor driven hydraulic raw. The cone assembly was pushed into the ground by means of a steel rod connected to the driving head. These rods were protected from friction with the soil by hollow outer rods.

The cone driving rods and outer rods were pushed together into the ground for a distance of 200mm. The driving pressure was then applied to the inner rods and the cone was advanced independent of the outer rods for a distance of about 40mm at a rate of approximately 100mm/sec. The penetration resistance was recorded. The outer tube was advanced and the whole assembly was driven a further 250mm where the operation was repeated.

Tables 4.5 and 4.6 below show the guide for estimating soil types (After schemartman. 1969)

Table 4.5: Cohesive Soils

Cone End Resistance Value(kg/cm^2)	**Soil Type**	**Inferred Cu Value(After B.S.8004:1986)**
0-4	Very soft clay	20 KN/m^2
4-6	Soft clay	20 - 40 KN/m^2
6-10	Firm clay	40 - 75 KN/m^2
10-20	Stiff clay	75 - 100 KN/m^2
Above 20	Very stiff clay	100 - 150 KN/m^2
	Hard clay	>150 KN/m^2

Table 4.6: Granular Soils

Cone end Resistance Value (kg/cm^2)	**Soil Type**
0 – 40	Very loose to loose
40 – 120	Medium dense
120 – 200	Dense
Above 200	Very dense

The samples obtained at the site were subjected to laboratory analysis. The tests carried out on selected samples recovered from the boreholes using procedures specified in the British Standard B.S 1377: Part 1:2016(Methods of for Civil Engineering Purposes) is as shown in table 4.7 below. Detailed test reports are as presented in the appendix of this report.

Table 4.7: Laboratory Test done for selected soil and water samples

S/N	Type of test	Number of Samples	Remark/Purpose
1	Atterberg limit	2	Classification purpose
2	Natural moisture contents	3	Classification purpose
3	Sieve Analysis	2	Classification purpose
4	Bulk Density	2	Classification purpose

4.6.3 Summary of subsoil encountered at ATVL Substation site

The summary of the subsoil condition of the project site based on the DCPT conducted is as shown in table 4.8 below.

Table 4.8: Summary of subsoil encountered at ATVL substation site

Depth Range(m)	Description of subsoil Encountered	Laboratory Analysis description/Remark	Stratum Thickness(m)
0.00 – 0.50	Dark brown, silty, Clayey sand with plant root	Nil	0.50
-0.50 – 2.75	Reddish brown, silty, firm to stiff to very stiff sandy lateritic clay	Stiff to very stiff LL: 40 – 43% PL:25 – 26% PI:15 – 17% BD:1.76g/cm^2–1.84 g/cm^2 NMC:(11 – 14)% SA: Predominantly medium to fine grained sand	2.25

KEY: LL – Liquid Limit, PL-Plastic Limit, PI –Plastic Index; NMC – Natural Moisture Contents; SA- Sieve Analysis

Generally, groundwater cannot be accurately determined during cone penetration tests. However, a fair estimate was made by observing the penetration rods to depth of -2.75m even though the site investigation was done during wet season.

Plasticity

From Atterberg Limit Tests values of Liquid and Plastic Limits ranged from 40% - 43% and 25% - 26% while Plasticity indices was in the range 15% - 17% respectively for the lateritic clay between the existing ground level and -2.00m. The results indicate low to medium compressibility.

Natural Moisture Contents

The natural moisture content values ranged between 11% and 14%. These values indicate lateritic clay of low to medium plasticity with low moisture content on Casagrande Plasticity Chart. The soil is in the A-6 group of AASHTO soil classification system.

4.6.4 Foundation discussion on soil at ATVL Substation project site

Engineering analysis of the field data derived from the investigation conducted indicate that the subsoil materials encountered at the substation site in its present state particularly in the trial pit and DCPT locations were ***underlain by firm Sandy lateritic Clay followed by Stiff to very stiff becoming hard sandy laterite Clay.***

The following factors should be considered prior to placement of any foundation type at the substation site;

- Depth of topsoil, rubbish of uncontrolled fill or suspicious materials if any.
- Depth of poor surface deposit such as peat, mud or sanitary landfills
- Ground water table and its seasonal fluctuations
- Depth of poor or better underlaying strata
- Depth of adjacent footings as applicable

Considering the proposed substation on this site and the subsoil conditions as revealed in the completed trial pit, DCPT results and Laboratory analysis of selected subsoil samples, it is suggested that Reinforced Shallow Foundation in form of Pad & Column could be adopted for the proposed building to a minimum depth of -1.50m below the existing ground level.

4.6.4.1 Shallow Foundations

Based on the available subsoil conditions and considering the nature of the building (control room) to be erected on the substation site, Shallow foundations in form of pad and column can be adopted on the proposed site.

The result of the investigation gave a General Safe Bearing Pressure value of 121.50kN/m² for a rigid well reinforced Square/Circular footings placed at -1.50m as recommended above.

Moreover, ancillary structures such as gate house (if applicable) could be placed on Shallow Strip footings of up to 0.50 while the generator house could be placed on pad footing up to 0.75m below the existing ground level in view of the vibration it would induce on the ground.

Note: Subsoil below 1.00m is composed of Stiff to very stiff sandy lateritic Clay.

The result of the investigation was calculated based on Meyerhof's formulae for strips or Square/Circular foundations of 1.2m width at various depths. The following Allowable Bearing Pressure values were obtained for the subsoil condition in the site's present natural state as shown;

qa = 2.7Ckd kN/M² Where Ckd = cone resistance in kg/cm² and qa = allowable bearng pressure in kN/m²

Table 4.9: Cone Penetration Test (CPT) 1 Area

Depth Range (m)	Allowable Bearing Pressure *(qa) in kN/m²*
-0.50	67.50 kN/m^2
-1.00	121.50 kN/m^2
-1.50	216.00 kN/m^2
-2.25	310.50 kN/m^2

Table 4.10: Cone Penetration Test (CPT) 2 Area

Depth Range (m)	Allowable Bearing Pressure *(qa) in kN/m²*
-0.50	54.00 kN/m^2
-1.00	94.00 kN/m^2
-1.50	121.00 kN/m^2
-2.00	189.00 kN/m^2
-2.50	283.50 kN/m^2

Table 4.11: Cone Penetration Test (CPT) 3 Area

Depth Range (m)	Allowable Bearing Pressure *(qa) in kN/m²*
-0.50	54.00 kN/m^2
-1.00	108.00 kN/m^2
-1.50	121.00 kN/m^2
-2.00	202.50 kN/m^2
-2.50	256.50 kN/m^2

However, the CPT test locations represented a very small statistical sampling of the subsurface conditions. These subsurface conditions could vary substantially from those indicated by the soil test results shown later in this chapter.

4.7 Climate and *Meteorology*

The proposed project area is in the moderately hot, humid tropical climate zone of South-west, Nigeria. The climate in the area is tropical with alternating wet and dry seasons. The climate 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 in the study area; 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.

Rainfall

The rainfall pattern in the area is characterized by high rainfall in the months of April to October (wet season) while the lowest mean rainfall amount is recorded in December (Table 4.4, Figure 4.4). Of the total amount (1342.05 mm), about 1180.68 mm was recorded during the wet season (April – October) while only 161.40 mm was recorded in the dry season (November to March). The rainfall regime is determined by the two major air masses dominating the area: the moist Tropical Maritime (Tm) with its associated westerlies and the dry Tropical Continental air mass (Tc) with its associated easterlies. The long-wet season is characterized by a short break in August as

the sun passes over the equator on its way from the Northern to the Southern Hemisphere). The specific month to month rainfall amounts at ATVL proposed substation project area for 26 years, from January 1991 to December 2017 from Nigerian Meteorological Agency (NIMET) is presented in table 4.12., While the mean monthly distribution is shown in Figure 4.4.

Table 4.12: Rainfall data(mm) in Ogun state from January 1991 to December 2017

						RAINFALL (mm)						
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1991	Trace	165.5	19	174.1	135.3	82.3	219.9	191.4	170.4	182.8	2.2	26.4
1992	0	0	28.5	92.9	103.6	237.4	202.3	107.8	127.4	152.5	36.2	0
1993	0	25.9	141.7	44	145.9	187.5	26.2	384	235.5	183.2	55.9	48.3
1994	2.1	30.2	20.9	75.4	234.8	62.9	177.4	36.8	135.1	112.7	17.6	0
1995	0	11.4	106.3	118.5	256.6	267.8	188.9	204.1	159.4	185.1	36.6	Trace
1996	0.1	125.1	133	167.7	146.7	187.4	305.7	242.9	184.9	160.2	0	Trace
1997	9.3	0	200.4	158.1	128.9	98.8	63.8	111.8	113.6	182.9	5.8	23.7
1998	0	23.4	37.6	70.1	133.7	95.8	115.4	149.3	248.2	122.2	17.1	5.2
1999	0.3	75	111	74.2	122.7	321.9	385.8	149.6	209.5	348	16.9	0
2000	30.1	0	95.7	126.1	80.6	116	220.7	232.4	127	215.9	0	0
2001	0	8.4	121.6	142.2	231.2	114.9	257.1	53.2	285.6	72.3	2.1	1.1
2002	0	6.9	57	122.8	184.3	323.8	171.7	247.2	114.5	207.4	79.7	0
2003	25.2	81.6	3.6	184.1	191.3	147.8	156.2	40.9	128.5	132.1	51.7	0
2004	78.7	32.5	92	231.9	183.9	181.2	161.2	156.2	196.3	0.3	0	Trace
2005	0	33.1	101.9	118.2	114.7	212.6	182.9	64	225.7	134.9	4	12.2
2006	19.1	1.5	109.1	79	197.3	164.5	65.2	128.1	312.5	166	17.8	0
2007	0	0.5	36.2	39.5	303.8	173.7	138.3	98.1	231.7	254	6.5	8.3
2008	0	43.7	49.3	57.7	164.8	162.6	164.1	149.9	209.6	261.1	49	26.7
2009	1.5	138.1	80.4	203.7	129.9	217.4	205.6		328.5	205.5	21.1	16.5
2010	0.8	18	64.4	88.8	195	76.9	109.5	320.3	311.3	214.7	34.3	0
2011	0	61.3	66.2	64.1	151.12	285.4	298.8	511.1	238.2	213.3	19.4	0
2012	0		36.2	125.1	215.9	215	218.2	93.3	218.2	141.3	54.9	0
2013	2.1	30.2	20.9	75.4	231.4	62.9	177.4	36.8	135.1	112.7	17.6	0
2014	0	11.4	106.3	118.5	256.6	267.8	188.9	204.1	159.3	185.1	36.6	Trace
2015	0.1	125.1	133	167.7	146.7	187.4	305.7	242.9	184.9	160.2	0	Trace
2016	9.2	0	200.4	158.1	125.3	98.8	63.8	112.5	113.6	182.9	5.8	23.7
2017	0	23.4	37.6	70.1	133.7	95.8	115.4	149.3	248.2	122.2	17.1	5.2

Source: Nigerian Meteorological Agency, 2017

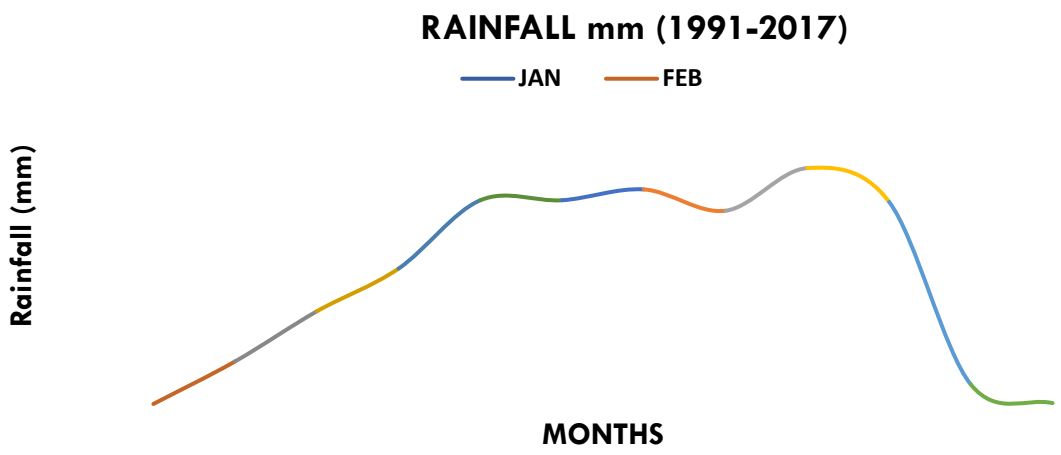


Figure 4.4: Rainfall in the study area (1991 - 2017)

Ambient Temperature

Temperature is relatively high and stable all the year round in view of the location of the study area around the tropic. The key factors influencing temperature in the area are the movement of the sun, wind speed and direction, and land configuration. The highest temperature value of about 34.77 ^{0}C occurs in the month of March and the lowest value of 21.34 ^{0}C in August (Figure 4.5).

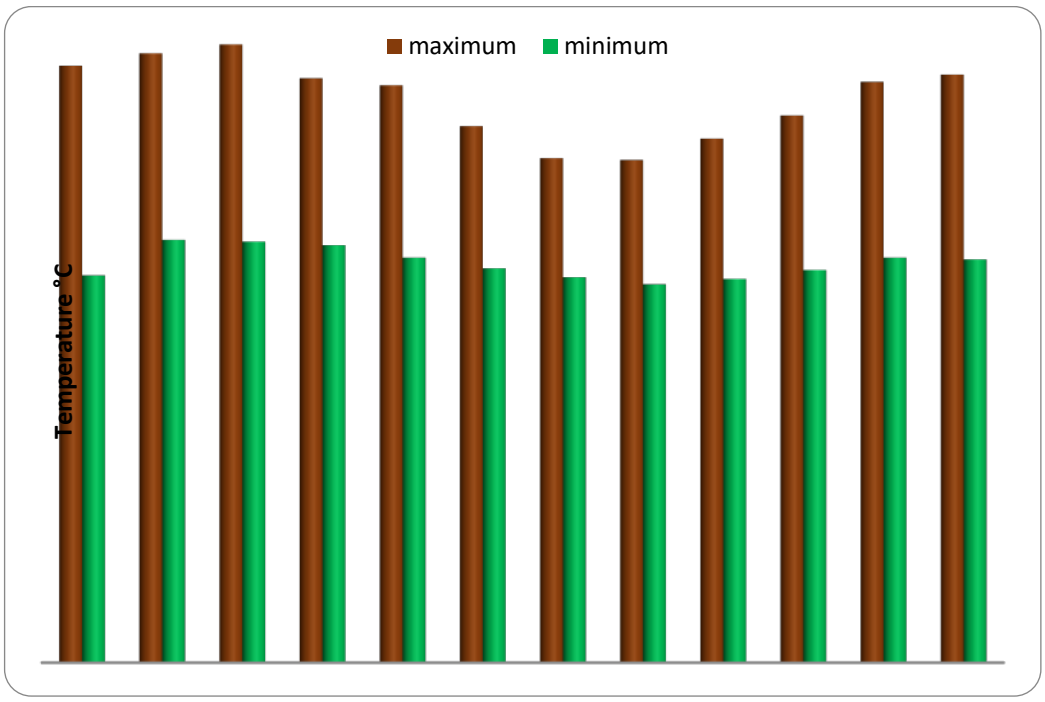


Figure 4.5: Mean Temperature °C at project site. Source: NIMET, 2017

Relative Humidity

The study area experiences high relative humidity 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 area indicate that humidity measured in the morning ranges between 68.11% in January and 87.33% in August while in the afternoon the value ranges from 41.26% [in February] to 76.78% [in August] (Figures 4.6).

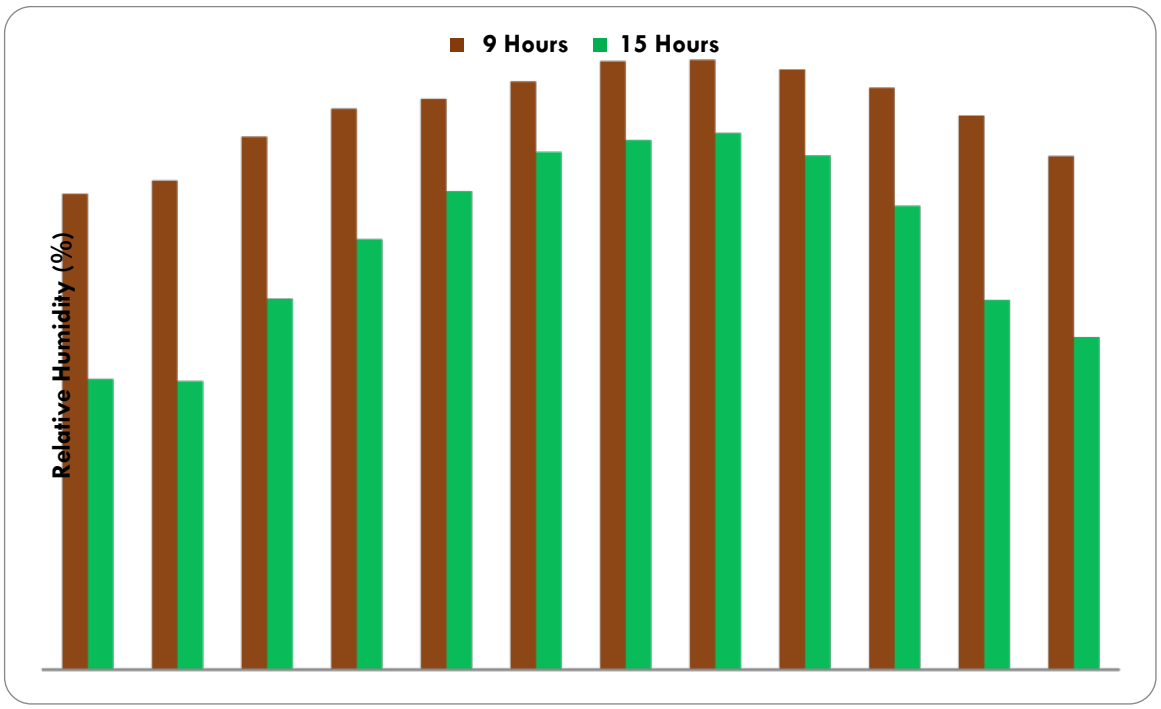


Figure 4.6: Relative Humidity in the project area (1991 to 2017) ***Source:*** **NIMET, 2017**

Wind Direction and Speed

The quasi-stationary ITCZ over the region commands high maritime influence from the Atlantic. 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 Southwesterly 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 study area ranges from 3.1m/s to 5.0m/s. The highest speed is recorded at the onset and offset of seasons when squalls, lightning and thunder accompany torrential rains. The wind direction was predominantly south west.

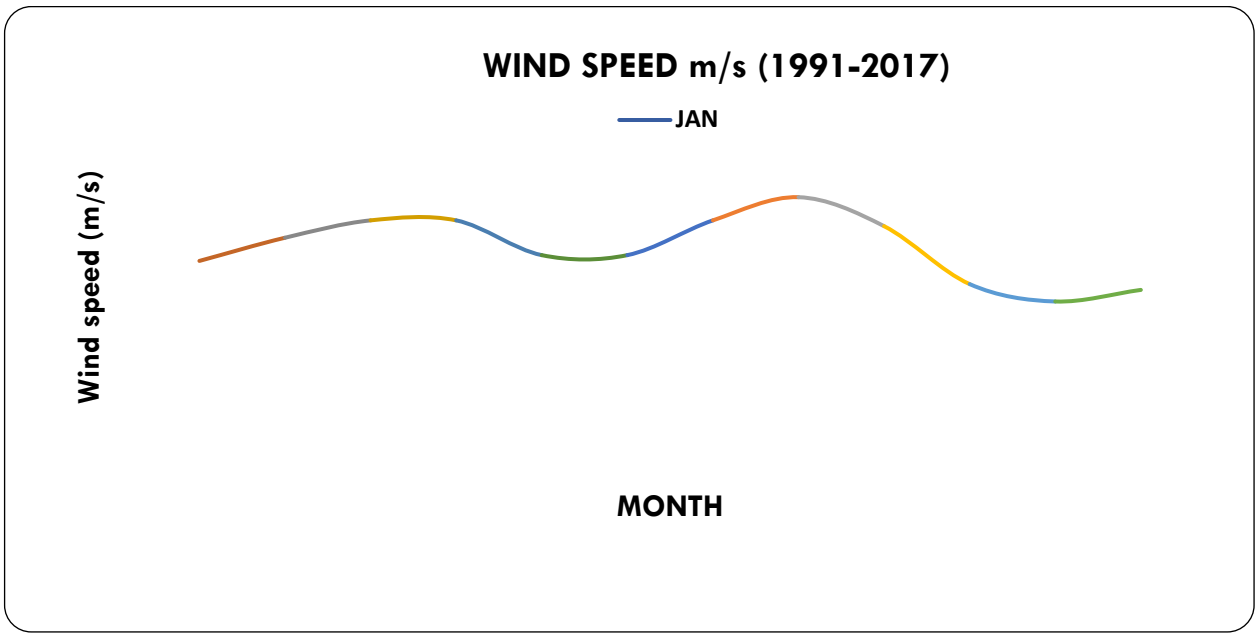


Figure 4.7: mean wind speed in the project area (1991 to 2017) ***Source:*** **NIMET, 2017**

Sunshine hours and Cloud cover

A sunshine hour is a general indicator of cloudiness of a location or measuring duration of sunshine in given period (usually, a day or year) for a given location, typically expressed as an average value over several years. The mean sunshine hour at the project site range between 2.8 in August and 6.4 in December. Cloud cover data is used in both weather analyses and meteorological data and it is important for solar energy and air traffic management. The mean cloud cover at the project site range between 6.9 - 7.0 through January to December for the year 1991- 2017.

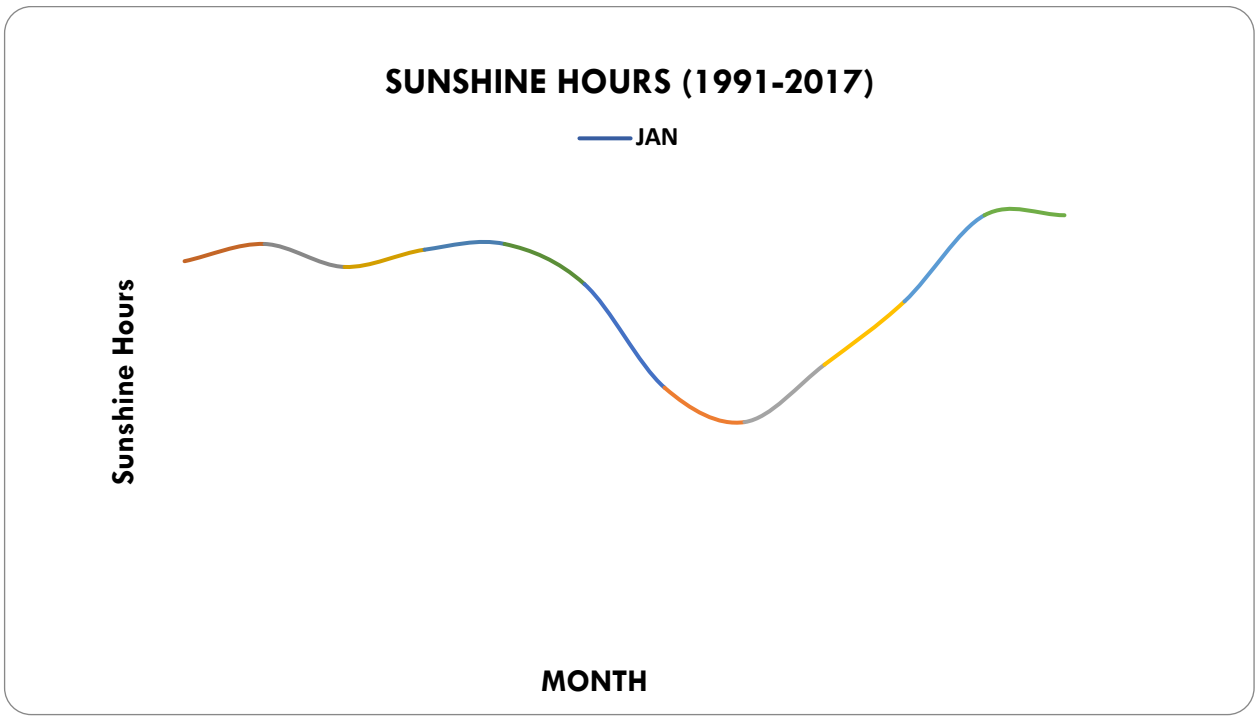


Figure 4.8: mean sunshine hour in the project area (1991 to 2017) ***Source:*** **NIMET, 2017**

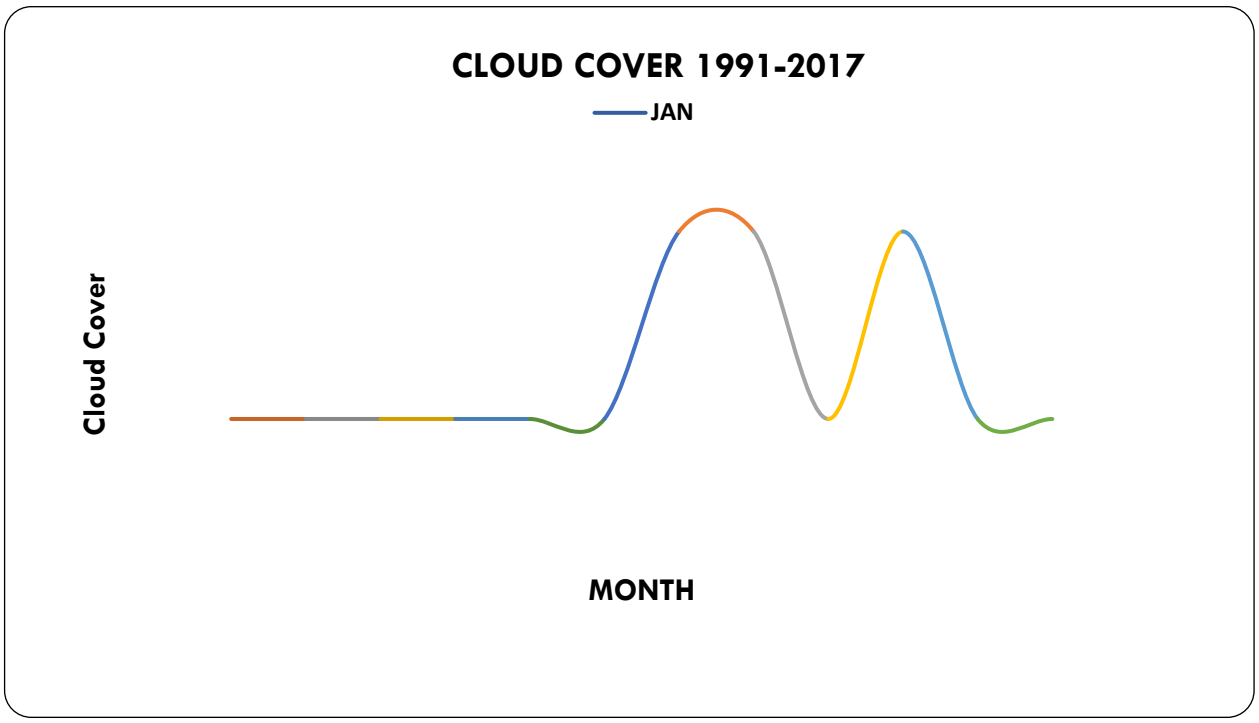


Figure 4.9: mean cloud cover in the project area (1991 to 2017) ***Source:*** **NIMET, 2017**

4.8 AIR QUALITY ASSESSMENTS

The possible air pollutants from the operations at Adefolorunsho Technical ventures Limited substation project were determined using pre-calibrated digital handheld Air Quality Monitoring Equipment such as pre-calibrated Gray wolf Advance Sense Pro Environmental Test Meter, Met One Particulate Counter for the Suspended Particulate Matter (SPM) with a Total Suspended Particulate Matter (TSPM) number concentration range 0.3-10.0µm and ExTech VOC/HCHO meter for determination of Total Volatile Organic Compound and formaldehyde. The values obtained were compared with FMEnv Ambient Air Quality Standards.

The air contaminants generated at Adefolorunsho Technical ventures Limited substation project site were determined and compared with the set standards especially the Nigerian ambient air quality standards. Information on health and other effects of the contaminants were obtained from various literatures.

Table 4.13: Parameters and Sampling Methods used for Air Quality analysis

PARAMETER	SAMPLING METHOD
Suspended Particulate Matter (SPM)	METONE Handheld Air Borne particulate counter (HPPC 6+) Counting Efficiency – 50% at 0.3 um; 100% for particles > 0.45 um (ISO 21501-4)
Total Volatile Organic Compounds (TVOC) and Formaldehyde (HCHO)	EXTECH VOC/CH_2O VFM200. TVOC range: 0.00 to 9.99ppm HCHO range: 0.00 to 5.00ppm
Temperature, Relative Humidity and Dew point	Gray Wolf Advance Sense Pro Operating Range: -10°C to 50°C (15°F to 122°F), 0 to 100 %RH non-condensing
NO, SO_2, CO_2, NH_3, H_2S, NO_2, CO, NO	Gray Wolf Advance Sense Pro Environmental test meter

***Source*: Azmarineberg Limited**

4.8.1 Air Quality, Temperature and Noise Level Quality

For the purpose of documenting the existing air quality of the project area, Air quality monitoring was carried out at seven (7) different points including control within and around the proposed project site.

