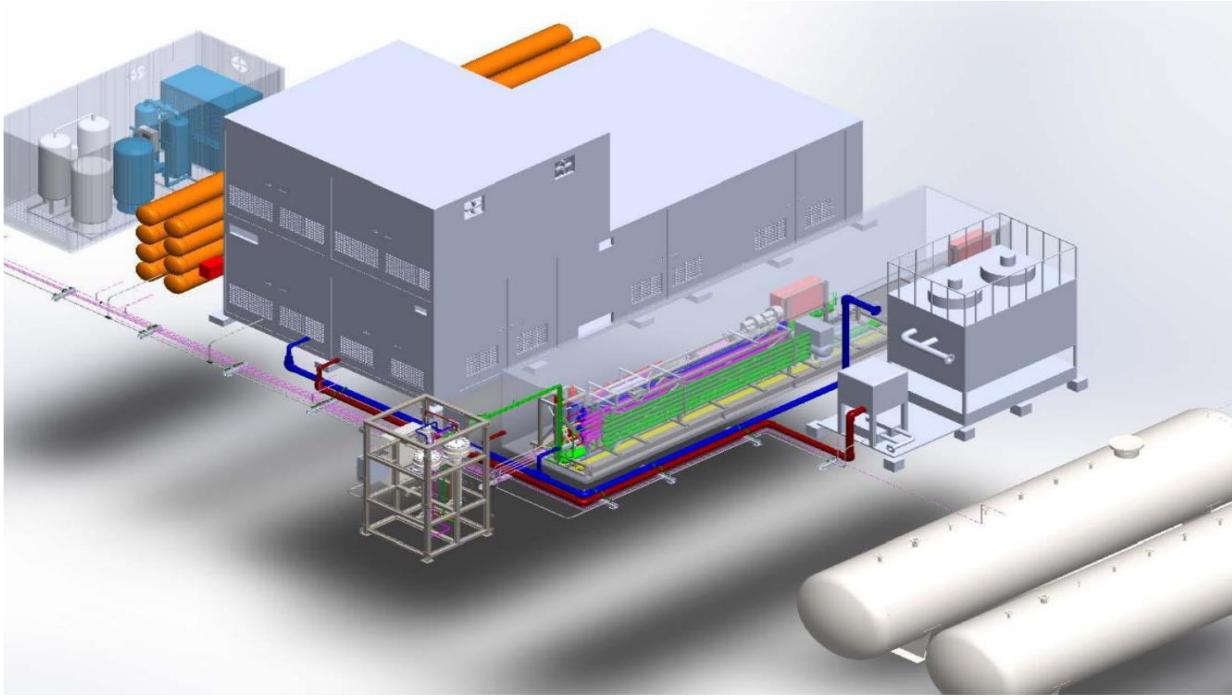


# ENVIRONMENTAL IMPACT ASSESSMENT STUDY REPORT 2022

## THE PROPOSED GREEN ANHYDROUS AMMOMINA FACTORY AT KENYA NUT COMPANY

PROPONENT: TALUSAG KENYA LTD IN PARTNERSHIP WITH KENYA  
NUT COMPANY



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## ACRONYMS

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<b>°C</b>	Degrees Celsius
<b>Bgl</b>	Below Ground Level
<b>B.O.D</b>	Biochemical Oxygen Demand
<b>COD</b>	Chemical Oxygen Demand
<b>EIA</b>	Environmental Impact Assessment
<b>EMCA</b>	Environmental Management Coordination Act
<b>EMP</b>	Environmental Management Plan
<b>Ft</b>	Feet
<b>GSK</b>	Groundwater Survey (K) Limited
<b>Ha</b>	Hectare
<b>IEA</b>	Initial Environmental Audit
<b>IMCE</b>	Inter-Ministerial Committee on Environment
<b>KM</b>	Kilometres
<b>KVA</b>	Kilo Volts Amperes
<b>KWS</b>	Kenya Wildlife Services
<b>LPG</b>	Liquefied Petroleum Gas
<b>NEC</b>	National Environment Council
<b>NEAP</b>	National Environment Action Plan
<b>NEMA</b>	National Environment Management Authority
<b>NGOs</b>	Non Governmental Organizations
<b>NPEP</b>	National Poverty Eradication Plan
<b>PEC</b>	Poverty Eradication Commission
<b>PPE</b>	Personal Protective Equipment
<b>TOR</b>	Terms of Reference
<b>TSS</b>	Total Suspended Solids
<b>V</b>	Volts
<b>WRMA</b>	Water Resources Management Authority
<b>WSSD</b>	World Summit for the Social Development

# TABLE OF CONTENTS

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<b>ACRONYMS.....</b>	<b>3</b>
<b>TABLE OF CONTENTS .....</b>	<b>4</b>
<b>EXECUTIVE SUMMARY .....</b>	<b>8</b>
INTRODUCTION .....	10
1.1 BACKGROUND.....	10
1.2.1 Scope.....	11
1.2.2 Terms of Reference (TOR) for the EIA Process .....	11
1.2.3 Data Collection Procedures .....	14
1.2.4 EIA Organization and Structure .....	14
1.2.5 Reporting and Documentation .....	14
1.2.6 Responsibilities and Undertaking .....	14
The output from the consultants includes the following: .....	15
1.2.7 Methodology Outline .....	15
1.2.7.1 Environmental Screening.....	16
1.2.7.3 Environmental Scoping.....	16
1.2.7.4 Desktop Study.....	16
1.2.7.5 Site Assessment .....	16
1.2.7.7 Reporting .....	16
<b>2 DESCRIPTION OF THE PROJECT.....</b>	<b>17</b>
2.1 INTRODUCTION: OVERVIEW FERTILIZER.....	17
2.3 : THE TALUSAG PROJECT DESIGN.....	29
2.2.1.1 Construction.....	32
2.2.1.2 Infrastructure .....	32
2.2.1.3 Security .....	32
2.2.1.4 Management .....	32
2.2.3 Infrastructure.....	33
2.2.3.1 Electrical.....	33
2.2.3.2 Water .....	33
2.2.3.3 Waste / Sewerage.....	33
2.2.3.4 Storm water run-off .....	33
2.2.4 Estimated Project Investment Cost .....	33
<b>3 BASELINE INFORMATION OF THE STUDY AREA.....</b>	<b>33</b>
3.1 LOCATION OF THE PROJECT .....	33
3.2 ALTITUDE AND TEMPERATURE .....	34
3.3 RAINFALL .....	34
3.4 GEOLOGY OF THE STUDY AREA.....	35
T IN THE OLS BETWEEN THE BOTTOM OF THE THIN PHONOLITE LAYER AND THE UNDERLYING BASEMENT. 35	35
3.5 SOIL TYPES AND AGRO-ECOLOGICAL USE.....	35
3.6 VEGETATION RESOURCES .....	36
3.7 FAUNA.....	37
3.8 WATER RESOURCES AND QUALITY.....	37
3.9 INFRASTRUCTURE .....	39
3.10 POPULATION SIZE AND DENSITY.....	<b>ERROR! BOOKMARK NOT DEFINED.</b>

3.11 ECONOMIC ACTIVITIES .....	39
3.12 ENVIRONMENTAL CHALLENGES IN THE STUDY AREA .....	39
<b>4 LEGISLATIVE AND REGULATORY FRAMEWORKS .....</b>	<b>39</b>
4.1 INTRODUCTION .....	39
4.2 ENVIRONMENTAL PROBLEMS IN KENYA .....	40
4.3 ENVIRONMENTAL POLICY FRAMEWORK .....	41
ENVIRONMENTAL IMPT.....	41
4.4 INSTITUTIONAL FRAMEWORK .....	41
4.4.1 <i>National Environmental Management Authority (NEMA)</i> .....	41
4.4.1.1 Provincial and District Environment Committees.....	44
4.4.1.1.1 District Environment Committee .....	44
4.4.1.1.2 Provincial Environment Committee .....	44
4.4.1.2 Public Complaints Committee .....	44
4.4.1.3 National Environment Action Plan Committee .....	45
4.4.1.4 Standards and Enforcement Review Committee.....	46
4.4.1.5 National Environmental Tribunal .....	47
4.4.2 <i>National Environmental Council (NEC)</i> .....	47
4.4.3 <i>National Environmental Action Plan (NEAP)</i> .....	47
4.4.5 <i>The World Commission on Environment and Development (The Brundtland Commission of 1987)</i> ..	48
4.4. ....	<b>Error! Bookmark not defined.</b>
4.4.7 <i>The National Poverty Eradication Plan (NPEP)</i> .....	48
4.4.8 <i>The Ramsar Convention</i> .....	49
4.5 ENVIRONMENTAL LEGAL FRAMEWORK .....	50
4.5.1 <i>Public Health Act (Cap. 242)</i> .....	50
4.5.2 <i>Local Authority Act (Cap. 265)</i> .....	52
4.5.3 <i>Physical Planning Act, 1999</i> .....	53
4.5.4 <i>Land Planning Act (Cap. 303)</i> .....	53
4.5.5 <i>Water Act, 2002</i> .....	54
4.5.6 <i>Electricity Power Act No. 11 of 1997</i> .....	55
4.5.7 <i>Building Code 2000</i> .....	56
4.5.8 <i>Penal Code Act (Cap.63)</i> .....	56
4.5.9 <i>Factories and Other Places of Work Act (Cap 514)</i> .....	57
4.5.9.1 Health .....	57
4.5.9.2 Safety .....	57
4.5.9.3 Welfare .....	58
4.5.10 <i>The Forest Act CAP 385</i> .....	59
4.5.11 <i>Food Drugs and chemicals substances Act (Cap 254)</i> .....	59
4.5.12 <i>the Petroleum Act, Cap 116</i> .....	59
<b>6 IDENTIFICATION OF THE PROPOSED PROJECT ENVIRONMENTAL IMPACTS ...</b>	<b>60</b>
6.1 CONSTRUCTION PHASE .....	3
6.1.1 <i>Positive Impacts</i> .....	3
6.1.1.1 Job Opportunities.....	3
6.1.1.2 Gains in the Local and National Economy.....	3
6.1.1.3 Roads .....	4
6.1.1.4 Land value .....	4
6.1.1.5 Improved livelihood.....	4
6.1.1.7 Provision of cheap eco-friendly fertilizer .....	4
6.1.2 <i>Anticipated Negative Impacts</i> .....	4
6.1.2.1 Soil Erosion .....	4
6.1.2.2 Storm water.....	5

6.1.2.3 Noise pollution .....	5
6.1.2.4 Disposal of Excavated Soil .....	5
6.1.2.5 Oil Spills .....	5
6.1.2.6 Increased water demand.....	6
6.1.2.7Dust Emissions .....	6
6.1.2.8 Faecal Waste Management .....	6
6.1.2.9 surface water pollution.....	6
6.1.2.10Destruction of existing vegetation .....	6
6.1.2.11 Generation of Exhaust Emissions .....	6
6.1.2.12 Increased Runoff from New Impervious Areas .....	7
6.1.2.13 Surface and ground water Hydrology and Water Quality Degradation.....	7
6.1.2.14 Aquatic species and communities .....	7
6.1.2.15 Workers accidents and hazards during construction .....	8
6.1.2.16 Vector borne and water borne Disease incidence .....	8
6.1.2.17 Possible exposure to workers to diseases.....	8
6.1.2.18 Solid Waste Generation .....	8
6.1.2.19 Loss of plant species and communities.....	9
6.1.2.20 Loss of Wildlife and Wildlife Habitat.....	9
6.1.2.22 Energy Consumption .....	9
6.2 OPERATION PHASE.....	9
6.2.1 <i>Impacts</i> .....	<b>Error! Bookmark not defined.</b>
6.2.1.1 <i>Employment Generation</i> .....	9
6.2.1.2 Increase in Revenue.....	9
6.3 DECOMMISSIONING PHASE .....	11
6.3.1 <i>Impacts</i> .....	11
6.3.1.1 Rehabilitation.....	11
6.3.1.2 Employment Opportunities.....	11
6.3.2 <i>Negative Impacts</i> .....	11
6.3.2.1 Solid Waste.....	11
6.3.2.2. Dust.....	12
6.3.2.3 Noise and Vibration .....	<b>Error! Bookmark not defined.</b>
<b>7 MITIGATION MEASURES AND MONITORING PROGRAMMES .....</b>	<b>12</b>
7.1 MITIGATION OF RELATED IMPACTS .....	12
7.1.1 <i>Air quality</i> .....	12
7.1.2 <i>Noise Pollution</i> .....	13
7.1.3 <i>Generation of Exhaust Emission</i> .....	14
7.1.4 <i>Hydrology and Water Quality Degradation</i> .....	14
7.1.5 <i>Worker accidents and hazards when handling hazardous wastes</i> .....	15
7.1.6 <i>Populations of disease vectors</i> .....	15
7.1.8 <i>Increased runoff</i> .....	15
7.1.9 <i>Possible exposure of workers to diseases</i> .....	15
7.1.10 <i>Worker accidents during construction and shall be mitigated by enforcing adherence to safety procedures and preparing contingency plan for accident response in addition safety education and training shall be emphasized.</i> .....	16
7.1.11 <i>Minimization of Vegetation Disturbance</i> .....	16
7.1.13 <i>Minimization of Run-off and Soil Erosion</i> .....	16
7.1.14 <i>Minimization of Noise and Vibration</i> .....	16
7.1.15 <i>Reduction of Energy Consumption</i> .....	17
7.1.16 <i>Minimization of Water Use</i> .....	17
THE PROPONENT SHALL ENSURE THAT WATER IS USED EFFICIENTLY AT THE SITE BY SENSITIZING STAFF TO AVOID IRRESPONSIBLE WATER .....	17
7.3 MITIGATION ON CHEMICAL SAFTEY .....	17

➤ PERSONAL PROTECTION.....	17
➤ FIRST AID.....	17
CARE AND MAINTENANCE OF ANHYDROUS AMMONIA EQUIPMENT .....	18
LABELS, MARKING AND SAFETY SIGNS LEGAL REQUIREMENTS.....	19
ADDITIONAL SAFETY RECOMMENDATIONS FOR THE TANK.....	20
SAFE FIELD PRACTICES.....	21
ROADWAY TRANSPORT SAFETY .....	22
<b>8 ANALYSIS OF PROJECT ALTERNATIVES .....</b>	<b>23</b>
8.1 RELOCATION OPTION.....	23
8.2 NO PROJECT ALTERNATIVE .....	24
8.3 ANALYSIS OF ALTERNATIVE TECHNOLOGY .....	25
8.4 WASTE WATER MANAGEMENT ALTERNATIVES .....	25
<b>9 ENVIRONMENTAL MANAGEMENT PLAN (EMP) .....</b>	<b>26</b>
9.1 SIGNIFICANCE OF AN EMP.....	26
<b>10 CONCLUSION.....</b>	<b>31</b>
<b>REFERENCES .....</b>	<b>31</b>

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## EXECUTIVE SUMMARY

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Talus AG in partnership with Kenya Nut Company has proposed to put up a containerized fertilizer factory, which will be involved in the manufacture and processing of green anhydrous ammonia. The fertilizer will be used at Kenya Nut Company, to cut down on fertilizers costs. The proposed project will be based in the outskirts of Naivasha town, Nakuru County and specific location is at the Kenya Nut Company farm, the Morendat Farm. The land belongs to the farm. There is a partnership agreement with Talus AG and Kenya Nut Company for the proposed project. The farm is located on LR R3621 along Naivasha – Nakuru Road, in Nakuru County. There is the upper farm, mostly composed of the vineyard and the lower farm, comprising of the livestock rearing grounds and the slaughter house.

Environmental Impact Assessment is a tool for environmental Planning and has been identified as a key component in new project implementation. According to section 58 of the Environmental Management and Coordination Act (EMCA) No.8 of 1999 second schedule 9 (1), and Environmental (Impact Assessment and Audit) regulation, 2003, new projects must undergo Environmental Impact Assessment. The Report of the same must be submitted to National Environment Authority (NEMA) for approval and issuance of relevant certificates. This was necessary as many forms of developmental activities cause damage to the environment and hence the greatest challenge today is to maintain sustainable development without interfering with the environment.



