Controlling Environmental Pollution in Nigeria through NESREA Regulations: An Assessment of Air Pollution Control

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Abstract

Environmental pollution (EP) continues to pose one of the most pressing global challenges, and air pollution remains a critical aspect of this problem with far-reaching consequences for human health, ecosystems, and sustainable development. In Nigeria, air pollution is recognized as one of the most severe environmental problems, driven by rapid urbanization, industrial activities, fossil fuel combustion, and weak enforcement of environmental standards. These challenges highlight the urgent need for an effective legal and institutional framework to regulate and mitigate the harmful impacts of air pollution. The National Environmental Standards and Regulation Enforcement Agency (NESREA), established under the NESREA Act, 2007 bears the mandate of safeguarding Nigeria's environment through the enforcement of compliance with environmental laws and regulations. This study employs the normative juridical research method to assess NESREA's regulatory framework for air pollution control. The normative juridical research method bases its analysis on applicable laws, and regulations that are relevant to the legal issues that are the focus of research. Findings reveal that NESREA has enacted regulatory measures aimed at addressing air pollution; however, challenges persist in areas of enforcement, monitoring, and institutional capacity. The study underscores the need for strengthening compliance mechanisms, enhancing institutional efficiency, and ensuring stricter penalties for violations to promote environmental justice. It amongst others, recommends improve and adequate funding of NESREA by the Nigerian Federal Government to enable the Agency to perform optimally by strengthening its capacity, efforts and reach. It concludes that improved enforcement of existing regulations is crucial for reducing air pollution, protecting public health, and achieving sustainable environmental quality in Nigeria.

Keywords: Environmental Pollution, Air Pollution, Air Pollution Control, NESREA, Environmental law, Nigeria

I. Introduction

Air pollution is increasingly recognised as one of the gravest environmental threats globally, responsible for substantial morbidity, mortality and degradation of ecosystems. According to the World Health Organization[1] and other recent assessments,[2] both ambient (outdoor) and

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[1] World Health Organization (WHO), Ambient (outdoor) air pollution (24 October 2024) <https://www.who.int/news-room/fact-sheets/detail/ambient-%28outdoor%29-air-quality-and-health> accessed 23 October 2025; WHO, Noncommunicable diseases and air pollution (29 March 2019) <https://www.who.int/europe/news/item/29-03-2019-noncommunicable-diseases-and-air-pollution> accessed 23 October 2025.

[2] The Non-Communicable Disease (NCD) Alliance, Report confirms deadly impact of air pollution, brings new data on dementia (23 October 2025) <https://ncdalliance.org/stories/news-blogs/2025/report-confirms-deadly-impact-air-pollution-brings-new-data-dementia> accessed 23 October 2025; Anyanwu C, Bikomeye J C and

household air pollution remain among the leading risk factors for non-communicable diseases (NCDs) in low- and middle-income countries. In Nigeria in particular, rapid urbanization, industrial expansion, vehicular emissions, biomass combustion, and weak regulatory oversight have exacerbated air quality problems. For example, a study of Lagos in 2020-2021 estimated population-weighted $PM_{2.5}$ exposure at ~47 μg/m³, associated with tens of thousands of premature deaths, widespread respiratory infections among children, cardiovascular mortality, and cognitive risks from lead exposure.[3]

Similarly, satellite data and ground monitoring from 2018-2022 show elevated concentrations of NO_2, SO_2, ozone, carbon monoxide and aerosol indices across various Nigerian states, often exceeding WHO guideline values.[4] These empirical findings underscore that the air pollution burden is not simply theoretical: it translates into concrete harm to public health, especially the vulnerable populations such as children, the elderly, and those in communities affected by oil and industrial emissions. For instance, in Eleme and Port Harcourt in Rivers State, elevated $PM_{2.5}$ levels correlate strongly with higher reported incidence of respiratory tract infections.[5] Indoor and outdoor assessments in smaller cities (e.g. Ikere-Ekiti) further show that residential and institutional exposures to pollutants such as ozone, NO_2, and fine particulate matter are above safe thresholds, pointing to serious health risks.[6]

Given the foregoing backdrop, there is an urgent need for robust regulatory frameworks to manage emissions, enforce standards, monitor air quality, and respond to violations. In Nigeria, the National Environmental Standards and Regulations Enforcement Agency (NESREA), established under the NESREA Act of 2007, is the lead federal agency for environmental regulation and enforcement. Its mandates include setting environmental standards, issuing regulations, enforcing compliance, and imposing penalties for environmental violations. Legal instruments relevant to air pollution include regulations controlling emissions from industrial sources, vehicular emissions, waste burning, gas flaring, and setting ambient air quality standards, among others.

Despite NESREA's mandates, there is an increasing recognition in the literature and policy circles that the regulatory framework in Nigeria exhibits several weaknesses.[7] First,

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Beyer K M., 'The impact of environmental conditions on non-communicable diseases in sub-Saharan Africa: A scoping review of epidemiologic Evidence' (2024) 14 J Glob Health 04003; Pérez Velasco R and Jarosińska D., 'Update of the WHO global air quality guidelines: Systematic reviews - An introduction' (2022) 170 Environ Int. 107556; Fisher Samantha and others, 'Air pollution and development in Africa: impacts on health, the economy, and human capital' (2021) 5(10) The Lancet Planetary Health, e681-e688.

[3] Joseph V Spadaro and others, 'The Health Burden of Outdoor Air Pollution in Lagos, Nigeria, between 2020 and 2021' ISEE 2022: 34th Annual Conference of the International Society of Environmental Epidemiology (ISEE Conference Abstracts, Volume 2022, Issue 1) https://doi.org/10.1289/isee.2022.P-0924.

[4] Omokpariola D O, Nduka J N and Omokpariola P L, 'Short-term trends of air quality and pollutant concentrations in Nigeria from 2018–2022 using tropospheric sentinel-5P and 3A/B satellite data' (2024) 6 Discov Appl Sci 182.

[5] Perri Tamuno-owunari and others, 'The Impact of Particulate Matter (PM2.5) Pollution on Respiratory Health in Eleme and Port-Harcourt Local Government Areas of Rivers State from 2015-2019' (2024) XI(XII) International Journal of Research and Scientific Innovation 317-327.

[6] Arifalo M K and others, 'Evaluating air quality and associated health risks in Ikere Ekiti, Nigeria: an indoor and outdoor assessment' (2025) 1(1) *Discov. Sens.* 1-34.

[7] Akintububo O S, 'A Critical Analysis of the Legal Frameworks for Sustainable Solid Waste Management Practices in Nigeria' (2025) 7(1) Chukwuemeka Odumegwu Ojukwu University Journal of Private and Public Law (COOUJPPL) 84-105; Ogunkan D V, 'Achieving sustainable environmental governance in Nigeria: A review for policy consideration' (2022) 2(1) Urban Governance 212-220; Centre for Environment, Human Rights and

there are problems with enforcement: though regulations exist, monitoring capacity is limited, budget constraints are acute, and institutional coordination is often weak. NESREA itself has highlighted inadequate funding and limited enforcement infrastructure as major impediments to effective compliance monitoring.[8] Second, there are gaps in legal authority: certain sectors (notably parts of oil & gas) lie outside full regulatory reach of NESREA, and jurisdictional overlaps between federal, state, and local agencies sometimes hinder coherent enforcement. Third, community awareness, public participation, and transparency are often insufficient, reducing pressure on polluters and compromising accountability.

Given the magnitude of harm posed by air pollution, and given that legal/regulatory mechanisms are central to prevention and control, there is strong justification for assessing how well Nigeria's regulatory framework is functioning in practice, what its strengths are, what gaps remain, and what reforms may be needed. Though there is empirical evidence about pollutant levels and health impacts, fewer studies examine in depth the legal instruments, their implementation, enforcement, and barriers. To ensure that policy, regulatory reforms, and institutional capacity are aligned with environmental health needs, such an assessment is essential. The purpose of this study is to assess NESREA's regulatory framework for air pollution control in Nigeria: to examine the laws, regulations, institutional structures, enforcement mechanisms, and penalties, to identify gaps or deficiencies, and to propose recommendations for strengthening compliance monitoring, enforcement, and regulatory effectiveness.

2. Sources of Air Pollution in Nigeria

This section examines four major sources of air pollution in Nigeria. They are burning of fossil fuels, automobile emissions, industries and factories, and bush burning and use of fuel wood.

