1 Introduction

Cashew-nut processing involves the hazards of both air pollution and indoor pollution while the former burns away the planet, the latter affects the health of the factory workers engaged in different processes, hence, to assess the air quality impacts of the construction, operational and decommissioning/closure phases of the Proposed Cashew-nut Processing Project by Diaoune Agro-Industrie Sarl ("DAI or the Company"), it was considered necessary to determine existing ambient air quality in the vicinity of the proposed development (baseline air quality).

In accordance with the Presidential Decree No.199/PRG/SGG/89 of 18th November, 1989, made under Articles 82 and 83 of the Environmental Code which sets out the projects requiring an Environmental Impact Assessment (EIA) study, Diaoune Agro-Industrie Sarl has appointed Richflood International Limited to undertake an Environmental and Social Impact Assessment (ESIA) for the new Cashew nut Processing Plant. Therefore, as part of the ESIA, an air quality study has been undertaken for the pollutants of primary concern (SO_2, NO_2, $PM_{2.5}$, and PM_{10}) to better characterise the air quality in the project area. This report, therefore, provides the results of the air quality measurements undertaken and evaluated the impacts of these pollutants.

1.2 Purpose of the Report

The ESIA is to comply with the International Finance Corporations' (IFC's) Performance Standards (PS), Good International Industry Practices (GIIP) and other relevant standards, including the World Bank Group Environmental, Health and Safety General and sector-specific Environmental, Health and Safety (EHS) Guidelines. As part of the ESIA, a specialist Air Quality Impact Assessment (AQIA) is required because ambient air monitoring is an integral part of an effective air quality management system. In addition, an air quality study is conducted to:

i. assess the extent of pollution;
ii. provide air pollution data to the general public promptly;
iii. support implementation of air quality goals or standards;
iv. evaluate the effectiveness of the proposed emissions control strategies;
v. provide information on air quality trends;

2 Background of the Project

2.1 Project Location

The proposed Cashew nut processing project facility will be located in Boke prefecture, which is one of the prefectures in the Boke region of Guinea. The project will be situated in Kataba village on a land area of 30,0000sq m along the major Boke-Kalaboui Road. The site is situated approximately 14.3km due west along the main road, outskirts of the main Boke town. Accessibility by road through the project site to Boke town from Conakry is through the Boke-Kalaboui Road which serves as the only access to the part of Guinea. A map showing the project site with the entire Boke region is shown in Figure 2.1. Furthermore, the project site boundary coordinates are as indicated below:

- SW corner: 10^{O} 50′11.1″N, 14^{O} 21′23.2″W
- SE corner: 10^{O} 50′11.8″N, 14^{O} 21′25.2″W
- NE corner: 10^{O} 50′4.3″N, 14^{O} 21′28.2″W
- NW corner: 10^{O} 50′3.9″N, 14^{O} 21′24.4″W
- NW corner: 10^{O} 50′3.9″N, 14^{O} 21′24.4″W

