

*ENVIRONMENTAL IMPACT ASSESSMENT OF THE
PROPOSED EARTHCARE COMPOST FACILITY AT
ODOGUNYAN FARM SETTLEMENT, IKORODU,
LAGOS STATE.*



REVISED REPORT

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Lagos.
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LIST OF ACRONYMS

LIST OF ABBREVIATIONS/ACRONYMS

AAS	-	Atomic Absorption Spectrophotometer
BAT	-	Best Available Technology
BOD	-	Biochemical Oxygen Demand
cfu	-	colony forming units
COD	-	Chemical Oxygen Demand
CV.	-	coefficient of variation
dB	-	decibel
DO	-	Dissolved Oxygen
EIA	-	Environmental Impact Assessment
EMP	-	Environmental Management Plan
ENL	-	Earthcare Nigeria Limited
FEPA	-	Federal Environmental Protection Agency
FMEEnv-	-	Federal Ministry of Environment
g	-	gram
GPS	-	Global Positioning System
Ha	-	Hectare
h	-	hour
H ₂ S	-	Hydrogen sulphide
kg	-	kilogram
km	-	kilometer
L	-	litre
LGA	-	Local Government Area
m	-	metre
max	-	maximum
mg	-	milligram
min	-	minimum
mm	-	millimeter
N	-	North

NO _x	-	Nitrogen Oxides
NTU	-	Nephelometric Turbidity Unit
°C	-	Degree Celcius
%	-	per cent
ppm	-	parts per million
Pt-Co	-	Platinum Cobalt
QA/QC	-	Quality Assurance/Quality Control
ROW	-	Right Of Way
RPI	-	Research Planning Institute
SD (s.d.)	-	Standard deviation
s.e.	-	Standard error
SS	-	Suspended Solids
TDS	-	Total Dissolved Solids
THB	-	Total Heterotrophic Bacteria
THF	-	Total Heterotrophic Fungi
TOC	-	Total Organic Carbon
TSP	-	Total Suspended Particulate
TSS	-	Total Suspended Solids
WHO	-	World Health Organization
>	-	greater than
<	-	less than
μ	-	micro

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EXECUTIVE SUMMARY

Lagos, with an estimated population of about 12 million people, is one of Africa's most populous cities and is on its way to becoming one of the world's largest with a projected population of 23.2 million people by 2015. This high rate of population growth far outstrips the physical infrastructure and consequently has adverse effects on the already poor waste management system. Domestic waste production in Lagos is estimated between 7,500 and 11,100 metric tons every day, with about 50 % of this waste derivable from food and other biodegradable components.

It is therefore not surprising that the Economic Intelligent Unit (EIU), in a survey carried out in 127 cities around the world to assess their liveability, ranked Lagos, the fifth worst city to live in.

Waste is dumped in the already poor surface drainage system resulting in the constant flooding of many sections of the city.

The adverse effects of solid waste management include health and aesthetic issues and have become a national security problem because individuals incapacitated by the adverse effects of waste are unable to produce optimally, thereby hampering national development.

- 🕒 **THE SOLUTION:** The two major solutions that can be proffered to curtail the menace of waste are landfills and bioremediation technology. The former is expensive to construct and maintain while the latter can convert part of the waste to wealth.

THE PROPONENT - EARTHCARE AND THE PROFFERED SOLUTION:

EarthCare Nigeria Limited (ENL) was incorporated in September, 1999 under the Nigeria's Companies and Allied Matters Act, 1990. ENL, in collaboration with EarthCare Technologies, Inc., Arkansas, USA, is proposing a bioremediation process to tackle the problem of waste generation and disposal in Lagos and to be extended to the nation at large in the nearest future. Its finished product – **compost** or **humus** – can benefit the environment as a natural fertilizer for gardening and farming.

The EarthCare compost is more correctly defined as a digested, earthy matter having the properties and structure of humus. Humus acts as a site of nutrient absorption and exchange

for plants in the soil. The surface of humus particles carries a negative electrical charge. Most of the plant nutrients, such as calcium, sodium, magnesium, potassium, and most trace minerals carry a positive electrical charge in the soil solution and are thereby attracted and adhere to the surface of the humus. Some of the plant nutrients are not positively charged, such as phosphorous, sulphur, and the form of nitrogen that is available to plants.

