



REPORT OF THE AUDITOR GENERAL

Value for Money Audit on Monitoring and Enforcement of Air Quality Standards in Selected Cities by the National Environment Management Authority (NEMA)

DECEMBER 2024

THE REPUBLIC OF UGANDA



**VALUE FOR MONEY AUDIT REPORT ON THE MONITORING AND ENFORCEMENT
OF AIR QUALITY STANDARDS IN SELECTED CITIES IN UGANDA BY THE
NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY (NEMA)**



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DECEMBER 2024

AUDITOR GENERAL'S MESSAGE

27th December 2024

The Rt. Hon. Speaker of Parliament
Parliament of Uganda
Kampala

VALUE FOR MONEY AUDIT REPORT ON THE MONITORING AND ENFORCEMENT OF AIR QUALITY STANDARDS IN SELECTED CITIES IN UGANDA BY THE NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY (NEMA)

In accordance with Article 163(3) of the Constitution of the Republic of Uganda 1995 (as amended), I hereby submit my report on the Value for Money audit undertaken on the Monitoring and Enforcement of Air Quality standards in selected cities in Uganda by the National Environment Management Authority (NEMA).

My office intends to carry out a follow-up at an appropriate time regarding actions taken in relation to the recommendations in this report.

I would like to thank the staff of National Environment Management Authority (NEMA), and lead agencies, including the selected City Authorities, Ministry of Works and Transport, Uganda National Bureau of Standards, Makerere University School of Public Health, Makerere University Lung Institute, and AirQo for the assistance offered to my staff during the period of the audit.



Edward Akol
AUDITOR GENERAL

27th December 2024

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LIST OF ACRONYMS

Acronyms	Meaning
AQG level	Air Quality Guideline Level
AQI	Air Quality Index
BAM	Beta Attenuation Monitor
Bn	Billion
COPD	Chronic Obstructive Pulmonary Disease
eDOC	Electronic Documentation System
EPA	Environmental Protection Agency
ESIA	Environment Social Impact Assessment
KCCA	Kampala Capital City Authority
Mn	Million
MoWT	Ministry of Works and Transport
NEA	National Environment Act
NDP	National Development Plan
NEMA	National Environment Management Authority
NDP	National Development Plan
NOx	Oxides of Nitrogen
OAG	Office of the Auditor General
PM	Particulate Matter
SDG	Sustainable Development Goals
UgIFT	Uganda Intergovernmental Fiscal Transfers
UNBS	Uganda National Bureau of Standards
UNRA	Uganda National Roads Authority
USMID	Uganda Support to Municipal Infrastructure Development
VFM	Value for Money
WHO	World Health Organisation

GLOSSARY OF TERMS

Air Quality	A state of the air, characterised by the concentration of pollutants in the atmosphere at the point of measurement. ¹
Air Quality guidelines	A series of WHO publications that provide evidence -informed, non-binding recommendations for protecting public health from the adverse effects of air pollutants by eliminating or reducing exposure to hazardous air pollutants and by guiding national and local authorities in their risk management decisions ²
Air Quality Index (AQI)	This is a tool for reporting daily air quality. It tells you how clean or polluted your air is and what associated health effects might be a concern for you. ³
Air Quality Standard	A given level of an air pollutant (for example, a concentration or deposition level) that is adopted by a regulatory authority as enforceable. ⁴
Particulate Matter	A mixture of solid and liquid particles in the air that are small enough not to settle out on to the earths' surface under the influence of gravity classified by aerodynamic diameter ⁵
PM _{2.5}	Particulate matter, where particles have an aerodynamic diameter equal to or less than 2.5 µg/m ³ .
PM ₁₀	Particulate matter, where particles have an aerodynamic diameter equal to or less than 10 µg/m ³ .

¹ Air quality regulations 2024

² WHO global air quality guidelines 2021

³ <https://floridadep.gov/air/air-monitoring/content/air-quality-index-aqi>

⁴ WHO global air quality guidelines 2021

⁵ WHO global air quality guidelines 2021

EXECUTIVE SUMMARY

Air quality is a critical aspect of environmental management, as it influences human health and environmental sustainability. It is compromised when contaminants are introduced to the atmosphere, disrupting the chemical composition, rendering it unsafe. Pollutants such as particulate matter (PM)⁶, gases, and total volatile organic compounds significantly degrade air quality. Health problems arise from short- and long-term exposure to these pollutants. PM_{2.5}, the most prevalent and harmful air pollutant, penetrates the respiratory system and enters the bloodstream, contributing to higher incidence of asthma, stroke, heart disease, lung disease, and cancer, among other complications.

