Establishment of a polyurethane foam manufacturing plant in Hastings village, Western Area, Sierra Leone

Environmental and Social Impact Assessment Document

Prepared by
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ACRONYMS AND ABBREVIATIONS

C	-	Degree Celsius
%	-	Percentage
″	-	inch
AC	-	Affected Community
cm^2	-	Cubic Metre
CBD	-	Convention on Biological Diversity
CDAP	-	Community Development Action Plan
CDC	-	Community Development Committee
CROC	-	Community Relations Committee
CO	-	Cabon monoxide
dB	-	Decibel
EIA	-	Environmental Impact Assessment
EMP	-	Environmental Management Plan
EPA	-	Environmental Protection Act
SECT	-	Environmental and Scientific Consulting Group
Ft	-	Feet
GOSL	-	Government of Sierra Leone
GPS	-	Global Positioning System
GVWC	-	Guma Valley Water Company
HOB	-	Hexochlorobenzen
Hrs	-	Hours
IUCN	-	International union for Conservation of Nature and Natural Resources
Kg	-	Kilogram
Km	-	Kilometre
Km^2	-	Kilometre square
KTS	-	knots
Kva	-	Kilo volt amps

1/s	-	Litre per second
Le	-	Leone
LRSP	-	Land Resources Survey Project
m	-	Metre
MAF	-	Ministry of Agriculture and Forestry
MEP	-	Ministry of Energy and Power
Mg/1	-	Milligram per litre
Mins	-	Minutes
NASSIT	-	National Social Security Insurance Trust
NGO	-	Non-Governmental Organization
NO^2	-	Nitrogen dioxide
pH	-	Hydrogen ion Concentration
POPs	-	Persisitent Organic Pollutants
SC	-	Steering Committee
SL	-	Sierra Leone
USS$	-	United State Dollars
VDC	-	Village Development Committee

NON-TECHNICAL SUMMARY

INTRODUCTION

This Environmental and Social Impact Assessment (ESIA) has been prepared to address the potential environmental impacts that could arise from the proposed polyurethane manufacturing plant to be situated at Hastings, Freetown Sierra Leone.

The purpose of the project is to augment the burgeoning demand for faom products in a rapidly growing society and employment for the rural poor in Sierra Leone. Proper design/selection, construction, and management of the manufacturing operations would mitigate such negative impacts. The main sections of the EIA include definition of the legal and institutional frameworks, description of the project and the environment, impacts assessment, identification of mitigation measures, and presentation of an environmental management plan (EMP).

LEGAL AND INSTITUTIONAL FRAMEWORKS

In the legal framework, a New Environment Protection Agency Act has been passed in Parliament to replace the Environment Protection Act, 2000 for the establishment of the Sierra Leone Environmental [Protection Agency. The Environmental Protection Agency (EPA) Act of 2008 is now the legal instrument governing environmental protection in the country. The EPA Act, 2008 sets the procedures and guidelines for the proponent of every proposed project that could have significant impacts on the environment, to prepare its own ESIA or Environmental Statement (ES). The Sierra Leone Environmental Protection Agency (SLEPA) in the Ministry of Lands, Country Planning and the Environment (MLCPE) is the main institution responsible for the revision and approval of the EIA.

PUBLIC INVOLVEMENT

The project has the backing of the local authorities in Koya Rural District, Western area, Sierra Leone. The authorities were involved from the inception of the

project idea. During this study, the consultants met with representatives of the Council and with the community elders. During these meetings, the forecasted projects for the area were presented to the public. In compliance with EIA guidelines, a notice would be posted at the concerned local district offices informing the public of the EIA study, the proposed sawmill operations, and soliciting comments. A public hearing would be held before the commencement of the project activities. Local Council officials and members of the community are expected to attend the public hearing.

DESCRIPTION OF THE PROJECT

The main activities of the project would be the production and sale of flexible and hard polyurethane products.

Foams are made by forming gas bubbles in a plastic mixture, with the use of a blowing agent. Foam manufacture can either be a continuous process for making laminate or slabstock or a batch process for making various shapes by cutting or moulding.

The main reaction is between liquid polymers that, when combined with water, produce an exothermic (heat generating) reaction in the presence of catalysts and surfactants. Additives such as flame retardants, volatile organic compounds (blowing agents), simple volatile chemicals such as acetone or methylene chloride, etc are also added to improve the performance and strength of the foam.

DESCRIPTION OF THE ENVIRONMENT

The site is located at Egba Town in Hasting Village approximately 9.4 km (15 miles) from Freetown. It lies between Paul Street, Old Water Road and Smith Water Road. The area leased to the proponent is around 15 acres in area.

The climate is tropical and is characterized by the alternation of rainy and dry seasons. Conditions are generally hot and humid. Daily mean minimum and maximum temperatures range between 24oC to 29oC. Average annual rainfall is approximately

2,776 mm. Average monthly rainfall varies between 8 mm in January to around 941 mm in August.

Local habitants are mainly members of the active population (between 18 and 50 years old). The economy in the area is driven by agriculture. Hastings is a suburb of Freetown and boast of schools, hospitals and other recreational facilities.

IMPACT ASSESSMENT

On-site and off-site impacts can be induced during the construction of the facility, and later during its operation. On-site impacts result from construction activities carried out within the construction site. The impacts of off-site work result from activities carried out outside the construction site, such as traffic, yet are directly related to the project. In the case of solid waste treatment facilities, the main potential receptors are soil, surface, and ground water bodies, in addition to human amenity. Table summarizes the potential impacts on the physical, biological and socioeconomic environments caused by the proposed foam manufacturing plant. The extent of impacts depends primarily on the management practices that would be adopted during facility operation.

MITIGATION MEASURES

Potential adverse impacts of the proposed foam manufacturing plant may include dust emissions, odor and, noise generation, degradation of natural resources, public health hazards, and adverse aesthetic impacts. Proposed mitigation measures for the above-mentioned adverse impacts, monitoring for actions affecting environmental resources and human amenity are summarizes in the Table II below.

Table I. Environmental Impacts of the proposed Foam Manufacturing plant during Construction and Operational Phase

Media	*Potential Impact*	*Cause*	*Significance*
During Construction			
Physical Environment			
Soil	Erosion	Earthmoving and excavation works	-
	Soil contamination	Oil and fuel spillage of equipment and trucks	-
Water		Oil and fuel spillage of equipment and trucks	0/-
		Wastewater discharge from housing facility of contractors	0/-
Air	Noxious Odors	Construction equipment, machinery and trucks	-
	Dust Emissions	Onsite construction activities	-
		Off site construction activities i.e. hauling material	-
		Truck movement	-
	Gaseous Emissions	Trucks, construction machinery and equipment	-
Biological Environment			
Flora and Floral Habitat	Loss of habitat	Construction of Foam factory	-
Fauna and Faunal Habitat	Loss of habitat	Construction of Foam factory	-
Socio-economic Environment			
Public & Occupational Health & Safety	Public health and safety	Unauthorized entry	-
	Occupational health and safe	Construction activities	-
Economic	Employment opportunity	Employment	+ / -
Social	Aesthetic	Site development	- -
	Dust	Increased traffic	- -
		Construction activities	- -
	Noise	Construction equipment, machinery and trucks	- -

Table I. Environmental Impacts of the proposed Foam Manufacturing plant during Construction and Operational Phase (contd)

Media	*Potential Impact*	*Cause*	*Significance*
During Operations			
Physical Environment			
Soil	Soil contamination	Oil and fuel spillage of equipment and trucks	-
		Improper handling and storage of chemicals	
Water		Oil and fuel spillage of equipment and trucks	-
		Generation of solid waste and wastewater	-
		Improper handling and storage of chemicals	-
Air	Noxious Odors	Emissions from volatile compounds	-
		Improper handling and storage of chemicals	-
		Poor house keeping	
	Dust Emissions	Use of machinery and equipment	-
		Off site construction activities i.e. hauling material	-
		Truck movement	-
		Poor house keeping	-
	Gaseous Emissions	Emissions from volatile compounds	-
		Poor house keeping	-
Socio-economic Environment			
Public & Occupational Health & Safety	Public health and safety	Unauthorized entry	-
	Occupational health and safety	Use of machinery and equipment	-
Economic	Employment opportunity	Employment	+ / -
Social	Aesthetic	Unsightly Facility	- -
	Dust	Increased traffic	- -
		Use of machinery and equipment	- -
	Noise	Use of machinery and equipment	- -
		Truck movement	- -

Table II. Mitigation Measures, Monitoring, and Estimated Costs for Actions Affecting Environmental Resources and Human Amenity

Action	*Potential impact*	*Mitigation measures*	*Monitoring of mitigation measures / responsibility*	*Estimated cost of mitigation (USD)*
A. During Construction				
Excavation and earth movement	Dust emission	• Wetting excavated surfaces • Using temporary windbreaks • Covering truck loads	Vitafoam EPD	15,000
	Noise generation	• Restriction of working hours to daytime • Employing low noise equipment • Proper maintenance of equipment and vehicles, and tuning of engines and mufflers	Vitafoam EPD	10,000
	Erosion	• Proper resurfacing of exposed areas • Inducing vegetation growth	Vitafoam EPD	5,000
	Disturbance to biodiversity	• Conservation of present trees and used as wind brakes and aesthetic cover for the facility. • Inducing vegetation growth	Vitafoam EPD	5,000
Dumping of excavated and construction material into the environment	Groundwater pollution	• Prohibition of uncontrolled dumping. Disposal at appropriate locations • Education of workers on environmental protection	Vitafoam EPD	TBD

Action	*Potential impact*	*Mitigation measures*	*Monitoring of mitigation measures / responsibility*	*Estimated cost of mitigation (USD)*
A. During Construction				
Discharge of wastes (chemicals, oils, lubricants, etc.) on-site	Soil and water pollution	• Prohibition of uncontrolled discharge. Proper disposal of hazardous products • Education of workers on environmental protection	Vitafoam EPD	15,000
Storage of hazardous material, traffic deviation, deep excavation, movement of heavy vehicles, etc.	Hazards to public and occupational safety	• Proper supervision for high workmanship performance • Provision of adequate safety measures, and implementation of health and safety standards	Vitafoam EPD	35,000
B. During Design & Operation				
Inadequate process design and control	Generation of obnoxious odors	• Improving operation and maintenance design procedures • Storage of wastes and compost in enclosed areas • Provision of covers where possible • Landscaping a proper natural windbreaker around the facility • Installation of biofilter • Provision of internal negative pressure of building • Maintaining proper cleanliness and housekeeping • Transportation of odorous byproducts in enclosed	Vitafoam EPD	15,000

		container trucks		
	Impaired aesthetics	• Maintaining cleanliness around and within the plant • Proper fencing and landscaping	Vitafoam EPD MOHS	TBD
	Noise generation	• Limit waste collection and delivery to daytime hours • Incorporating low-noise equipment • Locating mechanical equipment in proper acoustically-lined enclosures • Proper fencing and landscaping	Vitafoam EPD MOH	15,000
	Traffic generation	• Proper routing of waste delivery trucks • Limiting waste collection and delivery to daytime hours	Vitafoam SLP EPD	5,000
	Public & occupational hazards	• Restricting unattended public access • Providing adequate safety measures and monitoring equipment • Emphasizing safety education and training for system staff • Implementing health and safety standards	Vitafoam Factory Inspectorate	45,000
Inappropriate waste collection	Accumulation of waste at waste collection bins	• Increasing the capacity and number of collection vehicles	Vitafoam Freetown City Council	50,000
Total				**115,000**

ENVIRONMENTAL MANAGEMENT PLAN

In order to ensure the proper operation of the factory, a management system must be implemented. This management scheme shall assure regular monitoring and compliance, and process performance. Proper staff training and organized record keeping will also take place.

1.0 INTRODUCTION

1.1 Purpose and Structure of the Document

This document has been prepared as an Environmental and Social Impact Assessment Document pursuant to sections 23 and 24 of the Environmental Protection Agency Act, 2008 (Part IV). The foam manufacturing development proposal falls within the First Schedule which indicates the projects requiring an Environmental Impact Assessment to be prepared by the proponent and submitted to the Environment Protection Agency before issuance of an EIA license.

The purpose of this document is to identify potential negative environmental impacts, relevant key environmental factors and to outline an environmental management plan/mitigation plan. This document is consistent with the requirements for Environmental Impact Assessment Documents as detailed in the *Environmental Impact Assessment Procedures Document* (EPD 2004).

Overall, this document:

- provides an overview of the Vitafoam Proposal;
- describes the setting of the project;
- presents key environmental factors considered relevant to the project; and
- environmental impacts and management.

1.2 Proponent

The proponent for the development proposal is VITAFOAM Sierra Leone Limited

The contact for the project is:

Lancelot Caramba-Coker
Director
Vitafoam Sierra Leone Limited
14 Lumley Beach Road
Congo Cross, Freetown
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1.3 Background

Vitafoam Nigeria Plc, the proponent of Vitafoam Sierra Leone Limited is a leading manufacturer of flexible, reconstituted and rigid foam products. It is the largest foam manufacturing and distribution network which facilities just–in –time deliver of products throughout Nigeria. The company was incorporated on 4th August 1962 and listed on the floor of the Nigerian Stock Exchange in 1978.

The company is the first foam manufacturing company in Nigeria to subject its quality system to Quality Management System championed by the Standard Organisation of Nigeria (SON). The NIS ISO 9002 Certificate was obtained in 2001 and upgraded to NIS ISO 9001: 2000 in 2004.

