ENVIRONMENTAL IMPACT ASSESMENT STUDY REPORT

FOR

THE PROPOSED LPG CYLINDER PRODUCTION LINE AND LIQUEFIED PETROLIUM GAS (LPG) REFILLING PLANT ON plot No. MAKUYU/MARIAINI/BLOCK.III/460 IN MAKUYU, MURANG'A COUNTY

PR Reference No: NEMA/PR/5/2/18,377

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The following expert visited the site and prepared the following Environmental Impact Project Report

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TABLE OF CONTENTS

ABBREVIATIONS

AGO	Automotive Gas & Oils
DOHS	Directorate of Occupational Health & Safety
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EMCA	Environmental Management Coordination Act
EMP	Environmental Management Plan
EMS	Environmental Management System
ERPs	Emergence Response Plans
ERC	Energy Regulatory Commission
IEA	Initial Environmental Audit
IK	Illuminating Kerosene
LPG	Liquid pressurized gas
NEC	National Environment County
NEMA	National Environmental Management Authority
OHS	Occupational Health and Safety
PPE	Personal Protective Equipment
PMS	Premium Motor Spirit

DEFINITION OF ANALYTICAL TERMS

1. **Environmentally Sound Design**: Is the design and implementation of activities and projects such that the environmental harm associated with a particular development objective is kept to a practicable minimum.

2. **Positive Impact**: A change which improves the quality of the environment (for example by increasing species diversity; or improving the reproductive capacity of an ecosystem; or removing nuisances; or improving amenities).

3. **Neutral Impact:** A change which does not affect the quality of the environment.

4. **Negative Impact**: A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem, or property or by causing nuisance.

5. **Significant impact**: An impact which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.

6. **Profound impact**: An impact which obliterates sensitive characteristics.

7. **Do-Nothing Impact**: The environment as it would be in the future should no development of any kind be carried out.

8. **Indeterminable Impact**: When the full consequences of a change in the environment cannot be described.

9. **Irreversible Impact:** When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost.

10. **Residual Impact**: The degree of environmental change that will occur after the proposed mitigation measures have taken effect.

11. **Synergistic Impact**: Where the resultant impact is of greater significance than the sum of its constituents.

12. **Worst Case Impact:** The impacts arising from a development in the case where mitigation measures substantially fail.

13. **Cumulative impacts**: Are identified as impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions.

14. **Indirect impacts**: Are defined as impacts on the environment which are not a direct result of the project, possibly produced some distance away from the project or as a result of a complex pathway.

EXECUTIVE SUMMARY

The proponent, Excellent Logistics Limited has proposed to develop an LPG Cylinder production Line and Liquefied Petroleum Gas (LPG) Plant in Makuyu, on plot No. MAKUYU/MARIAINI/BLOCK.III/460, Murang'a County. The proposed project involves the installation of an offloading point for LPG Road tankers, a manual cylinder filling plant, LPG cylinders loading and offloading area, cylinders storage space, loading gantry, fire fighting system and related offices. In addition, an LPG cylinder production line will be built. The nature of the LPG to be stored and handled is 70% butane and 30% propane as specified in KS 91. This proposed development will enhance provision of LPG mainly for domestic use. In addition, it will optimize use of the land; hence increasing its value. The project will also enhance Economic investment, leading to increasing national wealth and both County Government and National government revenue collection.

The proponent will realize income growth following expanded business as a result of the project. The project also is bound to create employment opportunities during construction, operation and decommissioning phases.

At specific phases, the project will equally be important. During construction phase, the project will create market for construction inputs, which include raw materials and construction machinery. In addition, many secondary businesses are envisioned to spring up especially those providing foods and beverages to the installation workers. During operation stage, many business are expected to spring up too and mainly for provision of support services to the facility.

The need for proper environment has become the main theme for oil industry world over. As a result, it has become mandatory for all environmental concerns to be integrated and addressed in the project during the planning and implementation stage. The key objective is to mitigate conflicts of the project with the environment throughout its life cycle hence enhancing Sustainable Environmental Management. Kenya is not an exception and therefore makes it mandatory for projects of such magnitude like the construction of facility to undergo a full Environmental Impact Assessments so as to properly align them to the environment devoid of degrading environment.

In Kenya, the National Environmental Management Authority (NEMA) regulates environmental management. This is in accordance to the provisions of EMCA, 1999. Pursuant to the prevailing legal

requirements as envisaged in the EMCA, 1999, and to ensure sustainable environmental management, the proponent undertook this EIA study for the facility; and incorporated substantial environmental aspects as advised by the NEMA registered lead expert. This EIA report thus provides relevant information and environmental considerations on the project proponent's intention to seek approval from NEMA for the development of the proposed project.

Potential Positive impacts of the proposed project facility

The proposed project will have positive impacts to the society and the general environment. Some of the benefits include the following: -

1. Provision of a convenient LPG refilling facility
2. It will optimize use of the land; hence increasing its utility.
3. Increase economic investment hence increases in wealth which will translate in Government revenue increase.
4. The proponent will enjoy income generated through sale of products.
5. The project will also provide employment during both construction and operation phases.
6. It will create a market for goods and services, especially construction inputs which include raw materials, construction machinery.
7. Many secondary businesses are also likely to spring up during the operation phase especially those providing foods and beverages to the workers.
8. Increased competition for the provision of service, which might encourage price incentives by vendors leading to lower pricing of the products as well as increased quality of offered service.

Potential negative environmental impacts

Anticipated Impacts

The anticipated impacts during the project`s entire cycle namely, construction, operation and decommissioning phase include;

Land degradation and contamination;

- Air pollution;
- Noise nuisance during construction;
- Contamination of water resources;
- Solid and liquid waste generation;
- Dust nuisance during construction phase of the project;

- Vegetation loss;
- Increase in vehicular traffic in the area both from construction vehicles as well as during operational phase of the facility
- Increased demand for water and electricity supply to the area;
- Impacts of solid waste from the proposed LPG refilling plant and LPG cylinder production line
- Impacts of sewage from the proposed LPG refilling plant and LPG cylinder production line
- Occupational accidents and diseases

Proposed mitigation measures for the likely impacts

Expected negative impacts	Recommended mitigation measures
Solid waste generation	• Ensure solid generated at the plant are regularly disposed of appropriately at authorized dumping areas. Use of integrated solid waste management of options i.e. source reduction, recycling, composting and re-use, combustion and sanitary land filling • Carry out environmental awareness training to construction workers and plant employees during operation • A private company to be contracted to collect and dispose solid waste on regular basis
Release of sewage to the environment	• Effluent disposal to be done by use of conservancy tanks • Apply for the license from NEMA for effluent disposal • Conduct regular inspection for the system to ensure it works effectively
High demand for water	• Create water conservation awareness • Install a discharge meter at water outlets to determine and monitor total water usage • Ensure water taps are not running when not in use • The management to conserve water e.g. by avoiding unnecessary toilet flushing • Promptly detect and repair of water pipes and tank leaks
Security	• Ensure the general safety and security at all times by providing day and night security guards and adequate lighting within and around the premise
Fire control	• Fire extinguisher to be placed strategic positions • Escape routes to be provided • Servicing of fire extinguishers as is necessary. Always inspect electricity wires • Installation of a diesel engine driven fire pump and associated systems • A 200,000 litre firefighting water storage tank with connected water network and firefighting nozzles
High demand for electricity	• Switch off electrical appliances and lights when not in use • Install occupational sensing lights at various locations such as storage areas which are not in use all the time

	• Install energy saving fluorescent tubes • Monitor energy use during the operation of the project and set targets for efficient use • Sensitize workers to use energy efficiently
Dust disturbance	• Avoid excavation works in extremely dry weather • Regular sprinkling of water to be done on open surface and dusty grounds during dry season until paving is done; • Ensure strict enforcement of on-site speed limit regulations • Covering of all haulage vehicles carrying sand, aggregate and cement • Stockpiles of fine materials (e.g. sand and ballast) should be wetted or covered with tarpaulin during windy conditions. • Access roads and exposed ground must be wetted at a frequency that effectively keeps down the dust. • Workers in dusty areas on the site should be issued with dust masks during dry and windy conditions. • Providing appropriate enclosure for the concrete mixer and • Use of dust nets at high levels of the building.
Noise disturbance	• Sensitize construction drivers to avoid running of vehicles engines or hooting especially when passing through sensitive areas such as churches, schools or hospitals • Ensure the construction machinery are well kept in good condition • Sensitize construction drivers and machinery operators to switch off engines when not being used • Trees to be planted on site to provide some buffer against noise propagation • Ensure all generators and heavy machines are insulated or placed in an enclosure to minimize ambient noise levels • Restrict noisy construction activities to normal working hours (8am - 5pm). • Inform local residents beforehand, via notices and advisories, of pending noisy periods and solicit their tolerance well before the commencement works. • Workers operating equipment that generate noise should be equipped with noise protection gear including ear muffs and plugs. Workers operating equipment generating noise levels greater than 80 dBA continuously for 8 hours or more should use earmuffs. • Limit pick-up trucks and other small equipment to an idling time of five minutes, observe a common-sense approach to vehicle use, and encourage workers to shut off vehicle engines whenever possible. • All construction equipment should be regularly inspected and serviced
Traffic control	• Issue notices/advisories of pending traffic inconveniences and solicit tolerance by local residents before the commencement of construction works. • As far as possible, transportation of construction materials should be scheduled for off-peak traffic hours.