**EXPERT CERTIFICATION**

This Environmental Audit Report was prepared in accordance with the Environment Management and Coordination Act, 1999, the Environmental (Impact Assessment and Audit) Regulations, 2003 and the Environmental (Impact Assessment and Audit (Amendment) Regulations 2003 (Amended in 2009), for submission to the National Environmental Management Authority (NEMA).

I certify that this report contains fair disclosure from the Proponent and the recommendations to be undertaken by the Proponent.

Mr. HENRY MAKOBA SUMBA.

Lead Expert Registration No.0548

SIGNATURE: \_\_\_\_\_

**PROPONENT CERTIFICATION**

On behalf of the TalusAg Ltd and Kenya Nut Company Limited, I confirm that all information contained in this report is accurate and truthful representation of all findings as relating to the proposed project.

NAME: \_\_\_\_\_ DESIGNATION:

SIGNATURE: \_\_\_\_\_

DATE/STUMP: \_\_\_\_\_

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## INTRODUCTION

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### 1.1 Background

TalusAg Kenya Ltd has a partnership with Kenya Nut Company, TalusAg proposes to develop a containerized factory comprising of 4 containers and 3 tanks to be used in the manufacture and processing of green anhydrous ammonia. The fertilizer will be used for farming operations at Kenya Nut Company. This will be pilot phase of the proposed project. Green anhydrous ammonia is eco-friendly, whereby all its energy supply will be from solar energy ,anhydrous ammonia has a high nitrogen value as compared to other nitrogenous fertilizers.

The land belongs to Kenya Nut Company and it is located in Naivasha town, specifically of the Nairobi-Nakuru Highway. The neighbouring community next to the project is the large scale farms, namely the flower farms and livestock rearing farms. The general public/ population is far away from the proposed project, about 11 km from the proposed site.

Kenya Nut Company Limited –Morendat Farm is a farm where livestock is reared and thereafter slaughtered at the abattoir, and the meat processed and sold within the Country, the farm is also involved in grapes growing; the grapes are harvested and ferried to the winery where they are processed into wine. The farm is located on LR R3621 along Naivasha – Nakuru Road, in Nakuru County. There is the upper farm, mostly composed of the vineyard and the lower farm, comprising of the livestock rearing grounds and the slaughter house.

Due to its many farming operations which take in a lot of costly fertilizers, the company found it prudent to be in partnership with TalusAg to be involved in the processing of anhydrous ammonia for farm use.

### **1.2.1 Scope**

The Kenya Government policy on all new project, programmes or activities requires that an environmental impact assessment is carried out at the planning stages of the proposed undertaking to ensure that significant impacts on the environment are taken into consideration during the design, construction, operation and decommissioning of the facility.

The scope of this Environmental Impact Assessment, therefore, covered:

- The baseline environmental conditions of the area,
- Description of the proposed project,
- Provisions of the relevant environmental laws,
- Identification and discuss of any adverse impacts to the environment anticipated from the proposed project,
- Appropriate mitigation measures,
- Provision of an environmental management plan outline.

### **1.2.2 Terms of Reference (TOR) for the EIA Process**

It was recognised that any form of development such as this fertilizer factory is likely to impact the site and the surrounding environment hence, before any commencement of any work, there was an urgent need to carry out a full Environmental Impact Assessment study in compliance with the Environmental Management and Coordination Act (EMCA) of 1999 and Environmental Impact Assessment/Audit Regulations 2003.

The Environmental Impact Assessment study included the necessary specialist studies to determine the environmental impacts relating to the biophysical and socio-economic aspects and to determine the issues or concerns from the relevant authorities and interested and/or affected parties. The appropriate measures to ensure co-existence of the

proposed development with other social and economic activities in the area are provided as part of Environmental Management Action Plan.

The main objective of the assignment was to assist the TALUS AG and KENYA NUT COMPANY to prepare a study report after carrying out an Environmental Impact Assessment (EIA) of green anhydrous ammonia to ensure the proposed facility takes into consideration appropriate measures to mitigate any adverse impacts to the environment. The study identified existing and potential environmental impacts and possible concerns that interested and/or affected parties have with the development, as well as the associated prevention and mitigation measures for the negative impacts as stipulated in the environmental Management Plan (EMP) proposed.

The consultant on behalf of the proponent conducted the study by incorporating but not limited to the following terms of reference:

- The proposed location of the proposed facility
- A concise description of the national environmental legislative and regulatory framework, baseline information, and any other relevant information related to the project.
- The objectives of the project.
- The technology, procedures and processes to be used, in the implementation of the project.
- The materials to be used in the construction and implementation of the project.
- The products, by-products and waste to be generated by the project.
- A description of the potentially affected environment.

- The environmental effects of the project including the social and cultural effects and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated.
- To recommend a specific environmentally sound and affordable wastewater management system.
- Provide alternative technologies and processes available and reasons for preferring the chosen technology and processes.
- Analysis of alternatives including project site, design and technologies.
- An environmental management plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment, including the cost, timeframe and responsibility to implement the measures.
- Provide an action plan for the prevention and management of the foreseeable accidents and hazardous activities in the cause of carrying out development activities.
- Propose measures to prevent health hazards and to ensure security in the working environment for the employees, residents and for the management in case of emergencies.
- An identification of gaps in knowledge and uncertainties which were encountered in compiling the information.
- An economic and social analysis of the project.
- Such other matters as the Authority may require.

### **1.2.3 Data Collection Procedures**

First, the Consultancy undertook environmental screening and scoping to avoid unnecessary data. The data collection was carried out through questionnaires/standard interview schedules, use of checklists, observations and photography, site visits, desktop environmental studies and scientific tests, where necessary in the manner specified in Part V (section 31-41) of the Environmental (Impact Assessment and Audit) Regulations, 2003.

### **1.2.4 EIA Organization and Structure**

The EIA was carried out to full completion within a period of twenty one (21) days from the date of undertaking. This delay from the anticipated 14 days was due to delayed project documents. The Consultant (Lead Expert) coordinated the day-to-day functions and any related institutional support matters.

### **1.2.5 Reporting and Documentation**

The Environmental Impacts Assessment Study Report from the findings was compiled in accordance with the guidelines issued by NEMA for such works and was prepared and submitted by the proponent for consideration and approval. The Consultant ensured constant briefing of the client during the exercise. Description plans and sketches showing various activities are part of the Appendices.

### **1.2.6 Responsibilities and Undertaking**

The Consultant undertook to meet all logistical costs relating to the assignment, including those of production of the report and any other relevant material. The proponent also provided site plan(s) showing roads, service lines, buildings layout and the actual sizes of

the sites, details of raw materials, proposed process outline and anticipated by-products, future development plans, operation permits and conditions, land-ownership documents and site history, and estimated investment costs.

The output from the consultants includes the following:

- An Environmental Impact Assessment report comprising of an executive summary, study approach, baseline conditions, anticipated impacts and proposed mitigation measures,
- An Environmental Management Plan outline which also forms part of the report recommendations.

### **1.2.7 Methodology Outline**

Since the proposed site is located within Kenya Nut Company, with no rich natural resources whose total effect to the surroundings could not be adverse and noting that the intended development and use of the facility will be in line with what exists in the surrounding areas, an environmental project report would be seen to be adequate. The general steps followed during the assessment were as follows:

- Environment screening, in which the project was identified as among those requiring environmental impact assessment under schedule 2 of EMCA, 1999
- Environmental scoping that provided the key environmental issues
- Desktop studies and interviews
- Physical inspection of the site and surrounding areas
- EIA Public participation Meetings and
- Reporting.

### **1.2.7.1 Environmental Screening**

This step was applied to determine whether an environmental impact assessment was required and what level of assessment was necessary. This was done in reference to requirements of the EMCA, 1999, and specifically the second schedule. Issues considered included the physical location, sensitive issues and nature of anticipated impacts.

### **1.2.7.3 Environmental Scoping**

The Scoping process helped narrow down onto the most critical issues requiring attention during the assessment. Environmental issues were categorized into physical, natural/ecological and social, economic and cultural aspects.

### **1.2.7.4 Desktop Study**

This included documentary review on the nature of the proposed activities, project documents, designs policy and legislative framework as well as the environmental setting of the area among others. It also included discussions with managers and design engineers as well as interviews with neighbouring communities.

### **1.2.7.5 Site Assessment**

Field visits were meant for physical inspections of the site characteristics and the environmental status of the surrounding areas to determine the anticipated impacts. It also included further interviews with 10 random members of the surrounding communities.

### **1.2.7.7 Reporting**

In addition to constant briefing of the client, this environmental impact assessment study report was prepared. The contents were presented for submission to NEMA as required by law.



## 2 DESCRIPTION OF THE PROJECT

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### 2.1 Introduction: Overview Fertilizer

The proposed project will be involved in the manufacture and processing of green anhydrous ammonia fertilizer. Green anhydrous ammonia production is where the process of making ammonia is 100% renewable and carbon-free. One way of making green ammonia is by using hydrogen from water electrolysis and nitrogen separated from the air. These are then fed into the Haber process (also known as Haber-Bosch), all powered by sustainable electricity ( in the case of TALUS AG, it will be solar energy) In the Haber process, hydrogen and nitrogen are reacted together at high temperatures and pressures to produce ammonia,  $\text{NH}_3$ . Therefore the proposed project is basically involved in the manufacture of an eco-friendly fertilizer, green anhydrous ammonia.

Fertilizers natural or artificial substance containing the chemical elements that improve growth and productiveness of plants.

Fertilizers enhance the natural fertility of the soil or replace chemical elements taken from the soil by previous crops. Soil fertility is the quality of a soil that enables it to provide compounds in adequate amounts and proper balance to promote growth of plants when other factors (such as light, moisture, temperature, and soil structure) are favourable. Where fertility of the soil is not good, natural or manufactured materials may be added to supply the needed plant nutrients. These are called fertilizers.

modern chemical fertilizers include one or more of the three elements that are most important in plant nutrition: nitrogen, phosphorus, and potassium. Of secondary importance are the elements sulfur, magnesium, and calcium.

Most nitrogen fertilizers are obtained from synthetic ammonia; this chemical compound ( $\text{NH}_3$ ) is used either as a gas or in a water solution.

TALUSAG will be involved in the manufacture and processing the green anhydrous ammonia.

## **2.2 GREEN ANHYDROUS AMMONIA**

Anhydrous ammonia is one of the most efficient and widely used sources of nitrogen for plant growth. The advantages of ammonia's relatively easy application and ready availability have led to its increased use as a fertilizer on farms.

Anhydrous means without water. Consequently, when anhydrous ammonia and moisture come into contact, they rapidly combine. When it is injected into the soil, the liquid ammonia expands into a gas and is readily absorbed in the soil moisture.

Under atmospheric temperature and pressure, anhydrous ammonia is a colorless gas and use as an agricultural fertilizer, it is compressed into a liquid resembling water. In the liquid state, under pressure, it is stored in specially made tanks strong enough to withstand internal pressures of a minimum of 250 pounds per square inch (psi). As the outside temperatures increase, the temperature of the anhydrous ammonia increases, causing the vapor pressure in the tank to increase. For example, at 60° F, the pressure is 93 psi and at 100° F, the pressure is nearly 200 psi.

Ammonia is corrosive to certain metals and their alloys, such as copper and zinc. Galvanized pipe and brass fittings must not be used with equipment used for storing or applying ammonia. Containers should be made of high-strength steel or other suitable material and fittings should be made of black iron.

### **2.2.1 Health and Safety aspects of anhydrous ammonia use in the farm**

Due to its properties and the manner in which it is stored, anhydrous ammonia can create a dangerous situation when it is accidentally released. The following are some examples of misusing anhydrous ammonia and its equipment that can result in accidents:

- Filling tanks beyond recommended capacity.
- Knocking open the hose-end valve accidentally.
- Moving the applicator tank before filling hoses have been disconnected from nurse tank.
- Venting pressure release valve while a person is in line of discharge.
- Breaking of transfer hose, especially an old or misused one.
- Failing to bleed hose coupling before disconnecting.
- Rupturing of low pressure hose due to pressure buildup when knives plug.
- Releasing ammonia when knives are unplugged.
- Overturning an applicator or nurse tank while in transit or in the field.

All of the above accident situations can result in injury, extensive property damage or both.

To minimize the chance of an accident, take steps to ensure all equipment is in top operating condition. Be sure all agricultural workers handling or applying ammonia have been specially trained in equipment maintenance and operation, proper personal protective equipment and emergency first aid.

Even with the best precautions, you may be involved with the accidental release of ammonia. Simple protection can prevent serious consequences if used consistently.

A face shield or goggles, rubber gloves and a heavy-duty long-sleeved shirt are recommended as minimum protection for operators routinely handling ammonia. Wear gloves and eye protection whenever you are working on or operating anhydrous equipment or handling hoses.

It is important to wear properly fitting goggles or a face shield when working with ammonia. A face shield will help prevent you from breathing a direct blast of ammonia and also will reduce possible eye exposure. Regular glasses do not provide adequate protection. Never wear contact lenses when working with ammonia. Ammonia might get under the lenses and cause permanent eye damage before you can remove the lenses and flush your eyes with water.

Loose-fitting rubber gloves with an extended cuff are recommended for handling anhydrous ammonia. Turn the extended cuff down so ammonia does not run down your sleeve when you raise your arms. You can remove gloves that fit loosely in case of an emergency.

You can further protect your arms from splashes by wearing heavy-duty clothing such as coveralls or work shirts that cover your arms. Thin dress shirts or short sleeves don't provide satisfactory protection.

If you store bulk quantities of anhydrous ammonia on your farm, you will need additional protective equipment. Keep two chemical suits or slickers and gas masks with an ammonia canister filter available for emergency work. The protection from a canister filter is limited and you should only use it in low concentrations of ammonia. When a serious leak occurs, call your local fire department for assistance. Firefighters have the proper training and equipment - including a self-contained breathing apparatus and protective suit to deal with major ammonia leaks where high concentrations of ammonia are probably present.

The operator's manual for anhydrous ammonia equipment should include instructions on proper procedures and protective equipment to use when handling ammonia. Review this information before operating the equipment.

**FIRST AID = WATER + WATER + WATER**

Every second is critical when someone is sprayed with liquid ammonia or engulfed in concentrated vapors. Exposure to anhydrous ammonia can be harmful if it contacts the skin and eyes or if it is inhaled or swallowed. When ammonia contacts the skin or eyes, tissue damage occurs rapidly. Immediately flushing the exposed body area(s) with water is crucial. Regulations require that all farm vehicles used for anhydrous ammonia carry a container filled with at least 5 gallons of water. This water must be readily available for flushing the eyes and skin in case of exposure. You should change the water daily to ensure you have a clean supply.

Safety specialists recommend you keep a second 5-gallon container of water on the tractor. This provides another source of water for first aid in case the tractor operator is unable to reach the water container on the nurse or applicator tank. You should also carry a 6- to 8-ounce, water-filled plastic eye wash bottle in your shirt pocket. It provides an immediate supply of water if an accident does occur. The objective of the eye wash bottle is to get the excess ammonia out of the eyes in the first few seconds until you or the victim can get to the larger water supply to continue flushing.

When a victim has been exposed to anhydrous ammonia, move him or her to a safe place and flush the exposed area immediately with water for a minimum of 15 minutes. Remove contaminated clothing as soon as you have thawed them out. (Remember, the sub-zero

temperature of anhydrous ammonia can freeze exposed clothing to skin below it. If you remove clothing before you thaw it with rinse water, extensive skin damage can result.)

Do not apply salves, creams or ointments. They won't stop the damaging action to skin. Contact a doctor immediately after emergency first aid treatment.