Vitafoam has carved a niche for itself in the industry by its offer of a vast array of high and superior quality products that present the customer multiple choices. Mattresses of varied densities, resilience and hardness are available nationwide.

Vitafoam is a responsible corporate citizen and it adopts best practices in all operations. The code of corporate governance has been well implemented by the company and it is committed to continuous improvement of its operations.

The company's policy is determined by a competent and dynamic Board, a mix of executive and non-executive directors of who are experts in their own fields. The Board is supported by a robust management team.

The company's turnover and asset base have grown tremendously over the past three years. Vitafoam has consistently over the years declared and paid dividends to its shareholders. The unaudited financial statements depict, for the year ended 30th September, 2008, a turnover of USD70million.

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1.3.1 Eligibility Criteria

The project is registered with the Ministry of Trade and Industry, the Income Tax Department of National Revenue Authority and the Ministry of Finance, Development and Economic Planning. The company was registered on the 22nd August, 2008 with registration number CF/584/2008.

1.3.2 General Objectives of the Company

Vitafoam Nigeria in conjunction with Sierra Leonean and/or foreigners intends to invest USD 5 Million (Five Million United States Dollars). The major objectives are:

- To introduce vitafoam quality brands in Sierra Leone market and to subsequently export into the neighbouring countries of Liberia and the Guinea
- To provide foam solutions for comfort of the citizens.
- To set up a factory, preferably somewhere around the capital, Freetown, for the manufacturing of foam products, mattresses, pillows etc
- To create job opportunities, directly and indirectly, for the locals
- To create wealth in the country and discharge its social obligations to the Sierra Leonean government such as payment of corporate tax and any other taxes

1.3.3 Investment Portfolio Mix

In attaining the above objectives, a capital injection of USD5 Million (five Million United States Dollars) is proposed and to be contributed as follows:

Table 1: Investment Portfolio of Vitafoam

	% Holding	$'M
Vitafoam Sierra Leone Limited	60	3
Sierra Leonean/Foreigners	40	2
Total		**5**

1.4 Company Incorporation

In pursuance of taking advantage of emerging opportunities in the industry in Sierra Leone, Vitafoam Nigeria Plc has concluded the incorporation of Vitafoam Sierra Leone Limited as the vehicle for the attainment of the aforementioned goals and objectives. The incorporation expenses shall form part of the capital injection for the project.

2.0 PROJECT DESCRIPTION

2.1 Project Rationale

It is obvious that the foam industry in Sierra Leone is still at the rudimentary stage. There is yet to be installed a modern and efficient foaming plant in the country. In addition, a majority of the indigenes are yet to own foam mattresses or quality made of foam. In our view, the following opportunities exist:

- If foam products can be offered at affordable prices, demand can be quite high
- Based on the long experience of vitafoam in manufacturing and marketing foam products, the company can easily develop products that will meet the need of the locals. By use of a continuous foaming system, unit cost of production is expected to be much lower than the current offerings.
- With little marketing effort, it should be possible to make the brand a household name all over the country within the shortest possible time.
- Since the export channels into Liberia and Guinea are already in existence, it should not be difficult for vitafoam to exploit further these channels.
- At the early stages, only the economic range products will be manufactured locally to be augmented by import of premium grades from Nigeria.
- Once Vitafoam commences to offer various grades of foam sheets, the furniture industry in Sierra Leone will significantly grow. This will checkmate the current imports form china and Dubai.

2.2 Project Title

The establishment of a polyurethane foam manufacturing plant in Egba Town, Hastings village, Western Area, Sierra Leone.

2.3 Project Cost

The injection of the USD5million (five Million United States dollars) by the promoters shall be utilized as follows:

Table 2: Distribution of Investment Portfolio

	US $
Plan and Machinery	620.75
Land and Building	3,477.50
Motor Vehicles	135,00
Working capital	766.75
Total	**5,000.00**

For the project to take off, a combination of new and fairly used equipment will be installed. Vitafoam Nigeria Plc is shutting down one of her factories in Nigeria and it will be prudent to relocate to Sierra Leone some surplus equipment that is still in sound operational condition. Listed below are the required plant and machinery and cost estimates.

Table 3: Required Plant and Equipment Cost Estimates

		No	**Status**	**Estimated Value**
1	Continuous foaming plant (capacity of 500 tons/ years)	1	Fairly used	290,000
2	Rotary machine	1	New	45,000
3	Vertical splitters	2	New	25,000
4	Tape-edge machines	3	Fairly used	37,500
5	Tape – edge machines	2	New	41,750
6	356KVA Generator	1	New	100,000
7	75 KVA Generator	1	New	20,000
8	Compressor	1	New	41,500
9	Pillow Crumbling machine	1	New	20,000
	Total			**620,750**

Table 4: Proposed civil works and fitting

		No	Status	Estimated Value (s)
1	Land Purposes		New	50,000
2	Building Structures		New	3,200,000
3	Water Bore hole	1	New	41,500
4	Hydrant plant	1	New	166,000
5	Furniture		New	20,000
	Total			**3,477,500**

Table 5: Operational vehicles to be acquired by Vitafoam

		No	Status	Estimated Value (s)
1	Saloon cars	3	New	75,000
2	Pick – up vans	2	Fairly used	20,000
3	Lorries	2	Fairly used	40,000
	Total			**135,000**

2.4 Personnel Requirement/Cost Estimate

It is envisaged that a total of 64 (Sixty-four) person shall be engaged at the onset of the project. Details of the manpower disposition are as follows:

Table 6: Manpower Requirements of Vitafoam

	Staff Designation	Number
1	General Manager (Expatriate)	1
2	Manager – Production (Expatriate)	1
3	Manager – Accounts/ Admin (Expatriate)	1
4	Manager – Sales	1
5	Supervisor (Expatriate)	2
6	Supervisor	4
7	Junior Staff	54
	Total	**64**

Table 7: Estimated annual personnel cost

	Staff Designation	No	Annual Emolument (US $)	Total Annual Emolument (US $)
1	General Manager (Expatriate)	1	80,000	80,000
2	Managers (Expatriate)	2	40,000	80,000
3	Manager	1	20,000	20,000
4	Supervisors (Expatriate)	2	11,250	22,500
5	Supervisor	4	5,625	22,500
6	Junior Staff	54	2,500	135,000
	Total			**360,000**

2.5 Project Location

The site is located at Egba Town in Hastings Village approximately 9.4 km (15 miles) from Freetown (Figures, 1 & 2). It lies between Paul Street, Old Water Road and Smith Water Road. The area leased to the proponent is around 15 acres in area (Appendix 2).

Entry to the site is from the main Freetown-Waterloo Highway which is up to the location a tarmac road. The distance from the Junction of the Freetown-Waterloo Highway is approximately 0.45 km (450 m) and is a dirt road.

2.6 Description of the process

The flexible foam manufacturing process produces a urethane polymer by reacting an isocyanate (i.e., toluene diisocyanate) with a polyol. A subsequent reaction of the isocyanate and water produces urea and carbon dioxide (CO,). The CO, formed in this reaction expands the cells of the foam, thereby reducing its density. The urea gives the foam its rigidity or firmness. In higher density foams (densities greater than 1.5 pounds per cubic foot, or lbs/ft3), carbon dioxide often is the sole blowing agent. These "water-blown" foams compose about 40 percent of the total amount of slabstock foam that is produced (EPA, 1991).

While increasing the amount of water in the foam formula can produce less dense foam, it also will increase the foam's firmness. To produce lower density, soft foams, an auxiliary blowing agent like methylene chloride is used to further expand the cells of the foam without simultaneously making it stiff or rigid (Figure 1). The auxiliary agent also helps to control the reaction temperature. Otherwise the temperature could reach sufficiently high levels (>165*C) to result in combustion or scorching of the foam interior (UNEP, 1989).

Several process control agents also are necessary in the foam formulation. These include amine catalysts to increase the isocyanate/water reaction, tin catalysts for the polyol/isocyanate reaction, and surfactants to control the size of the foam cells and to stabilize the foam as it rises (Sayad and Williams, 1979a; 1979b). In addition, melamine, graphite, or alumina trihydrate is added to combustion-resistant foams to improve their performance in fire tests (UNEP, 1989).

Slabstock flexible foam is produced as a large continuous bun that is cut into pieces with desirable dimensions (see Figure 1). The ingredients of the foam formulation are pumped to a mixing head and discharged through the nozzle onto the front of a conveyor belt, called the foam line. The conveyor first passes through an enclosed, ventilated section, or tunnel, where the ingredients react quickly to form the foam "bun." From its maximum expansion, the foam begins to release blowing agent and unreacted chemicals. These emissions are exhausted from the enclosed section. As the bunstock leaves the conveyor, it is sawed into sections and transported to a curing and storing area.

2.7 Product Transportation

Entry to and exit from the Hastings Vitafoam factory will be the Freetown – Waterloo Highway , including the off-site transport of product and on-site transport of consumables. It is estimated that, when the factory becomes fully operational there will be around 10-15 loaded trucks that leave the factory and around 20-50 empty truck returns to the factory per week. The number of truck movements will increase over the years with the number of truck movements increasing proportionately to throughput increase.

The Freetown-Waterloo Highway is a heavy haulage route, providing heavy vehicle access to a number of sand collection sites and also a carriage way of commercial vehicular traffic.

2.8 Water Supply

Hastings village has a pipe borne water system and water for use in the manufacturing process would be piped in through this source.

2.9 Support Facilities

Facilities to be located within the site include the Maxfoam plant, bulk tanks, warehouse (2,100 sq.m), scrap shed, Administrative block, Loading Bay approximately 250 sq.m (packing and loading area for finished product), three gates houses to be constructed on the fence.

2.10 Hours of Operation

The factory is expected to operate Mondays to Saturdays from 8:00 Am to 7:00 Pm. On Sundays, the factory would not operate and only repairs to machinery and product sales would be undertaken.

2.11 Alternative options considered

Several alternative sites along the outskirts of Freetown (Goderich, Ogoo Farm, Allen Town and Mile 13 at Peninsula road) were considered. However due to proximity of these sites to settlements and economic advantage of not being too far from a large market these options were rejected in favour of Hastings.

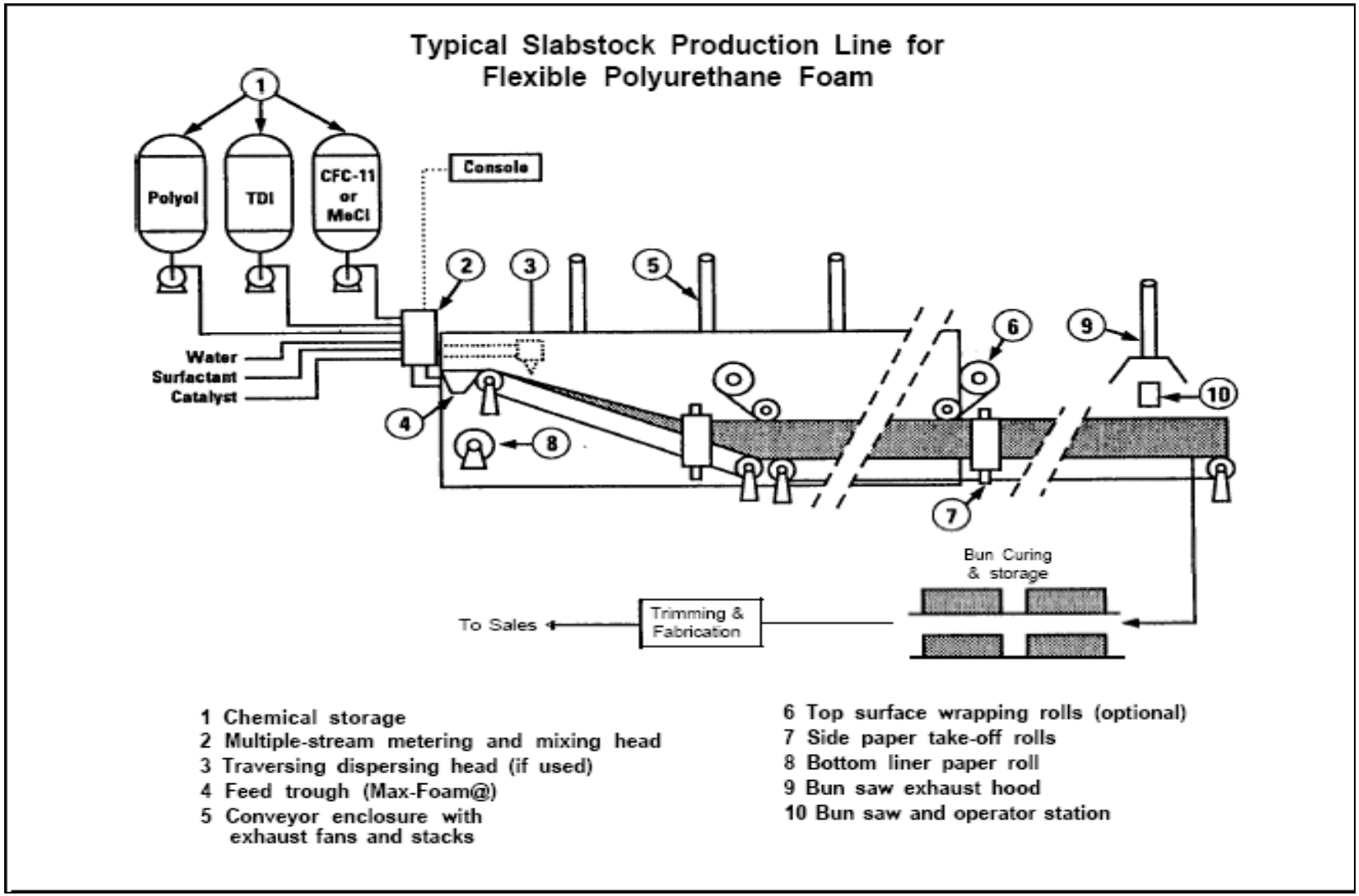

Figure 1. Typical Slabstock Production Line for Flexible Polyurethane Foam (EPA, 1991).

