



GHANA GRID COMPANY LIMITED

161 kV ACCRA CENTRAL POWER PROJECT

DRAFT

ENVIRONMENTAL IMPACT STATEMENT



2015



Figure 1 GRIDCo’s corporate environmental policy statement

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LIST OF ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
BSP	Bulk Supply Point
CEB	Communate Electrique du Benin
CIE	Compagnie Ivoirienne d'Electricité
CDO	Community Development Officer
DA	District Assembly
DBO	District Budget Officer
DCD	District Coordinating Director
DCE	District Chief Executive
DDCD	Deputy District Coordinating Director
DDPO	District Development Planning Officer
DPO	District Planning Officer
EA	Environmental Assessment
EC	Energy Commission
ECG	Electricity Company of Ghana
EIA	Environmental Impact Assessment
EMF	Electro Magnetic Field
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
EPC	Engineering, Procurement & Construction
ESIA	Environmental & Social Impact Assessment
ESIS	Environmental & Social Impact Statement
ESMP	Environmental and Social Management Plan
GoG	Government of Ghana
GRIDCo	Ghana Grid Company Limited
HIV	Human Immune Virus
IEC	Information, Education and Communication
IUCN	World Conservation Union
JHS	Junior High School
kV	Kilo Volt
LI	Legislative Instrument
LVD -	Valuation Division of the Lands Commission
MCD	Municipal Coordinating Director
MCE	Municipal Chief Executive
MDPO	Municipal Development Planning Officer
PAPs	Project-Affected Persons
PIU	Project Implementation Unit
RoW	Right of Way
SEST	Socio-Economic Studies Team
SHS	Senior High School
TL	Team Leader
TOR	Terms of Reference
VRA	Volta River Authority

EXECUTIVE SUMMARY

Introduction

The Ghana Grid Company Limited (GRIDCo) was established in accordance with the Energy Commission Act, 1997 (Act 541) and the Volta River Development (Amendment) Act, 2005 Act 692, which provide for the establishment and exclusive operation of the National Interconnected Transmission System by an independent utility and the separation of the transmission functions of the Volta River Authority (VRA) from its other activities within the framework of the Power Sector Reforms.

This was as a consequence of major re-structuring in the context of the Ghana Government Power Sector Reforms which resulted in the amendment of the Volta River Development Act 1961 (Act 46), which established the Volta River Authority (VRA) as a public-owned corporate utility with the primary function of generating electric power, first by the development of the hydroelectric potential of the Volta River and the construction and operation of a transmission system for the supply of electrical energy for industrial, commercial and domestic use in Ghana.

Following the enactment of the Amended Act, the power transmission function of the VRA was transferred to GRIDCo which is now responsible for the entire national power evacuation and transmission infrastructure that VRA had hitherto managed in addition to its power generation functions. GRIDCo was incorporated on December 15, 2006 as a private limited liability company under the Companies Code, 1963, Act 179 and granted a certificate to commence business on December 18, 2006. The company became operational on August 1, 2008 following the transfer of the core staff and power transmission assets from VRA to GRIDCo.

GRIDCo as a transmission utility company is mandated to:

- Carry out the business of economic dispatching and transmission of electricity from facilities of wholesale suppliers to bulk customers or distribution companies and utilities in Ghana and West Africa without discrimination.
- Acquire by purchase or otherwise construct, establish, manage, maintain, and otherwise deal with all transmission facilities, works, buildings, and other systems necessary to transmit electric energy.
- Undertake metering and billing of all power transfers in the National Interconnected System.
- Carry out any general commercial activities related to the safe and reliable operation of transmission system and economic dispatch of electric energy.

GRIDCo now owns and operates a countrywide transmission system for the distribution of bulk electric power in Ghana, consisting of about 218km of 330kV transmission line, About 4,000 circuit-kilometres 161 kilovolts (kV) transmission lines and 50 of 161/34.5kV and/or 11.5kV substations. Six hundred (600) circuit-kilometres of the 161 kV lines are currently operated at 34.5 kV and are referred to as “161 kV light lines”. The transmission system is a 161 kV loop serving loads in the southern part of the country and two separate radial lines from Techiman to the north. The radial circuit towards the Upper West Region supplies the loads of major towns of Sawla and Wa. The radial circuit towards the Upper East Region supplies the loads of major towns of Buipe, Tamale, Bolgatanga, Zebilla, Bawku, and Youga

in Burkina Faso. The Northern circuit extends to supply other communities in Ghana and also serve as an interconnection to Dapaong and Cinkasi in Northern Togo.

The GRIDCo Transmission System is also interconnected with the power systems of La Cote d'Ivoire and Togo/Benin. A 225 kV single-circuit inter-tie connects the GRIDCo network to the network of Compagnie Ivoirienne d'Electricité (CIE) of la Côte d'Ivoire at Prestea and Abobo respectively. In addition, a double-circuit 161 kV transmission line from Akosombo to Lome connect the GRIDCo network to the network of Communate Electrique du Benin (CEB) of Togo and Benin.

The Avenor-Graphic road line was constructed among other lines between 1960 and 1964 and became operational in 1965 as part of the grid system. The transmission lines were operated by the Volta River Authority (VRA), a power utility company established by an Act of Parliament in 1961 (Act 46). By the Volta River Development Act, 2005, Act 692, the power transmission function of the VRA has been transferred to GRIDCo thereafter with the entire national power evacuation and transmission infrastructure that VRA had hitherto managed in addition to its generation function.

GRIDCo intends to upgrade its transmission line between the bulk supply point at Avenor and Graphic road supply point spanning approximately 3km. To meet the ever increasing electricity demand in Ghana, a total of approximately 240MVA lines from three different thermal power plants have been constructed at Tema. With the introduction of other Independent Power Producers, the installed capacity in Tema is expected to increase and subsequently exceed an estimated 1,000MVA within the next couple of years.

During periods of high generation and transmission from Tema, the Avenor-Graphic road line will be loaded beyond its estimated carrying capacity. Strategically, it is imperative to put in place the necessary and appropriate mechanism to contain and arrest any damage to equipment arising from the overload. The proposed project is meant to increase the power transfer capability between Avenor and Graphic road with the main objective of reinforcing power supply to Accra central.

There is in place, an existing 15m Electricity Company of Ghana (ECG) Right Of Way (ROW) adequate enough for the implementation of the expansion works, consequently, the transmission lines will be built using the already existing ROW which will carry bigger Towers and stronger conductors.

The project activities to be undertaken will include de-commissioning of the existing double line of approximately 3km stretch between Avenor and Graphic road Substations by dropping the lines and the construction of double circuit line using 2x265mm sq ACSR conductors using the existing Way leave. New and stronger towers will be built and raised to a height adequate enough but not impeding the existing towers before dropping the old towers and mounting the new conductors in the shortest possible time that consumers are not inconvenienced too much during the swap period.

The Ghana Environmental Assessment Regulations, 1999, LI 1652, categorizes the construction of power transmission lines as environmentally critical projects for which an Environmental Impact Assessment (EIA) is mandatory. In compliance with national legislation and in furtherance of its Corporate Environmental Policy, GRIDCo intends to carry out an environmental impacts assessment of the proposed transmission system.

Prior to the preparation and submission of this report a scoping study was carried out in order to narrow down the issues to be discussed in the EIS and to agree with the EPA on the important and critical issues that should be addressed in the EIS subsequently undertaken for the proposed project. In January 2015, GRIDCo submitted the Scoping Report to the EPA outlining the Terms of Reference (TOR) for the study. The EPA has formally responded and given a satisfactory comment on the issues to be addressed in the EIS. This EIS has therefore been carried out taking special cognisance of the agreement of the EPA with the issues raised by GRIDCo.

The relevant documents on policies and regulatory framework that must be considered for the successful implementation of the project have been gathered and reviewed as part of the EIA study. All relevant national laws, policies, regulations, guidelines and standards that may apply to the transmission line project will be considered in the preparation and submission of the EIS as required. Consultations have also been carried out with some of the relevant agencies to ensure that as many shades of opinion and expertise are considered in the design, construction and operation of the proposed project.

The proposed construction activities of the transmission line will be carried out across only in Okaikoi South sub-Metropolitan Assembly under Accra Metropolitan Assembly of Greater Accra Region.

The project will be carried out within a narrow corridor of 30 m that will span within the sub-metro (and some of its communities) for a distance of about 3km. The project may therefore be termed a 'linear' one.

In the alignment of the proposed transmission line, the proponent has ensured that fragile and environmentally sensitive areas have been avoided. Deliberate efforts were made to avoid as many communities as possible.

The Environmental and Social Impacts Statement has concentrated on environmental issues that relate to delivery to site of equipment and materials, erection of towers, stringing of lines, testing and commissioning of a 3kilometre 161 kV transmission line.

In accordance with GRIDCo's engineering design and construction practice, the proposed project will consist of the erection of steel transmission towers along the route. The height of the towers will be such as to provide a minimum of 7.5 – 8 m clearance between the lines and open ground and 8 m clearance for roads. Typically, as with the existing system, the towers will be about 35 – 40 m high.

The proposed project is expected to adversely impact on the environment if mitigative measures are not put in place. The proponent however is conscious of the sustainability of the environment within which it operates, especially with regard to the socio-economic and socio cultural environments. The proponent is therefore committed to the implementation of all the environmental mitigation measures put forward in this document.

Legal and policy considerations

An undertaking of this nature can only be carried out within certain legal and policy frameworks. The following relevant regulations guide the implementation of the undertaking:

- ❖ Environmental Protection Agency Act 1994, (Act 490)

- ❖ Environmental Assessment Regulations, 1999 (LI 1652)
- ❖ Volta River Development Act, 1961 (Act 46)
- ❖ World Bank's Operational Directive 4.01, "Environmental Assessment"
- ❖ International Finance Corporation, Environmental, Health and Safety Guidelines for Electric Power Transmission and Distribution
- ❖ World Bank's OP 4.12
- ❖ Factories, Offices and Shops Act, 328 of 1970 (For Occupational health and safety).
- ❖ Energy Commission Act, 1997 (Act 541)
- ❖ Lands (Statutory Wayleaves) Act, 1963 (Act 186)
- ❖ Lands (Statutory Wayleaves) Regulations, 1964 (LI 334)
- ❖ Lands (Statutory Wayleaves) (Amendment) Regulations, (LI 334)
- ❖ Volta River Authority (Transmission Line Protection) Regulations, 1967 (LI 542)
- ❖ Volta River Authority (Transmission Line Protection) (Amendment) Regulation, 2004 (LI 1737)
- ❖ The Land Policy, 1999
- ❖ Volta River Authority (Transmission Line Protection) (Amendment) Regulation, 2004
- ❖ Volta River Development Act (2005), Act 692
- ❖ Water Resources Commission Act (1996), Act 522
- ❖ Wild Animals Preservation Act (1961) Act 43
- ❖ Wildlife Reserve Regulation (1971) LI 710
- ❖ Immovable Property Rate Regulations (1975) LI 1049
- ❖ National Museums Decree (1969) NLCD 387
- ❖ Factories, Offices and Shops Act, 1970, Act 328
- ❖ Fees and Charges (Amendment) Instrument, 2011 (LI 1986)

Consideration of alternatives

Prior to the design of the proposed transmission line, various alternatives were considered both in terms of equipment and the feasibility of the project itself during the project planning stage. The EIA has presented alternatives in comparative form, defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public. Some of the information to be used to compare the alternatives is based upon the design of the alternative and some of the information is based upon the environmental, social, and economic effects of implementing each alternative.

Some factors considered that informed the decisions of the proponent include:

- a) The "No Development Scenario"
- b) Possibility of the Use of Alternate Mode of Transmission
- c) Selection of Optimal Transmission Line Route
- d) Alternative Phase Conductors
- e) Alternative Tower Design

The options above have been discussed in the report indicating the reasons for the choices made.

Identification of issues of environmental concern

The Accra Central Power Transmission Project will depend on an existing 15m Electricity Company of Ghana (ECG) Right Of Way (ROW). Unlike other projects whose impacts would be generally confined to specific areas of influence, the Project is considered a 'linear' project. The potential impacts from such a project would affect a much wider area of influence. The diverse locations of the various sections of the transmission line project enhance the potential adverse impacts of the project. These potential impacts require proper management in order to minimise or eliminate the negative impacts and, if possible, maximise the beneficial ones to ensure the sustainability of the environment.

The identification process considered the likely impacts of the project in relation to each activity under the three main phases of the project, viz:

- a) Pre-constructional
- b) Constructional and
- c) Operational phases

The list of environmental compartments likely to be affected is shown as follows:

Impact category	Specific environmental compartment	Potential significant issues for EIA Consideration
Environmental	Soils and Land Use	Potential impacts resulting from the land-take for the power transmission line.
	Noise and Traffic	Potential limited impacts during construction. Identification of construction impacts, specification of mitigation and monitoring to be included in the EIS.
	Air quality	No significant potential new impacts. Identification of construction impacts, specification of mitigation and monitoring to be included in the EIS.
	Landscape and Visual	Potential for views to local communities, although considered to be insignificant this will be recorded in the EIS.
	Water resources	Potential limited impacts on the quality of surface water during construction. Identification of construction impacts, specification of mitigation and monitoring to be included in the EIS.
	Air quality	No significant potential new impacts. Identification of construction impacts, specification of mitigation and monitoring to be included in the EIS.
	Infrastructure	Potential impacts from land acquisition resulting in destruction of structures and crops and subsequent compensation.

Impact category	Specific environmental compartment	Potential significant issues for EIA Consideration
Socio-economic	Transportation and Traffic	Potential impacts on traffic due to road crossings
	Cultural and social conditions	Potential impacts principally resulting from change of land-use through land take for power transmission line route. Potential impacts on sites of archaeological and/or cultural heritage significance as a result of land-take.
	Means of livelihood	Potential benefits of electricity power access to communities in the longer term.
	Occupational health and safety	Potential impacts arising from use of machinery and equipment.
Health and safety	Public health and safety	Potential impacts principally arising from location of power line with respect to properties and restricted to that of fear or uncertainty regarding personal health.

Mitigation measures

GRIDCO has identified impacts associated with the proposed development that are quite typical of transmission line projects. It has also recommended mitigation measures that it will carry out to ensure that the environment within which it will operate is protected. These will also ensure that environmentally sound practices are adhered to in order to safeguard the safety and health of persons or any group of persons working on the project during project implementation.

The proponent, together with the Land Valuation Division of the Lands Commission, is in the process of compiling a detailed list of all potential project-affected persons for the purposes of the payment of fair, adequate and prompt compensation. The Rehabilitation Action Plan (RAP), sometimes referred to as Resettlement Action Plan (RAP) that will subsequently be prepared shall be submitted to the Environmental Protection Agency within six weeks after receipt of the environmental permit for comments. Recommendations proposed in the Environmental and Social Management Plan will be strictly adhered to in order to mitigate the impact on the affected persons.

On potential air quality deterioration and generation of noise, the proponent will carry out watering of exposed ground surfaces close to residential areas in order to reduce the possibility of generation of airborne particulate matter. Adequate and regular maintenance of machinery and the avoidance (as much as possible) of constructional activities in the vicinity

of local communities at night will minimise noise nuisance impacts on the local communities. Daytime noise levels are not expected to be a nuisance.

Upon the discovery of any archaeological sites, the Museums and Monuments Board will immediately be informed and the site will be isolated for further action by the Board. GRIDCo will ensure that the sites will no more be worked by the construction team. In addition GRIDCo will ensure that cultural and religious properties of the local communities are not destroyed or desecrated as a result of the construction activities.

The safety of the public in relation to the transmission line and towers will be ensured by posting signs on the towers warning of the dangers of the line. Regular patrols and maintenance will also ensure that vandalism and wear and tear of the towers are immediately noticed for redress.

The proponent will ensure that the health status of the public in the area of environmental influence of the proposed project is not made worse off by the introduction of migrant workers who may use their economic power to compete for members of the opposite sex and indulge in unprotected sex and increasing the incidence of STDs and/or HIV/AIDS. The proponent will ensure the education of the workforce on the dangers of promiscuity and unprotected sex.

The management of waste in the work camp and the construction sites have been planned to exert minimum adverse effects on the environment.

The proponent acknowledges that the proposed investment in the transmission line project would be worthless if the safety, health and welfare of the employees are not safeguarded. Management will therefore do its utmost to ensure that safety, health and welfare provisions of the Factories, Offices and Shops Act 328 are strictly adhered to.

The use of personal protective equipment will be strictly enforced in order to protect workers and prevent accidents. In addition, GRIDCo will ensure the provision of, among others, first aid boxes, drinking water and sanitary facilities at the construction sites and work camp (non-residential) to provide for the health and welfare of all employees engaged on the project.

Monitoring

GRIDCo will carry out continuous monitoring of the identified impacts. The indicator parameters to be monitored shall include, but not limited to, noise, air quality, socio-economic issues and occupational safety and health issues. A monitoring programme has been developed to determine impacts on the physical, biological and socio-economic/cultural environments within the project's area of influence including the sites for the substations. The monitoring results are expected to indicate whether the predictions of potential environmental impacts are accurate and also whether the mitigation measures proposed for the management of the impacts are appropriate and adequate. The programme will also serve as an early warning system by revealing unforeseen impacts and allowing additional corrective measures to be implemented to arrest the situation and ensure that irreversible

damage is not caused. The programme is also expected to provide useful guidance for the successful planning and implementation of future power transmission line projects that will be undertaken by GRIDCo.

Further, an Environmental and Social Management Plan (ESMP) shall be prepared as part of the EIA and as a separate document to help document relevant processes and personnel as well as cost of the environmental monitoring and management process. In addition, a Resettlement Action Plan (RAP) is being prepared as a separate document for the mitigation of impacts on all project-affected persons.

GRIDCo will finance the environmental monitoring component of the transmission line from the project implementation cost. An amount of US\$62,115 has been estimated as budget item for environmental monitoring activities for the constructional phase of the project.

Provisional Environmental and Social Management Plan (PESMP)

A provisional environmental and social management plan has been provided in accordance with the EIA requirements and for the purposes of managing the substantive environmental issues arising from the implementation of the proposed project. The PESMP details active remedial measures and monitoring activities to be continuously carried out to prevent or minimize impacts on the physical, biological and socio-economic/socio-cultural environments as well as to promote occupational safety and health of employees. The objective of the PESMP is to establish and provide basic guidelines, policies, and procedures which shall be used in establishing, administering, and maintaining the environmental program.

Institutional arrangements and training

The ESIA details active remedial measures and monitoring activities to be continuously carried out to prevent or minimize impacts on the physical and biological environments as well as to promote occupational safety and health of employees.

Consultations

Consultations were made with some regulatory agencies, sub-metropolitan assembly, project-affected persons and local communities prior to the preparation of this EIS. The communities predicted to be affected by the proposed project were identified and consulted to determine the potential impacts the implementation of the proposed project might have on them. The methodology and results of the consultations have been presented in this report.

Conclusion

This Environmental Impacts Statement has identified potential impacts on the physical, biological, socio-economic/cultural environments, occupational safety, health and welfare of the employees. Mitigative and potential remedial measures have also been outlined. These will be actively pursued in order to minimise or, if possible, eliminate the identified negative impacts.

The transmission line project cannot be carried out without any impacts on the environment. Indeed, some of the impacts are unavoidable. However, the mitigative measures put forward are expected, as far as possible, to be able to minimise the impacts so as to make them pose no threats to the continued sustainability of the environment.

A review of the identified impacts shows that there will be some significant adverse irreversible impacts on the environment (e.g. land ownership and land-use characteristics). Other impacts will be minimal and temporary.

The implementation of the project will ensure an increased reliability of supply of power in the Accra central business area in the Greater Accra Region, reduction of the rather high system losses as a result of the construction and maintenance of rather long distribution lines. It will also reduce the long and rather frequent power outages, voltage fluctuations and consequently lower supply reliability.

The proposed transmission line is therefore designed to also fulfil the objective of providing a more reliable and secure transmission of power to meet the expected increase in demand of electrical power within the aforementioned enclave.

The Ghana Grid Company Limited believes that this EIS has sufficiently dealt with the significant issues on the ground and will therefore meet the expectations of the EPA and warrant the issuance of an Environmental Permit to enable it proceed with the implementation of the project without delay.

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1.0 INTRODUCTION

1.1 Ghana Grid Company Limited

The Ghana Grid Company Limited (GRIDCo) was established in accordance with the Energy Commission Act, 1997 (Act 541) and the Volta River Development (Amendment) Act, 2005 Act 692, which provide for the establishment and exclusive operation of the National Interconnected Transmission System by an independent utility and the separation of the transmission functions of the Volta River Authority (VRA) from its other activities within the framework of the Power Sector Reforms.

This was as a consequence of major re-structuring in the context of the Ghana Government Power Sector Reforms which resulted in the amendment of the Volta River Development Act 1961 (Act 46), which established the Volta River Authority (VRA) as a public-owned corporate utility with the primary function of generating electric power, first by the development of the hydroelectric potential of the Volta River and the construction and operation of a transmission system for the supply of electrical energy for industrial, commercial and domestic use in Ghana.

Following the enactment of the Amended Act, the power transmission function of the VRA was transferred to GRIDCo which is now responsible for the entire national power evacuation and transmission infrastructure that VRA had hitherto managed in addition to its power generation functions. GRIDCo was incorporated on December 15, 2006 as a private limited liability company under the Companies Code, 1963, Act 179 and granted a certificate to commence business on December 18, 2006. The company became operational on August 1, 2008 following the transfer of the core staff and power transmission assets from VRA to GRIDCo.

GRIDCo as a transmission utility company is mandated to:

- Carry out the business of economic dispatching and transmission of electricity from facilities of wholesale suppliers to bulk customers or distribution companies and utilities in Ghana and West Africa without discrimination.
- Acquire by purchase or otherwise construct, establish, manage, maintain, and otherwise deal with all transmission facilities, works, buildings, and other systems necessary to transmit electric energy.
- Undertake metering and billing of all power transfers in the National Interconnected System.
- Carry out any general commercial activities related to the safe and reliable operation of transmission system and economic dispatch of electric energy.

GRIDCo now owns and operates a countrywide transmission system for the distribution of bulk electric power in Ghana, consisting of about 218km of 330kV transmission line, About 4,000 circuit-kilometres 161 kilovolts (kV) transmission lines and 50 of 161/34.5kV and/or 11.5kV substations. Six hundred (600) circuit-kilometres of the 161 kV lines are currently operated at 34.5 kV and are referred to as “161 kV light lines”. The transmission system is a 161 kV loop serving loads in the southern part of the country and two separate radial lines from Techiman to the north. The radial circuit towards the Upper West Region supplies the

loads of major towns of Sawla and Wa. The radial circuit towards the Upper East Region supplies the loads of major towns of Buipe, Tamale, Bolgatanga, Zebilla, Bawku, and Youga in Burkina Faso. The Northern circuit extends to supply other communities in Ghana and also serve as an interconnection to Dapaong and Cinkasi in Northern Togo.

The GRIDCo Transmission System is also interconnected with the power systems of La Cote d'Ivoire and Togo/Benin. A 225 kV single-circuit inter-tie connects the GRIDCo network to the network of Compagnie Ivoirienne d'Electricité (CIE) of la Côte d'Ivoire at Prestea and Abobo respectively. In addition, a double-circuit 161 kV transmission line from Akosombo to Lome connect the GRIDCo network to the network of Communate Electrique du Benin (CEB) of Togo and Benin. A fact sheet on GRIDCo's transmission system is outlined in Table 1.

Table 1: Fact sheet on transmission network - transmission line lengths

330 kV	219.5 km
161kV	3,888.1 km
225 kV	73.4 km
69 kV	132.8 km
No. of Transformers (including spares)	100
Transformer Capacity	2,915 MVA
No. of Transformer/Switching Substations	53
Largest switching Substation is Volta substation	Tema
Transformer Substations	330/161kV, 161/69kV, 161/34.5kV, 161/11.5kV

1.2 Project Rationale

The Ghana Government regards the electricity sector as a priority development sector to convert economic structure of Ghana, and is increasing electric capacity and improving transmission/distribution networks for major cities. GRIDCo is in charge of the development of transmission/distribution networks and they are promoting those projects. However, these efforts have not fulfilled the demand of electricity especially for the metropolitan area and major cities. Therefore, GRIDCo requested the Government of Japan the Project to improve transmission lines and substations for the central area of the Accra Metropolitan Area.

GRIDCo intends to develop a bulk supply point (BSP) within the Central Business District (CBD) of Accra to meet the increasing Energy demand in this area, which is growing at a rate higher than the rest of the demand growths in the country adequately and reliably.

The total power demand in the Greater Accra Region of Ghana is projected to range from 800 MVA to 1,000 MVA by 2015 with a combined average annual growth rate of about 8%. The main power consuming areas are the Central Business District of Accra and the industrial city of Tema, where demand growth per annum exceeds 10%. The others include the University of Ghana, the affluent communities of Airport Residential Area, East and West Legon Residential Areas, Trassacco Valley, heavily populated townships of Teshie, Labadi, Osu, Nungua, Dansoman, Ashaiman, Kasoa and the upcoming developing territories of Dawanya, Weija, Madina. Power is also supplied to locations outside the region to Nsawam, the

Akwapim mountains etc. In all these localities, there are many developments going on in the areas of real estates, commercial and industrial activities faster than anywhere in the country. The present sources of supply of electricity to these communities are from the Achimota and Mallam Bulk Supply points (BSPs), with a total transformation capacity of almost 600 MVA. The third bulk supply point (A3BSP) near Adjiringanor was in 2014 with a capacity of 130 MVA bringing the total supply capacity in the Greater Accra region to about 730 MVA. It is worth noting that all the BSP's (existing and planned) are located well outside the CBD, where about 30% of the demand is located. The closest BSP being Achimota substation requires several medium voltage circuits to be able to serve the continuously growing load adequately. This is not possible due to several Right Of Way (ROW) challenges in the CBD. Also the nature of the load has changed considerably with increased penetration of reactive power consuming loads such as air conditioners, vacuum cleaners and other sophisticated gadgets which consume lots of reactive power. This load requires a reliable supply and a means of voltage control and switching. There is therefore the need to inject a new HV/MV substation within the CBD of Accra in order to mitigate the above challenges and enhance the reliability of supply to the most densely electricity consuming location in Ghana.

1.3 Purpose of the Environmental Study

Under the provisions of the Ghana Environmental Assessment Regulations, 1999, LI 1652 and Environmental Protection Agency, 1994, Act 490, the proposed undertaking is categorized as one for which an Environmental Assessment is required for acquisition of an environmental permit for commencement of physical construction. Again, Section 2.1.5 of the Environmental Impact Assessment Guidelines (EIA) for the Energy Sector, Volume 1, dated August 2010, indicates that the "High voltage transmission lines, either HVDC (High Voltage Direct Current) or HVAC (High Voltage Alternating Current), either overhead or underground, equal or exceeding 70 kV class; Retrofitting, upgrading as well as decommissioning included" requires that an EIA is carried out and submitted to EPA for the purposes of acquisition of an Environmental Permit. It is therefore a legal requirement in Ghana that development projects such as the "Accra Central Transmission Project" with a 161 kV transmission line component should be subjected to an EIA. The EIA processes have been further outlined in the Volume 2 of the EIA Guidelines for the Energy Industry.

The purpose of this EIA study is to achieve the following:

- Facilitate the understanding and determination of the likely implications of the transmission line project, the relevant considerations, planning and mitigation options, that will ensure that the project is implemented in an environmentally sound and sustainable manner.
- Provide sufficient information to justify the environmental and social aspect, approving, modifying, selecting other alternatives or rejecting in respect to financing and the execution of the transmission line project.
- Act as the basis of identifying the main measures, which will accompany the implementation of the transmission line project and associated facilities concerning environmental aspects.

- Form the basis for consideration for environmental approval and permit from the EPA for the implementation of the proposed project.

The EIA process begins with the submission of the relevant EIA Form to EPA to register the project. This is then followed by a scoping exercise and the preparation of a Scoping Report, detailing the Terms of Reference (ToR) for review. The scoping exercise is an important component of EIA methodology and aims at achieving the following, among others:

- Providing an opportunity for consultants, relevant authorities, project proponent, interested and affected parties as stakeholders to express their views and concerns regarding the proposal before the EIA is conducted.
- Focusing the study on key and relevant issues for quick decision making.
- Identifying potential stakeholders with an interest in the project.
- Identifying shortcomings in existing information
- Providing the basis for agreement with the EPA on critical issues of concern that should be addressed by the EIA.

During scoping, the main environmental and social issues are to be identified; the depth of analysis required for each impact is also to be identified or stated in the ToR. The approval of the Ghana EPA of the ToR in the scoping study is required prior to the submission of the EIA Report, also known as Environmental Impact Statement.

In compliance with national legislation and in furtherance of its Corporate Environmental Policy, GRIDCo engaged the services of Department of Environmental and Natural Resources of the Presbyterian University, Ghana, a local environmental consulting firm with vast experience in environmental assessment in the power sector, to undertake the EIA required for the environmental permit application for the “Accra Central Transmission Project” (ACTP).

GRIDCo completed and submitted the required EPA application form with the objective of applying for an Environmental Permit to enable the physical construction of the ACTP to commence. The EPA has confirmed that the project falls under the category for which an EIA and a Scoping Study is required. A Scoping Report was therefore prepared by GRIDCo in fulfilment of EPA’s Environmental Assessments requirements. This report provided, among others, the Terms of Reference of the EIA study for the “Accra Central Transmission Project”. In line with the EA Guidelines, a Scoping Notice¹ was subsequently placed in various widely circulating newspapers in the country to inform the general public about the project and to solicit concerns for consideration and incorporation in the EIA document. EPA formally responded to the Scoping Report in their letter attached as Appendix 1.

This Draft EIA Report for the Accra Central Transmission Project has therefore been undertaken as a result of the aforementioned activities. The EIA Report is intended to prevent or minimise potentially adverse environmental impacts and enhance overall quality of the project as it allows environmental issues to be addressed in a timely and cost effective

¹ Scoping Notice attached as Appendix 1

way during the project design, preparation and implementation. As a feasibility study tool, the EIA Report can help reduce overall project cost, assist in completing the project on schedule and help design projects that are acceptable to all stakeholders.

The Environmental Assessment study is concerned with the ecological and social aspects of the project within its area of environmental influence, particularly the possible adverse consequences such as pollution, disturbance of habitat, truncation of land uses, dislocation of people and other forms of social distress, loss of buildings and fields, and dangers to people and animals. The study has addressed indirect as well as direct impacts and recommended mitigation measures.

Potential impacts were identified from critical analysis of the transmission construction and operations conducted in relation to their environment setting. This drew on data from the scoping and baseline study and on the experience of the study team as well as similar environmental assessments reports both in Ghana and elsewhere. The nature of the predicted impact is described and its significance determined by reference to appropriate standards or guidelines.

Mitigation describes the programs or processes to be implemented to eliminate or minimize the potential impacts identified for each system studied. Mitigation includes preventive engineering implemented during the design phase of the transmission project, on-going and planned programs to eliminate or minimize impacts during development of the project, and monitoring plans to evaluate the success of the mitigation. Mitigation measures indicated outlined on-going measures in place at the project site. A programme of monitoring to be put in place to verify the mitigation works and the effectiveness of the management practices is outlined.