Even if small amounts of ammonia enter the eyes, irrigate them immediately with water for 15 minutes or more. Hold the eyelids open during irrigation to ensure water contacts all parts of the eye. Immediate first aid is important to avoid partial or total loss of vision. Again, consult a doctor after giving emergency first aid.

Ammonia vapors are easily detected because of their pungent odor, even in low concentrations. Inhaling ammonia can irritate the respiratory tract and lungs. At high concentrations, ammonia combined with the moisture in the lungs may damage the lung lining and reduce the lungs' ability to transfer oxygen to the bloodstream.

When a person has inhaled ammonia, move them to a safe area. Exposures to low concentrations of ammonia for a short period of time may not require treatment. Exposure to higher concentrations may cause convulsive coughing and respiratory spasms. Provide cardiopulmonary resuscitation if the victim is not breathing. Obtain medical help as soon as possible.

In case ammonia has been swallowed, contact a doctor immediately. Have the victim, if conscious and able, drink large amounts of water to dilute the chemical. Do not induce vomiting if the victim is in shock or unconscious. If vomiting occurs, keep the head lower than the hips to prevent vomitus from entering the lungs.

**CONTAINER                      AND                      SYSTEM                      REQUIREMENTS**

All parts and contact surfaces must withstand a minimum working pressure of 250 psi. This includes pressure welds, safety valves, gauges, fittings, hoses and metering devices.

All containers used for storing ammonia must be painted white or silver. Light colors reflect heat and this helps keep the temperature and pressure down inside the tank during warm weather.

## **MAINTAIN ANHYDROUS AMMONIA EQUIPMENT**

Keep anhydrous ammonia equipment in good condition. Be on the lookout for defects in nurse tanks, regardless of whether you own them or lease them. Make periodic inspections and repair or replace equipment. Accident victims are just as injured regardless of who owns the tank.

**Daily inspection.** Each day give the tank and hoses a brief inspection. Look for problems with:

- Hoses - Check for cuts, soft spots, bulges, kinking, flattening or slipping at the coupler.
- Tires - Inspect for proper inflation, cuts, weathering, wear and tightness of lug bolts on wheels.

Each time you fill the nurse tank, check the liquid level gauge and pressure gauge. The gauges should be working properly and be consistent in their readings. Don't use nurse tanks with faulty gauges. To repair or replace faulty gauges, the tank must be emptied and the tank pressure dropped to zero before faulty parts can be removed.

**Immediate repair.** Several situations are cause for immediate repair or replacement. Any leak in a liquid or vapor shut-off valve calls for repair or replacement of the valve. If an

accident causes a dent, gouge, crack or other damage to the tank that might result in failure, inspect the tank, and if necessary, repair it before placing it back into service. A certified welder must make any welding repairs on the tank and the welds must be hydrostatically tested to ASME standards. An overturned tank or collision between the tank and other farm machinery are examples of causes for inspection.

**Annual inspection.** At least once a year, inspect these items carefully and repair or replace as needed:

**Hoses.** Lay hose out straight and examine carefully for:

- cuts exposing reinforcement fabric
- soft spots or bulges
- blistering or loose outer cover
- unusual abuse, such as kinking or flattening by a vehicle
- slippage of hose at any coupling
- brass or copper fittings or waterhose-type clamps
- hoses over 1/2 inch O.D. not marked with the following information:
  - "Anhydrous Ammonia"
  - xxx psig (maximum working pressure)
  - Manufacturer's name or trademark
  - Year of Manufacture

Immediately replace hoses that show these defects. Hoses exposed to anhydrous ammonia lose strength. You should replace them according to the following schedule regardless of visible damage:



## AMMONIA TRANSFER

Most ammonia accidents involve improper handling procedures. Read your owner's manual and follow instructions. Do not leave during the transfer procedure. Check with your dealer if you are unsure about the correct procedure. Ask for instructions when renting or borrowing equipment. Review the procedures with farm workers before allowing them to handle equipment to ensure their safety.

When filling a nurse or applicator tank, be thoroughly familiar with the equipment and procedures prior to any transfer. Because most accidents occur when transferring ammonia, it is very important to wear a protective face shield or goggles and rubber gloves when you are involved in this procedure.

Be sure the 5-gallon container is full of clean water.

Park the nurse tank on level ground, downwind from the filling operation. Place it close to the operation to eliminate any stress on the hose. Avoid working near any obstacles that would make evacuation difficult, such as fences, buildings or ditches. Block the wheels to prevent the nurse tank from moving. A serious situation could develop if the tank moved and a hose tore loose during the filling operation.

Before connecting the hose, make sure the coupling and connections are free of dirt and other foreign material. Visually check to see that the threads are not damaged. This will reduce the chance of an ammonia leak when pressure is applied.

Workers should carry the filler hose by the valve body or coupling, not by the valve wheel. This reduces the chance of the valve wheel opening and spraying ammonia. Remember the valve wheel and fitting are designed to be closed by hand pressure only. Don't use a wrench - it can damage the fitting.

If you are using a compressor to transfer ammonia, follow recommended instructions in your operator's manual. Maintain a vapor pressure 5 to 10 pounds lower in the tank being filled to keep a forward flow.

Do not overfill the nurse or applicator tank. Keep check on the liquid level by opening the 85 percent fill bleeder valve. A white fog will appear when it reaches this level. As a part of the normal loading procedure, check the liquid level float gauge accuracy by comparing it with the fixed liquid level gauge. It is important to fill only to 85 percent or less of the total liquid capacity of the tank. As the outside temperature increases, the temperature of the liquid increases and the liquid expands, causing the vapor pressure in the tank to increase. If the tank is overfilled and no vapor space is available, the safety relief valve might fail, causing the tank to rupture or explode.

After the filling operation is complete, secure the hose in the storage position for transit. Take a final walk around the nurse or applicator tank to confirm that all steps have been taken.

**Prevention and precautions Work upwind!** Work upwind of machinery, the hose-end valve, bleeder valve, coupler or plugged applicator tubes. This gives an advantage of getting away quickly if anhydrous ammonia is suddenly released. Plan an escape route. Know which way to run.

**Handle valves with care!** Grasp valves by the valve body or the coupling, not by the valve handle. The valve handle might accidentally turn and open. If you throw a hose with an end valve over the tank, it might open when it hits the tank and spin open the rest of the way. All tanks are fitted with excess flow valves that operate automatically when a hose ruptures. A carelessly handled valve that is partially opened may not provide adequate flow to activate

the excess flow valve and the entire tank of ammonia could escape. Attach the end coupling to the dummy fitting provided when transporting or not using the hose.

**Respect pressure!** You must release pressure from the coupler using a bleeder valve before disconnecting the coupler. Bleed the pressure off slowly and then disconnect the coupler immediately. On a warm day, leaving a coupler connected for five to 10 minutes after bleeding allows ammonia in the hose to rebuild pressure. On cold days, rubber seals are stiff and may not seal completely. The resulting leak might spray anhydrous ammonia vapors as the tank valve is opened. It also may create cloud of vapor, limiting access to the equipment for reclosing the valve.

**Check your safety water tank!** Check this water supply (at least 5 gallons) daily. It may freeze in cold weather or become too hot to safely flush eyes on warm sunny days.

**Change the water weekly.** It might absorb ammonia from the air and become contaminated. Carrying a water supply on both tank and tractor gives extra protection.

**Check applicator tubes!** When removing dirt from a plugged applicator tube, treat it as if it contains pressurized anhydrous ammonia. They often do. This could be of particular concern when you work among the knives of an anhydrous ammonia applicator. You might not be able to move fast enough to escape the pungent fumes without injury.

**Leave a message!** Co-workers should know each other's activity schedule when applying anhydrous ammonia. An overdue operator may have had an accident. An accident causing eye damage leaves the operator helpless and stranded. Check if you see operators stopped in the field for an unusual period of time when conditions are normal and equipment should be moving.

## **ROAD SAFETY**

Towing a nurse tank presents problems because anhydrous ammonia is a hazardous material. An accident with a nurse tank on the highway could result in serious injury, costly repairs and liabilities.

Nurse tanks of 3,000 gallons or less mounted for transport are considered "implements of husbandry" when they are used exclusively for agricultural purposes. Nurse tanks must have the words "anhydrous ammonia" in large green lettering and a non-flammable gas placard with the words "non-flammable" or "1005" on both sides and on each end of the tank. Applicator tanks must contain the same identification on at least the rear of the container. Motorists on the highway can easily identify an ammonia tank by these markings.

All nurse tank wagons must be securely attached to the vehicle pulling them. Use a drawbar, hitch pin, safety clip and a safety chain. Before each highway trip, check the hitch pin, safety clip and safety chain to see that they are secure.

Nurse tank wagons are designed to follow smoothly in the path of the towing vehicle. Nurse tanks can overturn or collide with another vehicle if the tank wagon swerves from side to side. Make sure your tank wagon is hooked up properly. Also make sure the wheel lug nuts are tight and the tires are in good shape and properly inflated.

When hauling a loaded nurse tank, drive at speeds of 30 mph or less. The potential for a serious accident is increased at higher speeds, because you might lack sufficient braking capacity to safely control the wagon. Hauling more than one loaded nurse tank is a violation of Missouri law.

Because farm implement tires are designed for travel at low speeds, allow sufficient time to reach your destination. When towing at 25 mph or less, display a slow-moving-vehicle sign on the wagon.

State law has additional requirements for towing a nurse tank or applicator tank at night. You must display two red reflectors, visible to the rear, at the extreme right and left projections of the trailing unit. If the brake and turn lights on the towing vehicle are obscured, you must put brake and turn lights on the nurse or applicator tank.

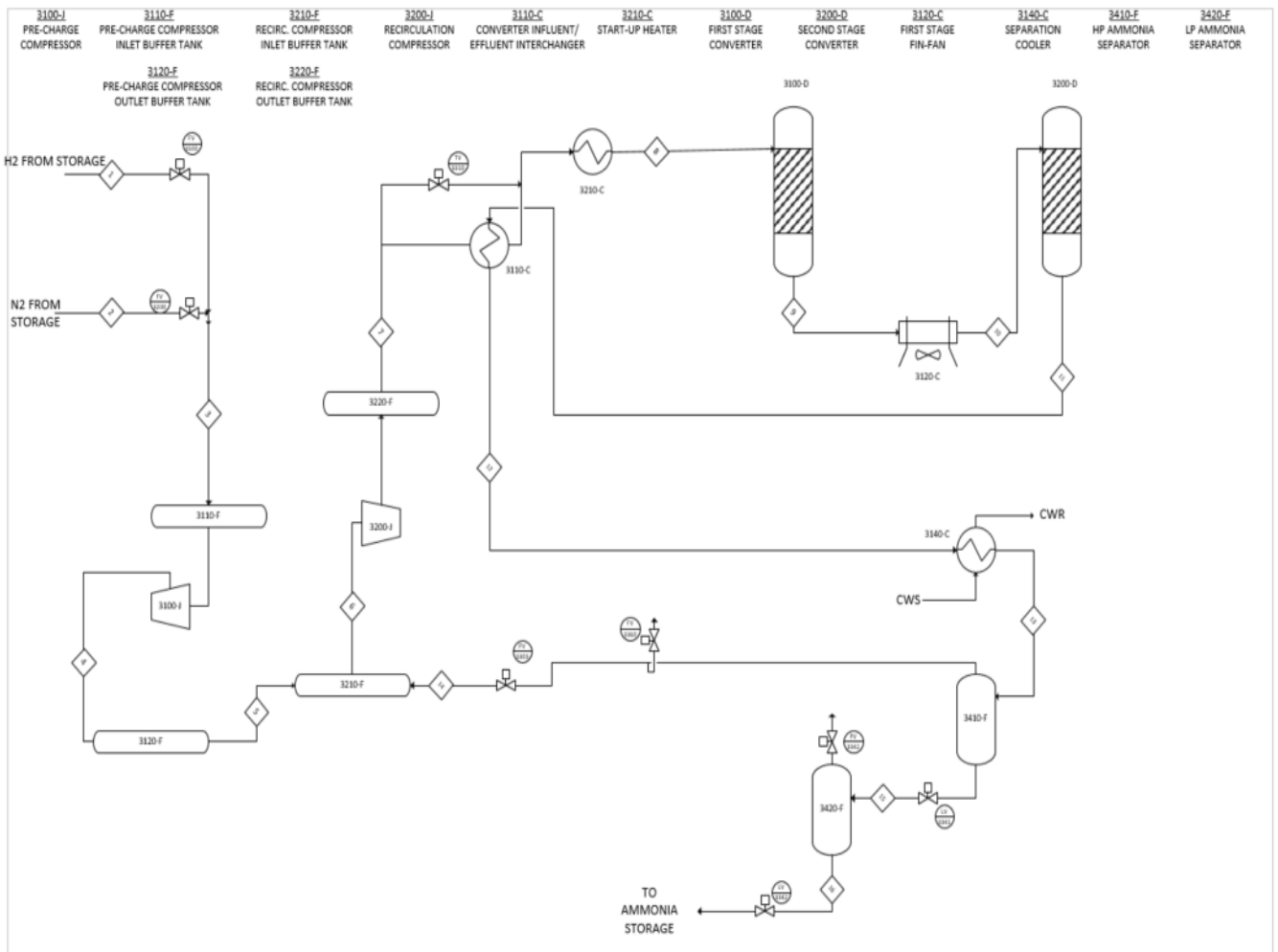
### **2.3 : THE TALUSAG PROJECT DESIGN**

The technology proposed for this project is very different from other standard continuous green ammonia processes. This is a small-scale autonomous plant that uses water, air and renewable energy to generate green anhydrous ammonia (NH<sub>3</sub>). The process is optimized to operate on intermittent power; it utilizes a predictive algorithm to maximize production of NH<sub>3</sub> by making and storing gases when renewable power is readily available and then lowering power consumption to a standby mode powered by a small battery.

#### **Process description**

Hydrogen is generated from water by electrolysis. Air is fed through a PSA (Pressure Swing Adsorption) system to generate nitrogen. These gases are mixed in a molar ratio of 3:1 and carried at high pressure and temperature. At 180 bar and 345 oC, the gas mixture flows through synthesis converters that use an iron-based catalyst to combine hydrogen and nitrogen to produce ammonia (NH<sub>3</sub>). Typical rates should generate a conversion of 13-20% to ammonia. The mixture is dropped in

temperature to separate the liquid ammonia. Unreacted gases are recycled through the converters.



### Resource consumption

The process requires under 200 liters of treated water per hour, at full capacity (again, <8 hours per day). This water is treated by RO and used to generate hydrogen by electrolysis. The closed cooling water circuit requires up to 1.1 m<sup>3</sup>/h of feed-up water to make up for evaporation. The charge of the synthesis catalyst is about 135 liters and its expected service life is 10 years

### **Storage of the final product**

The plant is equipped with storage tanks for 60 tonnes pressurized ammonia and buffer tanks for hydrogen and nitrogen with the following maximum quantities:

- Nitrogen – about 1240 kg
- Hydrogen – around 270 kg

All tanks will operate at 25-75% of the total storage capacity

### **Space required**

The main system consists of 4 shipping containers + 2 storage tanks the size of a container. A 2MW solar installation is required to supply power to this system and will likely require almost 2 hectares of space.

### **Emissions, Effluent and Waste**

The process does not generate liquid effluents or emissions of matter into the atmosphere; only some ventilation to the atmosphere of oxygen and nitrogen, minimum ventilation of hydrogen in the daily commissioning of the system and purging of synthesis gas can be produced:

- Oxygen: 150 kg/h
- Synthesis gas purge: 0.5 kg/h (69% H<sub>2</sub>, 24% N<sub>2</sub>, 7% NH<sub>3</sub>)
- Catalyst spent: 350 kg for 10 years

Gas monitors throughout the system will alarm if gas emissions reach unsafe levels. The generation of waste is reduced to the operations of implementation and commissioning of equipment and the maintenance of the facilities during their operation. We do not expect any wastewater or liquid discharge as all water used as cooling water is either evaporated or is returned to our water tank.