The long-term effects of EarthCare compost development would not only be cleaner surroundings, but also boost food production, create jobs, reduce the cost of health-care services, and improve living standards.

Project Location: ENL has been allocated 35.494 hectare of agricultural land (Plan No LS/D/KD264 of 19th, February, 2005) at Odogunyan farm settlement, in Ikorodu Local Government Council of Lagos State. The plot shares a boundary with the Lagos State Polytechnic to the south. The plot is traversed by an existing Power Holding Company Nigeria (PHCN) high tension line to the west of the property while another high tension line is proposed for the eastern end of the ENL property.

On registration of this project with the Federal Ministry of Environment (FMEnv) as statutorily required in the EIA process in Nigeria, the project's terms of reference (ToR) were prepared by EarthCare Nigeria Limited and submitted to the FMEnv for approval. This provided a framework for achieving the overall objectives of the EIA to wit:

- ☞ Define the relevant framework of legal and administrative requirements of the incineration project;
- ☞ Outline the general scope of the EIA including the overall baseline data requirements on affected project environment;
- ☞ Define the procedures and protocols for identification and assessment of associated and potential impacts, and also for selecting appropriate mitigation (prevention, recovery and control) measures for such impacts; and
- ☞ Define guidelines for an effective Social and Environmental Management Plan (EMP).

The objectives of ENL

ENL proposes to collect and process 1,500 metric tons of waste daily in its Ikorodu factory for the production of about 600 metric tons of organic fertilizer or 200,000 metric tons per annum. This process will represent the utilization of about 10 to 20 % of the daily generation of waste in Lagos city and will translate to the following:

- ⌚ The ENL project would reduce the quantity of generated waste in Lagos city and result in clean surroundings;
- ⌚ A cleaner environment would reduce the cost of health-care services;
- ⌚ The project would create jobs in waste collection and handling, transportation, skilled and semi-skilled factory workers at the project site;
- ⌚ The application of the end product of this process – compost- would also boost food production; and
- ⌚ The project would improve the living standards of residents in the state through direct and indirect benefits derivable from a healthier organically grown food, healthier environment and better health.

The functions of the EarthCare compost in agricultural rejuvenation and increased productivity include the following:

- ☞ **Improved structure:** EarthCare compost breaks up clay and clods and binds together sandy soils. It also helps produce aeration in clay and sandy soils;
- ☞ **pH Buffer:** A healthy percentage of EarthCare compost in the soil helps resist changes in the pH;
- ☞ **Fertilization:** EarthCare compost contains some nitrogen, phosphorous, potassium, magnesium, and sulfur, but is especially important for trace elements. The important principle is to return to the earth, by the use of plant residues and manure all that has been taken out;
- ☞ **Moisture retention:** EarthCare compost holds six (6) times its own weight in water. Soil with a healthy amount of organic matter soaks up water like a sponge and regulates the water supply to the plants. On the other hand, a soil with a poor amount of organic matter resists water penetration, thus leading to crusting, erosion and flooding;

- ☞ **Microbial munchies:** EarthCare compost creates a virtual smorgasbord for beneficial organic, that live in the soil. It harbours earthworms and certain fungi; that fight nematodes and other soil pests that deplete the soil;
- ☞ **Aeration:** Plants can obtain 96% of the nutrients they need from air, water, and sunlight. A loose, healthy soil assists in the diffusion of air into the soil and in the exchange of nutrients. Carbon dioxide released by the decomposition of organic matter is absorbed by the canopy of leaves above; and finally
- ☞ **Soil toxin neutralizer:** EarthCare compost reduces plants' uptake of lead, heavy metals and other pollutants by firmly binding to them.

The advantages of EarthCare compost include the following:

- ☞ The high cost of petrochemical based fertilizer and the Environmental blow of damaged soils and polluted water tables makes EarthCare compost a preferred choice;
- ☞ EarthCare compost plus reduces the dependence on chemical fertilizers, by at least 50 %;
- ☞ EarthCare compost plus has NO ODOR, NO ENVIRONMENTAL CONTAMINATION AND NO TOXINS;
- ☞ EarthCare compost plus repairs damaged soil from fertilizer residue and mining activities;
- ☞ Increases the yield of crops significantly;
- ☞ Reduces the land space needed for landfill applications. Reduces the volume of municipal solid waste between 80 % and 93 %. This extends the life of a landfill by 5 or 10 times.