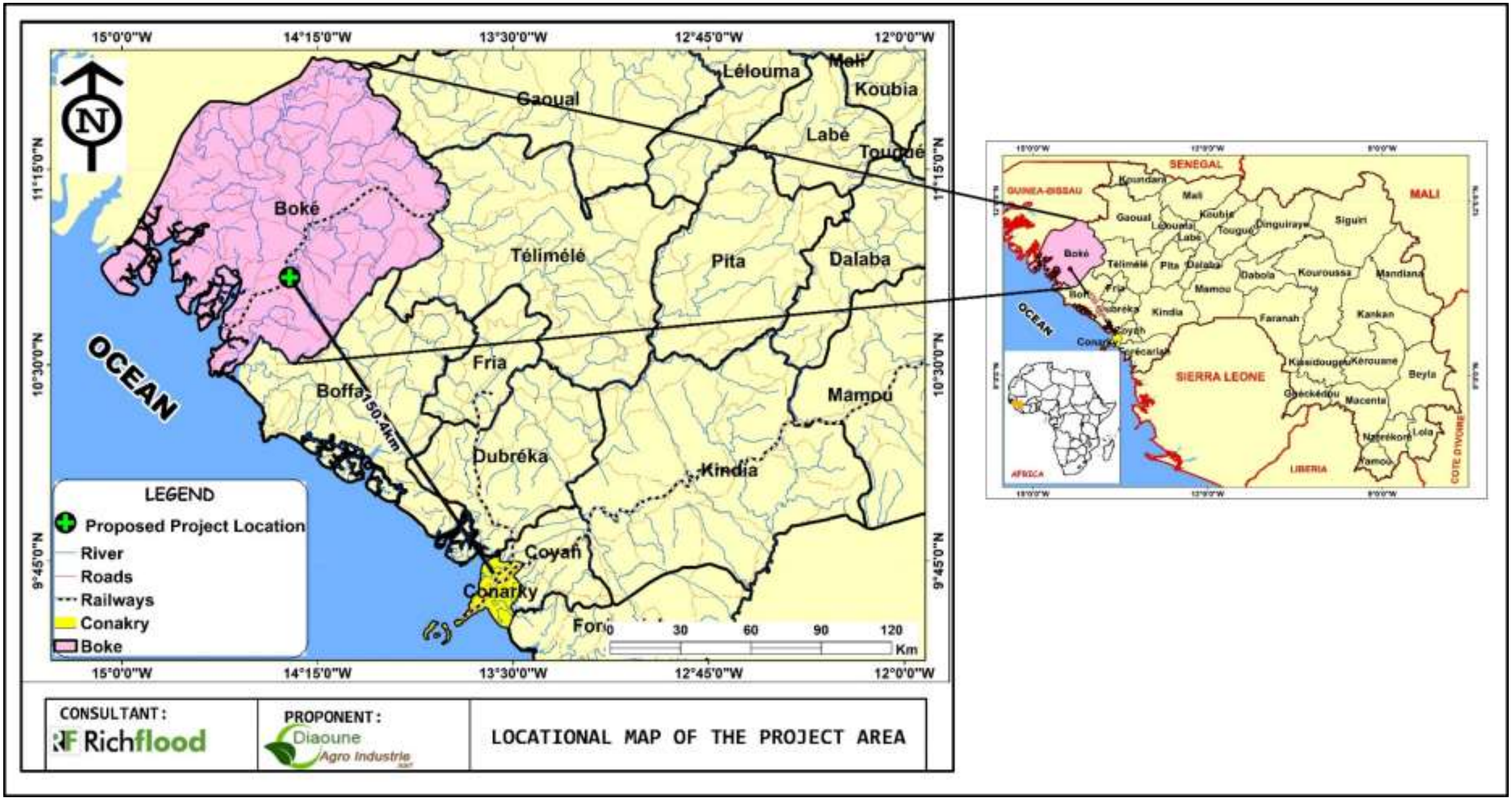

Figure 2.1: Location of the Proposed Project

Source: Richflood, 2022

2.2 Project Phases

2.2.1 Pre-construction Phase

This stage involves carrying out various studies to ascertain the economic, financial and environmental viability of the proposed Cashew processing project. Also, included in this stage are designing, feasibility studies, socio-economic surveys and community engagement etc. for the proposed project. More so, the construction of residential camps and offices for the contraction workers and provision of associated facilities.

2.2.2 Construction Phase

The Project site is located on a fallow vegetation area and part of which had a gallery forest around the nearby stream on the west section of the site. The construction of the Project is not expected to lead to land taken beyond the proposed land plot allocated to the Project. At the time of the site visits undertaken in developing this ESIA (October 2022), the Project site has been cleared for setting up the various units of the plant with fencing structures. The description of the key sections of the cashew processing plant which is largely based on the knowledge of similar plants in Kankan includes the following:

- Administrative and service block
- Processing factory
- Processing and storage Warehouse
- Sorting and Calibration warehouse
- Security Gate and Weighing bridge area
- Car/ trailer park

The construction phase will involve works such as project site fencing, surface run-off channelization, drilling borehole water source, excavation and foundation work as well as factory and warehouse structure erection and installation. Construction-related nuisances such as noise and dust will be very limited given the temporary nature of the works.

The construction works for the cashew nut plant and the various activities will include:

- Vegetation clearance, surface stripping and topsoil stockpiling;
- Excavation works for structural foundation;

- Channelling and installation of site drainage;
- Establishment of hard standing for laydown areas, roads, paths; and
- Laying of concrete;
- Vegetation landscaping

2.2.3 Project Construction Contractor

Most of the raw materials (steel, cement) and other materials will be brought to the site by trucks. DAI has retained *Societe de Gestion Immobilière et de Construction* (SOGICO) for the construction of the proposed plant in Boke. SOGICO is a Guinea-based company with 15 years of experience in construction and civil works involving similar projects. Earlier, SOGICO was responsible for the construction of the DAI currently operating cashew plant in Kankan.

2.2.4 Operational Phase

Activities during the operational phase, the project will mainly focus on the following points:

- Sourcing and supply of raw cashew nuts to the factory;
- Processing of raw cashew nut into kernels;
- Distribution and export of finished raw cashew kernel

3 Air Quality Legislation and Standards

3.1 World Health Organisation

The World Health Organisation (WHO) provides guidelines to protect public health from the adverse effects of air pollutants and to eliminate or reduce exposure to those pollutants that are known or likely to be hazardous to human health or well-being. The guidelines are based on expert evaluation of current scientific evidence and are intended to inform policymakers and to provide targets for air quality management in different parts of the world. In establishing pollutant levels below which exposure – for life or a given period – does not constitute a significant public health risk, the guidelines provide a basis for setting standards or limit values for air pollutants.

In general, the guidelines address single pollutants, whereas, in reality, exposure to mixtures of chemicals occurs, with additive, synergistic or antagonistic effects. In dealing with practical situations or standard-setting procedures, therefore, consideration should be given to the interrelationships between the various air pollutants. It should be emphasized, however, that the guidelines are health-based or based on environmental effects, and are not standards per se. In setting legally binding standards, considerations such as prevailing exposure levels, technical feasibility, source control measures, abatement strategies, and social, economic, and cultural conditions should be considered.

3.2 International Standards

There are several International Environmental and Occupational Health and Safety Laws, Regulations and Protocols that apply to the project. These were taken into consideration during the AQIA and include:

- International Finance Corporations (IFC)’s Performance Standards on Environmental and Social Sustainability, 2012.
- The IFC General Environmental, Health, and Safety Guidelines (EHS) (April 30, 2007).
- IFC’s EHS Guidelines: Environmental Air Emissions and Ambient Air Quality, 2007.