### **Consumption of Natural Resources:**

**Water / energy** The water consumption will be carried out through the current supply of the factory, without the need to incorporate any new use. The current farm consumption is 400m<sup>3</sup>/h, so the annual increase in water consumption will only be 5%. The energy

consumption of the installation will be supplied with renewable energy, photovoltaic solar power

#### **Emissions to the atmosphere:**

Emissions of gases into the atmosphere are not foreseen. Some ventilation to the atmosphere of oxygen and nitrogen, minimal ventilation of hydrogen in the daily commissioning of the system and purging of synthesis gas can occur: - Oxygen: 150 kg/h - Synthesis gas purge: 0.5 kg/h (69% H<sub>2</sub>, 24% N<sub>2</sub>, 7% NH<sub>3</sub>) - Catalyst spent: 350 kg for 10 years Acoustic emissions will be minimal due to the small size of the pilot plant equipment and its location away from the perimeter and possible external receivers. The acoustic insulation of selected points with incidence inside the facilities will be guaranteed

#### **2.2.1.1 Construction**

The unit will be constructed using 4 containers with steel reinforcing, three tanks all reinforced. ( see attached drawing)

#### **2.2.1.2 Infrastructure**

A robust infrastructure including access roads, parking areas, water storage, ammonia storage solar panels distribution and waste disposal will be set up at the site, within the Kenya Nut Company.

#### **2.2.1.3 Security**

Security features including, perimeter security, security lighting, and access control.

#### **2.2.1.4 Management**

The facility will be managed autonomously by Talus Ag in partnership with Kenya Nut Company.



### **2.2.3 Infrastructure**

#### **2.2.3.1 Electrical**

All street lighting will be photoelectric cell controlled so that lights come on automatically at dusk and off at dawn and run off the 220V supply but metered from the administration office.

#### **2.2.3.2 Water**

This will be provided from the Kenya Nut Company boreholes.

#### **2.2.3.3 Waste / Sewerage**

Septic tank, which will be occasionally exhausted. Kenya Nut Company has complied by having an effluent discharge licence, hence it will cover wastewater management.

#### **2.2.3.4 Storm water run-off**

All storm water drainage will be run through grease traps and silt retainers before being discharged into the septic tank. Some flood flow will be captured for the project water supply.

### **2.2.4 Estimated Project Investment Cost**

The initial project investment cost is estimated to be **Kenya shillings one hundred million shillings (100,000,000) of which 0.1% will be paid to NEMA.**

## **3 BASELINE INFORMATION OF THE STUDY AREA**

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### **3.1 Location of the Project**

The proposed project will be located in the Kenya Nut Company Morendat farm, where livestock is reared and thereafter slaughtered at the abattoir, and the meat processed and

sold within the Country, the farm is also involved in grapes growing; the grapes are harvested and ferried to the winery where they are processed into wine. The farm is located on LR R3621 along Naivasha – Nakuru Road, in Nakuru County. There is the upper farm, mostly composed of the vineyard and the lower farm, comprising of the livestock rearing grounds and the slaughter house.

The facilities nearby are large scale farms involved in the flower production and livestock production, this include the Malu Farm, Delamere Farm, Kreative Roses, Maridadi Flowers, Panda Flowers, Vegpro-Delamere farm. The general population lives far away from this projects, the only people around this farms are the farms management staff and general workers for these farms.

### **3.2 Altitude and Temperature**

The area enjoys a pleasant climate similar to that of Nairobi although relatively warmer, The average daily maximum and minimum temperatures are 26.4 and 10 degrees centigrade, respectively while the mean annual temperature is 18.2 degrees centigrade. Mean annual humidity ranges from 36% to 44%.

### **3.3 Rainfall**

A huge proportion of the area is semi-arid and receives very little and erratic precipitation. There are two distinct rainy seasons. The long rains fall between March and May and short rains fall between October and December. The annual average rainfall varies from 700-900 mm with high altitude areas receiving more rain than low-lying areas. The rainfall however, is very unreliable and varies from year to year. Most farms here depend on irrigation for their sustenance.

### **3.4 Geology of the study area**

The geology of the study area is complex, as it lies on or near the boundary of two different geological systems. The investigated study area is underlain by a thin layer of volcanic (Kapiti phonolite) and the 'Basement Rocks (quartzo-feldspathic biotite gneiss). The Basement rock is overlain by the Tertiary Sediments composed of sands, lake beds and phonolitic fragments. A number of aquifers are commonly encountered within these formations, although their productivity and prospects for sustained abstraction differ significantly. Such significant aquifers as exist will occur in weathered or fissured Basement rocks, or in the OLS between the bottom of the thin phonolite layer and the underlying Basement.

### **3.5 Soil types and agro-ecological use**

The past geological studies have distinguished three events of major faulting activities in Miocene, Pliocene, and early Pleistocene, through which the Rift Valley has grown to the present form. The Rift Valley is intersected with varied tectonic structures, e.g. faults oblique to its axis and secondary minor troughs right angled to it, as represented by Kavirondo Rift. The upper sedimentary foundation is made up of a complex mixture of silt layer, sand layer, volcanic ash layer and pumice layer. It is clarified that these sedimentary soil layers are under exceedingly consolidated condition. The tuff or lava that constitutes the foundation of the area has the upper layer of weathered soil with a thickness of 0.5m to 1.0m and the lower layer in fresh condition (GoK, 1994). The Naivasha area exhibits strong volcanicity and geothermal activity. The geology of the study area is characterised by superficial deposits approximately 30m thick. These superficial lower-to-lower middle Pleistocene deposits consist of soil overlying unconsolidated pumice (boulder tuff with pumice and loose ash). In turn, this

unconsolidated pumice overlies black to green-grey, aphanitic Phenolitic Trachyte from the Pliocene (McCall, 1966).

The following prevalent soil types and their associated use:

**Aerosols**, that are well drained, porous, low base status, prone to surface sealing, low moisture storage.

**Ferrasols**, which are strongly weathered, porous, high moisture storage, low fertility. They are moderately affected by water and wind erosion.

**Vertisols**, Black cotton soils that are characterized by imperfect drainage, cracking, with high organic matter. They are suitable for horticulture, grazing and pigeon pea growing.

### 3.6 Vegetation Resources

The area and its environs cover land of medium agricultural potential with the aid of irrigation, with vegetation cover comprising mainly grasslands, scattered trees/woodland and shrubs. Approximately over 90% of the original land vegetation of the study area has been cleared to pave way to human settlement (a few scattered), cultivation of horticultural crops, grazing land and development centres. The vegetation varies with altitude. The area which receive less rainfall are characterized by open grassland with scattered acacia trees. The high altitude areas that receive high rainfall have dense vegetation and are more suitable for rain fed agriculture. The scattered indigenous trees of the surrounding area to the study area are the *Acacia lahai*, *Acacia seyal*, *Acacia Senegal*, *Acacia polycantha*, *Acacia sieberana* and *Acacia scolopia*, *Acacia drepanolbium*, *Euphorbia tirucalii* and *Euphorbia candelabrum*. The exotic trees surround this area but not in the site are *Agave sisalana* (Sisal), *Musaenda arcuata*, *Cocos nucifera*, *Cassia siamea*, *Cassia occidentalis*, and *Cassia didymobrya*. The *Cassia* sp. is also known as *Senna* sp. The common shrubs are *Aloe vera*, *Aloe barbadensis*, *Oxygonum sinuatum*, *Alternanthera pungens* and *Solanum*

*incanum*. Vegetation planted for agriculture in the neighbouring farm includes *Phaseolus vulgaris* (beans), *Brassica Oleracece* (kales), *Carica papaya* (paw paw), and Bananas *Musa sp.*

### **3.7 Fauna**

The project area was originally covered by large tracts of forest land inhabiting wildlife of different species but due to adverse human activities such as felling of trees for fuel wood, building and construction, cultivation and more so game hunting, wildlife population has diminished to a negligible scale. The private land which is the project site previously supported wildlife such as Zebras, Thompson gazelles, hares, buffaloes, snakes, hippopotamus, lion etc which some still inhabit the area. Currently the few patches of vegetation are a habitat for birdlife mostly if not only. These birds include cattle egret (*Bubulcus ibis*) and sacred ibis (*threskionis aethiopicus*).

### **3.8 Water Resources and Quality**

The land in this area slopes gently on a North-South aspect. Providing perfect drainage topography. This gives the enterprise a site with natural drainage, which effectively clears of run off without any undue problem. Availability of a network of drainage channels installed and maintained. The nearby water bodies are the River Malewa and the Lake Naivasha.

Lake Naivasha, one of the only two freshwater ecosystems in an otherwise soda lake series in eastern Rift Valley (Kenya) is situated in Nakuru District, Rift Valley province, about 100km Northwest of Nairobi.

Lake Naivasha is a remnant of a large freshwater body that once comprised of the present Lakes Naivasha, Elementaita and Nakuru. The large freshwater body is believed to have dried up due to changes in climatic conditions. Whereas Lakes Nakuru and Elementaita became saline, Lake Naivasha remained a freshwater lake, one of the few such lakes in the Rift Valley series. Its freshness is thought to be contributed by inflowing river waters, which causes dilution, loss of solutes through seepage out and also geochemical and biochemical sedimentation. Lake Naivasha is a shallow, endorheic lake system. The deepest body of water lies within a crater, which is bounded in part by the crater's rim or crescent islands. Lake Oloiden is located in the southwest direction; this normally connects to the main lake when water levels are high. Lake Naivasha system also includes a separate soda crater lake (L. sonachi). The main lake system has fringing swamps, submerged vegetation and a riverine floodplain with a delta that flood into the lake. During wet seasons the lake water level rises as a result of water input from the rivers originating from the eastern highlands. These are rivers Malewa, Gilgil and Karati. The River Malewa contributes about 90% of the surface water inflow into the lake, with the Gilgil contributing majority of the rest. The lake also receives water from underground seepage. The main water loss from the lake is as a result of evaporation. This lake has no surface water outlet, and some form of underground outflow through the extremely porous volcanic rocks that form the lake basin keeps the water fresh. The band of papyrus, which borders the lakeshore, helps by taking up soil sediments, chemicals, and excess nutrients. The lake also acts as a breeding ground for fish and habitats to various types of fauna. Normally the lake water levels can vary depending on various climatic conditions.

### **3.9 Infrastructure**

The major highway, is the Nairobi-Nakuru highway, the proposed site is about 5km from the highway. Therefore road access is adequate.

### **3.11 Economic Activities**

Agricultural practices in the project area range from large scale to small scale. Large scale farming in the area is practiced by horticultural farms Agriculture in the area is aided by irrigation from borehole supply or Lake water abstraction.

### **3.12 Environmental Challenges in the Study Area**

The area is faced by both natural and man made forces of ecosystem degradation including: Desertification and River pollution.

## **4 LEGISLATIVE AND REGULATORY FRAMEWORKS**

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### **4.1 Introduction**

There is a growing concern in Kenya and at global level that many forms of development activities cause damage to the environment. Development activities have the potential to damage the natural resources upon which the economies are based. A major national challenge today is how to maintain sustainable development without damaging the environment. The Environmental Impact Assessment is a useful tool for protection of the environment from the negative effects of developmental activities. It is now accepted that development projects must be economically viable, socially acceptable and environmentally

sound. It is a condition of the Kenya Government to conduct Environmental Impact Assessment on the development Projects.

According to Sections 58 and 138 of the Environmental Management and Coordination Act (EMCA) No. 8 of 1999 and Section 3 of the Environmental (Impact Assessment and Audit) Regulations 2003 (Legal No. 101), residential complexes require an Environmental Impact Assessment project/study report prepared and submitted to the National Environment Management Authority (NEMA) for review and eventual Licensing before the development commences. This was necessary as many forms of developmental activities cause damage to the environment and hence the greatest challenge today is to maintain sustainable development without interfering with the environment.

#### **4.2 Environmental Problems in Kenya**

There are many environmental problems and challenges in Kenya today. Among the cardinal environmental problems include: loss of biodiversity and habitat, land degradation, land use conflicts, human animal conflicts, water management and environmental pollution. This has been aggravated by lack of awareness and inadequate information amongst the public on the consequences of their interaction with the environment. In addition there is limited local communities' involvement in participatory planning and management of environmental and natural resources. Recognizing the importance of natural resources and the environment in general, the Kenyan Government has put in place wide range of policy, institutional and legislative framework to address the major causes of environmental degradation and negative impacts on ecosystem emanating from industrial and economic development programmes.



### **4.3 Environmental Policy Framework**

Environmental Impact Assessment (EIA) is a methodology used to identify the actual and probable impacts of the projects and programmes on the environment and to recommend alternatives and mitigating measures. The assessment is required at all stages of project development with a view to ensuring environmentally sustainable development for both existing and proposed public and private sector development ventures. The National EIA regulations were issued in accordance with the provisions of Environmental Management and Coordination Act (EMCA) of 1999. The EIA Regulations must be administered, taking into cognizance provisions of EMCA 1999 and other relevant national laws. The intention is to approve and license only those projects that take into consideration all aspects of concern to the public as they impact on health and the quality of the environment.

### **4.4 Institutional Framework**

At present there are over twenty (20) institutions and departments which deal with environmental issues in Kenya. Some of the key institutions include the National Environmental Council (NEC), National Environmental Management Authority (NEMA), the Forestry Department, Kenya Wildlife Services (KWS) and others. There are also local and international NGOs involved in environmental issues in the country.

#### **4.4.1 National Environmental Management Authority (NEMA)**

The object and purpose for which NEMA is established is to exercise general supervision and co-ordinate over all matters relating to the environment and to be the principal instrument of the government in the implementation of all policies relating to the

environment. A Director General appointed by the president heads NEMA. The Authority shall:

- Co-ordinate the various environmental management activities being undertaken by the lead agencies and promote the integration of environmental considerations into development policies, plan, programmes and projects with a view to ensuring the proper management and rational utilisation of the environmental resources on a sustainable yield basis for the improvement of the quality of human life in Kenya.
- Take stock of the natural resources in Kenya and their utilisation's and consultation, with the relevant lead agencies, land use guidelines.
- Examine land use patterns to determine their impact on the quality and quantity of the natural resources.
- Carry out surveys, which will assist in the proper management and conservation of the environment.
- Advise the government on legislative and other measures for the management of the environment or the implementation of relevant international conservation treaties and agreements in the field of environment as the case may be.
- Advise the government on regional and international environmental convention treaties and agreements to which Kenya should be a party and follow up the implementation of such agreements where Kenya is a party.
- Undertake and co-ordinate research, investigation and surveys in the field of environment and collect and disseminate information about the findings of such research, investigation or survey.
- Mobilise and monitor the use of financial and human resources for environmental management.

- Identify projects and programmes or types of projects and programmes, plans and policies for which environmental audit or environmental monitoring must be conducted under EMCA.
- Initiate and evolve procedures and safeguards for the prevention of accidents, which may cause environmental degradation and evolve remedial measures where accidents occur.
- Monitor and assess activities, including activities being carried out by relevant lead agencies in order to ensure that the environment is not degraded by such activities, environmental management objectives are adhered to and adequate early warning on impending environmental emergencies is given.
- Undertake, in co-operation with relevant lead agencies programmes intended to enhance environmental education and public awareness about the need for sound environmental management as well as for enlisting public support and encouraging the effort made by other entities in that regard.
- Publish and disseminate manuals, codes or guidelines relating to environmental management and prevention or abatement of environmental degradation.
- Render advice and technical support, where possible to entities engaged in natural resources management and environmental protection so as to enable them to carry out their responsibilities satisfactorily.
- Prepare and issue an annual report on the state of the environment in Kenya and in this regard may direct any lead agency to prepare and submit to it a report on the state of the sector of the environment under the administration of that lead agency and,
- Perform such other functions as government may assign to the Authority or as are incidental or conducive to the exercise by the authority of any or all of the functions provided under EMCA.