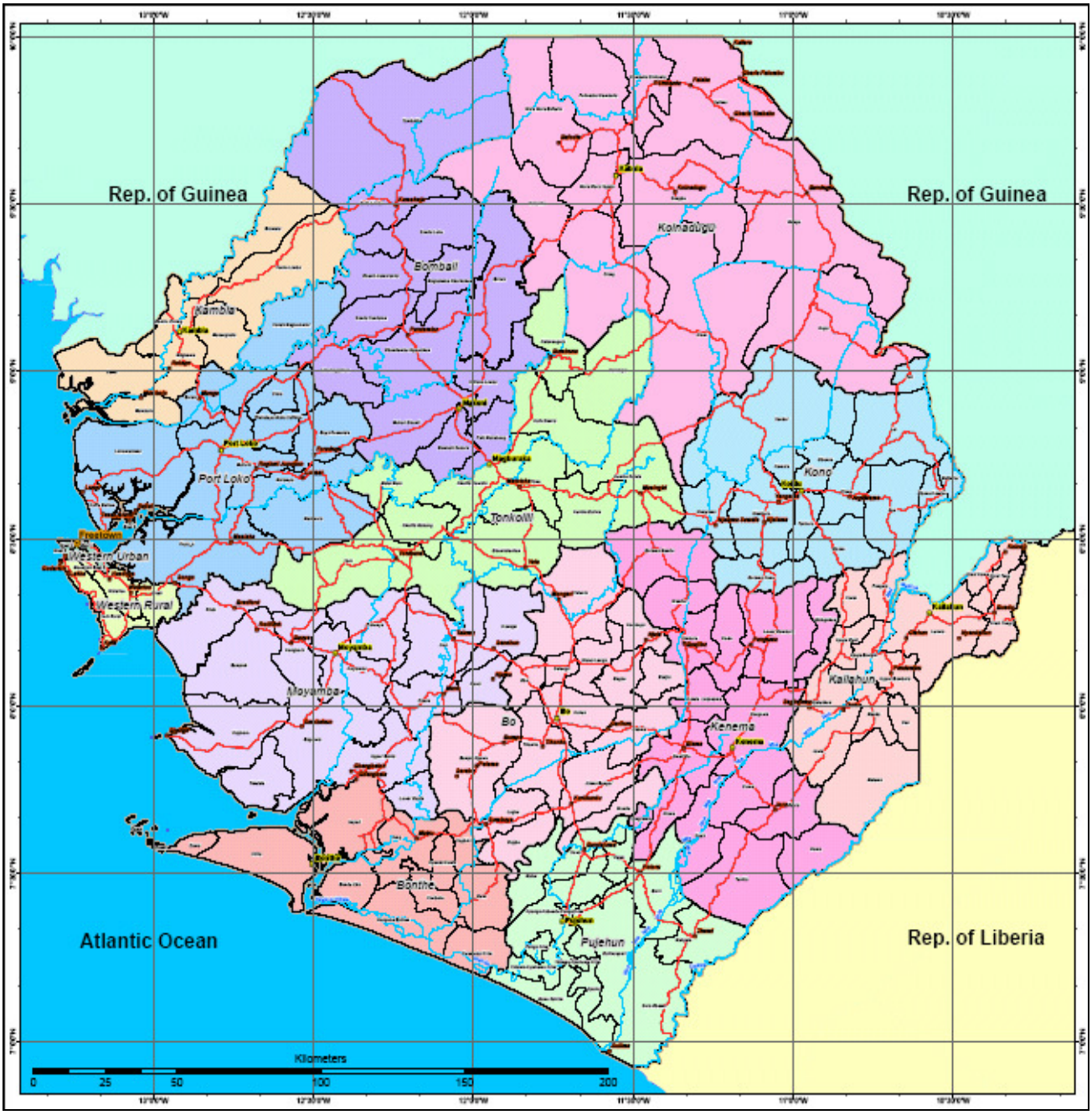

Fig 2: Map of Sierra Leone showing the location of Western Area in Sierra Leone

Figure 3: Map of Western Area showing regional Location of Project area

Figure 4: Villages around the location of the Proposed factory

3.0 LEGISLATIVE AND INSTITITIONAL FRAMEWORKS

3.1 Policy, Legal and Administrative Framework

For administrative purposes, Sierra Leone is divided into four distinct areas: the Northern Province with its Headquarters in Makeni, the Southern Province with Bo as its Headquarters, the Eastern Province with Kenema as its Headquarters and the Western Area (comprising Freetown and the Peninsular) with the capital Freetown as Headquarters. The three provinces are divided into Districts, with twelve Districts in the entire country.

3.1.1 Political System

Until recently, Sierra Leone experienced three decades of bad governance under authoritarian single party (1978-1992) and military dictatorship (1992-1996), which did not only undermine poverty alleviation efforts but also precipitated in a civil war in 1991. The highly centralized governance structures of the said regimes were characterized among other things by corruption, blatant disregard for the rule of law, nepotism, bloated and inefficient public institutions, gross human rights violations and limited citizen participation.

A general decline in State and citizens' capacity to tap human and material resources for sustainable development, a top-bottom approach to economic and human resource management in both the private and public sectors and over-centralization led to the exclusion of the majority of the citizens in state governance. The dissolution of the local government structures in 1972 and replacement by Management Committees by the one party regime fast tracked moves to undermine local government and decentralization in the country. These and many other developments precipitated economic decline and erosion of the standards of living for the majority of poor Sierra Leoneans. The eleven-year war further exacerbated the problem of human and material suffering and inability of government institutions to effectively govern the people and to provide them with an environment conducive to peace and development. Efforts to

address these problems were largely unsuccessful mainly because they were not implemented in a coordinated manner.

The general perception of most Sierra Leoneans is that good governance is a precondition for sustainable development and poverty alleviation in the country. Repeated surveys of the citizens in the country have, for example, consistently ranked governance among the top five priorities of the state. Sierra Leoneans envisions a new political system solidly anchored on governance and participatory democracy, multiparty democratic system, a new democratic civic culture, wherein citizens are educated on their rights and responsibilities and culture of active participation in the process of decision-making and implementation at the local, regional and national levels.

3.1.2 Local Government and Administration

The enactment of the Local Government Act in 2004, paved the way for the local government elections in May 2004. The elected local government councils replaced the appointed local councils or management committees, which will be accountable and answerable to the local communities.

The Local District and or Town Council is the highest political authority in the locality, with legislative and executive powers, and responsible for promoting the development of the locality and the welfare of the people in the locality with the resources at its disposal (The Local Government Act 2004). The local council is responsible among other things, for the mobilization of human and material resources necessary for overall development and welfare of the people of the locality; promoting and supporting productive activity and social development; initiating and maintaining programmes for the development of basic infrastructure and provide works and services; initiate, draw up and execute development plans for the locality; oversee Chiefdom Councils in the performance of functions delegated to them by the local councils; determine the rates of local taxes and approved the annual budgets of Chiefdom Councils and oversees the implementation of such budget. The local council is also responsible for the formation of committees.

The Chairman is elected by universal adult suffrage for a four-year term although as an interim measure the current chairmen of all Local Government Councils were elected by a simple majority of councilors.

The Vice Chairman, who is elected by the elected Councilors, assists the Chairman. In addition, in each council there is the Chief Administrator, who is appointed by the local council and is the Secretary to the local council. He/she heads the administration of the local council.

The local councils are made up several Wards. Each ward establishes a Ward Committee, which consists of every Councilor, the Paramount Chief of the Chiefdom and not more than ten others, at least five of whom shall be women, resident in the ward and elected by the ward residents. The Ward Committee is responsible for mobilizing residents of the ward for the implementation of the self-help and development projects; provide focal point for the discussion of local problems and needs and take remedial action where necessary; organizes communal and voluntary work; make proposals to the local council for the levying and collection of rates for special projects and programmes and educate the residents on their rights and obligations in relation to local government and decentralization.

3.1.3 Provincial Coordinating Committees

At the provincial level is the Provincial Coordinating Committee, which consists of the Resident Minister, Provincial Secretary, the Chairpersons and Chief Administrators of the local councils. The Provincial Coordinating Committee, among other things, coordinates the activities of the local councils in the Province; ensures that the local councils collaborate for the effective execution of development programmes in which the councils are jointly interested; reviews and coordinates the provision of the public services in the Province.

3.1.4 Inter Ministerial Council

At the national level is the Inter-Ministerial Committee on Decentralization, which comprise the Vice President (Chairman), the Ministers of Local Government, Finance, Development and

Economic Planning, Education, Health and Sanitation, Agriculture, the Attorney General and four chairpersons of local councils. The Permanent Secretary of the Ministry of Local Government is Secretary to the Committee.

3.1.5 Chiefdom and Village

Paramount Chiefs constitute an important component of governance. They are elected for life by Chiefdom Councilors, who in turn are elected by residents in each chiefdom. Each of the 149 chiefdoms in Sierra Leone has a Paramount Chief, or a Regent Chief who is appointed upon the death of a Paramount Chief and until a successor is elected. A Paramount Chief is appointed for general administration, the maintenance of law and order and the development of their chiefdom. The administration of the chiefdom occurs through a hierarchical system of traditional authorities under the Paramount Chief. There is a Chiefdom speaker who assists him and deputizes him when he is absent from the Chiefdom. The Chiefdom is divided into sections comprising a number of villages. A Section Chief heads each section while a Town Chief heads each village. The primary tasks of the Chiefdom Structure are the distribution of land, collection of land taxes and the settlement of disputes. The Paramount Chief works with a Chiefdom Committee, council of elders and the Native Administration. The local government powers relate to raising and disbursing of funds.

The ministry of Local Government and Rural Development in consultation with the respective Paramount Chiefs appoint local court chairmen in the 149 chiefdoms in the country. The local court buildings are known as court barriers. There are 287 court barriers throughout the country. The Native Administration utilizes the services of the Chiefdom Police and has “locks ups” for law enforcement purposes.

Areas are normally demarcated within the mining lease areas of mining companies in which housing and agricultural activities are not deemed advisable because of mining activities. Surface rent payments are made to local authorities as compensation for the loss of use of the land. The quantum of such payments (usually per acre) is stipulated in the Mining Agreement. The existing arrangement with the government is that the Paramount Chief, the Native Administration and the

landowner share the surface rent in equal proportions. Compensation is paid for housing and cultivations within the surface rent area, should relocation of these be necessary. The payments for such compensations are negotiated separately.

3.2 Local Legislation

Legislation governing environmental issues is found as Acts and regulations of the various government line ministries or institutions. Such legislation includes:

- The Environmental Protection Agency Act – 2008
- The Factories Act – 1974

These documents are available locally, and can be obtained from the institutions to which the Acts refer, for consultation by potential users of the land, whose activities may have an effect on the environment.

3.3 Extracts from the Acts pertinent to the manufacturing industry

3.3.1 The Environment Protection Agency Act – 2008

The Act was signed as a legal document in September 2008. Following the enactment of this Act, a National Environment Protection Board was established within the Sierra Leone Environment Protection Agency. The Board facilitates coordination, cooperation and collaboration among Government Ministries, local authorities and other governmental agencies, in all areas relating to environmental protection and management. The Sierra Leone Environment Protection Agency(SLEPA), subject to the Act, also coordinates environmentally related activities and acts as the focal point of national and international environmental matters, relating to Sierra Leone.

3.3.1.1 Project Activities Requiring an EIA

According to this Act an Environmental Impact Assessment Report (EIA) is required for certain types of project activities. The contents of assessment must be contained in a report that should be submitted to the Executive Director of the SLEPA. A company or project, requested to carry out an EIA, would be mandated to commence its operations, by the issue of an EIA licence, on approval of the submitted EIA report. The Board may also disapprove of the issue of an EIA license if it envisages that the company's activities would have a significance adverse effect on the environment and the community.

Projects requiring an EIA are those, as given in the first schedule of the Act, whose activities involve or include the following :

- Exploitation of hydraulic resources (e.g. dams drainage and irrigation projects, water basin development and water supply).
- Infrastructure (e.g. roads, bridges, airports, habours, transmission lines, pipelines and railways).
- Industrial Activities (e.g. metallurgical plants, wood processing plants, chemical plants, power plants, petro-chemical plants and refinery).
- Extractive industries (e.g. mining, quarrying, extraction of sand, gravel, salt, peat, oil and gas).
- Waste management and disposal (e.g. sewage systems and treatment plants, landfills, treatment of plants for household and hazardous waste).
- Housing construction and development schemes.