Uganda's Constitution guarantees the right to a clean and healthy environment, aligning with its commitment to Agenda 2030, which includes targets to reduce air pollution-related deaths and illnesses (SDG 3.9.1) and minimising the environmental impact of cities through improved air quality (SDG 11.6.2).

The National Environment Management Authority (NEMA) is Uganda's primary regulatory agency for environmental management, including monitoring and enforcement of air quality standards. NEMA's mandate is to safeguard environmental and public health by ensuring compliance with air quality standards through inspections, enforcement, and sensitisation for compliance, in collaboration with various stakeholders.

Despite these commitments, Uganda faces severe air quality challenges due to rapid urbanisation, industrialisation, and a lack of comprehensive monitoring and enforcement mechanism. Emissions from manufacturing industries, poorly maintained vehicles, waste burning, dust from unpaved roads, and other human activities contribute to deteriorating air quality. Uganda's annual average PM_{2.5} concentration reached approximately 50 µg/m³, which exceeded the 10 µg/m³ prescribed by the World Health Organisation (WHO)⁷. This problem was reportedly severe in cities and industrialised areas, leading to respiratory diseases, including a national asthma prevalence of 11.02% and an air pollution-associated mortality rate of 27.3 per 1,000 people.

In light of the above concerns, I undertook a Value for Money Audit to assess the performance of NEMA in monitoring and enforcing air quality standards in selected cities towards promotion of a clean and healthy environment.

KEY FINDINGS

i. High Pollution levels exceeding WHO and National Standards

The annual average air quality PM_{2.5} concentrations in the selected cities consistently exceeded the WHO and national set safe limits for the period under review. This pollution, primarily attributed to transportation, industrial emissions, and waste/biomass burning, was notably worse during drier months and peaked during rush hour traffic, highlighting the impact of human activity. Furthermore, air quality was significantly poorer in business areas with higher traffic and industrial activity compared to less congested residential zones.

⁶ Refers to a mixture of solid particles and liquid droplets found in the air such as dust, dirt, soot, or smoke among others

⁷<https://dicf.unepgrid.ch/uganda/pollution#:~:text=Available%20data%20indicates%20that%20Kampala,causes%20harmful%20emissions%5B6%5D>

ii. Inadequate monitoring equipment

The availability of air quality monitoring equipment is inadequate, with most (75%) of the operational stationary air quality monitors concentrated in Kampala, leaving monitoring gaps in the other cities in Uganda. This hinders comprehensive air quality assessments across the country.

iii. Non-functional Monitors

Out of the 162 installed air quality monitors in the selected cities, only 121 were operational, with significant downtime challenges. This leads to data gaps and compromises the accuracy of air quality assessments.

iv. Inadequate pre-export and periodic vehicle inspections

Pre-export inspections, conducted by Uganda National Bureau of Standards (UNBS) have continued to rely on outdated standards, that do not address key pollutants like PM_{2.5} and oxides of nitrogen, as required under the Euro 4 framework adopted by the East African Community. In addition, periodic vehicle inspections by Ministry of Works and Transport were not conducted for the review period. This allows high-emitting vehicles to operate unchecked, contributing to elevated levels of air pollution.

v. Ineffective enforcement by NEMA

NEMA has not effectively enforced the requirement for factories to install emission monitors and report on their air quality stack emission levels contrary to the law. Inspections are limited, facilitating unchecked industrial emissions.

vi. Limited Public Awareness

Public awareness on air quality issues were limited, with only two out of the nine selected cities having conducted outreach programmes. This limits voluntary compliance and personal efforts to reduce exposure to air pollution.

RECOMMENDATIONS

The Accounting Officer of NEMA, in collaboration with the lead agencies should;

- i. Develop a National Air quality monitoring programme and centralised database to streamline countrywide air quality monitoring, reporting, forecasting and impact-assessment;
- ii. Fast track the implementation of the adopted East African Community vehicle exhaust emissions Standards (Euro 4 equivalent), for pre-export and periodic inspection of motor vehicles.
- iii. Utilise the penalties provided in the National Environment Act, Cap. 181 and National Environment (Air Quality Standards) Regulations, 2024, to enforce compliance with air quality standards.
- iv. Conduct a risk assessment of registered factories to prioritize routine inspections of high-risk polluters.

