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ENVIRONMENTAL MONITORING IN INDUSTRIAL ZONES OF WEST AFRICA

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Abstract: Environmental monitoring is essential for assessing the status and supporting development policies related to soil, air, and water quality. This study focuses on Drury Industries Limited, established in 1986, which is one of West Africa's leading manufacturers of Aluminium sulfate and sulfuric acid. The company operates multiple production lines, including Sulfuric Acid Plant I (52,000 MT/year), Sulfuric Acid Plant II (60,500 MT/year), and Aluminium sulfate (90,000 MT/year). The sulfuric acid produced is a crucial raw material, enhancing efficiency in various industrial processes. Located on 177,145 m² at Plot 9/18, Opic Industrial Estate, Agbara, Ogun State, the facility's coordinates are N06032'28.1" E003o04'36.1". This study evaluates various physicochemical parameters that impact human health, productivity, and relevant meteorological data. The findings will not only safeguard health but also serve as a reference for similar industrial sites. By publishing this data in the Journal "Mine Surveying and Subsurface Use" we aim to fill a gap, as many relevant studies in Sub-Saharan Africa remain unpublished. This research will aid in preserving and protecting essential resources within complex environments.

Keywords: Environment, Universal, Health, Industrial, Monitoring

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МОНИТОРИНГ ОКРУЖАЮЩЕЙ СРЕДЫ В ПРОМЫШЛЕННЫХ ЗОНАХ ЗАПАДНОЙ АФРИКИ

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Аннотация: Мониторинг окружающей среды необходим для оценки состояния и поддержки стратегии развития, связанной с качеством почвы, воздуха и воды. В данном исследовании основное внимание уделяется компании Drury Industries Limited, основанной в 1986 году, которая является одним из ведущих производителей сульфата алюминия и серной кислоты в Западной Африке. Компания управляет несколькими производственными линиями, включая завод по производству серной кислоты I (52000 тонн в год), завод по производству серной кислоты II (60500 тонн в год) и сульфата алюминия (90000 тонн в год). Производимая серная кислота является важнейшим сырьем, повышающим эффективность различных промышленных процессов. Расположенный на участке 9/18, Opic Industrial Estate, Agbara, штат Огун, площадью 177145 м², объект имеет координаты N06032'28.1" E003o04'36.1". В данном исследовании оцениваются различные физико-химические параметры, которые влияют на здоровье человека, производительность и соответствующие метеорологические данные. Результаты не только защитят здоровье, но и послужат справочным материалом для аналогичных промышленных объектов. Публикуя эти данные в журнале Маркшейдерия и недропользование, мы стремимся заполнить пробел, поскольку многие соответствующие исследования в странах Африки к югу от Сахары остаются неопубликованными. Данное исследование поможет сохранить и защитить основные ресурсы в сложных условиях.

Ключевые слова: окружающая среда, общемировая, здоровье, промышленный, мониторинг

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Introduction

There are various techniques that can be intensified to enhance robust environmental monitoring, as reported by Kumar et al. (2013) [1]. Environmental monitoring can be done to recover valuable resources embedded in the earth's crust or in our biosphere environment inhabited by humans and different types of microorganisms. These are done in ways that our planet Earth will not be degraded. Industrial zones or establishments visited for this purpose include a big firm known as Drury Industries Limited that was incorporated by the Corporate Affairs Commission of the Federal Republic of Nigeria on the 27th of July, 1982, with registration number RC 39426.

Drury Industries Ltd was established in 1986 as one of the largest and pioneering manufacturers of Aluminium sulphate and Sulphuric acid on the West Coast of Africa. The company is a good example of self-reliance in the heavy chemicals manufacturing industry. The factory production lines (plant) include Sulphuric acid plant I (production capacity of 52,000 MT/Annum), Sulphuric acid plant II (production capacity of 60,500 MT/Annum), and Aluminium sulphate (production capacity of 90,000 MT/Annum).