2.1 Burning of Fossil Fuels

In Nigeria, the burning of fossil fuels is a chief cause of air pollution.[9] Because the national power grid is unreliable in many areas, industries, factories, small businesses, and homes often run on diesel or low-quality fuel generators. These generators, especially when not well maintained burn fuel incompletely, releasing carbon monoxide, particulate matter, volatile organics, and sulphur dioxide (when sulphur is present in fuel). A 2023 study in Ado-Ekiti measured Suspended Particulate Matter (SPM) from various power generating sets. The SPM concentrations ranged from about 1,413 to 5,300 µg/m³, with an average around 2,913 µg/m³- far above the Nigeria Ambient Air Quality Standard (250 µg/m³) and WHO guidelines (50

Development, Review of Environmental Legislations in Nigeria: Case Study of EIA Act, Nosdra Act, NESREA Act, EGASPIN Regulation and HYPREP Gazette (CEHRD 2020); Odeyingbo, O A, Deubzer O K. and Ogunmokun O A, 'Assessment of the Impact of the Revised National E-Waste Framework on the Informal E-Waste Sector of Nigeria' (2025) 10(3) Recycling 117.

[8] NESREA identifies challenges against effective environmental programme implementation (9 December 2021) <https://sustainableeconomyng.com/nesrea-identifies-challenges-against-effective-environmental-programme-implementation/> accessed 12 September 2025.

[9] Echendu, A J, Okafor H F and Iyiola O, 'Air Pollution, Climate Change and Ecosystem Health in the Niger Delta' (2022) 11(11) Social Sciences 525; Onyeka Virginia Ekunke and others, 'Advancements in Low-Emission Refining Technologies for Petroleum Products in Nigeria' (2024) 10(9) Path of Science 3007-3014.

µg/m³).[10] Another report by the World Bank on diesel generator usage in Nigeria highlights how PM from generators-including black carbon from incomplete combustion contributes substantially to local health burdens, especially in dense urban areas like Lagos and Abuja.[11]

Manufacturing sectors-cement, steel, soap/detergent factories, pharmaceuticals-also burn fuels or use heat intensive processes, producing emissions. Cement plants in southern Nigeria (South-South region) have been shown to affect "dry atmospheric chemistry," contributing to elevated levels of particulate matter and gaseous pollutants near their operations.[12] A study in the industrial area of the Niger-Delta region constructed an emission inventory, finding that industries contributed large daily amounts of SO_x, NO_x, CO_2, and total suspended particulates (TSP). For example, the industrial sector in that area contributed about 8,727 kg/day of SO_x, and 5,549 kg/day of TSP.[13] In Rivers State, at a fertilizer/chemical plant (Notore Chemical Industries), research has examined trends in SO_2 emissions and the potential for abatement, showing that such sectors are non-trivial contributors to local and regional SO_2 burdens.[14] Indoor air pollution from generators, cooking with solid fuels, kerosene, etc., is also significant. For example, a study in Nsukka, Enugu State, showed that a large proportion of households (71%) operate power generators. Also, kitchen, living, and bedroom indoor levels of NO_2, SO_2, and O_3 were measured and found to be influenced by generator use and unstable electricity supply.[15]

Artisanal refining in the Niger-Delta and the use of refined fuels of low quality add to SO_2, NO_x, HC, and CO emissions beyond what regulations permit. Indoor and ambient concentrations of air pollutants around generator-heavy areas frequently exceed Nigerian and WHO standards, posing significant public health risks, particularly respiratory and cardiovascular disease. Recent studies (2021-2025) document very high particulate emissions from generators, elevated SO_2 from chemical plants, and over-limit CO/HC from artisanal fuel combustion.[16] In the Niger-Delta region in particular, artisanal refining of crude oil and the use of "home-refined" or low-quality gasoline/petroleum products contribute to high pollutant emissions. A 2024 study found that when this artisanal gasoline is burned, emissions of hydrocarbons (HC) and CO were well above allowable limits. SO_2 and NO_x were within some national limits, but still in breach of stricter WHO, World Bank or EGASPIN (Environmental Guidelines) thresholds.[17]

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[10] Kolawole M O, Omole O O and Adesina O A, 'Assessment of Suspended Particulate Matter (SPM) and Toxicity Potential (TP) of Emissions from Different Power Generating Sets in Ado-Ekiti, Nigeria' (2023) 6(2) ABUAD Journal of Engineering Research and Development (AJERD) 50-56.

[11] Alex Abutu, 'Pollution from generator increases risk of premature death' *Daily Trust* (27 August 2014) <https://dailytrust.com/pollution-from-generator-increases-risk-of-premature-death/> accessed 13 September 2025.

[12] Nwogu F U and others, 'Effect of cement production processes on dry atmospheric chemistry in South-South Nigeria' (2025) 37 Environ Sci Eur 90.

[13] Ezeh G and others, 'Emission Inventory of Tsp, Sox, Nox and Co2 in an Industrial Area of Niger-Delta, Nigeria' (2020) 36(1) EQA-International Journal of Environmental Quality 1-7.

[14] Okeoma T F and others, 'Study and Analysis of Abatement of Sulphur (Iv) Oxide Emission in a Chemical Plant in Rivers State Nigeria, A Case Study of Notore Chemical Industries' (2023) 5(3) Journal of Energy Technology and Environment 73-87.

[15] Kevin Emeka Agbo and others, 'Household indoor concentration levels of NO2, SO2 and O3 in Nsukka, Nigeria' (2021) 244 Atmospheric Environment 117978.

[16] Oyewale B O and others, 'Investigation of the pollutant load of artisanal-refined gasoline in the Niger Delta region of Nigeria and its implications on air quality' (2024) 2 Discov Atmos 3; Omokpariola, Nduka and Omokpariola (n 4).

[17] Oyewale B O and others, ibid.

2.2 Automobile Emissions

Automobile emissions are a dominant and growing source of urban air pollution, driven by a combination of fuel combustion chemistry, vehicle fleet composition, traffic dynamics and inadequate regulatory controls. Combustion in internal-combustion engines produces primary pollutants-fine particulate matter ($PM_{2.5}$ and PM_{10}), nitrogen oxides (NO_x), carbon monoxide (CO), sulphur oxides (SO_x) and volatile organic compounds (VOCs)-which directly degrade air quality and form secondary pollutants such as ozone and secondary organic aerosols.[18] The fossil fuel cars we drive pollute the air with the nitrogen oxides they emit from their exhaust pipes.[19] The pollution from the road transport industry is increasing due to the rise in per capita vehicle ownership and high congestion of vehicles on city roads. The rapid increase in the number of vehicles on Nigerian roads has exacerbated air pollution issues. The emissions from cars, trucks and motorcycles contribute substantial amounts of pollutants.[20]

Fleet age and technology are key causes. In many low- and middle-income cities, including major Nigerian metropolises, a large share of vehicles are older, poorly maintained, or equipped with outdated emission controls; such vehicles emit disproportionately higher levels of PM, NO_x and VOCs per kilometre than modern, regulated fleets. Studies in Lagos show that vehicle engine characteristics and the prevalence of aged vehicles are closely associated with roadside pollutant peaks.[21] For example, a WHO study in 2007 indicated a growing trend in vehicular-derived air pollution in Lagos due to traffic volume comprising of 2-strokc engines motorcycles (which have higher emissions of particulate matter and un-burnt hydrocarbons than other types of engines) and old imported vehicles.[22]

Fuel quality and the widespread use of high-sulfur or adulterated fuels amplify emissions. Poor fuel standards increase SO_x and particulate emissions and accelerate catalyst failure, reducing the effectiveness of emission-control systems. In contexts where low-quality diesel and gasoline remain common, transport becomes a persistent source of toxic airborne compounds.[23] Traffic congestion, stop-start driving and high vehicle kilometres travelled (VKT) are proximate operational causes. Congested urban corridors cause engines to operate inefficiently (idling, acceleration and braking cycles), which increases fuel consumption and pollutant emission rates per trip. Roadside monitoring campaigns repeatedly identify traffic hotspots as locations of elevated $PM_{2.5}$, NO_2 and black carbon.[24] Non-exhaust sources-brake wear, tyre abrasion and road surface resuspension-are increasingly recognized contributors to traffic-related PM loadings. These solid particle sources can rival exhaust PM in some urban

[18] Air pollution <https://www.who.int/teams/environment-climate-change-and-health/healthy-urban-environments/transport/health-risks> accessed 13 September 2025.
[19] J O Ezeanokwasa, 'Legal Regulations on Air Pollution Control and Industrialisation in Nigeria' (2018) 1(1) UNIZIK Journal of Business 106.
[20] O Nengimote and I F Ikoedem, 'Air Pollution Control under Nigerian Law: Issues and Challenges' (2023) 11(1) AELN Journal of Environment & Natural Resources Law 54.
[21] Ajayi S A and others, 'The Impact of Vehicle Engine Characteristics on Vehicle Exhaust Emissions for Transport Modes in Lagos City' (2024) 12(1) Urban, Planning and Transport Research 2319328.
[22] L I Nwokike, 'Comparative Analysis of the Legal Framework against Air Pollution in Nigeria and India' (2021) 2 IJOLACLE 61.
[23] Joseph Akpokodje, 'Air Quality Management Planning for Lagos State (World Bank 2022).
[24] Arter C A and others, 'Air pollution benefits from reduced on-road activity due to COVID-19 in the United States' (2024) 3(1) PNAS Nexus 17.