3.1.1.2 Establishment of Environmental Standards

Subject to this Act, regulations are also made, as given in section 12 (Part 111), to establish national environmental standards, pertaining to the following parameters:

- Water quality
- Effluent limitations

- Air quality
- Waste
- Atmospheric protection
- Ozone protection
- Noise control
- Pesticide residues
- Odour

The introduction of any internationally banned chemicals or substances into Sierra Leone is prohibited, as well as the discharge of any hazardous and toxic substances into the air, land and water of Sierra Leone. The implementation of any project set out in the first schedule without a valid EIA Licence in respect of such project is a crime. Failure to comply with this regulation is an offence, and the defaulting company is liable on conviction to a fine not exceeding Le25, 000,000 in the case of a Sierra Leonean or USD 10,000 in the case of a non-Sierra Leonean or a term of imprisonment not exceeding two years, or to both the fine and imprisonment.

3.1.1.3 Factors determining the necessity of an EIA

The second schedule of this Act, gives several determine whether a potential project requires the preparation of an EIA. These factors are given below as stated in the schedule.

- The environmental impact on the community
- The location of the project
- Whether the project transforms the locality
- Whether the project has, or is likely to have, a substantial impact on the ecosystem of the locality.
- Whether the project results in the diminution of the aesthetic, recreational, scientific, historical, cultural or other environmental quality of the locality.
- Whether the project will endanger any species of flora or fauna or the habitat of the flora and fauna of the locality.
- The scale of the project.

- The extent of degradation of the quality of the environment.
- Whether the project will result in an increase demand for natural resources in the locality.
- The cumulative impact of the project together with other activities or projects on the environment.
- The contents of the EIA.

The third schedule of the Act indicates the contents to be considered in preparing the EIA. It is stated in this Act, that an EIA shall contain a true statement and description of:

- The location of the project and its surroundings.
- The principle, concept and purpose of the project.
- The indirect or direct effects the project is likely to have on the environment.
- The social, economic and cultural effects that the project may have on the society.
- The communities, interested parties and Government Ministries consulted
- Any action or measures which may avoid, prevent, change, mitigate or remedy the likely effect on the society.
- Any alternatives to the project.
- Natural resources in the locality to be used in the project.
- The plans for decommissioning of the project.
- Any other information, necessary for a proper review of the potential environmental impact of the project.

3.1.1.4 Compensation

The Board and SLEPA have the authority as stated in part three , to make regulations that would make it incumbent on the project owner and maintain an insurance or other appropriate financial security. This is to guarantee payment of compensation for any damage, resulting from the operations of the project, or to guarantee payment for preventive measures or for rehabilitation where necessary.

3.3.2 The Factories Act. – 1974

This Act became effective on the 30th May, 1974. It basically deals with health and safety measures as they concerns the factory workers. It protects the workers through demands for all aspects of cleanliness, reports of all injuries, accidents, diseases and death.

A Factories Appeal Board is in operation and has the duty of hearing and determining any appeal submitted by factory owners, thus giving right where it is due. Going by the interpretation of the word factory, as stipulated in this Act, mining companies are factory based companies, and are therefore covered by any legislation pertaining to this aspect. The necessary environment conditions of the Act are therefore stated or highlighted below.

3.3.2.1 Powers of Inspectors

Section 14 of part IV of this Act states that an inspector shall, in executing this Act, have the power to do the following:

- To enter, inspect and examine a factory and its environs at any time, as long as he has reasonable cause to believe that explosive or any highly inflammable materials are stored or used.
- To take with him during an inspection, a police officer, if he has reasonable cause to expect any serious obstruction during the execution of his duty
- To require the production of all documents and to examined and copy them in pursuance of this Act.
- To make necessary inquiries and examinations to ascertain whether the provisions of the Act are compiled with.
- To prohibit the use of any machinery, if he is reasonably of the opinion after examination, that it is not in good and safe condition.

If anyone willfully delays or obstructs the Inspector in the exercise of any of his duties under this Act, then such a person shall be guilty of an offence and be liable to a fine not exceeding twenty leones or to imprisonment for a term not exceeding one month or both. The occupier of the

factory shall also be guilty of such an offence and be liable to punishment in like manner, even though he has not personally caused the obstruction.

3.3.2.2 Rules for the implementation of the act

As stated in section 16, the Minister may make rules for the effective implementation of this Act as such rules may provide –

- For the safety of persons employed in such trades and occupations as my be declared to be dangerous trades;
- For imposing obligations for the better safeguarding of persons against accidents from dangerous parts of any machinery;
- For the construction and maintenance of fencing to the dangerous parts of any machinery;
- For the proper maintenance and safe-working of raising and lowering;
- For prescribing the duties of inspectors appointed for the purpose of this Act;
- For prescribing the qualifications to be possessed by engineers and other persons, for them to be placed in charge of, or entrusted with the care or management of any specified machinery;
- For the reporting of any occurrences at any works arising from, or in connection with, the use, maintenance or repair of any machinery;
- For the appointment of persons to hold enquiries under this Act, and prescribing powers and duties of such persons;
- For the fixing of penalties not exceeding a fine of one hundred leones or imprisonment for a term of six months or both such fine and imprisonment, for the contravention of any rule.

3.3.2.3 Appeal to Board Following Decision of Chief Inspector

If the holder of the lease, or any other person of the factory is aggrieved by a decision of the Chief Inspector, under the provisions of this Act, then section 18 states that a person may within fourteen days from the date of such decision, send to the Board through the Chairman, and to the

Chief Inspector, written notice of his intention to appeal against the decision stating the grounds of the appeal. On hearing the appeal, the Board may confirm, verify or reverse the decision of the Chief Inspector and this shall not be questioned in court.

3.3.2.4 Safety, Security and Welfare of Employees

Part V of this Act, deals with the aspect of health and stipulates that every factory shall be kept in a clean state and free from effluent arising from any drain, sanitary convenience or nuisance. This part of the Act also states that for overall safety of all employees, the factory must not be overcrowded, must be effectively ventilated, and provided with suitable lighting systems. Every care must be taken by the factory holder, to secure the health, safety and welfare of all employees.

As indicated in section 38, it is incumbent on the company to notify the District Inspector, in writing, of any accident or death in the factory. It is also stated in section 39 that all factory contracted diseases identified by a medical Practitioner, must be brought to the notice of the Chief Inspector in Freetown.

Where injury immediately results in death, section 40 states that the site of the accident must be left undisturbed, after the removal of the corpse, until inspected by a police officer or an inspector.

On receipt of the report of an accident, the inspector shall if he considers it necessary or if directed by a higher authority immediately proceed to the scene of the accident, as indicated in section 41, and shall make enquiry, the inspector is free to use any one under oath, any document, and award fees for giving evidences, as may be fixed by the minister.

Any person, who, without reasonable cause, fails to comply with the terms of summons of the inspector, or refuses to be examined or to answer questions other than that which may incriminate him, or any one who obstructs an Inspector or any person acting under his directions in the execution of his duty under section 41, shall be guilty of an offence.

The owner of every factory, according to section 45, must within 24 hours report in writing to an Inspector every dangerous occurrence caused by any machinery or electrical abnormality.
Section 26 of part VI stipulates that there shall be kept posted in prominent position in every factory.

- The prescribed abstract of this Act;
- The address of the Chief Inspector and of the nearest Inspector;
- Printed copies of any regulations made under part of this Act which are for the time being in force in the factory; or the prescribed abstracts of such regulations.

3.3.2.5 Offences and Penalties

Part VIII of this Act deals with offences, penalties and legal proceedings. Section 47, subsection 1 of this part, states that in the event of any contravention of the provisions of this Act or of any Regulation or Order made there, the occupier or owner of the factory, shall, be guilty of offence under the Act.

Regarding offences for which there are no penalties provided, section 48 stipulates that, any person guilty of an offence under this Act for which no express penalty is provided by or under the Act, shall be liable to a fine not exceeding fifty Leones or to imprisonment for a term not exceeding one month or both. If the contravention for which he was convicted continues, he shall be guilty of a further offence and liable to a fine not exceeding ten Leones for each day on which the contravention is continued.

Section 50 states that if anyone is killed, or dies, or suffers any bodily injury, in consequence of the occupier or owner of a factory having contravened any provision of this Act, the occupier or owner of the factory, shall, without prejudice to any other penalty, be liable to a fine not exceeding two hundred Leones or to imprisonment for a term not exceeding three months, or to both.

All offences committed under this Act shall, section 56 states, be prosecuted in a magistrate court.

3.4 International Environmental Requirements

Sierra Leone is a signatory to many mining related international conventions, some of which include:

3.4.1 The Montreol Protocol

In 1985, scientific concerns about damage to the ozone layer prompted governments to adopt the Vienna Convention on the Protection of the Ozone Layer, which established a first international legal framework for action. Then in 1987, international negotiators met again, this time in Montreal, to adopt legally binding commitments, finally putting into effect the Montreal Protocol on Substances that Deplete the Ozone Layer, which required that industrialized countries reduce their consumption of chemicals harming the ozone layer. As a result of worsening environmental conditions and increased scientific information, more demanding phase-out requirements were added to the Montreal Protocol in the form of amendments, adopted in London (1990), Copenhagen (1992), Montreal (1997), and Beijing (1999).

As of June 2004, 187 countries have ratified the Montreal Protocol. It sets a time schedule to “freeze”, reduce, and eventually phase out completely consumption and production of ozone depleting substances (ODS). It also requires all Parties to ban exports and imports of substances controlled by the Montreal Protocol to and from non-Parties.

Since the Montreal Protocol is in place, the production and consumption of chlorofluorocarbons (CFCs), of halons as well as other ozone depleting chemicals have been almost completely phased out in industrialized countries; furthermore, a schedule has been introduced to eliminate the use of methyl bromide, a pesticide and agricultural fumigant with particularly devastating ozone depleting effect. Developing countries whose annual per capita ODS consumption is less than 0.3 kg, so called Article 5 Parties, obviously working not only under different

environmental, but also economic and social preconditions, participate in the Montreal Protocol, under different phase-out schedules. They have a grace period before phase-out measures apply to them, recognizing both their special need for industrial development and their relatively small production and consumption of ODS1. Developing countries agreed to freeze their CFC consumption as of July 1999, based on 1995-1997 averages, aiming to reduce consumption by 50 per cent by January 2005 and by 85 per cent by January 2007, to eliminate fully CFC consumption by January 2010. Again different percentage reductions and time schedules apply to other ODS, such as halons, carbon tetrachloride, methyl chloroform, and methyl bromide.

Developing countries receive help in meeting their treaty obligations by the four implementing agencies of the MLF, being assisted in strategic planning and policy formulation and getting technical support in project identification, preparation, and implementation.2 As the financial mechanism to facilitate this work, the MLF was set up in 1990 to cover the incremental costs of complying with the Protocol's provisions.

MLF funds expended for ODS phase out activities were US$ 1.2 billion at end of 2003. The MLF estimates that MLF funded projects already eliminated approximately187,000 ODP tons of ODS consumption from the Article 5 countries by the end of 2003

The convention was adopted in September 1987 and Sierra Leone signed and rectified it in April 2003.

3.4.2 The Stockholm Convention on Persistent Organic Pollutants

This Convention was adopted on the 22nd May 2001 in Stockholm and Sierra Leone became a signatory on the 27th August 2001.

Persistent Organic Pollutants (POPs) are chemicals that are persistent bio-accumulates found in fatty tissues. They are bio-magnified through the food chain, and adversely affect health and the environment. This convention recommends the elimination or restriction of production and use of all internationally produced POPs (i.e. industrial chemicals and pesticides). The chemical to

be eliminated are Aldrin, Chlordane, Dieldrin, Endrin, Heptachlor, Hexachlorobenzen (HCB), Mirixtexaphene, Polychlorinated Biphensylsis (PCBs).

The convention also seeks continuing minimization and, where feasible, ultimate elimination of the releases of POPs, such as Dioxins and Furans. Stockpiles and waste containing POPs, must be managed and disposed of in a safe, efficient and environmentally friendly manner, with regards for international rules, standards and guidelines.

3.5 World Bank Requirements

3.5.1 World Bank Guidelines

Appropriate IFC/World Bank policies and guidelines include:

- Biological diversity (OD 4.00) – promotes conservation of endangered plants, animal habitats and protected areas;
- Cultural properties (OD 4.25)- protection of archaeological sites, historic monuments and historic settlements;
- Environmental guidelines)open pit and underground);
- Indigenous people (OD 4.25) addresses the traditional rights of people including land and water rights and ensures that indigenous people benefit from development project;
- Induced development and other socio – cultural aspects;
- Involuntary resettlement (OP 4.12) – describe how to proceed when involuntary resettlement is unavoidable.
- Land settlement (OD 4.31);
- Occupational health and safety guidelines;
- Environmental assessment (OP 4.01) – policy and procedures for environmental assessments whereby potential impacts are taken into
- account in selecting, sitting, planning and designing projects. Designed to ensure that IFC projects are environmentally and socially sound and sustainable;

- Water Resources Management (OD 4.07) - policy to promote economically viable environmentally sustainable and socially equitable water management.

3.5.2 World Bank Environmental, Health and Safety guidelines

A. Liquid Effluent

The following are guidelines for effluent discharged to receiving sedimentation basins, sewage systems, and stormwater drainage.

pH	6 to 9
BOD_5	50 mg/1
Oil and Grease	20 mg/1
Total Suspended Solids	50 mg/1
Temperature at the edge of A designated mixing zone	Max 5^0 C above ambient temperature of receiving waters. Max 3^0C if Receiving waters >28^0 C

B. Residual Heavy Metals

The following are recommended target guidelines below which there is expected to be no risk for significant adverse impact on aquatic biota or human use. In cases where natural background concentrations exceed these levels, the discharge may contain concentrations up to natural background levels. Concentrations up to 110% of natural background can be accepted if no significant adverse impact can be demonstrated.