4.8.2 Ambient Air Quality and Noise Assessment Study Approach

The present air quality status and airshed classification according to the World Bank Guidelines were determined using the national and World Bank standards (Table 4.14). The measured noise levels were also compared with the permissible noise levels of the Federal Ministry of Environment and that of the World Bank.

Table 4.14 Ambient Air Quality Standards considered in the Study

Air Pollutant	Time Average	Limit ($\mu g/m^3$)	
		FMEnv	World Bank
NH_3	24-hr	0.28 ppm	-
CO	24-hr	11,400 (10 ppm)	-
SO_2	1-hr	260 (0.1 ppm)	-
	24-hr	26 (0.01 ppm)	20
NO_X	1-hr	-	200
	24-hr	75 – 113 (0.04 – 0.06 ppm)	-
H_2S	24-hr	0.008	
Ozone	24-hr	0.1 ppm	
VOCs	24-hr	160	-
$PM_{2.5}$	24-hr	-	25
PM_{10}	24-hr	-	80
TSP	24-hr	250	-

Table 4.15: Nigeria's Standard Noise Levels (FEPA, 1991)

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

Table 4.16: Maximum Allowable Log Equivalent (hourly measurements) in dB (A)*

Receptor	Day-time (7:00 – 22:00)	Night-time (22:00 – 7:00)
Residential, institutional, educational	55	45
Industrial, commercial	70	70

*(World Bank, 1999)

4.8.3 Observed Conditions of the Investigated Airshed

The field observations as recorded during the study are herein reported. Also included are the results of analyses on the measured microclimatic parameters, air quality parameters and noise. These were then combined with other relevant information from literature and past studies on the study area to describe its atmospheric conditions. The results of ambient air quality, temperature and noise level measurements are as presented below.

Plate 4.5: Air quality monitoring at ATVL substation site Sango Ota, Ogun state

Plate 4.6: In-Situ water analysis at ATVL substation site Sango Ota, Ogun state

Table 4.17: Ambient Air Quality results on Project site during the wet season

LOCATION	SO_2 (ppm)	NO_2 (ppm)	NO (ppm)	TVOC (ppm)	RH (%)	DP (°C)	O_2 (%)	NH_3 (ppm)	H_2S (ppm)	CO_2 (ppm)	CO (ppm)
AN 1	0.00	0.00	0.00	0.06	89.2	26.5	20.8	0.00	0.00	264	0.00
AN 2	0.00	0.00	0.00	0.04	91.2	25.0	20.8	0.00	0.00	269	0.00
AN 3	0.00	0.00	0.00	0.03	84.6	23.5	20.9	0.00	0.00	265	0.00
AN 4	0.00	0.00	0.00	0.03	85.6	24.6	20.9	0.00	0.00	264	0.00
AN 5	0.00	0.00	0.00	0.02	80.2	26.9	20.9	0.00	0.00	265	0.00
AN 6	0.00	0.00	0.00	0.02	75.9	25.0	20.9	0.00	0.00	265	0.00
AN Control	0.00	0.00	0.00	0.01	73.4	23.9	20.9	0.00	0.00	264	0.00
FMEnv	**0.01**	**0.06**	**NS**	**NS**	**NS**	**NS**	**21.0**	**NS**	**NS**	**NS**	**10.0**

Source: Azmarineberg Limited, 2020

Table 4.18: Ambient Air Quality results from secondary data used

S/N	LOCATION	O_2 (%)	CO (ppm)	NO_X (ppm)	SO_X (ppm)	H_2S (ppm)	TEMPERATURE (^oC)	DEW POINT (^oC)	RELATIVE HUMIDITY (%)
1	AS1(Main Gate)	20.9	0.00	0.00	0.00	0.00	31.0	27.7	79.8
2	AS2 (Perform Bottle Blowing)	20.9	0.00	0.00	0.00	0.00	**32.9**	28.3	80.5
3	AS3(Around the Security Post)	20.9	0.00	0.00	0.00	0.00	31.2	27.5	82.5
4	AS4(Beside Compressor Room)	20.9	0.00	0.00	0.00	0.00	**33.4**	24.6	70.6
5	AS5(Nylon Waste Area)	20.9	0.00	0.00	0.00	0.00	**32.8**	25.2	72.0
6	AS6(Behind the Conveniences)	20.9	0.00	0.00	0.00	0.00	**32.5**	28.0	81.9
7	AS7(Warehouse)	20.9	0.00	0.00	0.00	0.00	**32.7**	27.7	80.8
8	AS8 (Behind the Generator House)	20.9	0.00	0.00	0.00	0.00	31.0	25.4	68.6
FMEnv/NESREA LIMIT		**21.0**	**10.0**	**0.04-0.06**	**0.1**	**NS**	**32.0**	**NS**	**NS**

Source: Azmarineberg Limited, 2020

During the wet season, ten gases were monitored namely; SO_2, NO, NO_2, CO, H_2S, O_2, CO_2, HCHO, NH_3 and TVOCs in all locations and control. Meanwhile five gases namely SO_2, NO_2, CO H_2S and O_2 were monitored for the secondary data. During the wet season study period, SO_2, NO_2 and H_2S, NO, NH_3, CO, were not detected in all the sampled locations including the control point by the instrument used and were therefore within specified FMEnv limits. Similarly, SO_2, NO_2, CO and H_2S were not detected for the secondary data with only oxygen detected in all locations and were within limits.

Total Volatile Organic Compounds

Total volatile organic compound are emitted as gases from solids or liquids chemicals, some of which may have short and long-term adverse health effects. The health effects include eyes, nose and throat irritation, headache, loss of coordination and nausea, damage to liver, kidney and central nervous system. The concentration of total volatile organic compounds recorded ranged from 0.02ppm to 0.06ppm and a mean concentration value of 0.03ppm as compared to 0.01ppm obtained for the control point. There was no record of TVOC in the secondary data used.

Relative Humidity

The relative humidity of an air–water mixture is defined as the ratio of the partial pressure of water vapor in the mixture to the equilibrium vapor pressure of water over a flat surface of pure water at a given temperature. It is expressed as a percentage; Relative humidity can affect the incidence of respiratory infections and allergies. The influence of relative humidity on the abundance of allergens, pathogens, and noxious chemicals suggests that indoor relative humidity levels should be considered as a factor of indoor air quality. The majority of adverse health effects caused by relative humidity would be minimized by maintaining indoor levels between 40 and 60%. The relative humidity concentration ranged from 75.9% to 91.2% with control value of 73.4%. The mean concentration of relative humidity recorded for wet season was 82.9%. Meanwhile a range of 68.6 -82.5% was recorded for the secondary data.

Oxygen

Oxygen is the only component present in air we breathe capable of supporting life. Workers can become asphyxiated by exposure to atmosphere deficient of oxygen that can lead to serious injury or loss of life. The mean concentration of oxygen values recorded for the wet season was

20.9% and it ranged from 20.8% - 20.9%. The oxygen concentrations recorded within the project site were in line with the recommended FMEnv limit of 21.0% during the wet season. Also the range was 20.9% in all locations for the secondary data and also within FMEnv's limit for oxygen.

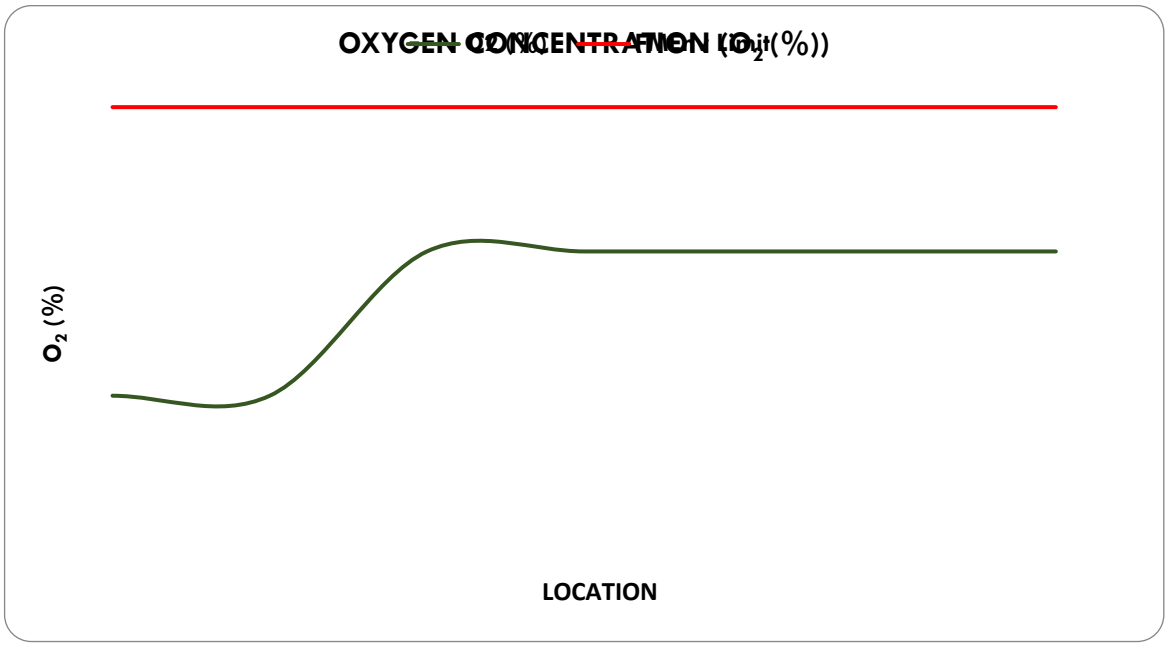


Figure 4.10: Graphical representation of Oxygen concentration at project area for wet season.

Carbon dioxide

Carbon dioxide CO_2 occurs naturally in the atmosphere. Levels of atmospheric carbon dioxide have increased since the industrial revolution. CO_2 emissions impact human health by displacing oxygen in the atmosphere. In closed areas, high levels of carbon dioxide can lead to health complaints such as headaches, dizziness, restlessness and difficulty in breathing. The mean concentration of carbon dioxide recorded was 265ppm and it ranged from 264ppm to 269ppm during the wet season study period. Carbon dioxide was not recorded for the secondary data.

Particulate Matter

Particulate Matter (PM) is a mixture of solid particles and liquid droplets found in the air. Some particles, such as dust, dirt, soot, or smoke are large or dark enough to be seen with a naked eye. Others are so small that they can only be detected by using electron microscope. Particulate matters are considered to be a primary contributor to air pollution, smog formation and environmental contamination. They are emitted from various source including power stations,

industrial activities and vehicles. METONE Handheld Airborne particulate counter (HPPC 6+) was used to measure the Total Suspended Particulate Matter (TSPM) number concentration of size range of 0.3-10.µm. The particulate counter measures six (6) channels ranges of suspended particles: $PM_{0.3}$, $PM_{0.5}$ $PM_{1.0}$, $PM_{2.0}$, $PM_{5.0}$ and $PM_{10.0}$. $PM_{2.5}$ was chosen as a representative of the submicron particles while $PM_{10.0}$ was chosen as a representative of the coarse particles.

Table 4.19: Particulate Matter (PM) Level Result at the project site during wet season

LOCATION	PM $_{10.0}$ µg/m^3	$PM_{2.5}$(µg/m^3)
AN 1	17.4	45.7
AN 2	18.1	50.6
AN 3	19.6	36.2
AN 4	19.6	29.4
AN 5	23.3	36.6
AN 6	15.3	33.0
AN Control	26.6	47.0
Range	15.3-23.3	29.4 – 50.6
Mean	20.0	39.78
FMEnv LIMITS	**250.0**	**NS**

Source: Azmarineberg Limited, 2020

Table 4.20: Suspended Particulate Matter Level Result for the secondary data

S/N	LOCATION	SPM PM 10.0µm/m^3
1	AS1(Main Gate)	**615.6**
2	AS2 (Perform Bottle Blowing)	74.2
3	AS3(Around the Security Post)	**1083.8**
4	AS4(Beside Compressor Room)	**282.3**
5	AS5(Nylon Waste Area)	**285.9**
6	AS6 (Behind the Conveniences)	181.3
7	AS7(Warehouse)	150.2
8	AS8 (Behind the Generator House)	**350.5**
FMEnv LIMIT		**250.0**

The suspended particulate matter (PM $_{10.0}$) recorded for wet season was in the range 15.3 – 23.3 µm/m^3 with a mean of 20 µm/m^3 while 47 µm/m^3 was obtained for the control location as compared to 250 µm/m^3 stipulated by FMEnv. The $PM_{2.5}$ (µg/m^3) for the wet season was in the range 29.4 – 50.6 µm/m^3 and a mean of 39.78 as compared to a control value of 26.6(µg/m^3). However, a range of 150.2µg/m^3 -1083.8µg/m^3 was obtained in the secondary data used with some of the locations exceeding the FMEnv's recommended limit of 250 µm/m^3.

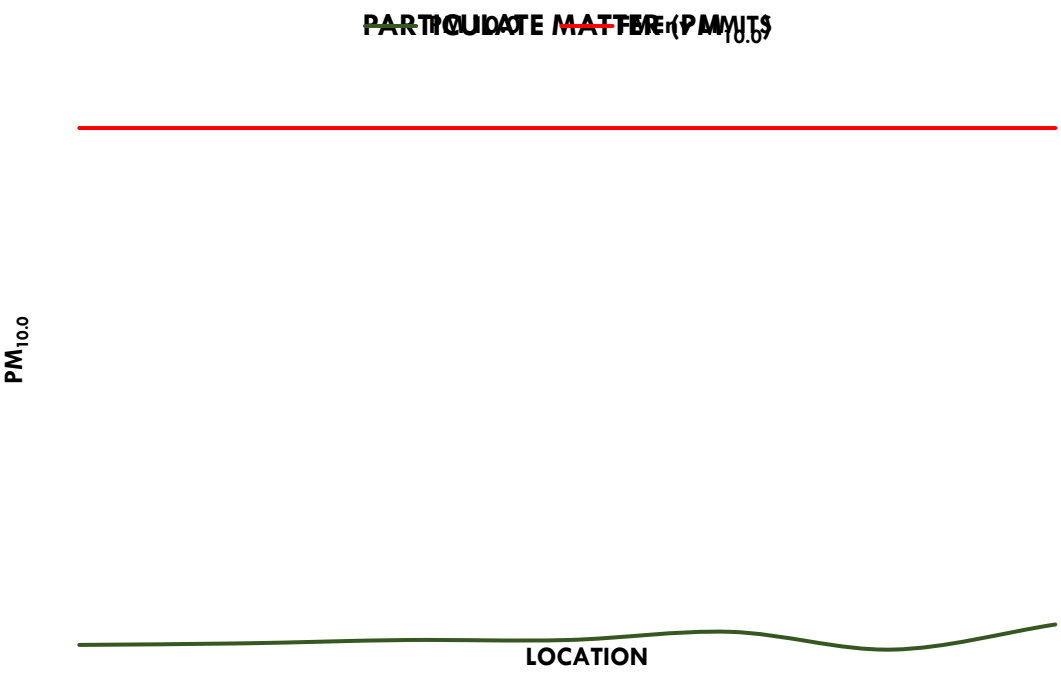


Figure 4.11: Graphical representation of Suspended particulate matter (PM $_{10.0}$ in $\mu g/m^3$) concentration at project area for wet season

Temperature

When the temperature at workplace gets too hot, it is more than just an issue about comfort. If the temperature goes too high, it can become a health and safety issue which can result to dizziness, increased body temperature, fainting, or even heat cramps. If the blood temperature rises above 39°C, there is a risk of heat stroke or collapse. Delirium or confusion can occur above 41°C. Blood temperatures at this level can prove fatal and even if a worker does recover, they may suffer irreparable organ damage. Table 4.21 below show the temperature data observed during the exercise.

Table 4.21: Temperature Level Result around the project site for wet season

LOCATION	TEMPERATURE (°C)
AN 1	26.4
AN 2	26.3
AN 3	26.2
AN 4	26.4
AN 5	27.1
AN 6	30.3
AN Control	31.4
Range	26.2-30.3
Mean	27.7
FMEnv LIMITS	**32.0**

Source: Azmarineberg Limited, 2020

Table 4.22: Temperature Level Result for secondary data

S/N	LOCATION	TEMPERATURE (ºC)
1	AS1(Main Gate)	31.0
2	AS2(Perform Bottle Blowing)	**32.9**
3	AS3(Around the Security Post)	31.2
4	AS4(Beside Compressor Room)	**33.4**
5	AS5(Nylon Waste Area)	**32.8**
6	AS6 (Behind the Conveniences)	**32.5**
7	AS7(Warehouse)	**32.7**
8	AS8 (Behind the Generator House)	31.0
FMEnv LIMIT		**32.0**

The mean temperature at Adefolorunsho Technical Ventures limited Substation is 27.8°C. The temperature gradient recorded, ranged between 26.2°C at ANS 3 to 30.3°C at ANS 6 and a value of 31.4°C at the Control. All sampled sections were in compliance with the **FMEnv** limit **32.0°C** during the wet season. Similarly, for the secondary data used the range was 31 – 33.4°C with the values exceeding the recommended FMEnv's limit of **32.0°C** in most of the locations.

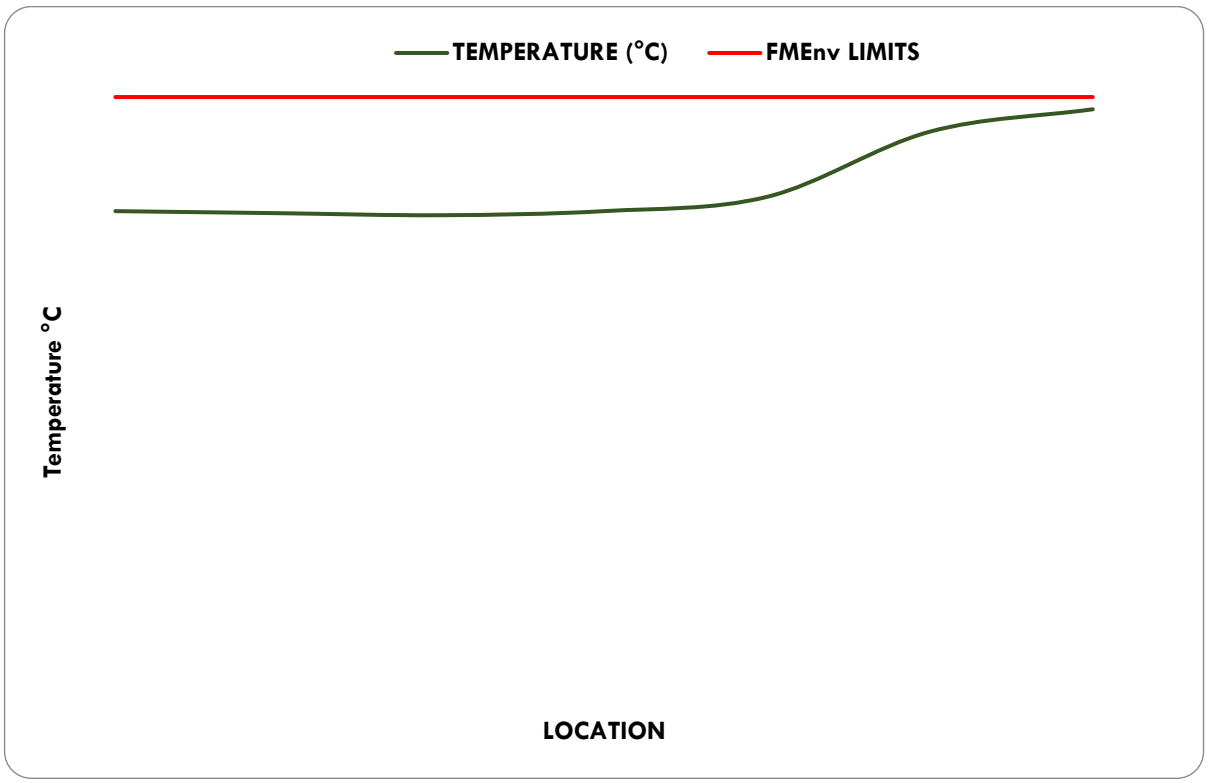


Figure 4.12: Graphical representation of Temperature (°C) at Adefolorunsho Technical Ventures limited Substation, Sango-Ota, Ogun State for wet season.

4.9 Noise Level Assessment

Environmental noise is the accumulation of all noise present in a specified environment; the principal sources of environmental noise are surface motor vehicles, aircraft, trains and industrial sources. These noise sources expose millions of people to noise pollution that has increasingly been identified as a public health issue especially in an occupational setting. Exposure to noise is associated with several negative health outcomes, depending on the duration and level of exposure; noise may promote hearing loss, high blood pressure, cardiovascular diseases, sleep disturbances and birth defects.

The ambient noise levels within Adefolorunsho Technical Ventures limited Substation were determined in six (6) strategic and selected locations including a control point during the wet season using the UNI-T UT352 sound Level digital survey meter. The equipment consists of several parts mainly Microphone, Pre-amplifier, frequency weighting, Processor, Display System, Communication system and Power supply. The dB (A) Leq denotes the time weighed weighted average of "A, which denotes the frequency weighting in the measurement of noise and

corresponds to frequency response characteristics of the human ear. The minimum and maximum noise level (Nmin and Nmax) was taken. Meanwhile, noise measurement was carried out at eight locations with no control in the secondary data used.

Table 4.23: Noise level Result at the project site for wet season

LOCATION	Minimum Noise dB(A)	Maximum Noise dB(A)	Average Noise level dB(A)
AN 1	50.6	63.7	57.2
AN 2	48.9	59.5	54.2
AN 3	53.0	54.7	53.9
AN 4	49.7	52.4	51.1
AN 5	59.0	64.9	62.0
AN 6	54.7	63.4	59.1
AN Control	50.7	67.2	59.0
Mean Range	-	-	52.37- 60.83
FMEnv LIMIT	**-**	**-**	**90.0**
NESREA LIMIT			**85.0**

Source: Azmarineberg Limited, 2020.

Table 4.24: Noise level Result for secondary data

S/N	LOCATION	NOISE LEVEL dB(A)
1	AS1(Main Gate)	68.9
2	AS2(Perform Bottle Blowing)	80.4
3	AS3(Around the Security Post)	76.4
4	AS4(Beside Compressor Room)	**89.6**
5	AS5(Nylon Waste Area)	80.9
6	AS6 (Behind the Conveniences)	66.4
7	AS7(Warehouse)	67.0
8	AS8 (Behind the Generator House)	80.3
FMEnv/ LIMIT		**90.0**

The mean noise level at Adefolorunsho Technical Ventures limited Substation was 56.4dB(A). The noise levels recorded mean of minimum and maximum values ranged between 52.37dB(A) to 60.83dB(A). All sampled sections were in compliance with the **FMEnv** limit **90.0dB(A) and NESREA** limit **85.0dB (A** for wet season). Moreover, a range of 66.4 – 89.6 dB(A) was recorded for the secondary data with only the value at Beside compressor room exceeding NESREA limit of **85.0dB(A) but within FMEnv's Limit** of **90.0dB(A).**

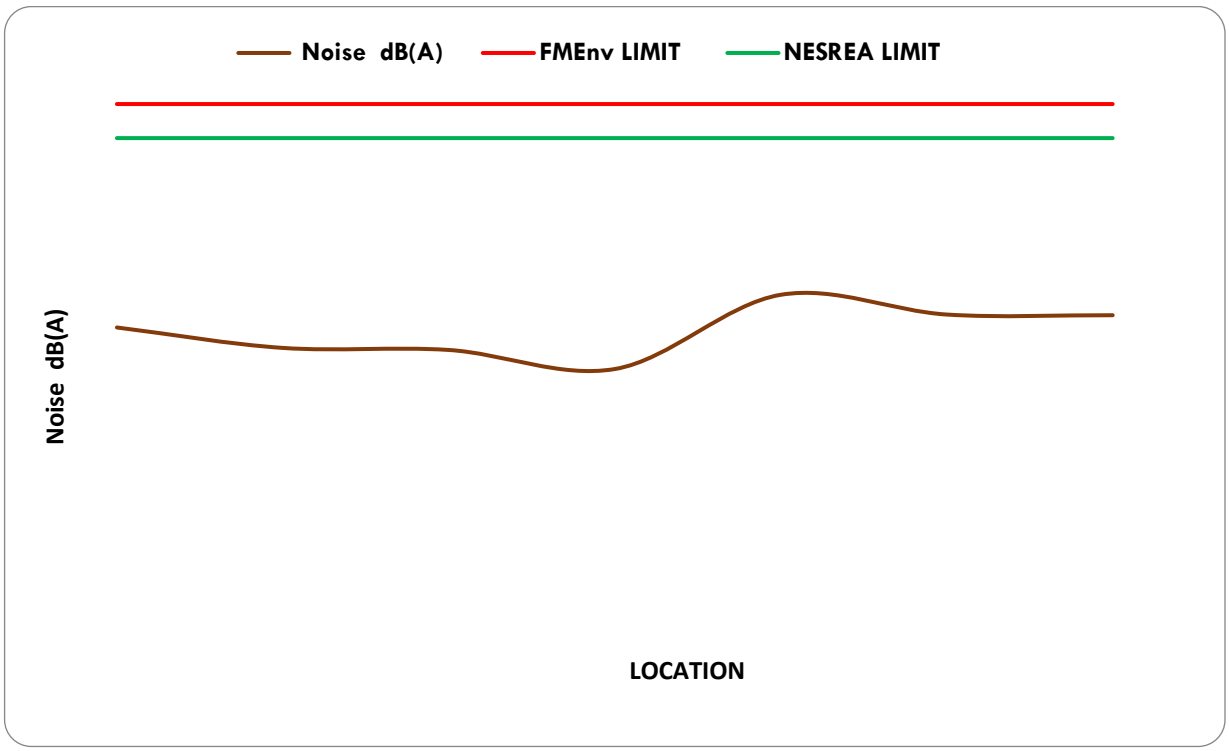


Figure 4.13: Graphical representation of Noise level dB(A) for wet season.

Figure 4.14: Air and Noise Sampled locations (wet season) at Adefolorunsho Technical Ventures limited Substation, Sango-Ota, Ogun State.

Source: Google Earth Pro, 2020

4.10 Land Tenure System and Land Use

This section presents the current land use in the study area and focuses on the identification of the land use characteristics of the area. The study combines ground trotting and observations involving residents who are familiar with the project area. Land tenure is an important part of social, political and economic structures. It is multi-dimensional, bringing into play social, technical, economic, institutional, legal and political aspects that are often ignored but must be taken into account. In simple terms, land tenure systems determine who can use what resources for how long, and under what conditions. Land use is defined as the arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain it. This definition establishes a direct link between land cover and the actions of people in their environment (Di Gregorio & Jansen, 2005). Land use surveys provide spatially defined information for land management, usually in the framework of rural development planning and decision making.

The land use classes, in their order of dominance, were as follows:

- Residential
- Commercial / Industrial

Commercial / Industrial: The project area is characterized by industrial and commercial activities; constituting approximately 50% of the total land use in the area. Notable industries are Food, Agro and Allied Industries Limited; Veepee Limited, Shongai Packaging Industries Ltd, Nigerian Breweries Plc. Ota, Vetri Industries Ltd; Homus Industries Limited among many others.

Residential Settlement: About 80% of the land within the 5km radius of the project site may be considered to be urban settlements. The settlement, housing patterns and demographic features of all communities are all characteristic of urban settlements.

Religious Places: Religious places have always been part of residential facilities in the land use structure. Few Mosques and churches were found in different parts of the area where people gather for religious purposes.

Adefolorunsho Technical Ventures limited substation is located in Sango-Ota with geographical coordinate latitude 06°42.754N and longitude 003°14.180E. She is bounded to the east by Shirish clinic, to the south by residence (Ifelodun community) and to the west by Jacob Nursery and Primary School.

4.11 Vegetation Cover Characteristics

The approach to ecological baseline data acquisition was an integrated and interdisciplinary one. The methods of data acquisition involve literature review and field survey. The field survey was carried out on 30th June, which was in wet season, to provide information on Flora and Fauna ecosystems while secondary data was collected in February 2018.

4.11.1 Flora

Vegetation is a general term for the plant life of a region; it refers to the ground cover provided by plants, and is, by far the most abundant biotic element of the biosphere. Vegetation serves several critical functions in the biosphere, at all possible spatial scales. It is psychologically important to humans, who evolved in direct contact with and dependence on vegetation for food, shelter and medicines. This is why the ecology of an area (flora and fauna) is an important component of the ecosystem. It is fascinating to observe, study and provides habitat for man, animals and maintains the functioning of the proposed ecological system. The existing climatic factors in Ogun State would have favored luxuriant tropical rainforests with teeming populations of fauna. However due to human activities, this one-time forested area has been drastically reduced.