However, NEMA mandate is designated to the following committees:

#### **4.4.1.1 Provincial and District Environment Committees**

According to EMCA, 1999 No. 8, the Minister by notice in the gazette appoints Provincial and District Environment Committees of the Authority in respect of every province and district respectively.

##### **4.4.1.1.1 District Environment Committee**

District Environment Committees are responsible for the proper management of the environment within the District in respect of which they are appointed. They are also to perform such additional functions as are prescribed by the Act or as may, from time to time be assigned by the Minister by notice in the gazette. The decisions of these committees are legal and it is an offence not to implement them.

##### **4.4.1.1.2 Provincial Environment Committee**

Like in the case of District Environment Committees, the Provincial Environment Committee is responsible for the proper management of the environment within the province, which they are appointed. They are also to perform such additional functions as are prescribed by this Act or as may from time to time be assigned by the Minister by notice in the gazette.

#### **4.4.1.2 Public Complaints Committee**

The Committee performs the following functions:

- Investigate any allegations or complaints against any person or against the authority in relation to the condition of the environment in Kenya and on its own motion, any

suspected case of environmental degradation and to make a report of its findings together with its recommendations thereon to the Council.

- Prepare and submit to the Council periodic reports of its activities which shall form part of the annual report on the state of the environment under section 9 (3) and
- To perform such other functions and exercise such powers as may be assigned to it by the council.

#### **4.4.1.3 National Environment Action Plan Committee**

This Committee is responsible for the development of a 5-year Environment Action plan among other things. The National Environment Action Plan shall:

- Contain an analysis of the Natural Resources of Kenya with an indication as to any pattern of change in their distribution and quantity over time.
- Contain an analytical profile of the various uses and value of the natural resources incorporating considerations of intergenerational and intra-generational equity.
- Recommend appropriate legal and fiscal incentives that may be used to encourage the business community to incorporate environmental requirements into their planning and operational processes.
- Recommend methods for building national awareness through environmental education on the importance of sustainable use of the environment and natural resources for national development.
- Set out operational guidelines for the planning and management of the environment and natural resources.

- Identify actual or likely problems as may affect the natural resources and the broader environment context in which they exist.
- Identify and appraise trends in the development of urban and rural settlements, their impact on the environment, and strategies for the amelioration of their negative impacts.
- Propose guidelines for the integration of standards of environmental protection into development planning and management.
- Identify and recommend policy and legislative approaches for preventing, controlling or mitigating specific as well as general diverse impacts on the environment.
- Prioritise areas of environmental research and outline methods of using such research findings.
- Without prejudice to the foregoing, be reviewed and modified from time to time to incorporate emerging knowledge and realities and;
- Be binding on all persons and all government departments, agencies, States Corporation or other organ of government upon adoption by the national assembly.

#### **4.4.1.4 Standards and Enforcement Review Committee**

This is a technical Committee responsible for environmental standards formulation methods of analysis, inspection, monitoring and technical advice on necessary mitigation measures.

Standards and Enforcement Review Committee consists of the members set out in the third schedule to the Environmental Management and Co-ordination Act. The Permanent Secretary under the Minister is the Chairman of the Standard and Enforcement Review Committee. The Director General appoints a Director of the Authority to be a member of the Standards and Enforcement Review Committee who is the Secretary to the committee and who provides secretarial services to the Committee. The Committee also regulates its own

procedure. The Standard and Enforcement Review Committee may co-opt any person to attend its meetings and a person so co-opted shall participate at the deliberations of the committee but shall have no vote. Finally, the Committee shall meet at least once every three months for the transactions of its business.

#### **4.4.1.5 National Environmental Tribunal**

This tribunal guides the handling of cases related to environmental offences in the Republic of Kenya.

#### **4.4.2 National Environmental Council (NEC)**

EMCA 1999 No. 8 part iii section 4 outlines the establishment of the National Environment Council (NEC). NEC is responsible for policy formulation and directions for purposes of EMCA; set national goals and objectives and determines policies and priorities for the protection of the environment and promote co-operation among public departments, local authorities, private sector, non-governmental organisations and such other organisations engaged in environmental protection programmes. It also performs such other functions as are assigned under EMCA.

#### **4.4.3 National Environmental Action Plan (NEAP)**

The NEAP for Kenya was prepared in mid 1990s. It was a deliberate policy effort to integrate environmental considerations into the country's economic and social development. The integration process was to be achieved through a multi-sectoral approach to develop a comprehensive framework to ensure that environmental management and the conservation of natural resources are an integral part of societal decision-making.

#### **4.4.5 The World Commission on Environment and Development (The Brundtland Commission of 1987)**

The commission focused on the environmental aspects of development, in particular the emphasis on sustainable development that produces no lasting damage to the biosphere and to particular ecosystems. In addition to environmental sustainability is the economic and social sustainability. Economic sustainable development is development for which progress towards environmental and social sustainability occurs within available financial resources. While social sustainable development is development that maintains the cohesion of a society and its ability to help its members work together to achieve common goals, while at the same time meeting individual needs for health and well being, adequate nutrition, and shelter, cultural expression and political involvement.

#### **4.4.7 The National Poverty Eradication Plan (NPEP)**

The NPEP has the objective of reducing the incidence of poverty in both rural and urban areas by 50 percent by the year 2015; as well as strengthening the capabilities of the poor and vulnerable groups to earn income. It also aims to narrow gender and geographical disparities and create a healthy, better educated and more productive population. This plan has been prepared in line with the goals and commitments of the World Summit for the Social Development (WSSD) of 1995. The plan focuses on the four WSSD themes of the poverty eradication; reduction of unemployment; social integration of the disadvantaged people and the creation of an enabling economic, political, and cultural environment. This plan is to be implemented by the Poverty Eradication Commission (PEC) formed in collaboration with Government Ministries, community based organizations and private sector.



#### **4.4.8 The Ramsar Convention**

Kenya ratified the Convention in June 1990. The Ramsar Convention on Wetlands is primarily concerned with the conservation and Management of Wetlands. Parties to the Convention are also required to promote wise use of wetlands in their territories and to take measures for the conservation by establishing nature reserves in wetlands, whether they are included in the Ramsar list or not. The proposed project is expected to observe strictly to the Ramsar Convention's principles of wise use of wetlands in the project area. Wetlands are defined by the Convention on Wetlands or the Ramsar Convention (1971) as: "Areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary with water that is static or flowing, fresh, brackish or salty, including areas of marine water the depth of which at low tide does not exceed six meters"

In Kenya, as well as in Eastern Africa, wetlands are defined as: "Areas of land that are permanently, seasonally or occasionally water logged with fresh, saline, brackish or marine water, including both natural and man-made areas that support characteristic biota". The latter definition has the approval of the national Wetland Standing Committee of Kenya's Inter-ministerial Committee on Environment (IMCE). It is the refinement of the Ramsar Convention's definition for the Eastern Africa and does not exclude anything defined by the Ramsar Convention. This definition included swamps, marshes, bogs, soaks, shallow lakes, ox-bow lakes, river meanders and flood plains, as well as riverbanks, lakeshores where wetland plants grow. It also includes marine and inter-tidal wetlands such as deltas, estuaries, mudflats, mangroves, salt marshes, sea grass beds and shallow coral reefs. For the purpose of the Environmental Management and Co-ordination Act 1999, wetland means "an area permanently or seasonally flooded by water plants and animals have become adopted.

## **4.5 Environmental Legal Framework**

Environmental Management and Co-ordination Act No. 8 of 1999, provide a legal and institutional framework for the management of the environmental related matters. It is the framework law on environment, which was enacted on the 14<sup>th</sup> of January 1999 and commenced in January 2002. Topmost in the administration of EMCA is National Environment Council (NEC), which formulates policies, set goals, and promotes environmental protection programmes. The implementing organ is National Environment Management Authority (NEMA). EMCA comprises of the parts covering all aspects of the environment.

Part VIII, section 72 of the Act prohibits discharging or applying poisonous, toxic, noxious or obstructing matter, radio active or any other pollutants into aquatic environment. Section 73 requires that operators of projects which discharge effluent or other pollutants submit to NEMA accurate information about the quantities and quality of the effluent. Section 74 demands that all effluent generated from point sources are discharged only into the existing sewages system upon issuance of prescribed permit from the local Authorities. . Figure 1 below shows the EMCA Institutional Framework.

### **4.5.1 Public Health Act (Cap. 242)**

Part IX, section 115, of the Act states that no person/institution shall cause nuisance or condition liable to be injurious or dangerous to human health. Section 116 requires that Local Authorities take all lawful, necessary and reasonably practicable measures to maintain their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable to be injurious or dangerous to human health.

Such nuisance or conditions are defined under section 118 as waste pipes, sewers, drainers or refuse pits in such state, situated or constructed as in the opinion of the medical officer of health to be offensive or injurious to health. Any noxious matter or waste water flowing or discharged from any premises into the public street or into the gutter or side channel or watercourse, irrigation channel, or bed not approved for discharge is also deemed as nuisance. Other nuisances are accumulation of materials or refuse which in the opinion of the medical officer of health is likely to harbour rats or other vermin.

On responsibility of the Local Authorities Part XI, section 129, of the Act states in part “It shall be the duty of every local authority to take all lawful, necessary and reasonably practicable measures for preventing any pollution dangerous to health of any supply of water which the public within its district has a right to use and does use for drinking or domestic purposes

Section 130 provides for making and imposing regulations by the local authorities and others the duty of enforcing rules in respect of prohibiting use of water supply or erection of structures draining filth or noxious matter into water supply as mentioned in section 129. This provision is supplemented by section 126A that requires local authorities to develop by laws for controlling and regulating among others private sewers, communication between drains and sewers and between sewers as well as regulating sanitary conveniences in connection to buildings, drainage, cesspools, etc. for reception or disposal of foul matter.

Part XII, Section 136, states that all collections of water, sewage, rubbish, refuse and other fluids which permits or facilitates the breeding or multiplication of pests shall be deemed nuisances and are liable to be dealt with in the matter provided by this Act.

#### **4.5.2 Local Authority Act (Cap. 265)**

Section 160 helps local authorities ensure effective utilization of the sewages systems. It states in part that municipal authorities have powers to establish and maintain sanitary services for the removal and destruction of, or otherwise deal with kinds of refuse and effluent and where such service is established, compel its use by persons to whom the services is available. However, to protect against illegal connections, section 173 states that any person who, without prior consent in writing from the council, 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.

Section 170, allows the right to access to private property at all times by local authorities 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 maintenance of health, safety, and well being of the inhabitants of its area as provided for under Section 201 of the Act.

The Act under section 176 gives powers to local authority to regulate sewage 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 sewage 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”.

#### **4.5.3 Physical Planning Act, 1999**

The Local Authorities are empowered under section 29 of the Act to reserve and maintain all land planned for open spaces, parks, urban forests and green belts. The same section, therefore allows for the prohibition or control of the use and development of land and buildings in the interest of proper and orderly development of an area.

Section 30 states that any person who carries out development without development permission will be required to restore the land to its original condition. It also states that no other licensing authority shall grant license for commercial or industrial use or occupation of any building without a development permission granted by the respective local authority.

Finally, section 36 states that if in connection with a development application, local authority is of the opinion that the proposed development activity will have injurious impact on the environment, the application shall be required to submit together with the application an environment impact assessment EIA report. EMCA, 1999 echoes the same by requiring that such an EIA is approved by the NEMA and should be followed by annual environmental audits.

#### **4.5.4 Land Planning Act (Cap. 303)**

Section 9 of the subsidiary legislation (The Development and Use of Land Regulations, 1961) under this Act requires that before the local authorities submit any plans to the Minister for approval, steps should be taken as may be necessary to acquire the owners of any land affected by such plans. Particulars of comments and objections made by the landowners should be submitted. This is intended to reduce conflict with the interest such as settlement and other social and economic activities.

#### **4.5.5 Water Act, 2002**

Part II, section 18, of the Water Act 2002 provides for national monitoring and information system on water resources. Following on this, sub-section 3 allows the Water Resources Management Authority (WRMA) to demand from any person or institution, specified information, documents, samples or materials on water resources. Under these rules, specific records may require to be kept by a facility operator and the information thereof furnished to the authority.

The Water Act Cap 372 vests the rights of all water to the state, and the power for the control of all body of water with the Minister, the powers is exercised through the Minister and the Director of water resources in consultation with the water catchments boards, it aims at among others:

1. Provision of conservation of water and
2. Appointment and use of water resources.

Water apportionment board is a National Authority whose duty is to advise the Minister on issues with respect to water use. Permission to extract underground water for large-scale use lies with the board and the pollution of such water source is an offence. Failure to comply with such directives is an offence. The Minister is given the power to appoint undertakers of water supply and in most cases are Town, Municipal and City Councils.

Further in order to provide security and supply of water the Minister can declare a catchment's area of particular source of water as protected area and restrict activities in those areas. Such orders must be publicized in Kenya gazette.

Pollution of any water course is an offence and the Act also prohibits whoever throws, conveys, cause or permits throwing of rubbish, dirt, refuse, effluent, trade waste to anybody of water. It enhances the Ministry's capacity to enforce the Act by reviewing the water user

fees. Section 73 of the Act allows a person with a licence (licensee) to supply water to make regulations for the purposes of protecting against degradation of water resources. Section 75 and sub-section 1 allows the licensee to construct and maintain drains serves 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.

Section 76 states that no person shall discharge any trade effluent from trade premises into sewers of a licensee without the consent of the licensee upon application indicating the nature and composition of effluent, maximum quality anticipated, flow rate of the effluent and any other information deemed necessary. The consent shall be issued on conditions including payment of rates for discharge as may be provided under section 77 of the same Act. *4.5.6 Electricity Power Act No. 11 of 1997*

The Electric Power Act No. 11 enacted in 1997 deals with generation, transmission, distribution, supply and use of electrical energy as well as the legal basis for establishing the systems associated with these purposes. According to the Act, the Minister through the Electricity Regulatory Board is conferred with the legislative power to grant licences and authorise works for generation or transmission of electrical energy. However, the provisions of section 4 of the Act require such authorisation only for generating plants with a rating capacity exceeding 1000kw. Section 9 (3) of the Act address environmental integrity of the power generating systems which, must be considered by the board in recommending the grant of licences to the Minister.

In this respect, the following environmental issues will be considered before approval is granted:

1. The need to protect and manage the environment, and conserve natural resources;

2. The ability to operate in a manner designated to protect the health and safety of the project employees; the local and other potentially affected communities.

Under schedule 3 of the Electric Power (licensing) Regulations 2003, it is mandatory to comply with all safety, health and environmental laws. Moreover, schedule 2 (regulation 9) of the Electric Power (licensing) Regulations 2003 stipulates that licensing and authorisation to generate and stipulates that licensing and authorisation to generate and transmit electrical power must be supported by the following documents which are approved by NEMA.

1. Environmental Impact Assessment Report (EIA) or
2. Initial Environmental Audit Report (IEA) and
3. Environmental Management Plan (EMP)

#### **4.5.7 Building Code 2000**

Section 194 requires that where sewer exists, the occupants of the nearby premises shall apply to the local authority for a permit to connect to the sewer line and all the wastewater must be discharged into sewers. The code also prohibits construction of structures or buildings on sewer lines.

#### **4.5.8 Penal Code Act (Cap.63)**

Section 191 of the penal code states that if any person or institution that voluntarily corrupts or foils water for public springs or reservoirs, rendering it less fit for its ordinary use is guilty of an offence. Section 192 of the same Act says a person who makes or vitiates the atmosphere in any place to make it noxious to health of persons /institution is dwelling or business premises in the neighborhood or those passing along public way, commit an offence.



#### **4.5.9 Factories and Other Places of Work Act (Cap 514)**

Before any premises are occupied, or used a certificate of registration must be obtained from the chief inspector. The occupier must keep a general register. The Act covers provisions for health, safety and welfare.