The EIA report is intended to meet the formal requirements of the Environmental Protection Authority of the Government of Ghana. The report is therefore structured as follows:

- Executive Summary
- Introduction - Chapter 1
- Description of the Proposed Project - Chapter 2
- Analysis of Alternatives - Chapter 3
- Description of the Existing Environment - Chapter 4
- Assessment of Impacts - Chapter 5
- Mitigation Measures - Chapter 6
- Monitoring Measures - Chapter 7
- Provisional Environmental Management Plan- Chapter 8
- Consultations - Chapter 9
- Demobilisation - Chapter 10
- Conclusions - Chapter 11
- References
- Appendices

A Resettlement Action Plan (RAP) and a separate Environmental & Social Management Plan (E&SMP) are being developed as separate volumes to this document.

1.4 Information sources

The general method being used in this environmental assessment for the development of the EIA involves an extensive review of baseline environmental data for the project area. Field visits to the project site have been undertaken for an assessment of the existing environment. Both primary and secondary data were collected. Primary data was collected on the economic characteristics and ecological details. Primary data on the social and economic factors were collected through visits to the project area. Interviews were also conducted with high profile indigenes of the communities as well as with various stakeholders including area administrative officials and government departments such as Town & Country Planning Department, Metropolitan Health Services, Metropolitan Assemblies, Department of Urban Roads, Ghana Railways Company and Metropolitan Education Service in the project affected area.

The secondary data to supplement the primary data was collected through a wide literature review on the project as well as the project area, both published and unpublished. The District Environmental Sanitation Strategy & Action Plan for the Okaikoi South Sub-Metropolitan Assembly provided detailed environmental and social information required for the EIA Study. A number of background documents and diagrams/figures on the project were obtained and reviewed, including the “Project Technical Report”, as well as various minutes on meetings to discuss the most appropriate materials and route for the transmission line.

The “World Bank Operational Policy 4.01 for Environmental Assessment” were also considered and reviewed. The preparation of the Scoping/EIA Reports were also guided by several examples of high voltage transmission system EAs’ prepared for International Development Agencies supported projects in Ghana and other countries in the African Region.

1.5 Existing policy, legal and administrative framework

The relevant policies and regulatory framework that must be considered for the successful implementation of the project have been gathered and reviewed as part of the EIA study. All relevant national laws, policies, regulations, guidelines and standards that may apply to the transmission line and its auxiliary structures were applied as required. Consultations have also been carried out with some of the relevant agencies to ensure compliance.

The broad mandate for environmental protection and over-arching resources and sustainable development fall under the EPA, as the lead regulator. The adoption of the National Environmental Action Plan led to the enactment of the EPA Act 490 (1994) which for the first time gave legal support to Environmental Assessment (EA) implementation in Ghana, after almost fifteen years of experimentation. The passing of the Ghana EIA Procedures into the EA Regulations (LI 1652, 1999) further consolidated EA application in Ghana.

All relevant policy, legal and administrative framework and their implications for the successful take-off and implementation of the proposed project were analysed and included in the EIA Report. The legal frameworks under consideration include:

1.5.1 National Acts & Regulations

a) *The Constitution of the Republic of Ghana, 1992*

The 1992 Constitution gives maximum protection to individual property rights. Private properties are only to be taken where there is compelling reasons for the state to interfere with such rights. Article 20 establishes that no property “shall be compulsorily taken possession of or acquired by the State” unless it is, among various purposes, “to promote the public benefit”.

The Constitution also provides that where private lands are surrendered for public good, the affected owners must not be made worse off. It states that “Compulsory acquisition of property by the State shall only be made under a law which makes provision for (a) the prompt payment of fair and adequate compensation; and (b) a right of access to the High Court by any person who has an interest in or right over the property. Further, “where a compulsory acquisition or possession of land affected by the State in accordance with clause (1) of this article involves displacement of any inhabitants, the State shall resettle the displaced inhabitants on suitable alternative land with due regard for their economic well-being and social and cultural values”.

All project related associated land acquisition exercise is to be guided by the requirements of the 1992 Constitution.

b) *The Environmental Protection Agency Act (1994) Act 490*

It has been realised that the failure of many environmental policies in many countries has generally been as a result of exclusive concentration on the development of policies, laws and standards to the neglect of implementation including compliance and enforcement. Consequently, the Environmental Protection Agency (EPA) Act 1994 (Act 490) was promulgated by the Government of Ghana to replace the erstwhile Environmental Protection Council Decree (NRCDC 239). The Act provided the Agency with the compliance and enforcement powers necessary for the achievement of the environmental policy objectives.

Act 490 established the authority, functions, structure and funding of the EPA and gave mandate to the Agency to ensure compliance of all investments and undertakings with all laid down Environmental Assessment (EA) procedures in the planning and execution of development projects, including compliance in respect of existing ones.

c) *Environmental Assessment Regulations (1999) LI 1652*

In order to give effect to provisions of the Act on environmental management, the Environmental Assessment Regulations 1999 (LI 1652) was enacted in February 1999, consistent with Section 28 of the Act 490. The LI sets out the requirements for environmental permitting, environmental impact assessment (EIA), the production of preliminary environmental reports (PERs) and subsequent environmental impact statements (EISs), environmental certificates and environmental management plans (EMPs).

The legislative functions conferred on EPA by the Act, included the authority to request from categories of undertakings, enterprises, construction or development an environmental

impact assessment and/or environmental management plan to regulate the type, quantity, conditions or concentrations of substances that may be released into the environment.

The Environmental Impact Assessment (EIA) procedure is not only a regulatory tool to be enforced pursuant to Section 24 of LI 1652, but also a compliance promotion tool to ensure effective preventive, minimisation and mitigation of potential impact of industrial developments existing prior to and after the coming into force of LI 1652. Construction and operation of a bulk transmission lines is one of the undertakings for which an EIA is mandatory.

d) Electricity Company of Ghana (ECG), Act 461 of 1997

The Electricity Corporation of Ghana (ECG) was established by a decree (NLC Decree No.125) in 1967 and replaced the Electricity Department of the Ministry of Works and Housing. However, under the provisions of the Statutory Corporations (Conversions to Company) Act, 1993 (Act 461), ECG has since 1997 been converted into a limited liability company called Electricity Company of Ghana. Prior to 1987, ECG was responsible for distributing electricity throughout Ghana when it receives bulk supply from the VRA. The ECG's responsibility for distribution is now limited to the Ashanti, Western, Central, Eastern, Greater Accra and Volta Regions.

e) Volta River Development Act, 2005, Act 692

Ghana's Power Sector Reforms culminated in the passing of the Amendment to VRA Act 46 in 2005. By the Volta River Development Act, 2005, Act 692, the power transmission functions of the VRA was transferred to a transmission utility company known as Ghana Grid Company Limited (GRIDCo). GRIDCo is now responsible for the entire national power evacuation and transmission infrastructure that VRA had hitherto managed together with power generation. GRIDCo shall be responsible for co-managing the transmission line component with VRA during the operational phase.

f) Volta River Development Act, 1961 (Act 46)

The Volta River Authority (VRA) was established on April 26, 1961 under the Volta River Development Act, Act 46 of the Republic of Ghana with the core business to generate and supply electrical energy for industrial, commercial and domestic use in Ghana. VRA started with the development of the hydroelectric potentials of the Volta River and the construction and maintenance of a nation-wide grid transmission system. Today, it has expanded into thermal generation to complement inadequate capacity for hydro generation.

The VRA is currently responsible for electric (bulk) power generation, and power produced feeds into the transmission system of GRIDCo, which shall include the proposed KTPP. GRIDCo then supplies to both internal and external market.

g) Energy Commission Act (1997), Act 541

Act 541 established the Energy Commission and provided for its functions relating to the regulation, management, development and utilization of energy resources in Ghana; provide for the granting of licenses for the transmission, wholesale supply, distribution and sale of

electricity and natural gas; refining, storage, bulk distribution, marketing and sale of petroleum products and to provide for related matters.

The provisions of the Energy Commission's 'PUBLIC NOTICE – EC N. 003' require the VRA to register the proposed project with the Commission and to obtain a permit prior to the commencement of construction of the proposed project. This permit is subject to the granting of an Environmental Permit by the EPA. A "Licensing Manual for Service Providers in the Electricity Supply Industry" was developed and issued by the Energy Commission of Ghana in 1996 to formally establish the framework for licensing electricity production, supply, and distribution and sale services in the power sector of Ghana as stipulated by the Energy Commission Act (Act 541), 1997.

GRIDCo is subsequently required to submit relevant documents to EC for the organization to be issued with a license for all of its transmission projects.

h) Public Utilities Regulatory Commission (PURC) 1997, Act 538

The Public Utilities Regulatory Commission (PURC) 1997, Act 538 requires the PURC to set up guidelines for pricing of power generated by thermal plants taking into consideration assurance of financial viability of power produced, investor interests and best use of natural resources.

i) Factories, Offices and Shops Act (1970) Act 328

Act 328 promotes and ensures the health, welfare and safety of persons employed in the country as well as the responsibilities of the employer. Under the Act, employers are required to ensure that a safe and healthy workplace is provided for the safety, health and welfare of all employees.

j) Labour Act No (2003) Act 651

Part XV, Section 118 (1) and (2a-h) of the Act enjoins employers to ensure that every worker employed by him or her works under satisfactory, safe and healthy conditions, and is further obliged to provide necessary information, instructions, training and supervision to ensure the health and safety at work of those other workers engaged in a particular work.

k) National Museums Decree (1969) NLCD 387

NLCD 387 provides for the care of any archaeological finds. This is the law governing the activities and operations of the National Museums and Monuments Board. Procedures to be followed on the discovery of any such artefacts are outlined in NLCD 387.

l) Volta River Authority (Transmission Line Protection) Regulations, 1967 (LI 542)

VRA (Transmission Line Protection) Regulations, (1967) LI 542 provide security for VRA Transmission Lines and ensure public safety. Define "transmission line right of way" and prohibit/restrict a number of activities in the RoW including farming, cultivation, mining and construction of buildings, which are only allowed with prior consent from the VRA.

m) *Volta River Authority (Transmission Line Protection) (Amendment) Regulation, 2004*

VRA (Transmission Line Protection) (Amendment) Regulation, 2004 (LI 1737) which provides for the right of way distances for 69 kV, 161 kV, 225kV, 330 kV transmission lines. The RoW for 225 kV and 330 kV transmission towers is 40 meters, whilst that of 69kV and 161 kV is 30 m. This regulation prohibits a number of activities in the RoW including mining, construction of buildings, and cultivation of some types of crops.

n) *Electricity Transmission (Technical, Operational And Standards Of Performance) Rules, 2008 L.I. 1934*

LI 1934 provide rules and define the national interconnected transmission system; and establish the requirements, procedures, practices and standards that govern the development, operation, maintenance and use of the high voltage national interconnected transmission system. The rules are to ensure that the transmission system provides a fair, transparent, non-discriminatory, open access, safe, reliable, secure and cost efficient transmission and delivery of electricity.

o) L.I. 1937: Electricity Regulations, 2008:

The purpose of these Regulations is to provide for (a) the planning, expansion, safety criteria, reliability and cost effectiveness of the national interconnected transmission system; (b) the regulation of a wholesale electricity market; (c) the market operations of the electricity transmission utility; (d) the technical operations of the electricity transmission utility; (e) minimum standards and procedures for the construction and maintenance of facilities and installations; (f) the protection of the mains and electrical installations and services; (g) the protection of life and property and the general safety of the public in respect of electricity services; (h) minimum reserve margins to satisfy demand; and (i) the development and implementation of programmes for the conservation of electricity.

p) *Fire Precaution (Premises) Regulations, 2003, LI 1724*

LI 1724 among other requirements requires that adequate measures are taken to eradicate potential sources of fire outbreaks and that a fire certificate be acquired for any project or facility.

q) *Lands Commission Act, (1994), Act 483*

Act 483 provides for the management of public and vested lands and the certification of stool lands transactions. Indeed, the 1992 Constitution requires that there shall be no disposition or development of any stool land unless the Lands Commission of the region in which the land is situated has certified that the disposition or development is consistent with the development plan drawn up or approved by the planning authority for the area concerned.

r) *New Lands Commission Act (2008) Act 767*

Act 767 integrates the operations of public service land institutions under the Commission in order to secure effective and efficient land administration and to provide for related matters. The new Lands Commission is made up of the following divisions:

- Survey & Mapping Division
- Land Registration Division
- Land Valuation Division
- Public & Vested Lands Management Division

s) *Immovable Property Rate Regulations (1975) LI 1049*

LI 1049 applies for the purposes of valuation of immovable property.

t) *Lands Statutory Way leaves Act, (1963) Act 186*

Act 186 provides for entry on any land for the purpose of the construction, installation and maintenance of works of public utility, and for the creation of rights of way for such works. The owner/occupier of the land must be formally notified at least a week in advance of the intent to enter, and be given at least 24 hours' notice before actual entry. (An authorized person may enter at any time for the purpose of inspecting, maintaining, replacing or removing any specified works (Section 5). Any damage due to entry must be compensated in accordance with the established procedure, unless the land is restored or replaced. (In the case of roads, not more than one-fifth of a plot may be taken and the remainder must be viable, or the entire plot must be taken; Section 6-3(b).

u) *The Lands (Statutory Way leaves) Regulations, 1964 (LI334)*

LI 1334 law restates the principles of the Lands (Statutory Way leaves) Act of 1963, and establishes provisions for Way leave Selection Committees to determine the optimal routing and to ensure that the selected way leaves are consistent with town and country planning.

v) *State Lands Act (1962) Act 125*

Act 125 vests in the President the authority to acquire land for the public good. The President "may, by Executive Instrument, declare any land specified in the instrument to be land required in the public interest" (Sect. 1-1). On the publication of an Instrument, the land shall, without any further assurance than this subsection, vest in the President on behalf of the Republic, free from any encumbrance whatsoever" (Sect. 1-3). The State Lands Act 1962 places responsibility for registering a claim on the party affected, for it recognises that it is only the affected person who can best establish the nature of his or her interest among others.

The State Lands Act, 1962 defines the terms "cost of disturbance", "market value", "and replacement value" and other damage (Sect. 7). "Cost of disturbance" means the reasonable expenses incidental to any necessary change of residence or place of business by any person having a right or interest in the land." "Market value" means the sum of money which the land might have been expected to realize if sold in the open market by a willing seller at the time of the declaration made under section 1 of this Act." "Replacement value" means the value of the land where there is no demand or market for the land by reason of the situation or of the purpose for which the land was devoted at the time of the declaration made under section 1 of this Act, and shall be the amount required for reasonable re-instatement equivalent to the condition of the land at the date of the said declaration." Finally, "other damage" means damage sustained by any person having a right or interest in the land or in

adjoining land at the date of the declaration made under section 1 of this Act, by reason of severance from or injurious affection to any adjoining land.”

w) *State Lands Regulations (1962) LI 230*

Established for the purpose of inspecting and making recommendations as to the suitability or otherwise of any land proposed to be acquired.

1.5.2 National Policies

a) *National Energy Policy*

The National Energy Policy outlines the Government of Ghana’s policy direction regarding the current challenges facing the energy sector. The document provides a concise outline of the Government’s policy direction in order to contribute to a better understanding of Ghana’s Energy Policy framework. It is hoped that the document will facilitate the effective management and development of the energy sector as well as provide the public with information about the Government’s policy goals. The energy sector vision is to develop an “Energy Economy” to secure a reliable supply of high quality energy services for all sectors of the Ghanaian economy and also to become a major exporter of oil and power by 2012 and 2015 respectively.

b) *National HIV/AIDS STI Policy (2004)*

The National HIV/AIDS STI Policy has been developed to address the very serious health and developmental challenges posed by HIV/AIDS. The policy provides the framework for Ghana’s strategy to reduce the spread of HIV infection. It provides the necessary statement of commitment around which a legislative framework will be built for an Expanded Multi-sectoral Response to reduce further spread of the epidemic, and for the protection and support of people infected with HIV/AIDS in Ghana.

Subsequently, a National HIV/AIDS Strategic Framework for Ghana has been formulated in recognition of the developmental relevance of the disease. Ghana, by this document has joined the global community in a united effort to combat the epidemic. The Strategic Framework document is updated periodically and it provides for a “Workplace HIV Policy”, which requires all workplaces to manage and mitigate the impact of HIV/AIDS on the world of work.

c) *National Land Policy (1999)*

Provides land policy, a background to land administration and land delivery system in Ghana, problems and constraints of the land sector, the policy framework, guidelines, and actions.

1.5.3 National Guidelines

- a) Environmental Assessment in Ghana, A Guide (1996) produced by the EPA provides detailed guidance on the procedures to be adhered to when undertaking an EA.
- b) Environmental Impact Assessment Guidelines for the Energy Sector (2010), Volume 1 has been prepared to ensure the sustainable use of energy resources and also contribute towards sound environmental management in the energy sector. Volume 2 of the Guidelines provides systematic procedures on EIS preparations for the energy sector as well as guidelines on common potential impacts and mitigation measures.

- c) Environmental Impact Assessment Procedures (1995) produced by the EPA details the procedures to be adhered to when undertaking an EA.

1.5.4 International Guidelines

- a) Guidelines for electric and magnetic fields

Electro-Magnetic Fields (EMF) can be produced wherever there is a voltage or a flow of electricity, and occur both naturally and as a result of man-made products, including transmission lines. In recent years there has been much debate on the potential human health effects of EMFs, in particular in relation to electromagnetic forces generated by transmission lines. However, major research programmes throughout the world have not shown any proven causal link between ill health and EMFs. Limits for electric and magnetic fields have been published by a number of authorities including the World Health Organization (WHO), the International Commission on Non Ionizing Radiation Protection (ICNIRP) and the National Radiological Protection Board (NRPB). The two most frequently used guidelines are those produced by ICNIRP (supported by the WHO) and the NRPB. These limits are detailed in Table 2.

Table 2: NRPB and ICNIRP Guidelines

	NRPB		ICNIRP	
	Electric (kV/m)	Magnetic (μ T)	Electric (kV/m)	Magnetic (μ T)
Public	12	1600	5	100
Occupational	12	1600	10	500

The NRPB produced guidelines on restrictions on exposure to static and time-varying EMFs in 1993. Their recommendations are based on biological data relating to thresholds for well-established direct and indirect effects of acute exposure. These guidelines have been widely accepted in the UK. For both sets of guidelines, the recommendations to restrict exposure are based on the interactions of EMFs with body tissues and are termed basic restrictions. Compliance with the basic restrictions cannot, however, be generally determined directly. Investigation levels (NRPB)/Reference levels (ICNIRP) are therefore recommended as values of measurable field quantities for assessing whether compliance with the basic restrictions has been achieved. The current advice from the NRPB is that, apart from standard safety clearances, no special precautions near to power lines are necessary to guard against EMFs. At the European Union level, a Council Recommendation to limit the exposure of the general public to electromagnetic fields was adopted in July 1999, based on the guidelines of the International Commission on Non Ionizing Radiation Protection.

- b) *World Bank's Operational Directive*

The EIA study is also being done under the framework of the World Bank's Operational Directive. In order to ensure compliance with current international best practice, the EIA study is being carried out in accordance with the policies, safeguard procedures, and guidance of the World Bank Group. The World Bank screens projects based in their possible environmental impacts, in order to classify them as A, B or C. A transmission line power

development project is normally classified as a Category B project. A proposed project is classified as Category B if its potential adverse environmental impacts on human populations or environmentally important areas - including wetlands, forests, grasslands, and other natural habitats - are less adverse than those of Category A projects. These impacts are site-specific; few if any of them are irreversible; and in most cases mitigation measures can be designed more readily than for Category A projects. The scope of EA for a Category B project may vary from project to project, but it is narrower than that of an EA for Category A projects. Like Category A EA, it examines the project's potential positive and negative impacts and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance.

Detailed advice and guidance on the conduct of environmental assessment is provided publicly by the World Bank in its Environmental Assessment Sourcebook.

1.5.5 GRIDCo Environmental Policy

a) GRIDCo Corporate Environmental Policy Statement²

The GRIDCo Corporate Environmental Policy Statement commits the organization to ensuring continuous improvement of environmental performance to minimize the impacts of all its operations on the environment, in line with the principles of sustainable development, in addition to complying with national and international environmental protection regulations.

² See Cover Page

2.0 DESCRIPTION OF THE ACCRA CENTRAL POWER PROJECT

2.1 Project Overview

GRIDCo intends to construct a 3km 161kV transmission line from Avenor to link a proposed Bulk Supply Point at Central Business District in Accra to address the increasing Energy demand in this area, which is growing at a rate higher than the rest of the demand growths in the country.

. The proposed project shall involve:

A. 161kV Switching Station

- Design, manufacture, testing delivery to site installation, commissioning and bringing into commercial operation of a 161kV indoor GIS substation with six (6) feeders in a ring bus configuration at Avenor and located under the existing 161kV lines.
- Provision of the substation buildings, offices, security gatehouse, concrete fence wall, drainage facilities, access roads etc.
- Provision of standby diesel generating sets, solar power systems, security surveillance systems etc
- Provision of power system protection, control and metering systems; SCADA and communication systems etc
- Extension of 34.5kV power supply from ECG Station D at Avenor to the site.

B. 161/34.5kV Substation at Ring Road West

- Design, manufacture, testing delivery to site installation, commissioning and bringing into commercial operation of a 161kV indoor GIS substation with six (6) feeders in a ring bus configuration.
- Provision of the substation buildings, offices, security gate house, concrete fence wall, drainage facilities, access roads etc.
- Provision of standby diesel generating sets, solar power systems, security surveillance systems etc
- Provision of power system protection, control and metering systems; SCADA and communication systems etc
- Design, manufacture, testing delivery to site installation, commissioning and bringing into commercial operation of 2No., 161/34.4kV, 145MVA power transformers.

C. Transmission Lines

- Decommission existing 34.5kV double circuit transmission line between Avenor and the ECG Project Office at Ring Road West and construct 161kv line to connect the substation.
- Design, manufacture, testing delivery to site, installation and commissioning of a steel tubular pole line of four (4) circuits each made up of 400mmsq conductors and insulated at 170kV. Two of the circuits will initially be operated at 34.5Kv.

A feasibility study has been undertaken by GRIDCo to determine the transmission system requirements for the evacuation of power in the Accra Central Business District. There would be approximately 3km of new 161 kV double circuit twin bundled toucan conductor overhead to connect new substation at the Accra Central. GRIDCo shall develop the detailed design and specification for the transmission line components.

The elements of the project that has currently been carried out at this pre-construction stage have been the preparation of detail design drawings, specification and bill of quantities for the construction of the civil and structural ancillary buildings as well as land surveying and pegging to help in line route identification. Engineering, Procurement & Construction (EPC) type of contract shall be awarded for the construction of the substation and transmission lines. Tendering for the supply and construction of the project component is currently underway. The EPC Contractor will be responsible for procuring and constructing the transmission line equipment and associated components. All contractors/sub-contractors shall assume full professional liabilities with regard to fulfilment of any statutory requirements and shall be expected to carry out all civil based works in line with GRIDCo's approved specifications and drawings as well as national/international standards and codes. GRIDCo has allocated funds as part of its budget to cover eligible payments under the contract for the project, including the EIS Study.

2.2 Project location

Detailed survey works has commenced and this will provide information on exact areas or stretch where the Right of Way (RoW) of the line will be traversing. The route shall be designed to be as direct as possible. The line shall also as much as possible follow existing transport infrastructure so aiding construction and maintenance activities.

GRIDCo shall acquire the right-of-way of 3km x 0.03km, in the project area for the smooth implementation and operation of the proposed Project. The transmission line route shall run from Avenor to Ring road central in the Okaikoi South Sub-Metro in the Greater Accra Region. Table 3 presents the list of affected businesses and suburbs.

Table 3: List of affected districts and communities

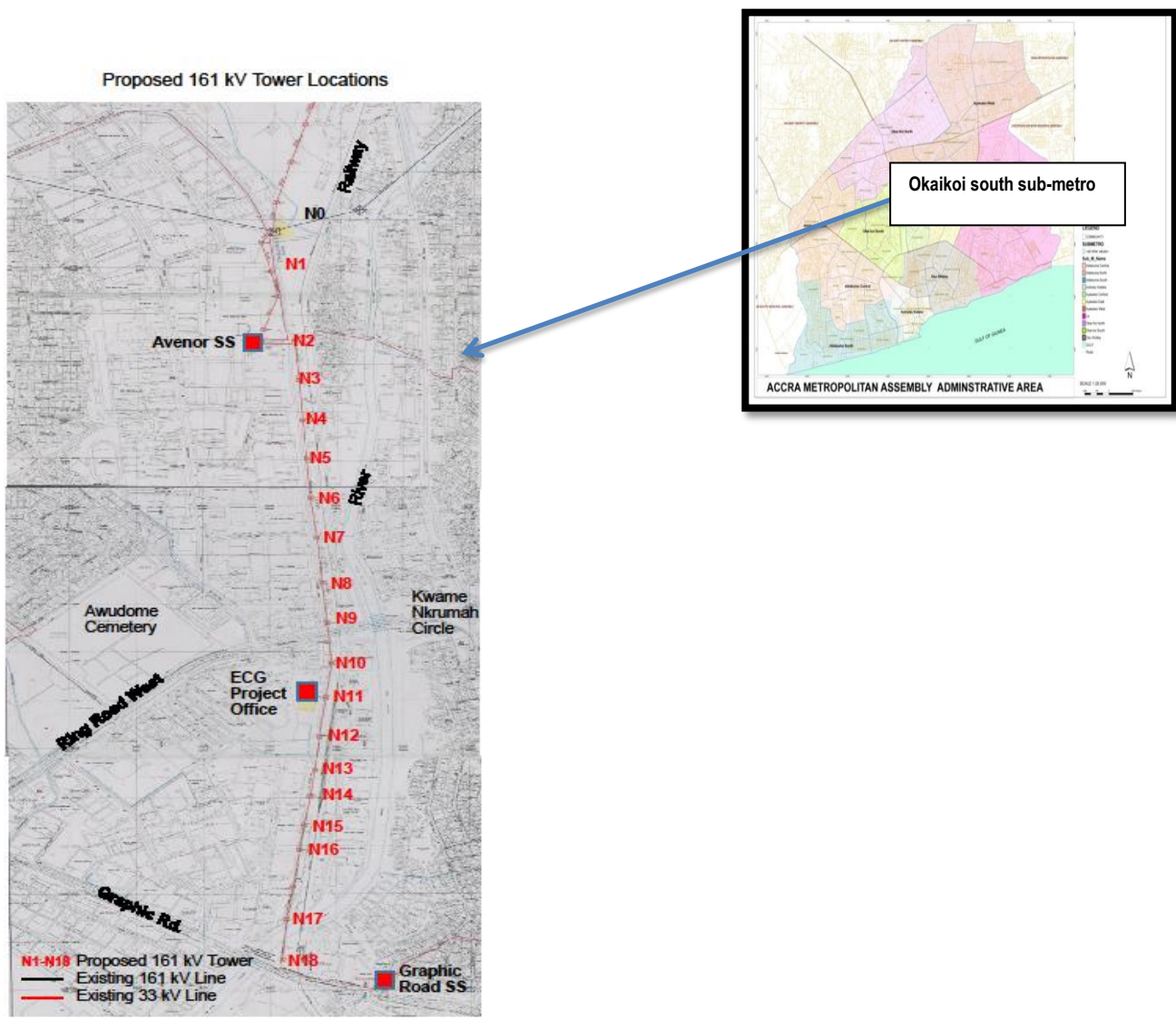
Region	Municipal/District	Settlements/Communities
Greater Accra	Okaikoi South sub-metropolitan Assembly	Avenor Baltimore, Las Palmas, Ecomog

2.3 Right-Of-Way (RoW) selection and acquisition

For such a 161 kV High Voltage transmission line, a right-of-way of approximately 30 meters (15 meters on either side of the tower) is the approved width as outlined under LI 1737, VRA (Transmission Line Protection) (Amendment) Regulation, 2004. Thus the total land take along the entire stretch of the 3km stretch will need to be secured for the RoW. Once the route of the transmission line has been established, the land lying within the RoW will be subject to provisions of the Way leaves laws, which prohibit a number of activities in the RoW, including mining, construction of buildings and cultivation or farming.

The land earmarked for the BSP at Accra central would be within ECG substation enclave. The preliminary route for the line was established from a review of existing mapping and a field survey. Professional surveyors have undertaken a survey to establish the most appropriate route corridor. The geographical coordinates of the pillars have been taken with a GPS. Due process would be followed in the acquisition of the RoW.

Figure 2: Map of proposed transmission line



2.4 Valuation and compensation of properties

GRIDCo has gone to great lengths to ensure that the line route follows a path that will entail the minimum impacts on buildings and other structures. However try as we may, it is possible that the project may impact on some of these properties. Thus, it is possible that there may be some compensation required for buildings and other properties that may be impacted upon during the construction of the line and may require valuation and compensation. GRIDCo has commenced the explanation of the contents of the project to the local residents in advance to avoid any disputes after the commencement of the project during the public consultations. This included information on modalities for compensation as well as grievance procedures.

As is usual, GRIDCo shall engage the Lands Valuation Division (LVD) to assist in undertaking a detailed survey of any affected properties for the purposes of compensation payment. The valuation exercise shall comprise of identification and consultations with all project-affected persons (PAPs) in order for issues of compensation to be appropriately addressed. This shall be followed by valuation of affected properties and the cost of replacement of lost property in such situations. The cost for compensation payment for affected properties will be outlined in a detailed Valuation Report to be prepared for the project.

The general processes for compensation are explained below:

- Referencing of all properties, land, structures and buildings, by officers of the Land Valuation Division (LVD) to be monitored by Surveyors from the Land Management Section of GRIDCo.
- Assessment of the compensation values by the LVD and the valuation advice forwarded to GRIDCo.
- The assessed report would be vetted and corrections effected where necessary to ensure that the amounts are accurate and fair to both claimants and GRIDCo. These would then be processed for payment.
- Offers would be made to the claimants on the basis of the LVD's advice.
- Claimants dissatisfied with the offer have a right to petition for reconsideration.
- In this regard, such claimants are required to submit counter proposals supported by valuation opinion prepared by private valuers of their choice. The private reports are considered by GRIDCo in conjunction with the LVD to ensure that claimants are treated fairly.
- Where necessary, dissatisfied victims would be invited to negotiate and arrive at acceptable figures.
- Project affected persons may resort to legal action in order to have their grievances addressed.

It must be noted that it is only on the basis of the issuance of an Environmental Permit from the EPA that GRIDCo shall go ahead and undertake a valuation of any affected properties in compliance with all laws, regulations, operational directives and guidelines just before physical construction. This is because from experience with previous transmission projects in the country, engaging in valuation of affected properties long before physical construction only provides provisional data which needs to be validated all over again during actual construction. Apart from contributing to additional costs, valuation of properties long before physical construction also leads to undue anxiety on the part of the Project Affected Persons (PAPs) as well as pressure from such persons on the implementing agency as a result of the long waiting period.

2.5 Preparation of EIA for environmental permit

EIA preparation is mandatory to allow for the commencement of the physical construction for such a project. Various activities have been undertaken regarding the acquisition of Environmental Permit for the project including the registration. Following the approval of this Scoping Report, GRIDCo shall prepare and submit the EIS document to the EPA for the Environmental Permit. The Permit would outline various conditions that must be adhered to in project implementation. It must be noted that it is an offence under Regulation 29 of the Environmental Assessment Regulations LI 1652 of 1999 to start a project without an Environmental Permit.

2.6 Description of the project components and associated works

The works covered by the technical specifications and forming the “Construction of the 161kV Accra Central Power Project” involves the design, manufacturing, testing, supply, transportation to site, off-loading, erection and commissioning of plant and equipment for the works. It is intended to rehabilitate and upgrade sections of the network of GRIDCo in the business district of Accra central in order to ensure adequate supply for the increasing demand and thereby reduce suppressed demands in the system.