- OHSAS 18001 for Occupational Health and Safety and the "Pollution Prevention and Abatement Handbook" by the World Bank Group, 1998.
- United Nations Framework Convention on Climate Change

3.3 Guinean Legislation

Presidential Decree No.199/PRG/SGG/89 of 18 novembre 1989, made under Article 82 and 83 of the Environmental Code (Code de l'Environnement) (Décret présidentiel 199/PRG/SGG/89 du 18 novembre 1989 portant Codification des études d'impact sur l'environnement, pris conformément à l'article 82 et 83 du Code de l'environnement), sets out the projects requiring an environmental impact assessment (EIA) study. This decree lists the types of projects that require an EIA and the content of the EIA study. In terms of Air Quality, they include the following listed below:

- Guinean Standard NG 09-01-011:2012 / CNQ: 2004 On Atmospheric Pollution – Discharge (Norme Guinéenne NG 09-01-011:2012 / CNQ: 2004 Sur la Pollution Atmosphérique– Rejet)
- Climate and Clean Air Coalition (CCAC), 2014

3.4 Ambient Air Quality Standards

In Guinean, ambient air quality standards are defined in the Guinean Standard NG 09-01-011:2012 / CNQ: 2004 On Atmospheric Pollution – Discharge. The IFC (International Finance Corporation) General EHS Guidelines (2007) set guidelines for ambient air quality. Table 3.3 presents international air quality standards, for the following pollutants: NO_2, PM_{10}, $PM_{2.5}$ and SO_2. The international standards set by the IFC Environmental, Health, and Safety Guidelines for Air Emissions and Ambient Air Quality published in 2007 refers to the WHO Air Quality Guidelines.

The Guidelines are intended to confer a maximum degree of protection for human health. However, these also include a degree of pragmatism in recognising that achievement of the guidelines may not be achievable in all circumstances; in these cases, for some pollutants, interim targets are identified. These are designed to confer a degree of protection of human health, with the aim that regulators should work towards the achievement of the Guideline. Given the context of the site, it was recommended that where the Guinea limit is not available, the WHO interim target 1 be used. Table 4.2 below summarizes the Guinean standards and the IFC standards.

Table 3.1: Guinean and IFC/WHO air quality standards

Parameter	Time Weighted Average	Guinean Air Quality Standards	IFC/WHO Guidelines Value
SO_2	Annual Average	50µg/m^3	-
	Daily average	125µg/m^3	**125 (Interim target 1)**
			50 (Interim target 2)
			20 (Guideline)
NO_2	Annual Average	40µg/m^3	40µg/m^3
	1 hour	200µg/m^3	**200µg/m^3**
PM_{10}	Annual Average	80µg/m^3	70 (Interim target 1)
			50 (Interim target 2)
			30 (Interim target 3)
			20 (Guideline)
	Daily average	260µg/m^3	**150 (Interim target 1)**
			100 (Interim target 2)
			75 (Interim target 3)
			50 (Guideline)
$PM_{2.5}$	Annual Average	65µg/m^3	35 (Interim target 1)
			25 (Interim target 2)
			15 (Interim target 3)
			10 (Guideline)
	Daily average	-	**75 (Interim target 1)**
			50 (Interim target 2)
			37.5 (Interim target 3)
			25 (Guideline)

4 Baseline Assessment

The climate and meteorology of the area are described in this section and include a discussion of the local meteorological conditions of the site.

4.1 Meteorological Conditions

In addition to meteorological data obtained from literature, meteorological parameters such as; wind speed, relative humidity, dew point, wet bulb, atmospheric pressure and temperature were measured with the aid of the handheld Sper Scientific Mini Environmental Quality Meter 850027 during the fieldwork. Measurements were taken at heights of 2 meters above ground level across the monitoring location. The results obtained are presented in Table 4.1. below

Table 4.1: On-site Meteorological Readings

CODE	Sample Location	Temp (°C)	Dew Point (°C)	Wet Bulb (°C)	Relative Humidity (%)	Atmospheric Pressure (HPA)	Wind Speed (m/s)
		Avg	Avg	Avg	Avg	Avg	Avg
MET_1	Project Location	29.0	47.6	48.5	80.2	1009.6	0.00
MET_2	Project Location	28.0	47.4	48.2	60.0	1009,6	0.30
MET_3	Entrance	30.0	48.4	49.7	54.1	1009.7	0.10
MET_4	Kataba Village	31.0	46.7	47.6	72.5	1008.2	0.40
MET_5	Fodecontea Village	29.0	48.2	49.4	72.4	1007.5	0.20
MET_6	Tambouni Village	30.6	48.1	49.4	54.8	1005.2	0.00
MET_7	Tambobo Village	31.2	47.4	48.5	56.6	1005.1	0.03
MET_8	Kataba Fula	28.4	49.1	50.0	65.2	1003.5	0.00
MET_9	Tamaransi Village	29.0	47.6	48.1	82.1	1009.7	0.10

Source: Richflood fieldwork, 2022

4.1.1 Regional Climate

Generally, the climate in Guinea is influenced by the Inter-Tropical Convergence Zone (ITCZ) north and south of the equator and is characterised by wet and dry conditions controlled by the north-south movements of the Inter-Tropical Convergence Zone around the equatorial line. Climatic conditions specific to the Boke region are largely dominated by two dominant air masses, namely the Tropical-Continental air mass (cT) which brings the dry and dusty northeasterly wind from the Sahara Region and the Tropical-Maritime (mT) air mass which originates from the Atlantic Ocean and brings warm and wet southwesterly winds. Both air masses are controlled by the movements of the Inter-Tropical Convergence Zone. This interplay of two major air masses results in a distinct wet and dry season in the area.