Arsenic	1.0	mg/1
Cadmium	0.1	mg/1
Chromium, Hexavalent	0.05	mg/1
Chromium, Total	1.0	mg/1
Copper	0.3	mg/1
Total Iron	2.0	mg/1
Lead	0.6	mg/1
Mercury	0.002	mg/1
Nickel	0.5	mg/1

Zinc	1.0	mg/1

C. Ambient air

Concentrations of contaminants, measured outside the project property boundary, should not exceed the following limits:

Particulate Matter (<10 micron)

Annual Arithmetic Mean	100 microg/rn^3
Maximum 24 - hour Average	500 microg/rn^3

Nitrogen Oxides, as NO^2

Annual Arithmetic Mean	100 microg/rn^3
Maximum 24 – hour Average	200 microg/rn^3

Sulfur Dioxide

Annual Arithmetic Mean	100 microg/rn^3
Maximum 24 – hour Average	500 microg/rn^3

3.6 Other General Environmental Requirements

A. Solid Waste Disposal

Project sponsors are encouraged to recycle or reclaim materials where possible. If recycling or reclaim is not practical, these wastes must be disposed of in an environmentally acceptable way in compliance with local laws and regulations.

Solvents and similar hazardous materials must not be disposed of in a manner likely to result in soil or groundwater contamination if groundwater is potentially useable for potable water or irrigation purposes. Waste rock dumps should be designed and engineered so that materials with high potential to generate acid leachate are isolated from oxidation or percolating water.

B. Workplace Air Quality

1) Periodic monitoring or workplace air quality should be conducted for air containments relevant to employed tasks and the plant's operation.

2) Ventilation, air contaminant control equipment, protective respiratory equipment and air quality monitoring equipment should be well maintained

3) Protective respiratory equipment must be used by employees when the exposure levels for welding fumes, solvent and other materials present in the workplace exceed local or internationally accepted standards, or the following threshold limit values (TLVs):

Arsenic	5 mg/rn^3
Carbon Monoxide	29 mg/rn^3
Copper	1 mg/rn^3
Free Silica	5.0 mg/rn^3
Hydrogen Cyanide	11 mg/rn^3
Hydrogen Sulfide	14 mg/rn^3
Lead, Dusts & fumes, as Pb	0.15 mg/rn^3
Nitrogen Dioxide	6 mg/rn^3
Particulate (Interior Nuisance Dusts)	10 mg/rn^3
Sulfur dioxide	5 mg/rn^3

C. Work plan Noise

1) Feasible administrative and engineering controls, including sound insulated equipment and control rooms should be employed to reduce the average noise in normal work areas.

2) Plan equipment should be well maintained to minimized noise levels

3) Personnel must use hearing protection when exposed to noise levels above 85 dBA.

D. Hazardous Materials Handling and Storage

1) All hazardous (reactive, flammable, radioactive, corrosive and toxic) materials must be stored in clearly labeled containers or vessels.

2) Storage and handling of hazardous materials must be in accordance with local regulations, and appropriate to their hazard characteristics.

3) Fire prevention systems and secondary containment should be provided for storage facilities, where necessary or required by regulations, to prevent fires to the release of hazardous materials to the environment.

E. Health General

- Sanitary facilities should be well equipped with supplies (e.g. Protective creams) and employed should be encourage to wash frequently, particularly those exposed to dust, chemical or pathogens

- Ventilation systems should be provided to control work area temperatures and humidity.
- Personnel required to work in areas of high temperatures and/ or high humidity should be allowed to take frequent breaks away from areas
- Pre-employment and periodic medical examinations should be conducted for all personnel, and specific surveillance programs instituted for personal potentially exposed to toxic or radioactive substances.

F. Safety General

- Conveyors and similar machinery should be provided with a means for stopping them at any point

- Shield guards or guard railings should be installed at all belts, pulleys, gears and other moving parts
- Evaluated platforms and walkways\, and stairways and ramps should be equipped with handrails, toes boards and non- slip surfaces
- Electrical equipment should be grounded, well insulated and conform to applicable codes
- Employees should be provided with hard hats, safety, eye and ear protection, and snug fitting gloves as appropriate
- Masks and dust-proof clothing should be provided to personnel working in areas with high dust levels
- Procedures must be strictly enforced for the storage, handling,, and transport of explosives

G. Training

- Employees should be trained on the hazards, precautions and procedures for the safe storage, handling and use of all potentially harmful materials relevant to each employee's task and work area.
- Training should incorporate information from the Material Safety Date Sheets (MSDSs) for potentially harmful materials.
- Personnel should be trained in environmental, health and safety matters including accident prevention, safe lifting practices, the use of (MSDSs), safe chemical handling practices, and proper control and maintenance of equipment and facilities.
- Training also should include emergency response, including the location and proper use of emergency equipment, use of personal protective equipment, procedures for raising the alarm and notifying emergency response teams, and proper response actions for each foreseeable emergency situation.

H. Record keeping and Reporting

- The sponsor should maintain records of significant environmental matters, including monitoring data, accidents and occupational illnesses, and spills, fires and other emergencies
- This information should reviewed and evaluated to improve the effectiveness of the environmental, health and safety program
- An annual summary of the above information should be completed.

4.0 DESCRIPTION OF THE ENVIRONMENT

4.1 Social Environment

4.1.1 Land use types in the project area

Land uses surrounding the project area include:

4.1.1.1 Agriculture

Agriculture is definitely one of the very important land uses in the project area. Cultivation normally takes place on the flood plains at foot of the hills. These flood plains are perennially cultivated, with rice planted during the rainy season and vegetables, maize, sweet potatoes and cassava in the dry season. In most cases, fertilizers are applies to paddy rice whilst organic manure is used for vegetables.

Subsistence farming is mainly practiced as vegetable excesses are generally sold to generate income. Backyard cultivation (vegetables) is also practiced, especially by non-communal members who are generally not entitled to plots. These are mainly migrants engaged in building construction whose wives cultivate the backyards with vegetables for subsistence.

4.1.1.2 Livestock

There is no large scale livestock farm in or around the project area. In the settlements around the proposed project area poultry, mainly chicken but some few ducks are reared for subsistence. Similarly other ruminants such as goats, sheep and native pigs are also reared mainly for subsistence although sometimes these animals could be sold to augment family incomes.

The method of rearing these animals is mainly free range system where the animals roam about freely feeding on grasses and any other edibles along their path. In the dry season, animals like

goats and sheep are only confined at night. However, they are normally confined during the rainy season to minimize damage to cultivated gardens.

4.1.1.3 Fishing

Fishing is not a very common practice amongst the inhabitants of the project area. Approximately, 20% of the people are engaged in fishing and fishing related activities.

The fishermen with out board engines normally spend few days at sea and sell most of their catch whilst some leftover is used for home consumption. The women folk are normally responsible for organizing fish sales and also fish processing such as drying over the local "bandas".

4.1.1.4 Hunting

Although this practice is uncommon, however it is evident and is done by traps on the forested hills overlooking the quarry site. Animals normally caught include monkeys, deers, grass cutters and antelopes and are mostly used for home consumption rarely are they sold.

4.1.1.5 Fuel wood

The once virgin forest vegetation that covered the hills within the project area has been vastly depleted and the forest resources used mostly for fuel wood and charcoal which is the main source of energy for cooking in the country. In rural settings like Hastings cooking is mainly done with firewood as charcoal is deemed as expensive. At the time of the scoping mission which was in middle of the rains, Charcoal was going for Le 7000 at hasting beach but Le 10,000 in Freetown. The fuel wood is presently being obtained from bushes and forests of the hill range in the environs of the proposed factory. The firewood and charcoal are transported by head to the Freetown-Waterloo. The charcoal is the transported by vehicles for sale Freetown and sometimes Waterloo.

4.1.1.6 Energy

The Hastings community and surrounding settlements are connected to the national grid. However due to the very frequent power outages most houses use generators for lighting at night, otherwise, kerosene is the main source of energy for generating light, (by kerosene lamps and lantern) and for igniting firewood and coal for cooking.

4.1.1.7 Anthropology

The only cultural activity claimed to be practiced in the area is that of the female secret society referred to as Bondo society. The surrounding forests and bushes evident around proposed project area provide a conducive environment for the meeting and practices of such a secret society.

Hasting is claimed to have several churches and mosques. There is a court barrie, the general meeting place of the community and a market within the community.

4.2 Physical Environment

4.2.1 Climate

The climate is tropical and is characterized by the alternation of rainy and dry seasons. Conditions are generally hot and humid. Mean monthly temperatures range from the upper 70s F (mid-20s C) to the low 80s F (upper 20s C) in low-lying coastal areas; inland they may range from the low to mid-70s F (low 20s C) to the low 80s F.

The Meteorology weather station nearest to the proposed site is at Falcon bridge, located approximately 16 km from the project area. Daily mean minimum and maximum temperatures range between 24oC to 29oC (Figure 5).

Average annual rainfall, as recorded at the Falcon bridge weather station, is approximately 2,776 mm. Average monthly rainfall varies between 8 mm in January to around 941 mm in August. The mean number of rain days varies from around two in January to around 29 in August (Figure 6).

Climatic trends in the Western area indicate some changes in rainfall and temperature throughout the region. Rainfall has decreased especially the months of July and August in the last decade, and day- and night-time temperatures have increased gradually but cannot be substantiated with the final reports from the Climate Change Project.

A combination of the enhanced greenhouse effect and natural climate variability has been the explanation for these climatic changes (IPCC 2002).

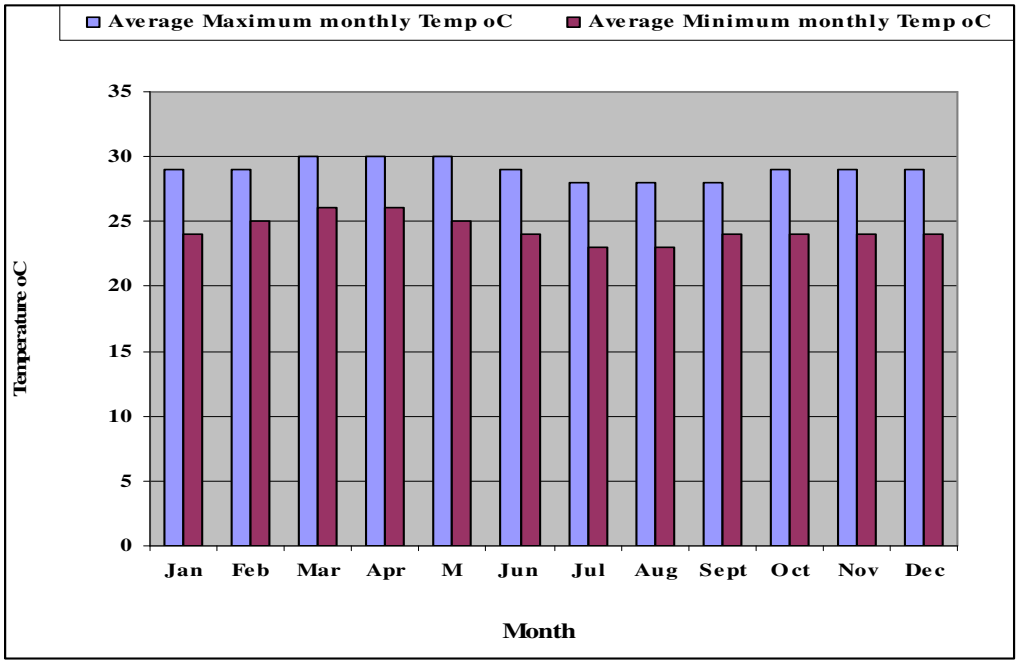

Figure 5: Mean monthly maximum and minimum temperatures as recorded at Falconbridge Point (Freetown)

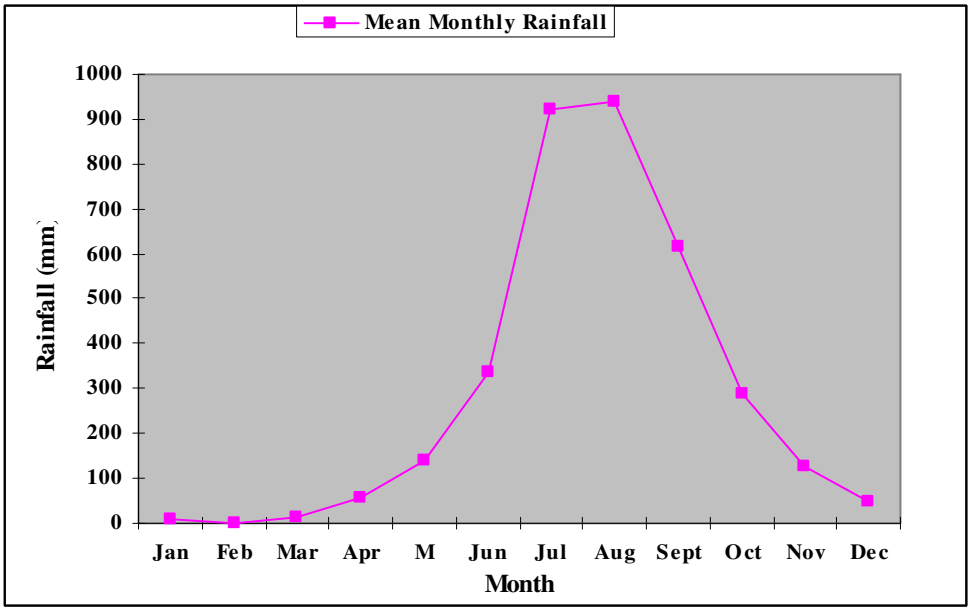

Figure 6: Monthly rainfall data as recorded at Falconbridge Point (Freetown)

Wind speeds recorded for the area ranges from 1.02m/s and 1.74m/s at noon time. It is therefore expected that prevailing winds at the site would carry airborne particles towards the Mama Beach settlement approximately 2km away on an easterly direction.