The rapidly increasing human populations and expanding anthropogenic activities have brought about extensive land use changes throughout the area. The area is undergoing development and vegetation has been cleared for developmental projects such as housing, roads, worship centres and majorly commercial activities.

The flora observed in the Adefolorunso Technical Ventures Limited (ATVL) Substation EIA project area during the wet season include the following; *Stenotaphrum secundatum,* Abelmoschus esculentus, *Manihot esculenta, Aspilia Africana, Stenotaphrum secundatum, Cynodon dactylon, Cynodon dactylon and Mangifera indica* (Plates 4.7 – 4.13) as compared to *Stenotaphrum secundatum* and *Heliotropicum steudneri* recorded in the secondary data.

Plate 4.7: Common Name: Buffalo Grass
Family Name: Poaceae
Botanical Name: *Stenotaphrum secundatum*

Plate 4.8: Common Name: Ladies Finger
Family Name: Malvaceae
Botanical Name: Abelmoschus esculentus

Plate 4.9: Common Name: Cassava
Family Name: Euphorbiaceae
Botanical Name: *Manihot esculenta*

Plate 4.10: Common Name: Haemorrhage plant
Family Name: Asteraceae
Botanical Name: *Aspilia africana*

Plate 4.11: Common Name: Buffalo Grass
Family Name: Poaceae
Botanical Name: *Stenotaphrum secundatum*

Plate 4.12: Common Name: Bahama Grass
Family Name: Poaceae
Botanical Name: *Cynodon dactylon*

Plate 4.13: Common Name: Mango tree
Family Name: Anacardiaceae
Botanical Name: *Mangifera indica*

Table 4.25: Species list of the ATVL substation project area during wet season

S/N	Scientific Name	Family	Common name	Uses
1	*Stenotaphrum secundatum*	Poaceae	Buffalo Grass	Weed and Forage Crop
2	*Abelmoschus esculentus*	Malvaceae	Ladies Finger	The products of the plant are mucilaginous, resulting in the characteristic slime when the seed pods are cooked; the mucilage contains soluble fiber.
3	*Manihot esculenta*	Euphorbiaceae	Cassava	Used as important sources of food in the tropics. It offers flexibility to farmers because it serves as either subsistence or a cash crop.
4	*Aspilia africana*	Asteraceae	Haemorrhage plant	Also known as haemorrhage plant as it is applied on wounds to stop bleeding and for cleaning of surfaces of sores. It also helps to reduce febrile headache. The leaf is important as painkillers, sedatives and ecbolics.
5	*Hedera sp*	Araliaceae	Climbing Ivy	Used for their evergreen foliage, attracting wildlife, and for adaptable design uses in narrow planting spaces and on tall or wide walls for aesthetic addition.
6	*Mangifera indica*	Anacardiaceae	Mango	Used to treat diarrhaea, anaemia, dysentery, tumour, toothache, haemorrhage, pile etc Also used as laxative
7	Cynodon dactylon	Poaceae	Bahama Grass	Weed and Forage Crop

4.11.2 Fauna

The detection of faunal species is highly variable and dependent on the complex relationship between an animal's behavioral adaptations and its environment. Consequently, there is a high degree of variation in determining the composition of species in faunal assemblages. Field surveys were conducted to determine the types of fauna species present in the project area. Fauna species were taxonomically identified. Plate 4.14 show fauna species found around the project area. *Agama agama* were seen at the project site both during the wet season and secondary data used as vegetation was minimal of which could have disrupted the fauna natural habitat.

Plate 4.14: Fauna species (*Agama agama*) around the project area
Common Name: Red head Agama
Family Name: *Agamidae*
Botanical Name: *Agama agama*

4.12 Soil Quality

The field investigation and sampling were carried out on the 30th of June 2020 for the wet season while data was collected in February as recorded in the secondary data used. Following field reconnaissance and on basis of physiography (local relief), surface drainage, land use and cover types, five (5) soil sampling points including control point away from the site was established for the assessment of the soil quality during wet season. The results obtained are compared with analysis of four (4) sampled locations including control from the secondary data used.

Topsoil (0 – 15 cm) and subsoil (15 – 30 cm) samples were collected using Soil Auger. At each soil sampling location, minimum of two core soil samples were collected and bulked in two different plastic colorless buckets, one labeled as Topsoil and the other Subsoil. Collection of bulk/composite soil samples is reported to ensure that representative soil samples in an area are taken and thereby reducing local variability.

Following thorough homogenization of the bulked/composited core soil samples in each bucket, sub-samples were taken, and appropriately labeled for physical & chemical characterization, microbiology and the organics. The coordinates, land cover and brief description of the soil sampling environment were documented.

Laboratory Analysis

Soil sample analyses were carried out within the holding time of the respective parameters, and only functional and calibrated equipment was employed. Table 4.26 presents the summary of laboratory analytical methods used for the analysis of the soil samples collected within the study area.

Table 4.26: Summary of the Analytical Methods used for Soil Samples from the Study Area

PARAMETER	METHOD EMPLOYED
Physical	
Grain (Particle) Size Distribution	Hydrometer (Bouyoucos, 1951 ; Page *et al.*, 1996)
Organics:	
Total Hydrocarbons (THC) (or "Oil and Grease") Content	n-Hexane extraction/UV Spectrophotometer set at 420nm wavelength

Total Organic Carbon (TOC)	Dichromate Wet Oxidation (Walkley and Black, 1934; Page *et al*., 1996)
Metals:	
Alkali & Alkaline Metals (K, Na, Ca, Mg)	Digestion / Flame Photometry & AAS (Jones, 1988)
Heavy Metals: (Cd, Cr, Cu, Fe, Pb, Zn, Ni, Co, V)	Acid Digestion/Atomic Absorption Spectrophotometry (AAS) (Jones, 1998; Allen, 1974)
Physical / Chemical Properties/ Nutrients:	
pH	Glass electrode meter (Page *et al*., 1996)
Total Nitrogen	Macro Kjedahl (Jackson, 1962; Black, 1965; Page *et al*., 1996)
Exchangeable Acidity	Titration (Black, 1965; I.I.T.A., 1979)
Total Phosphorus	Colorimetric (Jones, 1998; Murphy and Riley, 1962; Page *et al*., 1996)
Sulfate – Sulfur	Turbidimetric (Tabatabi, 1974)
Chloride	Potassium Chromate/Silver Nitrate Titration

Quality Assurance and Quality Control

Quality assurance/quality control (QA/QC) formed an integral part of all aspects of the substation project and was used to address the variance associated with both the samples and analytical methods. Sample chain of custody forms were used for the registration and tracking of samples from the field to the laboratory. The quality assurance program was put in place to prevent sample contamination and deterioration, and covered all aspects of the study, including sample collection, handling, laboratory analysis, data coding, and manipulation, statistical analysis, presenting and communicating results.

In general, the followings were ensured:

- The study methodology was consistent with those approved by the national regulatory body, the FMEnv environmental guideline (1992);
- The study adequately encompassed the project area with sufficient buffer to capture the extreme boundaries of environmental influence the project may possibly have;

- Separate samples were collected for parameters requiring different treatment/preservation methodology before analysis; and
- Samples were adequately preserved and labeled.

Soil sample analyses were carried out within the holding time of the respective parameters, and only functional and calibrated equipment was employed.

Soil Physical Characteristics

To assess the quality of soils in the study area, top (0-15 cm) and sub (15-30 cm) soil samples (n = 1) was collected and analyzed. The physical and chemical properties of such soil samples are presented in Table 4.28 for wet season and table 4.29 for the secondary data used for comparison.

The soil texture in the area can be described as loamy sandy because of the dark colour noticed in the top soil although the soil morphology on the site indicated preponderance of fine sand. Top and surface soil particle size distribution and hence texturally are not significantly different.

Table 4.27: Geographical Sampling coordinates for soil quality during wet season

Location	Longitude	Latitude
SS1	003°14.180'E	06°42.754'N
SS3	003°14.184'E	06°42.749'N
SS3	003°14.192'E	06°42.755'N
SS4	003°14.204'E	06°42.747'N
SSC	003°14.280'E	06°42.801'N

Figure 4.15: Soil Sampling Location at Adefolorunsho Technical Ventures limited Substation, Sango-Ota, Ogun State

Source: Google Earth Pro, 2020

Table 4.28: Soil Sampled Results at the substation project site for wet season

S/N	PARAMETERS	SS1		SS2		SS3		SS4		Mean		SSC	
		Top Soil	Sub Soil	Top Soil	Sub-Soil	Top Soil	Sub-Soil	Top Soil	Sub-Soil	Top Soil	Sub-Soil	Top Soil	Sub-Soil
1	Colour	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown
2	Permeability (cm/s)	0.035	0.028	0.048	0.790	0.028	0.038	0.029	0.028	0.035	0.221	0.048	0.049
3	Porosity (%)	32.1	38.2	44.0	40.3	30.0	29.8	22.2	23.6	32.1	32.9	33.1	32.0
4	Bulk Density (g/cm3)	1.45	1.50	1.68	1.52	1.24	1.26	1.46	1.44	1.46	1.43	1.35	1.32
5	pH (Soil: Water,1:1)	6.5	6.7	6.5	6.5	7.3	7.5	6.6	6.8	6.7	6.9	7.2	7.4
6	Moisture Content (%)	8.0	9.16	8.90	8.56	8.39	8.69	8.90	9.16	8.54	8.89	10.40	10.8
7	CEC (meq/100g)	0.42	0.58	0.32	0.31	0.53	0.61	0.76	0.57	0.51	0.52	0.44	0.39
8	Total Organic Matter (%)	1.24	7.4	2.1	1.55	1.534	1.051	1.50	1.48	1.59	2.87	1.57	1.72
9	Total Organic Content (%)	0.72	2.6	0.67	0.52	0.89	0.61	1.80	1.76	1.02	1.37	1.02	1.99
10	Sulphate (mg/kg)	50.68	70.73	60.4	77.45	46.09	57.10	98.5	70.9	63.9	69.04	55.8	62.7
	Nitrate (mg/kg)	80.0	70.9	87.8	76.0	78.50	79.7	90.2	86.56	84.13	78.29	82.3	89.7
11	Potassium (mg/kg)	572.0	364.5	458.5	266.1	182.8	165.51	210.6	214.9	355.9	252.8	196.4	198.6
12	THC	0.290	0.440	0.329	0.016	0.015	0.020	0.099	0.080	0.183	0.139	0.404	0.305
13	Chromium (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
14	Iron (mg/kg)	85.5	50.5	23.0	39.4	27.50	28.56	34.9	38.9	42.7	39.34	22.5	20.5
15	Cadmium (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001
16	Zinc (mg/kg)	1.199	1.309	1.414	1.369	1.340	1.303	1.398	1.369	1.338	1.338	1.297	1.290
17	Copper (mg/kg)	0.204	0.244	0.199	0.309	0.298	0.222	0.233	0.253	0.234	0.257	0.172	0.250
18	Nickel (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
19	Lead (mg/kg)	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
20	Faecal Coliform	1	1	7	3	2	1	3	6	4	3	2	3
21	THB	5.2×10^1	4.7×10^1	2.4×10^1	1.7×10^1	2.0×10^1	2.2×10^1	2.1×10^1	2.1×10^1	2.9×10^1	2.8×10^1	1.1×10^1	1.3×10^1
22	THF	4.0×10^1	3.3×10^1	1.5×10^1	1.3×10^1	1.9×10^1	1.6×10^1	1.9×10^1	2.0×10^1	2.3×10^1	2.1×10^1	1.4×10^1	1.4×10^1

Table 4.29: Analysis Result of the Soil samples for secondary data

S/N	PARAMETERS	SS1		SS2		SSC1		SSC2		FMEnv LIMIT
		Top Soil	Sub Soil	Top Soil	Sub-Soil	Top Soil	Sub-Soil	Top Soil	Sub-Soil	
1	pH (Soil: Water,1:1)	7.6	7.4	8.1	7.8	7.3	7.5	7.2	7.4	NS
2	Moisture Content (%)	7.5	2.6	6.4	2.8	5.0	2.5	4.8	3.5	NS
3	Total Organic Matter (%)	1.24	0.99	2.1	1.55	1.534	1.051	2.57	1.96	NS
4	Total Organic Content (%)	0.72	0.58	0.67	0.52	0.89	0.61	1.02	1.99	NS
5	Sulphate (mg/kg)	50.68	70.73	60.4	77.45	46.09	57.10	55.8	62.7	NS
6	Nitrate (mg/kg)	35.00	18.1	33.58	20.22	18.50	23.50	22.8	31.2	NS
7	Chromium (mg/kg)	1.55	1.35	2.01	1.8	4.75	1.45	5.9	3.2	100
8	Iron (mg/kg)	66.57	109.04	70.5	118.5	207.50	128.56	222.5	201.5	NS
9	Cadmium (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	3
10	Zinc (mg/kg)	24.53	20.62	33.5	28.3	6.92	8.19	9.25	11.2	421
11	Copper (mg/kg)	5.08	7.19	6.22	9.01	3.66	2.82	4.55	3.85	NS
12	Potassium (mg/kg)	772.20	604.54	558.5	466.9	82.76	65.51	96.6	78.5	NS
13	Sodium (mg/kg)	359.03	211.87	401.8	335.2	95.85	70.39	100.8	85.3	NS
14	Nickel (mg/kg)	<0.001	<0.001	0.001	0.001	<0.001	0.001	<0.001	0.001	NS
15	Lead (mg/kg)	1.74	0.85	1.005	0.09	<0.001	<0.001	0.001	<0.001	164

Results Discussion for soil analysis

pH: The pH is a measure of the degree of its acidity and alkalinity. The mean pH values of the top soil and sub soil samples were 6.7 and 6.9. The pH value of the top soil samples ranged from 6.5-7.3 and 7.2 for control. The pH value of the sub soil samples ranged from 6.5-7.5 with 7.4 at the control point during the wet season. However, for the secondary data the pH values was in the range 7.6 - 8.1, sub soil was in the range 7.5 – 7.8 with control points having a range of top soil 7.2 – 7.3 and sub soil 7.4 – 7.5

Permeability: it is the ability of a substance to allow gases or liquids to pass through it. During wet season, the mean permeability values of the top soil and sub soil samples were 0.035cm/s and 0.221cm/s respectively. The permeability value of the top soil samples ranged from 0.028cm/s-0.048cm/s and control of 0.048cm/s while that of the sub soil samples ranged from 0.028cm/s-0.790cm/s and control value of 0.049cm/s.

Porosity: is the ability of a particle or substance to have small holes, so that liquid or air can pass through. The mean porosity values of the top soil and sub soil samples during the wet season were 32.1% and 32.9% respectively. The porosity value of the top soil samples ranged from 22.2% - 44.0% and 33.1%. at the control. The porosity value of the sub soil samples ranged from 23.6% – 40.3% and 32.0% at the control. There was no record for porosity in the secondary data.

Moisture Content: is the percentage of liquid such as water in a substance. The mean moisture content values of the top soil and sub soil samples were 8.54% and 8.89% respectively. The moisture content value of the top soil samples ranged from 8.0% - 8.9% and control of 10.4% but of the sub soil samples ranged from 8.56% – 9.16% with a control of 10.8%. The secondary data had moisture content value of the top soil samples ranged from 6.4% - 7.5%. The moisture content value of the sub soil samples ranged from 2.6– 2.8% with a control range of 4.8% – 5.0% at the topsoil and 2.5% – 3.5% at the subsoil.

Bulk density is the weight of soil in a given volume. Bulk density increases with compaction and tends to increase with depth. The mean bulk density values of the top soil and sub soil samples were 1.46% and 1.43% respectively. The bulk density value of the top soil samples ranged from 1.24% - 1.68% with control value of 1.35% while the sub soil samples ranged from 1.26% – 1.52% and control of 1.32%. Nothing was recorded for bulk density in the secondary data report.

Heavy Metals: refers to any metallic chemical element that has a relatively high density and is toxic or poisonous at low concentrations. Heavy metals in the soil sample such as cadmium, chromium, nickel and lead were recorded below the detection limit of Atomic Absorption Spectrophotometer (AAS) used for the analysis for the wet season analysis results while only cadmium and Nickel was not detected at all the sampling points in the secondary data report..

Copper: The mean copper values of the top soil and sub soil samples were 0.234mg/kg and 0.257mg/kg respectively. The copper value of the top soil samples ranged from 0.199mg/kg – 0.298mg/kg and 0.172mg/kg at control. The value of the sub soil samples ranged from 0.222mg/kg – 0.309mg/kg and 0.250mg/kg at control for wet season data. Moreover, the secondary data had top soil samples range from 5.08mg/kg – 6.22mg/kg. The value of the sub soil samples ranged from 7.09mg/kg – 9.01mg/kg with the control range of 3.66 mg/kg – 4.55 mg/kg for topsoil and range of 2.82 mg/kg – 3.85 mg/kg for subsoil.

Zinc: The mean zinc values of the top soil and sub soil samples were 1.338mg/kg and 1.338mg/kg respectively. The zinc value of the top soil samples ranged from 1.199mg/kg – 1.398mg/kg and control of 1.290mg/kg. The zinc value of the sub soil samples ranged from 1.303mg/kg – 0.369mg/kg with control of 1.297mg/kg for wet season. The zinc value of the top soil samples ranged from 24.53mg/kg – 33.5mg/kg. The zinc value of the sub soil samples ranged from 20.62mg/kg – 28.3mg/kg with control range of 6.92 mg/kg – 9.25 mg/kg for topsoil and 8.19 mg/kg – 11.2 mg/kg for subsoil in the secondary data report. All the values in both seasons were within 421mg/kg as stipulated by FMEnv.

Iron: For wet season, the mean iron values of the top soil and sub soil samples were 42.7mg/kg and 39.4mg/kg respectively. The iron value of the top soil samples ranged from 23.0mg/kg – 85.5mg/kg and control of 22.5mg/kg. The iron value of the subsoil samples ranged from 28.56mg/kg – 50.5mg/kg and control of 20.5mg/kg. In the secondary data, the iron value of the top soil samples ranged from 66.57mg/kg – 70.5mg/kg. The iron value of the sub soil samples ranged from 109.04mg/kg – 118.5mg/kg and control range were 207.50mg/kg - 222.5 mg/kg for topsoil and 128.56 mg/kg - 201.5 mg/kg for subsoil.

Microbial Characteristics of Soil Sample Analysis during wet season

For the soil sample during the wet season, the mean faecal coliform count of the top soil and sub soil samples were 4cfu/g and 3cfu/g respectively. The faecal coliform count of the top soil samples ranged from 1cfu/g – 7cfu/g while control sample was 2cfu/g. The faecal coliform count of the sub soil samples ranged from 1cfu/g – 6cfu/g and control sample was 3cfu/g.

The mean total heterotrophic bacteria counts of the top soil and sub soil samples were 2.9 x 10^1cfu/g and 2.8 x 10^1cfu/g respectively. The total heterotrophic bacteria count of the top soil samples ranged from 2.0 x 10^1cfu/g – 5.2 x 10^1cfu/g and control sample was 1.1 x 10^1cfu/g. The total heterotrophic bacteria count of the sub soil samples ranged from 1.7 x 10^1cfu/g – 4.7 x 10^1cfu/g but control sample was 1.3 x 10^1cfu/g..

The mean total heterotrophic fungi counts of the top soil and sub soil samples were 2.3 x 10^1cfu/g and 2.1 x 10^1cfu/g respectively. The total heterotrophic fungi count of the top soil samples ranged from 1.5 x 10^1cfu/g – 4.0 x 10^1cfu/g with control sample 1.4 x 10^1cfu/g. The total heterotrophic fungi count of the sub soil samples ranged from 1.3 x 10^1cfu/g – 3.3 x 10^1cfu/g and control sample was1.4 x 10^1cfu/g.
No microbiology result was recorded for the secondary data.

Plate 4.15: Soil sampling using a soil auger by Azmarineberg personnel

4.13 Water Quality

Water safety and quality are fundamental to human development and well-being. Providing access to safe water is one of the most effective instruments in promoting health and reducing poverty. The international authority on public health and water quality, WHO leads global efforts to prevent transmission of waterborne disease by promoting health-based regulations to governments and working with partners to promote effective risk management practices to water suppliers, communities and households. Water is essential to human life and the health of the environment as a valuable natural resource, it comprises of surface and groundwater environment that stretch across coastal and inland areas used for various purposes such as commercial/industrial, domestic, agricultural, recreational, scientific research and transportation.

Water quality is commonly defined by its physical, chemical, biological and aesthetic (appearance and odour) characteristics. Although scientific measurements are used to define water quality, it is not a simple thing to say 'that water is good' or 'that water is bad', so the

determination is typically made relative to the purpose of the water-is it for drinking or for other purposes. A healthy environment is one in which the water quality supports a rich ecosystem habitat and protects public health. Poor water quality poses a health risk for human lives, ecosystems as well as commercial and domestic value of our water resources will diminish. This water quality monitoring aim is to provide information to answer questions relating to the management of water and protection of aquatic habitat. The water sample was collected from the water treatment plant located within the company premises. The physico-chemical characteristics of the ground water sample were analyzed to ascertain the quality of water in the premises. The methodology used and results are discussed below.

4.13.1 Sampling Methodology and Analysis Methods

For this Environmental Impact Assessment report, two (2) ground water samples and one control sample were collected within 1km radius of the project site. The sample thereafter was stored in an ice box on site and transported immediately to a Federal Ministry of Environment (FMEnv) accredited laboratory – Azmarineberg limited, Plot 242 Ganiyu Alimi crescent Gbagada Phase 2 Lagos - for analysis of other physico-chemical and microbiological parameters. The physico-chemical characteristics of the water samples were analyzed to ascertain the quality of water in the premises. Standard methods of analysis of water and wastewater (summarized in Table 4.25) contained in the handbook ***"Standard Methods for the Examination of Water and Wastewater"*** 22st Edition of 2012 Prepared and Published by The American Public Health Association (APHA). American Water Works Association (AWWA) and Water Environment Federation (WEF) was used. Some parameters such as; pH, Dissolved Oxygen (DO), Total Dissolved Solids (TDS) and Conductivity were measured *in-situ* with calibrated potable meters. Table 4.32 below show the results of analysis of water samples collected for wet season.

Table 4.30: Geographical Sampling coordinates for ground water quality during wet season

Location	Longitude	Latitude
GW1	003°14.200'E	06°42.741'N
GW3	003°14.218'E	06°42.752'N
GWC	003°14.072'E	06°42.681'N

Table 4.31: Methods for the Analysis of Water Samples

PARAMETERS	STANDARD REFERENCE	TEST METHODS
pH	APHA 4500-H B	Electrometric Method
Conductivity	APHA 2510-B	Electrometric Method
Turbidity	APHA 2130 B	Nephelometric Method
Total hardness	APHA 2340-C	EDTA Titrimetric Method
Dissolved Oxygen	APHA 4500-O G	Membrane Electrode Method
Fluoride	APHA 4500-F C	Ion-Selective Electrode Method
Chloride	APHA 4500-Cl B	Argentometric Titration Method
Calcium	APHA 3500-Ca B	EDTA Titrimetric Method
Acidity	APHA 2310-B	Titrimetric Method
Salinity	APHA 2520 B	Electrical Conductivity Method
Alkalinity	APHA 2320-B	Titrimetric Method
Nitrate	APHA 4500-E	UV Spectrophotometer Method
Sulphate	APHA 4500 S0 E	UV Spectrophotometer Method
Total solids	APHA 2540 B	Gravimetric Method
Total dissolved solids	APHA 2540 C	Gravimetric Method
Total suspended solids	APHA 2540 D	Gravimetric Method
Total Phosphorus	APHA 4500-P E	Ascorbic Acid Method
Total Nitrogen	APHA 4500-N C	Persulphate Digestion Method
Total Hardness	APHA 2340 B	EDTA Titrimetric Method
Biochemical Oxygen Demand	APHA 5210 B	Hach's Method
Zinc	APHA 3111 B	Atomic Absorption Spectrophotometry
Sodium	APHA 3500-Na B	Flame Photometric Method
Potassium	APHA 3500-K B	Flame Photometric Method
Nickel	APHA 3111 B	Atomic Absorption Spectrophotometry
Mercury	APHA 3112	Atomic Absorption Method
Manganese	APHA 3111 B	Atomic Absorption Spectrophotometry
Magnesium	APHA 3500-Mg B	Atomic Absorption Spectrophotometry
Lead	APHA 3111 B	Atomic Absorption Spectrophotometry
Iron	APHA 3111 B	Atomic Absorption Spectrophotometry
Copper	APHA 3111 B	Atomic Absorption Spectrophotometry
Chromium	APHA 3111 B	Atomic Absorption Spectrophotometry
Cadmium	APHA 3111B	Atomic Absorption Spectrophotometry
Barium	APHA 3113 B	Atomic Absorption Spectrometry
Arsenic	APHA 3113 B	Atomic Absorption Spectrometry
Aluminium	APHA 3113 B	Atomic Absorption Spectrometry
Total coliform	APHA 9221 B	Multiple-Tube Fermentation Technique
Faecal coliform	APHA 9221 E	Membrane Filter Technique

Figure 4.16: Aerial Image of Water Sampling at Adefolorunsho Technical Ventures limited Substation, Sango-Ota, Ogun State

Source: Google Earth Pro, 2020

Table 4.32: Ground water analysis results for wet season

S/N	PARAMETERS	GW1	GW2	MEAN	GWC	FMEnv LIMIT (Maximum Permissible Level)
PHYSICOCHEMICAL						
1	pH @ 25^{0}C	6.2	6.4	6.3	6.4	6.5-8.5
2	Colour (Pt.Co)	5	3	4	4	15.0
3	Temperature (^{0}C)	25.3	24.7	25	25.9	NS
4	Dissolved Oxygen (mg/L)	0.4	0.3	0.35	0.4	7.5
5	Conductivity (µs/cm)	51.9	64.5	58.2	190.4	NS
6	Total Dissolved Solids (mg/L)	25.9	29.4	27.7	94.2	500
7	Total Suspended Solid (mg/l)	5.0	7.9	6.5	22.4	>10
8	Total Hardness (mg $CaCO_3$/L)	16.0	30.4	23.2	21.6	200
9	Chloride (mg/L)	17.5	19.4	18.4	18.5	250
10	Magnesium (mg/L)	1.45	1.55	1.50	1.98	NS
11	BOD (mg/L)	13.0	15.1	14.1	5.3	Nil
12	COD (mg/L)	35.1	40.7	37.9	14.6	NS
13	Nitrite (mg/L)	0.01	0.01	0.01	0.04	1.0
14	Nitrate (mg/l)	0.97	0.61	0.79	0.07	10.0
15	Sulphate (mg/L)	1.34	1.55	1.45	1.47	500
16	Cyanide (mg/L)	<0.001	<0.001	<0.001	<0.001	0.1
17	Flouride (mg/L)	<0.001	<0.001	<0.001	<0.001	1.5
18	THC (mg/L)	<0.05	<0.03	<0.03	<0.03	NS
HEAVY METALS						
19	Iron (mg/L)	0.01	0.03	0.02	0.01	1.0
20	Manganese (mg/L)	<0.001	<0.001	<0.001	<0.001	0.05
21	Cadmium (mg/L)	<0.001	<0.001	<0.001	<0.001	0.01
22	Copper (mg/L)	0.004	0.001	0.0025	0.006	0.1
23	Zinc (mg/L)	0.004	0.014	0.009	0.02	5.0
24	Arsenic (mg/L)	<0.001	<0.001	<0.001	<0.001	0.2
25	Lead (mg/L)	<0.001	<0.001	<0.001	<0.001	0.05
26	Nickel (mg/L)	<0.001	<0.001	<0.001	<0.001	0.05
27	Chromium (mg/L)	<0.001	<0.001	<0.001	<0.001	0.05
MICROBIOLOGICAL TEST						
28	Faecal Coliform (cfu/100ml)	17	6	12	1	NS
25	Total Plate Count (cfu/100ml)	30	25	28	16	NS
26	Total Heterotrophic Bacteria (cfu/ml)	1.0 X 10^1	0.3 X 10^1	0.7 X 10^1	1.4 X 10^1	NS
27	Total Heterotrophic Fungi (cfu/ml)	1.0 X 10^1	1.6 X 10^1	1.3 X 10^1	0.1 X 10^1	NS

Table 4.33: Analysis Result of Water Samples from secondary data report

S/N	PARAMETERS	GWS1	GWS2	GWC1	FMEnv (Maximum Permissible Level)
PHYSICOCHEMICAL					
1	Colour (unit)	4	3	4	50
2	pH @ 25^{0}C	**4.9**	6.6	**4.6**	6.5-9.2
3	Dissolved Oxygen (mg/L)	4.0	3.2	3.4	NS
4	Conductivity (µs/cm)	76.2	80.3	69.3	NS
5	Chloride (mg/L)	23.27	25.6	19.54	600
6	Total Hardness (mg $CaCO_3$/L)	20.0	33.2	28.0	500
7	Total Dissolved Solids (mg/L)	38.1	39.8	34.7	NS
8	Nitrite (mg/L)	0.003	0.001	0.002	2
9	Sulphide (mg/L)	0.018	0.01	0.055	NS
10	Sulphate (mg/L)	3.61	3.1	2.8	400
11	Cyanide (mg/L)	<0.001	<0.001	<0.001	NS
12	Flouride (mg/L)	<0.001	<0.001	<0.001	1.5
	HEAVY METALS				
13	Iron (mg/L)	0.03	0.02	0.05	1.0
14	Manganese (mg/L)	<0.001	<0.001	<0.001	0.5
15	Cadmium (mg/L)	<0.001	<0.001	<0.001	NS
16	Copper (mg/L)	<0.001	0.001	0.006	1.5
17	Zinc (mg/L)	0.020	0.04	0.017	15
18	Arsenic (mg/L)	<0.001	<0.001	<0.001	NS
19	Magnesium (mg/L)	2.91	3.2	4.08	150
MICROBIOLOGICAL TEST					
20	Total Plate Count (cfu/100ml)	1	0	2	NS
21	Total Coliform (cfu/100ml)	2	1	3	10

Discussion for water quality

pH: The pH of water is a measure of the degree of its acidity and alkalinity. The pH values of the ground water samples were 6.2 and 6.4 with mean as 6.3. The pH value for the control sample was 6.4. All values recorded were lower than the **FMEnv LIMIT** of 6.5-8.5 during the wet season. For the secondary data, the pH values of the groundwater samples were 4.9, 6.6 and 4.6 respectively. The pH values for GWS1and GWC1were lesser than the FMEnv's Maximum Permissible Level while that of GWS2 complied. The pH values obtained from the analysis of the water samples (GWS1and GWC1) were observed to fall within the acidic mark; thus, showing acidity of the ground water samples.