The sulphuric acid produced in the acid plant is considered an invaluable raw material and is known to improve efficiency in numerous industrial processes. The facilities are located on the land area of 177,145 m^2 at Plot 9/18, Opic Industrial Estate, Agbara, Ogun State, with the following coordinates N06032'28.1" E003o04'36.1''; N06o32'30.3'', E003o04'38.5''; N06o32'30.5'', E003o04'38.3'; and N06o32'28.8'' E003o04'39.2''.

Before the last decade of the 20th century, not much emphasis was placed on the management of the environment in a global and internationally sustainable way. However, the increasing awareness of global warming, land, water, and air pollution by industries and other service providers have engendered international collaboration through conventions and treaties culminating in the enactment of national and local laws and regulations to ensure the mitigation of pollution in the environment [2-10].

The environment is a continuum, and the activities of one facility that generates waste and pollutants would ultimately affect its neighbor. It is in the realization of this that the Earth Summit was held in Rio de Janeiro, Brazil, in June 1992, where a declaration was made on Environment and Developments by the Government under the United Nations Agenda 21 (Programme of Action for Sustainable Development). Nigeria is a signatory to most of the conventions on environmental management and protection, and therefore both the national and state governments have enacted various laws and regulations to monitor and protect the environment from solid, liquid, gaseous wastes, and noise pollution. The scientific report by Dunkerley (2022) [11] provided vital information on the geological formations necessary for some amelioration and development.

Environmental monitoring describes the processes and activities that need to take place to characterize and monitor the quality of the environment. Environmental monitoring is a way to check the condition of an environment by comparing the results of investigations done at different times. In many circumstances in which human activities carry a risk of harmful effects on the natural environment, all monitoring strategies and programs have reasons and justifications, which are often designed to establish the current status of an environment or to establish trends in environmental parameters. In all cases, the results of monitoring will be reviewed, analyzed statistically, and published.

The study of Chueh et al. (2001) [12] described the possibility of using an electronic computerized system to optimize the detection and proper evaluation of some environmental components in the process of environmental monitoring systems.

Similarly, the use of some facilities described by Allil et al. (2021) [13] and Wang et al. (2021) [14] on earth seismic movements and earthquakes, including related scientific management structures, will go a long way to avert some disasters in the environment.

- Benefits of Environmental Monitoring:
- Protection of public water supplies;
- Urban air quality;
- Natural resources protection and management;
- Weather forecasting;
- Economic development and land planning;
- Endangered species and biodiversity;
- Global climate changes.

This report describes the environmental conditions in terms of air quality and noise level of Drury Industries Limited, Agbara, Ogun State, as of the time of this study. The data on the environmental conditions of the area were collected during the field survey, and the key findings are discussed here.

Objectives of the Study

The aims and objectives of the Environmental Monitoring Report:

1. To comply with statutory regulatory requirements of the Ogun State Ministry of Environment, Ogun State Environmental Protection Agency, Federal Ministry of Environment, Ogun State Land Bureau, Physical Planning, and other statutory regulatory regulations relating to the environment and property development.
2. To meet the international (Agenda 21) and National requirements for environmental practice in industries for sustainable development.
3. Determine whether facilities to minimize environmental impacts are adequate and cost-effective or whether other appropriate technologies should be introduced.

Scope of Study

1. Climatic Characteristics of Drury Industries environment.
2. Air Quality determination of Drury Industries premises and environs.
3. Effluent Results Log Sheet & Discussions (If applicable).
4. Soil Quality Determination & Discussions (If applicable).

Justification

In line with the environmental guidelines such organizations as OGEPA, NESREA, and FMEnv, Roygbiv Analytical and Environmental Services Limited were commissioned to carry out the air quality, dust emission, noise level, and meteorology of Drury Industries Limited, plot 9/18, Opic Industrial Estate, Agbara, Ogun state. The results are presented and discussed here.