	• Appropriate traffic warning signs, informing road users of a construction site entrance ahead and instructing them to reduce speed, should be placed along the main road in the vicinity of the entrance to the site during the construction period. • Flagmen should be employed to control traffic and assist construction vehicles as they enter and exit the project site. • Maintain on site a record of incidents and accidents

Environmental Management Plan for the proposed LPG Plant.

The EMP developed for the proposed project will ensure that environmental pollution and or degradation does not occur as a result of implementation and operation of any of the components of the proposed development.

The EMP covers the following management plans among others:

- Solid waste management plan;
- Sewage management plan;
- Noise management plan;
- Dust management plan; and
- Occupational Hazards Management Plan;

The project proponent and contractor will need to undertake the following to ensure the success of the EMP:

- Develop and document environmental management policies that will guide construction work and other site operations during and after implementation of the project. These policies should address environmental conservation measures to be put in place, occupational health & safety and handling of waste generated by the project
- The project proponent to avail required finances for implementation of the EMP and ensure adherence to the EMP by the contractor implementing the project.
- The project contractors to adhere to the environmental management plan

Environmental Monitoring Plan for the proposed Project

This plan provides for both active and reactive monitoring of various environmental parameters including:

(a) Monitoring of the achievements of specific plans of the Environmental Management Plan, performance criteria and fulfillment of objectives;
(b) Systematic inspection of workplace;
(c) Surveillance and monitoring of the work environment, including the organization of work and activities involved;
(d) Monitoring of workers' health; and
(e) Monitoring of compliance with laws, regulations and requirements.
(f) Environmental conservation and related activities in the area;
(g) Work related injuries, ill health (including record keeping and monitoring of sickness/absence), disease and accidents;
(h) Losses such as damage to property;
(i) Deficient safety and health performance including OHSMS failures;

Decommissioning plan for the project.

A conceptual programme for closure of the LPG refilling Plant and LPG cylinder production line is proposed as summarized:

1. Demolition waste management
All buildings, machinery, equipment, structures and partitions that will not be used for other purposes must be removed and recycled/reused as far as possible
All foundations must be removed and recycled, reused or disposed of at a licensed disposal site
Where recycling/reuse of the machinery, equipment, implements, structures, partitions and other demolition waste is not possible, the materials should be taken to a licensed waste disposal site
Donate reusable demolition waste to charitable organizations, individuals and institutions
2. Rehabilitation of proposed project site
Implement an appropriate re-vegetation programme to restore the site to its original status
Consider use of indigenous plant species adapted to geology and climate in re-vegetation

Considering the proposed project location, design and construction technology, operational management by the proponent of the proposed LPG refilling Plant and LPG cylinder production line to undertake this project, mitigation measures that will be put in place and the potential to encourage industrialization in Murang'a County, the implementation of this project is of paramount importance and beneficial not only to the proponent but also to the people of Murang'a County and the entire country at large. It is therefore our wish to recommend the project to go on with full compliance with the requirements of the law.

CHAPTER ONE: INTRODUCTION

1.1 Introduction

Background

For a very long time, many development projects worldwide didn't take into account the effects of projects on the environment. This led to much environmental degradation which caused environmental problems. Some of these problems have been irreversible and costly. In Kenya for instance, the policies, programs and strategies did not integrate environmental issues into development. A comprehensive environmental policy was therefore needed to take care of the environment in a holistic way. This was achieved through enactment of the Environmental Management and Coordination Act (EMCA), 1999 repealed (EMCA 2015). The Act stipulates that Environmental Impact Assessment be carried out on projects in the Second Schedule. It is in response to this provision that this study report has been prepared. The proposed project entails the construction an **LPG Cylinder production plant** and an **LPG refilling plant**. The facility will get raw material from abroad.

The LPG cylinder manufacturing plant will be established by the supply and integration of the following equipment and services namely:

LPG Cylinder Blanking Line:

Decoiler-straightener-feeder (12tons) -1

500 tons double blanking hydraulic press -1

Double blanking die set -3

Srap coil shear-1

LPG Cylinder Body Forming Line:

300 tons hydraulic deep drawing press- 2

Deep drawing tool set- 4

Trimming joggling machine- 4

100 ton body embossing press with embossing tool -1

LPG Cylinder Foot Ring and Guard Ring Production Line:

Decoiler- straightener-feeder 2tons -2

60tons hydraulic press-2

300 tons hydraulic press-1

150 tons hydraulic press-1

200 tons hydraulic press-1

170 tons mechanical press-1

Serial number stamping hydro pneumatic press-1

Round bending machine-2

Double welding apparatus for foot ring (MIG/MAG)-1

MIG/MAG rectifier-2

Foot ring and guard ring production tool sets-2

Welding line:

Valve boss welding machine (saw)-4

Foot ring welding machine (MIG/MAG)-3

Guard ring welding machine (MIG/MAG)-3

Body welding machine (saw)-6

Double torch welding machine (saw)-1

Longitudinal welding machine (saw)-1

Rolling machine for commercial cylinders-1

Total saw rectifier-13

Total MIG/MAG rectifier-6

Heat Treatment Section:

Heat treatment unit-1

Testing Line:

Hydraostatic test unit with 5 stations-3

Surface Preparation and Painting Line:

Short blasting machine-1

Semi automatic matallization unit-1

Automatic electrostatic painting line-1

Finishing Line:

Valve screwing unit-1

Air leakage test unit-1

Tare weight scale and ink jet unit-1

Manual serigraphy equipment-1

LPG cylinder bursting equipment-1

Part Transportation Equipment

Chain conveyors for complete plant-1

Note*: A comprehensive booklet for the whole production process for LPG cylinder manufacture was annexed in the Project Report. Approved architectural drawings are annexed.*

LPG Refilling Plant

In order to meet the desired goal and objectives, the LPG filling plant will comprise the following primary features: -

- One LPG road tanker offloading point
- Three manual cylinder filling points
- LPG cylinders offloading zone
- A segregated drainage system for the management of storm water and potentially contaminated wastewater
- Firefighting facilities
- Approved pipe and pumping systems

LPG through tankers and stores them in mounted tanks for refilling 6kg, 13kg and 35kg cylinders for selling to consumers. Liquefied petroleum gas (LPG) is used mainly for domestic cooking in Kenya. Consumption of LPG in Kenya stands at about 50,000 tones/year. The principal market is Nairobi with significant consumption in other urban areas of Mombasa (Coast region) and Western Kenya region.

EXCELLENT LOGISTICS LIMITED facility falls in the category listed in the Second Schedule of the Environmental Management and Co-ordination Act (EMCA), 1999 under item 10 and is therefore required to undergo Environmental Impact Assessment (EIA).

1.2 General overview and Rationale of Environmental Impact Assessment (EIA)

The proposed project involves the installation of Above ground Storage Tanks (ASTs), loading gantry, pumps, offloading points, cylinder filling points, LPG cylinders offloading zone, a segregated drainage system for the management of storm water and potentially contaminated wastewater, Firefighting facilities, approved piping and pumping systems.

The proposed development will enhance the provision of LPG mainly for domestic use. It will optimize the use of land; hence increasing its utility. Government revenue will increase as well as enhancement of Economic investment which will translate in wealth creation.

The proponent will enjoy income generated through sale of the petroleum products. The project will also provide employment during both construction and operation phases. It will create market for goods, services, and especially construction inputs, which include raw materials and construction machinery. Many secondary businesses are also likely to spring up during the construction phase especially those providing foods and beverages to the installation workers.

Recently the industry, spurred on by regulators world over, has recognized the need for change in order to safeguard the environment. In relation to this, the Environmental concerns have now been integrated in the planning and implementation processes of any proposed projects in Kenya. The key objective is to mitigate conflicts with the environment at the vicinity during implementation and operational phases. In addition, it is now mandatory for projects of such magnitude and nature to carry out Environmental Impact Assessments in order to enhance Sustainable Environmental Management as well as controlling and revitalizing the much degraded environment.

It is against this background that the proponent undertook this EIA study for the facility so as to incorporate substantial environmental aspects as advised by NEMA regulations. This comprehensive EIA report was done by a team of multi sectoral experts under the coordination of a NEMA registered lead experts, thus

provides relevant information and environmental considerations which the project proponent has/intents to put in place even as he seeks an approval from NEMA for the development of the proposed project in accordance with the EMCA, 1999.

1.3 Objectives of the proposed project

The main objective of the proposed project is to develop an LPG cylinder production plant and LPG gas refilling plant that will be in unison with the environment void of any conflict with the neighborhood. In order to achieve these goals, the objectives of the project are to -

1. Construct a plant for manufacture of LPG cylinders and LPG refilling plant in accordance with local and international design standards
2. Use materials of construction that are locally available or imported from oversees
3. Create employment professionally qualified individuals of operating the facility
4. Ensure optimum sourcing of LPG in bulk for bottling and sale to the customers, and
5. Maintain sound and high standards EHS management system while operating the plant.