Dissolved Oxygen: For the wet season, the dissolved oxygen is a measure of the amount of oxygen dissolved in the ground water sample. The dissolved oxygen values of the ground water samples were 0.4mg/L and 0.3mg/L with mean as 0.35mg/L. while value for the control sample was 0.4mg/L. All values recorded were below the **FMEnv LIMIT** of 7.5mg/L. For the secondary data, the dissolved oxygen values of the ground water samples were 4.0mg/L and 3.4mg/L and were below **FMEnv LIMIT** of 7.5mg/L

Electrical Conductivity: Electrical conductivity is the ability of any medium to carry an electric current. The presence of dissolved solids such as calcium, chloride, and magnesium in samples carries the electric current through it. The conductivity values of the ground water samples were 51.9µs/cm and 64.5µs/cm with mean as 58.2µs/cm. The conductivity value for the control sample was 190.4µs/cm for wet season. For the secondary data, the values were 76.2 µs/cm and 80.3 µs/cm with control value of 69.3 µs/cm. No limit was specified by FMEnv for this parameter.

Total Dissolved Solids: Total dissolved solids (TDS) is a measure of all dissolved substances in water, including organic and suspended particles that can pass through a very small filter. TDS is an indicator of how much ions are dissolved in the samples. The total dissolved solids of the ground water samples were 25.9mg/L and 29.4mg/L with mean as 27.7mg/L. The total dissolved solids for the control sample was 94.2mg/L. All values were within the FMEnv LIMIT of 500mg/L. during the wet season. Similarly, for the secondary data the values were 38. mg/L and 39.8 mg/L with control value of 34.7mg/L. All values were also within the FMEnv LIMIT of 500mg/L.

Biochemical Oxygen Demand (BOD) is the amount of dissolved oxygen needed (i.e. demanded) by aerobic biological organisms to break down organic material present in a given water sample at certain temperature over a specific time period. The BOD value of the ground water samples were 13.1mg/L and 15.1mg/L with mean as 14.1mg/L. The BOD value for the control sample was 5.3mg/L. All values are higher than the FMEnv LIMIT of 0mg/L. during the wet season period. There was no record for biochemical oxygen demand in the secondary data report.

Chemical Oxygen Demand (COD): In environmental chemistry, the chemical oxygen demand (COD) is an indicative measure of the amount of oxygen that can be consumed by reactions in a measured solution. The COD value of the ground water samples were 35.1mg/L and 40.7mg/L with mean as 37.9mg/L. The COD value for the control sample was 14.6mg/L. There was no record for Chemical Oxygen Demand in the secondary data report.

Magnesium: The magnesium concentration of the ground water samples were 1.45mg/L and 1.55mg/L with mean as 1.50mg/L. The magnesium concentration for the control sample was 1.98 for wet season.

Nitrate: Nitrate is a chemical which includes nitrogen and oxygen, often used as a fertilizer. The nitrate concentration of the ground water samples were 0.97mg/L and 0.61mg/L with mean as 0.79mg/L. The nitrate concentration for the control sample was 0.07 mg/L. All values were within the **FMEnv LIMIT of 10mg/L.** during wet season.

Chloride: For the wet season, the chloride concentration of the ground water samples were 17.5mg/L and 19.4mg/L with mean as 18.4mg/L. The chloride concentration for the control sample was 18.5 mg/L. All values were within the **FMEnv LIMIT** of **250mg/L**. For the secondary data the values obtained were 23.27mg/L and 25.6mg/L with control value being 19.54mg/L and were also within **FMEnv LIMIT** of **250mg/L.**

Hardness: Water described as "hard" is high in dissolved minerals, specifically calcium and magnesium. The degree of hardness becomes greater as the calcium and magnesium content increases. The hardness concentration of the ground water samples were 16.0mg/L and 30.4mg/L with mean as 23.2mg/L. The hardness concentration for the control sample was

21.6mg/L. All values are within the **FMEnv LIMIT** of **200mg/L.** For the secondary data the values were 20.0 mg/L and 33.2 mg/L with a value of 28.0 mg/L obtained for the control location. All values were within the **FMEnv LIMIT** of **200mg/L.**

Heavy Metals: Heavy metals in the ground water samples such as manganese, chromium, lead, cadmium, arsenic and nickel were recorded below the detection limit of Atomic Absorption Spectrophotometer (AAS) used for the analysis during the wet season. Meanwhile, manganese, cadmium, arsenic and copper were not detected for values recorded in the secondary data report. All samples for both seasons were thus within specified limits.

Iron: The iron concentration of the ground water samples were 0.01mg/L and 0.03mg/L with mean as 0.02mg/L. The iron concentration for the control sample was 0.01mg/L. All values were within the **FMEnv LIMIT** of **1.0mg/L** for the wet season. For the secondary data recorded Iron values were 0.03mg/L and 0.02mg/L with a value of 0.05mg/L at the control point. All values were within the **FMEnv LIMIT** of **1.0mg/L.**

Copper: The copper concentration of the ground water samples were 0.004mg/L and 0.001mg/L with mean as 0.0025mg/L. The copper concentration for the control sample was 0.006mg/L. All values were within the **FMEnv LIMIT** of **0.1mg/L.**

Zinc: The zinc concentration of the ground water samples were 0.004mg/L and 0.014mg/L with mean as 0.009mg/L. The zinc concentration for the control sample was 0.02mg/L. All values were within the **FMEnv LIMIT** of **5.0mg/L.** For the secondary data the values were 0.02mg/L and 0.04mg/L and a control value of 0.017mg/L. All values were within the **FMEnv LIMIT** of **5.0mg/L.**

Microbial Characteristics of the ground water samples

In the ground water during the wet season, the faecal coliform count of the ground water samples were 17cfu/100ml and 6cfu/100ml with mean as 12cfu/100ml. The faecal coliform count for the control sample was 1cfu/100ml.

The total plate count of the ground water samples were 30cfu/100ml and 25cfu/100ml with mean as 28cfu/100ml. The total plate count for the control sample was 16cfu/100ml.

The total heterotrophic bacteria of the ground water samples were 1.0 X 10^1cfu/ml and 0.3 X 10^1cfu/ml with mean as 0.7 X 10^1cfu/ml. The total heterotrophic bacteria for the control sample was 1.4 X 10^1cfu/ml.

The total heterotrophic fungi of the ground water samples were 1.0 X 10^1cfu/ml and 1.6 X 10^1cfu/ml with mean as 1.3 X 10^1cfu/ml. The total heterotrophic fungi for the control sample was 0.1 X 10^1cfu/ml.

However, for the secondary data used, total plate bacteria were observed in GWS1 (1cfu/100ml) and GWC1 (2cfu/100ml). The Total Coliform Count for all the water samples was however lesser than the specified FMEnv Maximum Permissible Level of 10cfu/100ml. The Coliform bacteria (a faecal indicator bacteria) are not pathogenic (disease causing) organisms but are only mildly infectious.

Plate 4.16: Water sampling around the substation project area by Azmarineberg personnel

4.14 Socioeconomic Study

The socio-economic, cultural and health profiles of the proposed project area are discussed under various sections. The information covers both the results from analysis of questionnaires administered as well as secondary sources of information about Ogun State.

4.14.1 Questionnaire Administration and Response

The questionnaires were administered within 5km radius of the project area predominated by both commercial and residential buildings. More than 50% of the population is likely to fall below the age bracket of target respondents age 18 and above. In deciding the sample size for this study, the following steps were taken:

- First, the size of the population within the project area was estimated.
- Determination of the desired precision of results. This is the closeness with which the sample predicts where the true values in the population lie. The difference between the sample error was put at 0.1.
- Determination of Confidence Level which is expressed as a percentage and represents how often the true percentage of the population who would pick an answer lies within the confidence interval. A 95% confidence level was used.

Ado-Odo/Ota Local Government Area had a total Population figure of about 527,242 people with a landmass of 878km^2 according to 2006 census. After 10 years, the estimated population of people living in Ado-Odo/Ota was about 733,400 people showing a growth rate of 39.10%.

Using the estimated 733,400 population based on official growth rate, it is estimated that the present population density of the study area is approximately 835 people per square kilometer. The estimated population size, at 95% Confidence Level and margin of error of 5%, the ideal sample size for the study was 83 respondents. However, only 30 people were interviewed due to unavailability of many inhabitants from the project area. The low number of people interviewed was due to unavailability of many residents who usually return from work to their residences late.

4.14.2 Historical Background and Social Structure

The Ado-Odo/Ota Local Government Area is one of the 20 Local Government Areas of Ogun State, Nigeria. It came into existence on May 19, 1989, following the merging of Ota, part of

the defunct Ifo/Ota Local Government with Ado-Odo/Igbesa Areas of the Yewa South Local Government. Ado-Odo/Ota borders on metropolitan Lagos. The Local Government Area is the second largest in Ogun State and it is headquartered at Ota (or Ota). Other towns and cities include Ado-Odo, Agbara, Igbesa, Iju-Ota, Itele, KookoEbiye Town, Owode, Sango Ota etc. The Local Government is populated mainly by the Awori people, a subset of the Yorubas and the original inhabitants of the area. Being primarily agrarian in nature, the Local Government Area produces cash and food crops especially cocoa, kola nut, palm oil, coffee, cassava, timber, maize, and vegetables. Mineral resources include kaolin, silica sand, gypsum, and glass sand.

Traditional Awori Yoruba folklore tells that Olofin's children, Osolo and Eleidi Atalabi founded Ota after migrating south from Isheri.Ota soon became important in the production and sale of cocoa. In 1842, the expansion of the Egba nation brought Ota under the control of Abeokuta, however Ota held a semi-independent status within the Egba kingdom, and remained the capital of the Awori people. Ota began to grow into the industrial city it is today and this led to the official designation of Ota as an industrial town, and the state government began to encourage industries to locate in and around the city.

Administrative Structure

Ogun State Government, in line with the 1999 Constitution, is made up of three arms –the Executive, the Legislature and the Judiciary. The Executive Arm comprises of the State Executive Council with an Elected Governor as its Chairman and the Deputy Governor, Secretary to the State Government, Head of the State Civil Service and Commissioners as members. The Executive arm is organized into Ministries, Agencies and Parastatals with offices at the State Secretariat. All the ministries have active programs that focus on education, economic and Agricultural development, land management, environmental protection and human related activities. Policy decisions are taken by the Executive Council and the responsibility of implementing such lies with commissioners through their respective Ministries and Agencies. The Political Administrative seat of Ado-Odo/Ota Local Government Area is located in Ado-Odo-Ota LG Secretariat, Ota, Ogun State. By all standards, Ado-Odo/Ota Local Government Area is an urban settlement given the available evidence of physical, human, economic development and social infrastructure forming part of the familiar landscaping of the Local Government Area.

Traditional Administrative Structure

Traditional institutions play a significant social role in governance. They are increasingly seen as part of the social capital of society. They serve primarily as custodians of people's culture and advisers to the government on traditional affairs.

Ogun state Government recognizes the effectiveness of traditional administrations in fostering grassroots socio-economic development and empowerment of people under their domains. It has acknowledged the critical importance of incorporating this institution as partner in the development process. The traditional administrations in the State are empowered to function as Government partners in:

- Fostering peace, harmony, social cohesion and security within and between their domains;
- Grassroots mobilization, advocacy and enlightenment of the people on Government programmes;
- Dispute resolution and settlement of other domestic disputes such as land, marriage and trade.

The project area is locally ruled by a crowned Oba, called the Olota of Ota; whose ruling privilege came from the Yoruba traditional home of Ile-Ife .There are currently Ten (10) other Traditional Obaship institutions in the Local Government Area

Demographics Characteristics

The total population of Nigeria in 2010 was estimated to be 158.4 million, with a population growth rate of three percent per year (World Bank, 2010). Approximately 51 percent of the national population is male, against 49 percent female. In 2009, Nigeria reported an average life expectancy at birth of 51 years, which was broken down into a life expectancy of 50 years for men and 52 years for women (World Bank, 2010). In 2007, the WHO reported that 70.8 percent of the population was living below the poverty line of less than USD1 per day (WHO, 2010).

According to the 2006 census figures, the population of Ogun State in general was 3,934,899 persons; Ado-Odo/Ota Local Government Area had a total Population figure of about 527,242 people. After 10 years, the estimated population of people living in Ado-Odo/Ota was about 733,400 people showing a growth rate of 39.10%. By virtue of the level of industrial, economic development and population concentration, the Local Government is rural-urban in status.

Table 4.34: Population Figures of the Local Government Areas (LGAs) of Ogun State

Local Government Area	Population
Ifo	539,170
Ado-Odo/Ota	**527,242**
Ijebu North	280,520
Shagamu	255,885
Abeokuta South	250,295
Obafemi-Owode	235,071
Abeokuta North	198,793
Egbado North	183,844
Egbado South	168,336
Ijebu Ode	157,161
Ipokia	150,387
Odogbolu	125,657
Ikenne	119,117
Odeda	109,522
Ijebu East	109,321
ImekoAfon	82,952
Ogun Waterside	74,222
Ijebu North East	68,800
Remo North	59,752
Ewekoro	55,093
TOTAL	**3,751,140**

Source: National Population Commission (National Census, 2006)

Population Structure and Distribution of Respondents

Male respondents across the communities within the spatial boundary constitute 53.3% of the total number of people interviewed while 46.7% of the respondents were female, as shown in Figure 4.27.

Table 4.35: Population Structure and Distribution of Respondents

Respondents	**Number**	**Percentage %**
Male	16	53.3%
Female	14	46.7%
Total	30	100

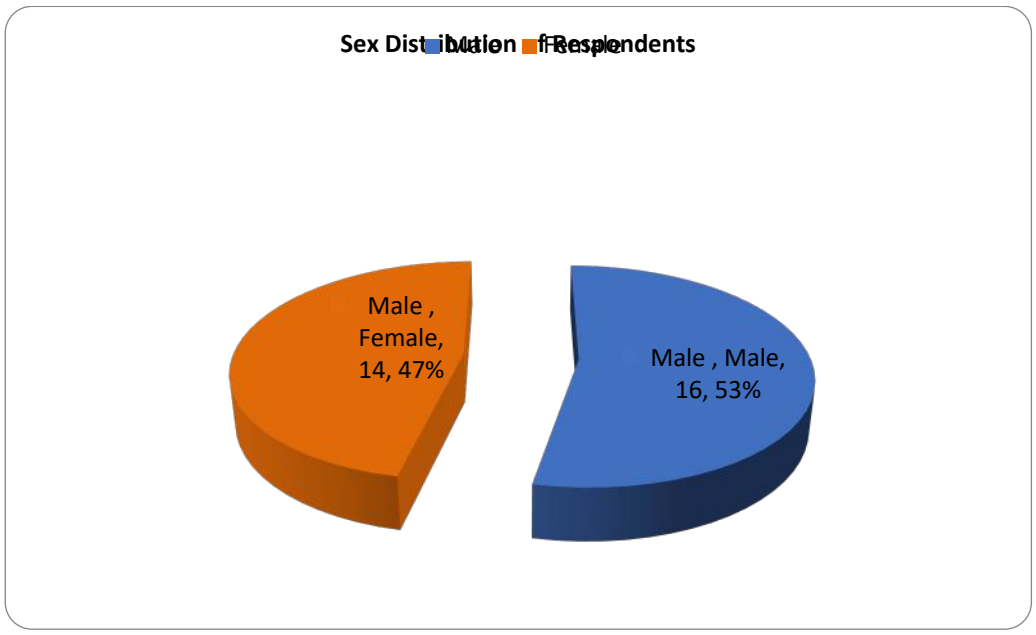


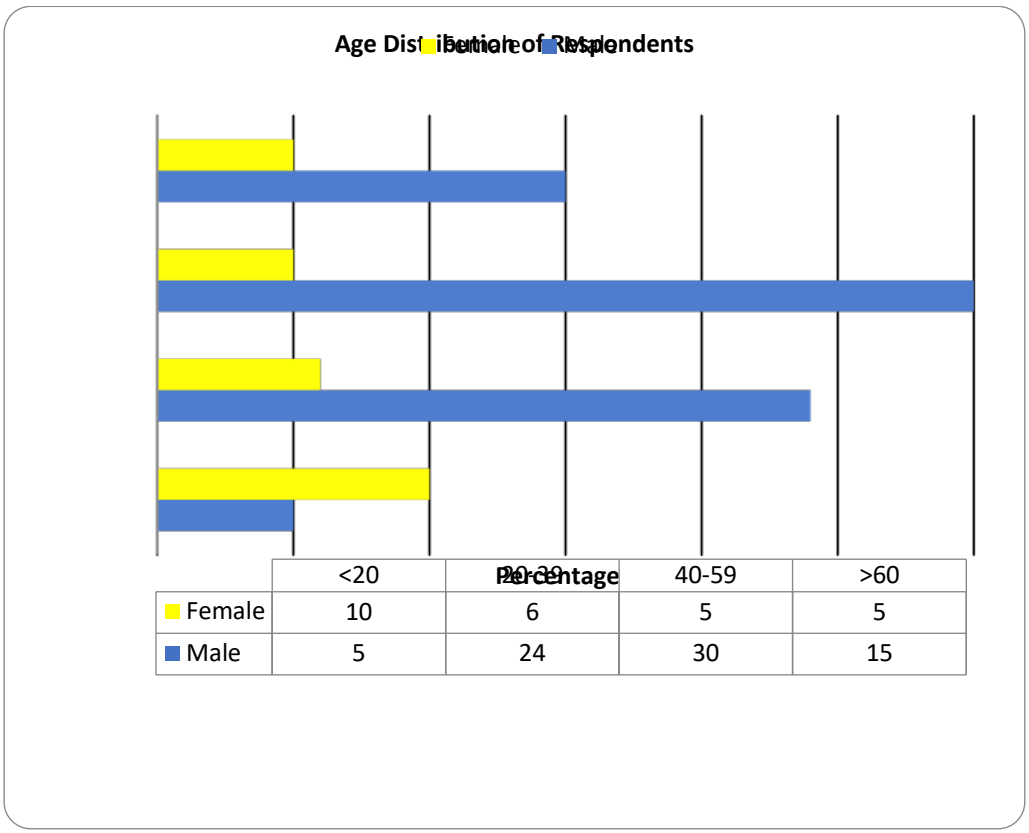
Figure 4.17 Sex Distribution of Respondents

Age Distribution of Respondents

The study shows that the majority of the respondents (30.0%) are of youthful age (20 to 39) comprising of 24.0% male and 6.0% female. The respondents within the age bracket of 40 to 59 are 30% male and 5% female. People above 60 years, who are less active in terms of occupation and general economic activities, are 15% male and 5% female (Table 4.36)

Table 4.36: Age Distribution of Respondents

Male %				**Female %**			
<20	20-39	40-59	>60	<20	20-39	40-59	>60
5	24	30	15	10	6	5	5



	<20	20-39	40-59	>60
Female	10	6	5	5
Male	5	24	30	15

Figure 4.18: Age Distribution of Respondents

Marital Status

For this study, married respondents are classified as those who are in stable unions irrespective of the degree of recognition under extant marriage law in Nigeria. Respondents were asked if they had ever been married or lived with a man, currently married, living with a man, widowed, divorced or separated. Of the total respondents, 55% were married, while 25% were single while 20% of the respondents were divorced, separated or widowed.

Resident Status and Length of Residence

All the respondents claimed to be resident or working in the project area all year round. The collated data indicate that most of the respondents have stayed in the study area for more than 10 years (10%). Some 30% of the respondents had stayed in the area for between <1year while 50% had lived in the area for 3-5 years, while 10% had resided in the proposed project area for more than 20 years. From this information, it is assumed that out-migration is minimal.

Ethnicity, Culture and Language

Ogun State enjoys a relatively homogenous ethnicity with the inhabiting ethnic groups of Egbas, Ijebus, Yewas, Aworis, Eguns and a host of other settlers and non-Yorubas such as Igbo, Hausa and people from Southern Benue, amongst others. Ogun State indigenes belong to the Yoruba ethnic group, comprising mainly the Egba, the Yewa, the Awori, the Egun, the Ijebu and the Remo. It also has sub-groups, namely, Ketu, Ikale, Ilaje, Ohori, Anago and Egun. There are also significant numbers of Nigerians from other parts of the country as well as foreign nationals.

Ethnic Profile of Project Area

Majority of the respondents in the project area are Yoruba's, constituting 80% of the total respondents. Igbo people, Edo, Delta, and other non-Yoruba respondents living or working in the area constitute the remaining 20%.

Religion and Festivals

Ogun cultural festival is celebrated annually to commemorate the revenge of a great hunter that was killed by his friends who turned enemy in disguise. This festival is celebrated largely in Ogun land within August and September to appease the ancestors and also in celebration of the Ogun the god of Iron for guiding and protecting the people and also to solicit for better days ahead.

The Ogun State Ministry of Culture and Tourism, on Tuesday, 19th April 2018, played host to the culture community, with its maiden edition of the Nigerian Drums Festival (NDF), at the Cultural Centre Complex, Kuto-Abeokuta, where a crowd of culture enthusiasts were treated to different scintillating drum performances from around the country.

Muslim festivals of Eid-el-fitr and Eid-el-kabir (sallah) are also celebrated by Muslims in the State while Christians celebrate Easter and Christmas annually. The Eid-el-fitr is celebrated on the 1st of shawwal which is the ninth month in the Islamic lunar calendar) which also marks the end of the Ramadan fasting period), while Eid-el-kabir is marked on the 10th of Dhull Hajj, the 12th month of the Islamic lunar calendar. The 12th of RabiulAwwal, which is the 3rd month of the Islamic calendar, is marked as a day for Maulud, in commemoration of the birth of the Prophet Muhammad.

Religions of Respondents

The two dominant religions in the area are Christianity and Islam. A small proportion of the people still practice traditional religion. According to the survey, 60% of respondents claimed to practice Islam while 40% were Christians. None of the people interviewed claimed to be

traditional worshippers. Plate 4.9 shows a Christian worship centre in one of the communities in the area.

Economics

In 2015, Nigeria attracted a net foreign direct investment of US$3.1 billion. 75% of this FDI came into Ogun State, making Ogun State the investment destination of choice in Nigeria. Numerous investors come to explore the numerous investment opportunities in Ogun State.

The State is a major economic hub. It has one of the largest concentrations of industries in the country and serves as the major corridor for transportation of goods, services and people between the nation's commercial center Lagos, and the rest of the country as well as the large West African markets.

Ogun State's labour costs are one of the most competitive in Nigeria, in the region and globally. The daily minimum wage of $3.00 is one of the lowest in the region and this serves as an advantage over Lagos. Labour force of 32,129 offers a huge opportunity.

On Gross Domestic Products, Ogun State is seen among the top ten contributors. The State, as the closest to Lagos State, is benefitting immensely from its proximity and is growing exponentially as an investment hub. Ogun State offers ready access to 181 million consumers in the Nigerian market, the third largest English-speaking population in the world. (Ogun info service 2017).

Occupation of Respondents

Occupation of population in the project area is dominated by Traders, Artisans and employees in private sector around the project area constituting 55%, 20% and 15% respectively. Student population pursuing first degree and other post-secondary education was 6% while 4% claimed to be civil servants at various local and state government establishments of the respondents interviewed in the area.

Household Income Levels

The interviewed respondents who claimed to be earning <N10, 000 per month were less than 35%, and were mostly students and petty traders in the project area. Majority of the respondents (60%) claimed to be above N10, 000 to a maximum monthly income limit of N99, 000. 5% of the respondents earn monthly income between N100, 000 and N250, 000.

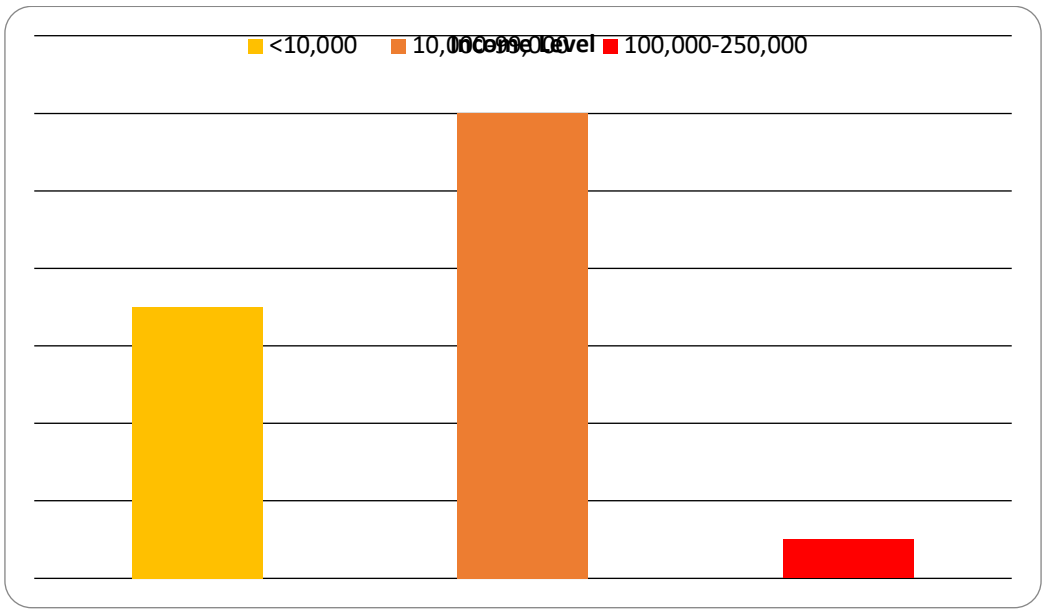


Figure 4.19 Income level of Respondent

4.14.3 Infrastructure

Source of Lighting and Fuel

The residents of the project area depend solely on public power supply and use of privately owned power generating sets, candles and lantern as source of lighting. Besides, some make use of rechargeable lamps in the absence of the two major sources of lighting. Most of the respondents (45%) claimed to be using only liquefied natural gas as source of fuel for cooking. 30% claimed to be using electric stove for cooking while 25% use Kerosene and firewood as source of fuel for cooking.

Sources of Water

The project area Ado odo/ ota and neighbouring communities make use of hand-dug wells and boreholes as their main source of water supply. None of the respondents interviewed have access to public water supply system. They all depend on boreholes and wells as sources of water for domestic purposes.

4.14.4 Transportation Systems

The transport network in the state is predominantly road based with 90% of total passengers and goods moved through that mode. A Bureau of transportation was established in Ogun State in year 2003 and vested with the provision and preserving road infrastructure which includes

marking of roads, installation of traffic signage and street furniture, signalization, traffic studies, road traffic engineering designs and alignment. It is also responsible for the formulation of transportation policy in the State. The new administration is equally making frantic effort to maintain the trend and ensure sound, effective and efficient road network. The Abeokuta expressway is located close to the facility making it accessible. People in the area make use of road transport system to move from place to place.

Plate 4.17: Sango Ota road leading to the Project area

4.14.5 Housing and Settlement Pattern

The pattern of human settlement in Ogun State is nucleated with defined population centres. Specifically, urban settlement pattern exhibits discrete format with the presence of a wide range of residential estates. The settlement type is mostly metropolitan, but has a mix of old and modern building. These include types of housing unit, construction materials for wall, roofing, and floor as well as toilet facility. Concrete houses had the highest percentage especially Bungalow and water closet system is the most commonly used toilet facilities among the respondents. Blocks of flats constitute 9.0% of the total housing units of respondents.

Table 4.37 summarizes the housing characteristics of the respondents in the study area. These include types of housing unit, construction materials for wall, roofing, and floor as well as toilet facility. Concrete houses had the highest percentage especially Bungalow and water closet system is the most commonly used toilet facilities among the respondents. Blocks of flats constitute 20% of the total housing units of respondents.