Project Alternatives

There are several alternatives to solid waste management but none as environmentally sustainable as composting as proposed by ENL. A number of alternative sites were considered but again Odogunyan farm settlement was the best option.

PROJECT / PROCESS DESCRIPTION: The project site will consist of a large industrial style steel frame building unit, which will accommodate the processing units. The compost pad and a pond would be constructed on the remainder of the 35-hectare plot.

Sources of raw materials include

- (1) Saw Dust from Oko Baba Sawmill, Ebute-Metta;
- (2) Animal Waste from the Oko Oba Abattoir;
- (3) Fruits and Vegetables from Bolade fruit market;
- (4) Domestic Waste from the Ojota / Ikorodu Road axis and the markets at Ikorodu town; and
- (5) Domestic Waste from Oregun dump site.

The waste-delivery company is expected to deploy 40 to 50-ton trucks to collect the waste from abattoirs, markets etc. around Lagos metropolis. Turnaround time for each truck has been established as two (2) hours, from test runs already conducted by ENL for delivery at night between 10 p.m. and 6 a.m. designed not to interfere with traffic.

EarthCare Composting Facility Process Flow

Municipal garbage is delivered to the composting facility by trucks, received at the facility entrance and run across the weigh bridge to establish the weight of the waste delivered. The presorted waste will be shredded and processed as shown in the Figure below. Rows are formed on compost pads made of cement concrete and a synthetic polymer laid for strength, durability and low permeability. The site is designed to direct all rainwater to a catch pond for reuse as moisture for the composting rows.