- v. Automate air quality management systems to facilitate swift identification, follow-up and actions on non-compliance.
- vi. Include specified interventions for air quality awareness in the approved work plans and budgets, and incorporate air quality issues in all training/sensitisation programmes conducted.
- vii. Prioritise development of the National Environment Action Plan, including air quality management measures, and support adoption or adaptation of the same by cities and other local governments, with clear strategies for resource mobilisation for establishment and operation of adequate systems for air quality monitoring, reporting, enforcement and public sensitisation;
- viii. Enhance public access to up-to-date air quality information through varied methods including displays on the NEMA website.

OVERALL AUDIT CONCLUSION

NEMA, in collaboration with lead agencies, has established a legal framework for air quality monitoring and enforcement, developed monitoring networks through partnerships, and initiated public awareness campaigns. However, compliance with air quality standards remains inadequate due to limited monitoring infrastructure, concentrated mainly in Kampala, leaving cities like Hoima and Mbale unserved. Reliance on independent operators, resource and staffing shortages, and non-functional environmental committees have further weakened enforcement efforts. Public awareness initiatives have been limited in coverage, heavily reliant on digital platforms, and dependent on development partners, limiting their impact. As a result, major pollution sources, including transportation, industrial emissions, and waste burning, operate with minimal regulation. Consequently, the annual and daily average PM_{2.5} concentrations consistently exceeded WHO and national set safe limits for the period under review, posing serious risks to public health and the environment.



Edward Akol

AUDITOR GENERAL

27th December 2024

CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND

Air quality is a critical aspect of environmental health, influencing both public well-being and ecological stability. Air quality refers to the state of the air, characterised by the concentration of pollutants in the atmosphere at the point of measurement.⁸ Air quality is compromised when any sort of contaminant is introduced into the atmosphere such that it disrupts the chemical composition and rendering it unsafe⁹. Pollutants such as particulate matter (PM), gases¹⁰ and total volatile organic compounds significantly degrade air quality. Health problems can occur as a result of both short- and long-term exposure to these pollutants¹¹.

Particulate matter (PM)¹² is the most prevalent and harmful air pollutant globally¹³, differing in concentration and composition. It is typically measured in diameters of 2.5 (PM_{2.5}) and 10 (PM₁₀) micrometres, with PM_{2.5} being particularly more harmful¹⁴ due to its ability to penetrate the respiratory system and enter the bloodstream. This can lead to health issues such as asthma, stroke, heart disease, lung disease, and cancer¹⁵.

Air pollution has become a growing concern in Uganda, particularly due to rapid urbanisation and industrialisation. Emissions from manufacturing industries, poorly maintained vehicles, waste burning, dust from unpaved roads and other human activities¹⁶ contribute to deteriorating air quality. Uganda's annual average concentration of PM_{2.5} is approximately 50 µg/m³, significantly exceeding the WHO guideline of 10 µg/m³. This problem is especially severe in cities and industrialised areas like Jinja and Kampala¹⁷, leading to a rise in respiratory diseases, including a national asthma prevalence of 11.02% (12.99% in urban areas) and an associated mortality rate of 27.3 per 1,000 people¹⁸.

Uganda's Constitution guarantees the right to a clean and healthy environment, aligning with the nation's commitment to Agenda 2030, which includes targets to reduce air pollution-related deaths and illnesses (SDG 3.9.1) and minimise the environmental impact of cities through improved air quality (SDG 11.6.2). To realise these targets, the current National Development Plan (NDP III) emphasises the importance of air pollution detection, monitoring and regulation¹⁹.