4.2.2 Land forms

The project site lies along the crest of the hills and slopes of the peninsula mountain with a broad terrace at the foot of the mountain. Hill slopes of the area are generally long to very long , straight to undulating, moderate to steep and frequently gullied and bouldery. The crest is short and narrow and prominent, nearly level and elongated. The terrace is level to nearly level. It is steepest at its junctures with the foots lopes of the hill and levels out away from the slopes. It is on the surface very stony and gravelly.

4.2.3 Soils

Soils in the project area are generally shallow, gravelly, well drained and strongly to weakly acid. Based on field observations the soils can be divided into 3 broad categories based on landforms:

a) Soils of the Hill crest: shallow to very shallow with bedrocks encountered at depths of less than 5cm. The shallowness of the soil is emphasized by the rife presence of rock outcrops. However pockets of deeper loams to clay with gravels are also evident with a well drained texture.

b) Soils of the hill-slopes: These are well drained soils with moderately shallow to shallow, reddish to yellowish gravelly clay loam to clay, frequently with gabbro or laterite boulders near the surface.

c) Soils of the Terraces: Medium to heavy textured colluvial soils, generally gravelly on shallow to bedrock parent materials. These soils are generally well drained.

4.2.4 Surface water

No streams, rivers or springs were found in the area. There is only the Breadfruit Water stream approximately 15metres away and is dry during the dry season.

4.2.5 Groundwater

Field observations indicate that there are no significant available groundwater resources close to the project area due to the elevation and geology of the project area. Groundwater is expected to generally be restricted to fractures within the granite basement, however, the company plans to sink a well within its premises to serve as a source of water for use in the manufacturing process.

4.3 Biological Environment

4.3.1 Vegetation

The vegetation of the area was originally typical tropical forest with high canopy plants reaching up to 30m. However closer to the project area is a mosaic with the type of vegetation depending

on drainage, slope and location. These are mostly secondary vegetation types formed after clearing of the forest, normally wooded savanna in nature.

4.3.2 Flora

The species composition of the secondary forest and forest regrowth differ significantly from that of the closed forest. Most common species encountered are *Musanga cercropioides, Albizzaia adianthiofora, Anthocliester nobilis, Daniella thurifera, Erythrina senegalensis, Phillanthus discoideus, Fagara microphylla, Chlorophora regia, tarrietta utilis, Amphimas pterocerpoides, Chysophyllum sp, Lophira alata, Diallum guineensis, Uapaca guineensis* and *Anisophyllea laurina.*

4.3.3 Fauna

Since these secondary forests abut with the closed forest mainly on top of hills within the WAPF animal species are known to frequently migrate within these systems with the presence of numerous corridors.

Over 50 species of mammals have been recorded for Western Area, of which seven species are primates, five of which are threatened - Western chimpanzee (En), Red Colobus monkey (Vu), Black-and-White Colobus monkey, Sooty Mangabey (NT) and Diana monkey (Vu). Other threatened mammals include Leopard (Vu), Jentink's duiker (Vu), Black duiker (NT) and Maxwell duiker (NT). An endemic toad *Cardioglosus aureolli* also occurs.

A total of 374 species of birds including occasional vagrants and migrants that visit water bodies within the forest, have so far been recorded, following the work of Field in the 1960s and early 1970s, Ausden and Wood in 1990 and Thompson in 1992. Five species of global conservation concern occur: the White-necked rockfowl (Vu) and Green-tailed bristlebill (Vu), Yellow-casqued hornbill (NT), Turati's boubou (NT) and Rufous-winged illadopsis (NT). Four active colonies of White-necked rockfowl containing of eight nesting sites were discovered during a study of the ecology and breeding biology of this species (Thompson, 1993; Thompson, 1997).

5.0 APPROACH AND METHODOLOGY

5.1 Objective of the Studies

This study is commissioned with the view to identifying possible impacts of the proposed polyurethane foam manufacturing plant, for which mitigating measure will be recommended on the basis of a pro-active strategy, under the Environment Protection Act 2000. The Environmental Impact Assessment (EIA) is a necessary pre-requisite for the launching of projects of this nature.

The stakeholders who are likely to be directly affected by the proposed project are the people of mama beach area and the neighboring communities such as Hastings, Grafton and Jui. The Koya Rural District Administration is also a stakeholder by virtue of its occupation in the geographical area of coverage.

5.2 Terms of Reference Consultants

The team was specifically mandated to investigate the following potentially negative impacts of the operations of the polyurethane foam manufacturing plant on the physical and socio-economic environment in the project area:

a) Effects of pollution emanating from oil spills, chemicals to be used, noise pollution, dust etc.
b) Overall damage to biological diversity (effect on biotic and abiotic aspects) where applicable.
c) Effects on watersheds, water yield, hydrologic cycle, soil stability and water quality.
d) Effect on environmental health, workers safety and protection through the use of equipment and machinery, generation of solid waste, emissions from volatile compounds, and improper handling and storage of chemicals.
e) Effect of operations on tourism and the aesthetic value of the surrounding landscape.

Operational conduct of past polyurethane foam manufacturing companies could influence people's attitude to the proposed operations. This aspect was therefore investigated through interviews with communities and information from past records.

5.3 Methodology

A multi-disciplinary team from the University of Sierra Leone (a chemist, process engineer, and Environmental Impact Assessment Specialist) was commissioned to undertake this study. Information provided in this report was purely based on the following main sources:

a) Extensive literature review on the subject
b) Experience in working with rural people in the Koya Rural District
c) Information gathered from the visit to the site
d) Information from other allied sectors or disciplines.

Impacts were characterized into those that affect the biophysical environment, and those, which affect the socio-economic environment. Each impact was briefly described and its significance analysed.

In addition, the negative impacts were ranked into low, medium and high using subjective reasoning in the absence of actual figures based on research results, under the conditions prevailing in the proposed operational area.

6.0 IMPACT IDENTIFICATION AND ANALYSIS

On-site and off-site impacts can be induced during the construction of the facility, and later during its operation. On-site impacts result from construction activities carried out within the construction site. The impacts of off-site work result from activities carried out outside the construction site, such as traffic, yet are directly related to the project. In the case of solid waste treatment facilities, the main potential receptors are soil, surface, and ground water bodies, in addition to human amenity. Table 9 summarizes the potential impacts on the physical, biological and socioeconomic environments caused by the proposed foam manufacturing plant. The extent of impacts depends primarily on the management practices that would be adopted during facility operation.

6.1. IMPACTS ON WATER RESOURCES

6.1.1 Impacts during Construction

No on-site impacts on water resources are anticipated during the construction phase of the facility. No streams, rivers or springs were found in the area. There used to be streams running in the southern and northern valley, but are completely dried out presently.

Care should however be exercised when handling fuel and oil (hydraulic, transmission, engine, etc.) to power and maintain the different equipment on site. Measures should be taken to avoid spillage of such material to the ground. Additionally, all earth-moving and other equipment should be in good working condition and well maintained (no leaks).

6.1.2 Impacts during Operation

During operation, the main activities that could possibly affect the natural resources are the waste management practices. Care should be exercised when handling fuel and oil (hydraulic, transmission, engine, etc.) to power and maintain the different equipment on site. Measures should be taken to avoid spillage of such material to the ground.

6.2. IMPACTS ON SOIL

6.2.1 Impacts during Construction

The total volume of soil and rock that would be excavated during plant construction is relatively small and thus should not lead to major erosion problems and impacts on soils.

Soil pollution from on-site as well as off-site works may occur by the intentional or accidental leakage of used chemicals, fuel, or oil products (from equipment and vehicles) on construction sites. Such practices should be strictly avoided and utmost precautions and workmanship performance should be adopted for the disposal of such hazardous products.

6.2.2 Impacts during Operation

The main concern during operation of the facility is related to soil quality rather than soil quantity, and is primarily attributed to generated waste management. However, impacts will occur from accidental leakage of used chemicals, fuel, or oil products used in equipment maintenance operations. Such practices should be strictly avoided and utmost precautions and workmanship performance should be adopted for the disposal of such hazardous products.

6.3. IMPACTS ON AIR

6.3.1 Impacts during Construction

Dust is the main impact on air quality caused primarily by the excavation works.
Increased traffic will also increase dust emissions both on-site and off- site. However, since the construction phase is of limited time, this impact should not be considered of high significance. Odor emissions may also arise during this phase by increased machinery.

6.3.2 Impacts during Operation

The main concern during the operational phase is the emission of noxious odors. The factory will be equipped with odor control measures; such as the maintenance of internal negative pressure and the installation of a biofilter. Failure to maintain these measures can lead to significant surges in odor levels.

Increases in traffic levels to and from the facility will also increase dust and gaseous emissions. Waste delivery trucks should all be equipped with adequate exhaust systems to reduce this impact.

6.4. IMPACTS ON BIODIVERSITY

6.4.1 Impacts during Construction

The proposed foam factory is not situated on an area of significant ecological concern. The construction of the facility therefore will not lead to the destruction of critical ecosystems or the extinction of endangered or rare species.

Potential negative impacts affecting biodiversity during project construction are summarized in Table 8. The main construction activities having negative results on the biodiversity are earth-moving activities, erection of the facility, and construction waste material and effluent discharges.

Table 8: Potential Negative Impacts on Biodiversity

Impact	Cause
Habitat loss or destruction	Construction works
Altered abiotic/site factors	Soil compaction, erosion
Mortality of individual organisms	Destruction of vegetation
Loss of individual organisms through emigration	Following disturbance or loss of habitat
Habitat fragmentation	Habitat removal and/or introduction of barriers like roads
Disturbance	Due to construction noise, traffic, or presence of people
Altered species composition	Changes in abiotic conditions, and habitats
Vegetation loss	Soil contamination due to disposal of oils and hazardous material

On the other hand, the project should include a landscape plan used primarily as a wind barrier for the prevention of odor emissions. The grown tree plants surrounding the site will lead to great positive impacts on the biodiversity level.

6.4.2 Impacts during Operation

With proper management of wastes, negative impacts on biodiversity during operation of the facility should be minimal. On the contrary, the projects could lead to positive environmental impacts on the biodiversity level if landscaping plans are developed. Inclusion of native/ endemic species, in the proposed landscape plan could be adopted to alleviate visual impacts and compensate loss of habitat and communities. Landscaped plants will also act as windbreak and eventually reduce the dispersion of odors around the facility.

Wastewater from the facility will pose a direct impact on the biodiversity of the surrounding area if a wastewater collection and treatment system is not installed. However, wastewater will be collected in tanks and regularly pumped out.

6.5. IMPACTS ON HUMAN AMENITY

Human amenity is defined here as general comfort of persons that could eventually be disturbed by factors such as aesthetic, litter, dust, noise, and odors.

6.5.1 Impacts during Construction

The main impacts on human amenity during plant construction are related to dust and noise generation. An increase in ambient particulate matter may be observed primarily during the excavation activities. However, given the fact that excavation will last for a limited period, the impacts from potential dust generation will probably not be significant. On the other hand, appreciable increases in noise levels may be expected during excavation and erection of the facility. The noise impact from excavation and associated truck movements are however not limited to construction phase given that waste delivery truck to the location will increase considerably during the operation phase.

6.5.2 Impacts during Operation

The main amenity impacts during plant operation are related to noise and odors. Noise may be generated mainly from the machines and from the generators. However, if adequate noise reduction/suppression measures are undertaken, the generated noise should not significantly

affect human amenity. However, the noise level increases caused by the increase in traffic levels of delivery will remain a concern. A proper routing system should be considered and scheduled at appropriate timings.

Odors emitted from a foam manufacturing facility may easily reach the local inhabitants, particularly Jui and Kossoh Town if prevalent wind direction is towards the residential areas. However, odors can be reduced or prevented through the provision of negative internal pressure and the installation of a proper biofilter. The provision of a maintenance design procedure will also ensure the reduction or prevention of odor emissions.

The proposed building might pose a visual intrusion to the local community, at the back of the proposed site. The provision of a landscape plan will alleviate this impact and may even provide aesthetics.

6.6. IMPACTS ON PUBLIC AND OCCUPATIONAL SAFETY

6.6.1 Impacts during Construction

In any civil works, public as well as construction staff safety risks can arise from various constructions activities such as deep excavations, operation, and movement of heavy equipment and vehicles, storage of hazardous materials, and disturbance of traffic. Because of the short duration and non-complexity of the construction phase, such activities are controlled and consequently the associated risks are minimal. Proper supervision, high workmanship performance, and provision of adequate safety measures will suppress the likelihood of such impacts on public and occupational safety.