The labour force during the construction of the transmission line is the responsibility of the contractor. The contractor is likely, and will be encouraged by GRIDCo, to use local sub-contractors and local people. It is anticipated that up to 50 Ghanaian staff may be required for the construction of the transmission line and the works at the proposed substation. GRIDCo will operate and maintain the transmission line once it has been commissioned.

2.6.1 Main equipment

The EPC Contractor will procure and install the minimum but necessary range of equipment while GRIDCo will procure and install the necessary equipment as is reasonably possible at its own expense with a view to encouraging self-reliant operation and maintenance. The specifications of the new equipment will comply with international standards as much as possible to ensure an economical design and compatibility with the existing facilities and equipment. The equipment will also have the minimum but necessary configuration to achieve the objectives of the Project.

The types of transport and construction equipment that would typically be used during the project as outlined in the “Project Technical Report” are outlined in Table 4.

Table 4: Project equipment

PRIMARY SUBSTATION	TRANSMISSION LINE	TRANSPORT & OTHERS
Down lead from the last pole and loading gantry; Installation of 161/34.5kV, power transformers; Instrument Transformers Protection, Control and Metering Control Cables Earthing of the transformers; Busbar system; Earthing grid; Overhead ground cable; Substation and equipment steelwork; Earthing of equipment and metallic structures; AC and DC low voltage systems; Interfacing cabling; Site lighting.	Galvanised Steel Pylons Conductors (i.e. wires) Earth wire Insulator Cable stringing pullers and tensioners; Cable reel carriers Line winders	Trucks for unloading materials and equipment at each tower site; Personnel Carrier Mobile cranes Excavator Concrete mixers

2.7 Key activities and programmes

The main project activities for the sub-transmission system project are:

- Procurement & Manufacturing
- Transportation of equipment to the sites
- Construction
- Testing and commissioning
- Demobilisation
- Operational Phase

Access to substation and transmission line wayleave will be gained by the use of existing public highways and access roads. No new roads will need to be constructed. The labour force during the construction of the substation and the transmission lines will be the responsibility of the EPC contractor. The contractor is likely, and will be encouraged by GRIDCO to use local sub-contractors and local people for civil works, electrical works and transportation of equipment to the site.

It is anticipated that up to 50 Ghanaian staff may be required for the construction of the transmission line and the work at the new and existing substations. The contractor is required

to prepare a detailed Health and Safety Plan prior to the start of construction. This will be reviewed and approved by GRIDCo prior to the start of construction on site. GRIDCo's substations are secured sites. Security at the proposed substation during construction will be the responsibility of the contractor and details for site security will be approved by GRIDCo prior to the start of construction. The key activities in the construction of the transmission line system are discussed below:

2.7.1 Procurement and manufacturing

The contractor will be responsible for manufacturing and/or procuring the transmission line components. A major proportion of the transmission line components will be manufactured and procured outside of Ghana e.g. tower steel and components, conductors and insulators, as they are not available for purchase in Ghana. Concrete and aggregates will be procured locally. Other local procurement will include foodstuffs and miscellaneous supplies and services. Materials and equipment will be stored at a secure site by the contractor.

The specifications of the new equipment will comply with international standards as much as possible to ensure an economical design and compatibility with the existing facilities and equipment. The equipment will also have the minimum but necessary configuration to achieve the objectives of the Project. It is expected that the materials and equipment for the substation will be stored within selected warehouses nearby at the project work camp site.

2.7.2 Transportation of equipment to the site

The equipment procured will be landed at the Port of Tema and will then be transported overland to the project site more than 40 km away, making careful packing of the equipment essential to avoid any problems at the transportation stage. After clearance from the port, the materials shall be stored at a designated storage site. These materials and equipment will be transported by road to the storage site. Materials and equipment procured locally or nationally will be transported directly to the storage site. It must be noted that the materials will not be bulky and unwieldy. They will therefore not require any specialised vehicles. During construction, the materials will be transported to the site via public roads and access tracks.

2.7.3 Construction

Contractors are required to prepare comprehensive method statements for all major construction activities and submit these to GRIDCo. The detailed design and specification for the substations and transmission line components shall be developed and provided by the Contractor and shall be based on the current designs for the construction and operation of the substations and sub-transmission lines and follows the technical specifications available in the construction of 161 kV transmission lines. Contractors are responsible for procuring and constructing the sub-station and transmission line equipment and associated components.

Construction activities will involve the following:

- Site survey;
- Route clearance and access;
- Civil works (i.e. excavation of the foundations, setting of tower templates and concreting of foundations)

- Assembling of towers
- Tower erection
- Stringing of Transmission Lines
- Substation Works; and
- Testing & Commissioning

The contractor will undertake the above activities. The contractor is likely to start at one end of the line and work through to the other end. No use of chemicals (e.g. cable oils or pesticides) will be required on site during construction.

2.7.3.1 Site survey

To determine the route for the new transmission line, a route map was firstly prepared using existing maps of the area. This was followed by field reconnaissance by a GRIDCo Study Team from May – July 2014 to check any obstacles, special natural conditions and other relevant matters. Generally, the process identifies the potential route for the transmission line through an analysis of alternatives taking into account constraints on the social and natural environment. These constraints are mostly the presence of built-up areas and environmentally sensitive sites. There is a close relationship between route location, design process and the EA.

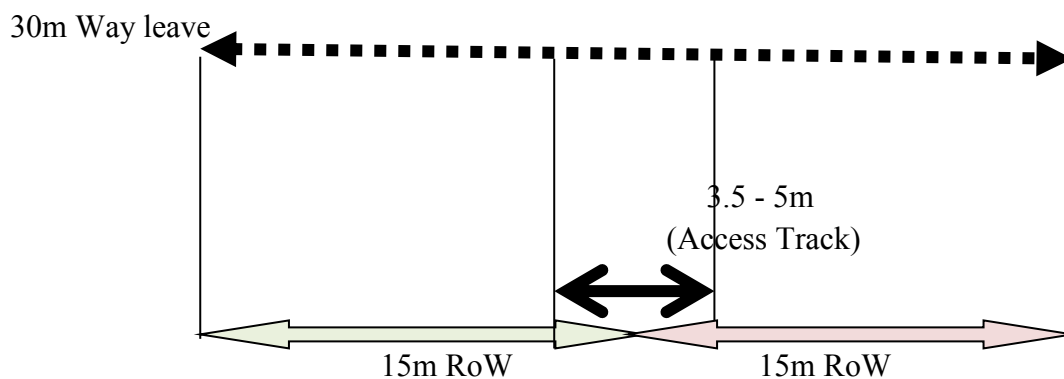
A conventional survey of route and profile and pole plotting, on profile will be made by GRIDCo for the transmission lines to the EPC Contractor. The Contractor is required:

- To check the line profiles that will be provided by GRIDCo and make any amendment, additional survey and updating that might be necessary for the construction of the lines in keeping with best engineering practice.
- To check the ground elevation at the pylon location and at the points of minimum clearance of conductors to ground.
- To check all the pylon-to-pylon distances.
- To update the line profile and strip route map up to the date of take-over of the line by GRIDCo.
- To be responsible for the observance of all specified clearances and of tower capabilities.

2.7.3.2 Route clearance and access

The construction and operation of the proposed line will require a right-of-way of approximately 15 metres on each side of the centre line of the transmission line. The right-of-way will therefore be of width of 30 metres. Tower corridor access tracks of approximately 3.5m - 5m wide, i.e. sufficient width for construction and subsequent maintenance traffic, will be constructed almost continuously along the centreline of the line route. This information is provided in simplified diagrammatical form as follows:

Based upon the results of the comprehensive land survey along the route of the proposed line, the RoW that is required to be cleared will be identified through the use of marker beacons. The tracks when constructed are used for the transportation of men and material to the line route for the installation of towers and the stringing of the lines. It also ensures the safety of construction workers from hazards associated with the works.



2.7.3.3 Civil works

Studies shall be done to determine the geology of the project area which is important to identify the tower spots. The specific spots for locating the individual towers will be finally determined based on various criteria including baseline information gathered during the EIA. Generally, wherever possible, the towers will be located at or near the summits of the uplands to maximize the clearance between the lines and the ground.

Tower spotting is the determination of the individual sites for the installation of the towers and this takes place over the whole length of the transmission line. Activities that go along with tower spotting will include final survey and soil investigation. These activities necessitate intrusive access and some clearing of vegetation, leading to possible destruction of crops. Geotechnical survey and tower spotting are therefore activities that shall be carried out subsequent to the issuance of an environmental permit and availability of funds from the lending agencies to identify the optimum foundation design for each tower.

The selection of the foundation design type will follow the collection and analyses of the data of each tower location after soil investigations. At this stage minor adjustments may be made to the final tower location, due to the vertical profile of the transmission line corridor, and to avoid buildings that may have been constructed subsequent to the collection of baseline data on structures in the proposed RoW. Such adjustments will be limited to a few metres in either direction. This activity is done during the construction phase and is therefore contingent upon the issuance of an environmental permit and the availability of funds.

The proposed tower base areas shall also be cleared of all encumbrances. The extent of clearing and depth of excavation depends on the nature of the obstacles cover, the physical and chemical properties of the soil. The area to be cleared for a single tower will be made up of the dimensions of the tower base of 29 m². This total area to be cleared will not be in addition to the total area to be cleared for the RoW but will be within the RoW.

Tower foundations will vary according to the prevailing geology. A majority of them will however have footings of the pad and chimney type, which will be excavated mechanically. By this method, a concrete pad will be constructed at the bottom of the excavation, and each foot of the tower erected within its own 'chimney' of steel reinforced concrete using wood for shuttering. After about two days, the formwork will be removed, and the excavation will then be backfilled to original ground level and consolidated.

The ground surfaces of the tower sites will be so graded as to gently provide drainage away from the tower legs and to avoid the collection of water (leading to the creation of stagnant

pools) at the tower bases. Where necessary, (particularly on hillsides), terracing, cribbing or riprap may be used to provide protection for tower foundations. In areas prone to flooding, a raft foundation for transmission line towers may be used. The raft foundation is similar in concept to the pad and chimney foundation except all four feet of each tower will be set on a single raft of concrete.

Water will be required during construction of the foundations for the concrete. Water will be procured by the contractor for the construction period and is likely to be delivered by water tankers.

2.7.3.4 Assembling of towers

The towers, which are manufactured abroad, are to be shipped to the Tema port from where the components of the towers will be transported by vehicles to the lay down areas where project office sites are expected to be created. Angle towers are used at points where the local topography demands it. Suspension towers are used between angle towers. The towers will be assembled on site.

2.7.3.5 Tower installation

The project shall utilise the conventional four legged freestanding towers of horizontal configuration. The tangent towers will have an average height of 26 metres under cross arms and an average total height of 30 metres. The angle towers are necessarily stronger and heavier, but will have a similar height. The height will vary from tower to tower and depends on the site topography. The height of the towers will be such as to provide a minimum of 7.5–8 metres clearance between the lines and open ground and 8 m clearance for roads. The number of angle towers is usually greater than the number of angles that can be seen along the route. The reason is that even in lengthy straight sections, it is advisable to place angle towers in order to strengthen the line. Those towers are called “Anti-Cascades”. The tangent and angle towers will each take up an average ground area of 29 m². Tower installation at each site will be erected using a crane. Anti-climbing guards would be fitted and maintained at an early stage of erection.

Economic study undertaken on the project has recommended that towers are spaced about 350 metre apart, it is estimated that a maximum of about 8 towers shall be required for an approximately 3.0 km span. These conventional four-legged towers are known to have a life expectancy of more than 30 years. Depending on the characteristics of the soil at the selected tower spot, a foundation depth of 2-3 meters concrete footing will be used. Once foundations have achieved their design strength, the next major task shall involve the assembly and erection of the tower structure. This commences with the delivery on site of the bundled steelwork members using a load-trailer and the full assemble conducted at the tower locations. The average span between towers will be about 350 m depending on the characteristics of the terrain.

2.7.3.6 Stringing of transmission lines

The next stage of the process will be to install onto the tower structures the necessary insulators to support the conductors as well as the equipment necessary for running out and stringing the conductors. Once a full section of towers have been assembled, the lines will be strung. The total construction time at a tower is approximately 1 week.

The actual line will be equipped with Aluminium Conductor Steel Reinforced (ACSR) of 265 mm². The line has been designed to always keep at least a 7.5 m clearance between the cables and the ground. This distance is slightly superior to the norms in effect, so it guarantees an optimum safety. The line will be fitted with an optic fibre conductor, which will be used for power system protection, control and communication purposes. As much as possible, the conductors are to conform to GRIDCo's specification for high-tension transmission lines in order to cater for any future developments in the area. The installation equipment and conductor drums would be delivered to each number of pre-selected stages along the line route to allow for stringing using the winch and brake method. The stringing method to be used by the contractor will be subject to prior approval by GRIDCo. In all cases where stringing will cross power lines, telephone lines, public roads etc, due notification to appropriate authorities will be given and the prescribed minimum clearances observed.

A pilot wire would initially be installed for each conductor and then used to draw through the conductor under constant tension so as to ensure that no contact is made with the ground. This would minimise both conductor damages as well as ground damage during installation. Any damage to the conductor during this process (particularly any contact with the ground) will impair the line function. Spacers would then be fitted between the pairs of conductors in each phase. When stringing across public roads, public safety (of persons, vehicles etc) is assured by the use of expandable aluminium scaffolds erected at both sides of the road. The wire is passed over the scaffolds to provide the necessary fixed, safe clearance from the road. Further protection is provided by the use of safety nets slung across the scaffolds beneath the line.

2.7.3.7 Substation works

A new 161/34.5 kV substation will be constructed at Accra Central. Activities during the construction of the Substation shall include:

- Site preparation
- Substation embankment
- Site sterilization
- Site datum and setting out
- Design and construction

Site preparation

The EPC Contractor shall be responsible for all clearance and other work required for preparation of the proposed primary substation sites. The Contractor shall clear the entire proposed primary substation site of all encumbrances.

Following site clearance, the site shall be excavated throughout, down to at least 150 mm below existing natural levels or as otherwise directed by GRIDCo. The resultant topsoil of the entire project site shall be loosened to a depth not less than 250 mm and the loose soil treated with an anti-termite chemical approved by GRIDCo and the Environmental Protection Agency (EPA). The EPC Contractor shall provide an approval letter from the Environmental Protection Agency (EPA) – Ghana, authorizing the use of the anti-termite chemical. The

chemical shall be applied strictly according to the directives of the manufacturer. The loose soil shall then be compacted back into place before the formation of embankment commences.

Substation embankment

The embankment shall be constructed as specified in the General Specification for Materials and Workmanship and shall be finished to the lines and levels determined by the embankment design drawings to be submitted by the EPC Contractor and approved by GRIDCo. The embankment shall be constructed to include but not limited to the characteristics to be approved by GRIDCo:

The embankment, its slopes and drainage facilities shall all be within the boundaries of the site depicted by the benchmarks provided on the site plan included in the enquiry drawings.

Depending on the soil conditions on site, GRIDCo may direct the EPC Contractor to excavate below the grade level to provide a sub-grade course. The embankment shall have layers of sub-base and/or base materials compacted as follows:

- Hard fill Type I material or suitably approved laterite as sub-base.
- 300 mm thick approved laterite base course well compacted on top of the sub-base.
- The side slopes of embankment shall not be steeper than 1:2 (vertical: horizontal) and shall be protected from erosion by stone pitching.
- The stone pitching shall be separated at 25m intervals by the introduction of 25 mm wide thermal expansion gaps aligned on the side slopes and appropriately filled with approved bituminous material. It shall also be provided with weep-holes appropriately sized with a granular filter, spaced and located to ensure adequate drainage and stable side slopes.
- The top and bottom peripheral edges of the embankment shall be protected with 250 mm thick concrete strip and toe respectively. The yard shall be finished with 100 mm thick 25 – 50 mm broken stone or chippings.

The EPC Contractor shall arrange for continuous field geotechnical testing of each layer of the embankment to ensure compliance with the requirements of the specifications and the approved geotechnical designs.

Site sterilization

The top surface and side slopes of the embankment shall be sterilized by the application of a chemical mixture to prevent weed growth. The sterilization mixture shall be subject to the approval of GRIDCo and the EPC Contractor shall provide an approval letter from the Environmental Protection Agency (EPA), Ghana, authorizing its use. The area to be treated shall be uniformly covered with the mixture at the rate indicated by the manufacturer. The area treated shall be wetted immediately following the application so as to cause penetration into the surface or as directed by the manufacturer. All surfaces of the embankment shall be sterilized as specified above, and in the case of the side slopes, before stones are pitched thereon.

Site datum and setting out

The EPC Contractor shall be wholly responsible for the true and proper setting out of the works in accordance with the approved working drawings and the setting out shall emanate from base points indicated by GRIDCo. The site datum and levels shall be based on data shown on the relevant project drawings. Measuring and setting out shall be done with calibrated measuring tapes and adjusted levelling instruments and angle gauges. The EPC Contractor shall provide permanent survey monuments on site at locations of setting out point, benchmarks and base line, to the approval of GRIDCo. All boundary points, measuring points, fire and water hydrants and comparable facilities located underground shall be either relocated or protected from damage. Any damage to any facility shall be made good by the EPC Contractor.

Design and construction

Buildings, equipment foundations, support and ancillary structures shall be designed for the worst combination of dead loads, construction loads, live loads, plant loads, impact and dynamic effects due to operation of plant, crane loads, short circuit forces, maintenance loads, earth pressure, wind loads, seismic loads, temperature effects, etc. Works shall be based on required standards or their equivalent as specified in the Technical Report and other project documents. Design specifications to be followed during construction are provided in Table 3.

Table 5: Project design specifications and standards

ITEM	WORKS	DESIGN STANDARDS
1	Foundations:	Design and construction of foundations shall be in accordance with BS 8004
2	Structural Concrete:	Structural concrete work shall be in accordance with BS 8110:1997.
3	Structural Steel works:	Design, fabrication and erection of structural steelworks shall be in accordance with BS 5950.
4	Liquid Retaining Structures (Concrete)	Design and construction of concrete liquid retaining shall be in accordance with BS 8007.
5	Blockwork/Brickwork:	Design and Construction of blockwork/brickwork shall be in accordance with the requirements of BS 5628.
6	Seismic Design:	Design for seismic loading shall be in accordance with approved specification.
7	Sound Insulation:	All roof and wall cladding systems including ventilators, openings, windows, doors, etc., shall be designed and constructed such that noise level emissions at the site boundary do not exceed 60 dBA.

Generally, the work will involve the erection of electrical components and structures onto a pre-cast concrete foundation required to support the new equipment, followed by physical connection onto an existing 34.5 kV bus bar. Once these have achieved a suitable strength, the electrical equipment will be delivered and mounted. This involves use of heavy lifting equipment to position the plant followed by wiring and connection. The work within the switchyard will not involve the removal or disposal of any obsolete equipment nor will any polychlorinated biphenyls be contained in any of the equipment proposed for this project. After completion of all construction activities the sites would be cleared and tidied up generally in accordance with the agreed mitigation programme. All surplus materials will be removed and the access routes will be reinstated. No polychlorinated biphenyls (PCBs) or Chlorofluorocarbons (CFCs) will be used in the construction, operation or decommissioning of the substations.

Rainfall run-off and general drainage of the substation yard, customer service area, car parking and landscaped areas shall be carried by appropriately sized reinforced concrete perimeter open channel drains to an appropriate outfall not less than 15m from the edge of the substation embankment and as shall be approved by GRIDCo. To prevent possible flooding of the station in extreme precipitation conditions, e.g. 50-year return period flood, the final level of the compacted laterite base course of the substation yard embankment shall be at least 0.3 m above existing ground levels of the adjoining areas. Cable trenches shall be provided with adequate slopes and their invert levels shall be such that the trenches can be drained through an appropriately sized uPVC pipes into the nearest point in the perimeter drains where gravity flow can be achieved.

In order to prevent flow of water into the control buildings, cable trenches shall be sloped and drained away from the control building. In addition, the design of the cable entry into the control room shall be such that they are as much as possible, water and air tight. Appropriately designed french-drains to direct run-off to the perimeter drains shall be provided to drain off substation yard areas cut-off by cable trenches.

GRIDCo in conjunction with the EPC contractor shall study the project site and determine the need to provide additional drainage to divert runoff from the catchment area away from the substation. When it is determined that catchment drainage is required to minimize the risk of the substation against flooding, the engineer shall liaise with the local planning authority and provide a suitable design for construction by the contractor. Only potable water shall be used for construction and shall be supplied to the site by the Contractor in tankers and kept in water storage facilities which shall be provided on site to meet constructional requirements at all times.

The layout of driveways shall be determined by the arrangement of buildings, transformer and other foundations. Such driveways shall have a width of 5 metres. The EPC Contractor shall provide suitable access driveways up to the off-loading bays of the control building. In addition, provision must be made for other access roads necessary for the proper movement, installation and post construction maintenance of all the major installed plant indicated on the conceptual drawings. The Contractor shall provide adequate access and facilities for the delivery and removal of transformers. These shall be designed to safely withstand all jacking point loads, etc., and adequate haulage bollards or rings shall be provided where necessary. Where driveways or transformer accesses pass over services like cables trenches or duct banks, special designs shall be incorporated to prevent damage to such services. The design

and construction of driveways shall take full account of the information provided by the site investigation and embankment soil test results. There shall be no special treatment required for areas earmarked for driveways other than that, which is required for the general finishing of the entire substation yard. The green grass shall be grown on black soil (of appropriate thickness) placed on the substation embankment. The contractor shall water and care for the grass until it has taken firm roots and fully covered the landscaping area before handing over to GRIDCo.

The yard surface is defined, as any area of the site not occupied by the parking area, buildings, foundations, cable ducts, or by other structures or equipment. The substation embankment shall be restored to its level of compaction/consolidation and design slope after equipment foundations and grounding mat have been backfilled and well compacted. The yard shall then be finished with a 100mm thick course of 25-50mm broken stones or chippings.

The boundary fence, internal fence and entrance gates shall be made of galvanized steel chain-link fencing and galvanized steel pipes. The height of the fence and the gates shall be 1.90 m vertical with a further 0.5 m extended outwards from the site on to which 3 No. rows of barbed wire shall be fixed as specified in this specification. The mid-sections of the fence shall be kept taut by the introduction of steel stiffeners. Fence posts shall be of galvanised tubular steel of diameter 50mm for intermediate posts and 75 mm for angle and tensioned posts, 3.0 metres apart, on the average centres. The fence posts shall have concrete foundations projecting 100mm above the finished laterite level but flushing with the top level of the crush rock. The top of the concrete foundations of the steel pipes shall be cambered to prevent water stagnations that might lead to rusting.

The vehicular and pedestrian gates shall be plastic coated chain link with galvanized steel frames/posts of type, size and strength to be approved by GRIDCo. The widths of the vehicular and pedestrian gates in fully opened position shall be 6.0 m and 1.0 m respectively. Where, feasible, vehicular gates shall be provided at both the entrance and exit points of the fence with respect to the substation access road.

2.7.3.8 Testing and commissioning

The contractor will be responsible for functional testing and commissioning of the new switchyard and works at the existing substation. This consists of connecting the line to the national grid to transmit power. Final commissioning involves, among others, the testing of the towers to ensure that all steelwork joints are correctly made and are tight, the integrity of the line hardware, the protection system, etc. Connection of electrical plant will be checked and once approved power connections shall be established.

2.7.4 Demobilisation

Upon, completion of the construction phase any temporary infrastructure will be removed and the areas rehabilitated. The wooden structures, which will be raised as offices, workshop, accommodation and storage rooms will be dismantled and the planks of wood, doors and other materials will be carted away for re-use at other project sites of the

contractor. The concrete floors will also be removed and disposed of at an approved landfill site. All mobile toilet facilities for the construction site workers will be removed from the site on completion of constructional works. Constructional equipment will all be transferred to the contractor's premises. This is to be done by the EPC Contractor under the supervision of GRIDCo.

2.7.5 Operational phase

GRIDCo shall be responsible for managing the operations of the transmission system using existing guidelines for such operations. Strict documented procedures are in place for the various technical operations, including that of transmission lines. GRIDCo will adhere to all existing Safety Codes & Guidelines for the operation and maintenance of transmission line infrastructure

The operation of the line will involve activities that have been discussed below.

2.7.5.1 Right-of-Way (RoW) management and access road maintenance

Right-of-Way and access road maintenance is aimed at eliminating hazards and reducing travelling required to access transmission lines. Based on report on ground patrol observations, access roads/line tracks are maintained at regular intervals. It includes erosions, culverts, bridges or any obstacle/work nearby which will endanger the lines or public e.g. blasting, excavation, fire hazards, harmful insects, etc. The objective is to prevent all forms of interruption of power supply due encroachments. It is also to facilitate ease of access for line maintenance activities. During the operational phase of the project the RoW will be maintained in such a condition as to ensure that the transmission line function, or safety of person within the vicinity of the line, is not compromised.

2.7.5.2 Line maintenance and operations

GRIDCo has comprehensive, planned and emergency programmes through its technical operations during the operation and maintenance phase for its existing transmission lines and these shall be adopted on the project. The maintenance activities carried out here include:

Aerial surveillance by helicopter: This is done to ensure that potentially hazardous defects are pre-empted and the integrity of the line is maintained and sustained. This is done on an annual basis.

Foot patrol: The Line Maintenance team carries out routine physical examination of the transmission line and its component parts to ensure the safety, security and integrity of the line. Such activities are carried out at least twice a year.

Security patrol: This is done to check on segments of the line close to populated areas for signs of vandalism, tampering, and general security of the lines. It is to ensure an early detection of and rapid response to acts of vandalism and to rectify such situations as promptly as possible.

During the operational phase of the line there is limited need for regular access with line inspection only being conducted, typically, on a six monthly basis and shut downs for maintenance only being required once every 2 to 3 years. In the course of operation, defects that are identified are repaired. Such defects may include the replacement of defective

conductors, flashed over insulators, defective dampers, vandalised components, and maintenance of access tracks and RoW.

2.7.5.3 Maintenance of towers

Tower auditing and repairs provide a means of assessing the ageing process of towers. It starts one year after the commissioning of a line section and it follows a one-year cycle. In a cycle of tower auditing, 10% of all suspension towers and all dead-end towers are thoroughly examined. As the line ages, it is subjected to wear and fatigue which may not be noticeable by a distant visual inspection. Detection and tightening of loose bolts on supports and hardware can reduce premature wear and indicate for replacement of worn components before failure.

Corrosion surveys are undertaken to ensure that the towers and associated parts are protected from atmospheric, chemical or electrolytic corrosion. Corroded towers are re-galvanised. Infra-Red Surveys also done to help to identify overheated connectors, clamps, etc, following which such line hardware is then replaced before any failure can occur. Vibration studies known as Aeolian vibrations are done based on ground patrol reports to analyse the nature of vibrations on lines. Vibration dampers are used to stop this. Insulator washing is done to avoid the building up of contaminants on the line insulators, which can cause flashovers. This is carried out using insulator washing machines and a high pressure stream of water. Security Patrols are carried out to stop vandalism of towers and other illegal activities along the RoW. Perpetrators are arrested for prosecution.

Tower Footing Resistance measurement is done to ensure that ground resistance is within acceptable limits. Subsequently, there is continuous checking of the grounding rods and counterpoise for continuity. Tower ground resistance is measured.

2.8 Financing details

The project is to be funded by Japanese International Cooperation (JICA). It is expected that GRIDCo shall select and enter into an Engineering, Procurement and Construction (EPC) contract on a competitive basis. The EPC Contractor will be responsible for the engineering, procurement, transportation, erection on site (including civil works), installation, testing, commissioning. Where appropriate, the contractor will use local subcontractors. The contractor will be responsible for any sub-contractors that it would engage.

2.9 Project benefits

The proposed project will have a significant impact on the macro-economic base of Ghana. Some of its inherent benefits are as follows:

- The Project will create jobs during the construction and operations phases and will create up to more than 100 jobs for both skilled and unskilled staff.
- The Project is likely to increase GRIDCo's revenue base through lower cost of transmission.

- The Project will also contribute vital electrical power infrastructure and will significantly support the development of the Ghanaian economy and stimulate industrialization in Accra metropolis.
- Diversified growth plan strategy for Ghana will be enhanced.
- The technical performance of GRIDCo will be enhanced reducing the impact of fault-related disturbances.
- The project will remove a capacity constraint that is denying GRIDCo from some much-needed additional revenues in the short term.
- A significant increase in wheeling revenue will accrue to GRIDCo without the need for additional capital investment on their part.

3.0 CONSIDERATION OF ALTERNATIVES

A description of the proposed development has been provided in Section 2 of this report. However, prior to the selection of the various components of the proposed development, various alternatives had to be considered both in terms of equipment and the feasibility of the project itself during the project planning stage.

Various feasibility studies have been carried out which have helped the EIA to present alternatives in comparative form, defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public. Some of the information to be used to compare the alternatives will be based upon the design of the alternative and some of the information shall be based upon the environmental, social, and economic effects of implementing each alternative

The EPC Contractor will procure and install the minimum but necessary range of equipment while GRIDCo will procure and install the necessary equipment as is reasonably possible at its own expense with a view to encouraging self-reliant operation and maintenance. The specifications of the new equipment will comply with international standards as much as possible to ensure an economical design and compatibility with existing facilities and equipment. The equipment will also have the minimum but necessary configuration to achieve the objectives of the Project. The locations of substations and the routes of feeder lines were studied from a technical perspective, geography (flat land), land use (unused land, no residence and permanent structures), land availability (public land, road reservation), consistency with urban plan, etc.

Alternatives addressed during the scoping stage are at the following levels of analysis:

- No Development Scenario
- Selection of Alternative Sites for Proposed Substation
- Mode of transmission
- Selection of Optimal Transmission Line Route
- Alternative Phase Conductors
- Alternative Tower Design

3.1 The “No development scenario”

Taking no action would, naturally, be a feasible option. The advantages and disadvantages of the “No development” scenario are:

- That land that would otherwise be occupied within the enclave and the transmission line system (or other project alternatives) would continue to remain available; in some instances, the population employs this land for income-earning activities (e.g., agriculture). With the reduced need for land acquisition and development, the likelihood of people being displaced would be reduced.

- No increase in likelihood of environmental impacts. Potential impacts that may be avoided if the “No-Project Alternative” were implemented include habitat disruption as well as potential contamination associated with construction activities.
- If construction does not take place, delivery of electricity and distribution will continue to be poor resulting in social dissatisfaction, fall of economic development and poor quality of life in the project area and Ghana as a whole. It should be remembered that hospitals, schools, hotels, industries, banks, residences all need cheap and reliable electric power to function well. One does not need to calculate the figure, but if he/she can refer to the cost people incur when there is load shedding, it is possible to get a feeling of how beneficial the supply of reliable energy is.
- The country will also be deprived of investment opportunities as a result of the lack of access to cheap electrical power sources and this will pose a serious obstacle to its developmental goals. It will also deal a major blow to regional integration and sustainable development. In addition, Ghana will stand to lose foreign currency that will accrue as a result of the sale of power to neighbouring countries.

In spite of the fact that the “No development scenario” does not relocate anybody, it does not guarantee that the existing environmental quality will continue to be maintained. At the same time the large society of people in the local area, e.g. in Greater Accra Region, and Ghana in general do not benefit rather they are going to lose in terms of development, quality of life, increased pollution and deforestation in some areas. The toll of fuel-wood and production of charcoal have already depleted the natural resources around many of the urban centres. Other electricity source alternatives (solar and wind energy) are still in the developmental stage in the country. If businesses, homes and workshops are not getting reliable grid electricity, they will embark on using diesel/petrol generators that will continue to pollute the air.