settings and are not reduced by cleaner tailpipe technologies unless vehicle mass and driving behaviour change.[25]

2.3 Industries and Factories

Industrial and factory activities are a major and growing source of ambient air pollution in Nigeria. The petroleum sector (refining, flaring and fuel storage) emits large quantities of SO_2, NO_x, volatile organic compounds (VOCs) and fine particulate matter ($PM_{2.5}$). Gas flaring and refinery fugitive emissions in the Niger Delta and around industrial terminals produce persistent plumes of pollutants that elevate local PM and sulfur oxide concentrations and form secondary pollutants (e.g., ozone and secondary PM).[26] Almost every industrial activity exudes pollutants into the air.[27] Heavy metals such as zinc, cadmium, lead, iron and mercury are common air pollutants emitted mainly from various industrial activities.[28] Heavy industry-cement manufacture, asphalt and bitumen works, metal smelting and foundries-contributes directly to high PM_{10}/$PM_{2.5}$ and metal-rich particulates via combustion, raw-material grinding and high-temperature processing. Studies near Nigerian cement plants and manufacturing zones document elevated respirable particulates and toxic metals in downwind communities, implicating point-source industrial emissions and inadequate dust control.[29]

Many factories and industrial estates rely on diesel or heavy-fuel backup generators and inefficient boilers. Frequent use of these on-site generators combined with widely available high-sulfur fuels-raises local emissions of black carbon, CO and SO_2, worsening urban air quality in industrial districts. The prevalence of small, high-emission generators across industry and commerce is repeatedly identified as an important source of urban $PM_{2.5}$.[30] Lack of emissions abatement technology and weak compliance exacerbate the problem. A substantial fraction of Nigerian industries operate without end-of-pipe controls, electrostatic precipitators or baghouses; in some urban areas fewer than 10% of industries have proper treatment facilities, allowing untreated stack and fugitive emissions to reach communities. Poor enforcement of ambient and point-source standards and limited continuous monitoring mean many industrial sources go unchecked.[31] Additionally, industrial activity at ports, shipyards and large logistics hubs (container terminals, oil terminals) adds diesel-engine exhaust and particulate emissions to adjacent urban populations; combined with open burning of industrial

[25] Julia C Fussell and others, 'A Review of Road Traffic-Derived Non-Exhaust Particles: Emissions, Physicochemical Characteristics, Health Risks, and Mitigation Measures' (2022) 56(11) Environ. Sci. Technol. 6813-6835.
[26] M A Lala and others, 'Particulate matters pollution in selected areas of Nigeria: Spatial analysis and risk assessment' (2023) 7 Case Studies in Chemical and Environmental Engineering 100288.
[27] S H Paul and others, 'Air Quality: Legislation and Advocacy in Nigeria' in A B Rabiu and O E Abiye (eds.), *Monograph of Atmospheric Research 2018* (Centre for Atmospheric Research, Anyigba, Nigeria 2018) 130.
[28] A G Benibo, 'Assessment of Ambient Air Quality around Ihetutu Minefield, Ishiagu, Nigeria' (2020) 45(6) J. Chem. Soc. Nigeria 1203.
[29] Awos A and others, 'Monitoring of Air Quality for Particulate Matter ($PM_{2.5}$, PM_{10}) and Heavy Metals Proximate to a Cement Factory in Ewekoro, Nigeria' (2024) 12 Journal of Geoscience and Environment Protection 152-180.
[30] Lagos and Air Pollution <https://www.cleanairfund.org/clean-air-africas-cities/lagos/> accessed 13 September 2025.
[31] ibid.

and commercial waste at or near industrial sites, these activities create mixed plumes of particulate and gaseous pollutants that are hard to control.[32]

2.4 Bush Burning and Use of Fuel Wood

Bush burning remains widespread in Nigeria and is a major contributor to air pollution, particularly during the dry season. Across many parts of the country, the indiscriminate burning of vegetation, grasslands, and forests is regularly observed. Nigeria has reported tens of thousands of "fire alerts" in recent years associated with these open burns, which exacerbate land cover loss and worsen air quality.[33] Farmers often cite several reasons for practicing bush burning: to clear farmland for planting, to improve soil fertility via ash deposition, to facilitate easier tilling/weeding, to control pests and diseases, and to encourage fresh pasture growth for grazing livestock.[34] Bush burning emits a variety of pollutants harmful to both the environment and human health. Among them are: particulate matter (PM), including fine $PM_{2.5}$ and PM_{10}, carbon monoxide (CO), carbon dioxide (CO_2), oxides of nitrogen (NO_x), sulfur dioxide (SO_2), volatile organic compounds (VOCs), and polycyclic aromatic hydrocarbons (PAHs). These pollutants contribute to reduced visibility, respiratory illnesses, cardiovascular problems, and climate change due to greenhouse gas emissions.[35]

In many urban and rural areas of Nigeria, the use of fuel wood (and other biomass fuels) for cooking and heating remains the norm. Because reliable and affordable alternatives are often unavailable, households, small commercial operations (e.g. bakeries, restaurants), and small-scale industries frequently depend on firewood or charcoal.[36] The combustion of firewood and similar biomass in poorly ventilated settings leads to indoor air pollution. Studies in Nigeria have shown elevated levels of pollutants in rural kitchens using firewood, including: One, high concentrations of CO, SO_2, and hydrogen sulfide (H_2S) in firewood-based cooking compared with charcoal in rural kitchens.[37] Second, emissions of $PM_{2.5}$ and PM_{10} that often exceed WHO guideline limits, especially during the dry season or periods of intense biomass

[32] ibid.

[33] Atlai Country Profile: Nigeria <https://c/68c63b88-4738-8332-8b22-843691ff734f> accessed 14 September 2025; B A Ambe, I E Eja and C E Agbor, 'Assessment of the Impacts and People's Perception of Bush Burning on the Grasslands and Montane Ecosystems of the Obanliku Hills/Plateau, Cross River State' (2015) 5(6) Nigeria. J. Nat. Sci. Res. 12-20; O I Asubiojo, 'Pollution Sources in the Nigerian Environment and their Health Implications' (2016) 18(4) Ife J. Sci. 973-980.

[34] Efobi Uchenna, 'Changing attitudes through information exposure: Experimental evidence on reducing agricultural burning in rural Nigeria' (2024) 55(5) Agricultural Economics: The Journal of the International Association of Agricultural Economics 714-738.

[35] ibid; B S Fakinle and others, 'An Estimation of a Trace Gaseous Emission Factor from Combustion of Common Fuelwood Species in South-Western Nigeria' (2017) 39(12) Energy Sources Part A: Recov. Util. Environ. Eff. 1298-1306.

[36] Łaska G and Ige A R, 'A Review: Assessment of Domestic Solid Fuel Sources in Nigeria' (2023) 16(2) Energies 4722; S I Ladan, 'Examining Air Pollution and Control Measures in Urban Centers of Nigeria' (2013) 4(6) International Journal of Environmental Engineering and Management 623.

[37] Adah A J, Daniel T and Akpaso D U, 'Estimation of Indoor Air Pollutants and Health Implications Due to Biomass Burning in Rural Household Kitchens in Jos, Plateau State, Nigeria' (2023) 27(1) Environmental Sciences Proceedings 29; O S Ukemenam, 'Causes and Consequences of Air Pollution in Nigeria: A Case' (2014) 2(2) South American Journal of Public Health 300.

burning.[38] Indoor air pollution of this kind disproportionately affects women and children, who spend more time near cooking fires.[39]

3. Effects of Air Pollution in Nigeria

This section examines three major effects of air pollution in Nigeria. They are sicknesses and death, climate change, and acid rain.