In order to meet the desired goal and objectives, the facility will comprise the following primary features:

1. Above ground Storage Tanks (ASTs)
2. Loading gantry
3. Offices
4. offloading points
5. cylinder filling point
6. LPG cylinders offloading zone
7. A segregated drainage system for the management of storm water and potentially contaminated wastewater
8. Firefighting facilities
9. Approved piping and pumping systems
10. LPG cylinder production line
11. Warehouse
12. Perimeter wall enclosing the plant.

Pictorial View of the proposed site:

 Sagana-Nyeri Road	 Project site
 Sample for cylinder production	
 The only immediate neighbor near the site	 Project site

1.4 Terms of Reference (ToR) for the EIA

The Terms of Reference of the Environmental Impact Assessment study included the following:

1. Importance of the facility
2. Standards, legal and regulatory framework
3. Proposed facility-location
4. Neighboring facilities
5. Environmental degradation likely to arise from the construction activities

6. Risks associated with any fire outbreaks.
7. Environmental risks associated with the Spillage/Leakage of the stored products (impacting soil and groundwater)
8. Environment mitigation and management measures to address the above potential risks,
9. Environmental Monitoring Plan
10. Conclusions and recommendations

1.5 Scope of the EIA Study

1.5.1 Impacts identification and evaluation

The study has been conducted to identify and evaluate the impacts of the proposed facility on the environment. Proposed mitigation measures to appropriately address the identified impacts. A comprehensive Environment Management plan has also been given as a guide to the proponent during the implementation of the project.

1.5.2 Study period

During this study impacts assessed covered the entire life cycle of the project, namely construction, operation and decommissioning phases. The areas of interest included:

1. Physical environment;
2. Flora and fauna;
3. Land use;
4. Socio-economic aspects;
5. Health issues;
6. Fire response preparedness;
7. Spill/leak containment;

1.6 Methodology

The study has assessed the impacts of the proposed facility on the environment in accordance to Environmental Management and Co-ordination Act of 1999 and the Environment Impact Assessment Guidelines. The environmental impact assessment impact assessment study covered the following activities:

1. A review of the policy, legal and administrative framework;

2. Description of the proposed project;
3. Baseline information;
4. Assessment of the potential environmental impacts on the project area;
5. Development of the mitigation measures and future monitoring plans.

To achieve this task, **literature review** of the project activities and salient features of the project was done. Some of the relevant data obtained at this stage was National and international standards and specifications for facility, the other relevant data was the environmental set up of site in light of physical, biological, and socio-economic attributes.

Field investigations too were employed. This included a reconnaissance to the site to establish its general set up. A detailed survey of site in order to collect vital information relating to the proposed project and its neighborhood including all features of biophysical environment including landscape; geology; soils; presence of nearby sensitive receptors; flora and fauna were recorded. Photographs were taken where necessary. Finally, a public consultation visit to capture what the neighborhood had to say about the project was done and questionnaires and minutes of the baraza were used to capture their views.

CHAPTER TWO: LEGISLATIVE AND REGULATORY FRAMEWORK

2.1 Introduction

This section discusses the environmental requirements and performance of facility on the basis of the applicable National regulations regarding EHS aspects.

2.2 Applicable Environmental legislations and regulations

2.2.1 The Environmental Management and coordination Act (EMCA), 2015 repealed

Previously, environmental legislation in Kenya was provided in over 77 statutes. In order to provide a structured approach to environmental management in Kenya, the EMCA was enacted in 1999 as a single regulatory framework to govern environmental matters in Kenya.

With the coming into force of the EMCA 1999, the environmental provisions within the sectoral laws were not superseded; instead the environmental provisions within those laws were reinforced to better manage Kenya's ailing environment. Under the EMCA1999, a number of institutions were created and the following section provides a brief outline on the institutional framework of the EMCA. Given later in this chapter is a brief outline of some of the main sectoral laws relevant to the facility.

2.2.2 Institutional Framework of the EMCA

In order to operationalize EMCA 1999, the Act established various administrative structures (GoK, 2000). These include the NEC, the NEMA, the PCC, the NEMA Board, Provincial and District Environment Committees, the SERC and the National Environment Tribunal amongst others.

The apex body under the Act is the NEC which amongst other things is charged with the responsibility of developing the national environmental policy in Kenya as well as to set annual environmental goals and objectives.

NEMA is the organ that was established to exercise general supervision and coordination over all matters relating to the environment in Kenya. Further NEMA is the Government's principal instrument in the implementation of all policies relating to the environment.

The PCC was formed to investigate environmental complaints against any person, submit their findings/recommendations to the NEC and to submit periodic reports of its activities to the NEC.

SERC was established under the Act to advise NEMA on the criteria and procedures for the measurement of environmental quality in Kenya. Environmental quality relates to air quality, wastewater (effluent) quality, solid waste quality, noise quality, land use quality among others. Additionally the SERC is required to recommend to the NEMA minimum environmental quality standards for all environmental parameters for which subsidiary legislation is or has been promulgated.

2.3 Regulations to operationalize EMCA, 1999 repealed

2.3.1 Legal Notice 101: The EIA/EA Regulations, 2003

On June 13th 2003, the Minister responsible for Environment promulgated Legal Notice 101: Environment (Impact Assessment and Audit) Regulations, 2003 as provided for under section 147 of the EMCA. These regulations provide the framework for undertaking EIAs and EAs in Kenya by NEMA licensed Lead Experts and Firm of Experts. The EIA/EA Regulations also provides information to project proponents on the requirements of either an EIA or EA as required by the EMCA. This EIA Study has been undertaken in accordance with the requirements of the above legislation (GoK, 2004).

2.3.2 Licenses and Permits

The Minister responsible for Environment has promulgated a number of regulations to further operationalize the EMCA. These include:

1. The Environment Management and Coordination (Water Quality) Regulations 2006; and
2. The Environment Management and Coordination (Waste Management) Regulations 2006.
3. The environmental management and co-ordination (wetlands, River banks, lake shores and sea shore management) Regulations, 2009

Some of the licenses required to be maintained annually by Proponents include:

1. Effluent Discharge License (for wastewater discharges); and
2. Waste License (for transport, treatment and disposal of wastes).
3. Environmental Impact Assessment License

All the above regulations apply to the proposed project.

2.3.3 Water Quality Regulations

The above regulation was promulgated on September 4th 2006 and became effective on July 1st 2007. This regulation provides for the sustainable management of water used for various purposes in Kenya. For industries in Kenya, the regulation requires that Proponents apply for an "Effluent Discharge Permit" annually for discharging process wastewater into the environment, aquatic environment or public sewers. The regulation contains discharge limits for various environmental parameters into public sewers and the environment. Non compliance with any provision of the regulation carries a penalty of not more than KShs 500,000.

2.3.4 Waste Management Regulations

The Waste Management Regulations were promulgated on September 4th 2006 and became effective on July 1st 2007. This regulation is comprehensive and covers the management of all kinds of waste in Kenya. It is applicable to the operations of the facility because the it will generate both hazardous and non hazardous waste and the contractor who handles it needs to be licensed. Generally, it is a requirement that a waste generator segregates their generated waste by type and then disposes the wastes in an environmentally acceptable manner.

Under the regulation, it is a requirement that waste is transported using a vehicle that has an approved "Waste Transportation License" issued by the NEMA. Wastes generated in Kenya must be disposed off in a licensed disposal facility. Such a facility requires an EIA license before coming into operation and subsequent annual environment audits to be undertaken by registered Lead Experts.

It is a requirement under the regulation for a Proponent to install at their premises antipollution equipment for treatment of various types of wastes. The treatment options are to be approved by the NEMA in consultation with the relevant lead agency.

The regulation contains definitions of hazardous wastes in the Fourth Schedule. The regulation requires that prior to generating any hazardous waste; a Proponent undertakes an EIA Study and then seeks approval from the NEMA. Labeling of hazardous wastes is mandatory under the regulation and the specific labeling requirements are provided in Regulation 18. The treatment options for hazardous waste disposal provided in Regulation 19 include incineration or any other option approved by the NEMA.

2.4 Applicable Energy Sector legislations and regulations

2.4.1. The Energy Act, 2006

The Energy Act, 2006 is presently the primary legislation in Kenya that contains provisions for the management of the petroleum sub-sector. Several legislations to operationalize the Act are currently under development. It is expected that they will stipulate stringent EHS licensing requirements for all types of petroleum installations.

Energy Act which was promulgated in 2006 contains several EHS provisions for the environmentally sound management of the petroleum subsector. These are highlighted below:

1. Section 91 (1) (b) of the Act requires a Proponent to ensure compliance with the requirements of the EMCA.
2. Section 98 of the Act requires the Proponent to comply with EHS standards set by the ERC.
3. Section 102 (h) (m) (v) empowers the Minister responsible for Energy to promulgate regulations for the environmentally sound management of petroleum related facilities and infrastructure.

2.4.2 The Energy (Liquefied Petroleum Gas) Regulations 2009

This regulation requires an organisation that is involved in importation, export, storage, wholesale, retail, transporting or filling of LPG to acquire a valid licence from the Energy Regulatory Commission. Operation of a bulk LPG storage facility shall be in accordance with the Act and the terms and conditions of a valid licence.