Climatic Characteristics

DRURY INDUSTRIES LIMITED is located within the humid tropical climate with a moisture index range between -19.5 and +18.5 based on the Thornthwaite classification scheme. The position of the Inter-Tropical Convergence Zone (ITCZ) relative to the apparent location of the overhead sun and the prevailing winds at different periods of the year all combine to determine the observed weather and climatic characteristics. However, human activities, especially urbanization and industrialization, have caused the removal of the forest cover and the conversion of wetlands into urbanized landscapes. This has resulted in the modification of

the climatic parameters, especially evapotranspiration, humidity, and to a lesser degree, temperature.

Rainfall

The season is characterized by two major seasons, the dry and wet seasons. The wet season (April/October) is bimodal, with the highest peak occurring during May and July, then separated from the lower peak by August (August break). The rainfall regime, which is the pattern of rainfall distribution over the seasons, is determined by the two major air masses dominating the area: the moist Tropical Maritime (TM) with its associated westerlies and the dry Tropical Continental air mass (TC) with its associated easterlies. The movement of the ITCZ, a quasi-stationary boundary that separates the TC from the TM, further modifies the process. Rain falls on more than 7 (i.e. > 23 %) of the days in every month from May to October and on just less than 5 (i.e. > 16 %) days between November and February. Overall, a total of about 1970 mm of rain is recorded annually.

As shown in Table 1, this gives an average of 164.22 mm per month. The minimum rainfall amount (24.25 mm) is received in the month of December while the maximum rainfall amount (320.42 mm) is received in the month of June (Figure 1). Of the total amount, about 1,792.49 mm was recorded during the wet season (April to October) while only 178.45 mm was recorded in the "dry" season (November to March).

Table 1 / Таблица 1

Climatic Characteristics of the Facility Area (Source: NiMet, 2019) / Климатические характеристики района расположения объекта (Источник: NiMet, 2019)

Month	Temperature °C			Rainfall (mm)	Humidity (%)	
	Min	Mean	Max	Total	10:00 Hrs	16:00 Hrs
January	21.56	25.75	29.94	26.12	93	66
February	26.42	27.21	28.00	25.89	87	64
March	24.52	26.32	28.11	101.89	79	71
April	25.78	27.31	28.84	162.02	89	70
May	21.85	25.93	30.00	210.21	92	74
June	23.58	25.28	26.98	291.54	91	83
July	22.69	24.85	27.01	320.42	96	77
August	24.11	25.48	26.85	192.54	95	81
September	23.25	25.18	27.10	287.25	94	80
October	22.98	25.20	27.41	250	92	79
November	22.70	25.91	29.12	78.51	95	75
December	24.11	26.53	28.95	24.25	92	65
Total	283.55	310.93	338.31	1970.64	1095.00	885.00
Mean.	23.63	25.91	28.19	164.22	91.25	73.75
Min	21.56	24.85	25.30	24.25	79.00	64.00
Max	26.42	27.31	29.00	320.42	95.00	83.00

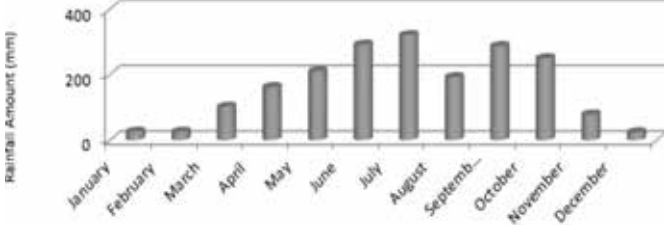

Fig. 1. Rainfall Characteristics of the Facility Area
Рис. 1. Характеристики осадков на объекте

Temperature

The project site is located at approximately latitude 6°32'00"N of the equator. Therefore, the temperature remains relatively high and stable throughout the year, with significant variations during the wet, dry, and short "harmattan" and "break between the two rainfall peaks" periods. The average daily temperature for the entire year is 25.91 °C. The harmattan season occurs when the northeast trade wind passes over the Sahara Desert into the West African region, typically between December and January.

Figure 2 illustrates the temperature patterns in the facility area.