The National Environment Management Authority (NEMA) is Uganda's primary regulatory agency for environmental management, including monitoring and

⁸ Air quality regulations 2024

⁹ International Journal of Environmental Sciences & Natural Resources, Volume 27, Issue 4, April 2021

¹⁰ Carbon monoxide, hydrogen sulphide, Ozone, Sulphur dioxide, and nitrogen dioxide

¹¹ Air Quality Measurements Series: Particulate Matter: September 2021; <https://www.clarity.io/blog/air-quality-measurements-series-particulate-matter>

¹² Refers to a mixture of solid particles and liquid droplets found in the air such as dust, dirt, soot, or smoke among others

¹³ Environment Protection Agency (US) <https://www.epa.gov/pm-pollution/particulate-matter-pm-basics>

¹⁴ Air Quality Measurements Series: Particulate Matter: September 2021; <https://www.clarity.io/blog/air-quality-measurements-series-particulate-matter>

¹⁵ <https://dicf.unepgrid.ch/uganda/pollution>

¹⁶ NDP III 2020/21-2024/25, Page 98

¹⁷ <https://dicf.unepgrid.ch/uganda/pollution#:~:text=Available%20data%20indicates%20that%20Kampala,causes%20harmful%20emissions%5B6%5D>

¹⁸ Air quality experts call for joint action to reduce air pollution-May 3, 2022; <https://blog.AirQo.net/air-quality-experts-call-for-joint-action-to-reduce-air-pollution-7219fbab70bf>

¹⁹ NDP III 2020/21-2024/25, Page 98

enforcement of air quality standards. NEMA's mandate is to safeguard environmental and public health by ensuring compliance with air quality standards through inspections, enforcement, and sensitisation for compliance in collaboration with various stakeholders²⁰. Their strategic plan²¹ focuses on fostering a "Clean, Healthy and Productive Environment" to support Uganda's social and economic transformation.

1.2 MOTIVATION

Monitoring air quality is crucial for assessing pollution levels, informing policy decisions, and tracking progress towards cleaner air. Due to the transboundary nature of air pollution, action is driven by both international commitments and national development strategies. Uganda's commitment to Agenda 2030 was followed by the East African Community's adoption of Euro 4 emissions standards to enhance regional air quality and public health. Vision 2040 and National Development Plan III emphasise proper waste management, air pollution detection equipment, and stricter regulations.

Despite these commitments, Uganda's air quality remains unsafe due to emissions from manufacturing, poorly maintained vehicles, dust from unpaved roads, waste burning, and other human activities²². In addition, over 95% of households use charcoal for cooking, contributing to harmful emissions. With the rapidly-growing urban population, air pollution is projected to worsen if no deliberate interventions are implemented to stem it.²³

Air pollution poses a significant health burden in Uganda, contributing to increased mortality and morbidity rates, with 155.7 deaths per 100,000 people – higher than Tanzania and Rwanda, and double that of Kenya²⁴. A 2019 population survey among 2,936 people in Uganda found an overall asthma prevalence of 11.02% with a higher rate of 12.99% in urban centres, resulting in a mortality rate of 27.3 per 1000 persons. The rise in asthma cases in Uganda is linked to the increased exposure to air pollutants²⁵.

Globally, air pollution was the second largest risk factor of deaths in 2021, accounting for 8.1 million fatalities. In East Africa, this was particularly severe for new-borns, contributing to nearly 30% of deaths within the first month of life. Of the global total, 58% of air pollution deaths resulted from ambient (outdoor) PM_{2.5}, 38% from household air pollution, and 6% from ozone²⁶.

In Uganda, the absence of air pollution detection equipment and a comprehensive monitoring and regulatory framework presents significant challenges. According to WHO, over 80% of the population in monitored urban centres are exposed to ambient pollution levels exceeding recommended safe limits²⁷. Air pollution in Sub-Saharan Africa, including Uganda, has become deadlier and costlier than historical crises such

²⁰ National Environment Act, 2019

²¹ NEMA strategic plan 2021/22-2024/25

²² NDP III 2020/21-2024/25

²³ <https://www.kcca.go.ug/news/540/>

²⁴ <https://dicf.unepgrid.ch/uganda/pollution>

²⁵ Air quality experts call for joint action to reduce air pollution-May 3, 2022; <https://blog.AirQo.net/air-quality-experts-call-for-joint-action-to-reduce-air-pollution-7219fbab70bf>

²⁶ State of global air 2024.

²⁷ State of ambient air pollution, Kampala city, Jan-May 2021

as starvation, unclean water, and HIV/AIDS. The failure to establish comprehensive air quality management systems further worsens the problem²⁸.

The lack of air quality monitoring in many parts of Uganda puts public health at risk²⁹, increasing the prevalence of respiratory infections, heart diseases and chronic lung conditions.