##### **4.5.9.1 Health**

The premise must be kept clean, daily removal of accumulated dust from floors, free from effluvia arising from any drain, sanitary convenience or nuisance and without prejudice to the generality of foregoing provision. A premise must not be overcrowded, there must be in each room 350 cubic feet of space for each employee, not counting space 14 feet from the floor and a 9 feet floor-roof height.

The circulation of fresh air must secure adequate ventilation of workrooms. There must be sufficient and suitable lighting in every part of the premise in which persons are working or passing. There should also be sufficient and suitable sanitary conveniences separate for each sex, must be provided subject to conformity with any standards prescribed by rules. Food and drinks should not be partaken in dangerous places or workrooms. Provision of suitable protective clothing and appliances including where necessary, suitable gloves, footwear, goggles, gas masks, and head covering, and maintained for the use of workers in any process involving expose to wet or to any injurious or offensive substances.

##### **4.5.9.2 Safety**

Fencing of premises and dangerous parts of other machinery is mandatory. Training and supervision of inexperienced workers, protection of eyes with goggles or effective screens must be provided in certain specified processes. Floors, passages, gangways, stairs, and

ladders must be soundly constructed and properly maintained and handrails must be provided for stairs.

Special precaution against gassing is laid down for work in confined spaces where persons are liable to overcome by dangerous fumes. Air receivers and fittings must be of sound construction and properly maintained. Adequate and suitable means for extinguishing fire must be provided in addition to adequate means of escape in case of fire must be provided.

#### **4.5.9.3 Welfare**

An adequate supply of both quantity and quality of wholesome drinking water must be provided. Maintenance of suitable washing facilities, accommodation for clothing not worn during working hours must be provided. Sitting facilities for all female workers whose work is done while standing should be provided to enable them take advantage of any opportunity for resting.

Section 42 stipulates that every premise shall be provided with maintenance, readily accessible means for extinguishing fire and person trained in the correct use of such means shall be present during all working periods.

Section 45 states that regular individual examination or surveys of health conditions of industrial medicine and hygiene must be performed and the cost will be met by the employer. This will ensure that the examination can take place without any loss of earning for the employees and if possible within normal working hours.

Section 55B provides for development and maintenance of an effective programme of collection, compilation and analysis of occupational safety. This will ensure that health statistics, which shall cover injuries and illness including disabling during working hours, are adhered.

#### **4.5.10 The Forest Act CAP 385**

Section 2 of the forest Act states that a forest area is an area of land declared under section 4 to be a forest area. The area to be occupied Project has not been declared as a forest area under section 4 of the Forest Act CAP 385.4.5.11 *Food Drugs and chemicals substances Act (Cap 254)*

The Food, Drugs and Chemical Substances Act (CAP 254) whose purpose is to make provisions for the prevention of adulteration of food, drugs and chemical substances. This Act (which has been invoked for the consumption of genetically modified food), requires that food, drugs, cosmetics, devices and chemical substances should not be sold if they are unwholesome, poisonous, or adulterated. It further prohibits deceptive labelling. The statute also gives powers to authorized officers to inspect and examine any premises for evidence of contravention of the provisions of the law. There is thus no explicit policy and legal framework for the development and introduction of modern biotechnology in Kenya.

#### **4.5.12 the Petroleum Act, Cap 116**

The Petroleum Act, Cap 116 is the primary legislation in Kenya that regulates petroleum operations. This Act whose commencement date is August 31<sup>st</sup>, 1948 is fairly old and was last revised in 1972. The subsidiary legislation appended to the main body of the Act is known as the Petroleum installations. A key aspect under this piece of legislation is the requirement for a petroleum project proponent to acquire an annual permit to store petroleum products in bulk and to display it conspicuously at the premise. These include the liquefied petroleum gas (LPG) facilities.

## 5 STAKEHOLDERS PARTICIPATION

### MINUTES OF THE STAKEHOLDERS' MEETING FOR THE ESIA STUDY FOR THE PROPOSED TALUSAG GREEN ANHYDROUS AMMONIA FERTILIZER PROJECT HELD ON 5<sup>TH</sup> OCTOBER 2022 AT THE KENYA NUT COMPANY

<b>Subject/Ref</b>	ESIA and RAP Studies for the Proposed Green Anhydrous Ammonia Fertilizer project
<b>County</b>	Nakuru
<b>Meeting Venue</b>	KENYA NUT COMPANY MORENDAT FARM NAIVASHA
<b>Date and time of Meeting</b>	5 <sup>th</sup> October 2022
<b>Project representatives Present</b>	Hiro Iwanaga –project proponent Tracy Keyes-project chemical expert/engineer Jenny Fletcher –solar project expert Jane Ndirangu- Kenya Nut localProject representative Henry Makoba Sumba- project Lead Expert Greame- Kenya Nut CEO
<b>Number Of participants</b>	Male: 25 Female: 7

#### **Agenda of the Meeting**

The agenda was as follows:

- Opening remarks/prayer
- Introduction of participants
- Overview of the agenda of the meeting by Henry Makoba Sumba
- Presentation of the proposed project by experts
- Presentation of the ESIA process
- Question and answer session
- Closing and adjourning of main meeting

#### **Commencement of the Meeting**

The Meeting was called to order at 10.00 am by Henry Makoba Sumba. He proceeded to state the agenda of the meeting as a stakeholders' meeting with Stakeholders fronting the Project alignment. He requested a member to open the meeting with a word of prayer which was done by Mr Solomon representing Kenya Nut Company. Thereafter, a round of introductions from the stakeholders who were present.

### **Project Description**

The lead expert commenced by thanking the community for being present and taking their time to understand the project. He provided an overview of the proposed ammonia fertilizer factory

- The justification of the proposed project was:
- The project is a Partnership between Kenya Nut Company and TalusAg Ltd
- Kenya Nut Company will provide the necessary infrastructure including the land and it will gain from the fertilizer TalusAg Ltd will process.
- Talus will process and manufacture the green anhydrous ammonia fertilizer from Air and water which will be provided by the farm. This is a new technology which processes eco-friendly fertilizer, by energy been provided by solar plant and water undergoing electrolysis under pressure to produce ammonia.

- The anticipated benefits of the proposed project include
  - a. Eco-friendly fertilizer for farm use
  - b. No effects of carbon hence climate change effects
  - c. Provision of job opportunities
  - d. Direct transfer of technology
  - e. Enhanced competitiveness
  - f. Reduction of vehicular emissions hence improved air quality
  - g. Attraction of international investors
  - h. Business opportunities for local supply chain
- The social and environmental issues that were highlighted were creation of employment opportunities, safety precautions during construction
- The mitigation measures were optimized land use.

- The lead Expert Henry Makoba Sumba defined ESIA as the process of maximizing positive impacts and minimizing or eliminating the negative ones. He also explained that the requirement for an ESIA is enshrined in the Environmental Management and Coordination Act (EMCA), 1999, (amended in 2015) which is the framework law on environmental management in Kenya. The Act provides for environmental protection through processes such as Environmental Impact Assessment, Environmental Audit and Monitoring.
- EMCA 1999 (Amended 2015) section 58 categorizes project as High Risk (Category I), Medium Risk (Category II), and Low Risk (Category III)
- All new projects are categorized as Category 1 in Section 58(2) of EMCA 1999 (2015) and requiring Full ESIA Study
- The green anhydrous ammonia falls under high risk project. It has been determined that

project will be subjected to a Full ESIA Study to enable an in-depth identification and analysis of potential impacts, and subsequent devising of appropriate mitigation and enhancement measures.

- The Consultant gave the progress of the ESIA which commenced with a desk study, then development of the Terms of Reference which were approved by NEMA
- The ESIA process entails screening a project to determine whether an EIA is required or not, and if needed, the level of scrutiny (environmental assessment) that the project should be subjected to. Screening is following by a baseline and scoping study to determine the nature and magnitude of anticipated environmental and social impacts
- Stakeholder consultation is a key aspect of the EIA Study and, is anchored in the Constitution of Kenya 2010 and is also supported by the Public Participation Bill of 2018. It is therefore crucial that stakeholders in any given development are identified and engaged at various levels with an aim of obtaining their views, concerns, suggestions and recommendations, to be incorporated in the project. He explained that it is for this reason that stakeholder engagement is being carried out with various parties.
- Henry explained that the Terms of Reference for the ESIA Study had been submitted to NEMA for review and the approval to proceed with the study was granted
- Once the ESIA Report is submitted to NEMA, the Authority will generate the summary of potential impacts and mitigation measures for publication in two local dailies and in the Kenya gazette. The public will be invited through the advert to peruse the report and give comments over a period of thirty days.
- NEMA will then review the report and decide whether to issue an EIA license with conditions or not.

<b>Interactive Session with Participants</b>
After presentations from the client and consultant, the meeting proceeded to an interactive session where participants were given opportunity to ask questions, comment on the project, seek clarification, and any other concerns and recommendations for project development.

**Table 1: ISSUES RAISED AND RESPONSES GIVEN**

<b>Topic</b>	<b>Participant</b>	<b>Issue Raised</b>	<b>Responses</b>
What is anhydrous ammonia		Enquired what is ammonia and how it is a fertilizer	Talus Expert . responded by stating what green anhydrous ammonia is objectively
	Samson Sirengo	If anhydrous ammonia is dangerous	Yes it is dangerous just like any other chemical substances and needed to be handled with a lot of care, which the proposed project has mitigated for.



<b>Topic</b>	<b>Participant</b>	<b>Issue Raised</b>	<b>Responses</b>
Water source	Kennedy Juma	Where the project will get water from and if it will interfere with the farms water supply	Talus Expert Hiro Iwanga responded by saying the proposed project will get water from the borehole supply of the farm. The amounts which are to be used are very minimal, only for electrolysis hence about 200lites was sufficient.
Proposed project timelines	Dorothy Akinyi	Clarity on when proposal on ESIA is completed.	THE ESIA report will be submitted by the end of October 2022. NEMA will publish the report and give a link for public to comment within 30 days.
		Experiencing high level noise pollution;	the factory will produce noise levels below 85 db, as exemplified in various case studies
Measures for ammonia escape	Eric Koech	Just incase there was a gas leak in the factory what were the measures provided	The proposed factory has about 130 safety values, just incase of a gas leak the whole factory shuts down, this was answered by Talus representative.

Topic	Participant	Issue Raised	Responses
		How much nitrogen is found in the anhydrous ammonia as compared to the convectional fertilizers	<p>The anhydrous ammonia contains the highest amount of nitrogen which is 82% therefore making it one of the best fertilizers.</p> <p>The fertilizer is cheap to manufacture and it does not leave carbon footprints hence its eco-friendly since it is manufactured from compressed air and water under electrolysis to release hydrogen and this done by use of solar energy. Therefore all the process from raw materials and power are all eco-friendly.</p> <p>-</p> <p>.</p>
		The need of the stakeholders after project before the proposed project is launched	<p>Project contract not a secret much as it was signed.</p> <p>Stakeholder engagements is for feedback mechanisms was open for everyone.</p>

Utility Relocations	Eric Koech	-whether farm processes will be adversely affected.	No farm process will be affected , the project is located far on the north side of the farm, hence the processes will run hand in hand.
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Topic	Participant	Issue Raised	Responses
Water utilization	Jane Nditrangu	Whether the project should maximize ion rain water harvesting	Good practice which was supported by all participants.
Project Impact during construction	Hiro Inawanga	Scope of work be shared with stakeholders;  - Youth employment	The proposed project is composed of four containers (4) and three tanks (3) and there will be minimal construction activities which are of significant impact.  Hiro expounded with caser studies done in USA.  At least some people will be employed to run the normal operations of the project.  Since the project is a pilot project, most of the initial experts will be foreigners, who will eventually transfer technology to farm and Kenya as a whole.

**With no other business the , the meeting was closed with a word of prayer and all stakeholders were in unison. They filled up questionnaires and signed the forms giving their objective feelings.**

**(SEE ATTACHED FULL MINUTES ATTACHED IN THE APPENDICES)**

## **6 IDENTIFICATION OF THE PROPOSED PROJECT ENVIRONMENTAL IMPACTS**

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This Section identifies both negative and positive impacts associated with the proposed project. These are identified according to Phases namely: Construction Phase, Operational Phase and Decommissioning Phase.

### **6.1 CONSTRUCTION PHASE**

#### **6.1.1 Positive Impacts**

##### **6.1.1.1 Job Opportunities**

There will be job opportunities especially to casual workers. Employment opportunities are a benefit both in economic and social sense. In the economic sense it means abundant unskilled labour will be used in economic production. In the social sense these young and energetic otherwise poor people will be engaged in productive employment other than remaining idle. Remaining idle may attract them into social ills like drug abuse and other criminal activities like robberies. Several workers including casual labourers, masons, carpenters, joiners, electricians and plumbers are expected to work on the site for a period that the project will start to the end. Apart from casual labour, semi skilled and unskilled labour and formal employees are also expected to obtain gainful employment during the period of construction.

##### **6.1.1.2 Gains in the Local and National Economy**

There will be gains in the local and national economy. Through consumption of locally available materials including. The consumption of these materials and others will attract taxes including VAT which will be payable to the government. The cost of the materials will be payable directly to the producers.

### **6.1.1.3 Roads**

The developers will a roads to the site, which leads to area development. This will be a positive impact to the surrounding community and Kenya as a whole.

### **6.1.1.4 Land value**

The proposed project is expected to increase the land value with anticipated high returns. This will have positive influence on the neighbouring community to open up to the same land use that cater for the conserving the natural environment while improving local land values.

### **6.1.1.5 Improved livelihood**

Increased direct and indirect employment opportunities, improved telephone and electricity network, training and other anticipated benefits will directly translate into improved livelihood for the local community. This is because the employment brings with it improved/better purchasing power hence improved the quality of life. The overall effect is enhanced life expectancy.

### **6.1.1.7 Provision of cheap eco-friendly fertilizer**

Anhydrous ammonia is one of the most efficient and widely used sources of nitrogen for plant growth. The advantages of ammonia's relatively easy application and ready availability have led to its increased use as a fertilizer on farms.

## **6.1.2 Anticipated Negative Impacts**

### **6.1.2.1 Soil Erosion**

This is even made worse by the type of soil on site and some rain water runoff from other areas finding its way to the site location. Such problems become serious when the topsoil is left bare and agents of erosion become active. Soil erosion is an important problem both at its source and downstream of the development site. Lost soil will be deposited somewhere, and the location of the deposition could alter downstream hydrology and

increase flooding. It may also pose a water quality issue directly as a result of siltation and indirectly from contaminants carried with or attached to soil particles.

#### **6.1.2.2 Storm water**

There is a likelihood of interference of the construction operation from the storm water runoff either from the site. The contractor should avoid steep gradients.

#### **6.1.2.3 Noise pollution**

The works will most likely be a noisy operation due to the moving machines and incoming vehicles to deliver construction materials and workers to site. However, this will not be a potential source of disturbance as the place that the fertilizer factory project is proposed is an isolated area and the neighbours are many kilometres away. However the site workers are likely to be affected since noise beyond some level is itself a nuisance and can be controlled within acceptable limits.

#### **6.1.2.4 Disposal of Excavated Soil**

Though little excavation is likely to take place at the project site, the excavation works to level the site will result in the generation of small amounts of excavated material. But there will be no cart away of excavated material. It will all be utilised on site to adjust levels where necessary. Therefore there will be no different types of excavated soil mixed up and no problem of dumping excavated soils.

#### **6.1.2.5 Oil Spills**

The machines on site may be containing moving parts which will require continuous oiling to minimise the usual corrosion or wear and tare. Possibilities of such oils spilling and contaminating the soil and water on site are real. Likewise, moving vehicles on site may require oil change. But these dangers are contained by maintaining the machinery in specific areas designed for this purpose.