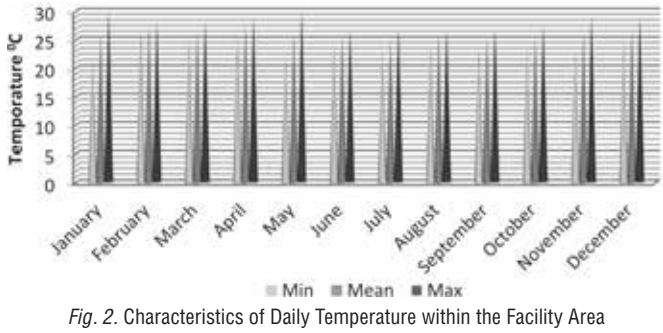

Fig. 2. Characteristics of Daily Temperature within the Facility Area
Рис. 2. Характеристики суточной температуры на территории объекта

Relative Humidity (RH)

The region is characterized by a relatively high humidity RH as a result of the prevailing TM air mass blowing over the environment almost all year round. Overall averages of 91.25 % and 73.75 % are recorded at 10:00 hrs and 16:00 hrs local time. Further assessment shows that the highest values are recorded in early mornings and late evenings while the lowest value of 64 % in the region is recorded in February. During the dry season, values between 65 % and 85 % are common, owing to the influences of the Dry Tropical Continental air mass that prevails over the region at this period.

Figure 3 shows the characteristics of relative humidity of the project area.

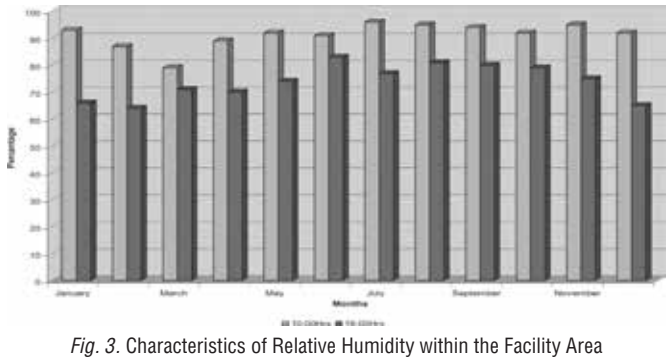

Fig. 3. Characteristics of Relative Humidity within the Facility Area
Рис. 3. Характеристики относительной влажности в районе объекта

Sunshine Hours

The mean annual sunshine hour in the area is about 1,537 hours. The mean monthly values vary between 51 and 170 hours in the months of July and December, respectively. The generally low amount of sunshine hours in July is due to the greater amount of cloudiness and rainfall characteristics of the area. Conversely, the higher December figure is due to the prevalent clear skies when the ITCZ has once more started its northward migration.

Wind Patterns

The wind pattern also follows the migratory ITCZ. Thus, it is mainly southwesterly during the rainy season and northeasterly

during the dry season. In general, the southwesterly swell is prevalent. The wind speed varies between 3 and 8 knots around the coast for most of the year with an average speed of 6 knots. Incidences of severe storms are now more frequent, with some rare occasions reaching as high as 55-60 knots. These are often associated with thunder and lightning, especially during changing seasons.

Air Quality Determination

Air Quality is an indication of the healthfulness of the air based on the quantity of polluting gases and particulates (liquid droplets or tiny solid particles suspended in the air) it contains. Air is considered safe when it contains no harmful chemicals and only low levels of other chemicals that become harmful in higher concentrations to humans, other animals, plants, or their ecosystems. Controlling air pollution has become extremely challenging with the enormous increase in emissions from energy-intensive industries. In view of this, the Federal Ministry of Environment (FMEnv) and the National Environmental Standards and Regulatory Enforcement Agency (NESREA) have established air quality standards to protect the health and welfare of people, plants, animals, as well as buildings, movements, water resources, etc. Drury Industries Limited therefore commissioned Roygbiv Analytical and Environmental Services Nigeria Limited to monitor the air quality, dust emission, noise level, and illumination of its factory at Plot 9/18 Opic Industrial Estate, Agbara, Ogun State on 28th September 2022, and the results are hereby presented and discussed in this report.