2.5 Applicable Safety and Health legislations and regulations

2.5.1 The Occupational Safety and Health Act, 2007

This Act of Parliament was enacted to provide for the health, safety and welfare of persons employed in workplaces, and for matters incidental thereto and connected therewith. Part II of the Act provides the

General duties that the Occupier must comply with respect to health and safety in the workplace. Such duties include undertaking S&H risk assessments, S&H audits, notification of accidents, injuries and dangerous occurrences, etc. A number of sections under this part are applicable to the facility.

1. Part III of the Act provides the Administrative framework for supervision of the Act.
2. Part IV deals with the enforcement provisions that the DOSHS has been provided with under the Act. It discusses the instances when Improvement and Prohibition Notices can be issued as well as the powers of OSH officers. This part of the Act will be mandatory for the proponent to comply with.
3. Part V of the Act requires all workplaces to be registered with the DOSHS. This part is applicable for the facility.
4. Part VI of the Act gives the requirements for occupational health provisions which include cleanliness, ventilation and overcrowding.
5. Part VII of the Act contains provisions for the safe operation of machinery and includes all prime movers and transmission equipment. Additionally this part includes the safe operation of cranes, chains, ropes, lifting tackles, pressure vessels and their statutory examination by DOSHS Approved Persons.
6. Part VIII of the Act contains provisions for general safety of a workplace especially fire safety.
7. Part X of the Act deals with the General Welfare conditions that must be present during the operational phase of the project. Such conditions include first aid facilities, supply of drinking water and sufficient restrooms.
8. Part XI of the Act contains Special Provisions on the management of health, safety and welfare. These include work permit systems, PPE requirements and medical surveillance.
9. Part XII of the Act deals with Special Applications such as platforms erected over water and workplaces where steam boilers or hoists and lifts are used.
10. Part XIII of the Act stipulates the various fines and penalties associated with noncompliance of the Act. It includes those fines and penalties that are not included in other sections of the Act and will be important for the Occupier to read and understand the penalties for non-compliance with S&H provisions.
11. Part XIV of the Act is the last section of the Act and contains miscellaneous provisions which are not covered elsewhere.

Some of the important subsidiary legislations which operationalize the Act (GoK, 2007) and are applicable to the facility are described below.

2.5.2 Fire Risk Reduction Rules 2007, (Legal Notice No. 59)

These rules were promulgated by the Minister for Labor on April 16th 2007 and apply to all factories and other places of work. The rules apply to the facility in several ways as enumerated below:

1. Regulation 6 requires that all flammable materials to be stored in appropriately designed receptacles.
2. Regulation 7 requires that all flammable storage tanks or flammable liquid containers be labeled with the words “Highly Flammable” in English or Kiswahili.
3. Regulation 8(3) requires a Proponent to have spill prevention; response and countermeasures plan (SPRCP). This is important given the nature of the business and products handled at the facility.
4. Regulation 16 requires Proponents to ensure that electrical equipment is installed in accordance with the respective hazardous area classification system. It is also a requirement that all electrical equipment is inspected biannually (after every 6 months) by a competent person and the Proponent is required to keep records of such inspections.
5. Regulation 17 requires Proponents to clearly delineate fire escape exits. The regulation provides for the minimum standards to be applied in marking out all fire escape exits.
6. Regulations 20 – 23 require Proponents to have trained fire fighting teams within their premises. The above regulations provide for the minimum number of fire team members based on the total number of employees that may be present at any given time within the Proponent’s premises. Each of the fire team members must undergo a training course in firefighting to be provided by a DOSHS approved institution. The DOSHS may develop a curriculum for this training including the minimum number of contact hours required.
7. Regulation 22 provides a description of the functions of a firefighting team.
8. Regulation 23 requires Proponents to mandatorily undertake fire drills at least once a year.

2.5.3 Medical Examination Rules 2005, (Legal Notice No. 24)

These rules provide for Occupiers to mandatorily undertake pre-employment, periodic and termination medical evaluations of workers whose occupations are stipulated in the Eighth Schedule of the Act and the First Schedule of the Regulation. The workers are to undergo medical evaluations by a registered medical health practitioner duly registered by the DOSHS. Because the employees of the facility mainly those

charged with filing and loading of petroleum products may potentially be exposed to hazardous substances this regulation requires that they undergo medical evaluations regularly.

2.5.4 Hazardous Substances Rules 2007, (Legal Notice No. 60)

The Minister of Labor promulgated these rules on April 16th 2007. They apply to the facility just as they are also applicable to other places of work which handle chemicals whose exposure to employee's posses' health and safety hazards. These rules are aimed at operationalizing EMCA, 1999.

The rules states that every proponent shall ensure that where chemicals come into contact with employees, the exposure limits set out in the First Schedule of the Regulations are not exceeded. Where employees may be exposed to two or more chemicals in the workplace the Proponent shall work out the combined exposure using the narrative given in the Second Schedule of the Regulations. The Minister of Labor is empowered to change the exposure limits given in the First Schedule of the Regulations.

It is the responsibility of the Proponent to ensure that all employees exposed to chemicals in the workplace are protected adequately from exposure to hazardous substances that may be present in them using the hierarchy of hazard control methods. Such methods include elimination of the chemicals, substitution of the chemicals with less hazardous ones, engineering controls, administrative controls, use of PPE and emergency response planning. If engineering controls are applied, the Proponent will undertake the maintenance and testing of the engineering controls once every 24 months by a DOSHS licensed Engineering Controls Examiner who will submit his report to the Director DOSHS within 30 days.

Regulation 11 requires Proponents to ensure that their employees are adequately protected from radioactive substances. For example if radiography is used to check the integrity of pipe welds the Proponent will be required to issue PTW for such work.

Regulation 12 – 15 requires Proponents to have a Hazard Communication program implemented at their workplace. The Proponent is required to maintain an inventory of all MSDSs for the chemicals stored in their workplace. As a minimum the MSDS shall comply with the format indicated in the Third Schedule of the Regulations and will be disclosed fully to the employees handling the chemical by the Proponent. All unused, obsolete or expired chemicals must be disposed off in an environmentally sound manner. All

containers containing chemicals must be labeled appropriately as indicated in the MSDS for that chemical. Training of employees on the hazards associated with handling chemicals safely in the workplace will be provided at the Proponent's cost.

Regulation 16 requires the Proponent to monitor chemical exposure levels in the workplace annually by engaging a DOSHS registered Air Quality Monitor. The cost of the exposure monitoring survey will be borne by the Proponent. The Air Quality Monitor shall submit a report to the DOSHS Director within 30 days.

Regulation 19 requires Proponents that use hazardous chemicals in the workplace to subject those employees exposed to medical examinations in accordance with the requirements of Legal Notice 24.

2.6 Other applicable legislations and regulations

2.6.1 The Physical Planning Act, Chapter 286

This is the principal Act governing land planning and the project proponent is required to acquire a Certificate of Compliance or approval letter from the relevant institutions as set out in the Act. The sole objective of the Act is to harmonize development. The site is well zoned for industrial use.

2.6.2 The County Government Act (Cap. 265)

Section 160 helps county governments ensure effective utilization of the sewerage systems. It states in part that counties have powers to establish and maintain sanitary services for the removal and destruction of, or otherwise deal with all kinds of refuse and effluent and where such service is established, compel its use by persons to whom the service is available.

Section 163 (e) gives powers to the counties to prohibit businesses which by reason of smoke, fumes, chemicals, gases, dust, smell, noise, vibration or other cause, may be or become a source of danger, discomfort or annoyance to the neighborhood, and to prescribe conditions subject to which such business shall be carried out will need to observe these requirements during the construction period.

Section 165 empowers the county to grant or to renew business licenses or to refuse the same. The proponent will therefore be required to obtain a business license from the county to enable her engage in development activities

Section 170, allows the right of access to private property at all times by county government, its officers and servants for purposes of inspection, maintenance and alteration or repairs of sewers. To ensure sustainability in this regard, the local authority is empowered to make by-laws in respect of all such matters as are necessary or desirable for the maintenance of health, safety and well being of the inhabitants of its area as provided for under section 201 of the Act.

Section 173 states that any person who, without prior consent in writing from the County, erects a building on; excavate or opens-up; or injures or destroys a sewers, drains or pipes shall be guilty of an offence. Any demolitions and repairs thereof shall be carried out at the expense of the offender.

The Act under section 176 gives power to the county government to regulate sewerage and drainage, fix charges for use of sewers and drains and require connecting premises to meet the related costs. According to section 174, any charges so collected shall be deemed to be charges for sanitary services and will be recoverable from the premise owner connected to the facility. Section 264 also requires that all charges due for sewerage, sanitary and refuse removal shall be recovered jointly and severally from the owner and occupier of the premises in respect of which the services were rendered. This in part allows for application of the “polluter-pays-principle”.