3.1 Sicknesses and Death

Air pollution in Nigeria causes a large and growing burden of sickness and premature death, driven by outdoor sources (vehicular traffic, industry, waste and crop open burning, dust) and indoor sources (household use of firewood, charcoal and kerosene). Short- and long-term exposure to fine particulate matter ($PM_{2.5}$), ozone and combustion-related gases increases risks for respiratory infections, chronic respiratory disease, lung cancer, stroke, ischemic heart disease and adverse neonatal outcomes-producing both acute episodes (e.g., asthma attacks, pneumonia) and chronic conditions (e.g., COPD, ischemic heart disease).[40] Quantitative estimates highlight the scale of the problem in Nigeria's cities. The World Bank's 2020 analysis of Lagos State of Nigeria estimated 16,000-30,000 premature deaths attributable to ambient fine particulate matter ($PM_{2.5}$) air pollution with about half of these being infants under 1 year. The report placed Lagos city's annual health-related economic losses in the billions of dollars.[41]

In addition, exposure to $PM_{2.5}$ causes an estimated 180,000-350,000 cases of acute lower respiratory infections (ALRI) annually in Lagos, especially pneumonia in children under five.[42] Children under five bear a large share of the burden, reflecting high susceptibility to ALRI (acute lower respiratory infection) from both household and outdoor pollution.[43] During periods of seasonal dust/harmattan, PM_{10} exposure adds to mortality: an estimated 250-500 extra deaths per year have been attributed to PM_{10} during the Harmattan in Lagos.[44] Lagos' population-weighted $PM_{2.5}$ concentration has been measured around 47 µg/m³, much higher than WHO guidelines.[45] Outside of Lagos, national estimates show that Nigeria could avoid a large number of deaths if its air quality improved.[46]

Household air pollution from cooking with solid fuels remains a major driver of respiratory illness and early death across Nigeria. The WHO estimates that household air

[38] Lelei Ke and Angaye T C N, 'Health Risk Assessment of Airborne Particulate Matter Emissions from Uncontrolled Garri Processing Kilns In Bayelsa State, Nigeria' (2025) 13(1) Greener Journal of Environment Management and Public Safety 19-27.
[39] Adah, Daniel and Akpaso (n 37).
[40] WHO, Household air pollution: Fact Sheets (16 October 2024) <https://www.who.int/news-room/fact-sheets/detail/household-air-pollution-and-health> accessed 14 September 2025.
[41] Croitoru Lelia, Chang Jiyoun Christina and Kelly Andrew, The Cost of Air Pollution in Lagos (World Bank 2020).
[42] Chukwuemeka Ayomide, 'Lagos losing $5.8 billion yearly to air pollution: World Bank' *Peoples Gazette* (13 September 2022) <https://gazettengr.com/lagos-losing-5-8-billion-yearly-to-air-pollution-world-bank/> accessed 14 September 2025.
[43] ibid.
[44] Joseph V Spadaro and others (n 1); Akpokodje (n 18) xvi.
[45] ibid.
[46] Climate and Clean Air Coalition, Nigeria Aims for Methane Cuts, Potentially Averting 300,000 Air Pollution Deaths Every Year (10 May 2024) <https://www.ccacoalition.org/news/nigeria-aims-methane-cuts-potentially-averting-30000-air-pollution-deaths-every-year-0> accessed 14 September 2025.

pollution caused millions of deaths globally and continues to contribute substantially to childhood pneumonia and chronic disease. Nigeria's extensive reliance on biomass for cooking means many households, especially, in rural areas and low-income urban settlements face high indoor $PM_{2.5}$ exposures and elevated risks of ALRI, COPD and low-birth-weight births.[47] Recent Nigerian monitoring and modelling studies show persistently high PM concentrations in many urban centres. Regional measurements and trend analyses (2020–2024) document seasonal peaks (including Harmattan dust episodes) and frequent exceedances of WHO air quality guidelines, which translate into increased emergency visits for respiratory and cardiovascular events and higher population-level mortality.[48]

A 2021 WHO report estimates that outdoor air pollution contributes to approximately 150,000 premature deaths in Nigeria annually, emphasizing the health risks associated with poor air quality. Poor air quality can have detrimental effects on public health, contributing to respiratory diseases and other health issues.[49] As note earlier, children are particularly affected: recent global reports and regional analyses estimate that thousands of young children die each year from pollution-related respiratory infections, and that air pollution contributes substantially to years of life lost and disability in Nigeria.[50]

3.2 Climate Change

In Nigeria, air pollution and climate change (CC) are deeply intertwined. Many of the same sources that degrade air quality-gas flaring, open burning, emissions from fossil fuel-powered transport and industries, inefficient household energy use-are also significant contributors to greenhouse gas (GHG) emissions and short-lived climate pollutants (SLCPs), creating a two-fold burden: damage to health via air pollution, and climate warming via GHGs and SLCPs.[51] Major pollutants linking air pollution & climate change in Nigeria are gas flaring, short-lived climate pollutants (SLCPs), and agriculture and open burning.[52] Gas flaring in Nigeria's oil and gas sector remains a central issue. Gas flaring emits large quantities of CO_2, methane (CH_4), black carbon (BC), sulfur oxides, and nitrogen oxides. Methane is a potent greenhouse gas; black carbon is a component of fine particulate matter ($PM_{2.5}$) that strongly warms the atmosphere, especially by absorbing sunlight and reducing surface albedo (e.g. when deposited on snow or ice). These pollutants drive both climate change and local air quality degradation.

[47] WHO, Household air pollution (n 40).
[48] M A Lala and other (n 26).
[49] Kareem Musiliu Iyanda and Rotimi Williams Olatunji, 'Analyzing Barriers to Sustainable Development Goal Implementation in Nigeria: A Multidimensional Assessment of Challenges and Opportunities' (2024) 4(5) Int. j. adv. multidisc. res. stud. 433; World Health Organization (WHO), Nigeria: Health Profile 2021 <https://www.who.int/nigeria> accessed 10 September 2025.
[50] Fiona Harvey, 'Almost 2,000 children die every day from air pollution, report finds' *The Guardian* (18 June 2024) <https://www.theguardian.com/environment/article/2024/jun/18/almost-2000-children-die-every-day-from-air-pollution-report-finds> accessed 14 September 2025.
[51] See A J Echendu, H F Okafor and O l Iyiola, 'Air Pollution, Climate Change and Ecosystem Health in the Niger Delta' (2022) 11 Social Sciences 525; Air Pollution and Your Health <https://www.niehs.nih.gov/health/topics/agents/air-pollution> accessed 13 February 2025; Climate and Air Pollution <https://www.cleanairfund.org/theme/climate/> accessed 12 February 2025..
[52] Echendu, Okafor and Iyiola ibid.

Recent reports note Nigeria flares large volumes of gas each year; this is not only a source of wasted economic value (billions of dollars' worth of gas lost), but also of harmful emissions.[53]

Short-Lived Climate Pollutants (SLCPs) such as methane, black carbon, tropospheric ozone precursors, and hydrofluorocarbons are of particular concern. SLCPs have relatively short lifetimes in the atmosphere compared to CO_2, but many have much higher per-molecule warming potentials.[54] The presence of SLCPs such as black carbon and methane accelerates climate warming, which can in turn worsen air quality. For example, higher temperatures increase the formation of ground-level ozone, intensify wildfires or biomass burning, and dry out soils, increasing dust. These feedbacks can amplify both climate impacts such as heat waves and extreme precipitation, and air pollution health burdens (respiratory, cardiovascular disease, etc.).[55] Thus, the reduction of SLCPs can yield relatively rapid climate and health benefits.

Also, agriculture and open burning contribute significantly both to air pollution and climate change. Open field burning of agricultural residues produces black carbon, CO_2, methane, and other pollutants, worsening local air quality and contributing to climate warming.[56] Rising CO_2, increased temperatures, shifting rainfall patterns, and episodic heat stress have begun to reduce crop yields in Nigeria. A study in 2022 showed carbon emissions and their intensity negatively affect agricultural productivity in Nigeria, undermining food production, which in turn threatens food security.[57] The warming effects of black carbon (e.g. from soot deposition) can also affect local microclimates, potentially altering growing seasons. Smoke from burning can reduce solar radiation reaching crops, reducing photosynthesis.[58] Together, these effects make agriculture more vulnerable to both air pollution and climate change.

3.3 Acid Rain

Acid rain-precipitation (rain, dew, mist) with elevated acidity-is an under-recognized but real consequence of Nigeria's air pollution profile. The primary chemical drivers are sulfur dioxide (SO_2) and nitrogen oxides (NO_x), which are emitted from gas flaring, oil and gas operations, power plants, cement and other heavy industry, diesel transport, and some forms of biomass and waste burning.[59] In the atmosphere these gases oxidize to form sulfuric and nitric acids; those acids and their particulate derivatives (sulfates and nitrates) return to the surface in wet

[53] Feyisayo Ajayi, 'Rethinking Gas Flaring: Turning Waste into Wealth for Nigeria's Energy Future' *Energy News Africa Plus* (20 January 2025) <https://energynews.africa/2025/01/20/rethinking-gas-flaring-turning-waste -into-wealth-for-nigerias-energy-future/> accessed 14 September 2025.

[54] Climate and Clean Air Coalition, Nigeria - National Planning on Short-lived Climate Pollutants 2015-2020 <https://www.ccacoalition.org/projects/nigeria-national-planning-short-lived-climate-pollutants> accessed 14 September 2025.