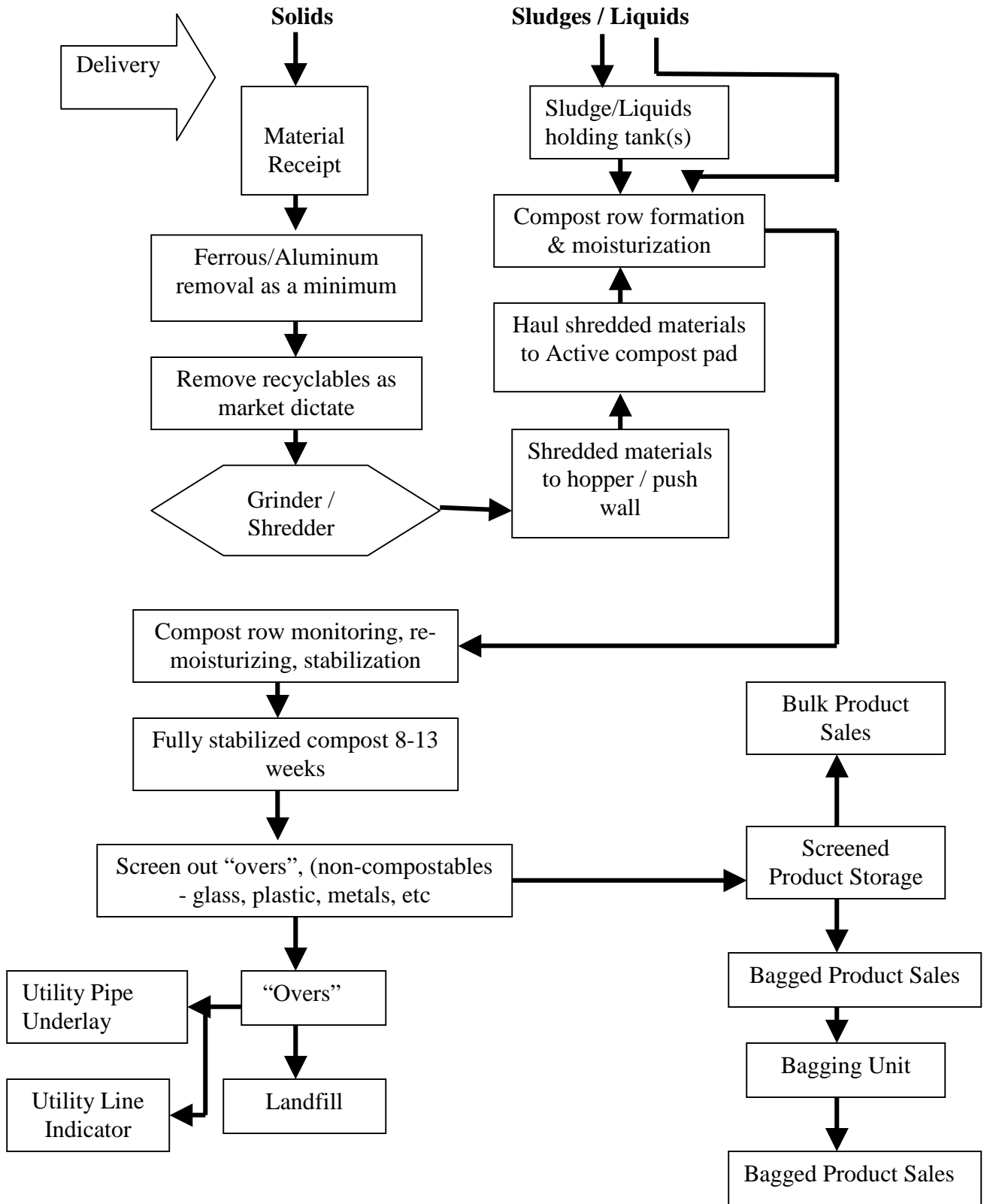


Figure 1: Municipal Garbage Process Flow Diagram

The two inoculants are added, mixed by a plough and trimmed to form a row, trimmed and monitored for temperature, moisture, carbon dioxide and oxygen. The compost row covers are used to shed rainwater while also allowing a continuous exchange of natural gases from the compost row with the surrounding air as part of the row management regime. .

The finished compost is tested for heavy metals, pathogens; and moved to the screening area. The screened compost is then bagged or sold bulk. The “overs” are then utilized for pipe bedding, drainage material in place of gravel or as land reclamation fill material.

The Inoculants: There is a dry and a liquid inoculant.

RGP: This is a special blend of minerals, natural acids and select soil nutrients and enzymes selected to speed the decay of oil and grease based wastes. The product is a tan to light brown free flowing powder with a yeast-like odour. This product may not act optimally above 55° C, when added to the shredded materials.

RCL: This is a special blend of minerals, natural acids, select soil nutrient enzymes produced from select deactivated and detoxicated organisms (fungi, moles etc.) used for the thermophilic degradation of organic waste. This product is a dark brown liquid with an acrid odour and only simple hygienic practices are recommended for its handling.

RCP: This is a special; blend of minerals, natural acids, select soil nutrients and enzymes selected to speed the decay of oil and grease based wastes. The product is a tan to light brown free flowing powder with a yeast-like odour. It contains naturally occurring, non-genetically engineered nutrients and enzymes that have been subjected to stringent antibiotic screening and only simple hygienic practices are recommended for its handling. Direct contact with the skin should be avoided if irritation is noticed. This product may be an alternative to RGP.

Various constituents within the inoculants also destroy pathogens, such as *Salmonella*, *Shigella*, *Helminth* ova and enteric viruses. All inoculants have no known environmental hazards. The products have been certified fit for importation to the country by the Federal Ministry of Environment of Nigeria by the FMEnv letter ref: FMENV/PC & EH/178/CR/Vol.T⁴ of 14th August, 2001.

Material Balance: The major materials are domestic and industrial waste (Sludges and liquid from industrial establishments).

1,500 tons of waste will start a compost cycle, during which water could be added to moisturise and cool the compost pad. Heat is evolved. After 8 – 13 weeks, the fully stabilized compost is screened leaving about 5 % of the starting material as “overs” and 600 tons of compost or 40 % of the original starting material.

A field test conducted by the National Farmers Association of Nigeria (NAFAN) yielded positive results, enough for the Association to enter into an agreement to purchase all the compost to be produced by ENL for the next four years. ENL has been duly registered by the Federal Republic of Nigeria as a manufacturer of fertilizer.