6.6.2 Impacts during Operation

During the operational phase of the facility, public and occupational safety is at a higher risk than during the construction phase. Operation of the facility machinery, especially shredding operations should be handled properly. Fortunately, various mitigation measures can be easily adopted to minimize occupational hazards. Such measures are detailed in Section 7 and should be stringently considered. Public safety risks are mainly posed by the increased traffic caused by

the waste collection vehicles. Attention to traffic routing and timing should considerably reduce this impact.

6.7. ECONOMIC IMPACTS

Additional positive impacts would be observed at the socio-economic levels. The proposed foam manufacturing plant will create certain job opportunities for skilled and unskilled labor.

The operation of the project is expected to create direct and indirect employment opportunities. It is estimated that 64 persons would be employed. Residents of Hastings, Jui or Kossoh town recognized that jobs will be created from the project but were skeptical of having access to these opportunities based on previous experience with similar projects in the area where labour was sometimes imported into the area.

6.8. IMPACTS ON ARCHAEOLOGICAL, TOURISTIC AND CULTURAL SITES

Research conducted to date indicates that there are no sites of archaeological or anthropological importance within the lease area of the project. However, should any findings of artifacts be made during the timber operations it is recommended:

- Vitafoam inform the Ministry of Tourism and Cultural Affairs and the National Museum
- Vitafoam to secure such sites.

Table 9. Environmental Impacts of the proposed Foam Manufacturing plant during Construction and Operational Phase

Media	*Potential Impact*	*Cause*	*Significance*
During Construction			
Physical Environment			
Soil	Erosion	Earthmoving and excavation works	-
	Soil contamination	Oil and fuel spillage of equipment and trucks	-
Water		Oil and fuel spillage of equipment and trucks	0/-
		Wastewater discharge from housing facility of contractors	0/-
Air	Noxious Odors	Construction equipment, machinery and trucks	-
	Dust Emissions	Onsite construction activities	-
		Off site construction activities i.e. hauling material	-
		Truck movement	-
	Gaseous Emissions	Trucks, construction machinery and equipment	-
Biological Environment			
Flora and Floral Habitat	Loss of habitat	Construction of Foam factory	-
Fauna and Faunal Habitat	Loss of habitat	Construction of Foam factory	-
Socio-economic Environment			
Public & Occupational Health & Safety	Public health and safety	Unauthorized entry	-
	Occupational health and safe	Construction activities	-
Economic	Employment opportunity	Employment	+ / -
Social	Aesthetic	Site development	- -
	Dust	Increased traffic	- -
		Construction activities	- -
	Noise	Construction equipment, machinery and trucks	- -

Table 9. Environmental Impacts of the proposed Foam Manufacturing plant during Construction and Operational Phase (contd)

Media	*Potential Impact*	*Cause*	*Significance*
During Operations			
Physical Environment			
Soil	Soil contamination	Oil and fuel spillage of equipment and trucks	-
		Improper handling and storage of chemicals	
Water		Oil and fuel spillage of equipment and trucks	-
		Generation of solid waste and wastewater	-
		Improper handling and storage of chemicals	-
Air	Noxious Odors	Emissions from volatile compounds	-
		Improper handling and storage of chemicals	-
		Poor house keeping	
	Dust Emissions	Use of machinery and equipment	-
		Off site construction activities i.e. hauling material	-
		Truck movement	-
		Poor house keeping	-
	Gaseous Emissions	Emissions from volatile compounds	-
		Poor house keeping	-
Socio-economic Environment			
Public & Occupational Health & Safety	Public health and safety	Unauthorized entry	-
	Occupational health and safety	Use of machinery and equipment	-
Economic	Employment opportunity	Employment	+ / -
Social	Aesthetic	Unsightly Facility	- -
	Dust	Increased traffic	- -
		Use of machinery and equipment	- -
	Noise	Use of machinery and equipment	- -
		Truck movement	- -

7.0 MITIGATION MEASURES

7.1. Defining Mitigation

In the Environmental Impact Assessment context, mitigation refers to the set of measures taken to eliminate, reduce, or remedy potential undesirable effects resulting from the proposed action, here the proposed foam manufacturing plant. Mitigation should be typically considered in all the developmental stages of the facility, namely, the site selection process, as well as the design, construction, and operation phases.

7.2. Mitigating Adverse Project Impacts

As identified earlier, potential adverse impacts of the proposed foam manufacturing plant may include dust emissions, odor and, noise generation, degradation of natural resources, public health hazards, and adverse aesthetic impacts. Proposed mitigation measures for the above-mentioned adverse impacts are discussed in the following paragraphs. Table 10 summarizes such mitigation measures, their monitoring for actions affecting environmental resources and human amenity.

7.2.1 Mitigating Air Pollution

Foam blowing processes are a source of hazardous volatile emissions to the environment and include the use of diisocyantes (hazardous chemical solvent) and chlorinated solvents (hazardous and ozone depleting solvents).

Emissions from heating of resins include volatiles, acetic acid and potentially toxic compounds such as carbon monoxide and acrolein.

In order to protect air quality and minimise emissions of volatile solvents including isocyantes and ozone layer depleting substances, the following mitigation measures are recommended;

- Exhaust gases must be extracted and filtered prior to discharge to the environment to prevent emissions of hazardous compounds. Filtration equipment includes activated carbon filters or water scrubbers.
- Chlorofluorocarbon compounds must not be used as auxiliary blowing agents (ABAs).
- Consider alternative and less polluting ABAs or introduce technology aimed at reusing ABAs. Consider non-chlorine blowing agents that are not atmospheric ozone depleting.
- Substitute acetone for hazardous ABAs such as methylene chloride (contains chlorine).
- Incinerating waste on site is prohibited.

7.2.2 Mitigating Dust Emissions

Dust emissions from piles of soil or from any other material during earthwork, excavation, and transportation should be controlled by wetting surfaces, using temporary windbreaks, and covering truckloads. Piles and heaps of soil should not be left over by contractors after construction is completed. In addition, excavated sites should be covered with suitable solid material and vegetation growth induced after construction completion, no soil surface should be kept bare subject to erosion.

The following management practices should be observed during the operation of the facility;

- Emissions from foam blowing activities must be extracted and filtered using activated carbon or a water scrubber to prevent emissions of volatile organic compounds (including isocyanates) to the environment.
- Control dust generation so that particles do not move off-site. Dusts may also contain hazardous materials and contaminate air, soil and waters.
- Immediately clean up material spilt on traffic areas before vehicle movement can move it.
- Regularly collect and place in a sealed bag any floor sweepings, dust, powder waste or absorbent clean up materials, before disposing in a covered waste bin.
- Use wet/dry vacuum cleaners with dust filters for general cleaning of the workshop floor surface instead of sweeping and hosing with water.

It is the responsibility of the Supervision Engineer to monitor for the mitigation of such impacts.

7.2.3 Mitigating Noise Pollution

Temporary noise pollution due to construction works should be controlled by proper maintenance of equipment and vehicles, and tuning of engines and mufflers. Construction works should be completed in as short a period as possible by assigning qualified engineers and supervisors. Construction works should also be confined to daytime hours. It is the responsibility of the Supervision Engineer to monitor for the mitigation of such impacts.

Noise pollution during operation would be generated by mechanical equipment. Noise problems should be reduced to normally acceptable levels by incorporating low-noise equipment in the design and/or locating such mechanical equipment in properly acoustically lined buildings or enclosures. In the presence of adequate buffer zones between the facility and residential areas, the need for noise control measures is minimized. In this case, the facility site is to be located at distance of 0.45 km from the Freetown-Waterloo Highway and a distance of 20 meters from the nearest household in the village. Furthermore, dispersion of noise can be reduced by implementing a landscaping plan of trees such as *Acacia spp*. that will act as a wind and sound break.

Increased noise levels will also be observed due to the increased traffic levels by waste delivery trucks to and from the Facility. Therefore all traffic activities should be limited to daytime working hours.

The following measures are further recommended for proper handling of noise pollution within the facility.

- Use the layout of the buildings and the natural topography as noise barriers where possible. Cost-effective landscaping improvements (e.g. fencing, mounds, and plants) can be used to reduce noise emissions and therefore noise complaints.

- Ensure that silencers fitted to air compressors, pumps, fans and blowers and other noisy machinery are effective.
- Reduce structural-borne noise and vibration by mounting equipment on vibration isolating platforms, rubber mats, or by increasing the mass weight of equipment.
- Fit mechanical ventilation systems (e.g. air conditioners, fans) with noise-proof ducting and acoustically designed intake and exhaust openings.
- Ask for noise reduction devices when purchasing new plant and equipment.
- Close windows and roller doors facing noise-sensitive premises and seal all unnecessary openings.
- Only operate heavy vehicles in daylight hours.

Regularly maintain all equipment and vehicles and attend promptly to any loose parts, rattling covers, worn bearings and broken components. This should be addressed through a regular maintenance schedule and correct staff training.

7.2.4 Mitigating Obnoxious Odours

Odors emitted by the facility may be potential nuisance to the public. However, through the provision of negative internal pressure and the installation of a biofilter odors can be reduced or prevented. Normal housekeeping, improved operation, and the provision of a maintenance design procedures will further reduce or prevent odor emissions.

The primary mitigation measure for odor control remains the proper site selection of the facility. The facility should be located at a site where prevailing winds mostly blow away from nearby residential areas. In this case, the proposed facility site is approximately 0.45km from the Freetown-Waterloo Highway and 20m from the nearest dwelling houses. These distances along with the odor control measures suggested should be sufficient in control odor dispersion.

The following additional measures are further recommended for reduction of obnoxious odours from within the foam manufacturing facility.

- Maintain adequate ventilation and hygiene to reduce the generation of odour.
- Control any exhaust emissions from vehicles to prevent nuisance or objectionable odours/fumes off-site.
- Maintain good housekeeping and cleaning practices.
- Use mechanical ventilation systems and activated carbon filters or scrubbers to prevent the release of any uncontrolled and objectionable odours from buildings or rooms.

7.2.5 Mitigating Impact on Biodiversity

Recommended mitigation measures to minimize or eliminate the impacts on the biodiversity at proposed location, include:

- Avoid deforestation activities: plan the building sites and roads on areas void of trees.
- Design a landscape plan that enhances the landscape aesthetic value using local and native population flora.
- When detected, sensitive species or habitats should be conserved.
- All waste resulting from construction works, land reclamation, or any other activity should be collected and disposed properly in an allocated disposal site. Littering in the project area and surrounding areas should be prevented.

7.2.6 Mitigating Impacts on Soils

The Foam factory construction works may lead to erosion of soil, however with proper resurfacing of exposed areas, and the induction of vegetation, significant reduction of erosion can be observed. In addition, impacts may also occur from accidental leakage of used chemicals, fuel, or oil products used in equipment maintenance operations that should be strictly prohibited. Utmost precautions and workmanship performance should be adopted for the proper disposal of hazardous product. Education of workers on environmental protection will improve those practices and it is the responsibility of the supervision engineers and factory operators to ensure such practices.

Store chemicals and other materials that may contaminate soil, storm water, groundwater in a manner that prevents or minimises the impact of any accidental spills or releases. This means:

- potential liquid contaminants stored in a secure, covered area away from through traffic. Such contaminants may include disinfectants, fuels, oils, detergents, poisons, cleaning solvents, alkaline or acidic solutions;
- storage areas provided in an impervious bunded area or compound to contain any leakage or spillage. The capacity of the compound shall be at least the capacity of the largest tank or package in the compound (Bunding may not be required where the storage is inside a workshop or similar area and the operator can demonstrate that any spills will not escape the area and contaminate storm water or surrounding ground.);
- Keep clean-up equipment, absorbent materials, and any materials for neutralising or decontaminating spills on the premises. Staff are to be adequately trained in the use of these materials.
- Immediately take action to clean-up spills or leaks. Contaminated materials are not to be reused and must be appropriately contained and packaged for transport for either recycling or disposal by a licensed waste operator.

7.2.7 Mitigating Adverse Aesthetic Impacts

To avoid possible visual impacts resulting from the existence of the facility to the local community, the following steps are to be implemented:

- Maintaining cleanliness within the treatment facility,
- Appropriate landscaping of the plant grounds with planting of suitable trees (such as Acacia ssp.), grass, and flowers.
- Fencing and screening the site with appropriate trees to obstruct the plant components from onlookers and area inhabitants. (All along with some noise reduction).

7.2.8 Mitigating Impacts from Waste

Disposal of wastes should be viewed as the last option in environmental management strategies. The life of material resources may be extended by recovery, reuse and recycling. To pursue a sound waste management policy in the factory the following general principles should be adopted;

- Implement a waste recycling (reuse) system for non-hazardous solid wastes using separate containers for individual waste streams.
- Clearly label waste containers and locate them in convenient areas to encourage use. Mixing wastes may make them unsuitable for reuse or recycling.
- Store solid wastes undercover so contaminants cannot be washed to storm water by rain.
- Never dispose of waste on site.
- Use wet/dry vacuum cleaners with dust filters for general cleaning of floors instead of sweeping and hosing with water.
- Material put into industrial bins will generally go to landfill. Do not dispose of gas cylinders, asbestos-containing materials or synthetic-mineral fibres into an industrial bin
- Only put solid inert waste in industrial bins.