[55] See Sampedro J and others, 'Marginal Damage of Methane Emissions: Ozone Impacts on Agriculture' (2023) 84(4) Environ Resour Econ 1095-1126.

[56] Climate and Clean Air Coalition, Nigeria - Abatement of Short-Lived Climate Pollutants (SLCPs) in the Nigerian Agricultural Sector by Reducing Open Field Burning (No Burn Alternatives) 2023-2026 <https://www.ccacoalition.org/projects/nigeria-abatement-short-lived-climate-pollutants-slcps-nigerian-agricultural-sector-reducing-open-field-burning-no-burn-alternatives> accessed 14 September 2025.

[57] Amaefule C and others, 'Carbon emissions, climate change, and Nigeria's agricultural productivity' (2023) 7(1) European Journal of Sustainable Development Research em0206.

[58] Riches M J and others, 'Wildfire smoke directly changes biogenic volatile organic emissions and photosynthesis of ponderosa pines' (2024) 51(6) Geophysical Research Letters e2023GL 106667.

[59] Ubuoh E A, Nwogu F U and Osuagwu E C, 'Wet deposition chemistry and neutralization potential in oil producing region of southern Nigeria' (2021) 289 J Environ Manage. 112431.

and dry deposition, lowering pH in soils, freshwaters and on infrastructure.[60] In Nigeria the Niger Delta and other oil-producing zones are especially vulnerable because of persistent gas flaring and stack emissions. Recent assessments show that gas flaring continues to emit substantial volumes of SO_2, NO_x and other combustion products that can travel downwind and contribute to acidic deposition in surrounding ecosystems and settlements. Monitoring and modeling studies (2020-2024) document episodic spikes in SO_2 and NO_2 over oilfields and urban/industrial corridors, raising the risk of acidifying deposition during rainy periods and harm to sensitive environments.[61]

Ecological impacts of acid rain in Nigeria follow the classic pathways observed globally. Acid deposition mobilizes and leaches essential base cations such as calcium (Ca^{2+}), magnesium (Mg^{2+}) and potassium (K^{+}) from soils, reducing fertility and buffering capacity. This process can stunt crop growth, weaken trees, and increase aluminium (Al^{3+}) solubility to levels toxic to plant roots. Experimental and field studies on simulated acid rain and soil chemistry underline that base cation loss and pH decline reduce nutrient availability and alter microbial processes important for soil health-outcomes that matter for smallholder farms and fragile forest patches in Nigeria. Freshwater systems are also at risk. Acidic deposition reduces lake and stream pH, mobilizes heavy metals, and disrupts aquatic biodiversity. Local surveys and case studies (including urban centers such as Warri) have documented episodes of low-pH rainfall and rainwater chemistry consistent with elevated SO_2/NO_x inputs, accompanied by reports of vegetation damage and altered water quality near industrialized zones. These observations suggest that acidifying deposition is already affecting some Nigerian watersheds and coastal wetlands.[62]

Additionally, infrastructure and cultural heritage are vulnerable to acid rain in Nigeria's humid tropical climate. Acidic precipitation accelerates corrosion of metal, erosion of calcareous stone and concrete, and damage to traditional building materials used in many historic sites and vernacular structures. Conservation studies on Nigerian heritage buildings show that increased rainfall intensity combined with pollutant exposure shortens the service life of historic fabric and raises maintenance costs for museums and monuments.[63]

4. Air Pollution Control in Nigeria Under the NESREA Act, 2007

This section examines air pollution control in Nigeria under the NESREA Act, 2007. Section 4.1 examines the establishment and powers of the NESREA to make regulations on environmental pollution control in Nigeria. While section 4.2 examines Air Pollution control in Nigeria through NESREA Regulations.

[60] Ukhurebor K E and others, 'Environmental Influence of Gas Flaring: Perspective from the Niger Delta Region of Nigeria' (2024) Geofluids 1-17.
[61] ibid.
[62] Onuoha T and others, 'Acid Rain and its Environmental Impact on Warri Municipal City' (2023) 2(1) Acta Biology Forum 19-22.
[63] Mela I and Cao Y, 'The Impact of Rainfall on The Conservation of Traditional Nigerian Heritage Buildings: A Case Study of The Museum of Traditional Nigerian Architecture (MOTNA), Jos' (2023) XII(I) PM World Journal 1-23.

4.1 Establishment and Powers of the NESREA to Make Regulations on Environmental Pollution Control in Nigeria

The National Environmental Standards and Regulations Enforcement Agency (NESREA) was established in 2007 under the NESREA Act as Nigeria's foremost environmental regulatory authority. Its mandate is to protect the environment, conserve biodiversity, and promote the sustainable use of natural resources while ensuring compliance with national environmental laws.[64] Section 2 of the Act entrusts NESREA with responsibilities such as environmental development, biodiversity conservation, and coordination with both local and international stakeholders on enforcement of environmental standards, regulations, rules, and policies.[65] This section empowers the Agency to act decisively for the environmental good of the nation by ensuring sustainability through strict enforcement of compliance mechanisms.[66]

To effectively carry out its mandate, Section 8(k) of the Act empowers NESREA to make regulations concerning environmental exploitation and protection in a holistic sense, including specific mention of air quality and pollution control. Section 8(k)(ii) provides that the Agency may submit proposals for the approval of the Minister on the evolution and review of environmental guidelines and standards in areas outside the oil and gas sector, such as air quality regulation.[67] Section 34 further strengthens this framework by empowering the Minister to make regulations for giving full effect to NESREA's statutory functions.[68] Additionally, Section 20 of the Act explicitly empowers the Agency to make regulations setting specifications and standards to safeguard Nigeria's air resources, thereby protecting public health, welfare, and the productivity of human, animal, marine, and plant life. These provisions authorize NESREA to set minimum air quality standards, regulate hazardous air concentrations, combat atmospheric pollution from industries, factories, power plants, and vehicles including aircraft and to establish monitoring stations for identifying pollution sources and assessing their risks.[69] Section 27 of the Act goes further by criminalizing the discharge of hazardous substances in harmful quantities into Nigeria's air unless authorized under an existing law.[70]

Since its inception, NESREA has developed thirty-five (35) environmental regulations, published in the Federal Republic of Nigeria's Official Gazette, several of which address air pollution. These regulations are instrumental in guiding businesses and industrial operators to

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[64] NESREA Act 2007, s.1; See Felicia A Anyogu and Empire H Nyekwere, 'Appraisal of the Legal and Institutional Framework for Sustainable Environmental Management in Nigeria' (2020-2021) 16 The Nigerian Juridical Review 167.

[65] NESREA Act, s.2; Agbo F O, 'Examining the legal implications of air pollution stemming from Nigeria's environmental governance framework' (2025) 16(1) Nnamdi Azikiwe University Journal of International Law and Jurisprudence 1-18.

[66] F O Ugbaja, Regulation of Environmental Pollution in the Nigerian Oil and Gas Industry: The Need for an Alternative Approach (Master's Thesis, Faculty of Law, University of Calgary, Alberta, Canada 2016) 56; See Anyogu and Nyekwere (n 64) 167.

[67] See NESREA Act, s.8(k); Lauretta D A, 'Examination of the legal framework for environmental regulation in Nigeria: Insights on the 2021 Air Quality Control Regulations' (2024) 5(2) African Journal of Law, Environment and Energy 45-63.

[68] NESREA Act, 34(c).

[69] NESREA Act, s.20(1)&(2); Kehinde A O, Osadola I O and Awonuga A, 'Reflection on Nigeria's air pollution regulations with a view to learning from the European Union' (2023) 69 Iuridica - International Journal of Legal Studies 105-118.

[70] NESREA Act, s.27(1).

adopt environmentally sustainable practices and comply with statutory standards. For instance, recent studies have highlighted the urgent need for stricter enforcement of vehicular emission standards, given the high concentration of pollutants recorded in Lagos, Abuja, Port Harcourt and other cities.[71] Similarly, field studies near cement factories revealed dangerous levels of respirable particulate matter and heavy metals, often exceeding NESREA and World Health Organization (WHO) thresholds.[72] Such findings underline the necessity of robust air quality regulation and the importance of NESREA's enforcement role. By integrating these legal frameworks with scientific evidence, NESREA plays a critical role in ensuring environmental sustainability and reducing the public health risks associated with air pollution in Nigeria.

4.2 Controlling Air Pollution in Nigeria through NESREA Regulations

In furtherance to the provisions of sections 20 and 27 of the NESREA Act which empower the Agency to regulate and criminalize air pollution in Nigeria. NESREA has enacted five air quality regulations aimed at ensuring environmentally friendly domestic and industrial practices, thereby preventing air pollution and protecting Nigeria's atmospheric environment. This section examines these regulations.