Reference Standard

The National Environmental (Chemical, Pharmaceutical, Soap, and Detergent Manufacturing Industries) Regulations, S.I. 36 of 2009; National Environmental Protection (Effluent Limitation) Regulations, S.I. No. 8 of 1991, and National Environmental (Noise Standards and Control) Regulations, S.I. No. 35 of 2009 were used for the discussion of the results.

Sampling

Ambient air quality and noise were monitored using calibrated portable gas analyzers and meters by monitoring experts.

The method of collecting samples is shown in Table 2.

Table 2 / Таблица 2

Method for Sample Collection and Equipment Detection Limit / Метод сбора проб и порог чувствительности оборудования

No.	Parameters	Equipment/Meter	Detection Limit	
1.	Noxious gasses	Multifunctional Gas Detector – GT-2000-JMDE	O_2 Sensor	0-25 % Vol
			CO Sensor	0-100 ppm
			CO_2 Sensor	0-5000 ppm
			H_2S Sensor	0-100 ppm
			SO_2 Sensor	0-10 ppm
			NO Sensor	0-250 ppm
			CH_4 Sensor	0 – 100% LEL
			VOC Sensor	0-100 ppm
2.	Total Particulate Matter (2.5,10.0um)	HTI Particle Counter (HT-9600)	0 – 5000 ug/m^3	
3.	Temperature		-50 +300 0C	
4.	Relative Humidity		20 – 99 %	
5.	Illumination	Extech Digital Light meter	0 – 50,000 Lux	
6.	Noise Level	Extech sound level meter	35 – 130 dB	
7.	Windspeed	Multi-functional Anemometer	0.4-45 m/s	

Air Pollutants and Their Impacts

The major air pollutants and their effect are expressed in the Table 3 below.

Monitoring Results

The results of gas monitoring are shown in Table 4.

The results of meteorology and particulate matter are shown in Table 5.

The results of noise monitoring are shown in Table 6.

Findings on Air Quality

Air quality survey of strategic locations within the factory indicated that most of the monitored parameters were within specifications and were localized within the areas of generation. Details are given in Tables 4, 5 and 6.

H_2S, VOCs, NO and CH_4 (LEL) were not detected in the factory in compliance with NESREA specifications.

SO_2 was detected in the factory at a range of <0.001 to 22.5 mg/Nm^3 which was within NESREA specification.

CO was detected in the factory at a range of 16.25 mg/Nm^3 to 49.00 mg/Nm^3 which was within NESREA specification.

CO_2 value in the factory varied from 738 ppm to 826 ppm.

O_2 value in the factory varied from 19.60 % to 19.92 % which is considered satisfactory and in abundance when compared with the 21 % natural composition.

The relative humidity measured in the facility varied from 60.8 % to 79.7 %. This is however considered satisfactory considering the prevalent temperature and weather in the area.

The temperature values in the facility ranges from 26.22 ℃ to 29.35 ℃. The temperature values in most of the unit in the facility compared favorably with the ambient temperature of 28.96 ℃. Considering the ambient temperature and weather, the temperature in the facility were normal.

The windspeed in the facility ranges from 0.4 m/s to 0.9 m/s. This is considered sufficient based on the prevalent climate and local geography.

PM2.5, PM10 and TPM detected in most of the locations in the facility were within the NESREA limits of 50 mg/Nm^3 except at the Alum Plant (Milling, Crushing/Bagging unit) and Acid plant (Sulphur melting unit) where the value was higher than the limit. TPM was however localized in the area.

Noise level in the factory varies from 47.8 dB to 98.7 dB. The noise levels in most assessed locations in the factory were within NESREA specifications except at the Boiler house and Generator house which were above the limit.