#### **6.1.2.6 Increased water demand**

Both the workers and the construction works will create additional demand for water in addition to the existing demand. Water will be mostly used in the creation of concrete for ammonia processing works and for wetting surfaces or cleaning completed structures.

#### **6.1.2.7 Dust Emissions**

Particulate matter pollution is likely to occur during the site clearance, excavation and spreading of the topsoil. There is a very small possibility of PM<sub>10</sub> suspended and settleable particles affecting the site workers and even neighbours health, it is minimal given the construction method of minimum excavation and nil cart away of soil, and also since the development is a containerised design.

#### **6.1.2.8 Faecal Waste Management**

The generated waste needs proper handling to prevent disease, for example diarrhoea, outbreak on the site. The developer intends to quickly connect all waste to the sewer so that this threat is minimized quickly, a registered sewerage contractor will be employed.

#### **6.1.2.9 Surface water pollution**

This will should be controlled by constructing storm water drainage channels and always unclogging them to prevent water logging.

#### **6.1.2.10 Destruction of existing vegetation**

The construction process will involve clearing of the existing vegetation cover to a small extent, since most of the proposed project is containerised.

#### **6.1.2.11 Generation of Exhaust Emissions**

Exhaust emissions are likely to be generated by the construction equipment during the construction phase. Motor vehicles used to mobilise the work force and materials for

construction would cause air quality impact by emitting pollutants through exhaust emissions

#### **6.1.2.12 Increased Runoff from New Impervious Areas**

Construction could result in additional runoff through creation of impervious areas and compaction of soils. Impervious areas and compacted soils generally have higher runoff coefficients than natural area, and increased flood peaks are a common occurrence in developed areas.

#### **6.1.2.13 Surface and ground water Hydrology and Water Quality Degradation**

Changes in surface hydrology alter the flow of water through the landscape. Construction of impervious surfaces such as parking lots, roads and buildings increase the volume and rate of runoff, resulting in habitat destruction, increased pollutant loads, and flooding. Built or paved areas and changes in the shape of the land also influence groundwater hydrology (i.e. recharge rates, flow, conditions).

Project related excavation could lead to surface and ground water quality degradation. Contaminated soil or ground water in the path of the project could be disturbed by excavation resulting in a potential transfer of the contamination to surface waters. The excavated area, if linear could act as a conduit to extend groundwater contamination to new areas. Spills of hazardous materials in excavated areas during construction could introduce contaminants to ground water.

#### **6.1.2.14 Aquatic species and communities**

Changes in surface hydrology and water quality can have adverse impacts on aquatic species such as fish, plants, and microbes. Increased turbidity, temperature, velocity of flow, and pollutant loads can have direct impacts on the species and their habitat.



#### **6.1.2.15 Workers accidents and hazards during construction**

it is expected that workers are likely to have accidental injuries and hazards as a result of handling hazardous waste. Because of the intensive engineering and construction activities including erection materials, metal grinding and cutting, concrete work, steel erection and welding among others, construction workers will be exposed to risks of accidents and injuries. Such injuries can result from accidental falls from high elevations, injuries from hand tools and construction equipment cuts from sharp edges of metal sheets and collapse of building sections among others.

#### **6.1.2.16 Vector borne and water borne Disease incidence**

When solid wastes are not well managed there is potential of disease outbreak due to suitable breeding conditions for vectors of cholera and typhoid. If the wastes find their way in this water body its quality may be lowered. Malaria outbreak could also be exacerbated by the presence of open water ditches for breeding of anopheles mosquitoes. The major vulnerable groups are children who could be exposed to these conditions.

#### **6.1.2.17 Possible exposure to workers to diseases**

During construction phase, workers are likely to be exposed to diseases from building materials. It is therefore recommended that before the construction commences, there is need for the materials to be well inspected according to the occupational health and safety standards.

#### **6.1.2.18 Solid Waste Generation**

solid waste will be generated these include papers used for packing materials , among others. Dumping around the site will interfere with the aesthetic status of the area. Disposal of the same solid wastes off-site could also be a social inconvenience if done in the wrong places. The off-site effects could be aesthetic, pest breeding, pollution of physical environment, invasion of scavengers and informal recycling communities.

#### **6.1.2.19 Loss of plant species and communities**

Direct impact results from: disturbances that cause changes in temperature, light, moisture and nutrient levels; removal activities (e.g. clear-cutting, bulldozing); impacts resulting from air and water pollution (e.g. turbidity, eutrophication). Indirect impacts result from changes in natural community processes or invasion of non-native plant species. Loss of plant communities also results in decreased water quality, increased erosion as a result of unstable soil, nutrient imbalances in the soil, and/or compaction of soil.

#### **6.1.2.20 Loss of Wildlife and Wildlife Habitat**

Like plant communities, wildlife habitat may be impacted both from direct and indirect activities associated with development. Alteration, fragmentation, or destruction of wildlife habitat can result in the direct loss or displacement of species and the ability of the ecosystem to support other biological resources such as the plant communities upon which the wildlife relied for survival.

#### **6.1.2.22 Energy Consumption**

The project will consume fossil fuels (mainly diesel) to run transport vehicles and construction machinery. Fossil energy is non-renewable and its excessive use may have serious environmental implications on its availability, price and sustainability..

### **6.2 OPERATION PHASE**

#### **6.2.1 Impacts**

##### **6.2.1.1 Employment Generation**

Employment opportunities are one of the long-term major impacts of the project that will be realised after construction and during the operation and maintenance of the houses.

##### **6.2.1.2 Increase in Revenue**

There will be positive gain for the revenue system arising from the sale of the fertilizer.

**6.2.1.3 CHEMICAL HAZARDS, USE OF THE ANHYDROUS AMMONIA.**

Anhydrous ammonia is caustic and will cause severe burns to the eyes, skin and respiratory tract. Anhydrous ammonia is a strong alkali that can cause death or severe injury to body tissue due to its caustic, corrosive, freezing, and dehydrating action. Its strong affinity for water and rapid evaporation creates an almost instant freeze-drying effect when the liquid  $\text{NH}_3$  comes in contact with body tissue.

Stored as a liquid under pressure,  $\text{NH}_3$  vaporizes to a colorless gas at atmospheric pressure and a temperature of -28 degrees Fahrenheit. The incidental release of anhydrous ammonia can create a dangerous situation for both the handler and bystanders.

The following situations can lead to an incidental release or personal injury:

- Overfilling the tank.
- Handling the hose by the valve handle or hand wheel.
- Weakened undercarriage structure.
- Moving the tank before disconnecting the hose.
- Faulty valves and deteriorated or out-of-date hoses.
- Failure to bleed pressurized  $\text{NH}_3$  from the hose before connecting or disconnecting.
- Overturning an applicator tank.
- External overheating of the storage container.
- Faulty hitch pin or weakened tongue.
- Not using personal protective equipment.

- Failure to have sufficient amounts of water available.

An estimated 80 percent of reported incidents result from improper procedure, lack of knowledge or training, and failure to follow proper safety precautions. Hazardous incidents can be reduced if all individuals follow safety rules and maintain the equipment properly. It is essential that all equipment be in good shape.

## **6.3 DECOMMISSIONING PHASE**

### **6.3.1 Impacts**

#### **6.3.1.1 Rehabilitation**

Upon decommissioning the project, rehabilitation of the project site will be carried out to restore the site to its original status. This will include replacement of topsoil and re-vegetation which will lead to improved visual quality of the area.

#### **6.3.1.2 Employment Opportunities**

Several employment opportunities will be created for the demolition staff.

### **6.3.2 Negative Impacts**

#### **6.3.2.1 Solid Waste**

Demolition of the project facility and related infrastructure will result in large quantities of solid waste. The waste will contain the materials used in construction including concrete, metal, drywall, wood, glass, paints, adhesives, sealants and fasteners. Although demolition waste is generally considered as less harmful to the environment since they are composed of inert materials, there is growing evidence that large quantities of such waste may lead to release of certain hazardous chemicals into the environment. In addition, even the generally non-toxic chemicals such as chloride, sodium, sulphate and ammonia which may be released as a result of leaching of demolition waste, are known to lead to degradation of groundwater quality.

### **6.3.2.2. Dust**

Large quantities of dust will be generated during demolition works. This will affect demolition staff as well as the neighbouring residents.

## **7 MITIGATION MEASURES AND MONITORING PROGRAMMES**

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This section highlights the mitigation measures for the expected negative impacts of the proposed project. The potential impacts and the possible mitigation measures have herein been analyzed

### **7.1 MITIGATION OF RELATED IMPACTS**

#### **7.1.1 Air quality**

It is recommended that a standard set of feasible dust control measures be implemented for all operations activities. Emissions of other contaminants (NO<sub>x</sub>, CO<sub>2</sub>, SO<sub>x</sub>, and diesel related PM<sub>B10E</sub>) that would occur in the exhaust from heavy equipment are also included. The proponent is committed to implementing measures that shall reduce air quality impacts associated with works. All personnel working on the project will be trained prior on methods for minimizing air quality impacts. Specific training will be focused on minimizing dust, chemicals dust and exhaust gas emissions from heavy construction vehicles. Vehicles drivers will be under strict instructions to minimize unnecessary trips, refill petrol fuel tanks in the afternoon, and minimize idling of engines.

Dust emissions will be controlled by the following measures:

- Watering to lay dust.
- Pave, apply water when necessary, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas

- Sweep daily (with physical sweepers) all paved access roads, parking areas and staging areas at construction sites.
- Fast growing trees will be planted around the project area to act as a wind breaks to reduce the uplift of particulate matter that lead to respiratory diseases.

### **7.1.2 Noise Pollution**

Significance of noise impacts depends on whether the project would increase noise levels above the existing ambient levels by introducing new sources of noise. Noise impacts would be considered significant if the project would result in the following:

- Exposure of persons to, or generation of, noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.
- Exposure of persons to, or generation of, excessive ground-borne vibration or ground-borne noise levels.
- A substantial permanent increase in ambient noise levels (more than five dBA) in the project vicinity above levels existing without the project.
- A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

The proponents shall put in place several measures that will mitigate noise pollution. The following noise-suppression techniques will be employed to minimise the impact of temporary construction noise at the project site.

- Install portable barriers to shield compressors and other small stationary equipment where necessary.
- Use quiet equipment (i.e. equipment designed with noise control elements).
- Co-ordinate with relevant agencies regarding all substation construction activities in the residential areas.
- Install sound barriers for pile driving activity.

- Limit pick up trucks and other small equipment to a minimum idling time and observe a common-sense approach to vehicle use, and encourage workers to shut off vehicle engines whenever possible.

### **7.1.3 Generation of Exhaust Emission**

In order to control exhaust emissions the following measures shall be implemented

- Vehicle idling time shall be minimized
- Alternatively fuelled construction equipment shall be used where feasible
- Equipment shall be properly tuned and maintained

### **7.1.4 Hydrology and Water Quality Degradation**

Several measures shall be put in place to mitigate the impacts that are likely to lead to Hydrology and water quality degradation. The proponent will prepare a hazardous substance control and emergency response plan that will include preparations for quick and safe clean up of accidental spills. It will prescribe hazardous-materials handling procedures to reduce the potential for a spill during construction, and will include an emergency response programme to ensure quick and safe cleanup of accidental spills. The plan will identify areas where refuelling and vehicle maintenance activities and storage of hazardous materials, if any, will be permitted.

Soil sampling and trial holes digging will be conducted and soil information will be provided to inform them about soil conditions and potential hazards. If hazardous substances are unexpectedly encountered during trenching, work will be stopped until the material is properly characterised and appropriate measures are taken to protect human health and the environment. If excavation of hazardous materials is required, they will be handled in accordance with applicable regulations. Appropriate personal protective equipment will be used and waste management will be performed in accordance with

applicable regulations. Oil absorbent material, tarps and storage drums will be used to contain and control any minor releases of engine and other equipment oil.

#### **7.1.5 Worker accidents and hazards when handling hazardous wastes**

Adequate collection and storage of waste on site and safe transportation to the disposal sites and disposal methods at designated area shall be provided. In addition the proponent is committed to adherence to the occupational health and safety rules and regulations stipulated in Occupational Health and Safety Act (Cap 514). In this regard, the proponent is committed to provision of appropriate personal protective equipment, as well as ensuring a safe workers as outlined in the EMP.

#### **7.1.6 Populations of disease vectors**

Disease vectors such as rats, flies, and cockroaches increase where refuse is exposed or uncollected and can be a hazard. Complete refuse collection and handling service will be provided by the proponent so that this is not a hazard.

#### **7.1.8 Increased runoff**

Increased runoff from paved grounds causing extreme flooding and overflows of drainage systems shall be mitigated. Surface runoff and roof water shall be harvested and stored in underground reservoir for reuse. A storm water management plan that minimizes impervious area infiltration by use of recharge areas and use of detention and/or retention with graduated outlet control structures will be designed.

#### **7.1.9 Possible exposure of workers to diseases**

Possible exposure of workers to diseases from building materials at site shall be mitigated by occupational health and safety standards enforcement.



**7.1.10** Worker accidents during construction and *shall be mitigated by enforcing adherence to safety procedures and preparing contingency plan for accident response in addition safety education and training shall be emphasized.*

#### **7.1.1 Minimization of Vegetation Disturbance**

Clearance of part of the vegetation at the project site to pave way for proposed project will be inevitable. However, the proponent will ensure proper demarcation of the project area to be affected by the construction works. This will be aimed at ensuring that any disturbance to flora and fauna is restricted to the actual project area and avoid spill over effects on the neighbouring areas.

Another important measure aimed at reducing disturbance of vegetation in the project area will be preservation of individual trees within the site. In addition, the proponent has committed itself to re-vegetation of some of the disturbed areas through implementation of a well designed landscaping programme. It is recommended that part of the topsoil excavated from the construction site be re-spread in areas to be landscaped to enhance plant health.

#### **7.1.13 Minimization of Run-off and Soil Erosion**

The proponent will put in place some measures aimed at minimizing soil erosion and associated sediment release from the project site. These measures will include terracing and levelling the project site to reduce run-off velocity and increase infiltration of rain water into the soil. In addition, construction vehicles will be restricted to designated areas to avoid soil compaction within the project site, while any compacted areas will be ripped to reduce run-off.

#### **7.1.14 Minimization of Noise and Vibration**

It is recommended that all generators and heavy duty equipment be insulated or placed in enclosures to minimize ambient noise levels.

### **7.1.15 Reduction of Energy Consumption**

The proponent shall ensure responsible electricity use. Complementary to these measures, the proponent shall monitor energy use during operations and set targets for reduction of energy use.

### **7.1.16 Minimization of Water Use**

The proponent shall ensure that water is used efficiently at the site by sensitizing staff to avoid irresponsible water

## **7.3 MITIGATION ON CHEMICAL SAFETY**

### **➤ PERSONAL PROTECTION**

Personal Protective Equipment (PPE) creates a barrier between the chemical and the human body. Goggles, rubber gloves and other chemical resistant protective clothing are necessary when handling anhydrous ammonia.

It is recommended that goggles and a face shield or an approved full-face respirator be used to protect the eyes and face from a direct blast of ammonia. Never wear contact lenses when handling anhydrous ammonia, since they can trap the gas and freeze the contacts to the eye. Contact with just a small amount of anhydrous ammonia can permanently blind and disfigure an individual.

### **➤ FIRST AID**

Washing with water is the emergency measure to use when skin or eyes are exposed to anhydrous ammonia. Time is important! Get water onto the exposed area of the skin or eyes immediately and flush for at least 15 minutes. Contaminated clothing should be removed quickly but carefully. Thaw clothing frozen to the skin with water before attempting removal. Wash the affected skin area with abundant amounts of water and do not apply anything except water for the first 24 hours. Stay warm and get to a physician immediately.

Water must be available for flushing the eyes and skin in case of exposure. Each vehicle used for anhydrous ammonia must carry a 5-gallon container of clean water. Anyone handling  $\text{NH}_3$  should carry a 6- to 8-ounce squeeze bottle of water in their shirt pocket for rapid emergency access.