In light of the above concerns, the Office of the Auditor General undertook a Value for Money Audit to assess the performance of NEMA in monitoring and enforcing air quality standards to promote a clean and healthy environment.

1.3 DESCRIPTION OF THE AUDIT AREA

NEMA, the lead agency for environmental management, was established in 1995 as a semi-autonomous institution. It spearheads the development of environmental policies, laws, regulations, standards, and guidelines to ensure sustainable development aligned with national vision and international commitments like the Sustainable Development Goals (SDGs)³⁰.

NEMA's Departments of Environmental Compliance, Enforcement and Field Operations, and Environmental Planning and Coordination (Division of Education and Advocacy) collaborate with environmental officers and units in other Ministries, Departments and Agencies (MDAs) and local governments to monitor and enforce compliance with air quality standards nationwide.

1.3.1 Mandate, Policy and Legal Framework

NEMA is mandated to monitor and enforce air quality standards, as outlined in the National Environment Act (NEA), Cap. 181. This legislation establishes NEMA as the primary agency responsible for regulating, monitoring and coordinating all environmental activities in Uganda³¹. Furthermore, the National Environment (Air Quality Standards) Regulations 2024 provide specific guidelines for managing, monitoring, and enforcing air quality standards within the country.

Uganda's commitment to a clean and healthy environment is enshrined in the Constitution³², which grants every citizen the right to such an environment. Vision 2040 and the National Development Plan III further emphasize the importance of environmental protection, proper waste management, and air pollution control. Additionally, Uganda is a signatory to international commitments, such as the 2030 Agenda for Sustainable Development, the Stockholm Convention on persistent organic pollutants (2001). On 1st July 2022, Uganda, as part of the East African Community, also adopted the East African Air Quality – Vehicular exhaust emission limits (EAS 1047:2022) which are aligned to the Euro 4 Vehicle Emissions Standards. These commitments focus on improving air quality, and align with NEMA's strategy theme of a clean, healthy, and productive environment for socioeconomic transformation.

²⁸ The state of ambient air quality in 2 Ugandan cities, A pilot cross sectional spatial assessment, article in international journal of environmental research and public health.

²⁹ World air quality report 2021

³⁰ https://www.nema.go.ug/new_site/

³¹ NEMA strategic plan 2020/21-2024/25

³² The 1995 Constitution of the Republic of Uganda (as amended)

1.3.2 Vision and Mission³³

NEMA's mission and vision drive and guide interventions for monitoring and enforcement of air quality standards in the country.

Vision: "An Efficient Agency, with People in Uganda living in a Clean, Healthy, Productive and Sustainable Environment."

Mission: "To promote and ensure sound environment management practices for sustainable development."

1.3.3 Functions of the National Environment Management Authority³⁴

The functions of the NEMA with relation to monitoring and enforcement of air quality standards are:

- i. To advise on the formulation and implementation of environmental and climate change policies, plans and programmes;
- ii. To undertake and coordinate environmental monitoring, inspections and compliance audits;
- iii. To support the mainstreaming and integration of environmental concerns in national and sectoral plans through coordination and collaboration with lead agencies³⁵;
- iv. To issue environmental compliance certificates;
- v. To issue permits and licenses in accordance with the Act and any other applicable law;
- vi. To prepare and disseminate the National State of the Environment Report;
- vii. To undertake public environmental awareness and literacy;
- viii. To coordinate lead agencies in their preparedness and response to environmental emergencies or disasters;
- ix. To advise the Government on regional and international environmental conventions, treaties and agreements to which Uganda should be a party and follow up the implementation of such agreements where Uganda is a party;

1.3.4 Organisational structure

The organisational structure for NEMA's departments involved in the monitoring and enforcement of air quality standards have been attached in **Appendix I**.

1.3.5 Funding

Over the last three financial years, the departments with responsibilities for monitoring and enforcement of air quality standards were allocated UGX.7.7Bn to facilitate their operations, as shown in the table below.