Table 4.37: Housing Characteristics of Project Area

BUILDING TYPES / PARTS	DESCRIPTION	PERCENTAGE
Type of Housing Unit	House on separate stand / yard	40
	Flat in blocks of flats	20
	Semi-detached House	31
	Others	9.0
	Total	**100**
Construction Material (Wall)	Mud	0
	Cement / Blocks / Concrete	100
	Others	0
	Total	***100***
Construction Material (Roofing)	Corrugated Metal / Zinc sheets	40
	Slates / Asbestos	60
	Others	0
	Total	***100***
Construction material (Floor)	Vinyl Tiles / Ceramic / Marble	35
	Concrete / Cemented	55
	Others	10
	Total	***100***
Toilet Facility	Pit latrine	15.5
	Water borne system	84.5
	Others	0
	Total	***100***
Tenure of housing	Owner occupier	20
	Rent/Lease	45
	Occupied rent free / Family Property	30
	Others	5
	Total	***100***

Source: AZMARINEBERG Field Survey, 2018

4.15 Health Assessment

Health Status Assessment & Common Ailments

The health status of the respondents was queried and Majority of the respondents claimed to be in good health conditions.

Source of medical care

From responses of the people interviewed across the communities, private hospital is the preferred option in terms of seeking medical assistance for ailments. Most of the respondents claimed to prefer visiting government hospitals and healthcare clinics for treatment and medical consultation for major health challenges but are faced with financial instability.65% of the respondents use combines herbs with orthodox medicine for treatment, while 35% usually resort to self-medication (without prescription) by purchasing drugs from pharmacy store to treat malaria or body ache.

4.16 Waste Disposal and Sanitation

Solid waste in the State is generated from some or all of these four sources namely domestic activities, commercial; institutional; and industrial activities. The volume of waste generated from each of these sources varies from one location to another depending on the population and industrial activities in the area. Most of the waste generated in the State, however, is from industrial, commercial, domestic, and institutional activities.

The Ogun State Government in collaboration with Private Investors is responsible for solid waste disposal within the State. Licensed operators are responsible for the collection of and evacuation of solid waste from flash points and designated bin sites within major towns in the State to the final dumpsite. The level of awareness of waste collection services and waste management regulations are relatively low in the project area, there are still a number of people in the State who use other indiscriminate solid waste disposal methods like open dumping, open burning, and dumping in drainages. Residents of the project area dispose their domestic solid waste through PSP and Ogun state accredited waste managers.

4.17 Project Perception & Support

Major stakeholders, especially residents and workers around the project site in Sango/Ota were interviewed about the project and their opinions were sought. There was no disapproval on siting the proposed substation project in the area with promised support for the project due to the potential benefits the project will bring to the area through increased production of the factory. Substantial number of the respondents requested for help with the repair of the dilapidated road to serve people working and living in the area.

CHAPTER FIVE
ASSOCIATED AND POTENTIAL ENVIRONMENTAL IMPACTS

5.1 Overview

This chapter discusses the associated and potential impacts of the proposed Adefolorunso Technical Ventures Limited construction and installation of a 2 x 7.5MKA,132/33KV substation, on the biophysical, social and health environmental characteristics of the project area. It presents the methods used to identify, screen, analyze and rank the potential and associated impacts of the proposed project. Both associated impacts (i.e., those that will occur) and potential impacts (i.e., those that could occur) were assessed.

The impact assessment approach utilizes elements of various impact identification and prediction methods that have been developed and tested over time and are internationally recognized, such as checklists, matrices, flowcharts, networks, mathematical and statistical models, as well as overlays. The approach used is a mixture of elements drawn from these techniques, and it meets the criteria for the EIA methodology as identified by the Scientific Committee on the Problems of the Environment (SCOPE, 1979). It is important that the approach used is;

- Comprehensive;
- Selective;
- Mutually exclusive;
- Objective;
- Predicts interactions; and
- Gives confidence limits to the predictions;

The impact assessment methodology is discussed further in Section 5.2 and the results of the impact assessments are discussed in subsequent sections of this chapter

5.2 Methodology

This section discusses the overall methodology used to identify, qualify and quantify the impacts of the proposed field development activities on the host environment. The overall methodology comprises five stages (Figure 5-1).

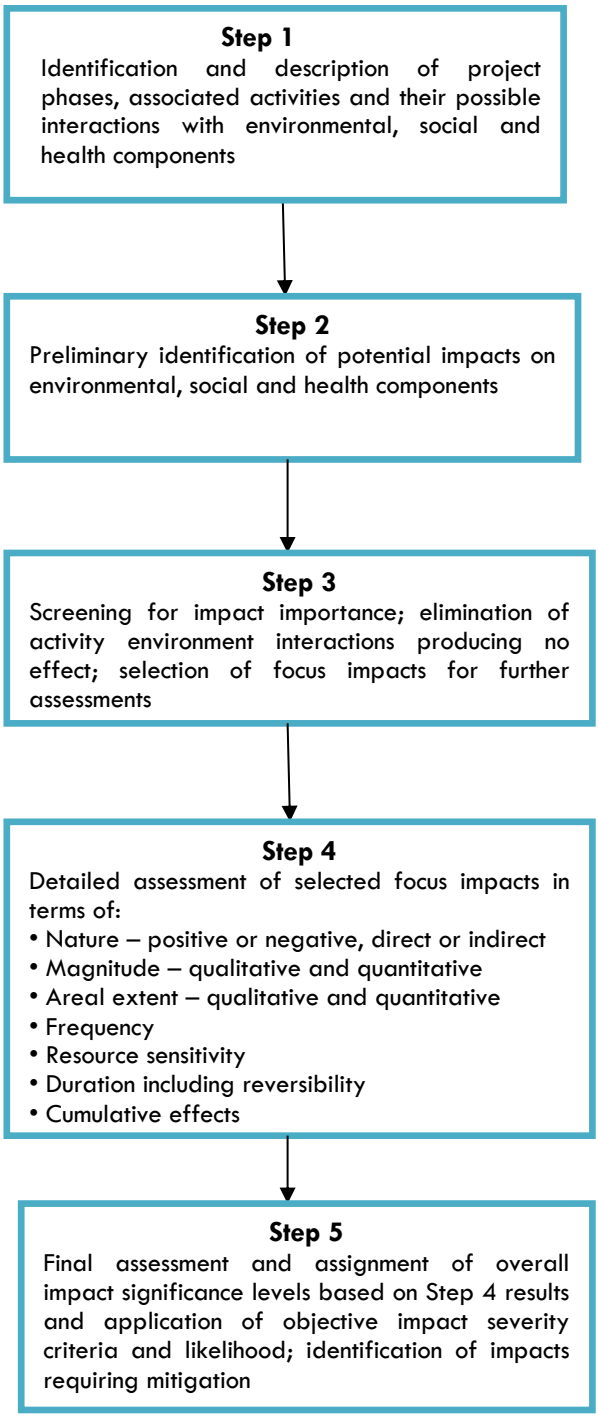


Figure 5-1: Impact Assessment Methodology

5.2.1 Basis for Screening

Activities that will, or could occur as a result of site acquisition, site clearance, construction, transportation, operation and maintenance, decommissioning and abandonment were screened. Other relevant and well-known EIA guidelines and tools were consulted for the screening. Also screened were components of the environment for assessing the potential Impact of the proposed ATVL substation project which are climate, ambient air, noise levels, water, soil and land use, vegetation, socio-economic and health. Screening was based on the following information and variables.

- Knowledge of project activities
- Knowledge of the work equipment implantation, where and when undertaken.
- Experience from similar EIA projects
- Comparison with FMEnv guidelines and standards
- Sources of discussions and consultation

The EIA team conducted scoping exercise by identifying all potential interactions between the project, the biophysical and socio-economic environments. These interactions were identified as a result of several key activities as follows;

- Bibliographical studies and reviews were conducted to identify and determine existing baseline information; existing information requiring updating or improving; information gaps; and the requirements for the collection of additional information to properly identify and assess potential interactions between the development project and the environment.
- A variety of consultation activities were also undertaken to:
    1. Determine the nature and characteristics of the proposed substation infrastructural facilities, their processes and extent;
    2. Identify issues that the regulatory bodies consider to be of greatest concern;
    3. Discuss the level and nature of information that the regulatory authorities require to be included in the EIA; and
    4. Identify, define and review the relevant regulatory and legislative framework with which the project would be required to comply.

The study team conducted focused field studies to link any identified information/data gap relevant for a comprehensive impact evaluation and formulation of mitigation measures. Identification of these interactions was based on the worst-case scenario, that the project is implemented without any environmental mitigation (without any emission control technology or waste management procedures). It was ensured that all potential interactions are identified, and that effective mitigation are designed and implemented at the appropriate time in the project's life cycle. The changes to the environment (whether adverse or beneficial, wholly or partially) arising from these interactions (Impact) were identified and assessed in the following subsections. The indicators for the various environmental components are shown in Table 5.1.

Table 5.1: Biophysical, Social and Health, Environmental Components and Impact Indicators

Environmental Components	Impact Indicators
Climate	Humidity, Temperature, Rainfall, Wind Speed and Direction
Air Quality	Particulate Matter($PM_{2.5}$, PM_{10}), Nitrogen Oxides(NO_X), Sulphur dioxide (SO_X), Carbon Monoxide(CO), Volatile Organic Compounds (VOCs) and Hydrocarbons (C_xH_y)
Water Quality	Dissolved and Suspended solids, Turbidity, pH, DO, BOD, COD, Toxicity, Pb, Cd, As, Ni, Fe, Hg, Mg. and Total Heterotrophic bacteria and fungi, Hydrocarbon Utilizing bacteria and fungi and Coliform, Hydrocarbon Utilizer
Soil and land use	Soil type, Soil pH, Soil texture, Total Organic Carbon (TOC), Soil Nutrients, Total Heterotrophic bacteria and fungi, Hydrocarbon Utilizing bacteria and fungi and Coliform, Hydrocarbon Utilizer; topography
Archaeology	Cultural relics, shrines and taboos
Noise	Day and night disturbance, hearing loss communication
Socio-economic	Population income, settlement pattern, health, safety security, and standard of living
Wildlife and Vegetation	Species No, diversity, health, endangered species
Hydrogeology	Pollution, water abstraction, aquifer recharge rate

5.3 Impact Quantification

There are various methodologies for evaluating potential environmental Impact of any project. Each of the methods employs basically the following steps;

- Identification of Impact
- Prediction of Impact
- Evaluation and interpretation of impact, and
- Communication

For Adefolorunso Technical Ventures Limited, the associated and potential Impact of the proposed substation project was predicted using a combination of Leopold Matrix (Leopold et al 1971) and the Rau method (Rau, 1970).

The Rau'Ad Hoc method is expected to indicate whether the impact is beneficial or adverse, whether it is temporal or spatial and whether it is cumulative, spontaneous, and whether it is primary or secondary. The method provides guidance for total impact assessment while suggesting the broad nature of the possible Impact. Using this procedure, it is possible to quickly judge the order of magnitude of effects or Impact: No effect, Positive effect, Negative effect, Beneficial, Adverse, Problematic, Short-term, Long-term, Reversible, Irreversible effects.
This method presents an analysis of field observations and results. It is subjective and depends a lot on the experience of the experts. In some instances, experts may not agree on specifics so the majority opinion is accepted. However, the experts used were those that are familiar with the study area and the decisions were unanimous.

The Leopold Matrix method was used to identify the cause-effect relationships between specific project actions in the environment and potential environmental Impact. A modified version was adopted. The checklist interaction matrix for environmental impact assessment was obtained by placing identified existing environmental components in the columns and the facility activities in the rows of the matrix. The figures in the cells of the matrix are quantitative estimate of the environmental loss/gain. The inherent subjectivity of judgment brought about by this method was minimized or controlled by setting up a team of inter-disciplinary experts and each expert was required to access a given interaction based on their field experience and expertise. The results of such assessment were more reliable because the submissions were guided by the interacting group Decision Making Process and the Delphi technique(a forecasting process framework based

on the results of several rounds of questionnaire sent to the group of experts and the method seeks to reach the correct response through consensus). The submissions of the experts were subjected to descriptive statistics. This method is also based on field observations and analysis. It is subjective and therefore calls for the use of experts in scoring and determining levels of impact. Where the experts disagree on specific issues, a majority opinion is taken. This can be very tedious as the dissenting experts must present a strong argument for any opinion. However final decisions are unanimous.

The checklist presented in Table 5.2 and 5.3 shows a list of environmental conditions and impact indicators that helped to review the possible consequence of the project based on both the Rau and Leopold matrixes.

Table 5.2: Modified Leopold Matrix

Project Activities / Environmental Indicators	Pre-construction			Construction and Installation									Operation and Maintenance										Decommissioning	
	Mobilisation of construction elements	Recruitment/Community Engagement	Site Preparation	Onsite Fabrication (Metal works)	Tower Foundation (piling, trenching etc)	Tower erection (Stringing activities)	Waste Management	Fuel/Hazardous material handling	Painting and Coating	Logistics support supply and servicing	Fires / Explosion	Incidents / Accidents	Commissioning / Testing	Power Transmission	ROW maintenance	Substation element replacement	Waste Management	Logistics (support, supply & servicing)	Tower falling incidents	Fires	Incidents and Accidents	Geo-hazards	Substation Decommissioning	Abandonment and Restoration
Air quality & climate																								
Climate	**0**	**0**	**1**	**3**	**3**	**2**	**1**	**2**	**3**	**3**	**1**	**1**	**0**	**0**	**0**	**0**	**1**	**1**	**3**	**4**	**3**	**3**	**1**	**0**
Particulates	**0**	**0**	**3**	**3**	**4**	**2**	**0**	**0**	**0**	**3**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**2**	**2**	**4**	**3**	**3**	**3**	**0**
NO_X, SO_X, CO_X, etc	**0**	**1**	**2**	**3**	**3**	**2**	**1**	**2**	**4**	**3**	**2**	**2**	**3**	**2**	**1**	**1**	**1**	**2**	**0**	**4**	**3**	**3**	**2**	**0**
Gaseous Hydrocarbons	**0**	**0**	**2**	**2**	**1**	**0**	**1**	**4**	**4**	**2**	**4**	**3**	**0**	**1**	**0**	**1**	**1**		**0**	**4**	**3**	**3**	**2**	**0**
Water Quality																								
Ground water	**0**	**0**	**2**	**2**	**4**	**2**	**2**	**3**	**4**	**3**	**2**	**2**	**0**	**0**	**2**	**0**	**2**	**2**	**0**	**2**	**2**	**2**	**2**	**0**

Project Activities / Environmental Indicators	Pre-construction			Construction and Installation								Operation and Maintenance										Decommissioning	
	Mobilisation of construction elements	Recruitment/Community Engagement	Site Preparation	Onsite Fabrication (Metal works)	Tower Foundation (piling, trenching etc)	Tower erection (Stringing activities)	Waste Management	Fuel/Hazardous material handling	Painting and Coating	Logistics support supply and servicing	Fires / Explosion	Incidents / Accidents	Commissioning / Testing	Power Transmission	ROW maintenance	Substation element replacement	Waste Management	Logistics (support, supply & servicing)	Tower falling incidents	Fires	Incidents and Accidents	Geo-hazards	Substation Decommissioning	Abandonment and Restoration
Terrestrial Ecology	**0**	**0**	**3**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**3**	**0**	**0**	**0**	**1**	**1**	**1**	**1**	**4**	**3**	**3**	**3**	**3**
Avifauna	**0**	**0**	**0**	**1**	**0**	**3**	**2**	**2**	**1**	**2**	**3**	**2**	**0**	**4**	**0**	**0**	**0**	**1**	**2**	**4**	**3**	**3**	**2**	**0**
Rodents and Mammals	**0**	**0**	**2**	**1**	**2**	**2**	**1**	**3**	**3**	**2**	**2**	**0**	**0**	**3**	**2**	**2**	**1**	**2**	**0**	**4**	**3**	**3**	**3**	**0**
vegetation	**0**	**0**	**3**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**3**	**0**	**0**	**0**	**1**	**1**	**1**	**1**	**4**	**3**	**3**	**3**	**3**
Soil quality																								
Physical Chemistry	**0**	**0**	**2**	**3**	**4**	**4**	**3**	**3**	**4**	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**0**
Topography/Natural Drainage	**0**	**0**	**3**	**3**	**4**	**2**	**3**	**2**	**2**	**2**	**3**	**3**	**2**	**1**	**4**	**2**	**2**	**3**	**1**	**2**	**2**	**2**	**3**	**0**
Sensory Perceptions																								

Project Activities / Environmental Indicators	Pre-construction			Construction and Installation								Operation and Maintenance										Decommissioning	
	Mobilisation of construction elements	Recruitment/Community Engagement	Site Preparation	Onsite Fabrication (Metal works)	Tower Foundation (piling, trenching etc)	Tower erection (Stringing activities)	Waste Management	Fuel/Hazardous material handling	Painting and Coating	Logistics support supply and servicing	Fires / Explosion	Incidents / Accidents	Commissioning / Testing	Power Transmission	ROW maintenance	Substation element replacement	Waste Management	Logistics (support, supply & servicing)	Tower falling incidents	Fires	Incidents and Accidents	Geo-hazards	Substation Decommissioning	Abandonment and Restoration
Noise Disturbance	**2**	**2**	**3**	**4**	**4**	**3**	**1**	**1**	**1**	**2**	**4**	**2**	**2**	**2**	**2**	**1**	**1**	**2**	**4**	**4**	**3**	**3**	**3**	**0**
Visual Intrusions	**0**	**0**	**3**	**4**	**4**	**2**	**2**	**2**	**3**	**2**	**3**	**3**	**1**	**1**	**3**	**1**	**2**	**2**	**3**	**4**	**3**	**3**	**3**	**0**
Socio-Economics/Human Health																								
Existing / Planned Infrastructures	**0**	**0**	**3**	**4**	**4**	**3**	**2**	**3**	**4**	**2**	**5**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**4**	**5**	**3**	**3**	**3**	**0**
Employment Opportunities	**4**	**4**	**3**	**4**	**4**	**3**	**1**	**1**	**2**	**3**	**2**	**3**	**3**	**0**	**2**	**1**	**0**	**3**	**0**	**2**	**2**	**2**	**4**	**0**
Worker Safety /	**2**	**4**	**3**	**4**	**4**	**4**	**1**	**3**	**3**	**2**	**5**	**3**	**2**	**4**	**1**	**1**	**2**	**2**	**4**	**5**	**3**	**3**	**3**	**0**

Project Activities / Environmental Indicators	Pre-construction			Construction and Installation								Operation and Maintenance										Decommissioning	
	Mobilisation of construction elements	Recruitment/Community Engagement	Site Preparation	Onsite Fabrication (Metal works)	Tower Foundation (piling, trenching etc)	Tower erection (Stringing activities)	Waste Management	Fuel/Hazardous material handling	Painting and Coating	Logistics support supply and servicing	Fires / Explosion	Incidents / Accidents	Commissioning / Testing	Power Transmission	ROW maintenance	Substation element replacement	Waste Management	Logistics (support, supply & servicing)	Tower falling incidents	Fires	Incidents and Accidents	Geo-hazards	Substation Decommissioning	Abandonment and Restoration
Occupational Health																								
Public Health	1	1	2	3	3	3	2	4	4	2	4	3	0	4	1	1	2	1	4	5	3	3	3	2
Landuse	0	0	2	3	3	3	2	2	2	3	3	3	2	3	3	2	2	2	3	3	3	3	3	2
Traffic on Local Roads	3	4	3	2	3	3	1	1	1	3	4	3	3	3	2	2	1	4	4	3	3	2	3	3
Macro & Micro Economics	2	2	3	3	3	3	2	2	2	3	2	2	3	4	2	2	1	3	4	4	3	3	3	3

Legend:

0	**No impact**	**1**	**Negligible**
2	**Low impact**	**3**	**Moderate**
4	**High**	**5**	**Severe**

Table 5.3: The Rau' Ad Hoc Method

Impact	No effect	Negative effect	Positive Effect	Beneficial effect	Adverse Effect	Problematic	Short-term	Long-term	Reversible	Irreversible
Disagreement due to land		*				*		*		*
Increase in temperature due to construction activities	*									
General climate change due to construction activities	*									
Reduce air quality due to SPM CO CO_2 and VOC		*				*	*		*	
Increase noise level due to construction activities		*				*	*		*	
Increase noise level due to power transmission from substation		*					*		*	
Increase noise level due to humming of transformer		*					*		*	

Impact	No effect	Negative effect	Positive Effect	Beneficial effect	Adverse Effect	Problematic	Short-term	Long-term	Reversible	Irreversible
Damage of water pipes during construction works.		*				*	*		*	
Impairment of aquatic life due to construction and maintenance operations	*									
Impairment of pipe borne water quality due to used/virgin oil contamination		*				*		*		*
Impairment of underground water quality due to used/virgin oil contamination		*				*		*		*
Reduced land use due to construction and operational activities		*				*	*		*	
Reduced land use due to used/virgin oil contamination		*				*		*		*

Impact	No effect	Negative effect	Positive Effect	Beneficial effect	Adverse Effect	Problematic	Short-term	Long-term	Reversible	Irreversible
Reduced soil fertility due to used virgin oil contamination		*				*		*		*
Habitat change/reduced population of wild life.		*				*		*		*
Loss of vigor and increased susceptibility of plants to diseases	*									
Destruction of vegetation due to construction work		*				*		*		*
Dislocation of farmers due to variable land take up	*									
Risk to life due to accidental fall of tower line or transformer		*				*		*		*
Health Problem due to emission from	*					*				

Impact	No effect	Negative effect	Positive Effect	Beneficial effect	Adverse Effect	Problematic	Short-term	Long-term	Reversible	Irreversible
substation										
Impairment of air traffic	*									
Destruction of archaeology heritage	*									
Increase revenue to government			*	*				*	*	
Employment			*	*				*	*	
Increase stable power supply			*	*				*	*	
Community development and youth empowerment			*	*				*	*	
Improved standard of living	*									

5.4 Impact Significance Evaluation

The significant environmental aspects were determined for the purpose of defining priority in which they can be avoided, mitigated or compensated. The criteria upon which the potential and associated Impact of the proposed development project was evaluated are presented in Table 5.4.

Table 5.4: Impact Significance Evaluation

Criteria	Consideration	Ranking
Legal/regulatory requirements (L)	There is no legal/regulatory requirement	0
	There is a legal/regulatory requirement	3
	There is a permit required	5
Impact frequency (F)	Low frequency	1
	Medium/intermediate frequency	3
	High frequency	5
Importance (I)	Low importance	1
	Medium/intermediate importance	3
	High importance	5
Public perception (P)	Low perception and interest	1
	Medium/intermediate perception and interest	3
	High perception and interest	5
Risk Level (R)	Low risk	1
	Medium/intermediate risk	3
	High risk	5

The significant potential Impact of the proposed substation project was identified as those Impacts to which the following conditions apply.

(L+R+F+I+P) ≥ 15: Sum of weight of legal requirements, risk factor, frequency of occurrence, importance and public perception greater than or equal to the benchmark (15).

(F + I) is > 6 Sum of weights of frequency of occurrence and importance of affected environmental component exceeds the benchmark (6).

P = 5: The weight of the public perception/interest in the potential impact is equal to the benchmark (5).

Table 5.5 shows the potential and associated Impact Significance and Rankings.

Table 5.5: Potential and Associated Impact Significance Criteria and Ranking

Activity	Associated and Potentials Impact Evaluation	Impact Ranking Criteria							Rating
		L	R	F	I	P	F + 1	L + R + F + I + P	
Pre-construction Phase									
• Permitting • ROW Acquisition • Mobilisation • Recruitment • Site Preparation	Employment opportunities arising from recruitment of technical and non technical substation construction workers	**0**	**1**	**1**	**3**	**3**	**4**	**8**	**Insignificant (+)**
	Business opportunities for local contractors through sub contracting activities	**0**	**1**	**1**	**3**	**3**	**4**	**8**	**Insignificant (+)**
	Local support services from road side supply markets and shops etc	**0**	**0**	**1**	**3**	**3**	**4**	***7***	**Insignificant (+)**
	Skill acquisition and enhancements to local indigenes and workforce.	**0**	**0**	**1**	**3**	**3**	**4**	***7***	**Insignificant (+)**
	Improvement in quality of life for landowners	**0**	**0**	**1**	**1**	**1**	**2**	**3**	**Insignificant (+)**
	Influx of people (migrant workers, subcontractors and suppliers) and increased pressure on existing social infrastructure	**0**	**3**	**1**	**1**	**3**	**2**	**8**	**Insignificant (+)**
	Increase of communicable diseases due to influx of people and poor living conditions around pre-construction site	**0**	**3**	**3**	**5**	**3**	**8**	**14**	**Significant (-)**
	Increase in social vices (like theft, prostitution) resulting from increased	**0**	**5**	**3**	**5**	**3**	**8**	**16**	**Significant (-)**

Activity	Associated and Potentials Impact Evaluation	Impact Ranking Criteria							Rating
		L	R	F	I	P	F + 1	L + R + F + I + P	
	number of people								
	Community agitations over compensations, land disputes, wrong stakeholder identification, leadership tussles, etc	0	5	3	5	3	8	16	Significant (-)
	Uncertainty and increased perturbation due to a lack of information and communication	0	1	1	3	1	4	6	Insignificant (+)
	Increased traffic during mobilisation on road with risks of accidents leading to injury/death and loss of asset	0	5	3	5	3	8	16	Significant (-)
	Risks of armed robbery attack and hostage taking leading to injury/ death of personnel.	0	5	3	5	1	8	14	Significant (-)
	Exclusion of vulnerable groups from consultations which may lead to strife	0	3	1	3	1	4	8	Insignificant (+)
	Nuisance (noise and vibrations) due to movement from heavy duty equipment and vehicles affecting site workers and wildlife	0	3	3	3	1	6	10	Insignificant (+)
	Increase of dust particles and vehicular emissions	0	1	1	3	1	4	6	Insignificant (+)

Activity	Associated and Potentials Impact Evaluation	Impact Ranking Criteria							Rating
		L	R	F	I	P	F + 1	L + R + F + I + P	
	Conflicts/community agitations over employment issues (quotas and methods)	0	1	1	3	1	4	6	Insignificant (+)
	Disturbance of the vegetation cover / loss of shrubs and minimal vegetation available) due to site clearing and preparation	0	0	1	3	0	4	4	Insignificant (+)
	Waste Disposal scrap metal, sand, concrete, domestic waste • Waste from substation site and ROW to the factory	0	1	1	1	3	2	6	Insignificant (+)
	Contamination of surface water as a result of siltation caused by increased erosion, during site preparation.	0	0	0	0	0	0	0	Insignificant (+)
	Workplace accidents from burns, cuts, bruises, trips and falls, objects at height, leading to injury or fatalities.	0	5	3	5	1	8	14	Significant (-)
	Employment of local labour and skills acquisition for workers taking advantage of new opportunities	0	3	3	3	3	6	12	Insignificant (+)
	increased business and economic activities as well as diversification of income sources due to supply contracting and sub-contracting	0	0	1	3	3	4	7	Insignificant (+)

Activity	Associated and Potentials Impact Evaluation	Impact Ranking Criteria							Rating
		L	R	F	I	P	F + 1	L + R + F + I + P	
	increase in revenue opportunities for local population due to presence of non-resident workers and travellers	0	0	1	3	3	4	7	Insignificant (+)
	Generation of dust and automobile / heavy duty equipment emissions from construction earth works.	0	3	3	3	3	6	12	Insignificant (+)
	Flora/habitat loss and disturbance through vegetation clearing and earthworks along ROW, access road and at substation site	0	1	3	3	1	6	8	Insignificant (+)
Construction / Installation Phase									
• substation slab and control room Foundation • Piling, trenching, etc • Transformer and other substation installations • Conductor wire	Fauna disturbance and displacement as a result of migration away from substation construction activity area (this includes impact on birds)	0	1	1	3	1	4	6	Insignificant (+)
	Soil / groundwater contamination resulting from accidental leakages and spills of hazardous substances (lubricants, hydraulic oil)	5	3	1	3	3	4	15	Significant (-)
	Risks of injury / death and loss of assets resulting from accidents associated with road transportation to and fro	0	5	3	5	3	8	16	Significant (-)

Activity	Associated and Potentials Impact Evaluation	Impact Ranking Criteria							Rating
		L	R	F	I	P	F + 1	L + R + F + I + P	
stringing • Painting and coating • Transportation and logistics, etc • Commissioning / Testing • Turnover • Waste management • Logistics	construction site								
	Traffic diversion and congestion along local roads during installation at road crossings.	**0**	**1**	**3**	**3**	**1**	**6**	**8**	**Insignificant (+)**
	Potential collapse of transmission towers and transformers as a result of unsuitable geotechnical conditions	**5**	**5**	**1**	**5**	**3**	**6**	**14**	**Significant (-)**
	Reduction in wildlife population as a result of poaching due to easier access created by ROW clearing	**0**	**0**	**1**	**1**		**2**	**2**	**Insignificant (+)**
	Inhalation by onsite workers of cement dust and toxic fumes during foundation works and welding of substation components	**0**	**5**	**3**	**5**	**3**	**8**	**16**	**Significant (-)**
	Noise nuisance (including impulsive noise) from construction activities (e.g. piling) resulting to temporary migration of sensitive mammals and rodents.	**5**	**3**	**3**	**3**	**3**	**6**	**17**	**Significant (-)**
	Visual intrusion as a result of alterations to normal landforms and aesthetic beauty of construction site	**5**	**1**	**1**	**3**	**3**	**4**	**13**	**Insignificant (+)**

Activity	Associated and Potentials Impact Evaluation	Impact Ranking Criteria							Rating
		L	R	F	I	P	F + 1	L + R + F + I + P	
	Risks of fire/explosions resulting from accidents onsite	0	5	3	5	5	8	18	Significant (-)
	Waste Disposal scrap metal, sand, concrete, domestic waste, used oil and replaced/obsolete equipment parts that may contaminate soil/groundwater Waste from substation site	0	1	1	3	3	4	8	Insignificant (+)
	Workplace accidents from burns, cuts, bruises, trips and falls, objects at height, leading to injury or fatalities.	0	5	3	5	1	8	14	Significant (-)
	Soil / groundwater contamination resulting from accidental leakages and spills of hazardous substances (lubricants, hydraulic oil)	5	3	1	3	3	4	15	Significant (-)
	Traffic congestion during transportation of demobilised equipments and personnel	0	3	3	3	1	6	10	Insignificant (+)
Decommissioning / Abandonment									
•Unstringing of conductor wires	Increased sedimentation process of ground water around the substation site	5	3	1	3	3	4	15	Significant (-)

Activity	Associated and Potentials Impact Evaluation	Impact Ranking Criteria							Rating
		L	R	F	I	P	F + 1	L + R + F + I + P	
• Transformer / Control room facilities removal • Waste generation	Risk of accident and injury to workers during demolition of structures	0	5	1	5	3	6	14	Significant (-)
	Increased dust and vehicular emissions	5	3	1	3	3	4	15	Significant (-)
	Risk of soil and surrounding ground water contamination from accidental oil and hazardous substance leakages.	5	3	1	3	3	4	15	Significant (-)
	Traffic obstruction from transportation of decommissioned structures and equipments.	0	1	1	3	3	4	8	Insignificant (+)
	Availability of land for alternative uses	0	0	0	1	3	1	4	Insignificant (+)

5.5 Risk Assessment

In accordance with the risk assessment matrix, a checklist of project activities and description of potential and associated Impact was developed. In addition, the Impacts are characterized as minor, major, slight, or low, medium and high in accordance with the EIA Procedural Guidelines (FEPA, 1995). The degree of risks associated with the Impact was determined using the Risk Assessment Matrix (Table 5.6).