In addition to the disadvantages of the “No development” option discussed, it must be noted that ultimately, “stopgap” solutions to the energy demand of Ghana could be expected to be developed, such as the use of diesel generating sets or the establishment of oil fired power plants. These solutions are likely to be less efficient and more environmentally damaging, and to have significantly lower net benefits (or even have net economic costs)

The “No development” alternative does not therefore represent an option that meets the best interests of Ghana and its development agenda.

3.2 Selection of alternative sites for proposed substation

The site selection process was dictated by:

- The availability of unencumbered land
- Proximity to load centres
- Topography of the site (not prone to flooding)
- Geology of the site (not prone to earth tremors and quakes)

The choice of a site is influenced by a balance between proximity to a point of access to the electricity grid, minimising the electric system impact of a substation failure and key load

centres. In addition, the time required to negotiate for the property rights to a site not owned by GRIDCo is an important consideration in the construction of substations.

The criteria that inform the decision to select a site for a proposed substation include:

- Availability of land: Land would have to be acquired for the proposed project, so its availability is critical to the siting of a project.
- Suitability of site with respect to its effect on future development layout plan, other services and social hazards due to the presence of a community.
- General flatness of terrain: Where substations are to be constructed, the terrain should be generally flat in order to reduce the construction costs due to earthworks
- Proximity to major roads: Easy access during construction and periodic maintenance carried out at the substation demands that it be close to a major road for easy accessibility.
- Natural drainage: Natural drainage generated by the terrain would help the free flow of rainwater, so that the substation does not flood or become filled with water.
- Connection to an existing transmission line: The substation site should be close to an angle tower so that it can tie into either a proposed or an existing transmission line.

3.3 Possibility of the use of alternate mode of transmission

GRIDCo intends to use overhead cables on steel lattice towers for the project. Another alternative means of transmission is underground cables. However, laying of transmission lines in underground cables over long distances is not practicable and might entail financial and environmental costs that might be too high to bear. Again, buried lines require high levels of insulation and are difficult to install over steep terrain or within wet valleys and are expensive to maintain. Installation of long runs of buried, high voltage lines is therefore cost prohibitive.

For this Project, sections of the line routes run through areas with high rainfall patterns which will require that underground lines be heavily insulated and strengthened. These will make this mode of transmission very expensive and difficult to maintain. The Project will therefore utilise overhead cables.

Apart from the visual positive impact of underground cables, underground cables do have a number of additional negative impacts that are not associated with overhead lines. The most important are highlighted below.

3.3.1 Construction impacts

3.3.1.1 Ecological

For overhead lines, the only land and habitat really lost is the land around the tower base and the access routes for construction, whereas the cable option affects the 15 – 30 m width of the entire cable route. A greater degree of land will be sterilised with an underground cable due to the restrictions that would need to be placed upon all subsoil activities as well as the planting of trees and bushes along the entire route length for safety purposes. An

underground option would also require large areas of land to be set aside to accommodate cable joint bays.

The removal of trees and shrubs along the route leads to irreversible ecological damage.

3.3.2 Operational phase impacts

3.3.2.1 Visual

Overhead lines impact on the landscape in rural settings and affect the scenery in tourist centres. Their impact is however only more pronounced in urban settings. Underground cables show impacts at sealing end points as well as at points where cable cooling systems are sited.

3.3.2.2 Noise

The most notable noise during normal operation is the hissing sound due to the corona effect. This type of noise will however be minimised by the use of bundle line conductors instead of single conductors. A cable system would have given constant audio noise from cable cooling stations.

3.3.2.3 Water pollution

There will be no water pollution from the overhead line itself. Had the transmission system been an underground one, pollution would have been expected from cable fluid leaks.

3.3.2.4 Outage time impacts

The time required to locate and mend a cable fault is significantly greater for underground cables than that of an overhead line resulting in reduced system security and availability.

3.3.3 Cost

As has been experienced throughout the whole of Africa, the economic case for the utilisation of an underground circuit cannot be normally justified at this voltage level and this is certainly the case for this project. Table 5 provides the cost of transmission line technology per kilometre. From these construction costs per kilometre when added with compensation costs of a particular section (area) will help to determine the least cost option. However, the final decision will consider the social impact and comments or concerns from stakeholders.

Table 6: Cost of overhead towers and underground cables³

Type	Underground cable	Overhead Towers Compact design	Overhead Towers Lattice steel towers
Cost per km (US\$)	400,000	84,500	85,000 –100,000

With the cost of 161 kV underground cables being over 500% higher than the equivalent capacity of overhead lines, the level of investment needed would be beyond the ability of

³ Reference: EIS for Reinforcement and Upgrade of Dar es Salaam, Kilimanjaro and Arusha Transmission and Distribution System Project

GRIDCo and the project would not be able to be developed. Again, experience in Africa has shown that underground cables attract a high degree of vandalism. The mineral content of pieces of underground cable at this voltage level could attract vandals leading to both costly replacement as well as unnecessary disruptions in power delivery. The environmental and financial impacts highlighted above prove beyond reasonable doubt that the overhead transmission system is more environmentally friendly and economically the better choice.

3.4 Selection of optimal transmission line route

3.4.1 Methodology

Construction of transmission lines can have a negative environmental, social, and cultural impact on living conditions, as well as undermine use of land by indigenes. If a line route is selected which is located far from obstacles, in an effort to prevent such adverse effects, ease and stability of line construction would be compromised. As a result, construction costs would increase. The optimum line route is defined as a line route that maximizes construction feasibility and stability while minimizing negative influences and cost of construction.

Currently, survey studies have been carried out to identify the possible line route for the transmission line component of the project. Generally, line route and substation selection guidelines of GRIDCo formed the basic premise of this study. The environmental constraints were considered to protect against any negative impacts as a result of construction. These constraints constitute resistance factors from the line route construction perspective. Areas with environmental constraints were excluded as inappropriate or were kept a reasonable distance from the line route. .

The selection of the most appropriate routing for the construction of a new transmission line is normally an iterative process that tries to secure the most environmentally acceptable route that is both technically and economically feasible. The process commences with the identification of constraints and then looks at finding a route that avoids those constraints as much as possible. A starting point would be to investigate the route that provides a direct line between the points to be connected and then identify reasons why this option cannot be selected.

The choice of corridors takes into account the following constraints and general considerations, which have repercussions on the feasibility and cost of project implementation:

- To be as short and as direct as possible, to minimize costs
- To avoid crossing identified problem zones, requiring non-standard and more costly technical solutions
- To stay a reasonable distance from urbanized areas
- To avoid crossing protected areas, such as parks, nature reserves, etc
- To avoid crossing tourist areas or important panoramic sites

In addition to constraints and criteria linked to the choice of corridors, GRIDCo sought to avoid as far as possible, sensitive environmental elements located inside the zone of study. These elements were as follows:

Table 7: Areas to be considered as sensitive environmental areas

Areas Protected by Law:	National parks (current or anticipated), Reserves (flora, faunal), Protected forests
Forest Areas and Vegetation:	Forests and forest groves, Plantations (pines, cashew trees, fruit trees), Gallery-forests and coastal vegetation hedges, mangroves, others humid or tropical ecosystems, areas containing threatened species and species of social, economic, cultural and scientific interest
Faunal Areas:	Bird migration corridors and flock areas, recognized faunal habitats, threatened species
Human habitat:	Populated areas (cities, villages, hamlets, etc.), Land use, anticipated development zones
Cultural Areas:	Sacred forests and woods, Archaeological or historical sites, Panoramic and tourists sites, Shrines/religious site/cemeteries

In addition, for technical considerations, as well as to reduce the visual impact of any proposed lines, heavily developed and residential areas should be avoided as much as possible. The placing of transmission lines within an existing route corridor provides significant advantages both in terms of reducing visual impact but more importantly in reducing the environmental impact of the project. This is based on the understanding that a way leave carrying two lines requires less ground area than two way leaves each carrying one line.

Therefore the next stage of the iterative process involves looking at existing lines and way leaves to see if these can be included for some or all of the proposed new line. Finally the process concludes with a detailed analysis of a variety of options to ensure that the best compromise of all the above factors can be adopted.

3.5 Alternative phase conductors

At present, the types of cable most currently used for high tension and very high tension overhead lines are ACSR Conductors (Aluminium Conductor Steel Reinforced), i.e., aluminium conductors with a steel wire core, AAAC (All Aluminium Alloy Conductors) and less frequently, ACAR conductors (Aluminium Conductors Alloy Reinforced) where the conductors are reinforced with some aluminium alloy wires.

Copper conductors are now only used in a number of particular cases due to the high cost of overhead lines equipped with this type of conductors. This high cost originates from the cost of these cables themselves, but especially from the high density of copper they require, this is in turn resulting from considerable mechanical loads and significantly greater sag, so that compared to lines with aluminium conductors of equal spans the higher sag calls for taller

towers if sufficient clearance has to be preserved. It now makes sense to use copper for more sophisticated applications than for line conductors.

In view of the fact that the proposed project will add on to an existing grid, it is imperative that its design specifications be compatible with those of the existing network, as much as possible. All the connection points where the proposed network will interface with the existing one have steel lattice tower structures and Aluminium Conductor Steel Reinforced conductors. It therefore stands to reason that the proposed network will have similar or at least compatible design specifications as the existing grid in terms of requirements for strength, system safety and security. For this project, ACSR has been chosen.

3.6 Alternative tower design

Independently from such characteristics as width of the tower base, angle of the members, height of the cross arms at the top of the tower, which dimensions result mainly of experience and the static design constraints, a tower is defined by its typical dimensions which include;

- Phase-to-phase clearances
- Phase-to-earth wire clearances correlated with the earth wire position(s) to provide effective protection of the phase conductor against lightning strokes
- The clearances to the tower structure
- The height with respect to ground level of the attachment point of the suspension and anchor strings.

There are various types of towers that can be used for supporting high voltage power transmission lines. Three configurations were studied for the suspension towers and these were:

- Triangular configuration tower with two earth wires
- Cat's head configuration tower
- Horizontal configuration tower

In analysing the types of towers to be used, factors such as loading stresses, wind loads, safety factors are all analysed. Horizontal configuration type tower is the most economic one and at the same time presents excellent behaviour with respect to lighting. Subsequently, GRIDCo has opted for the erection and use of horizontal configuration type tower based on the required strength, heights, safety and security for this line. The added advantage of this tower type is that they require less land for the tower support system and are very robust for construction. Figure 3 shows a typical horizontal configuration type tower.

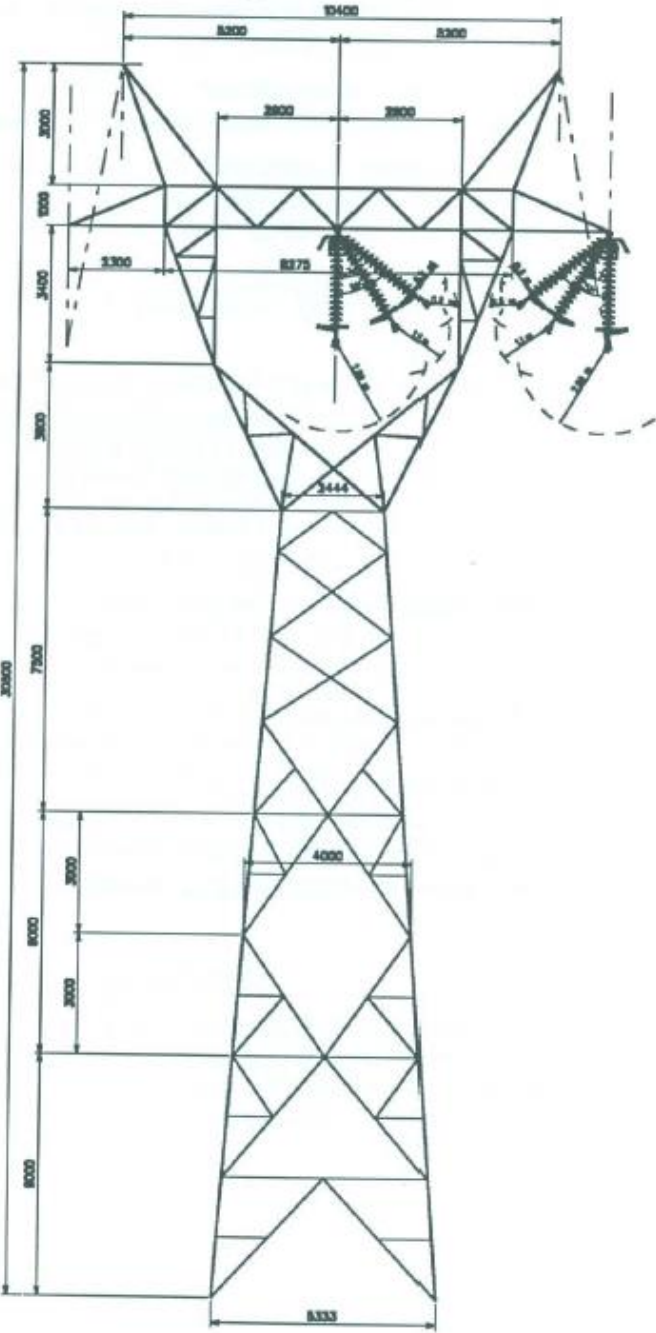


Figure 3: Typical Horizontal Configuration Type Tower

4.0 DESCRIPTION OF EXISTING ENVIRONMENT

The EIA requires that a baseline survey be undertaken to establish the existing ecological and socio-economic situation in the project area. This information is to help identify potential, positive and negative impacts of the proposed undertaking from the environmental, social, economic and cultural aspect in relation to the different phases of development of the undertaking. In this regard, a GRIDCo in-house team commenced research work on the existing biophysical and social environment from January – June, 2014. Following the engagement of the Environmental Consultants in November 2014, the environmental and social research work is continuing.

This scoping study therefore involved the first stage of a baseline survey to be undertaken to establish the existing ecological and socio-economic situation in the project area. The various field visits to the project site were undertaken for an assessment of the existing environment for a decision to be taken on factors to be considered in the terms of reference for the project. Findings of the GRIDCo in-house team and the Environmental consultants have been outlined in the Scoping Report.

4.1 Methodology

Both primary and secondary data are being collected on the socio-economic characteristics and ecological details. Primary data is being collected through visitation to the project area and the use of questionnaires. Interviews are also being conducted with the various stakeholders including area administrative officials, government departments, individuals within the project area.

The secondary data, which will supplement the primary data, is being collected through a wide literature review on the project area, both published and unpublished. A number of background document on the project have been obtained and review reviewed, the most important of which being the Project Documents for the proposed project, involving Pre-feasibility reports, and monthly progress reports; as well as various minutes on meetings with stakeholders to discuss the most appropriate materials and equipment for the project.

Public awareness and sensitisation is considered as an important activity in the EIA as all the major stakeholders have to be involved and made aware about the project. In this regard, GRIDCo has and continues to undertake various public awareness and sensitisation exercises. Details of this exercise, including persons consulted and contacted so far have been provided in this Scoping Report. This is to be continued and information obtained included in the EIA Report.

The World Bank Operational Policy 4.01 for Environmental Assessment was also reviewed and the preparation of the Scoping Report has also been guided by several examples of transmission lines EIAs' prepared recent for World Bank supported projects in Ghana and other countries in the African region. A brief on the initial findings on the existing environment are presented below.

4.2 SOCIO-ECONOMIC INFORMATION OF AFFECTED POPULATION

4.2.1 Profile of Okaikoi South Sub-Metropolitan Assembly

4.2.2 Location and Size

Okaikoi South Sub Metropolitan District Council is one of the eleven Sub Metropolitan District Council of the Accra Metropolitan Assembly (A.M.A.). It shares boundary with Okaikoi North to the North, Osu-Klottey to the South, Ablekema Central to the West and Ayawaso West to the East.

The Sub Metro has Eight Electoral Areas namely; Avenor, Awudome, Gontien, Kantsean, Kaneshie, Mukose, Bubuashie and Bubii. These electoral areas are also represented in the Assembly by eight Assembly Members.

4.2.3 Geology and Soils

The Okaikoi South Sub-Metro, consists of Precambrian Dahomeyan Schists, Granodiorites, Granites Gneiss and Amphibolites to late Precambrian Togo Series comprising mainly Quartzite, Phillites, Phylitones and Quartz Breccias. Other formations found are the Palaeozoic-Accraian Sediments - Sandstone, Shales and Inter-bedded Sandstone-Shale with Gypsum Lenses.

The soils in the Sub Metro Area can be divided into four main groups: drift materials resulting from deposits by windblown erosion; alluvial and marine mottled clays of comparatively recent origin derived from underlying shales; residual clays and gravels derived from weathered quartzites, gneiss and schist rocks, and lateritic sandy clay soils derived from weathered Accraian sandstone bedrock formations.

In many low lying poorly drained areas, pockets of alluvial 'black cotton' soils are found. These soils have a heavy organic content, expand, and contract readily causing major problems with foundations and footings. In some areas, lateritic soils are strongly acidic and when saturated are prone to attack concrete foundations causing honeycombing. Near the foothills are the large areas of alluvial laterite gravels and sands.

4.2.4 Vegetation and Climate

There is evidence to suggest the vegetation of the metropolitan areas has been altered in the more recent past century by climatic and other factors, mainly anthropogenic. Much of the metropolitan area was believed to have been covered by dense forest of which only a few remnant trees survive.

A climatic change combined with the gradient of the plains and cultivation has imposed vegetation structures similar to those of the southern Sahel, Sudan and Guinea Savannahs all of which lie north of the Accra plains.

There are three broad vegetation zones in the Metropolitan area, which comprise shrub land, grassland and coastal lands. Only the shrub land occurs more commonly in the western outskirts and in the north towards the Aburi hills. It consists of dense clusters of small trees and shrubs, which grow, to an average height of five metres. The grasses are a mixture of species found in the undergrowth of forests. They are short, and rarely grow beyond one

metre. Ground herbs are found on the edge of the shrub. They include species, which normally flourish after fire.

The coastal zone comprises two vegetation types, wetland and dunes. The coastal wetland zone is highly productive and an important habitat for marine and terrestrial-mainly bird life. Mangroves, comprising two dominant species, are found in the tidal zone of all estuaries and lagoons. Salt tolerant grass species cover substantial low-lying areas surrounding the lagoons. These grasslands have an important primary production role in providing nutrients for prawns and juvenile fish in the lagoon systems. In recent times, wetlands are however being encroached upon. Protection of the coastal wetland zone is very important to the long-term sustainability of the fish industry, which the Ga population of Accra depend upon.

There are two rainy seasons. The average annual rainfall is about 730mm, which falls primarily during the two rainy seasons. The first begins in May and ends in mid-July. The second season begins in mid-August and ends in October.

There is very little variation in temperature throughout the year. The mean monthly temperature ranges from 24.7°C in August (the coolest) to 28°C in March (the hottest) with annual average of 26.8°C. As the area is close to the equator, the daylight hours are practically uniform during the year. Relative humidity is generally high varying from 65% in the mid-afternoon to 95% at night.

The predominant wind direction in the Sub Metro is from the WSW to NNE sectors. Wind speeds normally range between 8 to 16 km/hr. High wind gusts occur with thunderstorm activity, which pass in squall along the coast. The maximum wind speed record in Accra is 107.4 km/hr (58 knots). Strong winds associated with thunderstorm activity often cause damage to property by removing roofing material.

4.2.5 The Built Environment

The housing landscape of the Sub Metro is characterized by an area comprising of indigenous, low class, and high-density development with depressed conditions and over stretched infrastructure services on the other. The total number of houses in the Sub-Metro according to the 2010 Population and Housing Census is 29,913. The average house size is 17 persons per house and approximately 3 households per house. The average household size is approximately 6 people. Housing can also be grouped in 3 broad categories: the low income, middle income and high income areas. The low income housing zones may be divided into indigenous and non-indigenous (dominantly migrant) areas.

4.2.6 Population and Housing Characteristics

Okaikoi South Sub Metro with an estimated population of about 121,718 people as projected from 2010 National Population and Housing Census by the Ghana Statistical Service, Okaikoi South, forms 15.25% of the entire population of Accra Metropolitan Assembly which has also contributed to the fast growing population of the Accra Metropolis. It has population growth rate of 3.17%. The most populated community in the Sub Metro is North Kaneshie while South Industrial Area constitutes the least populated locality in the Sub Metro. It should, however, be noted that spatial population distribution in the Sub Metro is almost evenly in most cases as depicted in Table 8.

4.2.7 Population Distribution by Age and Gender

Okaikoi South Sub-Metro population, like that of other Sub-Metros of A.M.A., is a very youthful with 54.66% of the population under the age of 24 years. It will be realised from the age sex ratio that 51.9% of the population are females (63,126) and the rest 48.1% being males (58,592). This gives a sex ratio of 1:1.08 males to females. The dominance of females over males is a reflection of the nationwide trend where the estimated ratio is 1:1.03. Age dependency ratio has been calculated to be at approximately 36% of residents of Okaikoi South Sub-Metro relying on the other 64% for their livelihood. About 64% of the population constitutes the working force..

Table 8: Localities Population Trends of Okaikoi South Sub-Metropolitan District Council

OKAIKOI SOUTH SUB-METROPOLITAN DISTRICT LOCALITY POPULATION TRENDS							
LOCALITY NAME	POPULATION					2010	2010
	2008*	%	2000	1984	1970	HOUSES	NO: HH
AVENOR	8,577	6.92	6,681	3,125	-	447	1,281
BUBUASHIE	30,769	+24.81	23,967	22,862	10,017	1,403	5,314
KANESHIE	33,609	27.10	26,179	22,363	29,763	2,450	5,712
NORTH INDUSTRIAL AREA	10,339	8.34	8,053	742	-	671	1,579
NORTH-KANESHIE	34,756	28.03	27,072	11,166	-	1,995	5,287
SOUTH INDUSTRIAL AREA	1,692	1.36	1,318	1,063	-	165	265
TESANO	4,275	3.45	3,330	5,612	1,758	238	673
TOTAL	124,017	100.00	96,600	66,933	41,538	7369	20,111

Source: 2000 Population and Housing Census. * Projected

5.0 IDENTIFICATION, ANALYSIS AND EVALUATION OF IMPACTS

5.1 Introduction

The project comprises the construction of approximately 3 km of insulated at 161 kV transmission line from Avenor through Circle La-Pamas, Railway station and Ecomog to ECG Sub-station near Graphic road. The proposed transmission line will utilize the existing 34.5kv 15m ECG transmission line corridor from Avenor to be terminated at ring road west in Accra central. The transmission line will traverse several bus terminals, goat/sheep selling points, spare-parts shops and slum settlements across one (1) Sub-Metropolitan assembly (under Accra Metropolitan Assembly) in the Greater Accra region. Thus apart from it being a site-specific project whose impacts would be generally confined to specific areas of influence, the project can also be considered a 'linear' project. There is an existing ECG 30 m RoW which the project will be associated. The potential impacts of such a project would affect a much wider area of influence. The diverse locations of the various sections of the transmission line project enhance the potential adverse impacts of the project. In recognition of this fact and in fulfilment of the requirements of permitting and funding agencies, GRIDCO has incorporated this environmental assessment in its project cycle.

5.2 Methodology

This section of the EIA Report deals with the methodology used to assess the potential impacts of the project and the results from the application of this methodology to the project, using project information and baseline data available at the time this report was prepared. It also outlines the key potential environmental impacts that could result from construction, operational and demobilisation activities of the project to enable relevant mitigation measures to be proposed to minimise environmental impacts. The main factors used in determining whether an impact may occur at each intersection between a project activity and a specific environmental medium include:

- Literature reviews (desk study);
- Field observations;
- Discussion with project proponent health, safety, and environment departmental officers and schedule officers;
- Consultations with local experts;
- Consultations with stakeholders;
- Experience from similar projects worldwide;

The impact assessment methodology used for this project consists of five major steps:

Step 1: Identification and description of project activities and their interaction with environmental media;

Step 2: Comprehensive preliminary identification of potential impacts;

Step 3: Screening or comparative assessment of impact importance; identification of impacts that are likely to be significant (i.e., identification of focus areas for further study) through application of a basic set of impact significance criteria to the preliminary information available about each impact;

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

Step 5: Final assessment of the severity levels of impacts through application of the results of the rigorous quantitative and qualitative characterization of impacts developed in Step 4 to a set of objective impact severity criteria; identification of impacts warranting mitigation.

Consultations with selected respondents met on the field as well as the experience gained by staff on similar projects have informed the identification and quantification of the identified impacts. The potential impacts associated with each focus area are qualitatively, and where possible quantitatively described and evaluated under the three (3) major phases of the project cycle: Pre-constructional, Constructional and Operational/Maintenance phases. An evaluation of the residual, i.e. remaining, impacts after implementation of the mitigation measures shall also be undertaken.

The impacts related to the modifications of the existing substation at Accra central, where significant, shall be considered with the transmission line impacts. Due to the minor scale of the works required at this site and to the location of the works within the substation, it is anticipated that these works will have minimal impacts.

5.3 Results of impact identification process

The proposed project may potentially result in impacts on the environment, socioeconomic conditions, and/or health and safety. Each of the specific compartments of the environment listed in Table 9, could potentially be affected by the impacts resulting from one or more of the project activities that have been discussed. Table 10 shows the expanded impact identification matrix for the various phases (and project activities) of the project cycle which identify the focus areas by project phase and activity as well as affected media. This table summarizes the identified focus areas. Focus areas are indicated by 0, 1, 2 or 2+. If the row

associated with a particular activity is 0, the impacts from that activity are considered to be negligible, or of lower significance and may be screened out of further consideration.

Table 9: Summary of key impacts

Project Phase	Proposed expansion of substation site	Transmission line
Pre-constructional	<ul style="list-style-type: none"> ✓ Socio-economic and local community impacts ✓ Compensation 	<ul style="list-style-type: none"> ✓ Socio-economic and local community impacts ✓ Compensation
Construction	<ul style="list-style-type: none"> ✓ Socio-economic and local community impacts ✓ Traffic and Transport ✓ Waste ✓ Noise ✓ Air quality ✓ Soils ✓ Public and occupational health and safety 	<ul style="list-style-type: none"> ✓ Socio-economic and local community impacts ✓ Traffic and transport ✓ Waste ✓ Noise ✓ Air quality ✓ Soils ✓ Public and occupational health and safety ✓ Compensation
Demobilisation	<ul style="list-style-type: none"> ✓ Traffic and transport ✓ Air quality and noise ✓ Public and occupational health and safety ✓ Wastes 	<ul style="list-style-type: none"> ✓ Traffic and transport ✓ Air quality and noise ✓ Public and occupational health and safety ✓ Wastes
Operation phase	<ul style="list-style-type: none"> ✓ Socio-economic and local community impacts ✓ Public and occupational health and safety ✓ Land use ✓ Landscape and visual impact ✓ Wastes ✓ Noise 	<ul style="list-style-type: none"> ✓ Socio-economic and local community impacts ✓ Public and occupational health and safety ✓ Land use ✓ Landscape and visual Impact

Table 10: Impact Identification matrix

Activities	Bio-physical Environment							Health & Safety		Socio-cultural Environment											
	Geology, Soils	Climate, air quality	Noise	Water	Resources	Flora	Fauna	Ecological sensitive sites	Public Safety	Occupational Safety & Health	Historical resources	Visual	Intrusion	Infrastructure	Cultural	Heritage Land tenure,	Ownership	Land use	Employment	Agriculture	Population
Pre-constructional																					
Project Feasibility	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Line Route Survey	0	0	0	0	0/1	0/1	0	0	0	0	0	0	0	1	1	1	2+	0	0	0	0
Environmental Impact	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acquisition of Land	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0
Constructional phase																					
Clearing of Site & Transportation of	0/	0/1	0/	0/1	0/1	0/1	0	0/1	1	0	0	0	0	1	0	2	2+	2	0	0	0
Civil works	0	0	0/	0	0/1	0/1	0	0/1	1	0/1	1	0	1	0	0/1	2+	2	0	0	0	0
Installation substation	0	0	0/	0	0/1	0/1	0	0/1	1	0/1	1	0	1	0	0/1	2+	2	0	0	0	0
Clearing of line route	0	0	0/	0/1	1	0/1	0	0/1	1	0	0	0	1	0	2	2+	2	0	0	0	0
Clearing of Tower	1	0	0/	0/1	1	0/1	0	0/1	0	0	0	0	1	0	2	2+	2	0	0	0	0
Excavation of Tower	0	0	0/	1	0	0	0	0/1	0	0	0	0	0	0	2	2+	2	0	0	0	0
Erection of Towers	0	0	0	0	0	0	0	0/1	0	0	1	0	1	0	0	2+	0	0	0	0	0
Stringing Lines	0	0	0	0	0	0	0	0/1	0	0	0	0	1	0	0	2+	0	0	0	0	0
Demobilisation	0	0	0/	0	0	0	0	0/1	0	0	0	0	0	0	0	0/1	0	0	0	0	0
Testing &	0	0	0/	0	0/1	0/1	0	0/1	0/1	0/1	0/1	0	0	0/1	0/1	0	0	0	0	0	0
Operational phase																					
Landscaping	0	0	0	0	0	0	0	0/1	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub-station	0	0	0/	0	0	0	0	0/1	0	0	1	0	0	0	0	0	0	0	0	0	0
Vegetation Control	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Line Maintenance	0	0	0	0	0	0	0	0/1	0	0	0	0	1	0	0	0	0	0	0	0	0
Tower Maintenance	0	0	0	0	0	0	0	0/1	0	0	0	0	1	0	0	0	0	0	0	0	0

Key: 0 No potential impact or insignificant impact. 2+ Potential significant beneficial impact. 1 Potential effect, expected to be insignificant.

2 Potential significant adverse impact.

5.4 Pre-construction phase

The elements of the project that are currently being carried out during this pre-construction stage are the preparation of detail design drawings, specifications and bill of quantities for the construction of the civil and structural ancillary buildings, equipment supporting structures and fencing, land surveying and pillaring to identify the route to be taken by the proposed transmission line. Acquisition of the Project Environmental Permit is subject to the submission of an EIS and approval by the EPA. These activities are expected to have negligible impacts on the environment and will therefore require no mitigation measures. The major pre-construction activities anticipated that requires mitigation includes the acquisition of land for the transmission line; this is because it will ultimately lead to loss of property and possible land use conflicts.

The following potential impacts have been identified to be associated with these activities:

5.4.1 Consultations with relevant agencies

The support and involvement of government agencies are essential to the smooth implementation of the project. There is the potential of conflict and misunderstanding with PAPs, and these have to be exhaustively addressed and resolved prior to the implementation of the project. Detailed consultations with both community members and state agencies have been done and this has been detailed out under Chapter 10 of this Report.

5.4.2 Loss of buildings and land ownership issues

The acquisition of the RoW and access tracks has no potential to adversely affect land ownership since the project will utilize the existing RoW but the land-use characteristics will be adversely affected, as the RoW has heavily been affected. The land-use to be affected by the implementation of the proposed project has the following categories of land-uses; Transport terminals, commercial structures and residential areas (affecting buildings).

There will not be any land acquisition, as the existing ECG corridor will be used for construction of the proposed 161kv transmission line. However, due to heavily encroached nature of the corridor by squatters, property impact Assessment will be conducted.

The demolition of structures that would be associated with construction can result in displacement of communities, loss of business, properties and incomes, social stress, social and psychological disruption for the affected individuals and families. The project will result in the prohibition of activities such as trading, transportation, food vending and others in the RoW. The major impact is associated with any involuntary resettlement and compensation that would have to be paid to project-affected persons.