2.6.3 Public Health Act- (Revised 1986)

The Act demands the adoption of practicable measures to prevent injurious and unhealthy conditions in the site. The Act requires the proponent to enhance effective management of Nuisances i.e. noxious matter or wastewater as will be discharged from the proposed project throughout the project cycle. To achieve this, systems on the management of both solid and liquid waste (effluent) will be adopted as proposed in the report. For instance, the effluent will be discharged into public Sewerage system. The solid waste shall be handled by a professional garbage collector on regular basis and disposed accordingly.

2.6.4 The Water Act, 2002

Part II, section 18, of the Water Act, 2002 provides for national monitoring and information systems on water resources. Section 73 of the Act allows a person with license (licensee) to supply water to make

regulations for purposes of protecting against degradation of water sources. Section 75 and sub-section 1 allows the licensee to construct and maintain drains, sewers and other works for intercepting, treating or disposing of any foul water arising or flowing upon land for preventing pollution of water sources within his/her jurisdiction.

2.7 Applicable standards and codes

2.7.1 Kenya Bureau of Standards- KS 1938(Parts 3 and 4)

The proponent must comply with Kenya standard specifications for the construction, handling, storage and distribution of Petroleum Products KS 1938 as set out by Kenya Bureau of Standards (GoK, 2006). The proponent will adhere to the scheme of supervision and control for storage and filling of products according to KS 1938-4:2005. The Scheme of supervision and control is a systematic guide to safe filling and storage procedures for Liquefied Petroleum Gas (LPG). It assists both the proponent and KEBS to ascertain that periodic tests and quality assurance activities are being carried out in the process satisfactorily.

2.7.2 Kenya Bureau of Standards KS 1969:2006 ICS 75:200

This is an indication of how compliance to the KS standards on petroleum handling facilities shall be achieved.

The Petroleum Industry – The installation of underground storage tanks. Pumps/dispensers and pipe work at service stations and consumer installations – Code of practice:

Tanks

- ✓ Positioning;
- ✓ Steel tanks;
- ✓ Fibre – reinforced resin tanks;
- ✓ Ultraviolet protection;
- ✓ Site topography;
- ✓ Corrosion protection;
- ✓ Transportation and off-loading of steel tanks.

Backfilling

- ✓ Stability;
- ✓ Observation wells;

- ✓ Backfilling material.

Installation of tanks and method of backfilling with cohesive backfilling material;

- ✓ Water level;
- ✓ Excavation of floor;

Tank installation;

- ✓ Ballast;
- ✓ Distribution of backfill;
- ✓ Other materials.

Installation of tanks and method of backfilling with cohesion-less backfill materials

- ✓ Installation procedure.

Holding down

- ✓ Saddles;
- ✓ Concrete slab;
- ✓ Holding slabs.

Pipe connections and manholes on fibre-reinforced resin tanks

- ✓ Pipe connections;
- ✓ Manhole construction.
- ✓ Pipe work and fittings

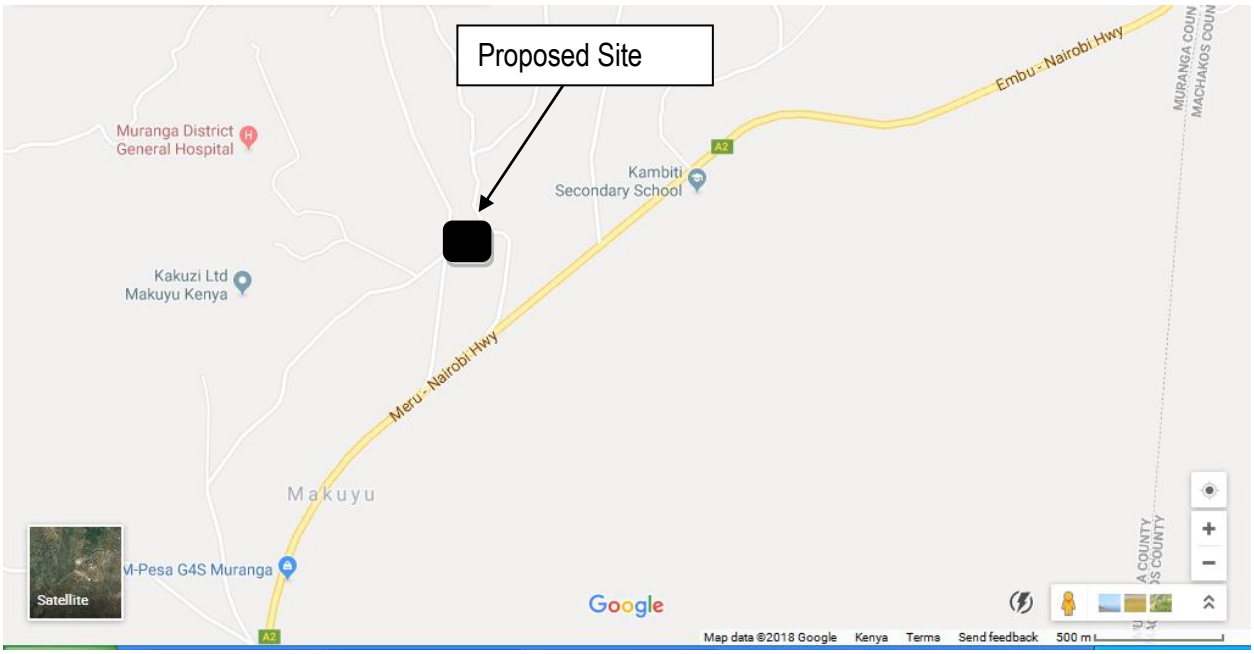
2.7.3 Building code 2000

This provides the basic rules, guidelines and standards that must be observed during construction. It is a comprehensive document, which every developer/proponent/ contractor should have.

CHAPTER THREE: PROJECT LOCATION AND BASELINE ENVIRONMENT

3.1 Introduction

The proposed project is located along Sagana-Nyeri road on plot No. MAKUYU/MARIAINI/BLOCK.III/460, Murang'a County. It lies between latitudes 0° 45' South and 1° 07' South and longitudes 36° East and 37° 27' East. See map of the proposed site below.



3.2 Social, Cultural and economic characteristics

Murang'a County where the project is situated is a predominantly an agricultural county and average farm holdings are generally small but vary between the highlands areas, the middle zone and the low areas. Kiharu Division falls under the lowland areas. Farms are relatively bigger in size ranging between 2-7acres of land. The terrain is generally flat and the climate is unsuitable for cash crop production of tea and coffee though the area has a high potential for food crops production. Human settlements are evenly distributed across the division but with a majority of the people concentrated in the peripheral areas of Murang'a town. Majority of the people are living below the poverty line. Most vulnerable include the unemployed who are mainly the youth. The farmers engage mainly in subsistence production and therefore realize little incomes to support modest livelihood.

The Human settlements are found along the steep slopes and generally limited flatter areas. Majority of the people enjoy affluent living standards. Average farm holdings are very small with some households occupying less than an acre of land. Crop diversification is very limited due to unsuitable weather patterns. Households have to purchase their food requirements from outside and this bears heavily on household income and impact negatively on other forms of livelihood. Most vulnerable to poverty include the unemployed youth, landless, the widows and orphans.

3.3 Climate and Physical features

The landscape of Murang'a County rises gradually from an altitude of 914m in the East to 3,353m above sea level towards the Aberdares. More than 95% of the land is generally mountainous landscape. There are two rainfall seasons i.e. Long rains (March – May) and Short rains (October - November). The highest potential areas receive an average annual rainfall of between 1400mm and 1600mm. Low potential receive rainfall less than 900mm per annum.

Rainfall in high and medium potential areas is reliable and well distributed throughout the year and is adequate for cultivation. However on low potential areas rainfall is unevenly distributed and therefore unsuitable for cash crop production.

Temperatures vary with altitude. In the Eastern lower areas the maximum annual temperatures range between 26° C and 30° C while the minimum annual temperatures range between 14° C and 18° C. Temperatures are moderate in the medium potential areas. Variations in altitude, rainfall and temperature between the highland and lowland coupled with the differences in the underlying geology of both volcanic and basement system rocks give rise to a variety of soil types. Highland areas have rich brown loamy soils suitable especially for tea. Coffee, maize and dairy farming are practiced. Soils in the lower areas are predominantly black cotton clay soils with seasonal impended drainage.

3.4 Soils and Geology

The predominant soils in Murang'a County are the deep and well-drained red/brown soils. These soils are loose and combined with the hilly terrain are easily eroded and sometimes are responsible for the landslides which are common in the county. Sometimes pockets of black soils are found around wetlands but these are more common in the low lands where cotton is grown. Soil erosion is one major environmental problem in the county. Most of the land in the county is hilly with sparse vegetation. Rill

erosion is very common in cultivated land while gully erosion is found in unprotected drainage channels, footpaths and culvert outlets. Landslides occur mainly on steep slopes where runoff is not well drained away.

3.5 Land Use

The county has a wide land use because of its wide Agro Ecological Zone range; from TA on the highlands to LM4 on the low lands. The forests occupy the highest grounds while cash crops like tea, coffee and macadamia follow the forests in that order. Horticultural crops and Subsistence crops like maize and beans are found in the mid and lower zones of the district.

3.6 Water Resources

Murang'a is endowed with plenty of the water resource. However much of it is not harnessed to benefit the county's developments. The Key water sources in Murang'a are:

- Surface water (rivers, swamps, wetlands etc)
- Ground water
- Rainwater harvesting
- Springs and shallow wells especially in the lower areas of the county.