4.2.1 National Environmental (Air Quality Control) Regulations 2021 (Amended)[73]

Pursuant to Sections 20(1) and 34 of the NESREA Act, this Regulation is enacted to strengthen the governance of air quality nationwide with the aim of safeguarding flora and fauna, public health, and other environmental resources from the deleterious effects of air pollution.[74] The fundamental objective is to secure for all persons the right to breathe clean air.[75] This Regulation establishes ambient air quality benchmarks, industrial and vehicular emission limits, and a permitting system for entities that generate or emit airborne pollutants.[76] It mandates compliance with concentration thresholds for industrial discharges, fuel-burning equipment, and other emission sources as specified in Schedules III through VI.[77] In particular, Part VI delineates Ambient Air Quality Standards (AAQS), prescribing maximum permissible levels of nitrogen dioxide (NO_2), sulphur dioxide (SO_2), carbon monoxide (CO), particulate matter ($PM_{2.5}$, PM_{10}), and other major pollutants.[78]

Operators of industrial infrastructure are required to install or retrofit air pollution control devices so as to conform with national emission standards. For newly installed or newly commissioned equipment, such technologies must be in place prior to operation; existing facilities shall upgrade as necessary to meet the prescribed emission levels within a stipulated compliance period.[79] NESREA is empowered to conduct inspections and where violations are detected, to enter and seal offending premises. Any person found in breach of the Regulation

[71] Ezeigwe N M and others, 'Characterization and quantification of vehicular emissions in Abuja municipality, Nigeria' (2024) 22(3) Journal of Environmental Health Science & Engineering 211-226.
[72] Awos A and others, 'Assessment of respirable particulate matter and heavy metal pollution near a cement factory in Nigeria' (2024) 15(7) Journal of Environmental Protection 503-518.
[73] The National Environmental (Air Quality Control) Regulations S. I. No. 88, 2021.
[74] ibid, Regulation 1(a); See S A Fagbemi, 'Right to Clean and Unpolluted Air in Nigeria' (2020) 4(1) AJLHR 67.
[75] ibd, Regulation 1(b).
[76] ibid, Regulation 39.
[77] ibid, Regulation 6.
[78] ibid, Regulations 32 & 33.
[79] ibid, Regulation 10.

is liable, upon conviction, to a minimum fine of ₦100,000, imprisonment for a minimum of six months, or both; additionally, a daily fine of at least ₦10,000 accrues for each day the offence continues.[80] Corporations committing offences are subject to a minimum fine of ₦1,000,000, with a daily penalty of ₦50,000 for duration of non-compliance.[81]

Recent empirical studies in Nigeria underscore both the urgency and relevance of this Regulation. A 2024 study of short-term trends of air pollutant concentrations (NO_2, SO_2, CO, O_3, aerosol indices etc.) from 2018-2022 using satellite data (Sentinel-5P and 3A/B) revealed elevated levels of several airborne contaminants, showing that ambient concentrations remain above safe thresholds in many locales.[82] In 2025, research in Ibadan measured fine particulate matter ($PM_{2.5}$) indoors and outdoors using low-cost sensors and found exposures that exceed health-based guideline values, highlighting the pervasive risk even in residential settings.[83] Moreover, case studies such as the assessment of particulate pollution in industrial areas of Eleme in Rivers State (2024) reveal that $PM_{2.5}$ concentrations regularly exceed NESREA limits, reinforcing the necessity of strict emission controls, effective monitoring, and technological mitigation.[84]

4.2.2 National Environmental (Ozone Layer Protection and Hydrofluorocarbons Phase Down) Regulations 2022[85]

This Regulation was promulgated to control compounds capable of depleting the ozone layer by restricting the importation, manufacture, sale, installation, and use of ozone depleting substances (ODS) and hydrofluorocarbons (HFCs).[86] Such restrictions are consistent with Nigeria's international commitments under the Montreal Protocol and its subsequent Kigali Amendment, which require progressive phase-down of ODS and HFC consumption.[87] In accordance with the Regulation, no individual or corporation may import, manufacture, install, offer for sale, or purchase any new or refurbished facilities or equipment designed for the production or use of ODS or HFC refrigerants, except in cases involving substances that have been previously recovered and recycled.[88] This provision reflects national targets of a 67.5 % reduction in hydrochlorofluorocarbon (HCFC) baseline consumption by 2025, in line with Nigeria's phase-out schedules.[89]

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[80] ibid, Regulation 40(a).
[81] ibid, Regulation 40(b).
[82] Omokpariola D O, Nduka J N and Omokpariola P L, 'Short-term trends of air quality and pollutant concentrations in Nigeria from 2018–2022 using tropospheric sentinel-5P and 3A/B satellite data' (2024) 6 Discov Appl Sci 182.
[83] Shittu A I and others, 'Quantifying Residential Particulate Pollution and Human Exposure in Ibadan, Nigeria, Using Low-Cost Sensors' (2025) 25(8) Aerosol Air Qual. Res. 1-14.
[84] Abubakar I A, 'Assessment of Particulate Matter in Industrial Area of Eleme Communities of Rivers State, Niger Delta, Nigeria' (2024) 9(5) Top Academic Journal of Environmental and Agricultural Sciences 1-16.
[85] The National Environmental (Ozone Layer Protection) Regulations S. I. No. 65, 2022 (hereinafter, Ozone Layer Protection Regulations).
[86] ibid, Regulation 21.
[87] Busola Aro, 'Minister: FG in stage three to phase-out ozone-depleting substances' *The Cable* (4 April 2024). <https://www.thecable.ng/minister-fg-in-stage-three-to-phase-out-ozone-depleting-substances/> accessed 9 September 2025.
[88] Ozone Layer Protection Regulations (n 85), Regulations 21, 22(1) & 5.
[89] Ajibola Adedoye, 'Nigeria targets 67.5 % reduction in HCFC baseline consumption by 2025' *EnviroNews* (5 April 2024) <https://www.environewsnigeria.com/nigeria-targets-67-5-reduction-in-hcfc-baseline-consumption -by-2025/> accessed 9 September 2025.

The Regulation also prohibits the handling, storage, or disposal of ODS and HFC refrigerants without a valid permit issued by NESREA. Only individuals who have (a) obtained the requisite permit, (b) successfully completed an authorised technical training course in ODS/HFC handling, storage, and safe disposal, or (c) been validated under an authorised code of practice, may legally engage in such activities.[90] This aligns with recent government-sponsored training programmes for refrigeration and air-conditioning technicians in Nigeria's South-South region to ensure safe practices during the phase-out of ODS.[91] Regulation 23 expressly prohibits the intentional release of ODS or HFCs into the atmosphere. This prohibition is supported by recent atmospheric monitoring studies, which show long-term variability of total column ozone over Nigeria and highlight the environmental risks of unregulated releases.[92]

Non-compliance with these provisions constitutes a criminal offence. Individuals are liable upon conviction to a maximum fine of ₦200,000, imprisonment for a term not exceeding one year, or both, with an additional daily fine of ₦20,000 for each day the offence persists.[93] For corporate entities, penalties include a maximum fine of ₦2,000,000 and an additional ₦200,000 for each day of continued violation.[94] These penalties reflect Nigeria's strengthened regulatory framework and commitment to achieving the 2040 complete phase-out target for hydrochlorofluorocarbons.[95]

4.2.3 National Environmental (Control of Vehicular Emissions from Petrol and Diesel Engines) Regulations 2011[96]

This Regulation was promulgated by the NESREA with the objective of enhancing, preserving, restoring, and improving ambient air quality in Nigeria. This Regulation seek to protect citizens' constitutional right to a clean and healthy environment by addressing emissions from motor vehicles, which remain a primary source of urban air pollution in the country.[97] The purpose of the Regulation is threefold: (i) to reduce vehicular contributions to air pollution, (ii) to improve the quality of vehicles operating on Nigerian roads, and (iii) to safeguard public health, particularly in densely populated urban areas where vehicular traffic is heaviest.[98] Importantly, the provisions apply only to vehicles registered after 28 April 2011, thereby exempting older vehicles from compliance obligations.

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[90] Ozone Layer Protection Regulations (n 85), Regulations 34(1), 6 & 11.
[91] Kelechi Nwaucha, 'Ozone depletion: Nigeria trains South South RAC technicians in push to phase out ozone-harmful substances' *BusinessDay* (19 August 2025) <https://businessday.ng/news/article/ozone-depletion-nigeria-trains-south-south-rac-technicians-in-push-to-phase-out-ozone-harmful-substances/> accessed 9 September 2025.
[92] Rabiu A B and others, 'Long-term variability study of total column ozone over Nigeria using multisensor reanalysis measurements' (2025) 3 Discovery Geoscience 75.
[93] ibid, Regulation 38(a)&(b).
[94] ibid, Regulation 38(c).
[95] Cynthia Alo, 'FG implementing phase-out plan of hydrochlorofluorocarbons by 2040 - Salako' *Vanguard News* (2024, April 8) <https://www.vanguardngr.com/2024/04/fg-implementing-phase-out-plan-of-hydrochlorofluorocarbons-by-2040-salako/> accessed 9 September 2025.
[96] The National Environmental (Control of Vehicular Emissions from Petrol and Diesel Engines) Regulation S. I. No. 20, 2011.
[97] ibid, Regulation 1(a); Enakireru E and Ekakitie O, 'Appraisal of the legal framework and regulation on automobile emissions: Nigeria perspectives' (2024) 4(3) Journal of Environmental Law & Policy 438-456.
[98] ibid, Regulation 1(b) & (c).