### **CARE AND MAINTENANCE OF ANHYDROUS AMMONIA EQUIPMENT**

A regular, scheduled maintenance program will ensure the tank, the valves and all hoses are safe for handling the high-pressure liquid and its vapor form. It is imperative that all equipment, when in use, be given a daily visual inspection to locate any defects in the tank or hoses. The most important components of a routine maintenance check are listed below.

#### **Tank Valves, includes Liquid Withdrawal Valve, Liquid Fill Valve, and Vapor**

**Return Valve**—Be sure valves are functional and will shut off. Any leak detected in the valve is cause for immediate repair or replacement. Each valve should be removed every five years and inspected for internal corrosion and thread deterioration.

**Excess flow valve**—Check the valve for movement of the valve plunger, corrosion of springs, valve seat and guide, and out of round disk. This valve should be replaced every five years.

**Pressure Gauge**—Check the consistency with other tanks of similar volume. Make sure the lens is clean and the dial face is clearly readable.

**Fixed Liquid Level Gauge**—Clean, repair or replace as needed.

**Liquid Level Float Gauge**—Check against the 85 percent level gauge for accuracy. An inaccurate reading, leaking at the seal, or unreadable lens should be repaired or the defective item replaced.

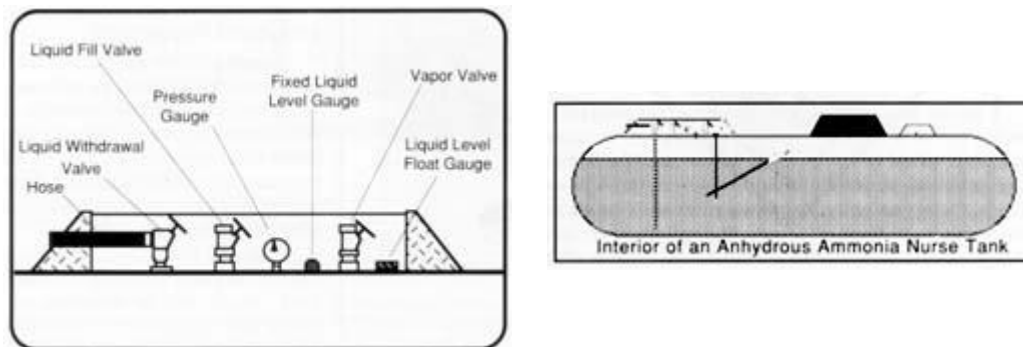
**Safety Relief (SR) Valve**—Stand to one side and use a mirror for viewing. The SR valve should be free of dirt and rust. Replace the rain cap if it is damaged or

missing. Leakage or discharge below 250 psi is cause for replacement. The SR valve should be replaced every five years.

**Hydrostatic Relief (HR) Valve**—Inspect the valve for leakage, corrosion or damage. The HR valve should be replaced every five years.

**Transfer Hose**—Examine the hose closely for cuts, abrasions, soft spots, bulges, kinking or flattening and similar defects. Check for slippage of the hose at coupling. The hose must be replaced five years from the date of manufacture (stamped on hose).

**Tank Condition**—Prevent corrosion and excessive pressure buildup from direct sunlight by keeping the tank painted with a reflective paint. Dented or damaged tanks should be taken out of service until checked by an authorized inspector and repaired as necessary. All welding on the tank must be done by a certified welder. Be careful in repairing or replacing these parts to prevent accidental exposure to anhydrous ammonia. Most retailers will assist you in repairing your nurse tank or applicator.



## LABELS, MARKING AND SAFETY SIGNS LEGAL REQUIREMENTS

These markings are listed below.

- Nurse tanks must be labeled “ANHYDROUS AMMONIA” in 4-inch letters, on contrasting background, on the sides and rear of the tank.

- The words “INHALATION HAZARD,” in association with the anhydrous ammonia label, in 3-inch lettering be placed on both sides of the tank.
- A DOT approved “NON-FLAMMABLE GAS” placard with the numbers 1005 (identifying it as anhydrous ammonia) must be located on both sides and both ends of the tank.
- A Slow Moving Vehicle (SMV) sign must be prominently displayed on the rear of the tank with the bottom of the sign at least 2 and not more than 6 feet from the ground.
- The valves must be appropriately labeled by color or legend as vapor (Safety Yellow) or liquid ( Orange). The letters of the legend must be at least 2 inches high on contrasting background and within 12 inches of the valves.

#### **ADDITIONAL SAFETY RECOMMENDATIONS FOR THE TANK**

- An operator’s manual should be available, ideally with the equipment, for reference at all times.
- A safety-type hitch pin with a standard safety chain attachment for the nurse tank wagons or running gear.
- In addition to the mandatory SMV sign, appropriate lighting for travel on roadway must include at least one red tail lamp and two amber flashing warning lamps. These may be on the towing vehicle or the tank wagon, but they must be visible from the rear. Additionally, the tank wagon must have at least two red reflectors visible to the rear.
- Turn signals, flashing warning lights and a red brake light are recommended on all anhydrous ammonia tank wagons which are towed on public roadways. To accommodate these lights, a standard seven terminal breakaway connector plug should be used on the tank wagon.

- At least one safety sign should be located in between the control valves and the 5-gallon water supply.

### **SAFE FIELD PRACTICES**

Some simple suggestions when working with anhydrous ammonia in the field include:

- Always have water readily available. This should include a squirt bottle of water with you and 5 gallons of emergency water mounted on the nurse tank.
- PPE should include: long sleeve clothing, goggles, chemical gloves, and respirator with approved cartridge. Have a back-up pair of personal protective equipment to use, if needed.
- Wear the proper PPE when connecting or disconnecting nurse tanks from the applicator or when making minor repairs or adjustments in the field.
- Ensure that a set of PPE is located in the cab of the tractor and in any vehicle used to transport nurse tanks. Follow the recommended procedures for connecting and disconnecting nurse tanks and applicators. Shortcuts can lead to unintended release or unexpected exposure.
- When changing nurse tanks or making field repairs, always work upwind of the applicator and the nurse tank. Applicator knives, flow meter, hose connections, bleeder valves, and nurse tank valves can be exposure opportunities for an unintended release.
- When changing nurse tanks, park the tractor upwind before opening bleeder valves or disconnecting hoses. This can minimize the chance of anhydrous ammonia from entering the cab.
- Watch for pinch points and crush points when hitching the nurse tank to the applicator.

- Point the hose end away from you and make sure connectors and connection points are clean when coupling the nurse tank hose to the applicator.
- Hand-tighten valve handles. Over tightening with a wrench can cause damage to the valve or seals. Inspect and replace hoses and valves as needed.
- Bleed off pressure in the hose before disconnecting it.
- Ensure hitch pins are secure and secondary chains are attached before moving the nurse tank.
- Park nurse tanks (empty or full) downwind and away from neighboring houses, public areas and businesses.

### **ROADWAY TRANSPORT SAFETY**

Below are helpful tips when transporting anhydrous ammonia tanks. Each state may have its own requirement for road transportation. In Ohio, the following regulations apply:

Operator Age—Individuals transporting anhydrous ammonia must be 30 years old.

- Towing—It is highly recommended that the vehicle used to tow the nurse tank be at least equal in weight to the gross weight of the nurse tank. This will assist the operator in maintaining control minimizing the risk of a roadway incident.

Roadway transport of an anhydrous ammonia nurse tank can include:

- tractor, applicator and one nurse tank
- tractor and two nurse tanks (Local supplier company policy may dictate that a customer may only tow one nurse tank.)
- pickup truck and one nurse tank
- Speed—The speed limit for anhydrous ammonia tanks traveling on the farm at 30kilometer per hour.

- **Personal Protective Equipment**—All vehicles transporting anhydrous ammonia shall carry a container of at least 5 gallons of water and be equipped with rubber gloves and either a full face gas mask, a pair of tight-fitting goggles, or one full face shield.
- **Nurse Tank Leak During Transport**—If a leak occurs in transportation equipment and it is not practical to stop the leak, the driver should move the vehicle to an isolated location away from populated communities.
- **Prior to operating a nurse tank on a public roadway, carefully check:**
- **Running Gear**—Inspect the farm wagon frame tongue, reach poles, anchor devices, wheel bearings, knuckles, ball joints and pins for structural damage, cracks, excessive wear and adjustments.
- **Tires**—Check for proper inflation. Check tire tread for cuts, badly worn spots, and signs of weathering. Assure that lug nuts are tight.
- **Lubrication**—Steering knuckles, wheels, tongues, or other applicable farm wagon equipment should be lubricated at least once every year.

## **8 ANALYSIS OF PROJECT ALTERNATIVES**

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This section analyses the project alternatives in terms of site, technology scale and waste management options.

### **8.1 Relocation Option**

Relocation option to a different site is an option available for the project implementation. At present the landowner/developer does not have an alternative site. This means that he has to look for the land. Looking for the land to accommodate the scale and size of the project and completing official transaction on it may take up to three (3) years although



there is no guarantee that the land would be available. The developer will spend another two years on design and approvals since design and planning has to be according to site conditions. Project design and planning before the stage of implementation will cost the developer millions of Kenya shillings. Whatever has been done and paid to date will be counted as a loss to the developer. Assuming the project will be given a positive response by the relevant authorities including NEMA, this project would have been delayed for about two (2) years period before implementation. This is a delay that our economy can ill afford. This would also lead to a situation like No Project Alternative option. The other consequence of this is that it would be a discouragement for private/local.

In consideration of the above concerns and assessment of the current proposed site, relocation of the project is not a viable option.

## **8.2 No Project Alternative**

The No Project option in respect to the proposed project implies that the status quo is maintained. This option is the most suitable alternative from an extreme environmental perspective as it ensures non-interference with the existing conditions. This option will however, involve several losses both to the landowner and the community as a whole. The No Project Option is the least preferred from the socio-economic and partly environmental perspective due to the following factors:

- The economic status of the Kenyans and the local people would remain unchanged.
- The local skills would remain under utilized.
- Reduced interaction both at local, national and international levels.
- No employment opportunities will be created.
- Increased urban poverty and crime in Kenya.
- Discouragement for investors to produce cheap affordable fertilizers.
- Farming productivity will be curtailed.

- Development of infrastructural facilities (roads, solar etc. will not be undertaken).

From the analysis above, it becomes apparent that the No Project alternative is no alternative to the local people, Kenyans, and the government of Kenya.

### **8.3 Analysis of Alternative Technology**

The best processing of ammonia is through the Haber process, and with all safety aspects in place, there is no other manufacturing technology for this.

### **8.4 waste water management alternatives**

Available technologies are discussed below:-

#### **Alternative one:** *Use of stabilization ponds/lagoons*

This refers to the use of a series of ponds/lagoons which allow several biological processes to take place, before the water is released back to the river. The lagoons can be used for aquaculture purposes and irrigation. However, they occupy a lot of space but are less costly. No chemicals are used/heavy metals sink and decomposition processes take place. They are usually a nuisance to the public because of smell from the lagoons/ponds. This option is not preferable in the area because the required space is not only available, and the local community are not likely to accept the option.

#### **Alternative Two:** *Use of Constructed/Artificial wetland*

This is one of the powerful tools/methods used in raising the quality of life and health standards of local communities in developing countries. Constructed wetland plants act as filters for toxins. The advantages of the system are the simple technology, low capital and maintenance costs required. However, they require space and a longer time to function. Long term studies on plant species on the site will also be required to avoid weed biological behavioural problems. Hence it is not the best alternative for this kind of project

**Alternative three:** *Use of septic tanks*

This involves the construction of underground concrete-made tanks to store the sludge with soak pits. However, the consultant has recommended for its construction for holding the sludge as a sub-component of the main waste treatment plant.

**Alternative four:** *Connection to the existing sewer system*

Connection to the available large main sewer line will solve the waste water management issue at a very minimal cost and in an environmental efficient manner. In conclusion, the recommended course of action for this site would be connection to the sewer.

## **9 ENVIRONMENTAL MANAGEMENT PLAN (EMP)**

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### **9.1 Significance of an EMP**

Environmental Management Plan (EMP) for development projects provides a logical framework within which identified negative environmental impacts can be mitigated and monitored. In addition the EMP assigns responsibilities of actions to various actors and provides a timeframe within which mitigation measures and monitoring can be done. EMP is a vital output of an Environmental Impact Assessment as it provides a checklist for project monitoring and evaluation.

<b>IMPACT</b>	<b>MITIGATION MEASURE</b>	<b>ACTION PLAN</b>	<b>RESPONSIBLE</b>	<b>BUDGET (KSH)</b>	<b>TIME FRAME</b>
Pollution from anhydrous green ammonia	Use methods that minimize pesticide and nutrient load in the environment	Scouting, Spot spraying,, calibration of spray equipment, block treatment, safe disposal of wastewater through constructed wetlands	Project Manager	80,000	During project operation
Increased accidents	Prevention and management of foreseeable accidents	Hazardous waste containment; carry out hazardous studies; meet the standard requirements practice, periodic testing of emergency plans, promote motivational safety, health surveillance, education and awareness, provide personal protective equipment, first aid equipment	Farm Manager	140,000	During project operation
Soil erosion	No construction of slopes of more than 35%; construct water velocity checks; safe water disposal to discharge points	Plant grass strips and construct terraces and safe disposal drainage lines, increase the ground plant cover in areas that are prone to erosion	Farm Manager	50,000	At construction phase
Risk of fire	Provision of fire prevention and fire protection, maintenance	Fire drills, construction of fire emergency exits, testing of alarm systems, guarding of all electrical applications and earthing	Project Manager	40,000	During the operational phase of the project

	of evacuation procedure				
Ergonomics	Minimization of hazards due to heavy manual lifting/handling of tools, materials	Provide fork lifts and/or handling machinery	Project Manager	10,000	All phases of the project
Water conflicts	Diversify water sources to reduce potential conflicts and economize on water consumption	Harvest rain water, recycle wastewater, minimize spillages, leakages.	Project Manager	Nil	In the project phases
Social conflicts	Minimize infiltration of foreign cultures and differences in wage earnings	Recruiting employees from the surrounding communities, promote awareness and education amongst the different communities in the project area	Farm Manager	Nil	At the operational phase of the project
Ground water contamination from latrines	Reduce ground water contamination	Site the pit latrines at a safe distance from water sources determined by soil hydraulic conditions and slope	Project Manager	20,000/-	At construction phase

Pollution from empty pesticide containers and paper cartons		Triple rinsing and dispose rinsate into a properly constructed hazardous waste landfill, puncturing the containers and disposing as hazardous waste	Project Manager	70,000	Operational phase of the project
Loss of aesthetics, risk of accidents due to abandoned plant and equipment	Restore the landscape to as close as possible to its original state	Clear the site of the abandoned plant and machinery and dispose as scrap metal	Manager	200,000 /-	At decommissioning phase
Danger of explosions from ammonia release from tanks	All safety valves should be working appropriately	All safety measures should audited and monitored always	Project Manager	100,000	Operational phase
Gaping holes at decommission phase	Dismantling of the site	Fill the gaping holes	Project Manager	200,000 /-	Decommissioning Phase



## 10 CONCLUSION

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The proposed project, anhydrous ammonia is one of the most efficient and widely used sources of nitrogen for plant growth. The advantages of ammonia's relatively easy application and ready availability have led to its increased use as a fertilizer on farms. The proposed project has clear social and economic benefits and will contribute to the improvement of the quality of life for the people associated with it and the neighbours and the society in general. The project will not be in any serious conflict with any major national physical or environmental protection policies.

The on-site or off-site anticipated impacts identified are of varying significance and these could be adequately mitigated to reduce any threat to the environment. When the environmental and social management plan developed in the assessment is fully implemented and the health and safety and environment policy is set up, then this will result in an overall improvement in the environmental quality of the project area and its surrounding.

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## **APPENDICES**

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