Due to the present degraded water catchments and the uncontrolled felling of trees in individual farms the amounts and quality of water resources have deteriorated over the last ten years. However, the situation has not reached critical levels. The new water Act 2002 lays the framework for the protection and conservation of the catchments; gives guidelines on water allocation and other issues pertaining to water resources management in the Tana Catchment Area. The water resources management authority (WRMA) is one of the institutions created by the new water act 2002 to be a lead agency in the prudent management of water resources in the country. Through regional offices as per catchment areas (Murang'a is within Tana Catchment area), the proper management and efficient ways of allocating water and generally enforcing the water act 2002 is guaranteed.

3.7 Energy Sources

There are two forms of energy namely: renewable and non-renewable. The raw materials for energy in Murang'a include biomass, fossil fuel, hydro, solar and wind. Dependence on woody biomass has far reaching effects on the forest cover while use fossil fuels contribute to climate change. Exploitation of either

energy sources create opportunities for employment and income generation, both of which have a positive impact on improving the quality of life while reducing poverty

3.8 Nature of Tourism

The nature of the tourism in Murang'a is equitable to that of other areas. It cannot be quantified in figures since specific sites/sceneries that are definite tourist destinations have not been identified. Hence the number of tourists in Murang'a is unquantifiable. However, due to the increasing activities in the urban/ town centres, offices, seminars and houses of worship; these qualify as tourism, thus the trend is increasing.

3.9 Murang'a Population

According to the household population census of 2009, the population in the district stood at 387,969 persons, the population in the county has grown at the rate of 0.8% per annum. It is expected that the population would grow to 444,365 persons by the mid plan period and will be 451,532 persons by the end of the plan period. Based on the 2011 population projections, the district has a total population of 437,311 persons. Murang'a County has the highest population density of 628 persons per square km. This is projected to reach 357 persons per sq km by the end of the plan period [2014].

CHAPTER FOUR: PROJECT DESIGN AND CONSTRUCTION

4.1 Nature of the Project

The proposed project involves the installation of ASTs, tanker offloading points, white oil loading gantry, cylinder filling points, LPG cylinders offloading zone, a segregated drainage system for the management of storm water and potentially contaminated wastewater, fire fighting facilities, approved piping and pumping systems.

4.2 Project Design

The proposed project will involve construction and operation of the following: -

- 3 No. LPG bullets of storage capacity 100 tons each
- LPG filing points with electronic scale complete with automatic maximum fill level protection
- A heat shrinking machine
- A road tanker loading /offloading point
- A decant system

- Installation of a power backup generator
- Installation of pipe and pumping systems
- Installation of fire fighting systems

4.2.1 Pumps

These will be two CorKen model C13SM pumping units complete with 2.2Kw, 240v, 50 Hz explosive proof motor on steel base plate.

4.2.2 Fire fighting System

This will be containerized fire fighting unit comprising:

- A fire pump
- A diesel engine driven
- Associated systems i.e. starting system, engine cooling system, engine silencer, fuel tank, fire pump controller and a remote panel.
- A 200,000 litre fire water storage tank with connected water network and fire fighting nozzles

4.3 Project activities

The proposed project activities can be divided in two main phases;

4.3.1 Construction phase

1. Construction and installation of the facility facilities, driveways and parking lots including an office.
2. The budget estimates for executing the project is provided in Appendix I.

4.3.2 Operational phase

Upon commissioning, the facility will involve the following operations:

- Receipt of products brought in by road and transfer into the Above ground Storage Tanks (AST)
- Transfer of the LPG to cylinders at the LPG filling station.
- Receipt, inspection of LPG cylinders brought in from distribution outlets for refilling Cylinder-filling with LPG (35kg, 25kg, 13kg and 6kg).
- Storage of empty and filled LPG cylinders
- Loading of filled and offloading of empty LPG cylinders into/from distribution trucks.

i) Design

The design layout of the facility is as in (**Annexed II**)

ii) Cylinder filling plant

Upon inspection, empty cylinders will be taken for filling in the LPG filing stations at the filling plant. The filling station will have two electronic scales with automatic fill level protection. The plant will be equipped with a decanting system to decant product from any faulty or overfilled cylinders.

The filling plant is designed to have high capacity with minimum number of operators. All machines and supporting systems for the above LPG facilities will be supplied as complete units and therefore installation, testing and commissioning will be as per the manufacturer specifications.

Empty and filled cylinders will be stored in pallets in the open yard to ensure proper ventilation and minimization of possibility of forming explosive vapours in case of leaks. Safe distances have been incorporated in the yard layout design.

iii) Forecourt and gantry (loading) point

The facility will be developed on approx. 3acre piece of land. The area will be paved and tank farm will be concreted.

iv) Product piping

The product piping will be underground and extends from the storage tanks to the pumps. Also, water for fire fighting will be connected through pipes.

v) Electrical systems

The facility will utilize electricity for its operations and lighting supplied from the mains by the Kenya power company. The electrical systems will be installed to the required standards.

vi) Office and storage building

The office block and store will be constructed within the facility to accommodate all services at the facility. There will be separate rooms for store, rest room as well as changing room for staff. The facility will have toilets separated and designated for ladies and gentlemen.

vii) Others

Other associated facilities include a, a fire water tank, a fire fighting system, a diesel driven fire engine, a standby generator, parking bays, and driveways infrastructure.

4.4 Material, products and by-products and disposal

This project is designed for handling compressed LPG. The products will be received in road tankers and transferred directly to the tanks and subsequent distribution to consumers

4.4.1 Construction Phase

The materials that will be required during construction will include: stones, concrete building blocks, concrete paving blocks, ballast, sand, roofing tiles, cement, gravel, paving tiles, construction timber, paint, thinners, plumbing pipes and plastics.

The wastes generated during this phase will include excavation materials (top soil), paint and thinner containers, wood, cement bags, paper and plastic packaging materials, metallic wastes, inert building and materials.

All the solid wastes will be disposed of appropriately. Excavation materials will be dumped at a licensed dumping site and all records will be kept.

4.4.2 Operational phase

LPG will be the main product handled at the facility during the operational phase of the project. Loses of products into the environment constitutes a major hazard for this project and strict measures in facility design and operation has been taken to ensure no or minimum release into the environment.

The facility will have bathroom facilities connected to the sewer system. During maintenance any wastes generated (mainly used lube oil and metallic wastes) will be handled appropriately. Recycling will be encouraged as much as possible for the entire project cycle.

4.4.3 Decommissioning phase

Scrap metal, inert building materials and paint waste will be the main product at decommissioning stage and this will be handled appropriately after being tested for any environmentally hazardous element.

CHAPTER FIVE: ANALYSIS OF PROJECT ALTERNATIVES AND PUBLIC CONSULTATION

During the course of formulating the proposed project, several project alternatives were considered to ensure that the best option of project development was adopted. The consideration of alternatives is one of the more proactive approaches of environmental assessment. This process serves to enhance the project design through an examination of other feasible options instead of only focusing on the more defensive task of reducing adverse impacts of a single design. The project alternatives considered include:

5.1 Project relocation alternative

Relocation is one of the alternatives for this project. In this case, the proponent will have to move the project to another site instead of implementing it on the proposed site. This is not however be a feasible option considering that:

- ✓ At the moment, the proponent has no alternative sites for relocation.
- ✓ Finding and acquiring land to accommodate the scale, type and size of the project and completing official transaction may take longer and delay the project.
- ✓ Even if the land was to be obtained, there is no guarantee that such land would be suitable in terms of environmental, health and safety requirements; accessibility and zoning based on land use.

5.2 The No action alternative

The other best alternative to address the significant impacts is the No action alternative. This alternative will ensure that things remain unchanged. The environment therefore will not be tampered with. This option is not feasible too. This is due to:

- ✓ It results in losses to the project proponent and other stakeholders, society and the Government.
- ✓ The proponent will continue to pay high taxes/land rate on the underutilized property.
- ✓ Lack of the facility results to forfeiture of economic benefits that would accrue to the proponent, the public and the government, and it could also discourage investors wishing to invest in the sector.
- ✓ Lack of creation of employment, hence, effect on socio-economic empowerment of the society.

5.3 Alternative design and technology

The proponent would also have opted to adopt alternative design and technology. This option too is not feasible since the adopted technology in this project is a brain child of various professionals including architect, engineers, and surveyors and environmental consultants who have vast experience in the LPG

and oil industry regulations and standards both local and international and they settled for the best as a way of fostering best practice within the industry.

From the analysis, it becomes apparent that all the available alternatives are not viable hence inappropriate for this project.

5.4 PUBLIC CONSULTATION

One of the key information sources used during the Environmental Impact Assessment exercise was public participation exercise. Positive and negative views of the project site neighbours were sought on October, 2017 during the project report and January 2018 for the study report

The purpose for such interviews was to identify the positive and negative impacts and subsequently promote and mitigate them respectively. It also helped in identifying any other miscellaneous issues which may bring conflicts in case project implementation proceeds as planned.