³³ Ibid

³⁴ National Environment Act 2019

³⁵ "lead agency" means a ministry, department, agency, city/ local government or public officer in which or in whom the functions of control or management of any aspect of air quality are vested (Refer to the National Environment Act, Cap 181);

Table 1: Budgetary allocations and releases

FY	Amounts (UGX. Bn)			Budget Performance	
	Approved Budget	Released	Spent	% of budget released	% of released amount spent
2021/22	3.042	0.848	0.848	27.9	100
2022/23	1.933	1.748	1.748	90.4	100
2023/24	2.725	2.376	2.376	87.2	100
Total	7.700	4.972	4.972	64.6	100

Source: OAG review of the NEMA approved Budgets and releases for FYs 2021/22-2023/24.

CHAPTER TWO

2.0 AUDIT DESIGN AND METHODOLOGY

The audit was conducted in accordance with the International Organisation of Supreme Audit Institutions (INTOSAI) Performance Auditing Standards and the Performance Auditing guidelines prescribed in the Office of the Auditor General (OAG) Value for Money (VFM) audit manual. The standards require that the audit be planned in a manner that ensures that an audit of high quality is carried out in an economic, efficient, effective and timely manner.

2.1 AUDIT OBJECTIVES AND QUESTIONS

2.1.1 Audit Objective

"To assess the performance of NEMA in monitoring and enforcement of air quality standards towards promotion of a clean and healthy environment."

2.1.2 Audit Questions

To achieve the above audit objective, the audit sought to answer the following questions:

- i. What is the state of air quality in the selected cities in Uganda?
- ii. To what extent has NEMA established mechanisms for monitoring and inspection of air quality in the country?
- iii. To what extent has NEMA established measures for enforcing compliance with air quality standards?
- iv. To what extent has NEMA enhanced public awareness about air quality management standards?

2.2 AUDIT SCOPE

The study assessed measures put in place by the National Environment Management Authority to monitor and enforce air quality standards in order to protect public health and environment. It focussed on NEMA's operations as the primary institution in charge of environmental protection, and other lead actors such as MoWT, UNRA, UNBS, Makerere Lung Institute, the Eastern Africa GeoHealth Hub and AirQo.

The audit targeted cities due to their rapid urbanisation and industrialisation, which heighten air pollution risks. Two cities were randomly selected from each Uganda's four geographical regions, with Hoima included due to its oil exploration and development activities and their potential risk to air quality. The cities selected were Jinja and Mbale (East), Soroti, Gulu, (North) Masaka and Kampala (Central), Mbarara and Fort portal (West), and Hoima.

The study focused on PM_{2.5} concentration indicators and ambient (outdoor) air pollution, which account for 58% of air pollution deaths globally³⁶. Data was collected over three financial years (2021/22, 2022/23 and 2023/24) to analyse performance trends.

³⁶ State of Global air 2024

2.3 **DATA COLLECTION METHODS**

The audit employed a combination of interviews, document review, physical observation and inspections to address the audit questions as detailed in the table below. The list and purpose for interviews conducted and documents reviewed are attached as **Appendices II and III** respectively.

Table 2: Data collection methods

S/N	Audit Question	Data Collection Methods
1	What is the state of air quality in the selected cities in Uganda?	To address this audit question, the audit reviewed monitoring data from NEMA, KCCA, AirQo, and the Eastern Africa GeoHealth Hub (Makerere University). To assess the associated public health impacts of air quality, the audit analysed health data and interview notes from the Ministry of Health, Makerere University Lung Institute, the Eastern Africa GeoHealth Hub healthcare facilities and environment officers in selected cities, as well as research publications. Additionally, field inspections were conducted in the selected cities to observe air quality conditions and interview responsible for the environment.
2	To what extent has NEMA established mechanisms for monitoring and inspection of air quality in the country?	The audit interviewed officers from NEMA, KCCA, UNRA, MoWT, UNBS, and environment officers from selected city authorities to establish the mechanisms put in place for monitoring and inspecting air quality. Additionally, the audit inspected the established monitoring equipment in the field and reviewed monitoring and inspection plans/reports to assess how these mechanisms were working.
3	To what extent has NEMA established measures for enforcing compliance with air quality standards?	The audit reviewed enforcement plans and reports and interviewed officers from NEMA, KCCA, UNRA, MoWT, and selected city authorities to assess the measures put in place for enforcing compliance with the air quality standards.
4	To what extent has NEMA enhanced public awareness about air quality management standards?	The audit reviewed sensitisation plans/reports, quarterly environmental reports, and interviewed officers from NEMA, KCCA, UNRA, MoWT, and selected city authorities to assess the efforts for public awareness regarding air quality management standards and procedures.