Illumination measured in the facility ranges from 3 to 15600 Lux. Lighting in most of the locations was considered adequate with respect to the usage and the age of personnel on duty except at the boiler house and Alum Plant where the value was lower.

Recommendations on Air Quality

Management should intensify effort on the following to improve compliance:

- Regular and continuous servicing of machines and equipment to reduce smoke/dust emanating from them.
- Routine check and maintenance of process operations and equipment for continual improvement.
- Servicing of pollution abatement devices (cyclone, fume extractors and alkali scrubber) on a periodic and regular basis for reliable and effective performance.
- Tag the Generator / Boiler house as ‘High Noise Area’ and enforce the use of ear protecting equipment in the units.

Table 3 / Таблица 3

Air Pollutants and Their Impacts /
Загрязнители воздуха и их воздействие

Name	Properties of Importance	Significance as Air Pollutant	Physiological Effects on Humans	
			Acute Effects	Chronic Effects
Carbon Dioxide (CO_2)	Colourless and odourless	Product of complete combustion of organic compounds, implicated in global climate change	Pulmonary inflammation	Displaces oxygen in air and cause suffocation
Carbon Monoxide (CO)	Colourless and odourless	Product of incomplete combustion, toxic at high concentration	Asphyxiation, heart and brain damage, impaired perception	Increased red blood cells (polycythemia) in blood, leading to increased resistance to blood to flow, weakness fatigue, and headaches
Ozone (O_3)	Very reactive	Damage to vegetation and materials, produces photochemical smog	Decreased pulmonary function and right-heart stress	Emphysema, fibrosis, right-heart failure, aging of lung and respiratory tissue
Nitrogen Dioxide (NO_2)	Brown or orange gas	Component of photochemical smog formation, toxic at high concentration	Incompletely understood, although cell membrane disruption appears to be the principal reason for respiratory tract edema	Cell membrane damage and acid-induced irritation leading to or contributing to diminished pulmonary function and right-heart stress
Nitric Oxide (NO)	Colourless, sometimes used in anesthetics	Produced during combustion and high temperature oxidation, oxidizes in air to NO2		
Закись азота (N_2O)	Colourless, used as aerosol carrier gas	Relatively inert; not a combustion product		
Sulfur Dioxide (SO2)	Colourless gas, intense acid odour, forms H2SO4 in water	Damage to vegetation, building materials, respiratory system	Gives rise to irritation reactions, which cause capillaries to dilate and exude fluid; this leads to tissue fluid accumulation and swelling (edema), bronchial spasms, and shortness of breath. General physiological reaction to SO2 is similar to allergic asthma, i.e with impaired pulmonary function via increased airway resistance, impaired lung clearance, and increased susceptibility to infection	Contributes to and aggravates lung diseases like chronic bronchitis, pulmonary fibrosis via irritation leading to decreased pulmonary function and increase in stress on the heart
Sulfur Trioxide (SO3)	Soluble in water to form H2SO4	Highly corrosive	Contributes to acid rain which can harm sensitive ecosystems	
Hydrogen Sulphide (H2S)	Rotten egg odour at low concentration, odourless at high concentrations	Extremely toxic		
Hydrocarbons (CxHy)	Many different compounds	Emitted from automobile crankcase and exhaust	The primary harm of hydrocarbons is in their participation in ozone protection	Cancer is one direct primary effect of some organic compounds
Particulate Matters (SPM)			Effect varies depending on nature and size of particles. Can cause irritation, altered immune defense, or systematic toxicity	Depending on the nature and size of the particles can cause decreased pulmonary function and stress on the heart

Таблица 4 / Table 4

Gaseous Monitoring Results (28th September, 2022) /
Результаты мониторинга газов (28 сентября 2022 г.)