ENL’S TECHNICAL PARTNER

EarthCare Technologies Inc. (ECTI) is a limited liability company registered and operating in Lincoln, Arkansas, USA.

ECTI are the world leaders in a composting technique that applies special inoculants to household and industrial standard waste, thus converting such waste into Grade A organic compost, marketed as “**Compost Plus**”.

The technology has been proven by the development of projects in the US (such as **City of Branson Municipal Waste Project**), China, Vietnam and Malaysia. In all these places, ECTI have met and exceeded the quality and safety parameters for organic composts.

PRESENT ENVIROMENTAL CONDITIONS OF THE PROPOSED ENL SITE

Climate and Metereology: The study area falls within the semi-hot equatorial zone of the tropical climate area of Nigeria. The prevailing wind directions are the south and southwest winds and a wind speed of 8 – 9 knots around March, July and August and in October to December The average temperature is 27° C throughout the year and an average monthly rainfall of about 160 mm. Relative humidity (58 % to 74 %) is usually slightly lower in the evenings than in the morning hours and. exhibits an inverse annual pattern with temperature.

Ambient Air Quality: The concentration of SO₂, O₃ and NO₂ were well below the statutory limit and were typical of the rural setting for the villages suggesting that the air quality of the project area is good.

Noise: The noise level of the project location was typical of small town / rural farmlands and generally within the acceptable limit of both the National (FMEnv) and International (World Bank) regulatory bodies.

Geology: Precambrian Basement Complex and the Sedimentary basins with the Basement complex areas account for approximately 60 % and 40 % of the entire landmass of Nigeria respectively.

Physico-chemical and Microbial Characteristics of Ground Water: The quality of the groundwater in the study area is relatively clean with specific reference to the physicochemical and microbial characterization. The concentration of heavy metals in the groundwater indicated that toxic metals (Pb, Hg, & Cr) levels in water were very low generally; usually less than 0.2 ppm.

Surface water in the study area contained more total solid in the rainy season than WHO allowable limit for potable water but lower than the limit set by FEPA for waste water. The surface water was also found to be partially polluted by metals and especially chloride.

Soil in the Study Area: The soil in the project area was very deep and moderately well drained. They have grayish brown, loamy sand surface underlain by dark yellowish brown to very pale brown loamy sand subsoils. The soil reaction in the topsoil is neutral to slightly alkaline (pH 7.0 – 7.4), and the exchangeable cations are moderate for Ca, Mg and Na but low for K. The soil is young, sandy tropical and of low fertility.

Geotechnics: The soil at the site can be grouped into two main groups using Casagrande's classification:

- (i) Fine –grained silts (inorganic), very fine sandy soil having more rock flour and silty fine soil; and
- (ii) Fine grained silty clays (inorganic) and sandy soil having clays.

Based on the engineering properties (Shear strength, Compression and Consolidation) the soil has high internal friction, low cohesion and detrimental capillarity or elasticity. It lacks stability under wheel loads, but furnished excellent support when loads are distributed.

Vegetation: The existing vegetation around the project area is derived savannah, covered mainly by *Andropogon* grass with some bush regrowth, bush fallow and farmlands. *Alchornea*, palm tree, bamboo and plantain can be found in the wet / swampy area to the north of the ENL site

Land Use Pattern in the Area: Land in Ikorodu LGC was used mostly for residential, industrial, commercial and agricultural purposes. Odogunyan, a rural community in the local government council hosts the PZ and the Lucky Star fibre factories in one of the largest industrial estates, a proposed 34-hectare fish farm and now the Compost project. The Odogunyan area is a designated farm settlement with houses for the farmers; vegetable farms and a piggery among other farming activities.

Wildlife Resources: The wildlife of the study area has been severely depleted through a combination of deforestation and intense hunting. About 17 types of mammals are reportedly present in the area. There was an abundance of species commonly associated with gardens, farmlands, fallows and secondary growth while the reptilian fauna is made of tortoises, snakes and lizards.

Socioeconomic Characteristics: Ikorodu LGC has a projected population of 305,381 by 2004 out of which about 10,000 live in Odogunyan – one of many villages. The people of Ikorodu migrated from Ijebu Remo.