Disputes over compensation and resettlement measures may be raised by project-affected persons (PAPs) informally with local notables or GRIDCo staff or, failing resolution at the informal community level, formally with the Commission for Human Rights and Administrative Justice (CHRAJ) and, ultimately, the courts.

GRIDCo shall identify and consult with all project-affected persons (PAPs) in order for issues of compensation and involuntary resettlement to be appropriately addressed. This shall be followed by valuation of the cost of affected properties and the replacement of lost private lands and property in such situations and the preparation of a “Valuation Report”, outlining the compensation package for all persons whose properties would be affected. A provisional amount of money has been set aside for the acquisition of land and compensation for affected properties.

This potential adverse effect on land-use requires mitigation measures to minimize the impact on individuals, communities and stools. This will need to be properly managed through sensitization and information sharing.

A further assessment of the potential impact on loss of buildings, kiosks, structures and shop ownership is considered with relevant mitigation measures provided.

5.5 Constructional phase

This section considers the environmental impacts of the activities of the project during construction. It addresses potential impacts on all resources and receptors so that the scale of overall impact of the project can be elicited.

5.5.1 Potential impact on socio-economic and local communities

Construction activities can potentially have a positive socio-economic impact by the provision of temporary employment opportunities and an improvement in local economies generated by an increased demand for local goods and services. Conversely, construction activities can also have a negative impact on local communities through the impact of an influx of construction workers, which may place pressure on local resources, affect social dynamics and culture, and exacerbate health problems etc.

The assessment of the significance of the positive or negative impact on socioeconomics is based on the number of workers likely to be employed, where these workers are recruited from, their cultural background and the period over which new workers will be in the area and thus potentially improve or put undue pressure on local resources. Although exact details of the construction workforce are not available at present, it must be noted that Ghanaian sub-contractors and people from the local area will be used, where skills permit, to undertake

construction works at the proposed sites. It is likely that up to 50 staff from Ghana will be employed temporarily during the construction period at the site, in jobs such as transportation, electrical, civil and mechanical works. This will provide significant benefits in terms of temporary employment opportunities.

This will also have a positive knock on effect on the local economy through the purchase of local foodstuffs and goods by the temporary construction workforce throughout the construction period. The significance of these benefits will depend on the number of national as opposed to local workforce numbers employed and the consequent likely increase in the demand for products. Although a workforce of about 50 would represent a significant temporary influx to the small villages in the vicinity of the project site, it is likely that a significant proportion of the temporary workforce would be employed locally. Furthermore, as temporary staff will be required for a number of different jobs, the 50 workforce will be required throughout the duration of the construction period and not at any one time, thus reducing the overall impact on local resources and on local communities.

The HIV/AIDS pandemic is a severe one that should continue to engage the attention of authorities in all sectors and in the management of the workers. Findings of international studies of HIV/AIDS in work places suggest that the construction sites of such projects are breeding grounds and a vehicle for the HIV/AIDS epidemic. People working on the project have to be mobile, they have to spend much time away from their homes and satisfy their sexual needs on the road. With any influx of temporary workers there is a significant risk of spreading HIV/AIDS; specific measures will need to be undertaken by the contractor to minimise this risk. Migration, short or long term increases opportunities to have sexual relationship with multiple partners, thus becoming a critical factor in the propagation of HIV/AIDS. Although awareness of the disease is said to be very high amongst the Ghanaian population, behavioural change lags far behind this awareness. This is likely to be the case among the workers as well and there will be need for education for the workforce and monitoring of incidence of HIV among community members.

The project would boost trading among construction and allied industries e.g. cement and iron rods production and other building materials manufacturers, suppliers and distributors. Other businesses such as the catering services springing up on the fringes of construction sites would also benefit immensely. In addition, there are both direct and indirect potential socio-economic benefits resulting from the project. These are employment arising primarily during the construction phase with limited opportunities during pre-construction and operation and improvement of roads during the construction phase.

There are no expected impacts on population and demography. Relevant issues that are thoroughly considered in the EIA are land ownership issues, Land-use conflicts (including compensation issues), Employment generation and incomes and impact on HIV and AIDS with relevant mitigation measures provided.

5.5.2 Potential impact on cultural heritage

The clearing of the project site, transmission line corridor and creation of access routes can lead to damage to areas of historic, scientific, social and amenity values, and also affect the aesthetics of cultural monuments and archaeological resources. This can occur where design and construction do not take account of such cultural heritage and resources. Damage may also be caused by construction related works such as burrow sites, and unregulated access to cultural heritage sites. The potential impacts to archaeology and cultural heritage as a result of the project arise from the potential for destruction of burial sites of significance as a result of the construction of new infrastructure. The main impacts relate to areas of ground excavation required for construction purposes e.g. lay down areas of work camps, new access roads and at the tower location sites.

Land take for construction activity can cause impacts on new access tracks and at the tower locations. The main land take for the RoW only requires vegetation clearance to be undertaken and it is proposed that clearance is limited to taller vegetation, i.e. greater than 1.25m in height. The greatest risk of damage to important sites that may exist arises from site excavations rather than the vegetation cutting. Vehicular traffic along the RoW for both construction and operation has the potential to affect sites of importance if they are above ground level. Construction of this maintenance track will not however require any excavation, but limited traffic over the sites identified below may occur.

Cultural finds may be the following:

- Sites of cultural significance such as sacred woods or trees or rock outcrops which the local residents may have not mentioned at the survey stage
- Archaeological heritage which may have remained unnoticed in the past

At this stage, there hasn't been any identified or known cultural heritage site within the area of impact of the project. However, issues regarding cultural properties and the possibility of cultural and/or archaeological 'chance finds' are considered to be significant requiring mitigation and are considered. Relevant issues that are thoroughly considered in this EIA include destruction of sacred, cultural and/or historical/archaeological sites/items with

specific reference to the shrines, the cemeteries and any archaeological “chance finds and relevant mitigation measures are provided.

5.5.3 Potential impact on traffic and transport

Potential impacts on traffic and transport during construction will arise as a result of additional traffic movements associated with the transportation of equipment to the plant site, from workforce movements to and from the site and as a result of the removal of wastes from the site. In terms of total traffic generated by the construction phase, daily movements will be low. The requirement will only be for the delivery of workers at the start and end of each day and the construction materials during the working day, both to the depots and to the construction sites. This will present an increased safety risk but with the application of proper mitigation measures particularly the speed controls through villages, this increased risk should be minor.

Taking account of the low overall total traffic movement that will occur, impacts are predicted to be adverse but temporary and insignificant in magnitude. The improvement of the main access routes for this project has the potential for positive impacts relating to improved access from the affected villages to the main road network. This will provide easier access to markets for their produce.

There can be serious disruptions to local traffic and also accidents during the construction period. This may result from the transportation of machinery and materials to the project site and also during the stringing of the transmission lines across roads. The situation can be aggravated without carefully planned detours and road closures. The effect of traffic disruptions includes increased travel time, congestion, social stress and agitations. However, this is expected to be minimal as the traffic densities in most of the communities where the transmission line project will traverse are low.

Mitigation measures are provided for this potential impact.

5.5.4 Potential impact of waste generation

Different forms of solid and liquid wastes including excavation spoils, vegetative matter, damaged cables; sewage, garbage and oil spills from construction equipment will be generated. Liquid waste from spilled oil, chemicals and paints are likely to be generated. The following wastes are likely to be generated as a result of constructional activities for the project:

- Clearance and excavation wastes:

- Clearance of site vegetation and removal of soils, inert construction materials and residues, spoil, etc.
- General construction wastes:
- Other wastes: from offices, food preparation wastes, sanitation etc.

Areas alongside the corridor especially where the corridor runs close to towns may become centres of intense trading which will leave in its trail serious sanitation problems. The largest volume of waste will be generated as a result of the excavation of the substation site for the foundations of the plant, ancillary equipment and the substation. If possible, the contractor will reuse excavated wastes on-site wherever possible, for example through the filling of the earthworks around the yard, thus minimising the impact of wastes generated.

In accordance with the Design Specification, the contractor is required to ensure that oily water drainage is provided for all areas where oily waste may occur, e.g. oil unloading areas, oil and fuel storage compound drainage, car parking areas, etc. Due to the nature of the site and the works to be undertaken, general construction wastes and hazardous wastes are predicted to be low. Appropriate sanitary facilities will be provided on the site for the construction period.

Further assessments of the potential impact on waste generation, both solid and liquid, are considered with relevant mitigation measures provided.

5.5.5 Potential impact of noise and vibration

During construction, activities such as the use of heavy equipment, the preparation of the site and traffic movements have the potential to generate noise impacts. Thus, the main potential impact will be vehicular and construction noise that may affect local residents. The main noise generating activities will be:

- Delivery traffic to and from the lay down areas and to the construction sites;
- On site construction activity with fabrication and construction of the towers and stringing of the lines

Heavy duty machinery and vehicular movement, friction between vehicles and the road surface, driver behaviour, vehicles' horns, resonance of traffic and piling, if found necessary, increase ambient noise levels and vibration shall occur far beyond the immediate transmission line corridor. The effects of excessive noise and vibration include physiological disruption, hearing impairment and communication problems. These may cause elevated

stress levels and associated behavioural and health problems. They can also cause auditory fatigue, sleep disorders, etc. Vibrations can damage roadside structures, particularly makeshift or lightly constructed buildings.

For traffic noise, overall daily traffic movements are predicted to be low as the delivery requirements for men and materials at any one site are low. However this is likely to represent a large increase over the current traffic volumes due to the very low current number of movements. The potential therefore exists for impacts to be felt by inhabitants along the transport routes due to this change. The overall total traffic volumes will be low and will be restricted to daytime only. As such, the noise increases over the current baseline along these routes will be adverse but temporary in nature and minor in significance.

The operations on site are also not intrinsically noisy, i.e. excavation of foundations, mixing of concrete, bolting of steel work, vehicle movement for delivery of men and materials and stringing of the lines. In addition to this, good site practice can minimise noise generation and the restriction of operations to the working day will avoid noise generation during the most sensitive, night time, period. Noise also has the potential to disrupt wildlife habitats and movement in sensitive areas.

An assessment of the potential impact on noise and vibration are considered with relevant mitigation measures provided.

5.5.6 Potential impact on air quality

Air pollution may adversely affect the health of people engaged directly or indirectly on the project activities. The effects are due largely to particulates from vehicular emissions and constructional equipment powered by gasoline or diesel as well as silica in dust from the earth agitated by constructional equipment and vehicles plying on un-tarred roads. The resultant effects are acute respiratory disorders, lung and heart diseases, the type of ailment depending on the size of particulates as well as the materials adsorbed on them. The use of construction equipment and vehicles will result in the emission of fugitive dusts, and contaminants adhering to dust particles.

These may arise from:

- On-site earth-moving operations for foundations and excavation;
- Use of construction equipment;
- Vehicles movement over bare ground in dry weather;
- Dust being blown off vehicles and spillage from vehicles;
- Wind blowing over bare-ground within and adjacent to the construction site.

The potential for dust to be emitted during construction is strongly dependent on the type of activities taking place, on wind speed and on whether winds carry emitted particles towards sensitive receptors, such as residential properties. Apart from the dust particles that will be generated, vehicular emissions that will emanate from the haulage trucks is also a potential source of air pollution. Vegetation clearing, construction of access routes, excavation and haulage of heavy machinery and construction materials to and from one location to the other along the tower corridor has the propensity to impact negatively on air quality. It is however expected that such impacts will be localised especially during the rainy season but has the potential to be widespread during the dry (harmattan) season occurring from December – Mid-March.

More minor impacts can arise from the excavation of materials during construction, during access track grading and gaseous emissions from plant and vehicles used during the construction process. However these minor sources will not have significant impacts. By virtue of the nature of a power transmission line the operational phase will not result in any significant dust generation. These activities are therefore too infrequent to cause a significant impact.

Assessment of the potential impact on air quality is considered with relevant mitigation measures provided.

5.5.7 Potential impact on soils

The preparation of the substation site could have an adverse impact on soils through topsoil compaction, rutting and mixing as a result of excavation of the site for civil works; and the movement of equipment on site during construction. The main impact on soils will be as a result of the excavation of the site for the foundations of the towers. Contamination of soils may also arise through the spillage of lubricants, oils and machine fuel during construction activities. Top soil removal, excavations, vehicular traffic impact on the un-tarred access routes, etc. has the potential to engender sheet erosion by exposing the soil to soil erosion agents.

This potential impact on soils is considered with relevant mitigation measures provided.

5.5.8 Potential impact on public and occupational safety and health

The transportation of heavy plant and equipment through settlements and the presence of unprotected tower base excavations could pose potential safety problems for the local populace.

Accidents constitute one of the most important risks in such construction activities resulting in injuries. These are likely to arise from moving machinery in the course of operation, unguarded parts of equipment and a disregard for health and safety measures. These are likely to pose risks to the workers. Injuries may also arise from road traffic accidents during haulage of construction machinery and materials to the site. This has the potential of harming both workers and road users, including pedestrians. Other sources of injuries to workers are: accidental falls from height, noise, vibration and heat, falling/swinging objects and also lubricants some of which contain solvents with potential to cause skin irritation and allergies, respiratory disorders and acute poisoning.

There are unlikely to be any significant public health and safety issues at the site, the main impact on the public being associated with the movement of heavy goods vehicles to and from the site. Without mitigation measures, all construction sites present a risk to occupational health and safety. The contractor is required to prepare a Health and Safety Plan to be reviewed and approved by GRIDCo prior to the start of construction on site. Construction equipment will be stored at a site to be secured and guarded by the contractor.

This potential impact on public and occupational health and safety is considered with relevant mitigation measures provided.

5.5.9 Potential impact on landscape and visual intrusion

The project may have an adverse visual impact as a result of tall construction equipment affecting views to the site from properties and amenity sites. The main construction equipment that will potentially be visible during construction will be the equipment to move the plant and substation into place.

Impacts on landscape character will also arise from both the imposition of the steel pylons (towers) into the existing landscape setting. The constructional activities have the potential to impact on scenic landscape values at the project site. Landscape impact assessment is based on two principal aspects. First, the alteration of the landscape character of an area including impacts on recognised features of landscape important. The second aspect is impact on public views of the site either from residential properties or areas of public access, e.g. footpaths, and from public roads. Landscape impacts relate to the construction and operational phase of the project.

Mitigation measures have been proposed for this potential impact.

5.5.10 Potential impact on buildings and other properties

As has been discussed elsewhere in this document, the proposed project will impact negatively on residential buildings, shop structures, some buildings, mosques, transport terminals etc.

The proposed project is expected to cover a total area of 0.045 km² (without the area covered by the existing substation at Graphic road). Provisional surveys have estimated that almost the whole area would not be under any form of land-use.

The proponent has gone to great lengths to ensure that buildings and other such structures are avoided as much as possible in the design of the line route. It has however been found that four mosques are directly within the RoW. This would obviously be impacted upon by the proposed project. So far, several other buildings in different categories have been found to be located in the proposed line route but this can be confirmed only at the detailed survey stage for construction purposes.

It is expected that every single project-affected person shall be identified during line-cutting at the constructional stage of the project cycle for the purposes of compensation payment. At present GRIDCo has made available an estimated amount of GhC4.0million for payment of compensation to all would-be project-affected persons.

Mitigation measures, as outlined under section 6.1.1 will be implemented to make up for all such losses to be incurred by all project-affected persons.

5.6 Operational phase

This section identifies the impacts associated with the project during the operational phase.

5.6.1 Potential Impact on socio-economic and local communities

GRIDCo intends to develop a bulk supply point (BSP) within the Central Business District (CBD) of Accra to meet the increasing Energy demand in this area, which is growing at a rate higher than the rest of the demand growths in the country adequately and reliably.

The total power demand in the Greater Accra Region of Ghana is projected to range from 800 MVA to 1,000 MVA by 2015 with a combined average annual growth rate of about 8%. The main power consuming areas are the Central Business District of Accra and the industrial city of Tema, where demand growth per annum exceeds 10%.

The existing ECG 34kV is not enough to deliver the necessary required power has compelled ECG to maintain rather long distribution lines to link all these areas and further extend them to developing areas. This has over the years resulted in high system losses, long and frequent power outages, voltage fluctuations and consequently lower supply reliability. GRIDCo is

considering creating another bulk supply point within the enclave to address the above issues and improve upon the power reliability and to reinforce power supply to Accra central.

The costs of the project will not be directly passed onto the customers. Furthermore, the improvement in system reliability will significantly reduce the need to run private diesel generators that are currently being used by customers during load-shedding periods. This will have a positive impact on air quality through the reduction of air emissions in urban areas and will reduce the cost of electricity for customers currently running diesel generators at their own expense. The operation of the project may also result in employment opportunities, through improved electricity supply to the Ashanti and Western regions of Ghana.

Due to the skilled nature of the operation, GRIDCo staff will be used to operate and maintain the transmission line site. There may be limited opportunities for local employment associated with clearance of the way leave vegetation for maintenance purposes e.g. to maintain access for maintenance workers and to maintain the vegetation within acceptable height limits to avoid damage to the line from falling trees.

The potential impact on the socio-economy of the local communities requires mitigation.

5.6.2 Potential impacts on traffic and transport

The operation of the substation has the potential to give rise to changes in road traffic levels on the roads within the vicinity of the substation as a result of worker vehicle movements, deliveries and the removal of wastes from the site. The main source of potentially significant additional traffic during operation will be that of site workers' vehicles. It is unlikely that all operating staff will have cars; therefore the actual increase in personal vehicle movements is expected to be significantly low.

No further mitigation will be proposed for this impact.

5.6.3 Waste generation

It is expected that a limited amount of waste will be generated during this phase from vegetative matter, cans, packaging materials, insulators etc. Liquid waste will also be generated from the possible washing of various items that may be used. There is the possibility of water pollution if washing is done in or close to nearby water bodies. It is, however, not anticipated that liquid wastes from the various washings will be generated in significant quantities. Accidental spillage of oil, fuel or paints will however need to be managed

Measures shall be proposed for the management of solid waste, however, no mitigation measures shall be proposed for the potential impact of liquid waste.

5.6.4 Occupational safety and health

Some occupational safety and health hazards are expected during the operational phase of the project. These hazards could result from falling and/or swinging objects, potential collapse of towers due to rainstorms or vandalism, electrocution, falling from heights and snakebites. These hazards pose potential threat to the safety and health of the workers.

Mitigative measures shall be proposed for occupational safety and health hazards during the operational phase.

5.6.5 Public safety

Potential public safety hazards are enhanced for a project such as the proposed transmission line project when the local populace has not been properly educated with regard to the potential hazards. In addition to the hazards posed to the public due to transportation of equipment and materials, other hazards such as potential exposure to Electromagnetic field (EMF) effects, potential collapse of towers and electrocution will exist during this phase of the project.

The falling of a live electrical conductor could cause severe burns to any object on which it falls. An electrical conductor could fall from the towers as a result of either a mechanical failure of an insulator string on the tower or snapping of the conductor itself. The mechanical failure of an insulator string could be as a result of a lightning strike, rusting of insulator pins or a heavy object falling on the transmission line. The failure of a conductor joint could also cause snapping of the conductor. Strict adherence to the non-encroachment requirement of the right of way will reduce the potential risks to public safety.

These potential hazards require mitigation to ensure the safety of the public.

One other potential impact of the proposed project is the perceived danger posed by the presence of transmission lines. Issues relating to electromagnetic fields are not normally understood by the public. The misconception that EMFs may cause cancer or harm children could create fear and perhaps panic among the local populace. This issue has been discussed below.

5.6.5.1 Electromagnetic field (EMF) effects

Electromagnetic fields (EMF) (properly called electric and magnetic fields) occur whenever a voltage is present or whenever a current is flowing. In nature EMF effects occur, as in

lightning and in other phenomena such as the northern lights (aurora borealis), by the interaction of solar wind and the earth's magnetic field.

Since the early 1880s when public electricity supplies were introduced, man has lived increasingly in electric and magnetic fields that vary with time (oscillate). However, electricity transmission, distribution and generating equipment are by no means the only source of man-made EMF. Such fields are everywhere, and are created by wiring circuits in homes, including currents that are induced in water and gas pipes. In addition, all electrical appliances and equipment, together with electric trains and other forms of transport, even the motorcar, all produce EMF. It is almost impossible to avoid man-made electric and magnetic fields.

Over the last two decades, debate has raged on over the impact of electro-magnetic fields (EMF) on human health. Power lines in particular have become a focus for conflicting conclusions. The Environmental Health Division of the Minnesota Department of Health (USA) has collated the current available results of research into EMF and health carried out worldwide. The information is readily available at their web site www.health.state.mn.us. In Table 11, the conclusions from the available research information have been duly summarised and presented.

Table 11; Summary of research findings on EMF and health

No.	Research Institution	Country	Year	Main Conclusions
1	American Physical Society	USA	1995	No plausible biophysical mechanisms for the systematic initiation or promotion of cancer by power line fields have been identified.
2	National Research Council	USA	1997	The conclusion of the committee is that the current body of evidence does not show that exposure to these fields presents a human health hazard.
3	National Institute of Environmental Health Science	USA	1999	The scientific evidence suggesting that EMF exposures pose any health risk is weak. However EMF exposure cannot be said to be entirely safe.
4	Institute of	USA	1999	There is not enough relevant scientific data

No.	Research Institution	Country	Year	Main Conclusions
	Electrical and Electronic Engineers + Engineers in Medicine and Biology			to establish whether common exposure to power-frequency fields should be considered a health hazard. There is general agreement that more research is needed to define safe limits of human exposure to EMF.
5	National Radiological Protection Board	UK	2001	Laboratory experiments have provided no good evidence that EMF causes cancer. However the possibility remains that intense prolonged exposure to EMF can increase the risk of leukaemia in children.
6	International Agency for Research on Cancer	10 Countries US, UK, Japan etc	2001	There is no evidence that EMF is associated with childhood leukaemia, and there is no consistent relationship between EMF and childhood brain tumours.
7	Health Council of the Netherlands	Holland	2001	It is not likely that children (or adults) living near to high voltage power lines are at risk through exposure to EMF generated by those lines.
8	Japan EMF Research Program	Japan	2001	There is little evidence of any adverse effects from EMF exposure. Very high intensity EMF (over 10000 times higher than real-world environments) can have certain biological effects, which are positive.

Source: Minnesota Department of Health, Environmental Health Division:

www.health.state.mn.us

According to the International Commission for Non-Ionisation Radiation Protection (ICNIRP), research evidence for EMF causing long-term, chronic, diseases such as cancer is not clear and therefore there are no guidelines based on this potential risk. The guidelines are based on short term, immediate health consequences such as stimulation of the peripheral nerves and muscles, and micro-shocks.

Only the higher voltage transmission lines at 400 kV would, under steady-state conditions, and directly beneath the lines, create a magnetic field maximum of 100 μT (the ICNIRP reference value). However, typical values are approximately a tenth of this field value. The same applies to electric field for 400 kV transmission lines, where maximum, steady-state, values could be above the reference value of 5 kV/m but the typical values might only reach this. The magnetic and electric fields drop rapidly with distance from the centrelines of the power line.

Human health impact

In the light of the findings presented in Table 19, it is not expected that the proposed 161 kV Accra Central Power Transmission System will have any adverse impacts on human health. During the field surveys, the various community groups were briefed in very simple terms on the current state of knowledge about EMF effects in order to allay their fears.

Fear impact

Perhaps the most serious impact is that due to fear, i.e. the perceived danger of the transmission lines. In some developed countries, the “fear impact” has been known to affect property prices and mobilise local action against the construction of new transmission lines. The public does not generally understand electromagnetic fields. They cannot be felt, tasted, seen, or touched. Most of the people interviewed were more concerned with electrocution (electric shocks) and they were admonished to comply strictly with the warning signals to be posted on the towers.

Corona discharge

Transmission lines are known to experience ‘corona discharge’ and this tends to increase with increasing voltage. Since the transmission project is intended to operate ultimately at 161,000 volts it is essential to consider this phenomenon as an issue of environmental relevance. Corona is defined as a discharge occurring at the surface of a conductor or between two (2) conductors of the same transmission line, accompanied by ionisation of the surrounding atmosphere. Corona is frequently luminous (spark of light) and produces noise of a hissing character. Corona is known to produce ozone, but this is unstable and reacts quickly with other gases.

Corona is caused by the electric field next to an object exceeding the breakdown value of air. The starting voltage for corona is typically 30 KV/cm radius. This may be lowered by the

presence of dust, water particles and sharp edges on the object. Corona causes loss of power as energy is lost in the discharge process. Corona also encourages corrosion of the line conductors as the reaction with the surrounding air sometimes produces nitrous acid (in the presence of adequate moisture). Corona is also known to cause radio interference on radio sets and TV sets in close proximity to high voltage transmission lines.

The moist environment in the forest areas tends to promote corona discharge and therefore every care shall be taken in the design, construction and operation of the transmission line to ensure that corona discharge is minimised. This shall be achieved by avoiding sharp edges and ensuring that adequate protection is built into the design of insulators and other power line accessories.

In conclusion, it is indicated that transmission lines are highly unlikely to create an electromagnetic field above the ICNIRP guidance values even at the highest risk location, i.e. straight beneath the line. With the rapid decay in EMF with distance, at the edge of the wayleave all international standards would be met. It is therefore concluded that the impacts of EMF on community health is local, but insignificant in magnitude. However, there is the need to provide mitigation measures that will be required to address the notions that EMFs may cause cancer or harm children and the resulting fear and possible panic among the local populations.

5.6.6 Effects on birds

The presence of transmission lines has the potential to impact on birds. The pylons and transmission lines will serve as landing facilities for birds. The possibility of electrocution exists. There is the potential danger of debasement of breeding grounds, electrocution, collision with lines and interference in the navigation of birds. No specific breeding grounds of birds have been identified within the line route hence the potential danger of debasement of such areas does not exist.

The potential dangers of birds flying into or colliding with the lines and interference in the navigation of birds exist and can only be regarded as residual hazards.

No further mitigation is proposed for this potential impact.

5.6.8 Fire hazards

There is the potential for fire outbreaks as a result of bush fires and electrical faults during this phase of the proposed project. Electrical faults can result in the transmission lines catching fire. The bush fires could either originate from worker operations or through the

activities of farmers, hunters and palm wine tappers. This could spread to nearby grasslands causing extensive havoc if not contained.

This potential hazard will have to be mitigated against in order to minimize the occurrence of fires.

5.6.9 Impacts on water resources

Due to the nature of the proposed transmission line development, surface water and groundwater issues are not of potential significance and do not require any significant mitigation measures.

Impacts on water resources during the operational phase will not be discussed.

5.6.10 Impact on telecommunications

By following the British Standard on Radio Interference Characteristics of Overhead Power Lines and High-voltage Equipment (BS5049:1994), transmission lines are known not to cause interference to radio or television services or to telecommunications systems.

Consultations with utilities on previous similar environmental studies on transmission lines have shown that equipment for mobile phone networks has been manufactured to standards taking into consideration potential interferences from electrical and electromagnetic sources. Thus transmission lines such as the one under consideration are not likely to cause harmful effects to mobile phone networks.

However, with regard to fixed lines, it was noted that in principle overhead telephone lines experience some interferences due to ‘induction effect’ from high-tension lines when they run close to or parallel to such lines. Consultations carried out with Ghana Telecom prior to this project indicated that in cases where telephone lines run parallel or close to high-tension lines, subscribers experience interferences as a result of induction effect. It is known also that resonance effect of power frequency fields may also affect telecommunications. However, this does not occur with the bulk transmission lines as they usually run outside settlements where interferences are likely to occur. In addition, utility companies adopt the procedure of “transpositioning” of the conductors (interchanging the individual phases from tower to tower) along the line route, in order to reduce the impedance that causes resonance. The phases are restored to the original at the termination of the lines.

Impacts on telecommunication systems during the operational phase will not be discussed.

5.6.11 Impacts as a result of operation of the substation

5.6.11.1 Transformer oils

The presence of transformers on the premises of substations introduces the potential environmental impacts inherent in transformer oils. Improper disposal of such transformer oils and lubricants could have an impact on the environment, especially when they are in large quantities such as those stored in storage tanks. This can contaminate both soils and water bodies through storm drains and can also be a source of fire outbreaks.

Polychlorobiphenyls (PCBs) are harmful substances to the environment. They are not produced during electricity generation or distribution, but are contained in certain equipment, mainly in transformers and condensers, which are purchased from manufacturers of electrical equipment, who in turn use it because of their good dielectric properties. The transformers to be purchased will be required to meet all applicable safety standards and will be enclosed in separate secondary containment structures that will prevent any accidental spills or routine leakages that may occur from being released to the environment.

Transformer lubricant oils are the main lubricant oils used on transmission line projects and are used for transformers, circuit breakers, reactors and voltage regulators that are located in the substations. Other minor lubricants include grease and oils used for maintaining equipment at the plant. Quantities of such lubricants used are very small. The transformers will not be dismantled and so the question of the disposal of the oils will not arise. The transformers are serviced outside the country.

No further mitigation measures will be required.

5.6.11.2 Fire hazards

The presence, storage and use of oils, fuels and other flammable products on the premises of substations give rise to the very likely hazards of fire outbreaks. In addition, there always is a real likelihood of fire outbreaks in substations that are sited in bushy surroundings.

Mitigation measures are proposed for fire hazards during the operational phase.

5.6.11.3 Noise

An assessment of an existing 161/34.5kV GRIDCo substation in Kumasi, similar to the proposed substation, indicated that generated noise could be heard up to only about 60m from the substation⁴. Additional noise in the surrounding area may be heard from other buildings and another substation (belonging to the Electricity Company of Ghana). This noise

⁴ Reference: 161 kV Kumasi – Sunyani Transmission Line Project EIS Report, Envirosound Associates

fluctuates on a daily basis, particularly the weekdays when vehicular use is at its peak in the vicinity. The noise level is however well within the guideline value within residential areas. No further mitigation for noise generated as a result of the presence of the substation will be proposed.

5.6.11.4 Avifauna

Potential impacts by/on bird species present in the area associated with the construction and operation of a substation include electrocutions and disturbance during the construction and maintenance of the substation. Other problems include electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure within the substation.

Mitigation measures are proposed for the potential impact on avifauna during the operations at the substation.

5.6.11.5 Substation security and public safety

Due to the high voltages to be experienced at the various substations, it is important that it is made secure at all times and that unauthorised persons are kept away from the premises. Just like all GRIDCo substations, the existing substation at Graphic road is already fenced to keep off unauthorised persons from the premises. In addition, security personnel already man the substation at all times to ensure security and report all incidents that might be out of the ordinary for prompt attention. Suitable warning signs, indicating the dangers within, shall be placed at regular intervals on the fencing to warn off would-be encroachers.

No further mitigation for security and public safety at the substation site is proposed.

5.6.11.6 Storm drains

A network of storm drains shall be constructed in the substation to collect and direct storm water away from the substation. This network shall be isolated from the oil and fuel storage areas to ensure that storm water is not contaminated with oil products prior to discharge.

No further mitigation for utilisation of storm drains at the substation site is proposed.

6.0 MITIGATION MEASURES

This section of the report will outline ways and measures to help reduce, and if possible, eliminate the adverse impacts identified in Chapter 5. The impacts identified so far are typical of transmission line projects. Mitigation measures provided under this section complements on-going environmental and social management practices that are underway by GRIDCo. The mitigation measures that have been proposed to minimise potential adverse environmental impacts and maximise beneficial impacts that are associated with the implementation of the project are presented.