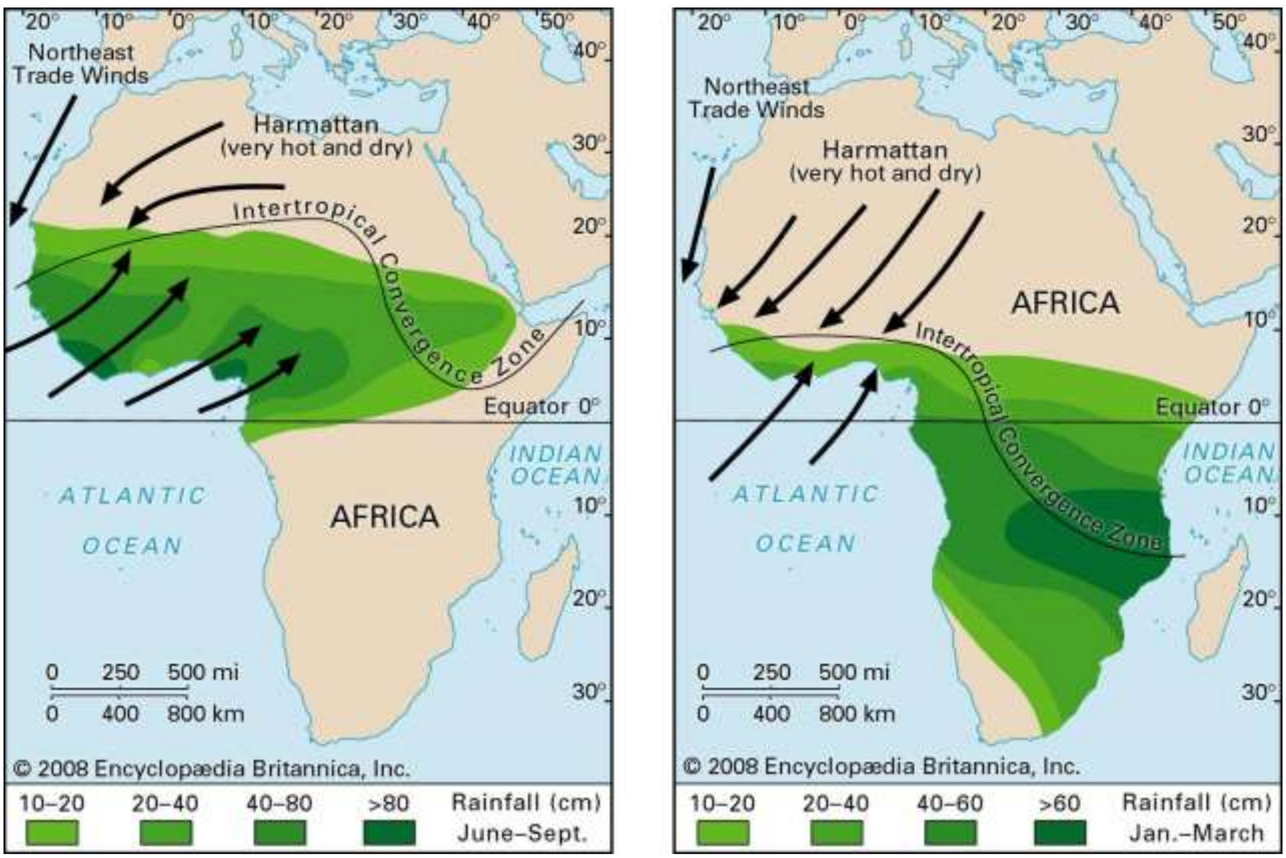

Figure 4.1: Schematic streamlines of near-surface flow in the Global Tropics

Source: *Encyclopaedia Britannica (2022)*

4.1.2 Local Climate

Rainfall and Temperature

Boke has a typically subequatorial tropical humid climate, which is characterized by a wet and dry season. With the arrival of the migratory Inter-Tropical Convergence Zone (ITCZ), the wet season starts from mid-May to mid-November, peaking in August, while the dry season starts from mid-November to mid-May, with its driest period in January. The dry season is typified by hot dry wind known as the harmattan, which blows from east and northeast, warm air and dust from the Sahara Desert.

The area experiences significant rainfall, with annual rainfall ranging from 2100 and 5000mm (mid-May to mid-November), and a monthly maximum of over 1000mm in August. The sub-Guinean tropical climate in Lower Guinea extends over the Boké region. During the coldest month of the year which is August, temperature ranges from 23 to 28°C. The average annual temperature for Boké during the dry season ranges between 24 and 38ºC. The hottest month of the year is January with daytime temperatures exceeding 37ºC.

Boké experiences extreme seasonal variation in the humidity. Considering that the climate within the project area is essentially tropical, relative humidity tends to be high for much of the year. Based on historical climate data from 1961 to 1990, the average monthly Relative humidity for Boké as obtained from the World Meteorological Organisation indicates an average of 68% indicating relatively high conditions for most of the year.