Odogunyan has a Baale as the head of the community under the prescriptive authority of the Ayangburen of Ikorodu.

About 50 % of the male respondents were polygamous. 48 % of the respondents were Christians Educationally, 76 % of the respondents had primary school education and 12 % each secondary and tertiary education. Respondents' occupation included farming 12 %, trading 24 % and self employment. Declared income per annum was ₦30,000.00 -

₦90,000.00 though 57 % of the respondents owned their own houses and 72 % had their own vehicle. There were four (4) primary schools in Odogunyan, one secondary school and a Lagos State Polytechnic. The residents of Odogunyan depended on bore hole water (64 %), hand dug well (24 %) and river or stream water (12 %). The community has one primary health centre and a maternity centre. The major environmental problems were flooding and erosion.

The respondents living within one kilometer of the project site were 48 % while the rest lived within a two kilometer radius and were all aware of the proposed ENL composting project. Most believed the project would impact positively on the community in the area of employment generation during construction and operation phases though the negative impact could be pollution of the environment. The respondents from the Lagos State Polytechnic, with whom the ENL shared a common boundary expressed the fear of foul odour and hoped it would be mitigated. The Chairman, Ikorodu local government area saw the project as laudable and hoped it would come on stream before May, 2007.

Associated and Potential Environmental Impacts: ENL will implement measures and practices detailed in this EIA report to avoid, minimize and mitigate potential adverse environmental impacts during the construction, operation and decommissioning phases of the project. The following summarizes the expected project impacts and the mitigation measures.

Construction Phase Impacts

Air Quality: The potential main sources of emission at this stage are:

Fugitive dust produced by the movement of soils during site clearing, grading and filling;

Emission from internal combustion engines of vehicles and construction equipment

These emissions are short-termed and localized to the immediate site area. Regular maintenance of vehicle and construction equipment so as to keep the engines in good operating conditions will greatly reduce emission from internal combustion engines.

The factory site lies in the within Odogunyan farm settlement with one good but longer access road and a shorter but rougher farm road. Emission of fugitive dusts will be greatly reduced by periodic spraying of construction ground with water on as-needed basis.

Geology and Soil: Impacts to geology are not expected as site clearing and preparation had been effected during the construction activities. The potential for soil erosion and degradation during the construction of the onshore facilities will be greatly reduced by the forest buffer to be created around the project site and the channeling of rainwater into a pond for reuse. Therefore no adverse impacts on soil resources are envisaged.

Control of fugitive dust through periodic watering of the construction area, and adherence to the erosion and sedimentation control practices by the construction personnel will be ensured. The construction personnel will be properly trained on the correct handling and disposal of solid and liquid wastes to avoid accidental spills, and on the use of appropriate clean-up procedure in case spills do occur.

Surface and Ground Water Quality: The project has little or no potential to impact surface water quality at the construction phase as berms would be put in place to curtail the washing away of excavated soil.

The project is not expected to impact on the groundwater in any adverse way. Groundwater flow is not expected to be disturbed during construction or operation phases. The storage area for lubricating and waste oils, diesel fuel and other chemicals and solvents will be designed and built to prevent any accidental spills from infiltrating to the groundwater.

Noise: Noise arising from construction activities is expected to be minimal and restricted to the project site, and of short duration. Adequate personnel protective equipment (PPE) will be provided to workers and site personnel.

Vegetation: Construction activities are expected to impact significantly on vegetation and wildlife of the area. Not less than 25 of the 35 hectares of the project site would be cleared of vegetation resulting in loss of cover and habitat for wildlife. Noise from the construction will scare off the wildlife, whose habitats have not been destroyed. This is the only significant impact of the project and can be mitigated by the establishment of buffer forest around the

project site and leaving the land between compost pads in its natural state as much as possible.

Socio-economics: Construction activities are not expected to impact negatively on the communities, it is expected that local hands will be employed during the construction to be carried out on site. Positive impact will be on job creation, increased productivity and higher income from the farms hence better living standard. More money will circulate through the compost facility employees, who would live within the community.