To ensure that environmentally sound practices are adhered to and in order to safeguard the safety and health of persons or any group of persons working on the project during project implementation, the following mitigative measures are proposed for significant potential impacts at the pre-constructional, constructional and operational phases.

6.1 Pre-constructional phase

6.1.1 Loss of properties

The proposed project is a linear one. This means land-use characteristics will have to change within the affected area. The proposed approximately 3.0km 161kv transmission line will utilize the existing 34.5kv 15m ECG transmission line corridor from Avenor to be terminated at ring road west in Accra central. There will not be any land acquisition, as the existing ECG corridor will be used for construction of the proposed 161kv transmission line. However, due to heavily encroached nature of the corridor by squatters, property impact Assessment will be conducted and buildings and other structures within this will have to be acquired and compensated for. In order to minimize the adverse effects of the projects on individuals, families, communities and/or firms, GRIDCo shall engage the Land Valuation Division (LVD) of the Lands Commission to undertake a detailed survey of all affected properties for the purposes of compensation payment. Following this, a detailed Valuation Report will be prepared. Prompt, adequate and fair compensation will be paid to all project-affected persons before the commencement of constructional activities. The key standard to be met is to 'assist the affected people in their efforts to improve their former living standards, income earning capacity and, production level, or at least to restore them'.

The processes for compensation as outlined in the company's "Land Acquisition & Resettlement Framework" are explained below:

- Referencing of all properties, land and buildings, by officers of the LVD to be monitored by Estate Surveyors from the Lands Management Section of GRIDCo.
- Assessment of the compensation values by the LVD and the valuation advice forwarded to GRIDCo.
- The assessed report would be vetted and corrections effected where necessary to ensure that the amounts are accurate and fair to both claimants and the GRIDCo. These would then be processed for payment.
- Offers would be made to the claimants on the basis of the LVD's advice.
- Claimants dissatisfied with the offer have a right to petition for reconsideration.
- In this regard, such claimants are required to submit counter proposals supported by valuation opinion prepared by private valuers of their choice. The private reports are considered by GRIDCo in conjunction with the LVD to ensure that claimants are treated fairly.
- Where necessary, dissatisfied victims would be invited to negotiate and arrive at acceptable figures.
- Project affected persons may resort to legal action in order to have their grievances addressed.

Grievances are sometimes raised by some project-affected persons (PAPs). From experience, most questions involve disputes over the physical inventory counts and subsequently, grievance resolution procedures have been put in place with the sole objective of minimising disputes that may arise in relation to the compensation payments.

A key element in such planning is often the establishment of a formal grievance procedure--a standardized set of procedures to follow when someone has a complaint or a problem. It is particularly important to have a grievance procedure when it is likely that people will be affected by the implementation of a project, notably, traders, individuals and the general public, whether represented by an association or not, are frequently in this position. Many decades of experience have resulted in fairly standard grievance procedures that might well be utilized by people in other situations as well.

There are two key factors in establishing a workable grievance procedure. The first is the concept of a progression of levels at which a given complaint may be handled. Typically this begins with a step that provides for rapid and informal addressing of a complaint by those immediately involved, with appeals to successively higher levels of management or other representatives possible in the event that lower-level resolution doesn't work. The second

factor is the availability of an alternative procedure, to be used if several successive attempts at negotiation have failed. Typically this will be mediation, arbitration, or both.

Many grievances can be resolved quickly by correcting a misunderstanding, or with a simple negotiation. In this case the grievance procedure saves time, money, and the relationship between the parties. Having the issue handled by those immediately involved is a benefit as well, as they get to know more about the problem at hand than do people at higher levels. However, a given grievance may involve a more difficult issue, or one or more of the parties may refuse to settle with a simple negotiation. The availability of appeals to a higher level not only provides an end to what might otherwise become frustrating bickering, but often serves to remind a given representative at any level that reasonableness at this stage will eliminate the need for review of his or her actions by someone higher up. Time limits at each step, so that no one can stall the process indefinitely, are typical. In the event that the parties have discussed the matter at all levels provided in the procedure and are still deadlocked, an arbitration provision generally provides for a final decision by a decision maker that both sides have had a say in choosing.

A Grievance Committee would be established in each of the affected communities to be responsible for relaying grievances to GRIDCo. From experience, most questions involve disputes over the physical inventory counts and subsequently, grievance resolution procedures have been put in place with the sole objective of minimising disputes that may arise in relation to the compensation payments.

The grievance/dispute processing and settlement mechanism will be based on the following:

Traditional dispute resolution

Dissatisfied claimants would be invited for negotiation together with the traditional authorities of the area or Assembly members of the area in order to arrive at acceptable figures.

Submission of counter proposals

Although field valuation is generally accurate, there may be disputes to the figures arrived at. Such disputes are usually brought to the attention of GRIDCo staff. The second stage of the mechanism is to request the claimant to submit counter proposals supported by valuation opinion prepared by private valuers of their choice. The private reports will be considered by GRIDCo in conjunction with the Land Valuation Division to ensure that claimants are treated fairly. At such meetings efforts will be made to arrive at amicable settlements in order to

ensure that the third stage of the dispute resolution is not triggered. GRIDCo, in consultation with the LVD, shall then decide each instance on a case-by-case basis.

Resort to Legal action

PAPs may raise issues formally when informal mechanisms fail to redress the concern. PAPs may, in the event of dissatisfaction with the decisions taken in the instances discussed above or without resort to any of the instances above resort to legal action to have the dissatisfaction resolved. If the issue cannot be resolved at this level, the aggrieved party has, in theory, access to redress through the judicial system, although in fact judicial resolution is expensive and time-consuming. Given the mechanisms described above, it is unlikely that disputes will end up in the law courts.

GRIDCo has established the Lands Management Section, with designated Environmental Officers, responsible for, among others, public information and sensitization campaigns in order to inform stakeholders in the project area on issues related to compensation and land acquisition. On-going public consultations would be held with PAPs as well as the relevant Chiefs, opinion leaders, and governmental agencies with the aim of providing information on the project and issues relating to compensation.

6.2 Constructional phase

The constructional phase of the project involves activities that have the potential to impact significantly on the physical, biological and socio-cultural/socio-economic environments within the project's area of environmental influence. The following mitigation measures have been proposed for the significant potential impacts:

6.2.1 Noise impacts

Noise impacts from constructional activities will be temporary- limited only to the constructional phase of the project. All equipment/plants and vehicles will be new. Thus their ability to generate undesirable sound will be very low indeed. When making order of equipment, requirement for low noise equipment should be priority in order to decrease noise impact. All such equipment and vehicles will undergo periodic routine maintenance to reduce vibrations and other faults that ultimately lead to the generation of noise. Particular attention will be paid to all noise-reducing devices or mufflers to ensure that they are in good working condition to minimize noise generation.

Routine machine operation and tractor-trailer transport are not anticipated to produce noise levels significantly in excess of routine highway noise levels, or approximately 60 dB(A),

however, workers in either case will be issued protective gear during working hours to offset any risk of noise-induced hearing loss. In all cases, noise travel will be least during daylight hours when air density is least, and therefore all of the above-referenced noise producing activities will be kept to daylight hours of operation. All moving and reciprocating parts will be well oiled to reduce friction and subsequent noise as much as possible. This is beneficial not only for noise attenuation, but also for an increased life span of our machines, since wear and tear will be drastically reduced.

The unnecessary tooting of horns during transportation of equipment and materials through settlements will be avoided as much as possible. Construction site workers will also be advised to avoid unnecessary noise making. In addition, night time work especially near communities will be avoided as much as possible to prevent undue noise impacts on local communities. Construction crew near noisy machinery and power tools will be provided with earmuffs to protect them from hearing loss damage. Noise levels shall be monitored within areas where work is on-going and compared with the Ghana EPA Ambient Noise level Standard as well as the USA Department of Labour OH&SA as provided in Table 12 and Table 13 respectively.

Table 12: Ghana EPA Ambient Noise Level Standards

Zone	Description Of Area Of Noise Reception	Permissible Noise Level In dB(A)	
		DAY 0600 - 2200	NIGHT 2200 - 0600
A	Residential areas with negligible or infrequent transportation	55	48
B1	Educational (school) and health (hospital clinic) facilities	55	50
B2	Areas with some commercial or light industry	60	55
C1	Areas with some light industry, places of entertainment or public assembly, and places of worship such as churches and mosques	65	60
C2	Predominantly commercial areas	75	65
D	Light industrial areas	70	60
E	Predominantly heavy industrial areas	70	70

	Cumulative period for which intermittent noise is present in any hour ⁵	Maximum allowable adjustment above the permissible ambient level {dB (A)} ⁶
F	More than 15 minutes	± 0
G	Exceeding 5 minutes but not exceeding 15 minutes	-5
H	Exceeding 1 minute but not exceeding 5 minutes	-10
I	Not exceeding 1 minute	-15

Table 13: Acceptable Employee Noise Exposure Levels⁷

Duration of Noise Exposure (Hours)	Sound Pressure Level (dB)
8	90
6	92
4	95
3	97
2	100
1 ½	102
1	105
½	110
¼ or less	115

Maintenance practices such as the following shall be followed to reduce noise levels:

- Replacing worn or loose machine parts.
- Performing high noise operations during hours when people are less likely to be affected.
- Maintaining and lubricating equipment to eliminate rattles and squeaks.

Engineering controls, such as replacing noisy materials, considering the noise level of new equipment or processes before purchasing or implementing, placing heavy machines on

⁵ **Note 1:** This schedule is for the calculation from its duration of the potential annoyance level where any noise present and measured is intermittent and not measured by statistical method.

⁶ **Note 2:** These duration adjustments are not applicable when noise being assessed includes discrete noise impulses or consists of repetitive noise with an impulsive character e.g. hammering or riveting.

⁷ USA Department of Labour Occupational Health & Safety Administration

rubber mountings, using sound absorbing acoustical tiles or baffles shall also be done as a means of reducing noise levels. All stationary machinery and equipment will be mounted on vibration-damping foundations. These measures will be enforced for all new installations. Workers will not be allowed to be in direct contact with machine which vibrates as an operational necessity. This is to help reduce whole body or segmental vibration.

It is expected that the full implementation of the measures outlined above will minimize the potential noise impacts on the workers as well as the local communities.

6.2.2 Impact on air quality

Fugitive dust will be generated during construction as a result of the exposure of the land surface due to the clearing of vegetation for construction of site facilities. Movement of vehicles over this exposed surface will also increase the concentration of dust particles. Air pollution in the form of dust clouds may be likely to form, particularly in dry weather, from truck travel on un-tarred roads within the project site. At this stage of the project, the dust generated will be from non-point sources. Controlling the concentration at the sources of generation therefore becomes almost impossible.

Wind pick up of dust from exposed unprotected land surfaces will be minimized by limiting land clearance to minimum area requirements for the constructional activities. For instance, excavation of the tower base areas will be restricted to the required dimensions. To further reduce dust pollution, regular watering of the site will be carried out during construction to reduce the effect of wind pick-up of dust particles. This potential impact will be short-lived or temporary since it is expected that the exposed areas will be covered quickly by vegetative re-growth. The vegetative cover will however be so maintained as to allow the passage of vehicles.

GRIDCo will ensure that all exposed surfaces, access roads and working areas, are sprayed with water by water browsers as part of regular construction activities. This shall be done when necessary by water browsers. The frequency of spraying will be increased during the dry season. In addition, the construction machinery and equipment will be maintained regularly to minimize the release of soot in the exhaust fumes. Furthermore, trucks that supply sand, gravel and stone aggregates will have their buckets properly covered with tarpaulin during transit to prevent wind pick-up of dust, spill of materials and the release of dust into the atmosphere.

These measures, when fully implemented, are expected to minimize the potential impact of dust pollution on local communities and bring particulate matter within the acceptable Ghana EPA standard for 24 hour Time Weighted Average of Particulate matter (PM10) of $70 \mu\text{g}/\text{m}^3$.

6.2.3 Erosion

Activities during the constructional phase will expose the disturbed ground surface, which will be temporarily unprotected, to the agents of soil erosion such as heat, wind and rain. Erosion of soil from exposed unprotected land surfaces will be minimized by limiting land clearance to the minimum area requirements for the constructional activities. In addition, the erection of towers/tower footings on steep slopes will be avoided as much as possible to prevent slip erosion. This potential impact will, however, be short-lived or temporary since it is expected that the exposed areas will be covered quickly by vegetative re-growth to stabilize the soil and minimize erosion. GRIDCo will apply erosion control practices such as re-grading, compaction and early re-vegetation to promote soil conservation.

6.2.4 Public safety

The transportation of heavy plant and equipment through settlements will be done in a manner not to jeopardise the safety of the local people. Equipment and materials will be properly secured when being transported to prevent them from falling and posing potential danger to people. It is important to note that it is not the constructed towers that will be transported to tower locations but rather the tower members or parts. Legally mandated speed limits on the roads and highways shall be strictly observed in all settlements.

Also, tower base excavations in or near settlements or farms will be protected or clearly marked to prevent people from inadvertently falling into these excavations. For areas with animal populations, these excavations will be guarded with boards to ensure no animals fall into the pits. Tree felling will be done by certified timber contractors using competent workers. Adequate warning will be given to ensure that public safety is not compromised during this activity. The transmission line poses potential public health and safety hazards when the local populace has not been properly educated with regard to the potential hazards, such as collapse of towers, which actually occurs rarely. In addition to the hazards posed to the public due to transportation of equipment and materials, other hazards such as potential exposure to Electromagnetic field (EMF) effects, potential collapse of towers and electrocution exist. It is in relation to these that residences are not allowed to be sited under the lines in order to ensure that EMF effects, if any, are minimized.

In line with existing practice, the towers have been clearly marked with a red inscription on white background - “**DANGER – 161,000 Volts**” to warn off trespassers and prevent them from exposing themselves to the potential dangers of electrocution. Further, regular maintenance ensures the minimizing of corrosion and wearing out of parts of the towers and their accessories.

6.2.5 Occupational safety and health

GRIDCo believes that its human resource is its greatest asset. It will therefore proactively pursue measures at promoting safety, health and welfare of its workforce. Relevant national policies, labour laws and codes of conduct concerning employment shall be applied to regulate behaviour of workers in the local communities. Measures shall be designed regarding employment and workforce policies to mitigate environmental, health and social impacts that are associated with the influx of formal and informal workers by the Contractor. Local employment and sourcing policies may be used to give priorities to people within the project affected areas.

A Safety & Health Plan (SHP) shall be prepared by the EPC Contractor and approved by GRIDCo and shall be in consonance with GRIDCo’s Corporate Safety Policy. Education and awareness training are given to every worker upon employment. GRIDCo shall promote the need for safety awareness in all aspects of the work by conducting safety awareness programmes and campaigns, displaying posters and signs and using audio visuals. Weekly and monthly safety meetings shall be held for the workers of GRIDCo and the EPC Contractor.

GRIDCo will ensure that the EPC Contractor carries out the work in compliance with the relevant provisions of the Factories, Offices and Shops Act, 1970 (Act 328) and the Contractor Safety Rules to minimize the potential occupational safety and health hazards and prevent or minimise accidents. To further minimize the potential safety and health hazards, GRIDCo will ensure that the contractor employs properly trained and experienced operatives and adheres to all technical specifications relevant to safety measures in the execution of the works. In addition, the contractor will be expected to provide an “All Risk Insurance” cover for the contractor, subcontractors, project management staff and all other employees.

GRIDCo/EPC Contractor shall conduct formal induction sessions for all persons on site, including issuing each of its employees and employees of its subcontractors with an induction safety and health booklet, and during the contract, continue with on-going training on site health and safety matters. Road safety signs will be pasted at the appropriate places to prevent accidents. Dangerous construction sites are always flagged with caution reflectors.

The specific issues considered are discussed below.

6.2.5.1 Occupational noise

Construction workers working with or near noisy equipment like pumps and power tools will be provided with earmuffs to protect them against noise-induced hearing loss damage.

6.2.5.2 Machine safety

All potentially hazardous machinery such as lifting appliances (cranes, forklifts, etc.) and unfired pressure vessels (compressors, etc.) will undergo statutory examination by a certified engineer. This will ensure that accidents due to material failure are pre-empted. All electrical cables of mobile or hand-held machines (electric hand drills, temporary lights) will be examined for flaws in insulation and when any flaws are detected the cables will be promptly replaced.

6.2.5.3 Sanitary/welfare facilities

Sanitary conveniences will be provided for construction workers. This is to ensure that decent and comfortable places of convenience are provided for the workers and also to prevent environmental pollution with human waste. In addition, lifting of excessive weights at the workplace will be prohibited. Lifting appliances (e.g. cranes and forklifts) will be provided for lifting heavy objects. First aid facilities and good drinking water will be made available for the use of workers in accordance with the Factories, Offices and Shops Act, 328, 1970. Raincoats, Wellington boots, etc., will be provided for construction workers who will be working in rainy or wet conditions.

GRIDCo has assigned medical centres in the country for treating workers in the event of any illness, including exposure to contamination and occupational injuries. The EPC Contractor shall be responsible for providing affordable health care for its workers.

6.2.5.4 Injuries from falling/swinging objects

Protective clothing such as hard hats and safety boots will be provided for all employees at the proposed project site for protection against falling and/or swinging objects. Tree felling will be done by competent and adequately trained workers. Adequate warning will be given to ensure that safety of workers is not compromised.

6.2.5.5 Accidental falls from height

Due to the hazard of potential accidental falls from heights during construction works all workers who will be required to climb and work on the towers will be provided with the

necessary safety equipment such as body harnesses, (climbing belts). Fall hazards must be minimized through the use of fall prevention or fall protection. Fall prevention refers to using permanent engineering controls so that hazards associated with working at elevated locations are reduced or eliminated. Fall prevention measures to be adhered to are as outlined below:

- a) Employees on a walking/working on platforms with unprotected sides or edges that are 1.2 m or more above a lower level shall be protected from falling by the use of a guardrail system or a personal fall arrest system.
- b) Employees working on an aerial lift that is 1.2 m or more above a lower level shall wear personal fall arrest systems, with the lanyard attached to the boom or basket.
- c) Employees on walking/working surfaces shall be protected from falling through holes more than 1.2 m above lower levels by the use of a guardrail system, a personal fall arrest system, or covers.
- d) Many falls occur because portable ladders are not placed or used safely. Ladder users are at risk of falling if a ladder is not safely positioned and moves or slips from its supports. A stairway or ladder shall be provided at all worker points of access where there is a break in elevation of 48 cm or more and no ramp, runway, embankment, or personnel hoist is provided.

GRIDCo shall ensure that only well-trained and experienced personnel work at heights on the towers.

6.2.5.6 Snake bites

Construction workers will be protected from the potential hazard of snakebites by providing them with safety boots long enough to cover the leg up to the knee in areas where there are particular risks of snakebites. Workers will be required to wear these boots at all times during working hours.

6.2.5.7 Impact of sexually transmitted diseases

Periodic community awareness training is often given to the workforce regarding Sexually Transmitted Diseases (STDs) and traffic safety regulations. HIV & AIDS education is an integral part of this educational activity. This includes education on appropriate use of condoms as well as provision of male condoms to all workers as a form of mitigating this impact.

6.2.6 Socio-economic/cultural issues

The relevant socio-economic/cultural issues are:

6.2.6.1 Potential destruction of sacred, cultural and/or historical/archaeological sites/items

In line with current international practice and the desire to ensure the sustainability of the environment within which GRIDCo operates, GRIDCo will avoid intruding into or interfering with cultural properties of the local communities as much as possible. The following procedure, which is derived from the National Museum Decree 1969 (NLCD 387), for dealing with all such finds will be followed:

Upon the discovery of any such chance finds:

1. The Director of the Ghana Museum and Monuments Board shall be notified immediately in writing, stating the exact site or location of the item. The letter shall include adequate photographs of the antiquity.
2. GRIDCo shall permit and facilitate such access to, and inspection of the site of discovery as the Director may so require. GRIDCo shall also permit to be affixed or applied thereto, any seal or identification mark of the board.
3. GRIDCo shall not alter, damage, destroy or remove any antiquity from its original site without the consent of the Board. If removal of the item becomes immediately necessary for safety or security reasons, the exact location shall be noted and the retrieved artefacts shall be sent to the custody of the Board.
4. Through liaising with the Board, the lawful owners of the land shall be duly informed and where necessary, payment shall be made by the Board after due assessment.

Further decisions with respect to site sampling or further excavation will be under the jurisdiction of the Board. The above will ensure that issues relating to archaeological/cultural ‘chance finds’ are properly handled.

Cultural “chance finds” - sites of cultural significance such as sacred woods or trees or rock outcrops which the local residents may have not mentioned at the survey stage, will be properly managed to the satisfaction of both the local communities, the EPA and the funding agencies. Where possible, such cultural properties will be left undisturbed or avoided. In cases where complete avoidance of such sites is impossible, every necessary step will be taken to minimize the potential impact of intruding into the site. This will be done in

consultation with and to the satisfaction of the chiefs, elders and opinion leaders of the local communities.

6.2.6.2 Employment generation and incomes

Some employment openings may be created for the local people. Those local people who may be employed will benefit from the payment of salaries/wages. This is expected to lead to improvement in local incomes.

6.2.6.3 Potential impacts on public health

With the introduction of migrant workers into the communities along the proposed line route, mitigation measures will be required to minimize the potential danger of the spread of sexually transmitted diseases (STDs) including HIV/AIDS. GRIDCo shall undertake HIV/AIDS education for the workforces of the contractors and consultants. The measures shall include the distribution of IEC materials and sale of condoms at subsidised prices to the workforce. The workers will also be continually educated about the dangers of indulging in casual unprotected sex.

6.2.7 Visual intrusion

Optical impairment of the landscape by the presence of the transmission towers, lines and the substation is unavoidable and could be regarded as a residual impact. The galvanised towers tone down after two to five years of operation to a dark grey colour. In addition, the line route was selected such that the lines blend with the natural landscape and mostly away from settlements. The 'glare effect' will therefore be minimal and unnoticeable.

Trees native to the area around the substation shall be planted at the frontage of the substation to act as windbreaks, noise buffer and to reduce the visual effect of having a substation located at the site.

6.2.8 Traffic impacts

Equipment and materials will be properly secured in vehicles while being transported to avoid the falling of such items on public roads to create potential hazards or safety problems for the public. Also, trucks and vehicles conveying such materials will display appropriate road safety signals - red flag and flashing amber lights. GRIDCo will ensure that deliveries are only made during daylight hours. Existing speed regulations shall be observed within settlements to minimize the potential for accidents.

To minimise traffic conflicts at the junction where the access tracks join public roads GRIDCo will ensure that road signs are erected at appropriate distances on either side of the junction to warn motorists of the potential danger of heavy-duty trucks turning into and off the main road. Obstructing vegetation at the junctions will be cleared to allow drivers to properly view and assess situations before joining main roads. Also, warning notices like “**NO ENTRY**” or “**NO TRESPASSING ALLOWED**” will be placed at entry to access tracks. In addition, random security patrols will be carried out to ensure that the local people do not unduly endanger their safety.

Furthermore, certain constructional activities like the stringing of transmission lines across public roads will cause temporary traffic disruptions. Traffic wardens will be employed to direct traffic during such times to avoid confusion and prevent accidents. As indicated earlier, the proposed transmission line will encounter various roads, some with asphalted surfacing. Some roads that the line will be crossing as a result of the proposed transmission line are already provided in this report. It is therefore important to ensure coordination with the road agency and GRIDCo to minimise interference between installation and operation following guidelines of the “*Road Reservation Management: Manual for Coordination*” (June 2001). Thus in all cases, where line stringing will cross public roads due notification to the general public and appropriate authorities (GHA, and/or District Assemblies) will be given as required.

6.2.9 Waste generation

Solid wastes in the form of trees, tree stumps and wooden containers will be gathered together and made available to the local communities as fuel wood. Metal wastes will be collected and disposed of appropriately and/or recycled. Solid wastes in the form of paper, food material, etc. shall be disposed of in dustbins that will be provided at the various work camps and offices. Accidental spillage of oil, fuel and paints will be avoided as much as possible. Any spilt materials will be quickly mopped up with rags and/or sawdust. The used sawdust and rags will be disposed of at appropriate public waste dumping sites.

With respect to waste management, the following measures shall be put in place to help keep a clean site and reduce environmental pollution:

- Adequate numbers of containers shall be provided with covers to keep rain out or to prevent loss of wastes when it is windy.
- Solid and hazardous waste containers shall be properly labelled to identify them to ensure that toxic liquid wastes (used oils, solvents and paints) are not disposed of in

solid waste containers. Additionally, the project personnel shall be trained on proper collection and disposal methods of different types of solid wastes.

- Construction waste and domestic waste shall be collected, removed and disposed of only at designated areas.
- Wherever possible, production of construction waste and domestic waste shall be minimized by reusing leftover materials wherever possible and also through proper planning and design.
- Construction workers shall be instructed in proper construction waste and domestic waste storage and handling procedures.
- If scrap metal occurs, these scraps shall either be reused or sold to companies whose business activity is dealing with scraps.
- Wood and cardboard wastes shall be reused if possible.
- Disposing of domestic waste on the construction site is prohibited for workers and visitors.
- Domestic rubbish field shall be established as planned, and regularly disinfected.
- Sanitary facilities shall be cleaned daily.
- Construction work camps and their surroundings shall be kept in clean and neat conditions at all times.
- Collected domestic waste and construction waste will not be stored in the vicinity of drainage systems or watercourses.
- No waste shall be disposed of or buried on the site. Illegal dumping, either at the construction camp, along public roads or in the surrounding areas, or into the river will not be allowed.

6.3 Operational phase

This section of the report presents the proposed mitigation measures put forward to minimise the significant potential environmental impacts that are expected to be associated with the operational or maintenance phase of the proposed project.

6.3.1 Effects of rust treatment and painting of towers

Accidental spillage of paints will be avoided as much as possible. Any spilt paints will be quickly mopped up with rags and/or sawdust. The used sawdust and rags will be disposed of at appropriate public waste dumping sites. Painting will be done as frequently as necessary to

prevent towers and tower members from rusting. GRIDCo will ensure that situations of extensive rusting of towers and steel pole members are avoided to pre-empt difficult rust treatment.

6.3.2 Waste management

During the maintenance phase, solid wastes in the form of trees, tree stumps and wooden containers will be gathered together and made available to the local communities as fuel wood.

Metal wastes will be collected and disposed of appropriately and/or recycled. Other solid wastes such as damaged cables, conductors and insulators, rags and paper cartons will be collected and disposed of at appropriate public waste dumping sites.

Accidental spillage of oil, fuel and paints will be avoided as much as possible. Any spilt materials will be quickly mopped up with rags and/or sawdust. The used sawdust and rags will be disposed of at appropriate public waste dumping sites.

6.3.3 Occupational safety and health issues

GRIDCo will carry out the operation and maintenance of the proposed transmission line based on accepted international standards, such as those of the International Electro technical Commission (IEC) and GRIDCo's Corporate Safety Rules.

However some specific potential occupational safety and health hazards expected during the operational phase of the project are dealt with below.

6.3.3.1 Falling and/or swinging objects

The measures proposed earlier to minimize the potential hazards posed by falling and swinging objects are valid for the maintenance phase of the project and will be fully implemented.

6.3.3.2 Falls from heights

Potential accidental falls from heights during the operational or maintenance phase of the proposed project will be minimised through the provision of appropriate personal protective equipment such as body harness, climbing belts, etc. GRIDCo will insist that only well-trained and experienced personnel work at heights on the towers.

6.3.3.3 Machine safety

All potentially hazardous machinery such as lifting appliances (cranes, forklifts, etc.) and unfired pressure vessels (compressors, etc.) will undergo statutory examination by certified engineer. This will ensure that accidents due to material failure are pre-empted. All electrical cables of mobile or hand-held machines (electric hand drills, temporary lights) will be examined for flaws in insulation and when any flaws are detected the cables will be promptly replaced to forestall the hazards of electrical burns and electrocution of employees. In addition, employees will be required to wear protective clothing in the course of work to protect them from undue exposure to electrical power.

6.3.4 Public Safety

In line with existing practice, all steel poles will be clearly marked with a red inscription on white background - “**DANGER – 161,000 Volts**” to ward off trespassers and prevent them from exposing themselves to the potential dangers of electrocution. Regular maintenance will minimize corrosion and wearing out of parts of the steel poles and their accessories. GRIDCo already has a comprehensive, planned and emergency maintenance programmes for the existing transmission lines. The same level of care to the new transmission lines to be constructed shall apply.

Security patrol will be conducted on sections of the transmission line especially the outskirts of urban areas and towns, which are more prone to acts of vandalism. It is expected that the patrols will ensure early detection of any acts of vandalism and signs of tower corrosion. Prompt and necessary remedial actions will be taken to repair the structures to forestall the possible collapse of towers.

Measures proposed earlier to minimize public safety hazards relating to transportation and potential tower collapse are valid for ensuring public safety. These measures will be fully implemented to enhance public safety. Other public safety issue of potential health and other implications of electromagnetic field (EMF) effects have been dealt with below. Threatening trees will be felled as stated earlier in the report to prevent them from falling onto the transmission lines during stormy weather conditions. This will minimize the potential of the fall of live electrical conductors, which could pose safety hazards to the public.

A potential positive public safety impact is the possible use of transmission lines and towers as landmarks to aid in “navigating” when driving through the countryside since they are clearly marked on Ghana’s topographical maps.

6.3.4.1 Electromagnetic field (EMF) effects

According to the World Environmental Library, WEL 1.1, information derived from prolonged observations and experiments in numerous countries indicate that the electric and magnetic fields around power transmission and distribution facilities exhibiting frequencies between 50 and 60 Hz have no harmful effects on human health. Magnetic field strengths below 0.4 mT at 50 – 60 Hz induce no detectable biological reaction in humans. The magnetic fields acting on the ground below overhead lines develop maximum field strength of only 0.055 mT for frequencies between 50 and 60 Hz. Hence potential effects of EMFs on human health are non-existent according to current knowledge.

However, an electrically grounded person touching an ungrounded metallic object or a conductor in a static or oscillating field may draw electric current from the object and may experience a micro shock from a spark discharge. This potential effect will be minimized by GRIDCo by multiple earthings. Protective multiple earthings minimize the chances of people getting electric shocks and the chances of such shocks being fatal.

In order to debunk the misconception that EMFs may cause cancer or harm children and minimize fear and avoid panic among the local populations, GRIDCo will undertake public education and create awareness in the local communities wherever such concerns are expressed.

6.3.5 Socio-economic/cultural issues

GRIDCo will carry out the valuation and compensation of all lands and properties that will be adversely affected by the project. Fair and adequate compensation shall be paid to all project-affected persons. Consultations have been held with all the communities along the line and these issues have been discussed with the people, opinion leaders, local government officials and chiefs of the area. We therefore do not expect major disputes arising out of this process.

No further mitigation measures are proposed.

6.3.6 Fire hazards

Potential fire hazards as a result of electrical faults will be minimized by adhering to technical specifications relevant to electrical safety. The use of low quality components, inadequate sizing of cables, and negligent execution of works and general non-observance of safety rules will be avoided to minimize the potential hazard of electrical fires. Also, the operating personnel will be sufficiently trained in connection with electrical safety measures and their observance. Proper and sufficient supervision of workers will be undertaken.

GRIDCo shall take necessary precautions to ensure fire accidents do not happen on site by controlling all operational activities and with good housekeeping. In order ensure adequate fire preparedness, GRIDCo will provide suitable and adequate number and types of fire extinguishers at vantage and easily accessible points on the sites. A fire brigade will also be formed on site to afford first aid fire-fighting capability. All fire extinguishers will be regularly serviced and recharged to ensure they are in serviceable condition. Extra caution shall be taken when working with flammable material on site.