Most of the neighbours were happy about the project as it will modernize the location, create employment, among others. The consultations done are as annexed in the report.

CHAPTER SIX: POTENTIAL ENVIRONMENTAL IMPACTS

6.1 Introduction

This part points out the identified environmental impacts during implementation of the project that is, construction, operation and decommissioning. The development of the proposed project will change both the biophysical and the socio-economic, salient and environmental features of the project area. During the implementation, potential positive and negative environmental impacts are expected to arise from the construction and operation phases.

6.2 Potential Positive Impacts

The positive impacts of the proposed development are expected to include creation of employment and generation of income and revenue for the proponent. The other benefits are as outlined in the below:

I. Reliable supply LPG/Reduction of Reliance on Wood Fuel and Charcoal

LPG supply is currently not meeting the high demand, this has resulted in price fluctuation, therefore, the proposed project will result in stabilized prices. Also, there is increased demand for clean fuel in Kenya. This will lead to steady and competitive supply of LPG hence, reduce reliance on wood fuel and Charcoal thus protecting our environment from degradation and deforestation.

II. Creation of Employment

The proposed facility will create employment opportunities. This will embrace both permanent and temporary staffing. This will be during site preparation which will include vegetation removal, top soil stripping, site planning, access road development within the facility and construction and installation of the tanks and other facilities. Besides the direct employment by the proposed development, other forms of employment are likely to result from the spillover effects, through indirect services during the construction and operation phases. The employment opportunities will generate income and improve the living standards of the local population and its environs. Distributors of petroleum products will get regular supply.

III. Contribution to Government Revenue

There shall be increased government revenue collection through payment of VAT and other levies charged on equipment and products. The development and running of the proposed facility shall result in payment of the necessary license fees and levies by the proponent to the different government agencies.

IV. Trade

Due to the increased demand for LP Gas in Kenya, there will be increased trade in the commodities.

6.3 Potential negative impact

6.3.1 Potential impacts during construction phase

i) Environment

1. Impact to soil (soil erosion and degradation) which is as a result of excavation and earthworks.
2. Increased solid and liquid waste generation.
3. Effects of the construction and maintenance activities to human environment
4. Clearing of existing vegetation on the site area
5. Terrestrial habitat alteration and disruption
6. Construction activities of the proposed facility structures and other activities associated with civil works:
   - Water demand for construction personnel & activities
   - Site Construction Waste Generation
   - Dust Emission
   - Noise from construction machinery

ii) Health and safety

1. Accident risks due to increased activities
2. Dust and exhausts from the machinery involved during the construction phase will lead to increased levels of noxious gases such as SOx, COx, and NOx.
3. Risk of new HIV and Aids infection due to movement of construction workers exposing them to new situations, meeting new people and hence increased risk of acquiring HIV and other sexually transmitted diseases

iii) Social

1. Constraint/pressure to the existing infrastructure including space, water, power, surface drains and roads.
2. Increase in population and therefore pressure on social amenities.

6.3.2 Operation phase

i) Environment

1. Increased storm water/ run off resulting from the roof catchments and decreased recharge areas, after pavement of most areas i.e. drive ways.
2. Contamination of land; due to equipment and machinery oil spills and leakages
3. Air pollution from fugitive gas leaks.

ii) Health and safety

1. Fire risks
2. Compromised health and safety of workers and facility neighbours due to accidents, pollution and disturbance.

iii) Social

1. Increased solid and liquid waste generation.
2. Pressure on social amenities

6.3.3 Decommissioning phase

- Increased solid waste generation.
- Dust and exhausts from the machinery involved during the construction phase will lead to increased levels of noxious gases such as SOx, COx, and NOx.

6.4 Significant impacts on the proposed construction site

- ✓ Soil erosion especially during construction
- ✓ Air pollution
- ✓ Solid waste management
- ✓ Release of petroleum into atmosphere during operation phase
- ✓ Fire risk
- ✓ Oil spillage

- ✓ Effluent discharge
- ✓ Problem of water utilization
- ✓ Noise pollution
- ✓ Accidents
- ✓ Increased traffic
- ✓ Pressure on social amenities

CHAPTER SEVEN: PROPOSED MITIGATION MEASURES

7.1 Mitigations

To reduce the occurrence likelihood and minimize the effect of the negative impacts, mitigation measures have been proposed against each of the anticipated impact. Some measures have been integrated in the project designs with a view of ensuring compliance with applicable environmental laws and guidelines. These mitigation measures include the following:

7.1.1 Construction phase

The contractor will barricade the site in accordance to the County by-laws and erection appropriate warning/ informative signs (bill boards) at the site. The contractor will also provide appropriate traffic control along the access to the site.

Compaction and watering of loose soils on all unpaved access areas will be done to minimize air pollution and erosion by the agents of soil erosion including water and wind.

Workers on site will be provided with appropriate personal protective equipment (PPE) and encouraged to use during operations. The same workers will be continuously reminded of Environmental, Health and Safety best practice during their tool box meeting. The contractor will maintain on site a well stocked first aid box and at least one trained first aider during operation hours.

Sewerage system will be properly designed (using approved materials), installed and effectively drained. Surface drainage system will be made in a way that will direct all potentially contaminated surface waters from the site into an oil/water interceptor.

The contractor will also put in place effective and efficient solid waste disposal systems. In this case, solid waste will include excavated soil and debris, which will be properly disposed off by backfilling or dumping in grounds approved by the County.

Upon completion of the construction, measures will be undertaken to restore the affected biodiversity through landscaping; i.e. planting of trees and grasses to cover unpaved areas. The contractor and the

proponent will implement the proposed mitigation and monitoring plan in order to protect the environment from any negative impacts.

7.1.2 Operation phase

The proponent will put in place formal operation procedures which guarantee high operating standards in the areas of environmental, health and safety management. The proponent will also ensure that prior to engaging or assigning anybody any task within the plant, the individual undergoes full induction training on the operating standards developed for the plant. This measure will guarantee safe operations.

The proponent will provide personal protective equipment to all employees based on the PPE evaluation. In addition, a continuous awareness creation for employees by the proponent on health and safety matters.

The proponent will develop and implement a sound emergency response plan. This will commence with a complete fire safety system that is adequate for the envisaged worst case scenario.

Procedures for utilities to be developed so as to optimize on their use. The staff will be encouraged to turn off unnecessary lights and not to leave water taps running.

Workers be provided with appropriate personal protective equipment (PPE) and encouraged to use them during operations.

A complete fire fighting system will be provided after completion of the project. The equipment should be clearly indicated in the design plan, and in the report. This will be installed or provided at strategic points. The fire extinguishers will be serviced accordingly i.e. after every six months to ensure effective and efficient performance when required.

Emergency shut downs (ESDs) will be installed in strategically locations to enable quick power cut off from all the operations in the case of emergency.
An adequately stocked “First Aid Box” will be provided and the facility employees will be properly trained on how to administer first aid.

Sound solid waste management systems and procedures will be implemented. This will involve provision of solid waste collection bins; segregation of waste at source, appointing a reputable garbage collector etc during operation phase.

The drainage and interceptor maintenance will be carried out regularly, including cleaning the interceptors of foliage, rubbish and grit. Sewerage system will be regularly maintained.

The proponent will implement the proposed mitigation and monitoring plan in order to protect the environment from any negative impacts.

7.1.3 Decommissioning phase

Decommissioning refers to the final disposal of the project and associated materials at the expiry of the project life span or when the proponent opts out of petroleum business. During this project, the proponent will be expected to demolish the site and remediate the soil.

During the decommissioning phase, the contractor will put in place effective and efficient waste disposal systems. Waste, including excavated soil and debris will be properly disposed off by backfilling or dumping in grounds approved by the county government.

Capacity building of the workers and staff involved in the decommissioning exercise will be done to create awareness towards potential risks and recommended incident/accident preventive measures. This will ensure safety process.

The proponent in consultation with the NEMA will remediate the resultant soil and the whole site as a whole to the initial status.

During the decommissioning phase, the contractor will put in place effective and efficient waste disposal systems. Waste, including excavated soil and debris will be properly disposed off by backfilling or dumping in grounds approved by county government.

Capacity building of the workers and staff involved in the decommissioning exercise will be done to create awareness towards potential risks and recommended incident/accident preventive measures. This will ensure safety process.

The proponent in consultation with the NEMA will remediate the resultant soil and the whole site as a whole to the initial status.

CHAPTER EIGHT: ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

The environment management plan is important process of ensuring project sustainability and environmental protection. Whereas efforts are usually made to develop mitigation measures for a proposed project, it is during the operation lifespan of the project that actual impacts are noted or experienced.

It is therefore important to integrate in the environmental impact assessment process, an environment management plan that includes the monitoring of the progress of mitigation measures being implemented while also monitoring the project for any new negative impacts that were not earlier considered or anticipated. Refer to Table 8 for the Environmental Management Plan.