Location, sample point	GPS Location	SO_2 mg/Nm³	CO mg/Nm³	CH4 % LEL	H_2S mg/Nm³	VOCs mg/Nm³	O_2 %	NO mg/Nm³	CO_2 Ppm
Clinic / safety office area	6032'28.1"N 3004'36.1"E Elev: 120ft	<0.001	18.00	<0.001	<0.001	<0.001	19.86	<0.001	738
Boiler house	6032'28.7"N 3004'37.4"E Elev: 95ft	<0.001	17.50	<0.001	<0.001	<0.001	19.80	<0.001	773
Generator house	6032'29.3"N 3004'37.5"E Elev: 142ft	<0.001	22.75	<0.001	<0.001	<0.001	19.69	<0.001	789
Alum section (milling unit)	6032'30.3"N 3004'38.5"E Elev: 23ft	<0.001	19.00	<0.001	<0.001	<0.001	19.72	<0.001	822
Evaporator area	6032'30.3"N 3004'38.6"E Elev: 5ft	<0.001	49.00	<0.001	<0.001	<0.001	19.60	<0.001	824
Crushing / Bagging unit	6032'30.5"N 3004'38ss.3"E Elev: 90ft	<0.001	16.25	<0.001	<0.001	<0.001	19.68	<0.001	824
Acid plant Sulphur melting	6032'31.5"N 3004'39.7"E Elev: 14ft	22.500	27.00	<0.001	<0.001	<0.001	19.65	<0.001	826
Acid production area	6032'31.7"N 3004'40.4"E Elev: 35ft	4.500	27.25	<0.001	<0.001	<0.001	19.68	<0.001	770
Bauxite yard	6º32'28.8"N 3º04'39.2"E Elev: 133ft	<0.001	21.25	<0.001	<0.001	<0.001	19.82	<0.001	742
Old acid plant	6º32'31.1"N 3º04'42.1"E Elev: 129ft	<0.001	23.25	<0.001	<0.001	<0.001	19.84	<0.001	769
Gate house	6º32'31.0"N 3º04'34.9"E Elev: 135ft	<0.001	34.75	<0.001	<0.001	<0.001	19.92	<0.001	778
NESREA FME Limit	S.I. No. 36 of 2009	450	500		5	50	21	300	

Table 5 / Таблица 5

Meteorology and Particulate Matter Results (28th September 2022) /
Результаты метеорологии и содержания твердых частиц (28 сентября 2022 г.)

Location, sample point	GPS Location	PM2.5 mg/Nm³	PM10 mg/Nm³	TPM mg/Nm³	RH %	Temp °C	LUX	Wind Speed m/s
Clinic / safety office area	6°32'28.1"N 3°04'36.1"E Elev: 120ft	15	17	32	85.4	26.22	7900	0.5
Boiler house	6°32'28.7"N 3°04'37.4"E Elev: 95ft	16	27	43	82.0	27.60	3	0.4
Generator house	6032'29.3"N 3004'37.5"E Elev: 142ft	5	6	11	78.4	28.66	120	0.6
Alum section (milling unit)	6°32'30.3"N 3°04'38.5"E Elev: 23ft	50	60	**110**	79.4	28.28	19	0.4
Evaporator area	6°32'30.3"N 3°04'38.6"E Elev: 5ft	10	15	25	78.3	28.56	17	0.4
Crushing / Bagging unit	6°32'30.5"N 3°04'38.3"E Elev: 90ft	50	68	**118**	76.2	29.35	16	0.4
Acid plant Sulphur melting	6°32'31.5"N 3°04'39.7"E Elev: 14ft	30	44	**74**	77.0	28.83	3430	0.8
Acid production area	6°32'31.7"N 3°04'40.4"E Elev: 35ft	7	6	13	84.9	27.95	9150	0.6
Bauxite yard	6°32'28.8"N 3°04'39.2"E Elev: 133ft	3	5	8	80.4	27.39	1220	0.9
Old Acid plant	6°32'31.1"N 3°04'42.1"E Elev: 129ft	7	10	17	80.6	27.91	13100	0.6
Gate house	6°32'31.0"N 3°04'34.9"E Elev: 135ft	7	10	17	82.2	28.96	15600	0.7
NESREA Limits		50				Ambient Temp		

Таблица 6 / Table 6

Noise Level Monitoring Result (28th September 2022) /
Результаты мониторинга уровня шума (28 сентября 2022 г.)