Table 5.6: Risk Assessment Matrix

CONSEQUENCE IMPACT					INCREASING PROBABILITY				
					A	B	C	D	E
Severity	Public Health	Asset Damage	Environmental Effect	Reputation Impact	Never occurs in the Power sector	Has occurred in a substation site	Happens several times/year in some locations in the sector	Happens several times in substations	Happen on ATVL factory site
0	No Injury	None	None	None					
1	Slight injury	Slight	Slight i	Slight					
2	Minor injury	Minor	Minor i	Limited					
3	Major injury	Localised	Localised	Considerable					
4	Single Fatality	Major	Major	National					
5	Multiple fatalities	Extensive	Massive	International					

Risk Ranking

Low	Medium	High
(1)	(2)	(3)

5.6 Impact Analysis

Impact analysis based on the combination of Leopold Matrix and Rau'Ad Hoc method, impact ranking criteria and risk assessment matrix were used to adequately analyse the impacts. In this section of the report, information on the analyses of associated and potential Impact of construction and operation activities related to the substation project is presented. The various activities covered under each phase of the project include:

A) Site Acquisition

- Acquisition of land

B) Construction Activities

- Movement of men and materials;
- Foundation and pilings;
- Civil works including construction of control room
- Installation of Transformers, transmission lines
- Electrical works;
- Installation of safety and fire prevention facilities;
- Commissioning and start-up

C. Operation Activities

- Power Transmission to factory
- Turnaround Maintenance
- Transmission and Receipt of electricity (Steady power supply
- Waste management

In discussing the Impact of the project therefore, an assessment of the effects of the activities listed above on the various relevant environmental components was undertaken, and is presented accordingly

5.6.1 Site Acquisition

The first activity to be carried out prior to the commencement of actual construction work is site acquisition. For the proposed substation project, an average landmass of 1174.821m^2 was acquired. Site owners may lose their income from the acquisition exercise. Conflicts may also arise

amongst site owners over the acquisition. Site clearing may result in vegetation and general land use loss. The magnitude of the impact will be minor and of short term because the project is restricted to the acquired land. Impact will be minor since the sites can be restored to their previous conditions, construction activities are not expected to exceed two month. The frequency of the impact will be major as the impact will occur permanently during the project life cycle. The areal extent of the impact will be minor given that total acreage in each case will be about 1174.821m^2. Some of the project areas are already built up and mostly consist of both residential and commercial land use. The areas are already largely devoid of their original vegetation, therefore, the sensitivity of the project area is adjudged minor. With this low sensitivity of the impact receptors, the Impact will not be visible. This impact is classified as an adverse impact of medium significance.

5.6.2 Construction Impact

The environmental impact during construction will be localized and short-term with no changes in use of the surrounding land as compared to the current conditions. Impacts will primarily relate to the civil works period, and less intensive impact is expected during erection of the equipment.

***Impact on Air/Noise Quality*:** Construction activities; land clearing, surface leveling, excavation and filling activities will result in the increase of dust generation especially during the dry season. Mobilization to the sites of heavy machinery and equipment such as excavators, low bed, concrete mixers, generators, etc. are involved in construction. In the process, a lot of noise and vibrations will occur. Emissions from fossil fuel combustion by the various pieces of machinery will contribute to air quality degradation, by emitting noxious gases, and suspended particulates. Cement dust will escape into the atmosphere, during concrete mixing, while suspended soil particles will be blown into the air during excavation and foundations construction. All of these could lead to an increase of ambient noise levels as well as a degradation of local air quality. These emissions will not emanate continuously there will be short term depending upon season of construction and meteorological conditions. The magnitude of the impact will be minor because the project is restricted to the substation site. The duration of the impact will be minor. Construction activities are expected to continue for not more than two months. The frequency of the impact will be minor as the impact will occur intermittently only during construction activities. Noise and air emissions will only take place within the immediate vicinity of the project area. The project area is already mostly heavily built up and consists of both residential and commercial land use, therefore noise

levels are not expected to significantly exceed prescribed regulatory limits as set by FMEnv. This impact is classified as an adverse impact of minor significance.

Impact on Transportation: There will be need to transport materials and men to the project site during construction activities by road. Aside from the people that will be working on the project, the various project components such as the generators, gravel, sand, fencing materials, etc will have to be taken to the site. The increased presence of heavy duty trucks associated with construction activities may further worsen the traffic situation in the area. This could lead to physiological stress on the human population around the project area and loss of valuable man hours as a result of traffic congestion. Also, economic and human losses could result from accidents during the various project-related transportation activities. The magnitude of the impact will be minor since the substation related transportation will be for designated hours of the day and will not be a major issue, the cumulative effect of these on transportation will be minor. The duration of the impact will be minor. Construction activities are expected to continue for not more than 2 months. The frequency of the impact will be minor, as the impact will occur intermittently only during the construction period. The extent of the impact will be minor. Because prior to the project commencement there was presence of vehicular traffic prevalent in the area, the sensitivity of the receptor is adjudged minor. Impact on transportation as a result of actions leading to the construction activity will be minimal and short-termed. Therefore the project has a Minor significance with regards to transportation Impact.

Impact on Income: Given the level of commercial activities currently going around the project area, casual workers exist in the area and are willing to work for daily pay. It is obvious that there will be a positive impact for them in this regard, as they stand to gain employment, even if temporary, during project construction. This is a positive impact. Similarly, a significant proportion of the materials to be used for the project can be obtained locally such as cement, blocks etc. Therefore, project proponent will acquire many of these things within the local market. This means that there will be financial injections into the economy. This is a positive impact. Food vendors and other small scale retailers will record a relative boom during the construction period, as project workers will rely on nearby food sellers for sustenance during construction. This will equally result in increased monetary inflows for local inhabitants.

Impact on Health and Safety: Occupational hazards associated with the construction of the ATVL substation project are typical of medium – scale construction work. Health and safety concerns during construction includes hazards such as transportation of equipment and materials to and within the site, handling and storage of materials onsite, use of crane and other heavy duty equipment, work on scaffolding, and other work at heights, welding, excavations, confined space work, electrical and other emergencies.

Construction activities will involve the construction of concrete bases for the transformers and transmission lines, construction of a control room for the substation, construction of a concrete wall security fence to further fortify the substation site, wiring and electrical works, etc. Project workers during the various construction activities will be exposed to loud noise levels, especially within the immediate vicinity of the project site. They also run safety risks of falling objects or falling off the erected poles of transmission lines. Major concerns include long-term health effects, such as hearing impairment. Similarly, workers could be exposed to harmful levels of emissions from the various equipment and machinery that will be used for the project. In addition, they could sustain falls, which could lead to permanent disabilities or even death, depending on the height from which they fall, and/or, how they land.

The magnitude of the impact will be minor because noise emission issues will be most significant within a 100m radius of the project location. Noise emissions will be attenuated by distance and diffused into background noise levels. The duration of the impact will be minor. Construction activities are expected to continue for not more than 2 months. The frequency of the impact will be minor, as this impact is expected to have very low likelihood of occurrence, given the high levels of safety and security required for project contractors and their equipment/facilities. The areal extent of the impact will be minor. Impact, where they occur, will be limited to the immediate vicinity (within a 100m radius) of the proposed substation project site. However, since the kinds of Impact anticipated are mostly long term to irreversible, and the receptor is human population, the sensitivity of the receptor is assessed to be major. The project construction activities will only last for a short while. Similarly, the likelihood of major accidents happening during the construction activities is low. Also, adequate hearing protection will be provided for all workers. Therefore, the project is deemed to have a minor impact, with regards to health and safety issues.

Impact on Waste Management: A lot of wastes will be generated during the construction phase of the project. These wastes will include metal cuttings, packaging materials, hazardous wastes such as anti-corrosion chemicals and paints, empty drums and tins, welding electrodes, excavated soils, etc.. Wastes generated from the project could constitute aesthetic issues for the project area. The handling of the wastes could also pose a major challenge. Accumulated wastes could lead to contamination of soils and vegetation.

The magnitude of the impact will be major because, wastes will be contained within 10m of the project site. The duration of the impact will be short term. Construction wastes will only be generated once during the construction phase of the project. The frequency of the impact will be minor, as the impact will occur only a few times during the project construction phase. The areal extent of the impact will be minor. All wastes will be contained within the project site and will not be allowed to leave project site except by a certified and duly authorized vendor by Ogepa. Based on the relatively small volume of wastes that will be generated at the substation site and the fact that most locations around the substation are already built up, sensitivity of the project environment is rated as major. Impacts of wastes from the project activities during construction are deemed to have negative impact. Therefore Adefolorunso Technical Ventures Limited in close consultation with Ogun State Environmental Protection Agency (Ogepa) shall secure the services of a registered waste contractor to handle all streams of wastes from cradle to grave with the regulator's supervision.

Operation Impact on Air Quality and Noise Level: During the operation phase of the substation, the main activities will include power transmission which shall involve operation and control of buttons from the substation's control room, storage and consumption of equipment accessories and spare parts, regular facilities maintenance, transmission and receipt of electrical signals. The main Impact of these activities on air quality and noise levels include an elevation of ambient noise levels due to humming of the transformers. Also fugitive emissions from flanges and joints of transformers could contribute hydrocarbon fumes into the ambient air. Noise emissions will be intermittent and likely elevate background noise levels in the project area. Negligible proportions of SO_2, NOx. CO2, CO, and particulate matter are envisaged to be released into the atmosphere during the operational phase of the proposed substation project.

The magnitude of the impact will be minor because the emissions will be from only a few pieces of equipment and vehicles at a time, thus, total emissions will be minimal. The duration of the impact will be short term. The substation is expected to have lifespan of not less than 30 years and during the period, emissions will be taking place all along. The frequency of the impact will be major, as the impact will occur continuously throughout the operational life of the project. Areal extent of the impact will be minor. The Impact of emissions and noise levels will be most acute within the immediate vicinity of the project site and would be significantly attenuated at distances beyond 100m from the project area. The sensitivity of the project environment is minor because mixing and dispersion of air emissions and noise are expected. The fact that the impact has a high likelihood of occurring continuously over the project life, this impact is rated as negative of medium significance.

Impact on Ground Water Quality: Transformer oils and other maintenance oils will be stored on site. In the event that accidental spill occur during the operational phase, oily products could find their way into underground water, thereby leading to groundwater contamination. The magnitude of the impact will be minor because only very small quantities of such oils will be stored at any single time. The duration of the impact will be moderate. Ground water contamination is often very difficult and expensive to remediate and contain. The frequency of the impact will be minor, as such Impact typically occur once in a long while. There is very little likelihood of such spills at any point in time. The areal extent of the impact will be minor. Since the groundwater provides domestic and industrial water for many of the inhabitants, the sensitivity of the receptor is adjudged to be moderate. Impact on ground water quality from the operation of the base substation will be minimal, based on the various extrapolations done earlier. There is no surface water close to the proposed substation site. Therefore the impact is rated as of minor significance.

Impact on Local Economy: The Impacts of the proposed substation project on the National and local economy are largely positive. For instance, jobs will be created for unskilled workers at the project area, either as artisans or casual workers. Also, the availability of the substation will boost steady power supply to ATVL factory and thus improve its productivity and lead to increased sales of products and thus, sellers will record increased turnover.

Operation Impact on Waste management A number of waste types shall be produced during the operational phases of the project. These include metal scraps from maintenance, burnt capacitors, lubricant filters and domestic waste from the control room personal of the substation. Improper waste disposal would lead to loss of aesthetics, risk of accidents by sharp objects/scrap piles, and contamination of soil and water bodies (through run-offs). The effects of improper waste disposal are significant but can be reversed following strictly the waste management plan of Adefolorunso Technical Ventures Limited.

Decommissioning Phase: The substation being a permanent electricity infrastructure, it is not envisaged that the transmission power line will be decommissioned in the foreseeable future. However, after operational design lifespan of about 30years, a reassessment of the current status of the transmission line in the substation shall be carried out.

CHAPTER SIX

MITIGATION MEASURES

Mitigation measures for the project area was developed considering baseline environmental conditions at the proposed substation project area and the environmental impacts of the project, based on available information, followed by discussions with relevant government agencies and different stakeholders, the best mitigation practices and mechanisms have been proposed. This was done in clear demonstration of Adefolorunso Technical Ventures Limited's (ATVL) commitment to Environmental Management and Sustainable Development, including ATVL's HSE policy. Mitigation measures are used to eliminate or reduce the risk(s) associated with the occurrence of the potential impacts of the proposed project. Some of the mitigation measures proffered for this project are discussed below: Table 6.1 – 6.4 shows a summary of the various mitigation measures for all identified impacts.

6.1 Impact on Site Acquisition and Land: To mitigate this impact, site owners shall be adequately consulted and compensated for acquired site. Records of such consultations and compensations effort shall be well documented for future reference. Basically, - Approvals shall be obtained from relevant Town planning and land use authorities for the purchased project area. The proponent shall in turn apply itself to the rules and regulations. - The proponent shall develop, implement and maintain proper housekeeping within and around the proposed site.

6.2 Construction Impacts on Air Quality and Noise Level: To mitigate this impact, noise attenuation measures shall be appropriately incorporated into all project equipment. Project vehicles and other combustion sources shall have high-efficiency burners that shall minimize the emission of noxious gases. Water shall be sprinkled on open soil surfaces during excavation, to reduce the amount of soil particles that get suspended in ambient air, while all noise/noxious gas-emitting equipment shall be well maintained at all times, including: - Installation and maintenance of warning sign posts - Regular surveillance to detect report and respond promptly to malfunctioning of equipment. - Radio Frequency (RF) energy shall have no impact on air quality.

6.3 Construction Impacts on Transportation: The impacts shall only occur during the peak construction phase and during peak hours. The overall impacts is therefore of low significance. In order to mitigate the impacts indicated above, the movement of project-related trucks and vehicles shall be properly timed to ensure minimal interference with local transportation system. In view of this, ATVL drivers shall be trained on safety measures during loading, dispatch and while driving.

6.4 Construction Impacts on Health and Safety: The mitigation measure for the impact shall include the provision of personal protection kits for all project workers. The noise level at the construction site shall not exceed the FMEnv regulatory threshold of 90dB (A) for an eight (8) hours operation as stipulated in the guidelines. Also, hard hats shall be provided for all personnel working on sites, as a safety measure in the event of falling objects, while those workers who have to climb the towers/poles shall be provided with harnesses to prevent the occurrence of accidental falls from the heights. The use of these protective kits shall be strictly enforced. Conspicuously displayed, safety signs and precautionary instructions with pictorial aid and 24-hr security arrangement shall be put in place to prevent unauthorized access into the substation area. There shall be provision of a high standard health and safety management on site in accordance with the power sector practice, the occupational health and safety risks associated with construction of the substation shall be minimized.

6.5 Construction Impacts on Waste Management: The project shall produce large quantities of wastes during times of peak site clearing and construction activities; soil, shrubs, rubbles and containers. During site preparation and construction the wastes produced shall be disposed of by Ogepa licensed waste contractors. All wastes generated from the project activities shall be properly contained in a manner that shall not allow the contamination of groundwater and soil. Runoff from the stockpile of wastes shall be avoided with good housekeeping maintained. Records of waste loads shall be properly kept.

6.6 Construction Impacts on Water Quality: The construction activities at the project site shall disrupt the drainage pattern of the area especially during rainy season. Fuel and other supplies for site construction activities shall be stored in a designated area in the project site. In addition, good site management and engineering practices shall be ensured during construction.

6.7 Construction Impact on Geology and Geomorphology: Construction of the project shall not significantly alter the geomorphology of the project area. Grading activities shall not significantly change the overall topography of the project site and immediate surrounding areas. Due to the characteristics of the soils and geology of the area, in particular the lack of any sensitive features, and the construction methods proposed for the substation project, no significant impacts are predicted to occur. Erosion and flood shall be avoided by the use of efficient drainage and sand filling of excavated areas.

6.8 Construction Impact on Soil: Fuel and other supplies for site construction activities shall be stored in designated areas in the project site. The contamination of soil from spills of fuel and lubricant, though, shall have low significance. Most of the top soil that shall be removed during earthmoving and grading shall be used within the site for back filling.

6.9 Construction Impact on Landscape and Visual Impacts: The project shall be constructed to be compatible with the surrounding land uses of the areas.

6.10 Operation Impacts on Air Quality and Noise Levels: To mitigate this impact, all flanges and vents shall be properly tightened to minimize fugitive emissions. All systems shall be regularly checked and serviced to ensure that there are no leakages and losses. All machinery, equipment and vehicles to be used for the project shall have high efficiency burners, to reduce emission of noxious gases, fugitive gases shall be monitored from time to time and contingency plans shall be strictly implemented by ATVL.

6.11 Operation Impacts on Groundwater Quality: Regular integrity checks shall be conducted on all storage tanks equipment so that falling parts can be quickly detected. Adequate measures to cope with accidental releases shall be put in place. This shall include provision of bioremediation product, bunding and sand or other recovery materials.

6.12 Operation Impacts on Socio-economics and Transportation: For the purpose of mitigating this impact, ATVL shall ensure that project related transportation operations are properly timed to avoid the peak traffic periods in the project area. However, adequate road traffic signs shall be made and conspicuously displayed in appropriate places to alert other traffic operators. In

addition, the substation shall put into consideration all necessary setbacks for such projects and thus shall not be constructed within the recommended 'safe distance' by Nigerian Electricity Regulatory Commission (NERC) and Ogun state Environmental Protection Agency (Ogepa). In the unlikely event that nearby residents are exposed to seemingly high levels of emissions and long duration of RF exposures, appropriate tests shall be carried out to ensure that these levels are still far below health-damaging limits. Maintenance Engineers and operators shall be equipped with safety and ray deflective/absorbing jackets and goggles when working on or near the substation. Regular environmental components monitoring shall be carried out by ATVL during the operational phase. The premises shall also be well lit with conspicuous safety signs to avoid intruders and vandalisation of equipment.

6.13 Accidental Occurrences: ***Accidental Collapse of structures*** - In order to mitigate these impacts, all erected structures at the substation shall be properly anchored to minimize the risk of collapse. ATVL shall adequately compensate those whose properties are damaged in the event of such a collapse. They shall also bear the expenses of medical treatment for those who sustain injuries. Adequate insurance shall be underwritten for all equipment at the substation, to ensure that they can be promptly replaced in the event of such accidental happenings.

Fire and Explosions - Fire-fighting equipment shall be provided at the substation. ATVL shall have a standing arrangement and hotline contact with the Federal Fire Service, to be called upon in the event of fire outbreak. Arrangements shall also be firmed up with the Ogun State fire service as a back-up in case of emergency fire outbreaks.

Obstruction to Navigation - To mitigate this impact, ATVL shall ensure that the structures at the proposed substation are illuminated with red flashing lights at all times. Relevant aviation bodies such as the Nigerian Airspace Management Authority (NAMA), Federal Airports Authority (FAAN), etc. shall be consulted to ensure that the location of the substation does not affect sensitive airlines and designated aircraft operational areas as much as possible. Similarly, obstructions to bird flights shall be As Low As Reasonably Practicable (ALARP).

Community Agitations - After ROW acquisition by the proponent, there is tendency for agitations by some groups of people or individuals over non-satisfactory engagement and compensations over land and other associated properties. This could lead to strife within communities or groups. This impact has been assessed and ranked with a major significance.

During labour recruitment and prior to full construction activities, there is also potential for conflicts between neighbouring communities or individuals over employment quota systems, sub-contracting procedures or recruitment methodology. This will pose major significant impact on the project construction phase. As far as possible ATVL shall employ persons from the surrounding communities during the construction phase of the development to reduce the numbers of persons that will migrate to the area seeking employment. This will also avoid any feelings of resentment and will ensure that the communities derive the most benefits from the development.

Unauthorised Access - Prior to the operation of the substation project, unchecked and unauthorised encroachment by locals or individuals into the substation right of way (ROW) may lead to land use conflict and possible accidents. This impact significant is ranked as medium. Mitigation measures will include:

• Provide warning signs at access roads to warn against unauthorised entry

• Through consultations, sensitize stakeholders and members of the communities on government policies along established ROW. Implementation of the above measures reduces the impact to negligible.

Table 6.1: Mitigation Measures of the proposed substation Project Activities – Pre-Construction Phase

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
Permitting & ROW Acquisition • Consultations • Acquisition of license to operate •Stakeholder identification • ROW Acquisition	Acceptance and co-operation/ participation from stakeholders (communities and government) leading to peaceful and timely execution of the project	**Beneficial**	ATVL contractor shall ensure that: •All relevant stakeholders are identified •Early stakeholders' engagement sessions are held, and all agreed issues properly documented and signed	**Beneficial**
	Uncertainty and increased perturbation due to a lack of information and communication.	Moderate	ATVL shall ensure • Early engagement of stakeholders • Establish and publicize grievance procedure •Provide the opportunities for all affected groups (women, youths, religious, etc) to participate in consultations and ensure that all concerns are duly addressed. • Plan and execute consultations to educate community members and stakeholders on project activities, schedules and potential impacts. • Ensure consultation	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			throughout project life span.	
	Integration of men and women concerns into the substation project design	**Beneficial**	ATVL contractor shall ensure: • Due consultation of relevant groups at all phases of the project. •Provide the opportunities for all affected groups to participate in consultations and that all concerns are duly addressed. • Establish and publicize grievance procedure	**Beneficial**
	Exclusion of vulnerable groups from consultations which may lead to strife	Moderate		**Negligible**
	Community agitations over compensations, land disputes, wrong stakeholder identification, leadership tussles, etc	Major	ATVL contractor shall ensure: • Project will develop a community relations and engagement plan that identifies fair strategies of engagement for all communities • Early stakeholders' engagement sessions are held, and all agreed issues properly documented and signed. • Establish and publicize grievance procedure	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			•Stakeholders (communities, Govt., land owners, etc.) are adequately consulted and relevant issues addressed. • As far as possible employ persons from the surrounding communities during the construction phase of the development to reduce the numbers of persons that will migrate to the area seeking employment. This will also avoid any feelings of resentment and will ensure that the communities derive the most benefits from the development.	
	Improvement in quality of life for adequately compensated individuals	**Beneficial**	• Consulting all relevant stakeholders and legacy issues identified early, clearly defined , and agreed on • Fair compensations in line with national standards are agreed upon and paid	**Beneficial**
Transport of Personnel	Increased traffic during		ATVL and their	

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
and Construction Elements	mobilisation on road with risks of accidents leading to injury/death and loss of asset.	Major	contractors shall ensure; • All vehicles and boats are certified road / water worthy prior to being mobilized for work activities. • Compliance to all roads and water ways safety transport rules including speed limits • Competency training and certification of drivers before mobilisation. • Limit movement to day time only	**Negligible**
	Risks of armed robbery attack and hostage taking leading to injury/ death of personnel	Major	ATVL shall • Develop a project security plan that addresses all project related security concerns • Ensure security procedures are strictly enforced and continually improved based on updated risk information. • Consultation and good public relation with the stakeholder communities. • Ensure government approved security personnel is used on	Moderate

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			transport vehicles and boats when warranted • Limit movements of personnel and equipment to daytime only	
	Nuisance (noise and vibrations) due to movement from heavy duty equipment and vehicles affecting public and wildlife	Moderate	ATVL contractor shall ensure: • Machinery, vehicles and instruments that emit high levels of noise should be used on a phased basis to reduce the overall impact. These pieces of equipment such as drills, graders and cement mixers should also be used when the least number of residents can be expected to be affected. • Workers, especially those working with machinery, vehicles and instruments that emit high levels of noise should be supplied with ear plugs and ear muffs to reduce the risk of hearing impairment. Prolonged exposure to this impact should be reduced where possible.	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Plan work activities to avoid heavy duty movement during peak hours • Consult with host communities and plan project activities accordingly • Limit movement and work activities to daytime only • Ensure equipments are properly maintained	
	Increase of dust particles and vehicular emissions.	**Minor**	ATVL contractor shall: • Ensure that all vehicles involved in the transport of construction material and staff and machinery involved in the construction is properly maintained and serviced. • Extra care must be taken to reduce dust in periods when wind speed are greatest and the rainfall amounts (dry season). This will involve extra wetting of the construction area to suppress dust particles. • Ensure that all material (sand and aggregate) stockpiled along the site	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			to be used in construction activities are regularly sprayed to reduce the effects of wind whipping. • Ensure all staff employed at the construction site must be provided with dust masks and be asked to use them. • Implement a traffic system that involves appropriate signals and signs to ensure the smooth flow of traffic. This will reduce the idling of vehicles that may occur and therefore reduce the emissions in the area. • Reduce speed along the roads • Plan journey to reduce travel times • Vehicles carrying earth materials should be covered • Install and operate air pollution control equipment e.g. mufflers.	
	Work place accidents/incidents from		ATVL and its contractors shall ensure;	