Part I of the Regulations addresses emissions from petrol engines. Specifically, Regulation 3 prohibits any person from installing or replacing the engine unit of a motor vehicle with a petrol engine that emits pollutants in excess of the standards prescribed under Schedule I.[99] Part II focuses on gaseous emissions from petrol engines, where Regulation 8 prohibits the emission of gaseous pollutants exceeding the limits outlined in Schedules I and III.[100] This Regulation also expressly prohibits visible exhaust smoke from petrol engines.[101] Part III extends these controls to diesel engines. Regulation 17 prohibits the installation or replacement of diesel engines in motor vehicles where emissions exceed the prescribed standards under Schedule VII.[102] The enforcement framework provides for both individual and corporate liability. An individual who violates these provisions is subject to a fine of ₦50,000, plus an additional ₦1,000 per day for the duration of the offence, or imprisonment for a term not exceeding one year.[103] Corporate organisations are liable to a fine of ₦500,000, plus ₦20,000 per day for the continuation of the offence.[104]

Recent empirical studies highlight the significance of this Regulation. For instance, Ezeigwe, Agbo and Mohammed[105] quantified vehicular emissions in Abuja and reported high concentrations of carbon monoxide (CO), nitrogen oxides (NOx), and particulate matter (PM), with severe implications for respiratory health.[106] Similarly, Oluwakoya, Yusuf and Nwachukwu[107] conducted a comprehensive assessment of transportation emissions in Nigeria, linking rising emissions to poor fuel quality, ageing vehicle fleets, and weak enforcement of existing standards.[108] Furthermore, public perception studies suggest that awareness of vehicular emission hazards remains limited. Research in Lagos found that compliance with emission regulations is strongly mediated by awareness campaigns and social attitudes towards air pollution.[109] These findings underscore the urgent need for effective vehicular emission controls. Therefore, while this Regulation provide a vital legal foundation for air quality protection in Nigeria, there is a need for continuous updating of emission standards to align with global benchmarks, stricter enforcement mechanisms, and enhanced public education. As noted by Enakireru and Ekakitie,[110] strengthening institutional capacity and addressing the influx of imported used vehicles remain central to ensuring the effectiveness of Nigeria's vehicular emission regulation regime.

[99] ibid, Regulation 3(1).
[100] ibid, Regulation 8(1).
[101] ibid, Regulation 8(2).
[102] ibid, Regulation 17(1).
[103] ibid, Regulation 30(1).
[104] ibid, Regulation 30(2).
[105] Ezeigwe P I, Agbo C O and Mohammed U, 'Quantification of vehicular emissions in Abuja, Nigeria' (2024) 65(1) Nigerian Medical Journal 18-25.
[106] ibid.
[107] Oluwakoya A, Yusuf O and Nwachukwu C, 'A comprehensive assessment of transportation emissions in Nigeria: Trends, drivers, and impacts' (2023) 16(2) Proceedings of the Nigerian Academy of Science 175-189.
[108] ibid.
[109] Adebayo T, Ogunleye I and Chukwuma P, 'Public awareness and perceptions of vehicular emission controls in Lagos, Nigeria' (2023) 9(12) Heliyon e21123.
[110] Enakireru and Ekakitie (n 97).

4.2.4 National Environmental (Control of Bush, Forest Fire and Open Burning) Regulations 2011[111]

This Regulation was established to prevent and mitigate ecosystem destruction resulting from uncontrolled fires and the release of hazardous air pollutants. The principal objective of these provisions is to safeguard biodiversity, protect soil fertility, and reduce air quality deterioration linked to fire outbreaks. Fire-induced emissions release carbon monoxide, nitrogen oxides, and particulate matter, all of which contribute to climate change and pose significant risks to human health.[112] The Regulations expressly prohibit the burning of bushes or forests, as well as any activity likely to trigger forest fires.[113] Furthermore, the use of fireworks in open spaces is restricted unless precautionary measures are adopted. These include the removal of all flammable materials within a reasonable distance of the ignition point and the provision of at least one appropriate fire extinguisher at the location.[114] The practice of burning of bush or forest for hunting purposes, which has been linked to habitat destruction and biodiversity loss, is also explicitly prohibited.[115] Enforcement provisions stipulate that any individual found guilty of violating these restrictions is subject to a fine of ₦50,000, imprisonment for up to three months, or both.[116] Corporate organisations face more stringent penalties, including a ₦1,000,000 fine and an additional ₦20,000 for each day the offence continues.[117] Such punitive measures are consistent with broader global strategies aimed at discouraging open burning and promoting sustainable land management.[118]

4.2.5 National Environmental (Quarrying and Blasting Operations) Regulations 2013[119]

This Regulation was enacted to mitigate the environmental and public health impacts of quarrying and blasting activities. The principal objective is to control air pollution and related hazards through the safe use of commercial blasting explosives and the adoption of best practices in quarry management.[120] Quarrying operations are a major source of dust and particulate matter (PM), which contributes to air quality deterioration, respiratory illnesses, and broader ecological degradation.[121] The Regulations mandate that dust and PM emissions from quarry operations must be abated and suppressed using the best available technologies.[122] This aligns with recent studies that emphasize the necessity of dust suppression systems, such as water sprays and enclosures, in reducing occupational and ambient air pollution from mining

[111] National Environmental (Control of Bush, Forest Fire and Open Burning) Regulations S. I. No. 15, 2011.
[112] ibid, Regulation 1; Ojo T, Bello R and Lawal M, 'Air pollution from open burning in West Africa: Health and environmental impacts' (2022) 13(9) Atmospheric Pollution Research 101512.
[113] ibid, Regulation 3(1).
[114] ibid, Regulation 18(a)&(b).
[115] ibid, Regulation 19; Akinyemi A and Adepoju A, 'Bush burning and biodiversity loss in Nigeria: An ecological assessment' (2023) 7(2) Environmental Sustainability Journal 145-158.
[116] ibid, Regulation 21(3).
[117] ibid, Regulation 21(4).
[118] FAO, Fire Management: Voluntary Guidelines (Food and Agriculture Organization of the United Nations 2021).
[119] National Environmental (Quarrying and Blasting Operations) Regulations S. I. No. 33, 2013 (hereinafter, Quarrying and Blasting Operations Regulations).
[120] ibid, Regulation 2(f) & (g).
[121] Onwualu A and Okeke C, 'Environmental impacts of quarrying and mining activities in Nigeria' (2021) 28(5) Journal of Environmental Science and Pollution Research 6112-6124.
[122] Quarrying and Blasting Operations Regulations (n 119), Regulation 12.

and quarrying.[123] The provisions also reflect global best practices in sustainable extractive industries, where environmental protection and worker safety are prioritized.[124]

Enforcement mechanisms impose strict penalties for non-compliance. An individual offender is liable to a fine of ₦1,000,000, imprisonment for up to two years, or both, with an additional ₦20,000 for every day the offence persists.[125] Corporate organisations face stiffer sanctions, including fines of not less than ₦10,000,000 and an additional ₦200,000 per day of continued violation.[126] These sanctions serve both deterrent and corrective functions, aiming to ensure adherence to environmental standards while protecting communities from the negative externalities of quarrying and blast.

5. Challenges in Implementing the NESREA Regulations On Air Pollution Control

This section highlights and examines the major challenges in implementation of NESREA regulations on air pollution control in Nigeria.