7.2.9 Mitigating Public and Occupational Health Hazards

The likelihood of impacts on public and occupational safety can be significantly suppressed by the following mitigation measures:

- Restricting unattended public access to the factory by proper fencing and guarding.
- Surrounding excavated locations with proper safety barriers and signs.
- Controlling movement of equipment and vehicles to and from the site, especially in the construction phase.
- Emphasizing safety education and training for system staff. Enforcing adherence to safety procedures.

- Providing appropriate safety equipment, fire protection measures, and monitoring instruments.
- Properly rating electrical installations and equipment and, where applicable, protecting them for use in flammable atmosphere.
- Providing sufficient lighting that should comply with zoning requirements.

As a conclusion, proper supervision, high workmanship performance, and provision of adequate safety measures will alleviate public and occupational risks.

Table 10. Mitigation Measures, Monitoring, and Estimated Costs for Actions Affecting Environmental Resources and Human Amenity

Action	*Potential impact*	*Mitigation measures*	*Monitoring of mitigation measures / responsibility*	*Estimated cost of mitigation (USD)*
A. During Construction				
Excavation and earth movement	Dust emission	• Wetting excavated surfaces • Using temporary windbreaks • Covering truck loads	Vitafoam EPD	15,000
	Noise generation	• Restriction of working hours to daytime • Employing low noise equipment • Proper maintenance of equipment and vehicles, and tuning of engines and mufflers	Vitafoam EPD	10,000
	Erosion	• Proper resurfacing of exposed areas • Inducing vegetation growth	Vitafoam EPD	5,000
	Disturbance to biodiversity	• Conservation of present trees and used as wind brakes and aesthetic cover for the facility. • Inducing vegetation growth	Vitafoam EPD	5,000
Dumping of excavated and construction material into the environment	Groundwater pollution	• Prohibition of uncontrolled dumping. Disposal at appropriate locations • Education of workers on environmental protection	Vitafoam EPD	TBD

Action	*Potential impact*	*Mitigation measures*	*Monitoring of mitigation measures / responsibility*	*Estimated cost of mitigation (USD)*
A. During Construction				
Discharge of wastes (chemicals, oils, lubricants, etc.) on-site	Soil and water pollution	• Prohibition of uncontrolled discharge. Proper disposal of hazardous products • Education of workers on environmental protection	Vitafoam EPD	15,000
Storage of hazardous material, traffic deviation, deep excavation, movement of heavy vehicles, etc.	Hazards to public and occupational safety	• Proper supervision for high workmanship performance • Provision of adequate safety measures, and implementation of health and safety standards	Vitafoam EPD	35,000
B. During Design & Operation				
Inadequate process design and control	Generation of obnoxious odors	• Improving operation and maintenance design procedures • Storage of wastes and compost in enclosed areas • Provision of covers where possible • Landscaping a proper natural windbreaker around the facility • Installation of biofilter • Provision of internal negative pressure of building • Maintaining proper cleanliness and housekeeping • Transportation of odorous byproducts in enclosed container trucks	Vitafoam EPD	15,000

	Impaired aesthetics	• Maintaining cleanliness around and within the plant • Proper fencing and landscaping	Vitafoam EPD MOHS	TBD
	Noise generation	• Limit waste collection and delivery to daytime hours • Incorporating low-noise equipment • Locating mechanical equipment in proper acoustically-lined enclosures • Proper fencing and landscaping	Vitafoam EPD MOH	15,000
	Traffic generation	• Proper routing of waste delivery trucks • Limiting waste collection and delivery to daytime hours	Vitafoam SLP EPD	5,000
	Public & occupational hazards	• Restricting unattended public access • Providing adequate safety measures and monitoring equipment • Emphasizing safety education and training for system staff • Implementing health and safety standards	Vitafoam Factory Inspectorate	45,000
Inappropriate waste collection	Accumulation of waste at waste collection bins	• Increasing the capacity and number of collection vehicles	Vitafoam Freetown City Council	50,000
Total				**115,000**

EPD – Environment Protection Department
MOHS – Ministry of Health and Sanitation
SLP - Sierra Leone Police

8. ENVIRONMENTAL MANAGEMENT PLAN

The proper implementation of a comprehensive environmental management plan (EMP) will ensure that the proposed foam manufacturing facility meet regulatory and operational performance (technical) criteria.

8.1. Objectives of the Environmental Management Plan

Environmental management/monitoring is essential for ensuring that identified impacts are maintained within the allowable levels, unanticipated impacts are mitigated at an early stage (before they become a problem), and the expected project benefits are realized. Thus, the aim of an EMP is to assist in the systematic and prompt recognition of problems and the effective actions to correct them, and ultimately good environmental performance is achieved.

A good understanding of environmental priorities and policies, proper management of the facility, knowledge of regulatory requirements and keeping up-to-date operational information are basic to good environmental performance.

8.2. Monitoring Schemes

Two monitoring activities have to be initiated for the proposed foam manufacturing factory to ensure the environmental soundness of the project. The first is *compliance monitoring*, and the second is *process control monitoring*. Compliance monitoring provides for the control and categorization of foam quality, while process monitoring relates to detecting the impact of the operational activities. Together, the objective is to improve the quality and availability of data on the effectiveness of operation, equipment, and design measures and eventually on the protection of the environment.

8.2.1 Compliance Monitoring

In this context, compliance to the regulations to be set by the Sierra Leone Environment Protection Agency (SLEPA) to limit air, water, and soil pollution should be observed. Compliance monitoring requirements include foam quality testing. Compliance monitoring shall be the responsibility of Vitafoam, thus monitoring activities shall be budgeted for accordingly.

For effective compliance monitoring, the following should be assured:

- Trained staff (facility operator, laboratory staff, maintenance team, etc.) and defined responsibilities
- Adequate analytical facility (ies), equipment, and materials,
- Authorized Standard Operating Protocols (SOPs) for representative sampling, laboratory analysis, and data analysis,
- Maintenance and calibration of monitoring equipment,
- Provision of safe storage and retention of records.

In the proposed foam factory, qualified plant operators and laboratory staff should carry out foam quality testing. The technical staff that would run the plant shall attend training programs to improve their qualifications and update their information. Both staff and trainers would be involved in knowledge transfer to operators and management through regular assistance and specialized technical workshops.

8.3. Process Control Monitoring

This course of action is needed since a precise and adapted process control strategy translates into a better process performance, and thus foam quality compliance. Process control monitoring also includes occupational health and safety monitoring. Table 11 presents the recommended process performance monitoring parameters.

Occupational health and safety is crucial for the proper performance of the factory. The main access roads connecting to the facility must remain in good condition to avoid vehicles accidents. In addition, Vitafoam must continuously observe the occupational safety standards of labor.

Vitafoam must also regularly check for outdoor odor levels. This is to be performed weekly by a field visit to the area surrounding the facility, especially in the predominant wind direction and close to the residential area. Monitoring for air quality deterioration is essential to maintain hygienic standards within the facility. This should be an ongoing process.

Table 11. Process Performance Monitoring Parameters

Domain	*Parameter*	*Frequency*
Health and Safety	Main access roads	Quarterly
	Occupational safety	Ongoing
Odor	Off site odor levels	Weekly
Air Quality	Total Suspended Particles (TSPs) Fumes from fuel Volatile emissions	Quarterly
Water	Temperature pH Conductivity CoD Turbidity Oils/Grease TSS	Quarterly
Waste management	Waste accumulation and disposal	Ongoing

8.4. Record Keeping and Reporting

Monitoring efforts would be in vain in the absence of an organized record keeping practice. It is the responsibility of the Vitafoam administration to ensure the development of a database that includes a systematic tabulation of process indicators, performed computations, maintenance schedules, logbook, and compliance and process performance monitoring outcomes. Such a historical database benefits both the facility operator and design engineers.

The Vitafoam administration should submit a periodic Compliance Monitoring Report to the assigned regional authority, namely the Koya Rural District Council and subsequently to the SLEPA. Such record keeping shall be requested and assured by the District Council.

8.5. Contingency Plan

The contingency plan in case of emergency would be tackled in the design consideration of the facility.

8.6. Capacity Building

Considered as corner stone of the EMP the capacity-building program consists of two major parts: On the Job Training (OJT) and a General Awareness Seminars (GAS).

8.6.1 On the Job Training (OJT)

The majority of the Operation and Maintenance training of the Factory will commence within 60 days of substantial completion of construction. The most significant training, especially as it relates to the processing equipment, will occur during the general equipment shake down period and continue during facility start up and performance testing. In addition, formal classroom lecture for process familiarization for the staff will take place. A highly technical training manual should be distributed to the participants to serve as a basis for future reference and application of proper environmental guidelines.

8.6.2 General Awareness Seminars (GAS)

General awareness seminars targeted to the local community in general is recommended. Issues addressed in a General Awareness Seminar are less technical than those in OJT, and aim at raising awareness and improve environmental practices of the local population. It would be however rather difficult and expensive to provide these seminars to a very large portion of the local communities during the duration of the project. It is believed to be a more sustainable

approach to train the trainers who will subsequently train and raise awareness in the community. These trainers include municipality officials, primarily school teachers and NGO's that could take over this educational role. Topics to be included in these seminars could be environmental impacts from poor waste practices, role of the local community in improving the environment and other general topics aimed to increase environmental awareness.

Awareness manuals and ready-made presentations will be prepared and provided to these trainers as tools to be used in raising awareness. Trainers would attend awareness seminars provided in schools and other public locations in order to be acquainted with the principle. Several General Awareness Seminars would be conducted in order to initiate the environmental awareness in the rural communities.

9. PUBLIC INVOLVEMENT AND PARTICIPATION

Public involvement started early in the process when Vitafoam requested from the Environment Protection Department in the Ministry of Lands, Country Planning and the Environment an Environmental Impact Assessment Licence to facilitate the construction and operation of a flexible polyurethane manufacturing plant to be located in Hastings, Koya Chiefdom Western Rural Area, Western area, Sierra Leone. Since it was a publicly initiated and supported project, public involvement was assured.

During this EIA study, the consultants met numerous times with Members of District Council of Koya Rural District along with the assistance of Vitafoam representatives and Contractors, to present the findings regarding many aspects concerning the site location, network system, process design, most appropriate technologies and many other aspects required to finalize the study. Additional meetings were also set between the Environment Protection Department, Ministry of Trade and Industry (MTI) and the Consultants to set the Specifications, Requirements and Standards requested for compliance of contractors.

In the preliminary stages of the study, information was requested from various institutions. The requested information related to the physical and biological environment, the socio-economic situation in the Koya Chiefdom Western Rural Area and particularly Hastings, and general requirements pertinent to the EIA process.

In conformity with the EPA Act, 2000, VITA Foam Sierra Leone Limited intends to conduct a public disclosure to enable the public to know about the EIA study that is being conducted and the proposed treatment facility, and soliciting comments. A public hearing will be held early in 2010 and all key stakeholders will be invited including officials from the Koya Chiefdom Western Rural Area and people from the local community. The consultants will give a presentation and make responses where questions and comments are solicited.

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Plate 1: Entrance to the Vitafoam property at Hastings

Plate 2: Dwelling houses close to the Vitafoam property

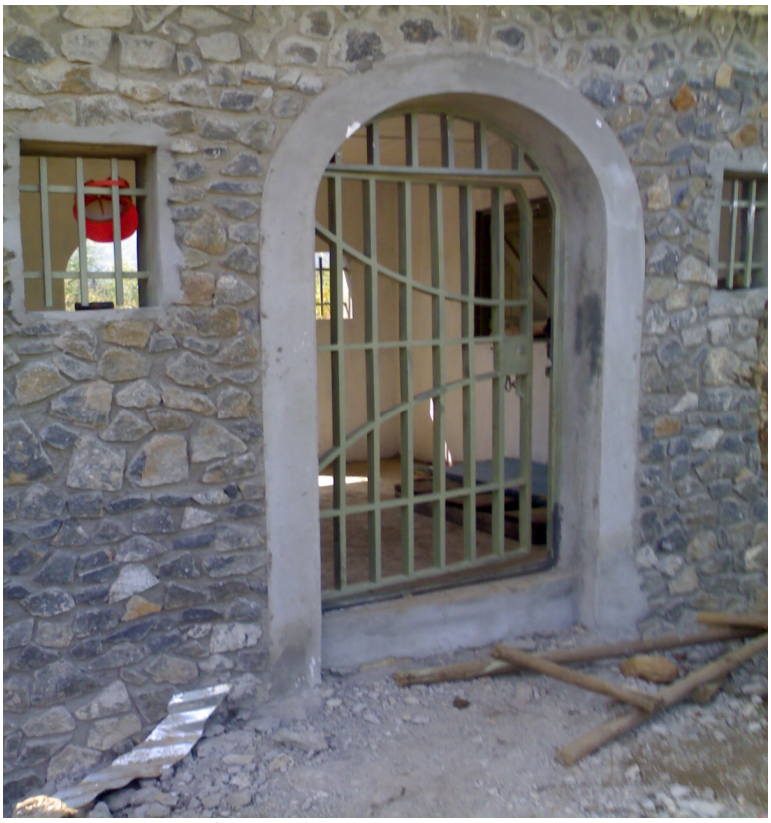

Plate 3: Gatehouse for security at the property

Plate 4: Overgrown grass inside the Vitafoam property

Plate 5: New constructions close to the proposed factory

Plate 6: Fence around the Vitafoam property

Plate 7: A view of the Vitafoam property

Plate 8: Entrance to the Vitafoam property from the Freetown – Waterloo Highway