Other fire prevention measures to be put in place by GRIDCo shall include:

- Provision of fire extinguishers where flammable materials are stored, handled, or used.
- Provision of fire notices
- Use of standard equipment for construction of storage areas
- Training of operating/security personnel in electrical safety measures and observance
- Provision of first aid facilities at the substations.

In addition, GRIDCo will not allow the use of fire for the maintenance of vegetative growth within the RoW. Bush fires originating from the activities of farmers, hunters and palm wine tapper will be minimized through public education.

It is expected that the full implementation of the measures above will minimize the occurrence of fires.

6.3.7 Substation operation

Discussed below are some of the mitigation measures proposed for the potential impacts to the operation of the substation.

6.3.7.1 Transformer oils

The major lubricant used for transmission projects are transformer oils. Only transformers that meet all applicable safety standards shall be purchased and these will be enclosed in separate secondary containment structures to prevent any accidental spills or routine leakages that may occur from being released to the environment. The specifications of transformer oil are to conform to General Requirement of IEC 296 Class II or IEC 666, BS 148 1998 Class 1A & 11A; IEC Class 1A & 11A and ASTM 3487 Standards.

The specifications for transformer lubricant oils are as follows:

• Neutralization Value	0.3–0.4 mg (KOH)/g (max.)
• Sludge % by Mass	0.1
• Neutralization Number (normal)	0.03mg(KOH)/g
• Water Content	0.35 – 40 ppm
• 2,6 Ditertiary-Butyl paracosol or 2,6 Ditertiary Phenol by Mass	0.3%
• Interfacial Tension @ 2525 °C	40 dynes/cm (min)
• Flash Point	140 deg C
• Viscosity @ 40 °C	11 – 12 mm ² /s
• Pour Point	-45 deg C.
• Density @ 20 °C	0.895kg/dm ³
• Corrosive Sulphur	NIL
• PCB Content mg/kg	Non Detectable

There will be no storage tanks constructed for transformer oils at the two associated substations. Transformer oils shall be transported to the substations as and when required. Improper disposal of such transformer oils could have an impact on the environment. It must be noted that these transformer oils are scarcely disposed of or replaced. They are usually filtered to take out moisture, carbon and other debris and re-conditioned for re-use.

However, in the event of disposal, GRIDCo as currently is the practice shall opt for the re-use option where the oil shall be sold to any external agencies that may need such oil for its operations. Such agencies are expected to first register with GRIDCo followed by an inspection of their facilities prior to allowing sale to these firms to ensure that such oils would be properly managed when procured.

6.3.7.2 Fire hazards

The best defence against fire outbreaks is to ensure they are not caused at all. GRIDCo is well aware of the potential disastrous consequences of fire outbreaks on its substations. Measures are therefore put in place to ensure that fires do not break out in the substations.

Prior to the operation of the substation, and as part of project planning, a fire survey shall be carried out on the premises to identify peculiar fire fighting equipment for the station. These pieces of equipment will be purchased and installed at vantage positions within the substation in addition to the standard water hydrants and fire extinguishers provided for all the

substations. This will ensure that the substation remains in a high state of preparedness against potential fire outbreaks.

In addition, a fire buffer (vegetation break) will be created and maintained around the fencing to ensure that potential bush fires are not able to affect the substations.

6.3.7.3 Avifauna

GRIDCo shall ensure that good housekeeping is kept at all times in the substations. Bird nests in areas likely to cause electrical faults shall be promptly removed and transferred to nearby trees, if practicable. The nests shall be removed by physical means as and when they are found and disposed of.

7.0 MONITORING

GRIDCo will undertake continuous monitoring of the identified impacts. The significance of monitoring stems from the fact that the inputs derived from the environmental and social assessment into the project design and planning, including mitigation measures are based largely on “predictions”. It is essential that the basis for the choices, options and decisions made in formulating or designing the project and other environmental and social safeguard measures are verified for adequacy and appropriateness. Monitoring verifies the effectiveness of impact management, including the extent to which mitigation measures are successfully implemented. The result of the environmental monitoring programme will go into the preparation of the environmental reports for the transmission project.

Monitoring specifically helps to:

- Improve environmental and social management practices;
- Check the efficiency and quality of the EA processes; and
- Provide the opportunity to report the results on safeguards and impacts and proposed mitigation measures implementation.

7.1 Monitoring programme

A monitoring programme has been developed to determine impacts on the physical, biological and socio-economic/cultural environments within the project’s area of influence and around the proposed substation. The monitoring results are expected to indicate whether the predictions of potential environmental impacts are accurate and also whether the mitigation measures proposed for the management of the impacts are appropriate and adequate. The programme will also serve as an early warning system by revealing unforeseen impacts and allowing additional corrective measures to be implemented to arrest the situation and ensure that irreversible damage is not caused. The programme is also expected to provide useful guidance for the successful planning and implementation of future power transmission line projects that will be undertaken by the GRIDCo.

Further, an Environmental Management Plan (EMP) shall be prepared to help document relevant processes and personnel. GRIDCo as well as the EPC Contractor’s Environmental Team members will be trained adequately to understand and appreciate the choice of parameters, sampling sites, methods of sampling/measuring and analysis and frequency of monitoring. Annual Environmental Reports to be prepared for the project will specifically provide information on the project activities.

A description of the monitoring activities showing frequency, parameters and responsibilities is presented in Table 21. The monitoring programme has been developed for the following parameters.

7.1.1 Noise pollution

Noise pollution levels will be measured once every week close to the areas where construction activities are being carried out including settlements such as indicated earlier. The noise measurements will determine the ambient levels of noise due to the operation of machinery in addition to the exposure of workers to noise for purposes of mitigating worker

health. Noise levels associated with certain identified plant equipment shall also be measured on regular basis to assess the need for protection for staff working in proximity to such equipment.

EPA guidelines shall provide the basis for comparison to adherence to regulatory requirements. Any unforeseen excessive noise from any machinery will indicate a lack of proper servicing and prompt remedial action can then be taken.

7.1.2 Transportation effects

The following parameters/activities will be monitored:

- Speed limits of vehicles especially within settlements. Random checks on speed limits of vehicles will be carried out daily.
- Loading of vehicles. Vehicle loading procedures will be monitored at all loading points to ensure that materials and equipment are properly secured in truck/vehicles.
- Covering of vehicles conveying dust-generating materials. Random checks will be carried out daily on vehicles.
- Trucks/vehicle conditions and maintenance (i.e. road worthiness of vehicles). Daily checks on conditions of vehicles. A monthly check will also be conducted on vehicles to ensure that maintenance schedules are adhered to.
- Vehicular accident records. All vehicular accidents or dangerous occurrences relating to vehicles will be recorded in the accidents record book or register.

7.1.3 Occupational safety and health issues

The availability and use of personal protective equipment will be closely monitored continuously during both the constructional and operational phases. All employees who refuse to use the protective equipment provided will be properly sanctioned. To ensure that personal protective equipment is always readily available, all equipment will be promptly replaced. Regular safety tests as recommended by manufacturers will be conducted on equipment such as cranes and winches.

7.1.4 Fire hazards

In order to prevent any outbreak of fires construction work will be monitored continuously to ensure that the execution of works is done adhering strictly to technical specifications relevant to electrical safety. The use of low quality components, inadequate sizing of cables, negligent execution of works and general non-observance of safety rules will be monitored regularly. Proper and sufficient supervision of workers will be monitored.

Fire extinguishers will be checked on a regular basis. Periodic servicing and recharging will be promptly done. The servicing and recharging schedule will be staggered in such a way as to ensure that adequate fire protection is provided at all times.

7.1.5 Waste management

The collection and use of wood wastes as fuel wood by the local communities will be monitored on monthly basis. Also, the collection and sale of scrap metal to dealers will be monitored monthly to ensure that metal wastes are managed efficiently. The management of

other solid wastes will be monitored on weekly basis to ensure that the wastes are collected promptly and disposed of at appropriate public waste dumping sites.

The clean-up of accidental spills of oil, fuel and paints whenever they occur will be monitored to ensure that the clean-up is promptly and properly done.

7.1.6 Transmission lines

Transmission lines will be monitored half yearly during the operational and maintenance phase through inspections for signs of damages and/or deterioration of insulators and accessories. Replacements of any such damaged parts will be promptly carried out. Aerial inspection through the use of helicopter will be done on an annual basis.

7.1.7 Public/Worker safety

Occurrences of accidents involving transmission lines and structures that affect public safety or worker safety will be monitored and recorded whenever they happen. The frequency and severity of such occurrences will be recorded. This will eventually indicate whether additional mitigation measures are required to make the system safer.

Further, GRIDCo shall continue with its public educational programme by placing warning notices, “**DANGER-161,000 VOLTS**”, on each pylon to deter the public from climbing the pylons. The warning signs on the pylons should be monitored on a regular basis and replaced in the event that they are removed or not visible enough.

Monitoring of the construction of homes and permanent structures shall be done and destroyed.

7.1.8 Identification of project-affected persons and compensation payment

Monitoring of project-affected persons will be carried as long as required to ensure that all affected persons have been identified and payment of adequate compensation duly effected. It is however expected that issues of compensation, if any, will be concluded within a period of five (5) years from the date of commencement of payment.

7.1.9 Cultural/archaeological ‘chance finds’

During the constructional phase, cultural/archaeological ‘chance finds’ - sites of cultural significance such as sacred woods or trees or rock outcrops and historical or archaeological heritage/items or sites which the local residents may not have mentioned at the survey stage will be monitored to ensure that such sites or items are properly managed to the satisfaction of both the local communities, the EPA and/or the Museums and Monuments Board.

7.1.10 Substation

During the operational phase of the project the substation will be monitored to ensure that it complies with all regulatory requirements. Parameters that shall be monitored shall include following:

7.1.10.1 Fire safety

Fire surveys shall be carried out at the substations once a year to ensure that all installed fire extinguishers and water hydrants are in working condition and that all extinguishers have been recharged as required by the Factories, Offices and Shops Act (Act 328). The perimeter of the substation shall also be inspected to ensure that the vegetation barrier (fire buffer) created against bush fires is well maintained.

7.1.10.2 Storm water drains

Storm water drains at the substation shall be monitored on a regular basis to ensure that there are no blockages and that the water drains out smoothly to avoid backflow and flooding of the substation.

7.1.10.3 Noise

Operating noise levels of the substation shall be monitored to ensure the levels do not go beyond the guideline limit values.

7.1.10.4 Occupational safety, health and welfare

The safety, health and welfare of the workers are of paramount importance to GRIDCo. Monitoring shall therefore be carried out on occupational safety and health within the substation during its operational phase. Parameters to be monitored shall include, but not limited to:

7.1.10.5 Personal protective equipment

The provision and use of PPEs shall be monitored on a monthly basis to ensure workers are well protected against the hazards of the workplace.

7.1.10.6 Good housekeeping

Management will ensure that good housekeeping is maintained at all times on the premises. All weeds springing up through the stone carpet of the substation shall be physically removed. The buffer zone of the substation shall also be monitored on a daily basis to ensure that there is always a fire break at the perimeter. The premises will be monitored to ensure that potential nesting places of birds are kept free of bird nests that are likely to cause electrical faults.

7.1.11 HIV/AIDS

In addition to the HIV/AIDS education of the workforce, GRIDCo will, in close cooperation with the District Health Management Team of the District, monitor the incidence rate of the districts for any drastic changes during the construction stage of the project cycle. Even though this monitoring programme could be useful, GRIDCo will ensure, through its educational programme that safe sex is practised by the construction teams so that incidences of the disease due to activities of the construction crew is prevented.

Table 14 Summary of the monitoring programme

Parameters to be Monitored	Measurements	Frequency of Measurement	Responsibilities
Line Route Survey Clearing of RoW. <ul style="list-style-type: none"> Clearing of various structures and kiosks Public Information Disclosure of EIS	Hectares (area cleared in project area) Disclosure in the National Dailies	Throughout line route survey One Disclosure	GRIDCo/Contractor GRIDCo/EPA
Transportation <ul style="list-style-type: none"> Speed Limits of vehicles, traffic congestion on main roads (near project sites) Trucks conditions and maintenance Vehicular accident records Vehicle safety signals (flares, warning lights, reflectors etc.) Vehicle fuelling procedures Vehicle loading/off-loading procedures Vehicle daily check outs Driving licenses and permit to drive First Aid and Fire Extinguishing kit 	<ul style="list-style-type: none"> Km/hr No. of Preventive Mtce. Number Number Number Number Number Number Number Quantity 	<ul style="list-style-type: none"> Daily Monthly Monthly Monthly Monthly Monthly Monthly Monthly Daily 	GRIDCo/Contractor
Waste Management <ul style="list-style-type: none"> Waste water handling Waste segregation Waste dump sites Disposal of conductor drums Disposal of metallic waste Disposal of empty chemical containers 	<ul style="list-style-type: none"> Cm3 Kgs. Number Number Kgs. Number 	Weekly	GRIDCo/Contractor
Public Safety Warning Signs on Pylons			
Socio-economic/cultural issues <ul style="list-style-type: none"> Shrines Identifying all affected persons Assessment of compensation Payment of compensation (adequate amounts, timely payments); Archaeological Chance finds Employment and job creation HIV/AIDS Education programme Condoms made available for workers Level of employment of local labour 	Number Number Amount Amount Number Number Number of programmes Number Number	Daily Daily Annually	GRIDCo/Contractor/ Museums/Ghana Health Service/District Assemblies
<ul style="list-style-type: none"> Routine ground/aerial inspection of lines 	Number	Quarterly	

Parameters to be Monitored	Measurements	Frequency of Measurement	Responsibilities
<ul style="list-style-type: none"> • Pole (vandalism, corrosion) • Insulators and accessories (damages, Replacements) • Accidents involving lines and structures • Occupational hazards and accidents • Accidents affecting public safety • Substations – oily wastes, transformer oil 	Number Number Number Number m ³	Quarterly Quarterly Quarterly Quarterly As and when it occurs Quarterly	GRIDCo
Occupational Safety & Health <ul style="list-style-type: none"> • Manual lifting • Hearing protection • Protective equipment • Good housekeeping • Fire prevention • Prevention of falls from heights • Electrical hazards • Machinery safety • Welding safety • Head protection • Feet protection • Provision of first aid items 	<ul style="list-style-type: none"> • Number • Number • Number • Number • Number • Number • Number • Number • Number • Number • Number • Number 	<ul style="list-style-type: none"> • Daily • Daily • Daily • Daily • Daily • Daily • Daily • Daily • Daily • Daily • Daily • Daily 	Safety Officer
Fire Prevention: <ul style="list-style-type: none"> • Posting of “no smoking” signs at fire sensitive areas (e.g. fuel storage areas at the work camp, etc) • Provision of appropriate and adequate number of fire extinguishers • Proper storage of rags used in cleaning hands and containing flammable liquids (e.g. in metal containers for safe disposal) • Handling of flammable materials by competent persons only • Provision of emergency fire alarm systems 	<ul style="list-style-type: none"> • Number 	<ul style="list-style-type: none"> • Daily 	Safety Officer

7.2 Monitoring cost

For purposes of achieving a very high level of compliance with regard to the implementation of all environmental commitments, GRIDCo/EPC Contractor shall make budgetary allocations towards all environmental programmes. An amount of US \$62,115.00 has been estimated for environmental monitoring activities for the constructional phase of the project. Financial commitments shall be made from these allocations on program-by-program basis. It is only the coordination costs that shall be included in the running cost of GRIDCo. Detailed budget for achieving environmental compliance shall therefore form part of GRIDCo Corporate Budget. A breakdown of the budget for the monitoring is shown in Table 15.

Table 15: Estimated budget for the environmental monitoring activities

Environmental Monitoring Parameter	Equipment	Contracts (Works & Services)	Training, Workshop and Communication	Sub-Total investment	Administration	National Consultants	International Consultants	Consumables	Sub-totals operations	Unforeseen Investments+ Operations (5%)	Grand Total (US \$)
Noise Level Monitoring at Project Site /Noisy Equipment	0.00	0.00	500.00	500.00	1,000.00	0.00	0.00	0.00	1,000.00	15.00	1,515.00
RoW clearing	0.00	0.00	500.00	500.00	1,000.00	0.00	0.00	0.00	1,000.00	15.00	1,515.00
Transportation effects	0.00	0.00	500.00	500.00	1,000.00	0.00	0.00	0.00	1,000.00	15.00	1,515.00
Occupational safety and health issues	15,000.00	0.00	500.00	15,500.00	1,000.00	0.00	0.00	0.00	1,000.00	165.00	16,665.00
Fire hazards	10,000.00	0.00	500.00	10,500.00	1,000.00	0.00	0.00	0.00	1,000.00	115.00	11,615.00
Disposal of Waste	2,000.00	10,000.00	500.00	12,500.00	1,000.00	0.00	0.00	0.00	1,000.00	135.00	13,635.00
Monitoring of Transmission lines	0.00	0.00	500.00	500.00	1,000.00	0.00	0.00	0.00	1,000.00	15.00	1,515.00
Public Worker safety	7,000.00	0.00	500.00	7,500.00	1,000.00	0.00	0.00	0.00	1,000.00	85.00	8,585.00
Community Social Impact Monitoring	0.00	0.00	500.00	500.00	1,000.00	0.00	0.00	0.00	1,000.00	15.00	1,515.00
Cultural/archaeological 'chance finds'	0.00	3,000.00	0.00	3,000.00	1,000.00	0.00	0.00	0.00	1,000.00	40.00	4,040.00
GRAND TOTAL	34,000.00	15,000.00	4,500.00	51,500.00	10,000.00	0.00	0.00	0.00	10,000.00	615.00	62,115.00

8.0 PROVISIONAL ENVIRONMENTAL MANAGEMENT PLAN

8.1 Purpose of the environmental management plan

The environment around construction areas shall certainly be affected during the construction period. The main sources of unfavourable effect and pollution to the surrounding environment during the construction period will come from not only all activities of all members of the work force during the construction phase of the project but also from some natural sources such as storm water during the construction period, and direct sources such as employees' activities in relation to wastewater, exhaust gas, noise, floating dust, construction garbage, domestic garbage, etc. Aiming at the above-mentioned unfavourable sources, GRIDCo will carry out relevant measures to decrease adverse effects and pollution to the surrounding environment during the construction period.

The provisional Environmental Management Plan (EMP) provides measures in a manner that would cause minimum temporary and permanent disfigurement to the existing natural beauty and amenities of the area. It details active remedial measures and monitoring activities to be continuously carried out to prevent or minimize impacts on the physical, biological and socio-economic/socio-cultural environments as well as to promote occupational safety and health of employees. It is imperative for GRIDCo to educate all members of its work force to comply with all relevant laws, ISO14001 and all requirements of the project to adopt all necessary control procedures in each area before work is allowed to proceed.

8.2 Policy on environment

GRIDCo has developed a Corporate Environmental Policy⁸ which aims at safeguarding the environmental quality and mitigating or offsetting the adverse impacts on the environment of all its activities in conformity with national and international environmental protection standards and regulations in a sustainable manner.

8.3 Environment management objectives and targets

The objective of the EMP is to establish and provide basic guidelines, policies, and procedures which shall be used in establishing, administering, and maintaining all environmental programmes as may be required by the Employer and other relevant parties.

The following list of guidelines to be used is however not exhaustive.

- Reducing waste.
- Good housekeeping.
- Reducing consumption of energy, fuel and materials.
- Controlling environmentally hazardous operations with regard to spills and leaks.
- Controlling pollution of soil, water and air.
- Reducing the production of polluting releases to the environment and minimizing the effects.
- Assessing the environmental effects arising from spills, incidents and emergency situations.
- Auditing and reviewing activities to ensure that the program is complied with per contractual requirements.

⁸ See Cover page

The objectives of this EMP are to:

- Comply with all applicable laws, regulations, ordinances, statutes, rules, and codes governing environmental requirements and conduct the works based on the requirements of all permits issued.
- Provide all documentation required by all levels of governing authority concerning environmental requirements.
- Provide and maintain effective planning and field control measures for the construction activities.

8.4 Environmental management system

In order to maintain control over the implementation of the project and also ensure that commitments made in the EIA are acted upon in a comprehensive and acceptable manner, an Environmental Management System is developed in this section. This programme will help to identify personnel, responsibilities and training requirements for the Project Environmental Management Team to be constituted.

The Project Environmental Management Team will be responsible for the following:

- Ensuring project's compliance with all relevant environmental, social, health and safety regulations
- Liaising with all relevant regulatory bodies and organisations- EPA, Factories Inspectorate Department, Energy Commission (Inspectorate Unit), etc.
- Formulation and review of environmental and social policies and practices associated with projects
- Liaising with relevant GRIDCo departments on all health, environmental, safety and social matters connected to projects
- Assisting in the education and training of project staff in environmental, social and safety awareness
- Making budgetary provisions for projects' environmental programmes
- Undertaking environmental and social monitoring activities for projects

Budget for environmental management will be provided as part of corporate budget for GRIDCo.

8.5 Environmental management structure

GRIDCo's organizational chart, which has been put in place to enhance the implementation of the Environmental Management Plan (EMP), is shown in Figure 10. The chart details the position of the Environmental Officer as well as other officers on the project that play various roles in the implementation of the EMP. In the absence of the jobholder, the relevant manager or subordinate undertakes the assigned duties or delegates as required.

The Director, Engineering has overall responsibility regarding the implementation of the EMP as well as the environmental protection procedure on site. The Director, Engineering will issue clear instructions to Departments, which shall impact on environmental protection,

to ensure that no unnecessary damage or environmental pollution is created during the construction.

The Manager, Land Management Section shall be responsible for, among others:

- The definition and implementation of the GRIDCo environmental policy
- The level of environmental management compliance the project achieves
- The availability of trained and capable workers to manage, perform and verify work affecting the environment
- Provision of budgetary allocation, financial resources and logistics

The Manager, Land Management Section has been empowered to order the cessation of work if he feels that it is unnecessarily detrimental to the environment. All Line Managers are responsible for:

- Organizing and managing personnel reporting to them,
- Ensuring that the requirements of the Environmental Management System as detailed in the company's environmental policy are implemented and maintained in their areas of responsibility

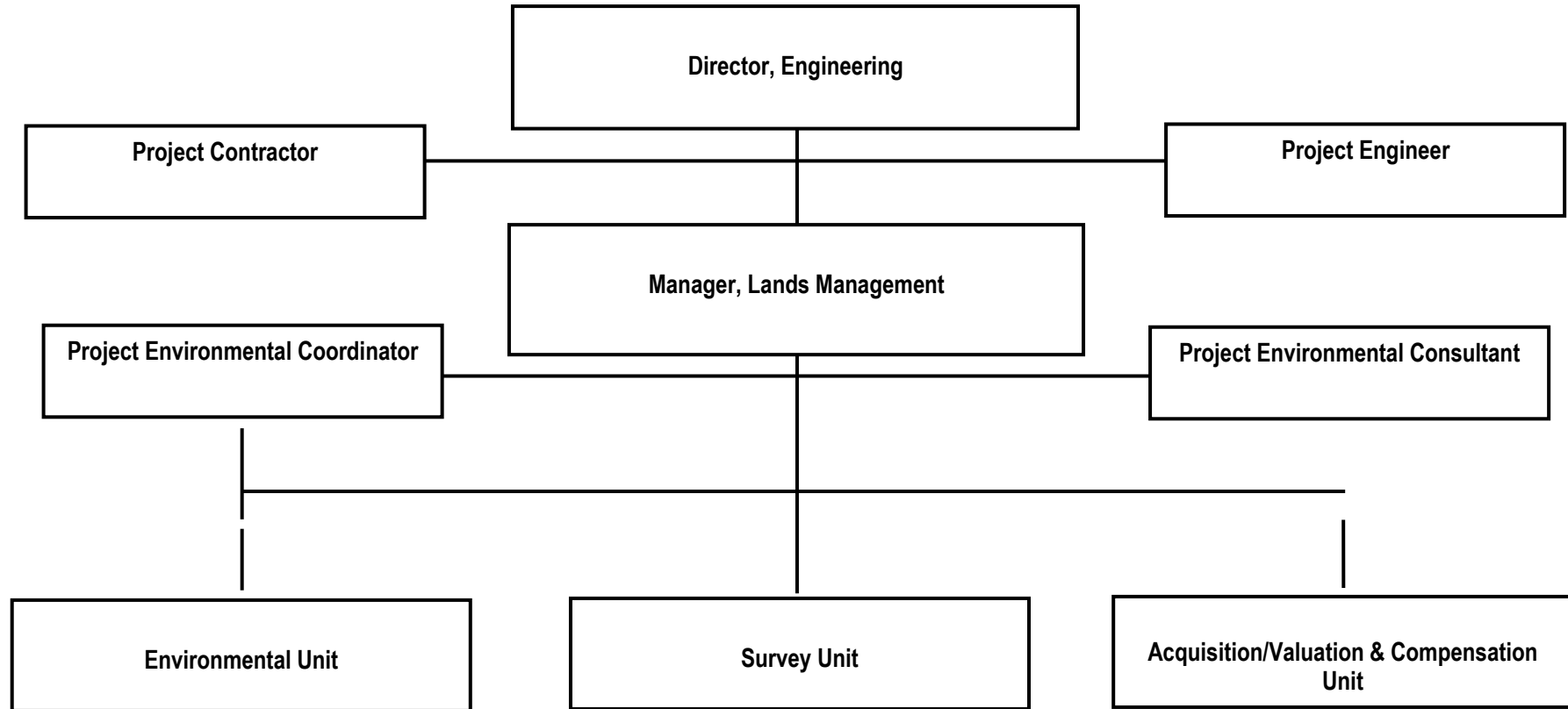
The Environmental Officer is the project's representative from the Engineering Department and reports through the Manager, Land Management Section to the Director, Engineering. The responsibilities of the Environmental Officer include:

- Monitoring all environmental and social programmes for the operation phase of the project, including those related to bio-physical and socio-economic/cultural components.
- Working closely and coordinating efforts with the EPA and other enforcement bodies to ensure full compliance with all legal and regulatory requirements.
- Organizing activities to motivate and maintain the interest of project staff in environmental and social issues and assisting to increase project staff awareness of environmental issues through training programmes and review meetings.
- Coordinating investigations into/of all types of accidents.
- Conducting environmental and social audits in accordance with project monitoring guidelines.
- Working closely with contractors to ensure that all monitoring and mitigation guidelines recommendations for the project are strictly adhered to. This includes compliance with all health, social and safety guidelines outlined and following strictly GRIDCo's environmental policy guidelines.
- Developing a work plan for the implementing of the EMP.
- Make budgetary provisions for projects' environmental programmes.
- Establishing and running a reporting system on progress (or otherwise) in implementing mitigation measures (including contractor's obligations), training, etc.
- Production of Progress Environmental Reports.

Despite these responsibilities, site supervisors within their own sections are responsible for the working methods, which are adopted in the working practices and must be made aware of

the serious consequences of any lapses in the implementation of the environmental protection procedure. Again, site operatives are responsible for their own actions in so much as they may be detrimental to the environment. The usual aids such as notices must be strategically placed in order to remind everyone on site of their responsibilities. The environmental management activities for the operation of ACPP will be incorporated into GRIDCo's Corporate Environmental Management System and implemented by the Engineering Department.

Figure 4: Environmentally-based organisational chart



8.6 General health and safety procedures

Procedures relating to occupational safety and health will be guided by the Factories, Offices and Shops Act, 328, (1970) which is buttressed by the occupational safety and health recommendations in the EIA. The relevant environmental and occupational safety and health issues to be covered include:

- Manual lifting
- Hearing protection
- Protective equipment
- Good housekeeping
- Fire prevention
- Prevention of falls from heights
- Electrical hazards
- Machinery safety
- Welding safety
- Head protection
- Feet protection
- Provision of first aid items

All occupational safety and health provisions in the Factories, Offices and Shops Act 328, (1970) shall be complied with during the implementation of the project. The mitigation measures recommended in the EIA will also be fully implemented.

8.7 Fire prevention system

The general fire precautions to be taken include:

- The posting of “no smoking” signs at fire-sensitive areas (e.g. fuel storage areas at the work camp, etc.)
- Provision of appropriate and adequate number of fire extinguishers
- Proper storage of rags used in cleaning hands and containing flammable liquids (e.g. in metal containers for safe disposal)
- Handling of flammable materials by competent persons only
- Provision of fire alarm systems

In addition, fire prevention training would be carried out for selected project employees.

8.8 Pollution prevention

Proper management of waste oils/lubricants, excavated earth materials and paint as recommended in the EIA will be enforced. Measures to be adopted will include:

- Collection, storage and disposal of waste oils and lubricants
- Proper management of excavated materials
- Prevention and management of oil, fuel and paint spills

To ensure the success of pollution prevention, the environmental team will be trained to identify and appreciate what hazards there are in relation to improper storage and disposal of polluting substances.

8.9 Socio-economic Impacts mitigation measures

Construction activities can potentially have a positive socio-economic impact by the provision of temporary employment opportunities and an improvement in local economies generated by an increased demand for local goods and services. Conversely, construction activities can also have a negative impact on local communities through the impact of an influx of construction workers, which may place pressure on local resources, affect social dynamics and culture, and exacerbate health problems, etc.

8.9.1 Employment

Relevant national policies, labour laws and codes of conduct concerning employment are to be applied to regulate behaviour of workers in the local communities. Measures are to be designed and adhered to regarding employment and workforce policies to mitigate environmental, health and social impacts that are associated with the influx of formal and informal workers by the Contractor. Local employment and sourcing policies are used to give priorities to people within the project affected areas.

8.9.2 Community support measures

GRIDCo and the EPC Contractor shall carry out relevant measures to support local communities to mitigate social, health and economic impacts of the project. Announcement of job opportunities would be made via both the electronic and print media. Announcements would be in English and the local dialects since a large proportion of the populace in the project area may have had no formal education.

The project would boost trading among construction allied industries e.g. cement and iron rods production and other building materials manufacturers, suppliers and distributors. Other businesses such as the catering services springing up on the fringes of construction sites would also benefit immensely.

Food vendors from the local communities would be encouraged to sell their food to workers at designated places within the project site. The main occupation of the fringe communities is farming. The Contractors' workforce would procure food stuff and fish from the local communities, thus providing a source of income for such communities. The local communities therefore must be encouraged to earn their income through the sale of cooked food to workers.

8.10 Change management

GRIDCo also recognizes that environmental and social issues that are to be covered under this EIA could change as the project proceeds. The PEC shall facilitate the change management responsibility. The PEC shall undertake the following:

- Review internal environmental reports
- Discuss significant issues as they arise
- Make decisions about modifications to mitigation and monitoring needs and requirements
- Advice on external reporting on environmental and social issues, as required

8.11 Monitoring

The monitoring parameters and the recommended frequency proposed will be strictly adhered to. The parameters to be monitored will be:

- Dust level
- Noise
- Vegetation clearing
- Transportation effects
- Occupational safety and health issues
- Fire hazards
- Waste management (Solid and Liquid waste)
- Structural failures
- Use of personal protective equipment (PPEs)
- Public/Worker safety
- Identification of project-affected persons and compensation payment
- Cultural/archaeological ‘chance finds’

It must be noted that the baseline established by the EIA will enable GRIDCo to indicate the thresholds that will signal the need for corrective actions and the detection limits. Sampling sites shall be the same sites used for the establishment of baseline data. The Environmental Team members will be trained adequately to understand and appreciate the choice of parameters, sampling sites, methods of sampling/measuring and analysis and frequency of monitoring.