Operation Phase Impacts

Air Quality: The only significant sources of air pollution, during plant operation, are the delivery trucks, diesel driven grinder, screener, loaders and ploughing tractors. Carbon dioxide and some methane may also be emitted. The vegetation buffer zone will act as a sink for the emitted CO₂ while the level of other air pollutants is expected to be insignificant.

Odour is a major concern in composting but the inoculants eliminate or reduce the odour to the barest minimum within one hour of application. The vegetation buffer around the project site is another mitigation factor that will reduce the spread of odour.

Noise: Noise generation will be limited to the pieces of equipment to be used in the factory and to move materials around. The level of noise will be insignificant but personnel at the noisy end of the operation will be mandated to wear earmuffs.

Geology and Soils: Significant adverse impact on the geology of the project site is not anticipated during the operation of the factory, however, the soil may be impacted though not significantly. The impact on soil will be mitigated by using best available technology to convey waste and move loads around.

Surface and Ground Water Quality: The operation of the compost facility is not expected to significantly affect surface and ground water quality as the dam will impound all stormwater for reuse. The floor of the factory and the compost pads will be concretized and the latter lined with synthetic polymers to reduce permeability.

- All employees will be trained properly on good operational practices, plant safety procedures and good house keeping.

Vegetation and Wildlife: The major impact would be during the construction phase of the project and it is expected that composting may indeed encourage some form of wildlife activities.

Cultural Resources: Cultural resources in the area will not be impacted by the construction and operation of the plant, as none is said to be located close to the facility.

Aesthetic Resources: The aesthetics of the agricultural area is not expected to be adversely impacted by the compost factory.

Socio-economics: The State government has legally acquired the land and compensation duly paid hence the displacement of farmers through land acquisition by the project will not be a major concern. ENL policy of good neighbourliness, corporate social responsibility and impact of organic fertilizer on the output of farms in the immediate vicinity of the compost factory will mitigate any adverse effect. Loss of jobs due to land acquisition can be mitigated by the employment of qualified indigenes and training others. ENL also proposes to institute educational endowment schemes and scholarship programmes for the Polytechnic students.

Stakeholders' Consultation Forums: ENL carried out an adequate Stakeholders' Consultaion Process. This involved consultations with the immediate neighbours around the Project sites and the general public. Some participants at the public consultations forum were members of the Odogunyan Community, local farmers, members of Lagos State Polytechnic (LASPOTECH), Representatives of Women Groups, Government Officials, members of staff of ENL etc. (see page 147 & 148 for attendance list of participants). All questions, concerns queries raised at the stakeholders' forum were answered satisfactorily.

Environmental Management and Monitoring Plans

ENL in carrying out its business activities, which is primarily the composting of biodegradable waste, has a standing policy of doing this in a lawful manner with a strong emphasis on maintaining a safe and healthy condition for its employees, clients and the general public. It is also part of the policy to minimise to the barest minimum, the effects of its activities on the natural environment within its areas of operation.

These two complimentary objectives form the basis of strategies and procedures employed in the environmental management programme that is to be implemented in the factory. The specific objectives of the programme include amongst others, the following:

- Protection of the health and safety of employees, clients, and the general public.
- Verification of compliance with applicable environmental and health and safety laws, regulations, and guidelines.
- Monitoring the effectiveness of implemented environmental pollution control and mitigation measures.
- Effectively train employees in the various components of the environmental management program.

The compost factory will within its activities, maintain, manage and monitor the environmental indicators of pollution to resist altering the natural ecosystem of the area. ENL has an Environmental Management Plan with budgeted cost of N 34,716,200 attached to its implementation. (See Table 7.1 in page 125 of the EIA report). ENL also has in place an Institutional arrangement for effective implementation of the Environmental Management Plan. The arrangement starts with the in house HSE Manager who reports to Chief Executive Officer through the General Manager. All environmental activities of the Plant is monitored and regulated by Lagos State Environmental Protection Agency (LASEPA) and the Federal Ministry of Environment. The World Bank has oversight responsibility on the Project's environmental activities.

Conclusion: The proposed ENL Nigeria plant is designed to be a state-of-the art composting facility, environmentally friendly and sustainable. It will be economical, create jobs, boost agricultural productivity and make Lagos a cleaner and safer city.