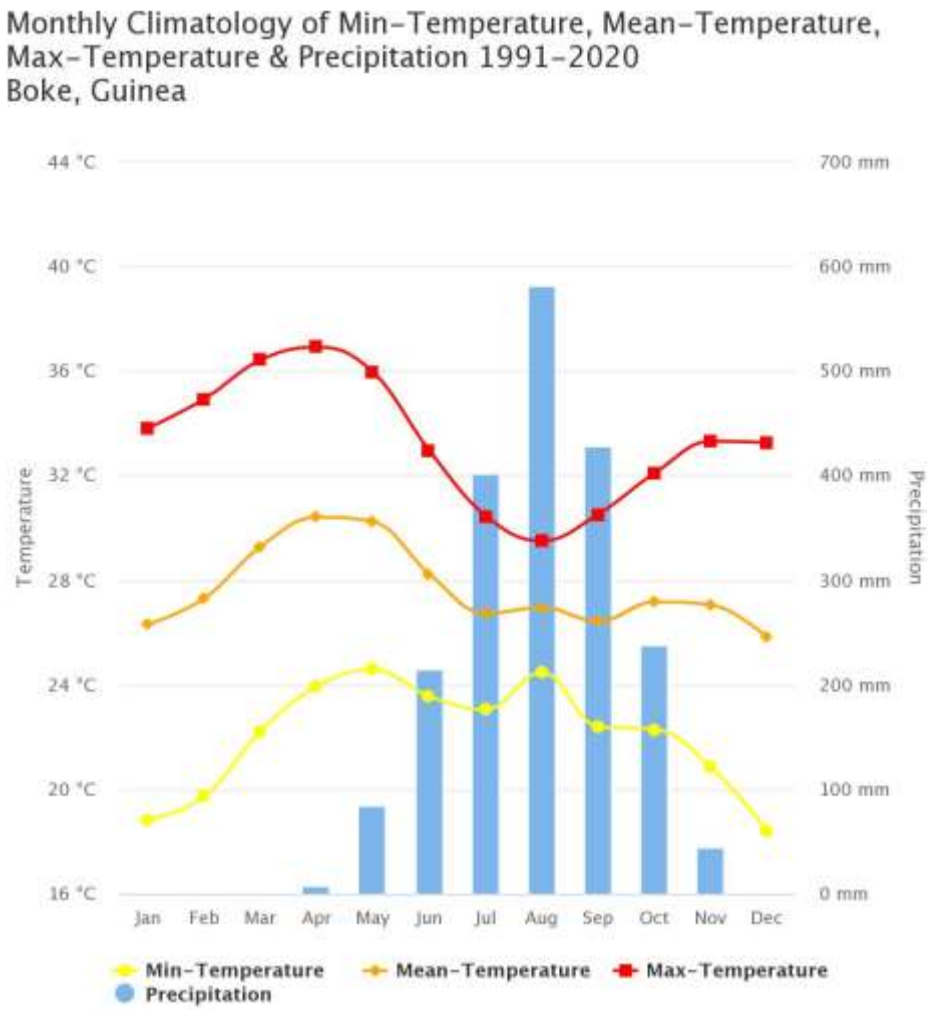

Figure 4.2: Mean Temperature and Mean Precipitation for Boke

Source: https://climateknowledgeportal.worldbank.org/country/guinea/climate-data-historical

4.2 Ambient Air Quality Assessment

Air quality varies with the season due to variations in temperature, humidity, and rainfall. During the dry season, dust that is suspended in the near-ground air layers may cause frequent, but not significant, hazes which reduce visibility. However, during the wet season, rainfall removes dust from the atmosphere and improves air quality. The dry season is characteristic of very dry and dusty conditions in the proposed project area. The pollutants assessed are discussed below:

- ***Particulate Matters (PMs)***

Particulate matters (PMs) are airborne particles that include dust, smoke, and soot. PMs can either be emitted naturally (e.g. windblown dust of loose soils) or through human activity (e.g. as a result of vehicular emissions). It is defined by size, with coarse particles being between 2.5-10 microns (PM_{10}), fine particles less than 2.5 microns ($PM_{2.5}$), and ultrafine particles less than 0.1 microns in aerodynamic diameter. Globally, PM_{10} and $PM_{2.5}$ have been identified as priority pollutants and they need to be monitored and managed where the source activity has the potential or is generating PM emissions.

- ***Sulphur Dioxide (SO_2)***

Sulphur Dioxide (SO_2) is a colourless gas and is characterised by a strong odour. It is a primary pollutant, which can react easily with other substances and form secondary pollutants such as sulphur trioxide and sulphuric acid, amongst others. SO_2 is formed by human activities through mainly industrial processes that contain sulphur.

- **Nitrogen Dioxide (NO_2)**

Nitrogen Dioxide (NO_2) is a naturally forming gas, characterised as having a strong odour. Small quantities can be produced by plants, soil, and water, but anthropogenic activities such as the combustion of fossil fuels and biomass are also seen as sources of NO_2 in the atmosphere.

- ***Carbon Dioxide (CO_2)***

Carbon Dioxide (CO_2) is the main product of fuel combustion in vehicle engines, along with water. CO_2 is the most significant greenhouse gas (GHG) influencing climate change, posing a threat to public health and the environment. Carbon Monoxide (CO) is released into the atmosphere as a result of incomplete combustion, which occurs when the carbon in the fuel is only partially oxidised, forming CO and not CO_2. It is a colourless and odourless but highly toxic gas. Direct exposure to CO reduces the flow of oxygen in the bloodstream and is particularly dangerous to people with heart disease. Like Hydrocarbons (HCs), CO also contributes to the formation of ground-level ozone and smog.

- ***Hydrogen Sulphide (H_2S)***

Hydrogen Sulphide (H_2S) is a colourless, poisonous, corrosive and flammable gas, with trace amounts in an ambient atmosphere having a characteristic foul odour of rotten eggs. It is most commonly formed due to the microbial breakdown of organic matter in the absence of oxygen.

- ***Ozone (O_3)***

Ozone (O_3) is a molecule made up of three oxygen atoms, often referenced as O_3. Ozone is formed when heat and sunlight causes chemical reactions between oxides of nitrogen (NO_X) and Volatile Organic Compounds (VOCs), which are also known as Hydrocarbons. This reaction can occur both near the ground and high in the atmosphere.

- ***Volatile organic compounds (VOCs)***

Volatile organic compounds (VOCs) are emitted as gases from certain solids or liquids. VOCs include a variety of chemicals, some of which may have short- and long-term adverse health effects. Concentrations of many VOCs are consistently higher indoors (up to ten times higher) than outdoors. VOCs are emitted by a wide array of products. VOCs are often components of petroleum fuels, hydraulic fluids, paint thinners, and dry cleaning agents. VOCs are common ground-water contaminants.