8.12 Training and development

An environmental training and awareness program is to be established to enhance the understanding of all staff, supervisors, workers and subcontractors pertaining with environmental impacts and mitigation measures. From commencing of the work, the PEC and Contractor’s Environment Inspectors are to undertake continuous environmental education during regular safety meetings for the employees, training staff in effective waste handling and management procedures, conduct regular and frequent HIV/AID and Sexual transmitted Infections (STIs) awareness for the workers. The first environmental training for the employees must be combined with the new recruitment training.

Environmental issues must be discussed by the superiors to their subordinates during all periodic meetings. Awareness training is to include the preservation of wildlife on the site. Proof of various trainings to enhance environmental performance must be outlined in training reports for the project. It is important that system is put in place to ensure that if a worker misses a key training session, it is flagged up and rescheduled for a later date. Procedures for recording training needs and keeping records of attendance must be kept at all times by relevant staff.

8.12.1 Information, Education and Communication (IEC)

In addition to the provision for continuous public education during the transmission project and subsequent posting of “Warning Signs”, sustained information, education and communication (IEC) programmes to ensure overall community safety shall be implemented on regular basis. The purpose of the IEC programme is to remind community members about project related risks and activities that will endanger their lives as well as the need to adhere to warning signs.

8.13 Proper and adequate records keeping

GRIDCo will keep a General Register in the prescribed form as required by the Factories, Offices and Shops Act, 1970 for the duration of the project. Records that will be kept, as prescribed by the abovementioned law will include, inter alia:

a. Accidents and dangerous occurrences

Particulars to be entered in the Register will include the following:

- i. Date of mishap
- ii. Name(s) of employees involved
- iii. Sex and Age
- iv. Usual Employment
- v. Precise occupation at the time of mishap
- vi. How mishap was caused
- vii. Period of disablement

b. Testing and examination of fire warning systems

Particulars to be entered in the Register will include the following:

- i. Description of fire warning system
- ii. Date of test or examination
- iii. Particulars of defects found
- iv. Particulars of action taken and date

c. Particulars of Pressure vessels and lifting appliances

Particulars to be entered in the Register will include the following:

- i. Date of last thorough examination
- ii. Maximum safe working pressure
- iii. Particulars of defects (if any) reported by the certified engineer/surveyor
- iv. Particulars of action taken to remedy defect indicated in iii. (If applicable)
- vi. Name and other particulars of engineer/surveyor including signature

8.14 Contractors' obligations and legal requirements

It must be noted that whether an Environmental Assessment (EA) and/or an Environmental Management Plan (EMP) is prepared for a particular project, it is important that before the order to commence any works the Contractor is required to prepare his own EMP for each subproject within a Lot as specified in the EA/EMP. The EMP shall spell out how the Contractor will achieve environmental targets and objectives specified in the EA/EMP.

The Contractor's EMP shall include, to the extent practicable and reasonable, all steps to be taken by the Contractor to protect the environment in accordance with the current provisions of national environmental regulations and/or the EIA/EMP for this project. Basic information required includes the following:

- Worksite/camp site waste management
- Material excavation
- Material deposit
- Rehabilitation and soil erosion prevention
- Water resources management
- Traffic management
- Blasting
- Disposal of relocated elements
- Health and safety
- Repair of private property

Notwithstanding the Contractor's obligation under the above clause, the Contractor shall implement all measures necessary to restore the sites to acceptable standards and abide by environmental performance indicators specified in the Projects EA/EMP to measure progress towards achieving objectives during execution or upon completion of any works.

8.15 Emergency preparedness and response

The basis for emergency response and planning is firstly incident prevention, and secondly rendering any incidents harmless. The priorities for protection in an emergency situation are the following:

1. Human life and health;
2. The environment;
3. Assets belonging to GRIDCo or the contractor;
4. Maintenance of normal operations on site.

Emergency response plan shall be prepared to manage effectively a wide range of incidents that may occur at the project site. This includes emergency plans for fire, storm, chemical spills and road accident, and other emergency as identified which may affect the project. The protection of the environment shall be primarily dealt with in this plan.

GRIDCo shall also take all reasonable measures to prevent contamination of water air or land as a result of any incident, to reduce such contamination if it is unavoidable and to remediate any contamination that has occurred during the works. The EPC Contractor is mandated to immediately report any significant incidents to the PEC, who shall in turn inform the Director, Engineering.

8.15.1 Emergency response plan for hazardous chemical spill

The following materials may be available on site are can be considered as hazardous: petroleum products, septic wastes, paints, stains, wood preservatives, pesticides, acids,

solvents, motor oil, lubricants, hydraulic fluid, detergents, batteries, glues, acetylene, cement, mastics/adhesives, medical wastes, etc. There is a potential of spillage of any of these hazardous materials and there is the need to prepare a procedure for an emergency preparedness plan in the event of hazardous chemical spills.

A. Purpose

The purpose of the procedure is to define a plan of action for potential hazards associated with the transmission line project including accidental spills of all hazardous materials in accordance with the material data safety sheet (MSDS) and international standards.

B Scope

The procedure covers the actions to be implemented in the event of substantial spillage or accidents caused by hazardous materials. It applies only to the project.

C Notification procedure

The notification procedure indicates the measures to be taken on discovering the spill, and the personnel to be informed. This will enable trained personnel and outside agencies to respond quickly.

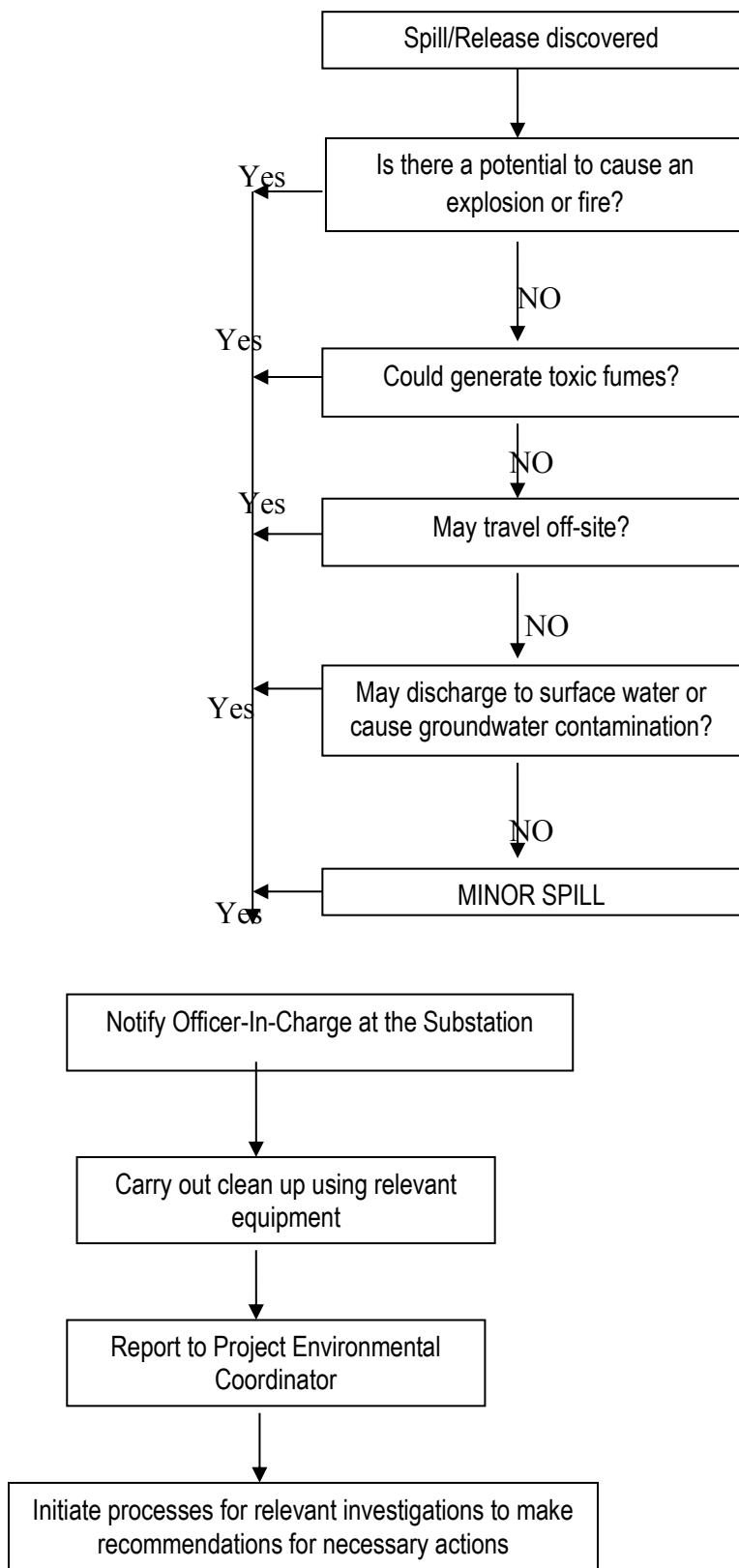
i) First notification

Upon the discovery of a spill or suspected spill from a transformer, the person discovering the spill, the **First Notifier**, must immediately contact the Officer-In-Charge (OIC). They should attempt to provide the following information:

1. Time of discovery
2. Possible spill material
3. Quantity of spill material
4. Area of land or lake involved in the spill event
5. Estimate of whether or not the spill is on-going
6. Actions which have been taken

Using the above information, together with knowledge of the volumes of petroleum products available for the project, available personnel, and visual observations, the OIC will make a determination of the severity of the spill event and the notification procedures to be implemented using the Hazardous Material Spill Notification Flowchart outlined in Figure 5.

Figure 5: Hazardous material spill notification flow chart



It is the responsibility of the Officer in Charge (OIC) at the project site to collect all the information indicated above to determine the source and cause of the discharge. It is anticipated that any hazardous chemical will be in very limited quantities and therefore any accidental spillages will be minor and will be well contained without any offsite notification.

ii) The OIC shall: -

1. Immediately move logistics as appropriate to the site of the incident.
2. Contain the spill and prevent its spread
3. Undertake the spill clean-up

Take appropriate steps to inform the Project Environmental Coordinator for any relevant internal or external action to be taken.

D. If any accident or incident detrimental to the environment occurs, the cause(s) of the accident/incident and the aspects of the action plan that could be improved shall be identified through GRIDCo's accident investigation procedures and plans to correct the hazard made.

8.15.2 Procedures for handling raw materials/products

All materials handling and storage shall be performed in accordance with the requirements contained in the Material Safety Data Sheet (MSDS). Since injuries may result from improperly handling and storing materials, it is important to be aware of incidents that may occur from unsafe or improperly handled equipment and improper work practices when handling and storing materials.

Some hazards associated with materials handling are outlined below to make all workers aware of the consequences:

1. Back injury is the number one injury associated with improper material handling.
2. Heavy or unbalanced loads could fall and injure employees, especially head and feet.
3. Vehicle becomes unbalanced and overturns with driver not wearing seat belts.
4. Improper or unsafe use of material handling equipment could cause injury or property damage.
5. Falls from working platforms or ladders could occur.
6. Damaged or poorly maintained equipment could cause injury.
7. Battery charging and filling pose significant risks.

8.16 Scheduling and reporting

From pre-construction to operation/maintenance phases, GRIDCo will carry the ultimate responsibility of ensuring that environmental reporting procedures are undertaken. The Project Team will carry out monthly discussions on the project which will form a forum for discussions on environmental issues, and decision making with regard to further mitigation, monitoring, or changes to project activities. All environmental procedures, periodic statutory reports to regulatory agencies such as the EPA, Energy Commission should be produced and controlled in accordance with the station's document control procedure.

The following types of reports are to be produced:

- Monthly Regular Report: This shall comprise of monthly activity report which shall provide information on environment protection activities performed during the period.
- Emergency report: This shall comprise of issues to be submitted promptly in case of emergencies
- Topic Report: Report concerning influential environment issues.
- Annual Environmental Report: This shall comprise of information on all environmental activities undertaken during the year beginning from January to December and submitted to the EPA.

The PEC will report directly to the Manager, Lands Management on all environmental activities for inclusion in the project monthly reports. The Environmental Officer shall coordinate the production of progress activity as well as legally binding environmental reports. The reports shall form the basis for the preparation of an Annual Environmental Report (AER), as a requirement of the Environmental Impact Assessment Regulations, to be submitted to the Environmental Protection Agency. The AER shall be prepared and must be submitted to the EPA by close of March, each year.

The EPA Environmental Impact Assessment Guidelines for the Energy Sector, Volume 2 provides guidelines for the production of environmental protection reports and this must serve as reference document for the PEC in the preparation of such reports. All monitoring and reporting documents must be kept on file, as part of GRIDCo/Contractor documentation procedures. An open door policy must be maintained by all agencies on information regarding all environmental issues; such information can be accessed by any worker for purposes of improving on work output.

8.17 Project Environmental Permit

Following the submission of the Final EIA Report and the subsequent payment of the project's processing and permit fees, the EPA issues an Environmental Permit to allow for the physical construction of projects to commence. The Permit outlines various conditions that must be adhered to in project implementation. It must be noted that it is an offence under Regulation 29 of the Environmental Assessment Regulations LI 1652 of 1999 to start a project without an Environmental Permit.

GRIDCo shall comply with all project specifications, mitigations, monitoring and other environmental management provisions that would be indicated in the Environmental Permit for the project. Management shall ensure that all conditions are strictly adhered to. The Environmental Officer is directly responsible for implementing the conditions outlined in the Permit.

8.18 Cost of Environmental Management

GRIDCo will make human resources available for environmental management and enhancement. In addition, financial provision shall be made to ensure that mitigation measures (including compensation), monitoring and training programmes are effectively

implemented. GRIDCo will make the necessary budgetary provisions to cover all commitments for the transmission project, including demobilisation and compensation.

The estimated total budget for the environmental management of the transmission project for 2015-2018 is US \$133,015.00 and is shown in Table 16. This cost does not include compensation and resettlement cost under the involuntary resettlement, if any, which will be outlined in detail in the Valuation Report following the valuation of affected properties.

Table 16: Environmental Management Budget

N°	ITEM	BUDGET (US \$)
1	Review & Disclosure of Environmental Report	5,000.00
2	Cost of preparation of EIA	30,000.00
3	Cost of Monitoring Activities (including Health & safety)	62,115.00
4	Demobilisation	15,900.00
5	Training of environmental management team in-house	20,000.00
	GRAND TOTAL	133,015.00

9.0 CONSULTATIONS

9.1 Introduction

Consultations play a major role in identifying the potential impacts of any proposed transmission system project. Consultations with the state agencies and regulatory agencies have assisted in defining the regulatory and institutional framework within which the project should be carried out. Community consultations also assist in the identification of socio-economic, religious and cultural impacts. Stakeholder consultation to support the EA and the resettlement process, if any, specifically aims to achieve the following objectives:

- To provide information about the project and its potential impacts to those interested in or affected by the project, and solicit their opinion in this regard;
- To manage expectations and misconceptions regarding the project;
- To agree resettlement preferences, if any, and discuss concerns; and
- To ensure participation and acceptance of the project by the communities.

Information obtained during consultations makes it possible to make the inventory of the existing infrastructures and to collect the component about the landed management, the socio-economic activities, the infrastructure and expectation of the people, which shall include.

- Habitat and demography (ethnic groups, religion, migrations);
- Organization socio-policy, traditional and administrative layer;
- Regional infrastructures;
- Medical health (life expectancy, mortality, infrastructures, causes major of disease, important regional project,
- Education (education level, education type, census of the schools);
- Economy (major economic activities, incomes and employment, problems, economic development);

With this method in the project, the inventory will correspond to the socio-economic influence zone/site which will result from the establishment of the transmission line. Information will be obtained from the regulatory agencies, chiefs, community leaders and members as well as private institutions. Subsequently, a program of ongoing public consultation and sensitisation has been developed separately to avoid any risk of apprehension associated with this project like the problems inherent in the destruction of farm produce. The following steps are being used for the public education and sensitisation component of the project in order to ensure smooth implementation of the project.

- Consultation with the relevant government agencies
- Consultation with the organized groups, community representatives and private companies.
- Introducing the project and making available relevant information
- Maintaining and collecting information by enquiry

This section provides details of ongoing consultations undertaken so far on the project.

9.2 Consultations with state agencies

Several levels of consultations have been held with state agencies, municipal assemblies, communities, leaders of the communities, assembly members, opinion leaders, etc. Various state agencies were consulted due to the key roles they will be required to play in the implementation of the project. The consultation process was initiated by officers from the Environmental Unit of the Lands Management Section of the Ghana Grid Company Limited. These officers carried out the initial sensitization and consultations with the relevant Municipal Assemblies, Assembly members and some of the communities likely to be affected by the proposed project. They therefore built up a list of names and contact numbers of the relevant leaders, organized groups and opinion leaders of the communities.

The details consultations undertaken with regards to the proposed project is provided below:

9.2.1 Department of Urban Roads

1. Mr. De-Graft Afful (Deputy Director, i/c Maintenance and Operations)

Tel. 0208117314/0244432346

The team consulted the Department of Urban Roads in connection with the Graphic road section of the proposed project. The Deputy Director of Urban Roads in charge of Maintenance and operations, Mr. De-Graft Afful, welcome the team and stated that he was happy about the consultation. He indicated that his outfit is prepared and ready to give any assistance to the project. He emphasized the essence of consulting the Dept. of Urban Roads and cited several examples as consequences of lack of consultation. A typical one is the traffic congestion at Accra shopping mall area, which is so because of lack of collaboration between the designers of that road and the Department of Urban Roads. The Director promised the team that he will always cooperate with them anytime the need arises. He complained about how certain compensations could have been avoided if proper consultations had been made.

9.2.2 Ghana Railways Company

Contact Persons: 1. Mr. Raynolds Quansah (Station officer)

Tel. 0244703750

2. Mr. M. A. Asare (Area Manager)

Tel. 0246512695

The team explained the project in details to them and showed the proposed route map to them. In response, they stated as follows:

The Railways Corporation allowed the people to occupy the land but asked them to leave 50 m space from the rail line but no caution was given to them on the electricity line.

The squatting area was not sold to the squatters but they pay yearly rent to the Ghana Railway Corporation. The rent is taken on yearly basis so that they can be ejected at any time when the need arises. Only temporary structures are allowed, permanent structures are not allowed in the railway catchments.

9.2.3 Okaikoi South Sub-metropolitan Assembly

Contact Persons: (i) Mr. Daniel Bulley, Building Inspector
(ii) Mr. Samuel Mormor, Sub-Metro deputy Director
Tel. 0244865106

The team introduced themselves and supported it with an introductory letter from GRIDCo. The team explained the project in detailed to them. The officers demanded a clarification of whether a permit is required and the team replied in negative. Mr. Mormor stated that though the chairman of the sub-metropolitan Assembly is not available at that moment the Assembly would not kick against such a project. He advised that actions on the project must be expedited, since the political will would not permit ejection and resettlement within the election year or around that time.

9.2.4 Electricity Company of Ghana

Contact persons: 1) Ing. Godfred Mensah (Sectional Manager/ System Planning)
Tel. 021221865/ 0244765788
2) Mr. Kwadwo Ayensu Obeng (Divisional Manager, System Planing)
Tel.0208112311

The team consulted the Electricity Company of Ghana with the above gentlemen as representatives. They expressed concerned about the sorts of structures and people that have encroached the right of way. They pledged their support to the project and wished it come to pass.

9.3 Consultation with the Project Affected Communities

i. Avenor –Baltimore

Venue	Under goat/sheep sellers' shed
Date	December 10, 2014
Time	9:30am to 11:35am

a. Attendee:

Attendees at the meeting	Designation	Contact numbers
Baba Idi	Leader	0244549146
Abraham Ali		
Mohamed Hamid		
Mustapha Armed		
Amidu Musah		
Adwoa Kwadwo		
Abubakar Yusif		

ii. DKM Transport

Venue	DKM Transport office
Date	December 11, 2014
Time	9:30am to 11:35am

b. Attendee:

Attendees at the meeting	Designation	Contact numbers
Philip Bakum	Leader	
Alhaji Seidu Alkurugu		
Abilla Yusif		
Abu Dekambe Osman		
Sulemana Bawa		

iii. Foryor (goats and sheep sellers)

Venue	Under goat/sheep sellers' shed
Date	December 11, 2014
Time	11:35am to 1:30pm

c. Attendee:

Attendees at the meeting	Designation	Contact numbers
Alhaji Sofo	Leader	
Alhaji Issah		0242531585
Mamudu Kasi		
Alhaji Sasihu		
Sophia Odoom		0246741528

iv. Dan Max Travel and Tour

Venue	Dan Max's office
Date	December 10, 2014
Time	2:30pm to 4:35pm

d. Attendee:

Attendees at the meeting	Designation	Contact numbers
Mr. Dan Max		0244626140
Mr. Yaw Bediako		
Ms. Edith Mills		
Mr. Kwasi Agyapong		
Alhaji Tailu		
Attah Fitter		
Sani Blacksmith		

v. OA travel and tour station

Venue	Station manager's office
Date	December 13, 2014
Time	9:30am to 11:35am

e. Attendee:

Attendees at the meeting	Designation	Contact numbers
Mr. Kofi Nyame	Station Chairman, Accra	

vi. Industrial Area Cargo and VVIP Transport

Venue	Station chairman's office
Date	December 10, 2014
Time	11:40am to 1:35pm

f. Attendee:

Attendees at the meeting	Designation	Contact numbers
Mr. John Kwabena Addison	Chairman	0268246631
Mr. Kwabena Badu	Neoplan Chairman	
Mr. Yaw Adomako	First Trustee	

vii. Spare-parts dealers

Venue	In front of the spare-parts shops
Date	December 12, 2014
Time	9:30am to 11:35am

g. Attendee:

Attendees at the meeting	Designation	Contact numbers
Mr. Badu Adomako	Leader	0244991981
Mr. Kojo Awusi		0244370835
Mr. Daniel Danso		0244235178
Mr. Kwaku Antwi-Bosiako (Boozing)		0243208002
Nana Osei Hwedie		0244885897
Mr. Jonas Ahadzi		0201011020
Mr. Nicholas Mensah		-
35 spare-parts dealers attended the meeting		

viii. Odaw Station

Venue	In front of the wooden kiosks
Date	December 13, 2014
Time	1:30pm to 2:35pm

h. Attendee:

Attendees at the meeting	Designation	Contact numbers
Simple	Leader	0244913434
Yaw Frimpong (Anoma)		0241574891
Moro Baki		0205776508
Richard Nii Quaye		0244290318
15 people attended the meeting		

ix. Ecomog

Venue	In front of 7UP bar
Date	December 10, 2014
Time	3:00pm to 5:35pm

i. Attendee:

Attendees at the meeting	Designation	Contact numbers
Mr. Ernest	Leader/Organizer	0244613030
Nana Yaw		0575898896
Mr. Osei Frank		0246831907
Mr. Ernest Osei Frimpong		0244613030
Ms. Fati Mohamed		0244075420
Mr. Kwaku Boateng		0266684460
Ms. Matilda Asare		0274417411
Mr. Alumbiri Awuni		0572761643
Mr. Geraldo		

The General Concerns of the communities

The following concerns raised were unanimous across all communities and organized groups consulted:

1. *Prompt, fair and adequate compensation payment for project affected properties.* The Consultation team assured the affected communities of timely and fair compensation of current cost of structures to all affected persons before commencement of constructional works.
2. *Job creation for the youth.* There was a cyclical request for employment particularly unskilled labour to be sourced from the various affected communities during implementation of the proposed project. The consultation team informed the affected communities that during construction, unskilled labour could be sourced from the communities but further indicated that such jobs would be short-lived as the project is linear and therefore traverse from one community to another.
3. *Permissible activities within the corridor.* All the organized groups and communities inquired whether they can bring back their structures, businesses and residences and would be allowed in the right-of-way. The team informed the affected communities that activities such as mining, structural development in the RoW are prohibited in line with the Volta River Authority (Transmission Line Protection) (Amendment) Regulation, 2004 (LI 1737)
4. *The health implications of the proposed high voltage line to the close-by communities regarding emission of EMF.* The team informed affected communities that EMF emissions especially out the RoW will be at its barest minimum and therefore would not pose any health concerns to inhabitants nearby.

9.4 Disclosure programme

As part of the consultation processes, GRIDCo shall disclose at various times to the general public, relevant documentation and activities for their attention and relevant action. The disclosure processes shall include, among others:

In accordance with the Ghana EIA procedures and as requested by EPA, an Advertiser's Announcement of the Scoping Exercise has been published in the widely circulating newspapers in Ghana, specifically the Daily Graphic and the Ghanaian Times. All those with concerns, interests or special knowledge relating to potential environmental effects of the proposed undertaking are to contact or submit such concerns to GRIDCo or the EPA. Such comments are to be reviewed and addressed as necessary and incorporated in the EIA report. The notice will also be distributed in the affected district as well as posted on vantage points in the affected communities.

Following the submission of the Draft EIA Report to the Ghana EPA, the EIA document shall be disclosed in the national dailies for comments for information purposes.

Prior to the acquisition of land for the project, GRIDCo shall publish a "Notice of Entry" for the purpose of constructing and operating the project, as legally required.

GRIDCo shall gazette the "Notice of Entry" in the National Gazette.

10.0 DECOMMISSIONING

10.1 Introduction

It is anticipated that the Accra Central Power Project and its associated facilities, will be continuously maintained and repaired and will be operated for several decades. Equipment may be upgraded based on cost/benefit analysis and the prevailing new technologies. Because of its long life span, the circumstances under which the ACPP might be ultimately decommissioned are difficult to foresee. There is therefore no specific decommissioning proposal for the transmission system and associated facilities itself at this stage of the project.

10.2 Pre-decommissioning assessment

Because of its long life span, there is no specific decommissioning proposal for the project itself at this stage of the project. However, this generic decommissioning plan is being posted to provide a guide on details of the activities to be undertaken in the event of the need to de-commission the substation and the transmission line.

10.3 Substation and transmission lines

The lifespan of the towers is typically 50 years. It is anticipated that the transmission line will be continuously maintained and repaired, and will be operated for several decades. Because of its long life cycle, the circumstances under which it might ultimately be decommissioned and abandoned are difficult to foresee. Towers may be upgraded and/or renewed based on cost/benefit analysis and new technologies. However, if decommissioning is undertaken the following generic approach may be adopted. Conductors and wires would be lowered to the ground, and all cables would be spooled and removed from the site for salvage. The towers would then be dismantled and removed from the site for salvage. The disposal or otherwise of the tower foundations would depend upon the intended future land use. This would need to be decided at the time of decommissioning. The decommissioning process would be undertaken in accordance with environmental laws and standards in place at the time of decommissioning.

The substation will be designed to have a life expectancy of 25 years. It is anticipated that the substation elements associated with the transmission line will be continuously maintained and repaired and will operate for the life of the power plant and transmission line. The decision on whether to decommission or upgrade will depend on the development of the system as a whole. Under a typical decommissioning process, all steel work would be lowered to the ground, the cables spooled, and all components including transformers removed for salvage. Transformer oil would be drained and recycled. The decommissioning process would be undertaken in accordance with environmental laws and standards in place at the time of decommissioning.

A full environmental departure audit will be carried out. This will examine, in detail, all potential environmental risks existing at the site and make comprehensive recommendations for remedial action to remove such risks. Following completion of the demolition, a final audit will be carried out to ensure that all remedial work has been completed. The audit reports will be made available to future users of the site. Prior to GRIDCo closing down the

substation, the relevant authorities will be notified as to the date of the closure and the results of the departure audit submitted. The site will be returned to a condition suitable for reuse.

10.4 Post-decommissioning assessment

At the end of the decommissioning exercise, the EPA will be invited to carry out a post-decommissioning assessment to establish compliance with all regulatory requirements and issue a certificate to that effect. A full Decommissioning Report is expected to be prepared in the event of any such activity for concurrence with the EPA and any other requisite state agencies.

10.5 Responsibility and budget

Budgetary provision shall be made as part of the overall investment budget and GRIDCo's corporate budget for the decommissioning and reclamation exercise. Costs of dismantling of the project's equipment are to be determined with contractors or to be included as buyer's costs.

11.0 CONCLUSION

GRIDCo intends to construct a transmission line from Avenor to Graphic Road ECG sub station to address the rather high power distribution losses, long and frequent power outages and voltage fluctuations. The project known as the “Accra Central Power Project” (ACPP) involves the construction of approximately 3km of 161 kV transmission line through from Avenor to Graphic Road to connect the ECG substation, to reinforce power supply to Accra central.

GRIDCo shall utilize the existing ECG right-of-way of 3km x 0.03km, approximately 0.09 km², in the project area for the smooth implementation and operation of the proposed Accra Central Power Project. The transmission line route shall run from Avenor to Graphic road, all Okaikoi South sub Metropolitan Assembly (under Accra Metropolitan Assembly) in the Greater Accra Region of the of Ghana. The transmission line will traverse two major slum communities and several organized transport companies, assorted trading companies and goat and sheep sellers.

The project, which is at the preconstruction stage, requires an Environmental Assessment study to be carried out and the preparation of an Environmental Impact Assessment Report in line with the Environmental Assessment Regulation, 1999, LI 1652. This EIA Report for the “Accra Central Power Project” has identified potential impacts on the physical, biological and socio-economic/cultural environments, occupational safety, health and welfare of the employees. Mitigative and potential remedial measures have also been outlined. These will be actively pursued in order to minimise or, if possible, eliminate the identified negative impacts. GRIDCo will also compensate all persons whose properties may be affected. A Valuation Report will be prepared in collaboration with the Lands Valuation Division and the compensation process will be guided by national laws for undertaking such exercises. This is an undertaking GRIDCo is firmly committed to and shall adhere to it.

The transmission system project cannot be carried out without any impacts on the environment. Indeed, some of the impacts are unavoidable. GRIDCo has put forward mitigation measures aimed at reducing, and if possible elimination the impacts to ensure that the end use of the land after the expiry for the project’s life span is not compromised. However, the mitigative measures put forward are expected, as far as possible, to be able to minimize the impacts so as to make them pose no threats to the continued sustainability of the environment. The benefits to be derived from the implementation of the project are immense, especially considering the problems of electricity distribution as experienced in Ghana.

GRIDCo believes that the EIA Report has sufficiently dealt with the significant issues on the ground. It is hoped that the report will meet the expectations of the EPA and warrant the issuance of Permit to enable GRIDCo to commence the project. GRIDCo commits to collaborate with EPA to jointly manage the environmental and social concerns related to the transmission project and shall submit environmental reports to the EPA as required.

In conclusion, it is affirmed that GRIDCo is committed to ensuring continuous improvement of environmental performance to minimize the impacts of all its operations on the environment, in

line with the principles of sustainable development, in addition to complying with national and international environmental protection regulations.

Appendix 1: Scoping Notice published in the national dailies



Appendix 2: Consultation Pictures



Plate 1: A picture with community members at Avenor ECG area



Plate 2: A picture with some members of DKM transport



Plate 3: A picture with sheep/goat sellers at Foryour headed by Alhaji Sofo



Plate 4: A picture with members of Dan Max Travel and Tour area



Plate 5: A picture with the chairman of OA Travel and Tours (Accra branch)



Plate 6: A picture with the executives of industrial area cargo transport /VVIP



Plate 7: A picture with members of spare parts dealers



Plate 8: A picture with members of spare parts dealers



Plate 9: Pictures with some community members at Odaw station area



Plate 10: A picture with community members of Ecomog



Plate 11: A picture with community members at Ecomog

Appendix3: Review comments on Scoping Report