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
	the use of cranes, forklifts, etc. during loading and offloading of materials/equipment.	Moderate	• All personnel are qualified and certified for their relevant works • That approved safe work procedures are provided and complied with at all times • Use of appropriate personal protective equipment (PPE) e.g. rubber hand gloves, hard hats, safety boots, etc. by all personnel at the project site • Limit work activities to daytime only	**Negligible**
	Obstruction of/damage to existing roads due to increased usage during mobilisation	Moderate	ATVL contractors shall assess: • Roads to be assessed prior to commencement of work to establish the status and its capability to safely handle material and personnel transportation, and after completion to determine extent of impact and where necessary, take steps to reclaim areas damaged by project activities • Plan work execution to	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			reduce travels and restrict where necessary, use of access roads	
	Interference with other road users along mobilisation route.	Moderate	ATVL and its contractors shall ensure that • Equipment, materials and personnel are mobilised after due consultation with relevant transportation authorities (FRSC, NMA, NURTW, etc) and other stakeholders to minimise interference along mobilisation routes. • Travels to and from sites shall be planned to maximize each trip and minimize number of travels	**Negligible**
	Leakage of fuel or lube oil onto land or into underground water during transportation and storage may lead to increased chemical toxicity.	Moderate	ATVL contractor shall ensure: • Safe operating practices are enforced during mobilisation • Implementation of project specific spill and emergency response plan • hydrocarbon/chemical spill containment and prevention measures and	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			equipment are functional and effective on site and for equipment and vehicles • hydrocarbon and chemical transfers in safely contained areas • Double handling to be avoided where possible • When transfer has to take place, ensure it is effected in lined and secured areas where containment is possible • Educate personnel on hydrocarbon and chemical handling risks/hazards, through SHE briefings/tool box meetings	
	Employment opportunities arising from recruitment of technical and non technical substation site workers	**Beneficial**	ATVL contractor shall: enhance this beneficial impact by • Creating requirements for contractors to hire local labour • Ensure skills acquisition and development • Recognise and commend personnel with outstanding performance	**Beneficial**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
	Skill acquisition and enhancements to local indigenes and workforce.	**Beneficial**	ATVL contractor shall: enhance this beneficial impact by • Creating requirements for contractors to hire local labour • Ensure skills acquisition and development • Recognise and commend personnel with outstanding performance	
	Influx of people (migrant workers, subcontractors and suppliers) and increased pressure on existing social infrastructure	Moderate	ATVL contractor shall: • Brief all employees to ensure awareness of any sensitivity to the local cultures, traditions and lifestyles • Continuous consultation while project is in progress • Implementation of community relations and engagement plan • Encourage hiring, as practicable, of appropriately qualified workers from areas in the vicinity of the project to discourage preventable influx of persons • Work with contractors	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			to ensure that specialised skill workers from outside the areas have access to proper accommodations and other basic infrastructure • Educate all workers to enhance their Health, Safety, Security, and Environment awareness, and performance on the job • Maintain medical emergency response plan so that all injured or ill personnel can promptly access appropriate care	
	Increase of communicable diseases due to influx of people and poor living conditions around pre-construction sites	Moderate	ATVL contractor shall ensure: • Project will develop a health plan to address potential health issues • Carry out health awareness program (malaria, corporate stop AIDS program, etc) • Provision of site medical personnel to attend to emergency situations • Engage the services of	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			retainer clinics to manage health issues • Educate workforce on the prevention of malaria	
	Increase in social vices (like theft, prostitution) resulting from increased number of people	Moderate	ATVL contractor shall: • Ensure its personnel and contractors undergo pre-employment background screening as required • Periodically discuss health and social education issues during toolbox/SHE meetings • Promptly deal with reported cases of misconduct to check recurrences	**Negligible**
	Conflicts/community agitations over employment issues (quotas and methods)	**Major**	ATVL contractor shall ensure: • Project will develop a community relations and engagement plan that identifies fair strategies of engagement for all communities • Project will also develop and implement a resettlement action plan to ensure equitable settlement of all project	**Minor**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			affected persons • Establish and publicize grievance procedure • Early stakeholders' engagement sessions are held, and all agreed issues properly documented and signed. •All affected stakeholders and legacy issues are identified early, clearly defined, and agreed on. •Stakeholders (communities, Govt., land owners, etc.) are adequately consulted and relevant issues addressed • Agreed fair compensation/rent for land are paid to identified owners promptly as per set standards. • As far as possible employ persons from the surrounding communities during the construction phase of the development to reduce the numbers of persons	

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			that will migrate to the area seeking employment. This will also avoid any feelings of resentment and will ensure that the communities derive the most benefits from the development	
Site Preparation • Access to ROW creation • Service roads	Business opportunities for local contractors through sub contracting activities	**Beneficial**	ATVL contractor shall: • Encouraging indigenous contractors and suppliers providing them opportunities to supply materials of acceptable standards • Encourage contractors to hire and to develop local labour • Workers are paid promptly as at when due	**Beneficial**
	Local support services from road side supply markets and shops etc	**Beneficial**		**Beneficial**
	Contamination of underground water as a result of siltation caused by increased erosion, during site preparation	Moderate	ATVL contractor shall: • Employ appropriate industry practices for substations construction and ancillary facilities in order to avoid adverse alteration drainage pattern • Reclaim as practicable topography of excavated or compacted areas upon completion	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			of activities.	
	Disturbance of the vegetation cover / loss of shrubs and grasses due to site clearing and preparation.	Moderate	ATVL contractor shall: • Ensure inclusion of threatened and endangered species management strategies in the site specific Environmental Management Plan to be developed by ATVL contractors to ensure appropriate flora and fauna management. • Vegetation clearing will be limited to minimum required for work although the site has minimum vegetation • Utilisation of existing accessible tracks as much as possible	**Negligible**
	Loss/disturbance of minimal wildlife due to habitat loss/fragmentation from vegetation clearing along ROW and access roads	Moderate		
	Soil compaction, destabilisation from excavation and runoff erosion resulting in sedimentation problems.	Moderate	ATVL contractor shall: • Install siltation traps within the drainage design to collect silt and sediments ensuring that they do not end up in adjacent aquatic areas. • Construction on steep slopes and in soft or erodible material will require erosion control	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			measures and correct grassing methods. • Reclaim as practicable topography of excavated or compacted areas upon completion of activities	
	Fragmentation of wildlife habitats/increase in poaching due to an easier access for the local population and non-resident workers	Moderate	The substation site is a built up area with few wildlife, mainly Avifauna	**Negligible**
	Waste Disposal • scrap metal, sand, concrete, domestic waste • Waste from laydown area from grubbing of ROW.	Moderate	ATVL contractor shall : • Develop project specific waste management plan and ensure proper implementation • Provide adequate containers for waste collection • Periodically assess contractor activities to check the level of compliance to regulatory and NERC waste management requirements. • Safe operating practices are enforced during construction	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Ensure use of only government approved waste management contractors	

Table 6.2: Mitigation Measures of the proposed substation Project Activities – Construction Phase

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
Fabrication and Metal works • Cutting, bending and welding tower steel components • Painting • Handling of conductor wires, strings, insulators and fittings	Workplace accidents from burns, cuts, bruises, trips and falls, objects at height, leading to injury or fatalities.	**Major**	ATVL contractor shall ensure that: • All personnel are qualified and certified for their relevant works • That approved safe work procedures are provided and complied with at all times • Use of appropriate personal protective equipment (PPE) e.g. rubber hand gloves, hard hats, safety boots, etc. by all personnel at the project site • Limit work activities to daytime only where practicable	**Negligible**
	Employment of local labour and skills acquisition for workers taking advantage of new opportunities	**Beneficial**	ATVL shall enhance this beneficial impact by • Creating requirements for contractors to hire local labour • Ensure skills acquisition and development	**Beneficial**
	Risk of electrocution and burns (to onsite workers)		ATVL and its contractors shall ensure;	

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
	from welding flashes and high currents during welding	**Major**	• All personnel are qualified and certified for metal works • That approved safe work procedures are provided and complied with at all times • Use of appropriate personal protective equipment (PPE) e.g. rubber hand gloves etc. by all metal works personnel	**Negligible**
	Noise and attendant vibration effects from fabrication and associated welding equipments	**Minor**	ATVL contractor shall ensure: • Machinery, vehicles and instruments that emit high levels of noise should be used on a phased basis to reduce the overall impact. These pieces of equipment such as drills, graders and cement mixers should also be used when the least number of residents can be expected to be affected. • Workers, especially those working with machinery, vehicles and instruments that emit high	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			levels of noise should be supplied with ear plugs and ear muffs to reduce the risk of hearing impairment. Prolonged exposure to this impact should be reduced where possible. • Ensure use of appropriate PPEs (ear plugs) by workers in areas with noise level above FMENV (90dBA) hourly work area limits. • Conduct daily SHE briefings prior to work	
	Inhalation by onsite workers of cement dust and toxic fumes during foundation works and welding of tower components	Moderate	ATVL and its contractors shall: • Utilise environmentally friendly electrodes, spray and paint liquids for welding as well as painting. • Use of appropriate personal protective equipment such as welding masks by welders shall be enforced. • ATVL shall also install fume expellers or blowers at confined	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			welding areas. • Implement appropriate work-site practices.	
	Generation of metal scraps from conductor wires, strings and steel elements associated with fabrication of tower components.	**Moderate**	ATVL contractor shall : • Develop project specific waste management plan and ensure proper implementation • Provide adequate containers for waste collection • Periodically assess contractor activities to check the level of compliance to regulatory and NERC waste management requirements. • Safe operating practices are enforced during construction • Ensure use of only Ogepa approved waste management contractors	**Negligible**
Foundation / Earth Works • On-site geotechnical tastings • Tower foundations • Pilings and trenching, etc	Increased business and economic activities as well as diversification of income sources due to supply contracting and subcontracting	**Beneficial**	ATVL and its contractors shall enhance this by: • Encouraging indigenous contractors and suppliers providing them opportunities to supply	**Beneficial**
	increase in revenue			

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
	opportunities for local population due to presence of non-resident workers and travellers	**Beneficial**	materials of acceptable standards • Encourage contractors to hire and to develop local labour	
	Soil / groundwater contamination resulting from accidental leakages and spills of hazardous substances (diesel, cleaning agents, lubricants, hydraulic oil	Major	ATVL contractor shall ensure: • Plan and set on-site sanitary facilities for the disposal of wastewater. • Maintain vehicles, machinery and equipment in good condition in order to avoid leaks and spill of hazardous materials (lube oils, chemicals, etc.) • Ensure safe management of hazardous materials (chemical s, etc.) • Ensure handling of fuels such as fuelling of vehicles and machinery,	**Minor**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			and fuels transfers, take place in contained areas, where sufficient measures are in place to ensure containment of spills • Plan emergency response measures and equipment are available, and personnel are capable of effectively using it for cases of accidental spill.	
	Increased jobs and job opportunities from local labour hire and sub-contracting to indigenous suppliers.	**Beneficial**	ATVL contractor shall enhance this by: • Encouraging indigenous contractors and suppliers by providing them opportunities to supply materials of acceptable standards	**Beneficial**
	Generation of dust and automobile / heavy duty equipment emissions from construction earth works.	Minor	ATVL contractor shall: • Ensure that all vehicles involved in the transport of construction material and staff and machinery involved in the construction is properly maintained and serviced. • Extra care must be taken to reduce dust in periods when wind	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			speed are greatest and the rainfall amounts are lowest. This will involve extra wetting of the construction area to suppress dust particles. • Ensure that all material (sand and aggregate) stockpiled along the site to be used in construction activities are regularly sprayed to reduce the effects of wind whipping. • All staff employed at the construction site must be provided with dust masks and be asked to use them. • Implement a traffic system that involves appropriate signals and signs to ensure the smooth flow of traffic. This will reduce the idling of vehicles that may occur and therefore reduce the emissions in the area. • Reduce speed along earth roads • Plan journey to reduce travel times	

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Vehicles carrying earth materials should be covered • Install and operate air pollution control equipment e.g. muffler	
	Flora/habitat loss and disturbance through vegetation clearing and earthworks along ROW, access roads and at tower sites	Moderate	This does not apply to the substation site as the area is already built up and there is minimal vegetation on site and ROW for laying of wire.	**Negligible**
	Fauna disturbance and displacement as a result of migration away from construction activity area (this include impact on bird life).	Moderate	The effect is low as there just a few birds flying around the area as it is built up	**Negligible**
	Potential collapse of transmission towers as a result of unsuitable geotechnical conditions	Moderate	ATVL contractor shall : • Carry out side by side geotechnical investigations during construction to determine suitability of soil to carry towers • Recommendations from geotechnical appraisals shall be appropriately implemented • Construction of tower foundations shall follow good industry	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			engineering practices.	
	Noise nuisance (including impulsive noise) from construction activities (e.g. piling) resulting to temporary migration of sensitive mammals and rodents.	**Minor**	ATVL contractor shall ensure : • Machinery, vehicles and instruments that emit high levels of noise should be used on a phased basis to reduce the overall impact. These pieces of equipment such as drills, graders and cement mixers should also be used when the least number of residents can be expected to be affected. • Workers, especially those working with machinery, vehicles and instruments that emit high levels of noise should be supplied with ear plugs and ear muffs to reduce the risk of hearing impairment. Prolonged exposure to this impact should be reduced where possible • Regularly maintain construction equipments to optimal function • Limit heavy duty	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			construction works to day hours only where practicable	
Tower Construction and Erection • Crane lifting and erections • Bolts and nuts tightening • Anti climbing guards and step bolts • Insulators and fittings • Conductor wire stringing • Connectors fixing, etc	Pollution of soil/water as a result spilled fuel and other waste oil discharge during tower construction and installation processes.	**Major**	ATVL contractor shall: • Develop and implement spill response plan • maintain storage facilities at optimal holding condition • train personnel in safe fuel handling procedures of chemicals and hydrocarbons • ensure all fuel storage facilities are bunded and lined with impermeable materials • vehicle and equipment maintenance activities implemented using proper containment or other strategies to guide against spills • Monitoring during maintenance of equipment to ensure that there is no discharge to the environment	**Minor**
	Traffic diversion and congestion along local roads during installation at road crossings		ATVL contractor shall : • Coordinate tower construction and stringing activities to avoid heavy	

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
		Minor	traffic periods • Use warning signs and traffic wardens/directors • Ensure activities causing blockages at road crossings are carried out within shortest time practicable • In the case of longer road blockages, divert traffic to approved alternate routes in liaison with appropriate authorities • Consult with affected communities prior to closures to provide warnings and alternatives.	**Negligible**
	Workplace accidents / incidents (trip/falls etc) from heights during conductor wire stringing and bolt/nuts tightening project activities	Moderate	ATVL shall ensure SHE briefings prior to commencement of work activities • Develop standard work procedures where work hazards are identified and addressed • Ensure personnel use appropriate PPE • Design work area to internationally acceptable standards	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Ensure availability of first aid facilities onsite • Ensure retainer clinics are engaged and site medical personnel are available in case of accidents • Maintain medical emergency response plan so that injured or ill personnel can promptly access appropriate care.	
	Risks of injury / death and loss of assets resulting from accidents associated with road transportation to and fro construction sites	Moderate	ATVL contractor shall ensure; • All vehicles are certified road worthy prior to being mobilized for work activities. • Compliance to all road safety transport rules including speed limits • Competency training and certification of drivers before mobilisation. • Limit movement to day time only	**Negligible**
	Risks of fire/explosions resulting from accidental ignition of onsite fuel storage tanks	**Major**	ATVL contractor shall ensure: • All fuel storage tanks are kept at safe distances from work	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			areas • Educate workforce on risks associated around storage areas and prohibit activities (such as smoking) that can ignite storage tanks • Designate no-smoking and smoke areas • Hold SHE meetings and talks on fire hazard	
	Waste Disposal • scrap metal, sand, concrete, domestic waste • used oil and replaced/obsolete equipment parts that may contaminate soil/groundwater • Waste from lay-down area and tower sites from grubbing of ROW	**Moderate**	ATVL contractor shall: • Develop and implement a waste management plan • Provide adequate containers for waste collection • Periodically assess contractor activities to check the level of compliance to regulatory and NERC waste management requirements. • Ensure engagement of Ogepa approved waste management contractors	**Negligible**
	Localised economic benefits from materials supplies by local contractors	**Beneficial**	ATVL and its contractors shall enhance this by: • Encouraging indigenous contractors and suppliers	**Beneficial**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			by providing them opportunities to supply materials of acceptable standards • Encourage contractors to hire and to develop local labour	
	Induced secondary development within the neighbouring host communities from increased economic activities.	Moderate	ATVL contractor shall: • Encourage indigenous contractors and suppliers by providing them opportunities to supply materials of acceptable standards • Encourage contractors to hire and to develop local labour	**Negligible**
	Socio-cultural conflicts between the construction team and indigenous populace due to contrasts in believes and traditions	Moderate	ATVL contractor shall: • Brief all employees to ensure awareness of any sensitivity to the local cultures, traditions and lifestyles • Establish and publicize grievance procedure • Continuous consultation while project is in progress • Implementation of community relations and engagement plan	**Negligible**
	Visual intrusion as a		Where practically	

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
	result of alterations to normal landforms and aesthetic beauty of construction site	Minor	possible, provide a minimum setback area between the substation and sensitive visual receptors; and • Rehabilitate disturbed areas around pylons as soon as practically possible after construction. This should be done to restrict extended periods of exposed soil.	
	Increased demand on existing infrastructure (roads, housing, medical facilities, etc) due to influx of workers / induced secondary development in the area during construction activities resulting in squatter settlements	Moderate	ATVL contractor shall: • Encourage hiring, as practicable, of appropriately qualified workers from areas in the vicinity of the project • Work with contractors to ensure that specialised skill workers from outside areas have access to proper accommodations and other basic infrastructure • Educate all workers to enhance their Health, Safety, Security, and Environment awareness, and performance on the job	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Maintain medical emergency response plan so that injured or ill personnel can promptly access appropriate care	
	Permanent loss of land (some with arable potentials) potentials along the substation cable ROW	Moderate	The substation site is a built up area with few wildlife, mainly Avifauna	**Negligible**
	Site conditions leading to increased malaria epidemic from uncontrolled mosquito breeding as well as water borne diseases e.g. diarrhoea and cholera associated with poor sanitary conditions	Major	ATVL shall: • Develop project health and safety plan to address all potential health issues • ATVL shall ensure personnel use appropriate PPE • Provide on-site emergency response plan • Ensure availability of first aid facilities onsite • Ensure retainer clinics are engaged and site medical personnel are available to attend to emergency cases • Ensure that workers are provided with training on health risks, exposure,	**Minor**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			and management • Provide appropriate domestic water supply to address additional needs. • Facilitate the implementation of appropriate latrines and other sanitation facilities. • Provide information, education and communication about safe uses of water and occupational safety. •Environmental management for vector control; avoidance via settlement location and design and use of bed nets and repellents; rapid diagnosis and treatment; focal insecticide and molluscicide application. • Safe food storage and handling.	

Table 6.2 Contd.

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
Demobilisation • Demobilisation after construction phase	Workplace accidents from burns, cuts, bruises, trips and falls, objects at height, leading to injury or fatalities	**Moderate**	ATVL shall ensure SHE briefings prior to commencement of work activities • Develop standard work procedures where work hazards are identified and addressed • ATVL shall ensure personnel use appropriate PPE • ATVL shall design work area to internationally acceptable standards • Ensure availability of first aid facilities onsite • Ensure retainer clinics are engaged and site medical personnel are available in case of accidents • Maintain medical emergency response plan so that injured or ill personnel can promptly access appropriate care.	**Negligible**
	Soil / groundwater contamination resulting from accidental leakages and spills of hazardous substances	**Major**	ATVL shall enforce good environmental demobilisation procedures (e.g. cleaning sites and restoring to	

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
	(diesel, cleaning agents, lubricants, hydraulic oil)		original status) • Use of drip pans during transfer of fuels and hazardous substances • Reclaim storage tank areas or contaminated soils • Carry out internal environmental assessment to check activities of construction team and status of lay-down areas, marshalling yards, tower sites, etc prior to demobilisation.	**Negligible**
	Traffic congestion during transportation of demobilised equipments and personnel	**Minor**	ATVL contractor shall: •Coordinate demobilisation activities to avoid heavy traffic periods • Use warning signs and traffic wardens/directors • Ensure activities causing blockages at road crossings are carried out within shortest time practicable • Consult with affected communities prior to demobilisation to provide warnings and	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			alternatives.	
	Generation of dust and automobile / heavy duty equipment emissions.	Minor	ATVL and its contractors shall: • Ensure that all vehicles involved in the transport of construction material and staff and machinery involved in the construction is properly maintained and serviced. • Extra care must be taken to reduce dust in periods when wind speed is greatest and the rainfall amounts are lowest. This will involve extra wetting of the construction area to suppress dust particles. • Ensure that all material (sand and aggregate) stockpiled along the site to be used in construction activities are regularly sprayed to reduce the effects of wind whipping. • All staff employed at the construction site must be provided with dust masks and be asked to use them. • Implement a traffic	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			system that involves appropriate signals and signs to ensure the smooth flow of traffic. This will reduce the idling of vehicles that may occur and therefore reduce the emissions in the area. • Reduce speed along earth roads • Plan journey to reduce travel times • Vehicles carrying earth materials should be covered • Install and operate air pollution control equipment e.g. mufflers	
	Reclamation of marshalling yards, tower sites, access roads (to prevent unauthorised access) and lay-down area	**Beneficial**	ATVL contractor : • Where possible contractor shall reclaim de-vegetated areas with topsoil, • Where possible, reclaim compacted floors with native plant species, etc. • Audit ATVL contractor to verify reclamation of work sites, marshalling yards, lay-down areas	**Beneficial**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			etc	
	Waste disposal (scrap metal, sand, concrete, domestic waste)	Moderate	ATVL contractor shall : • Provide adequate containers for waste collection • Ensure all waste are removed from site • Audit contractor on waste disposal activities to check the level of compliance to Ogepa and NERC waste management requirements before leaving site.	**Negligible**
	Loss of employment and business opportunities due to completion of construction phase	**Moderate**	ATVL contractor shall • Shall ensure skills acquisition and enhancement programs to further empower the workforce for meaningful employment opportunities after the project • Establish and publicize grievance procedure • Pay due wages for worked period and settle all financial commitments to workforce before	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			demobilisation	
	Illegal access to substation towers and structures leading to accident, sabotage, asset damage, and loss	Major	ATVL contractor shall: • Provide warning signs at access roads created to warn against dangers associated with substation • Through consultations, sensitize stakeholders and members of the communities on need to stay clear of the substation area and hazards associated with it • As much as practicable provide restrictions (e.g. anticlimbers) to unauthorised access to the substation site.	**Minor**
	Soil runoff and erosion resulting in sedimentation problems	**Moderate**	ATVL shall: • Install siltation traps within the drainage design to collect silt and sediments ensuring that they do not end up in aquatic areas. • Where possible contractor shall reclaim de-vegetated areas with topsoil, reclaim compacted floors with	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			native plant species, etc. • Appropriate flow diversion and erosion control structures i.e. earth embankments must be put in place where soil may be exposed to high levels of erosion due to steep slopes, soil structure etc. • Auditing ATVL contractor to verify reclamation of work sites, marshalling yards, lay-down areas etc	

Table 6.3: Mitigation Measures of the proposed substation Project Activities – Operation Phase

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
Operations • Commissioning and testing • Testing and Turnover	Community dissatisfaction regarding the conduct of ATVL on compensation issues may lead to strife before full operations of the substation project.	**Major**	Project will develop a community relations and engagement plan that identifies fair strategies of engagement for the host community • Establish and publicize grievance procedure • Early stakeholders' engagement sessions are held, and all agreed issues properly documented and signed. • All affected stakeholders and legacy issues are identified early, clearly defined, and agreed on. •Stakeholders (community, Govt., land owners, etc.) are adequately consulted and relevant issues addressed • Agreed fair compensation/rent for land are paid to identified owners promptly as per set standards. • As far as possible	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			employ persons from the surrounding communities during the construction phase of the development to reduce the numbers of persons that will migrate to the area seeking employment. This will also avoid any feelings of resentment and will ensure that the communities derive the most benefits from the development	
Operations • Electric power transmission using the installed lines from the substation after commissioning.	Increased and steady electricity transmission and distribution capacities within the national grid	**Beneficial**	Timely completion of the project so that associated benefits such as reduction in environmental pollution, business opportunities, quality of life, etc shall take effect.	**Beneficial**
	Increased business opportunities for ATVL and quality of life its clients and host community (small, medium, large scale) due to enhanced power delivery to the factory	**Beneficial**		

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
	Improvement in environmental standards due to reduced emission from standby diesel or fuel generators, use of Compressed Natural Gas (CNG)	**Beneficial**		
	Reduced demand on CNG and diesel used for power generation and further reduction in greenhouse gases and noise emissions.	**Beneficial**		
	Uncertain effects of electromagnetic radiation on ROW users exposed to (and residents near to) substation generating electromagnetic field	**Moderate**	Provide and ensure use of appropriate PPE • Alternative analysis of the ROW options ensured minimal to no exposure of public to electromagnetic fields • Moreover, substation has been designed in line with NERC standards	**Negligible**
	Electric shock and burns to members of the public in the event of tower collapse or damage to substation transmission wires	**Major**	Towers shall be installed following the best engineering standard • Towers shall be collapse tested to prove the tower design is in line with NERC requirements •ATVL shall carry out routine inspection of	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			towers in order to allow early detection of damaged towers and structures • Reported cases of damaged or fallen towers shall be promptly attended to • Adequate and automatic fault/damage detection system shall be installed. • Personnel shall be trained on the detection/handling of such emergencies arising from accidental damage	
	Unchecked encroachment on the ROW, leading to land-use conflicts and accident.	Moderate	ATVL contractor shall : • Provide warning signs at access roads to warn against unauthorised entry to the substation • Through consultations, sensitize stakeholders and members of the community on government policies along established ROW	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
	Noise along the substation transmission line due to corona effects (humming sound)	**Minor**	• The design of the substation transmission line shall be in line with standards observed by International bodies as well as NERC. • ATVL shall assure that during the substation power transmission, component testing in line with national and international standards and limits are complied with.	**Negligible**
	Distortion of transmission signals and electrostatic circuit due to electromagnetic induction.	Moderate		
	Use of track corridors for other facilities (Transmission Line, communication cables as well as water pipes etc)	**Beneficial**	ATVL shall enhance this : • By providing platform for consultation and communication to future developments along the project area	**Beneficial**
	Local fauna disturbances from electromagnetic field along the substation ROW	**Moderate**	The design of the substation shall be in line with standards observed by International bodies as well as NERC • ATVL shall assure during substation component testing that national and international standards and limits are met.	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
	Mortality of birds, due to collision with earth wires on towers.	**Moderate**	The routine line patrols by ATVL maintenance crew will look out for any bird collisions. If any collision "hot spots" are identified, these can be mitigated promptly	**Negligible**
	Add to FGN plan to meet 20,000MW electric power capacity by year 2020.	**Beneficial**	Impact is beneficial and shall be enhanced by sustaining the substation life span, through adequate and effective maintenance activities as well as complying with federal government's policies and laws on power transmission and distribution.	**Beneficial**
	Development of new infrastructures or improvement to existing ones.	**Beneficial**		
Maintenance • Tower inspection and checks • Substation element replacements • ROW maintenance •Substation maintenance	Proliferation of weeds around towers and below ROW	**Minor**	ATVL shall periodically carry out ROW maintenance activities to manage growths of weeds and other creeping plants on the tower bases in a manner that minimizes adverse impacts on vegetation	**Negligible**
	Disturbance of bird habitats and avifauna from activities of maintenance crew.	**Moderate**	Disturbance of grassland during construction and operation shall be kept to a minimum. • The activities of the	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			construction and operations staff shall be restricted to the ROW and immediate surroundings	
	Development of local maintenance activities to encourage employment and empowerment within the communities.	**Beneficial**	Ensure the participation of men and women in local maintenance activities such as weeding of the ROW.	**Beneficial**
	Interference with local traditional festivals or activities by unscheduled maintenance work and failure to keep to management plans may lead to community strife.	**Major**	Plan activities to minimize work activities during local events • Operators will obtain information about planned local activities and avoid disturbing them by shifting maintenance activities to other days whenever possible • Formal notice of any maintenance work should be given in advance to the community along the area.	**Minor**

Table 6.4: Mitigation Measures of the proposed substation Project Activities – Demobilisation Phase

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
Decommissioning/ Abandonment • Unstringing of conductor wires • Tower/facilities removal • Waste generation	Increased sedimentation process to river banks and underground water near the substation project site.	**Moderate**	Ensure that excavated and stockpiled soil material is stored on the higher lying areas of the site and not in any stormwater run-off channels or any other areas where it is likely to cause erosion or where water would naturally accumulate. • Decommissioning activities should preferably take place during the dry season months to prevent soil erosion caused by heavy thunderstorms associated with the rainy season in the project area. • The area shall be re-vegetated to ensure that rainwater drains gradually over the site without creating erosion gullies	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
	Risk of soil and adjoining groundwater contamination from accidental oil and hazardous substance leakages and wastes from decommissioning.	**Major**	Ensure that no wastes and hazardous materials generated on the site are dumped or deposited on adjacent/surrounding including roads or public places during or after the decommissioning period. • Enforce proper waste management policies in line with FMEnv standards and requirements. • Ensure that all project associated wastes and hazardous materials are disposed of in line with project waste management plan.	**Negligible**
	Increased dust and vehicular emissions during transport	**Minor**	• Wet all unprotected cleared areas and stockpiles with water to suppress dust pollution. • Cover materials such as sand and other rubble during transport to and from the site with a tarpaulin. • Ensure use of road worthy vehicles and	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			equipment as well as skilled operators and drivers • Limit speed of vehicles and travel time to and from decommissioning site	
	Increase in ambient noise levels above baseline conditions from movement and activities of decommissioning equipments and automobiles	**Minor**	Limit work activities to daytime only • Ensure maintenance of vehicles and equipments • Provide and encourage use of PPEs.	**Negligible**
	Traffic obstruction from transportation of decommissioned structures and equipments to receiving centre.	**Moderate**	Plan decommissioning activities in consideration of peak traffic times. • Ensure that the handling of equipment and materials is supervised. • Use signs, posts, and guides to manage traffic and direct users accordingly	**Negligible**
	Risk of accident and injury to worker during demolition of structures	**Major**	• Develop a work plan for safe demolition • Ensure hazards are identified and addressed prior to commencement of work. • Provide and enforce	**Negligible**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			the use of PPE • Ensure that decommissioning and demobilisation vehicles are under the control of competent personnel. • Provide adequate facilities on site to treat emergencies to staff.	
	Risks of attacks and possible hostage taking which may lead to injury or fatality of personnel.	Major	ATVL and contractors shall: • Ensure implementation of project security plan during decommissioning • Approved procedures are strictly enforced and continually improved based on updated risk information. • Maintain ongoing cordial relationships with the stakeholder community • Certify government approved security guards are used on demobilisation vehicles when warranted • when necessary ATVL shall activate its emergency response procedure	**Minor**

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Implement effective journey management plan.	
	Availability of land for alternative uses	**Beneficial**	This is a beneficial impact and ATVL, Ogepa together with stakeholders shall work out processes for land relinquishment or alternative uses as at the time of decommissioning	**Beneficial**

CHAPTER SEVEN

ENVIRONMENTAL MANAGEMENT PLAN (EMP)

7.1 Introduction

This chapter presents the Environmental Management Plan (EMP) developed for the proposed construction and installation of 2 x 7.5MVA, 132/33KV Substation at Sango Ota, Ado - Odo Ota Local Government Area, Ogun State by Adefolorunsho Technical Ventures Limited.