8.1 Environmental Management and Monitoring Plan for construction and operation phases

Environmental/ Social Impact	Proposed Mitigation and Aspects for Monitoring	Responsibility	Estimated cost (Kshs.)	Monitoring means (c) = Construction (o) = Occupation	Recommended frequency of Monitoring
Regulatory requirements	• Comply with the Energy Act, 2006, The Energy (Liquefied Petroleum Gas) Regulation, 2009, Scheme of Supervision and Control for Storage and filling of LPG according to KS 1938-4:2005 (Kenyan specifications for the construction, handling, storage and distribution of petroleum products KS 1938 as set out by the Kenya Bureau of Standards (KEBS)	Contractor	50,000 annually	Inspection	Monthly
Changes in hydrology/ impended drainage	• Proper Installation of drainage structures • Ensure efficiency of drainage structures trough proper design and maintenance • Provide gratings to the drainage channels • Regular checks on any sludge along drainage channels • Visual checks of oil interceptor and drainage channels for any leakage	Contractor	70,000	(c) Inspection (o) Routine maintenance	(c) During construction and on Completion of each structure (o) Once a week
Soil erosion	• Control any earthworks • Rehabilitate degraded environment to avoid siltation and wash offs. • Compact loose soils • Landscaping • Ensure management of excavation activities • Control activities especially during rainy conditions • Provide soil erosion control and conservation structures where necessary. • Proper disposal of excavated soil	Contractor/Proponent	250,000	(c) Inspection (o) Routine maintenance	(c) Daily; Erosion control measures: During construction and on completion of each measure (o) Once month during construction (o) Once a month during project lifetime
Air pollution through dust and gaseous emissions	• Prohibit idling of vehicles • Water should be sprayed during the construction phase of excavated areas • Regular maintenance of construction plant and equipment	Contactor	10,000	(c) Inspection/ observation	(c) Daily

Environmental/ Social Impact	Proposed Mitigation and Aspects for Monitoring	Responsibility	Estimated cost (Kshs.)	Monitoring means (c) = Construction (o) = Occupation	Recommended frequency of Monitoring
	• Engage sensitive construction workers. • Proper use of PPE				
Noise pollution	• Maintain plant equipment • Construction activities to be restricted to daytime • Workers in the vicinity of or involved in high-level noise to wear respective safety & protective gear i.e. earplugs & earmuffs • Appropriate selection of machinery	Contractor	10,000 (c)	(c) Inspection/ observation	(c) Random
Oil pollution	• Proper storage, handling and disposal of new oil and used oil and related wastes • Maintain plant and equipment to avoid leaks • Provide oil interceptors along the drains leading from loading area	Contractor	100,000	Inspection	(c) Daily
Water resource	• Management of water usage. • Recycling of water at the construction phase where possible • Use of water conservation signs at the wash rooms and install water conserving taps	Contractor	40,000	(c) Inspection/ observation	Random
Contractors lay down area	• Special attention should be paid to the sanitary facilities on site especially disposal of human waste. • Garbage should be disposed off in accordance with county government requirements	Contractor	55,000	(c) Inspection	Daily
Road safety	• Enforce speed limits for construction vehicles especially along road links leading to the site • Provide bill boards at the site/entrance to notify motorists about the development	Contractor	……..	(c) Observation	(o) Once a month
Public health and occupational safety and health	• Ensure proper solid waste disposal and collection facilities • Ensure effective wastewater management • Proper design of sewerage system	Contractor	100,000	(c) Observation (o) Observation	Weekly for solid waste disposal and once a month for others but annually for training.

Environmental/ Social Impact	Proposed Mitigation and Aspects for Monitoring	Responsibility	Estimated cost (Kshs.)	Monitoring means (c) = Construction (o) = Occupation	Recommended frequency of Monitoring
	• Provide First Aid kits on the site • Sensitize residents/workers on environmental management • Ensure there is no ponding to eliminate breading of mosquitoes during construction • Workers should be trained on occupational health & safety and first Aid administration • Train staff on petroleum product handling • Sensitise workers on HIV and AIDS				
Vegetation	• Landscaping and planting all unpaved areas • Planting flowers / grassing should be done just before the rains or irrigated on dry spells.	Contractor	5,000	(c) Inspection (c) Observation (o) Observation	(c) Daily (o) Weekly
Fire safety training/ Emergency response procedures (ERPs)	• To enhance health and safety preparedness among stakeholders • Ensure equipment is in good working condition. • Put up emergency response contacts • Put up ERP notification instructions • Put up simple instructions on how to handle fires, product spills, LPG incidents, armed robbery and product contaminations	Proponent/ Contractor	50,000	(c) Inspection (o) Inspection	Monthly
Record Keeping	• Collection and analysis of relevant environmental data at the site • Data of maintenance of firefighting equipment • Daily product reconciliation (stock loss control) • Staff Training records • Incidents and accidents registers • Weekly inspection records of oil water interceptor and drainage systems	Proponent/contr act or	50,000	(c) Inspection (o) Inspection	(c) Weekly (o) Daily
Internal Audits	• Monitoring will involve measurements, observations, evaluations, assessment of changes in water quality, waste management, Noise levels, contractor safety	Proponent/ contractor	50,000	(o) Inspection	(o) Random

Environmental/ Social Impact	Proposed Mitigation and Aspects for Monitoring	Responsibility	Estimated cost (Kshs.)	Monitoring means (c) = Construction (o) = Occupation	Recommended frequency of Monitoring
	etc				
Fire outbreak	• Install fire-fighting equipment as provided by OSH Act. • Sensitize the residents on fire risks i.e. conduct regular fire drills • Adapt effective emergency response plans • Provide emergency numbers at strategic points	Contractor	1,000,000	C) Observation O) Observation	(c) On completion time O) Random
Water Quality/Waste Management	• Follow NEMA regulations. Ensure registration of contracted garbage handlers with NEMA for compliance with the prevailing regulations	Proponent /contractor	100,000 per annum	Inspection	Random
Security	• Provide security guards and facilities during construction period • Security guards should always be available to alleviate cases of robbery.	Contractor	50,000 per month	Observation	Daily

8.2 Environmental Management/Monitoring plan for the decommissioning phase

Expected Negative Impacts	Recommended mitigation measures	Responsibility Party	Time Frame	Cost (Kshs.)
1. Construction machinery/structures & waste				
Scraps and other debris on site	• Use of an integrated solid waste management system i.e. through a hierarchy of options: • Wastes generated as a result of facility decommissioning activities will be characterized in compliance with standard waste management procedures. The contractor based on the properties of the particular waste stream will select disposal locations.	Project Manager & Contractor	One-off	10,000
	• All buildings, machinery, equipment, structures and tools that will not be used for other purposes should be removed and recycled/ reused say in other projects	Project Manager & Contractor	One-off	0
	• Where recycling/reuse of the machinery, equipment, implements, structures, tools and other waste is not possible, the materials should be taken to an approved dumpsite.	Project Manager & Contractor	One-off	0
2. Rehabilitation of project site				
• Vegetation disturbance • Land deformation: soil erosion, drainage problems	• Implement an appropriate re-vegetation programme to restore the site to its original status • During the re-vegetation period, appropriate surface water runoff controls will be taken to prevent surface erosion; • Monitoring and inspection of the area for indications of erosion will be conducted and appropriate measures taken to correct any occurrences; • Fencing and signs restricting access will be posted to minimize disturbance to newly-vegetated areas;	Project Manager & Contractor	One-off	10,000
	• Comprehensive Landscaping	Project Manager & Contractor	One-off	20,000
3. Safety of the project				
• Occupational hazards	• Ensure that safety measures have been effectively integrated and positioned in respective areas of the project to control and manage fire outbreaks • Staircases and other hazardous areas shall be suitably protected say	Project Manager & proponent	One- off	o

	using strong rails to avoid occurrence of incidences			
4. Safety and Social Economic impacts				
• Loss of income • Reduced ability to support dependants • Loss of quality of life • Loss of benefits i.e. medical, insurance cover etc	• The safety of the workers should surpass as a priority of all other objectives in the decommissioning project • Adapt a project – completion policy: identifying key issues to be considered. • Assist with re-employment and job seeking of the involved workforce. • Compensate and suitably recommend the workers to help in seeking opportunities elsewhere. • Offer advice and counseling on issues such as financial matters.	Project manager & contractor	N/A	N/A

CHAPTER NINE: CONCLUSION

In this EIA Study, the requirement of the terms of reference have been addressed through literature review, field study, description of baseline information, impact assessment, mitigation measures and monitoring plan. The information obtained adequately describes the salient ecological and socio-economic features of the Project area and the impacts of the proposed project.

Considering the proposed location, construction, management and mitigation measures that have been proposed to be put in place and the project's contribution in the provision of LPG, employment creation and its socio-economic benefits, the project`s benefits outweighs the identified negative impacts. That notwithstanding, all the identified negative Environmental Impacts have been adequately addressed by the proposed mitigation measures through the recommended Environmental Management and Monitoring plan.

The proponent is however reminded to embrace current maintenance systems including schedules and procedures upon completion of the facility, closely monitor the plant`s environmental interaction through annual Environmental self-Audits and reporting to NEMA the findings of environmental performance. In cases where the indicators vary from the expected/ recommended, immediate remediation measures should be considered.

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APPENDICES

Appendix 1: Terms of Reference

Appendix 2: Land ownership documents

Appendix 3: Design drawings

Appendix 6: Expert license

Appendix 7: Public participation questionnaire and minutes