Location, sample point	GPS Location	Noise (dB)	NESREA (S.I. No. 35, 2009) Max. Permissible Noise Level (dB)
Clinic / safety office area	6⁰32'28.1"N 3⁰04'36.1"E Elev: 120ft	60.4	75 (Regulation 2(2), Factory/Workshop Compound)
Boiler house	6032'28.7"N 3004'37.4"E Elev: 95ft	87.5	85 (Regulation 2(2), Factory/Workshop)
Generator house	6⁰32'29.3"N 3⁰04'37.5"E Elev: 142ft	98.7	85 (Regulation 2(2), Factory/Workshop)
Alum section (milling unit)	6⁰32'30.3"N 3⁰04'38.5"E Elev: 23ft	69.0	85 (Regulation 2(2), Factory/Workshop)
Evaporator area	6⁰32'30.3"N 3⁰04'38.6"E Elev: 5ft	68.4	85 (Regulation 2(2), Factory/Workshop)
Crushing / Bagging unit	6⁰32'30.5"N 3⁰04'38.3"E Elev: 90ft	79.5	85 (Regulation 2(2), Factory/Workshop)
Acid plant (Sulphur melting)	6⁰32'31.5"N 3⁰04'39.7"E Elev: 14ft	56.4	85 (Regulation 2(2), Factory/Workshop)
Acid production area	6⁰32'31.7"N 3⁰04'40.4"E Elev: 35ft	57.8	85 (Regulation 2(2), Factory/Workshop)
Bauxite yard	6⁰32'28.8"N 3⁰04'39.2"E Elev: 133ft	52.2	85 (Regulation 2(2), Factory/Workshop)
Old acid plant	6⁰32'31.1"N 3⁰04'42.1"E Elev: 129ft	47.8	85 (Regulation 2(2), Factory/Workshop)
Gate house	6⁰32'31.0"N 3⁰04'34.9"E Elev: 135ft	61.9	70 (Regulation 2(1), row E)

- Monitoring the use of filter-fitted respirator at the production area to reduce personnel exposure to pollutant.
- Handling of alum sludge at the dedicated drying area should be improved upon and the evidence of past activities should be ameliorated for compliance.
- Electrically powered forklifts and other safety machineries should be incorporated and encouraged to improve compliance.
- Install transparent roofing sheets in strategic locations to save energy and enhance the illumination as appropriate.
- Training of staff on the use and handling of PPE for improved compliance.

Discussion

This report shows the variations of different environmental parameters that can influence environmental quality and human survival. The climatic characteristics of the facility area, as shown in Table 1 (Source: NiMet, 2019) and Figures 1 to 3, give the climatic variables that can have an impact on the ecological environment.

Our findings in this environmental monitoring report (Table 2 to Table 6) show the use of appropriate devices in determining necessary environmental variables important to protect the ecological environment. This corroborates the report of previous scientists such as Zhan et al. (2021) [15], who show the possibility of using optical polarization-based seismic and water wave sensing on transoceanic cables, which had a diversified application of deep aquatic resources. Previous investigations by Monteiro et al. (2018) [16], Fernandez et al. (2020) [17], and Bogris et al. (2022) [18] supported this application.

Conclusion

In general, the air quality, noise level, dust emission, illumination, heat stress, and effluent results in the factory were considered satisfactory in most respects based on the assessment results and specifications.

Management of the facility should intensify efforts on the implementation of the above recommendations for improved compliance. The data obtained in this regard can also be a good guide for other related industrial settlements. This will help to recover and protect valuable resources in the complex environment.

Considering the available literature on industrial monitoring, there is little or no work done in this aspect of the research. Hence, we have decided to publish this data in the Journal "Mine Surveying and Subsoil Use" because most of the studies done by other authors are not published, especially in the Sub-Saharan Africa Region.

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