EMP is developed to ensure that the mitigation measures as described in chapter six of this report and monitoring requirements as outlined in this EIA and any environmental compliance review shall actually be carried out in subsequent stages of the project. EMP is therefore an important management tool which sets out conditions and targets to be met during project implementation. This EMP contains among others the following key items:

- Summary of potential impacts
- Planned mitigation measures
- Planned environmental monitoring
- Planned public consultation process
- Responsibilities and authorities for implementation of mitigation measures and monitoring requirements
- Mechanisms for feedback and adjustment

The EMP was developed to meet acceptable standards on environmental and social management performance. The plan entails the mitigation and enhancement measures Adefolorunso Technical Ventures Limited (ATVL) has committed to implementing throughout the lifespan of the substation project and it includes desired outcomes; performance indicators; monitoring; and timing for actions and responsibilities. It shall be the responsibility of the company to ensure that all measures outlined in the EMP are strictly adhered to, but may delegate responsibility to its contractors, where appropriate and monitor the implementation.

7.2 Objectives of EMP

The specific objectives of the EMP are to:

❖ Promote environmental management and communicate the aims and goals of the EMP;

- Ensure that all workers, subcontractors and others involved in the project meet legal and regulatory requirements with regards to environmental management;
- Incorporate environmental management into project design and operating procedures;
- Address concerns and issues raised by the relevant stakeholders and those that will likely continue to arise during the project's lifespan;
- Prepare and maintain records of project environmental performance (i.e. monitoring, audits and non-compliance tracking).

7.3 Environmental Monitoring Programme

Environmental monitoring programme serves as key part of the operational activities, and it is likely to generate the necessary information for environmental management and information dissemination. It is expected that monitoring of key environmental parameters will be conducted during the key phases of the project: design, location, construction and operation. This plan will play a fundamental role in ensuring that the trends for specific parameters are tracked and it will provide information on compliance with regulations, set guidelines or desirable operational limits; and form the basis for corrective actions and modification of project activities if necessary. The intensity of sampling will depend on the time and location of the activities and results derived from monitoring data.

The monitoring needs of the project will address the negative impacts to be generated during the implementation of the project at rehabilitation and operational phases. The key components of the proposed environmental monitoring plan are as follows:

7.3.1 Monitoring Objectives

The aim of the monitoring is to establish proper monitoring criteria to verify the predicted impact of the project, and to ensure that any unforeseen impacts are detected, and the mitigation measures are adjusted where needed at an early stage. The monitoring will keep relevant records to ensure compliance with thorough environmental procedures recommended. The monitoring plan will ensure that mitigating measures and impacts of the project during construction and operation phases are implemented.

The monitoring plan is intended to detect whether an environmental change has occurred that is linked to the substation project activities and to forewarn proponents of unanticipated adverse impacts or changes in impact trends. Other specific objectives of the monitoring plan are to:

- Check the effectiveness of suggested mitigation measures;
- Demonstrate that the project activities (construction and operation) are carried out in accordance with the prescribed mitigation measures and existing compliance regulatory procedures; and
- Provide early warning signals whenever an impact indicator approaches a critical level.

Impact indicators, in this context, are defined in terms of carrying capacity, threshold levels, and regulation and enforcement standards. Implementation of the EMP will allow ATVL to potentially control and manage the timing, location and level of impacts and potentially provide the cause and effect data for the empirical verification or validation of various predictive models of action/impact relationships

Construction Phase

At the construction phase of the substation project, the aim will be to assess the mitigation measures for noise, vibration, water quality, dust, air quality and public safety using visual assessment by the management and feedback from the other stakeholders. The nature and extent of pollution observed will be determined by laboratory analyses of samples taken from site. Appropriate measures shall then be taken to rectify the problem.

Operation and Maintenance Phase

The monitoring plan at this phase will ensure that the negative impacts of the operation and maintenance of the substation towers and structures as well as other ancillary facilities are reduced to barest minimum. This will guarantee the safety and health of employees and the public at large.

7.3.2 Monitoring Requirements

A monitoring program requires a number of components to ensure effective results. These include:

- Relevant baseline data against which to monitor project results;
- Verifiably objective indicators for each project and project component for which monitoring will be conducted;
- An independent body (Consultant) responsible for monitoring and those responsible for monitoring must have the technical capability for such;
- Monitoring on a regular basis;
- An effective monitoring reporting mechanism including feedback and commitment to action on monitoring results and recommendations.

The Environmental Monitoring Programme identifies the environmental monitoring requirements to ensure that all the mitigation measures identified in this EMP are implemented effectively. Environmental monitoring methodology for this project includes:

- Audit of detailed designs
- Audit and approval of site environmental planning documents
- Consultations with Boluwatife host community and other stakeholders as required
- Routine inspection to confirm or otherwise the implementation and effectiveness of required environmental mitigation measures

Non-compliance to environmental mitigation measures identified in the EMP will be advised to the concerned parties by ATVL HSE Department as required. The non-compliance notification will identify the problem, including the actions the concerned parties must take and a time frame for implementing the corrective action.

The monitoring plan defines roles and responsibilities distinguishing between the routine monitoring of the project. Routine monitoring focuses mainly on construction supervision and raising awareness in the context of human health and safety and environmental protection. Where applicable monitoring costs are estimated and roles and responsibilities for monitoring are also defined.

7.3.3 Roles and Responsibilities

The implementation of this EMP and its requirements shall be the responsibility of the ATVL and all the contractors and subcontractors engaged in the three phases of the proposed substation project. ATVL shall ensure adequate collaboration with Ogepa and other relevant government parastatals with specific responsibilities as assigned in this document.

ATVL, through its HSE Department shall also be responsible for the implementation and supervision of social and environmental check-list and for the overall supervision of both the contractors and the consultants on the entire project phases. A summary of roles and responsibilities are as presented in Table 7.1.

7.3.4 Awareness Creation and Training

During the construction phase of the project, the following environmental awareness and programs shall be conducted:

Induction Briefing

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

- The proposed tasks for new workers;
- Safe work procedures;
- Use of personal protective equipment
- Emergency responses and warning notices;
- Personal hygiene and site sanitation issues;
- Environmental protection; and
- Hazard recognition and incident reporting

Weekly Safety and Environmental Forum

There shall be weekly environmental and safety awareness forum for construction workers during the construction activities at the ATVL substation project site. ATVL shall be responsible for coordinating these meetings.

During the operation phase of the project, ATVL shall educate all its workers on environment, health, and safety issues using the following means to disseminate information to staff and workers:

- Staff and workers meetings;
- Local area network and the internet;

7.3.5 Public Participation/Involvement

ATVL shall welcome suggestions and information from relevant stakeholders, contractors, visitors and the general public, which shall help improve its operations in order to minimize impact on the environment and worker health and safety. The office of the HSE Manager shall be open to the general public for complaints and suggestions 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 ATVL's grievance redress mechanism.

7.3.6 Monitoring

Project activities shall be monitored in order to:

- Ensure that the EMP is implemented; and
- Assess the efficiency of mitigation measures;
- Provide updates where necessary

All contractors shall be required to self-monitor their performance with respect to environmental and social issues. The ATVL HSE Engineer shall also undertake quarterly environmental assessment and random walkthroughs to spot checks throughout the project lifespan. Assessment findings shall be reviewed by the project management team and where corrective actions are necessary, specific plans (with designated responsibility and timing) shall be developed to ensure continuous performance improvement.

In addition to evaluating operational aspects and monitoring, assessments shall also consider compliance with agreed objectives and targets, and the effectiveness of the EMP and its implementation. The EMP shall, therefore, be subject to ongoing review and development to ensure that it remains appropriate for all aspects of the project. As is typical with all Federal Ministry of Environment approved projects, the ministry will carry out an assessment before the end of the project to confirm compliance of project activities to the terms and conditions of the EIA approval.

7.3.7 Reporting

ATVL contractor shall be required to provide monthly reports on environmental and social monitoring and performance. The report shall include compliance status of the mitigation and monitoring requirements of the project EMP as well as other project related regulatory requirements. ATVL shall also develop a system of internal reporting that provides robust internal communication on the full range of environmental and socio-economic issues and monthly assessments of the effectiveness of the management programme.

7.3.8 Environmental Management

The environmental aspects that are likely to be significantly impacted by all the phases of the project such as pre-construction, construction, operation, and decommissioning have been identified and addressed in the environmental management plan. In addition to this, project specific plans that will incorporate implementation of recommended measures for each work phase and aspect will be developed by the contractors to ensure that all health, safety, and environmental concerns are fully covered for the entire project. Since these plans will be developed at stages where specific project details are available, they will therefore present comprehensive steps for the implementation, monitoring, and reporting from inception to projects completion and decommissioning.

Based on project related information available at the time of this study, the management objectives, set target, required actions, monitoring for various aspects/impacts are also presented below.

Table 7.1: Environmental Management Plan

Potential Impacts	Action Required	Objective	Monitoring	Target	Responsibility for Implementation
Air Quality Management Plan	•Maintenance programme shall be developed and implemented for all associated power generators and heavy-duty equipment • Controlling fuel consumption for all equipment and vehicles through prudent work execution and effective journey management • Implement basic environmental awareness management program • Limit use of diesel-powered generators to minimum required to sustain uninterrupted operation. • Vehicle speeds in construction area and unpaved local roads shall be limited to a maximum of 30km/h. • Where practicable, vehicles and machinery that are used intermittently should not be left idling for long periods of time. • Re-vegetate disturbed areas as soon as possible. • Wet areas that have the potential of raising significant dusts during work activities • No open burning of waste to be undertaken	To minimize the release of emissions (combustion products and particulate/dust) to air during all construction phases of the project	Visual inspection shall be undertaken by the HSE focal person/Contractors to check for evidence of excessive dust generation. If necessary, dust monitoring shall be undertaken in areas likely to generate dust that would affect nearby residents and workplaces to determine whether controls are being applied effectively. Maintenance schedule and records shall be kept	Limit emissions of pollutant gases like NOx, SOx, CO, in addition to dust, smoke, and fumes, within acceptable standards through all construction phases of the project work activities	Health Safety and Environment Manager and Site Environmental Officer
Noise and Vibration Management Plan	Contractors during the construction phase shall implement the following strategies: • Notify residents in affected areas of the project prior to commencement of construction. The notification would include the type of works to be undertaken, the duration of the proposed works, and a contact for any questions or concerns that may arise in the course of the work • Ensure that all equipment have effective noise control measures. Effective noise controls include: o Monthly inspection and maintenance of all vehicle and construction equipment and generators used in operation.	To minimize the generation of noise emissions during all the construction phases of activities and to mitigate any potential noise impacts	Monitor high noise areas for proper use of PPE equipment in accordance with WHO/ FMEnv guidelines and standards. Schedule maintenance shall be undertaken for construction equipment and power generators to ensure an optimal working condition	Construction activities undertaken to comply with FMENV recommended ambient noise level guidelines	Site Safety, Health and Environmental Officer

	o Use of sound suppressive device such as mufflers and silencers where possible. o Where practicable, vehicles and machinery that are used intermittently should not be left idling for long periods of time. • Noisy activities during construction/decommissioning shall be conducted during the day. • Best available work practices shall be engaged on-site to minimize occupational noise levels. • Haul routes for construction traffic entering and leaving the site shall be selected in a way that ensures noise levels at noise sensitive receptors are kept at a minimum. • Use of personal protective equipment (PPE) e.g. ear plugs for personnel working in areas where noise is a concern i.e. above 90dB(A) • Define high noise level working areas by engineering analysis of equipment for which hearing protection is required and provide appropriate warning sign				
Water Quality Management Plan	Implement controls and trays to ensure all transfer of fuels and chemicals are properly managed to prevent spillage. • Provide storage areas for fuels and hazardous substances with spill cleanup kits in accordance with FMEnv requirements/standards. • The project shall ensure that measures are adopted to avoid incursion into areas adjacent to the work site or any secondary effects from pollution, sedimentation, or accidental spills. • Suitable site drainage system to be constructed in lay-down areas and marshalling yards	Avoid the contamination of surface water during construction.	Inspections of construction areas and assessment of the condition and Functionability of site drains shall be conducted. Weekly inspection of all fuels and chemicals storage areas to ensure adequate containment and handling	Underground water is not contaminated during construction activities	Site Health and Environmental Officers
Soil Contamination Management Plan	Avoid the risk of soil contamination from all construction activities. Measures to be adopted shall include: • Construct spill containment facilities (containment walls). • Train operators on safe handling of chemicals and enforce the implementation of safe work practices/procedures. • Develop and implement site specific emergency and spills response plan • Provide emergency and spills response	Prevent soil contamination	Weekly inspection of all fuels and chemicals storage areas.	• No incidents of soil contamination by hazardous substances (diesel, petrol, hydraulic oil, lubricants and paints)	Site Environmental Officers

	equipment and training of personnel on effective and timely use • Use drip pans during fuel transfer operations • Identified contaminated area shall be promptly cleaned up, reported and monitored in accordance with regulatory and project approved requirements				
Flora Management Plan	There is minimal vegetation in the proposed substation project area since the area is already built up	To minimize disturbance and loss of local flora population	Periodic inspection of the site area. (6 monthly to a year depending on the phase of project to check for disturbances to floristic composition)	No disturbance of flora outside of designated construction areas.	Site Environmental Officers
Fauna Management Plan	There is minimal fauna in the proposed substation project area since the area is already built up. There are however a minimal presence of Avifauna at the site due to the presence of one or two trees in a neighbouring location close to the site.	To minimize temporary disturbance of terrestrial fauna during transmission line construction and operations	Monitoring for evidence of habitat disturbance or invasive species shall be undertake	Minimize impact on the local fauna	Site Environmental Officers
Aesthetics Management Plan	Landscaping where necessary on the acquired ROW • Identify and incorporate plant species with the potential to effective screening. • Utilize indigenous species, preferably those that are endemic to the area • Good housekeeping practices shall be maintained accordingly to reduce poor aesthetic conditions around construction sites.	Minimize the visual impact of the substation transmission line corridor on surrounding areas.	Inspection of the health and vigour of the landscaping/planting areas	Minimize visual impacts as practical	Site Environmental Officers
Social-cultural Management Plan	Develop and implement community relations and engagement plan . • No unauthorized disturbance of cultural activities by the substation transmission line works • Plan activities in recognition of indigenous cultural activities. • Continue to consult with the indigenous community. • Accommodation shall be provided for some construction workers (not from surrounding communities) to minimize pressure on existing infrastructure • Basic health and medical services (first aid) shall be available to reduce the demand on	To ensure that there are no adverse effects on the region's cultural values. • Minimize social and/or community impacts associated with all work activities. • Maximize opportunities for local engagement and business	Review feedback from the traditional rulers and the community groups and related Government/non-Governmental Organizations. Monitoring shall be by stakeholder feedback and by review of complaints	Cultural values understood and protected by ATVL • Receive and respond to complains about social or community management issues	Community Relations Officer

	existing health facilities. • Specify and implement the standards expected from all construction workers. This shall be formalized in a code of conduct that shall be agreed to and signed by every employee and sub contractor. • Complaints about unacceptable behavior from construction workers shall be investigated and, appropriate action taken . • Use a wide range of communication tools to ensure that community is kept informed of project progresses • Offer opportunities for the involvement of local businesses and for the employment of local residents.	opportunities during the various project phases especially during the construction period			
Security, Health, Safety, and Environmental Management Plan	ATVL contractor shall be required to prepare a project specific Security, Health, Safety, and environmental Management Plan in accordance with the requirements of the company management system. • Site specific Environmental Management Plan to be prepared by the ATVL contractors will be developed prior to construction activities, after specific areas have been determined for project activities to ensure appropriate environmental management strategies. • All workers on the project shall go through a compulsory orientation programme before they start work. • Environmental, Health, Safety, and Security plans, programs, and regulations governing the project would be implemented and complied with. • Every worker would be made to sign a personal commitment to individual and corporate safety while at work. • Health, Security, Safety, and environmental awareness programs e.g. AIDS, and malaria awareness) shall be organized for personnel.	To ensure that the project does not adversely affect the security, health, safety of the employees, contractors or the general public as well as the environment	The security, safety, health, and environmental performance shall be monitored in accordance with the substation project and corporate procedures and reported to the project management team. Monthly/Quarterly audits shall be executed	Zero reportable injuries, spills, and work-related illnesses	ATVL, Project SSHE Manager, and Project Manager

7.3.9 Responsibilities and Cost for EMP Implementation and Monitoring

Majority of the identified impacts would take place during preconstruction and construction phases. Impacts identified for the operation phase are minimal. Mitigation measures for each of the phases have been presented in Chapter 6 of this report

Part of the conditions for the approval of the EIA by the Federal Ministry of Environment (FMEnv) is that there will be regulatory monitoring of the approved project impacts mitigations and monitoring measures. The timing and frequency of the monitoring is determined by the FMEnv. FMEnv works closely with the state Ministry of Environment in monitoring the implementation of the EIA approval terms and conditions. Funding of the Impacts Mitigation and Monitoring (IMM) is borne by the proponent, in this case.

7.3.10 Waste Management

Waste shall be managed in accordance with Federal Ministry of Environment guidelines and ATVL waste management procedures. The principle of waste reduction, recycling, recovery and reusing shall be practiced. In addition to the regulations of FMEnv, the project will also comply with extant national and international environmental standards that are binding on all staff and contractors involved in the proposed substation project with respect to the following:

- Emission or release of pollutant, exhaust and/or fugitive gases;
- Discharge or spill of wastewater thereby contaminating underground water and surface water where applicable; and
- Discharge of solid wastes (including domestic waste) into surface water

The contractor is also expected to develop and submit for approval to ATVL a comprehensive waste management plan to be used during the proposed substation project. This waste management plan shall be in line with the Company's HSE Management System as well as comply with existing national and international waste management standards.

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 contractor and ATVL personnel shall define and document all wastes generated during all operational processes. The required

basic information that would be provided, as a minimum, for adequate definition of wastes include:

- Waste type identification;
- Proper waste categorization;
- Waste segregation information;
- Location of generation, and
- Recommended management practices

Waste Minimization

Waste minimization involves reduction to as low as practicably possible volume or toxicity of waste materials. The four principles of waste minimization process; recycle, reduce; reuse and recovery shall be adopted as applicable. This shall be done in order to achieve a significant reduction in waste volume during the proposed substation project, the functions of activity level, age depreciation and maintenance level of facilities and operating equipment would be closely monitored. A large proportion of excavated material shall be used for landscaping, backfilling or other remedial works on the site. The key elements of the four-waste minimization/management principles/practices are outlined below

Table 7.2: Key Elements of Waste Minimization

Category	Definition
Reduce	• Process modification / design change • Material elimination • Inventory control and management • Material substitution • Improved housekeeping
Reuse	• Chemical/oil containers • Re-use waste heat
Recycle/Recover	• Recycle scrap material • Burn waste lubricating oil for energy recovery • Recover oil from tank bottoms

Waste Segregation

For effective implementation of appropriate waste disposal methods, it is important that wastes be segregated, preferably at source into clearly designated bins at strategic locations

Wastes Inventory

An inventory of waste generated shall be maintained. Weighing scales or measuring devices shall be provided to measure quantities of waste generated/discharged. Records of waste generated, treated and sent for disposal shall be maintained on site.

Waste Disposal

All debris, spoil materials, rubbish and other waste, except excavated soil and rock, shall be cleared regularly from the site and sent to the dumpsite by Ogepa accredited vendor. Instructions on material safety handling sheet shall be strictly adhered to and shall form the basis for the disposal of wastes related to such products. Wastes in transit shall be accompanied and tracked by consignment notes.

Operational Wastes and Disposal Methods

Waste shall be managed in accordance with Federal Ministry of Environment and ATVL waste management guidelines and procedures. The contractor will develop a Waste Management Plan to be approved by ATVL and will be responsible for the management of all wastes from cradle to grave using licensed third party waste management contractors and facilities by Ogepa. Detailed inventory of the waste types, sources, for the different phases during the project lifespan is as presented previously in chapter three of this report.

7.4 Emergency Response Plan

In order to safeguard the lives of personnel and contractors during emergency situation, ATVL contractor shall develop and implement an emergency response plan in addition to the following.

- Emergency training shall be conducted by the Site Health Engineer (SHE) Manager to enhance workers preparedness to respond appropriately to emergencies.
- Emergency drill shall be conducted periodically, and such drill shall include fire, oil spill as well as first aid emergencies.
- Response time and roll call shall be monitored and recorded by the SHE Manager, supervisor or fire warden as required, at each drill/training to ensure compliance.
- All drills and training exercise shall be documented by the SHE Manager or the supervisor and copies sent to ATVL.

In situations where evacuation of personnel is necessary as a result of fire or any other related accidents, ATVL shall follow the emergency medical evacuation procedure with responsible parties.

Table 7.3: Personnel Responsibilities during Emergency Evacuation

Action Party	Responsibility
Personnel at scene of incident	• Maintain calmness and alert people around Contact site nurse or first aider/supervisor/safety officer • Begin mustering action
Medical personnel on site	• Arrange and administer first aid for sick/injured
Site supervisor/safety officer	• Contact project engineer / safety manager and report the following; • precise location and time of incidence; • site condition • patient(s)/injured or casualty; and • other pertinent information
Site Supervisor	• Arrange for medical evacuation after due consultation with management
SHE Manager	• To liaise with management to arrange for medical evacuation • Furnish management with available particulars/report about the emergency as provided by the site supervisor/safety officer • Conclude medical evacuation by ensuring the casualty is transferred from the first aid clinic (after a life saving treatment) to ATVLs retainer clinic

Fire Prevention/Contingency

The overall goal of the fire prevention system shall be to:

- Continuously monitor all areas of the installation where either a fire hazard may exist or an accumulation of flammable gas may occur;
- Alert personnel at the location of the presence, location and nature of the fire or emergency; •
- Automatically activate fixed fire protection systems, and
- Reduce the risk to personnel by implementing system automated systems.
- Ensure that all personnel are safely evacuated

Fire detectors (smoke, heat, flame, gas, etc) shall be installed at appropriate areas at the substation e.g the control room especially during the operation phase. The fire shall be detected by the quickest, most reliable means.

7.5 Environmental Audit and Assessment

SHE audits of the facility activities shall be conducted in order to ascertain extent of compliance with set guidelines, policies and requirements. The audits shall be carried out by certified auditors (both in-house and independent auditors) and in accordance with regulatory requirement and ISO 14001 guidelines. 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 EIA and assure implementations and application of recommended practices and procedures; and
- Make recommendation for the improvement of the management system of the operation.

Also, as part of audit and review this EMP shall be reviewed annually to determine its adequacy/suitability for continuous use.

7.6 Decommissioning and Abandonment Plan

The design of the substation project facilities (tower, conductors, transformer etc) shall take due recognition of the need for decommissioning at the end of project operational life (30years). However, in Nigeria, substation transmission lines are designed to last more than the set operational life and as such appraisals will be conducted periodically in line with international and NERC standards to assess the condition of the substation transmission line prior to revalidation or decommissioning.

ATVL shall set up strategies to checkmate project abandonment. In the unfortunate event of abandonment, a project abandonment plan shall be prepared in line with applicable national and international legislative requirements, in addition to implementing measures to mitigate the impact of such abandonment. The design of the facilities shall take due recognition of the need to decommission any ancillary facilities at the end of their operational life. Temporary structures installed at the construction phase to support construction activities shall be cleared and cleaned and safely disposed or reused.

CHAPTER EIGHT

REMEDIATION PLAN AFTER DECOMMISSIONING/CLOSURE

8.1 Introduction

Decommissioning is a general term for a formal process to remove something from an active status at the end of its lifecycle. This end-of-life phase for any project is associated with activities related to the demolition of infrastructure and the rehabilitation of disturbed areas. The total rehabilitation will ensure that the total area will be covered with topsoil and re-vegetated.

The following activities are associated with the decommissioning phase:

- Existing buildings and structures are demolished, rubbles removed, and the area is levelled;
- The remaining excavated areas, which are exposed are filled and levelled using overburden recovered from stockpiles;
- Stockpiles and tailings impoundments to be smoothed and contoured;
- Topsoil is replaced using topsoil recovered from stockpiles; and
- Land and permanent waste piles are prepared for re-vegetation.

During the phase, possible sources of fugitive dust emission include:

- Smoothing of stockpiles by bulldozer;
- Grading of sites;
- Transport and dumping of overburden for filling;
- Infrastructure demolition;
- Infrastructure rubble piles;
- Transport and dumping of building rubble;
- Transport and dumping of topsoil; and
- Preparation of soil for re-vegetation.

Exposed soil is often prone to erosion by water. The erodability of soil depends on the amount of rainfall and its intensity, soil type and structure, slope of the terrain and the amount of vegetation cover. Re-vegetation of exposed areas for long-term dust and water erosion control is commonly used and is the most cost-effective option.

The proposed project is being developed for a projected minimum of 30year operational lifetime. However, in Nigeria, substation transmission lines are designed to last more than the set operational life and as such appraisals will be conducted periodically in line with international and NERC standards to assess the condition of the substation transmission line prior to revalidation or decommissioning. At the point in time when the structure has outlived its usefulness/economic purpose, the structure can be safely dismantled and/or demolished, and the majority of materials sold as scraps for recycling and/or re-use.

In the event of decommissioning the substation project, ATVL shall ensure that the decommissioned site is left in a safe and environmentally acceptable condition. A standard decommissioning, abandonment and closure programme shall be employed.

8.2 Planned Abandonment Programme

At the time of project closure, a detailed and comprehensive abandonment, decommissioning and closure plan will be developed considering the most cost-effective and best practicable methods, legal requirements and industry practices at that time. The decommissioning plan will be submitted to the regulatory agencies at least one (1) year prior to scheduled abandonment and decommissioning.

The following steps shall be undertaken for decommissioning:

- To ensure that due consideration is given to all options a detailed evaluation of facilities decommissioning options will be carried out. The evaluation will consider environmental issues in conjunction with technical, safety and cost implications to establish the best practicable environmental options for the decommissioning of the proposed substation project.
- A risk assessment will be conducted to ensure that nothing, which could be considered as a hazard for other users of the area or for the environment in general, will be left at the site. The site will be left in a safe and environmentally acceptable condition.
- The appropriate authorities(such as NERC, Ogepa, FMEnv) shall be consulted and notified of the project status.
- Hazard identification and analyses shall be conducted to determine special safety concerns to be addressed.
- An HSE plan shall be implemented to ensure it is conducted in an environmentally sound

manner, of which should conform to existing environmental safety laws and regulations guiding such operations.

- Third party notification must be considered before demolition and shall be conducted in a phase sequence.
- The waste management philosophy of the organization shall be fully applied to this plan and execution.

CHAPTER NINE

CONCLUSION

9.1 Conclusion

This report, which presents the findings of the EIA study carried out for the proposed construction and installation of 2 x 7.5MVA, 132/33KV Substation at Sango Ota, Ado-Odo Ota Local Government Area, Ogun State by Adefolorunsho Technical Ventures Limited was prepared in accordance with the provisions of the FMEnv EIA guidelines and NERC as well as the applicable requirements of the Ogun State Ministry of Environment.

The study provided all necessary data/information which are expected to satisfy all stakeholders as objective evidence required for developing the EIA. To achieve this, the study identified all the relevant environmental regulations that would affect the project, establish the baseline conditions of the project area, and ensured that potential environmental, social and health impacts of the proposed substation project were fully assessed. In addition, practicable mitigation measures were recommended to manage the impacts associated with the project while and workable management plan was equally developed to mitigate unforeseen impacts that may arise.

The proposed ATVL substation project has been designed in line with the principle of sustainable development and international operational standards as blueprint to ensure its sustainability. This document described the nature of the proposed project in Chapter 3 and the baseline environmental, social and health conditions as detailed in Chapter 4. The overriding objective of the study is to ensure that potential environmental impacts, however minor and transient, are recognized and addressed.

The impacts of the proposed project are related to traffic accidents during construction, air quality impairment from dust generation at clearing and site preparation stages, increase in noise level, waste generation, surrounding water siltation, groundwater exploitation, among others. ATVL shall ensure a successful execution of the proposed substation project in an environmentally sustainable manner through proper management of processes/activities at may bring about disturbances to the environment.

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