4.2.1 Baseline Monitoring

Baseline monitoring was conducted between the 2nd and 7th of October, 2022. Given the limited time available to complete the study and the absence of long-term monitoring data, the baseline survey reflects only a snapshot of the existing air quality conditions. The result provides some insights into the current air quality on-site. To assess the current baseline ambient air quality situation, Aeroqual 500 series was used. This equipment was calibrated and each sensor measuring each specific air pollutant was connected to the equipment and held at arm’s length, 2 meters above ground level towards the direction of the prevailing wind at every monitoring location as detailed in Table 4.3 and illustrated in Figure 4.2 below. The concentration of each gaseous pollutant was read off directly from the equipment screen after 10 minutes. The findings of the short-term monitoring are reflected in the sections below.

Table 4.2: Air Quality Monitoring Locations

Code	Location Description	Coordinates		
		Latitude (N)	**Longitude (E)**	**Elev. (m)**
AQ_1	Project Location	10° 50' 7.8″	14º 21′ 23.8″	11
AQ_2	Project Location	10° 50' 2.0″	14º 21′ 25.2″	27
AQ_3	Project location Entrance	10° 50' 3.9″	14º 21′ 24.5″	13

Code	Location Description	Coordinates		
		Latitude (N)	Longitude (E)	Elev. (m)
AQ_4	Kataba Village	10° 50' 10″	14º 21′ 6.4″	66
AQ_5	Fodecontea Village	10° 49' 59.7″	14º 21′ 55.2″	21
AQ_6	Tambouni Village	10° 48' 59.6″	14º 22′ 44.1″	41
AQ_7	Tambobo Village	10° 50' 12.0″	14º 23′ 13.9″	22
AQ_8	Kataba Fula	10° 48' 47.8″	14º 20′ 2.3″	33
AQ_9	Tamaransi Village	10° 52' 29.0″	14º 18′ 38.6″	18

Source: *Richflood field survey, 2022*

Figure 4.3: Air Quality and Noise Monitoring Map

Source: Richflood, 2022

Table 4.3: Results of the Air Quality Monitoring

Sample Code	Sample Location	O_3 (µg/m^3)	CO (µg/m^3)	SO_2 (µg/m^3)	NO_2 (µg/m^3)	H_2S (µg/m^3)	CO_2 (µg/m^3)	SPM (µg/m^3)	
								$PM_{2.5}$	PM_{10}
AQ_1	Project Location	14.00	BDL	BDL	100.00	BDL	585000	BDL	BDL
AQ_2	Project Location	12.00	BDL	BDL	5.00	BDL	511000	BDL	BDL
AQ_3	Entrance	9.00	1360.00	BDL	BDL	110.00	517000	BDL	BDL
AQ_4	Kataba Village	11.00	BDL	BDL	38.00	10.00	477000	BDL	BDL
AQ_5	Fadecontea Village	BDL	BDL	BDL	2.40	BDL	485000	BDL	BDL
AQ_6	Tambouni Village	11.00	BDL	BDL	11.00	BDL	506000	BDL	BDL
AQ_7	Tambobo Village	6.00	420.00	BDL	BDL	10.00	466000	BDL	BDL
AQ_8	Kataba Fula	3.00	10.00	BDL	6.00	BDL	512000	BDL	BDL
AQ_9	Tamaransi Village	5.00	BDL	BDL	82.00	BDL	496000	0.003	0.006
Guinean AQS *(24 hourly)*		**-**	**-**	**125**	**200**	**-**	**-**	**-**	**260**
IFC/WHO AQS *(24 hourly: IT-1)*		**100**	**-**	**125**	**200**	**-**	**-**	**75**	**150**

[Note: *BDL* - Below Detection Limit of the Equipment (BDL = <0.01µg/m^3)]

Source: Richflood, 2022

Discussion

SPM: The $PM_{2.5}$ concentration in ambient air was recorded in the range of <0.01 – 0.003µg/m^3, which is below the 24-hour IFC/WHO AQS (75µg/m^3). The concentration of PM_{10} at the monitoring locations was reported in the range of <0.01 – 0.006µg/m^3. There were no exceedances of the PM_{10} 24-hour Guinea Standard (260µg/m^3) and the PM_{10} 24-hour IFC/WHO AQS (150 µg/m^3) throughout the monitoring stations; during the monitoring period, the maximum SPM concentration was reported at AQ_9 for both $PM_{2.5}$ and PM_{10} as 0.003µg/m^3 and 0.006µg/m^3 respectively.

SO_2: The SO_2 concentration was recorded as <0.01µg/m^3 across all monitoring stations. SO_2 concentrations measured were substantially below the 24-hourly Ambient Air Quality Standard for both the Guinean AQS and IFC/WHO AQS (125 µg/m^3). These results show that the generation of SO_2 concentrations as a result of DAI's proposed operations have a low potential to result in a nuisance and impact the health of nearby communities.

NO_2: The NOx concentration was recorded in the range of <0.01 – 100.00µg/m^3. NOx concentrations at all the monitoring locations were reported to be below 200 µg/m^3, which is the 24-hourly Ambient Air Quality Standard for both the Guinean AQS and IFC/WHO AQS. These results show that the generation of NO_2 concentrations as a result of DAI's proposed operations have a low potential to result in a nuisance and impact the health of nearby communities.

CO: The 24-hourly average CO concentration was recorded below the detection limits and ranged up to a maximum of 1360.00µg/m^3. The concentrations of CO are reported low at all the monitoring locations.

O_3: The O_3 concentration was recorded in the range of <0.01 – 14.00µg/m^3. O_3 concentrations at all the monitoring locations were reported to be below 100µg/m^3, which is the 24-hourly Ambient Air Quality Standard (NAAQS) for both National and IFC/WHO AQS.