5.1. Institutional Capacity Shortfalls

Institutions tasked with enforcing air-quality rules in Nigeria, including NESREA, suffer chronic capacity shortfalls. Staffing levels, technical expertise, laboratory facilities, and continuous monitoring networks are insufficient for nationwide surveillance and swift response. Limited skills in emissions-inventory development, data analysis, and enforcement litigation reduce effectiveness, and staff retention suffers because budgets are constrained and career pathways limited. These capacity gaps hinder credible inspections, weaken evidence for prosecution, and limit the agency's ability to design corrective programmes that protect public health and ecosystems. This constraint undermines regulatory credibility, increases public exposure to harmful pollutants, and raises long-term health and economic costs across communities.[127]

5.2. Poor Inter-Agency Coordination

A fragmented institutional landscape and poor inter-agency coordination impedes coherent air pollution enforcement across Nigeria. Environmental oversight responsibilities are distributed among federal ministries, federal agencies (such as NESREA and NOSDRA), state agencies, and sector regulators, producing jurisdictional overlap and confusion. This fragmentation complicates permit harmonization, joint inspections, and data sharing, and it creates regulatory blind spots that polluters can exploit to delay or avoid sanctions.[128] For example, the NESREA Act clearly exempted NESREA from providing protection to the environment against pollution arising from oil and gas companies in Nigeria. Sections 7, 8, 29 and 30 of the NESREA Act expressly exclude the Agency from entertaining issues of environmental pollution arising from the activities of oil and gas companies, which arguably accounts for more than 90 per cent of

[123] Aigbedion I, Eze P and Umeh C, 'Dust pollution and health risks in quarry environments in sub-Saharan Africa' (2023) 195(6) Environmental Monitoring and Assessment 789.
[124] World Bank, Sustainable extractive industries: Policy and practice guidelines (Washington, D.C.: World Bank 2022).
[125] Quarrying and Blasting Operations Regulations (n 119), Regulations 21(3) & 42(1).
[126] ibid, Regulation 42(2).
[127] Olujobi O J, Irumekhai O S and Aina-Pelemo A D, 'Sustainable Development and National Integration: A Catalyst for Enhancing Environmental Law Compliance in Nigeria' (2024) 54(1) Environmental Policy and Law 27-41.
[128] Aigbe G O, Stringer L C and Cotton M, 'Gas Flaring in Nigeria: A Multi-level Governance and Policy Coherence Analysis' (2023) 2(1) Anthr. Sci. 31-47.

environmental pollution and degradation in Nigeria.[129] Thus, formal collaboration protocols, interoperable information systems, and established joint-inspection procedures are essential to close gaps and ensure consistent enforcement nationwide. This constraint undermines regulatory credibility, increases public exposure to harmful pollutants, and raises long-term health and economic costs across communities.[130]

5.3. Inadequate Funding and Logistics

Insufficient funding and logistical constraints severely limit practical enforcement of air-quality regulations. Chronic budget shortfalls prevent procurement and upkeep of air monitoring stations, restrict laboratory capacity for pollutant analysis, and curb routine field inspections and compliance follow-up. Without adequate financial resources, agencies cannot sustain continuous monitoring networks, deploy mobile sampling teams, or support community engagement and epidemiological research that link pollution to health outcomes. These fiscal and logistical weaknesses translate into poor evidence for enforcement, delayed remedial actions, and uneven protection for vulnerable populations. This constraint undermines regulatory credibility, increases public exposure to harmful pollutants, and raises long-term health and economic costs across communities.[131]

5.4. Low Compliance and Enforcement Culture

A weak compliance culture among many businesses and informal operators undermines regulatory objectives and complicates enforcement. Small enterprises, artisanal refiners, and widespread generator users frequently prioritize short-term survival over investing in emissions control technologies, while some larger firms choose fines or negotiated settlements instead of meaningful pollution abatement. High capital costs for cleaner equipment, limited technical assistance, weak voluntary-compliance incentives, and uneven inspections reduce industry uptake of best practices. Building inspection credibility, strengthening sanctions, and providing financial and technical support (for example, subsidies or low-interest loans for abatement) are needed to shift behaviour toward lasting compliance. This constraint undermines regulatory credibility, increases public exposure to harmful pollutants, and raises long-term health and economic costs across communities.[132]

5.5. Political and Economic Pressures

Political influence and economic pressures erode independent enforcement of air pollution laws and weaken regulatory deterrence. Powerful companies, politically connected actors, and influential interest groups can delay, dilute, or derail sanctions through litigation, lobbying, or informal pressure on regulators. Concerns about employment, local revenue, and investment further discourage assertive action against major polluters, while corruption and patronage networks may capture parts of the regulatory process. These dynamics reduce transparency, undermine public trust, and make sustained prosecutions and remediation politically costly for regulators, thereby allowing ongoing pollution and health harms to persist. This constraint

[129] Anyogu and Nyekwere (n 64) 175.
[130] Aigbe, Stringer and Cotton (n 128).
[131] Simeon Ayo-Oluwa Ajayi and Olayemi Oluwatosin Akanji, 'Air Quality Monitoring in Nigeria's Urban Areas: Effectiveness and Challenges in Reducing Public Health Risks' (2022) 3(2) Journal of Frontiers in Multidisciplinary Research 21-28.
[132] Muzan Williams Ijeoma and others, 'Technical, economic, and environmental feasibility assessment of solar-battery-generator hybrid energy systems: a case study in Nigeria' (2024) 12 Front. Energy Res. 1397037,

undermines regulatory credibility, increases public exposure to harmful pollutants, and raises long-term health and economic costs across communities.[133]

6. Conclusion

This paper has made a holistic review of the control of air pollution in Nigeria through NESREA Regulations. The paper examined the major sources of air pollution in Nigeria including the burning of fossil fuels, automobile emissions, industries and factories, and bush burning and use of fuel wood. Also discussed are the principal effects of air pollution in Nigeria including sicknesses and death, climate change, and acid rain. Furthermore, the paper examined the establishment and powers of the NESREA to make regulations on environmental pollution control in Nigeria, particularly, air pollution control. The NESREA regulations on air pollution control in Nigeria were highlighted and examined.

This paper reveals that the NESREA has put regulations in place to control air pollution in Nigeria. However, how effective these regulations have been implemented to control air pollution in Nigeria is a question that attracts different answers from different persons. While some persons believe that the NESREA, through its regulations, has made tremendous progress in the control of air pollution in Nigeria. Others are of the view that after more than a decade of existence and operations throughout Nigeria, the NESREA's effectiveness on the control of environmental pollution, including air pollution, through standard regulation and enforcement actions are far below expectations. Nonetheless, the NESREA continues to be a pillar of the Nigerian government's efforts to create a cleaner and healthier environment for everybody, even as the country navigates its several environmental issues.

Against the above context, the authors recommend as follows:

1. NESREA should strengthen the compliance monitoring and enforcement of its regulations on air pollution to prevent the emissions of hazardous air pollutants into the atmosphere and ensure improved air quality for Nigerians.
2. To maintain an improved quality of air, NESREA should ensure the treatment of the various industrial hazardous air pollutants to safety levels before discharge into the atmosphere.
3. NESREA should partner with the Federal Government of Nigeria (FGN) to ensure sufficient supply of electricity throughout the nation, as this will lessen the amount of emissions produced and released through the burning (use) of fossil fuels for generators to provide electricity for homes, companies, and other commercial purposes.
4. NESREA should implement vehicle inspection so that drivers are required to do routine maintenance on their vehicles as well as to remove outdated, smoke-emitting vehicles off the road and only permit the usage of vehicles that are in good shape. This will help reduce emissions from automobiles.
5. NESREA should partner with the FGN to improve transport infrastructure base to reduce time spent by vehicles on congested roads. Also, NESREA should partner with the FGN to

[133] Zephaniah O Edo, Victor E Clark and Laz Etemike, 'Environmental laws and the politics of environmental enforcement in Nigeria oil-rich Niger Delta region' (2023) 72 Innovations 258-272; Noah Mulligan and Michael Curtis, Power and Paradox: How Corruption and Political Risk Undermine Nigeria's Energy Development (George Mason University's Schar School of Policy and Government, 14 July 2025) <https://cesp.gmu.edu/wp-content/uploads/2025/07/NigeriaFinalPaper_Mulligan_CESP.pdf> accessed 26 October 2025.

promote the use of public transport services as an alternative to private transportation to minimize automobile emissions.

6. NESREA should enlighten the public to avoid or at least reduce the burning (use) of fuel wood for domestic fuel as climate active pollutants are released during the process. To achieve this, NESREA should partner with the FGN to assist Nigerians in adopting cleaner energy sources for domestic use. Additionally, NESREA should discourage the public through adequate enlightenment to stop or at least reduce the incessant practice of bush burning.

7. NESREA should launch a significant public awareness and education campaign about the value of the environment to encourage environmentally responsible behaviour utilising a variety of media like print and social media, demonstrations, among others. As part of its public education campaign, the NESREA should promote awareness on the sources and effects of air pollution-this knowledge will help to discourage people from engaging in air pollution activities.

8. NESREA should effectively partner with other environmental regulatory agencies like NOSDRA, states ministries of environment, and sector regulators to ensure permit harmonization, joint inspections, and data sharing in other to close regulatory gaps and ensure consistent enforcement nationwide.

9. The Nigerian Federal Government should improve on their funding and budgetary provisions of the NESREA. With adequate funds, the NESREA will perform optimally by strengthening its capacity, efforts and reach.