H_2S: The H_2S concentration was recorded below the detection limits and ranged up to a maximum of 110.00µg/m^3. The concentrations of H_2S are reported low at all the monitoring locations.

A total of Nine (9) monitoring stations were established within and around the project area. Three (3) monitoring stations (AQ_1 to AQ_3) are located within the proposed project boundary area while six (6) monitoring stations (AQ_4 to AQ_9) are located in the surrounding communities. Results in all the monitoring locations are within both the Guinean Ambient Air Quality Standards and IFC/WHO AQS daily average. Also, there were no nearest sensitive receptors that could be affected by a Project-related degradation of ambient air quality.

5 Impact Assessment

5.1 Impact Assessment Methodology

The key elements used to assess impact significance are described in Table 5.1 and the characteristics that are used to describe the consequence of an impact are outlined in Table 5.2

Table 5.1: Impact Characteristic Terminology

Impact Magnitude	
Type	**Direct** – impacts that result from a direct interaction between the project and resource/receptor. **Indirect** – impacts that follow from direct interactions between the project and its environment as a result of subsequent interactions. **Induced** – impacts that result from other activities that happen as a consequence of the project.
Extent	**Local** – impacts are limited to the Project area and the surrounding area. **Regional** – impacts that are experienced beyond the local areas to the wider region. **International** – impacts that are experienced at an international scale i.e. affecting another country.
Duration	**Temporary** – predicted to be short-lived, of the order of hours to weeks. **Short-term** - predicted to last only for the duration of the drilling or construction operations (i.e. up to approximately two years). **Medium-term** - predicted to last from two years to the end of the project life **Long-term** - predicted to continue beyond the project life but will cease in time. **Permanent** – impacts that cause a permanent change in the affected receptor or resource that endures substantially beyond the project lifetime.
Frequency	**Continuous –** impacts that occur continuously or frequently. **Intermittent –** impacts that are occasional or occur only under specific circumstances
Likelihood*	**Unlikely –** the event is unlikely but may occur during the project. **Possible –** the event is likely to occur at some point during the project. **Likely –** the event will occur during the project (i.e. it is inevitable).

** For unplanned events only.*

Table 5.2 Significance Matrix

Sensitivity / Vulnerability / Importance	Magnitude of Impact			
	Negligible	**Small**	**Medium**	**Large**
Low	*Negligible*	*Negligible*	*Minor*	*Moderate*
Medium	*Negligible*	*Minor*	*Moderate*	*Major*
High	*Negligible*	*Moderate*	*Major*	*Major*

Using the matrix, the significance of each described impact is initially rated. This rating assumes the management measures inherent in the project design are in place. Where necessary additional mitigation measures have been recommended and the impact assessed for significance assuming implementation of the recommended mitigation measures. The impacts identified for assessment below include:

- Construction
  − Contribution to human health impacts associated with air pollutant emissions during construction
- Operational
  − Contribution to human health impacts associated with PM and dust emissions during operation
  − Contribution to human health impacts associated with gaseous SO_2 emissions during operation
  − Contribution to human health impacts associated with gaseous NO_2 emissions during operation
- Decommissioning and Closure
  − Contribution to human health impacts associated with air pollutant emissions during decommissioning.

5.2 Construction Impacts

During construction, air pollutant emissions are anticipated. Emissions from construction activities may affect the immediate project area and villages within the project study area but will decrease further away from the sources and in areas beyond the project footprint. Activities associated with the construction phase that is likely to result in emissions of the priority pollutants were identified as:

- Vegetation clearance/Habitat fragmentation/Habitat disturbance/Wildlife displacement
- Excavation works/Soil erosion and generation of site run-off.
- Vehicle exhausts emissions and vehicle entrainment of dust from vehicles travelling on the siteroads.
- Removal of topsoil and overburden.
- Waste generation/Dust//waste storage and disposal
- Equipment/material/worker transport
- Construction of buildings and structures associated with the Project, and installation of equipment associated with its operation.
- The physical presence of workers/Workers' safety

The emissions during construction are temporary and often are not at a consistent location. Further, they are extremely difficult to quantify as they depend on the activities being undertaken by specific equipment on any given day at any location subject to construction and the activity, equipment and location will vary each day during the construction phase.

Impact significance is expected to be low for air quality given that the impacts are short-term and of low consequence. While impacts are rated as low there are opportunities to easily reduce dust emissions. These mitigation measures are included below and it is expected that they would be incorporated into a construction ESMP.

Table 5.3 Impact on human health associated with air pollutant emissions during construction

	Magnitude	**Duration**	**Scale**	**Consequence**	**Probability**	**SIGNIFICANCE**	**+ /-**	**Residual**
Before Management	*Minor*	*Short*	*Local*	*Low*	*Possible*	*Low*	-	**Minor**

<table>
<tr><td colspan="9">The following mitigation measures are proposed:
• Maintain all construction equipment in good working order and do not leave running when not in use.
• Undertake awareness training on emissions. This is to be carried out at all levels of the workforce (workers, supervisors, managers) and can be included in induction courses. Training should focus on promoting understanding as to why mitigation measures are in place.
• Set speed limits to minimize the creation of fugitive dust within the site boundary.
• Wet exposed surfaces and unsurfaced roads with water to minimise wind-blown dust.
• Use enclosed processing and transportation equipment
• Avoid open burning of waste
• Establish indigenous vegetation on topsoil stockpiles that are to remain stockpiles for extended periods.
• Develop and implement a complaints system and make the community aware of the complaints procedure.
• Locate stockpiles within site boundaries considering the location of potential sensitive receptors and the predominant wind directions.
• Ensure machines and equipment planned for project use are installed with EMS to abate accentuating contributors of climate change.</td></tr>
<tr><td>After Management</td><td>Minor</td><td>Short</td><td>Local</td><td>Low</td><td>Possible</td><td>Low</td><td>-</td><td>Minor</td></tr>
</table>

5.3 Operational Impacts

The monitored PM concentration is below the Guinean Standard and IFC/WHO AQS. The main contributor to PM concentration in the cashew nut processing plant is the operation activities. As such, to effectively minimise impacts associated with these activities a mitigation programme should be developed and incorporated. Activities associated with the operational phase that is likely to result in emissions of the priority pollutants are identified as:

- Process emissions from streaming (cooking of raw cashew nuts)
- The odour from microbial action in stored waste areas
- Release of gaseous emissions (SOx, NOx) – with potential effects on air quality from the operation of the plant generators

- Exhaust from vehicular movements

Table 5.4: Impact on human health associated with PM and dust emissions during operation

	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Residual
Before Management	*Moderate*	*Medium*	*Local*	*Medium*	*Possible*	*Low*	-	*Minor*
The following specific mitigation measures are proposed: • Use of cyclone dust collectors and scrubbers as air pollution control measures to control the emission of particulate matter in the flue gas arising from boilers and power generating sets respectively • Odour (VOCs) generation from the cashew nut steaming process will be treated/ controlled using odour control technologies/equipment • Ensure an adequate water supply on the site for effective dust/particle suppression, using non-potable water where possible and appropriate. • Solid waste generated from process activity will be collected and stored in closed bins to minimise the odour problem near storage areas • Ensure all villages are aware of the grievance mechanism and ensure that all issues raised are actioned. • Use of PPE (like nose mask, helmet, ear plugs and glasses) shall be mandatory for workers/ employees/ visitors working in these areas. • Routine inspection and maintenance of engines, vehicles, generators and other equipment to minimise air emissions • All site employees will receive appropriate training to ensure that they are conversant with the site dust control strategy • Any exceptional incidents giving rise to dust and or air emissions, either on or off-site should be recorded and the action taken to resolve the situation should be recorded.								
After Management	*Minor*	*Medium*	*Local*	*Medium*	*Possible*	*Low*	-	*Minor*

Baseline concentrations of SO_2 are substantially below the Guinean AQS and IFC/WHO AQS so cumulative exceedances are not anticipated.

Table 5.5: Impact on human health associated with gaseous (SO_2) emissions during operation

	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+/-	Residual
Before Management	*Minor*	*Long*	*Local*	*Medium*	*Unlikely*	*Low*	-	*Low*
Proposed mitigation measure: • Biannual SO_2 screening								
After Management	*Minor*	*Long*	*Local*	*Medium*	*Unlikely*	*Low*	-	*low*

Baseline monitoring undertaken by Richflood demonstrates low NO_2 concentrations to be below IFC/WHO Air Quality Standard limit.

Table 5.6: Impact on human health associated with gaseous (NO_2) emissions during operation

	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+/-	Residual
Before Management	*Major*	*Long*	*Regional*	*High*	*Possible*	*Medium*	-	*Medium*
Proposed mitigation measure: • Continuous ambient NO_2 monitoring should be implemented								
After Management	*Moderate*	*Long*	*Local*	*Medium*	*Unlikely*	*Low*	-	*Low*

5.4 Decommissioning and Closure Impacts

During decommissioning and closure air pollutant emissions are anticipated from the dismantling of equipment, earthworks to rehabilitate the cashew nut processing plant and vehicles and equipment used to undertake to decommission. If undertaken correctly no emissions after closure is expected. The emissions during decommissioning are temporary and localised.

Table 5.7: Impact on human health associated with air pollutant emissions during construction

	Magnitude	**Duration**	**Scale**	**Consequence**	**Probability**	**SIGNIFICANCE**	**+ /-**	**Residual**
Before Management	*Minor*	*Short*	*Local*	*Low*	*Possible*	*Low*	-	*Medium*
The following mitigation measures are proposed: • Maintain all equipment in good working order and do not leave running when not in use. • Develop and implement a complaints system and make the community aware of the complaints procedure. • Monitoring air quality during decommissioning.								
After Management	*Minor*	*Short*	*Local*	*Low*	*Possible*	*Low*	-	*Medium*

6. Recommendations

6.1 Monitoring Requirements

The following key pollutants are recommended for monitoring at the timeframes and locations as detailed in Table 6.1. Monitoring should commence immediately to establish a baseline and continue through construction, operation, and decommissioning.

Table 6.1: Recommended Monitoring

Pollutant	Reference Location/ Monitoring Point	Monitoring Frequency	Implementing Body	Regulatory Body
PM_{10} and $PM_{2.5}$	Onsite Offsite – at locations established during the baseline assessment located around the plant site.	Continuous	DAI	BGEEE DFC
NO_2	At locations established during the baseline assessment located around the plant site.	Monthly	DAI	BGEEE DFC
SO_2	At locations established during the baseline assessment located around the plant site·	Bi-Annually (every 6 months)	DAI	BGEEE DFC

REFERENCES

- Climate and Clean Air Coalition (CCAC), 2014
- IFC's EHS Guidelines: Environmental Air Emissions and Ambient Air Quality, 2007
- Integrated Pollution Prevention and Control (IPPC) Reference Document on the General Principles of Monitoring (July 2003)
- International Finance Corporations (IFC)'s Performance Standards on Environmental and Social Sustainability, 2012
- OHSAS 18001 for Occupational Health and Safety and the "Pollution Prevention and Abatement Handbook" by the World Bank Group, 1998
- The IFC General Environmental, Health, and Safety Guidelines (EHS) (April 30, 2007)
- United Nations Framework Convention on Climate Change