2.4 **SOURCES OF AUDIT CRITERIA**

The audit evaluated NEMA's performance against the following criteria:

- **Legal and Regulatory Framework:** Compliance with the National Environment Act, Cap. 181, and the National Environment (Air Quality Standards) Regulations, 2024.
- **International Standards:** Comparison against WHO air quality guidelines, specifically for PM_{2.5}, and the East African Standard (Air quality - Vehicular exhaust emission limits), which are aligned to the Euro 4 emissions standards.

- **Strategic National Commitments:** Alignment with Uganda's Vision 2040, National Development Plan III, and international agreements like the 2030 Agenda for Sustainable Development.
- **Operational Standards:** NEMA's established policies, inspection protocols, and monitoring processes as outlined in their strategic plans and environmental compliance guidelines.

CHAPTER THREE

3.0 SYSTEMS AND PROCESS DESCRIPTION

3.1 ROLES AND RESPONSIBILITIES OF KEY PLAYERS

The National Environment Management Authority (NEMA) is a semi-autonomous institution, established in May 1995, as the principal agency in Uganda, charged with the responsibility of coordinating, monitoring, regulating and supervising environmental management in the country³⁷.

The monitoring and enforcement of air quality standards in major cities is a responsibility of different stakeholders as detailed in the table below:

Table 3: Stake holders in air quality management and their roles

S/N	Stakeholder	Roles
1	NEMA, through its departments of Environmental Compliance, Enforcement and Field Operations, and Environmental Planning and Coordination (Division of Education and Advocacy).	• Develop comprehensive policies and guidelines for monitoring and enforcement of air quality standards. • Plan and budget for monitoring and enforcement activities in the country. • Carry out capacity building and provide equipment for monitoring air quality standards. • Monitors and enforces air quality standards in the country. • Advocacy activities and awareness campaigns on environment issues including management of air quality.
2	Ministry of Works and Transport (MoWT)	• Regulate vehicle emissions of vehicles operating in the country through inspections and regulations; • Enforce standards related to road construction and maintenance.
3	Uganda National Bureau of Standards (UNBS)	• Pre-export inspection of vehicles for conformity to the East African Community (Euro 4-equivalent) vehicle emissions standards.
5	AirQo Project	• Independent air quality monitoring using low-cost sensors; data collection and analysis. AirQo has equipment to monitor air quality in selected parts of the country.
6	Makerere Lung Institute	• The institute carries out research activities on the impact of air quality on respiratory health.
7	The Eastern Africa GeoHealth hub	• Research on air quality and health impacts, in eastern Africa, including in Uganda. They monitor air quality in 10 Kampala schools and track related disease patterns in their respective divisions.
8	Cities /LGs	• To enact policies/ordinances for monitoring and enforcement of air quality standards in the cities/LGs. • Plan and budget for monitoring and enforcement activities within the local governments. • To collect data on air pollution activities/monitor air quality within their jurisdiction. • To participate in enforcement activities within the cities
9	Factories/industries.	• Collect data on emissions to aid monitoring and enforcement of air quality standards in accordance with approvals granted by NEMA.

³⁷ https://www.nema.go.ug/new_site/who-we-are/

3.2 PROCESS DESCRIPTION

This section describes the processes undertaken in the monitoring and enforcement of air quality standards in major cities in Uganda.

a) Developing a regulatory framework

NEMA, with input from lead agencies such as the MoWT, UNBS, public health institutions, Local Authorities and City Authorities, establishes and periodically reviews regulations and guidelines for air quality monitoring and enforcement. This involves setting permissible emission levels and aligning standards with international norms and commitments Uganda is a signatory to. Local governments supplement these with ordinances tailored to local environmental conditions.

b) Identification and establishment of monitoring points

NEMA conducts a comprehensive assessment of air pollution sources, including population density, industrial activity, geographical features, and traffic patterns. This assessment informs the development of a national air quality management plan, which includes identifying strategic locations for air quality monitoring stations. These stations are equipped with sensors to measure PM_{2.5}, nitrogen dioxide, and sulphur dioxide, and are calibrated to international standards or the Beta Attenuation Monitor (BAM).

To further strengthen air quality monitoring, NEMA mandates that industries and factories with significant emissions install self-monitoring systems. These industries are required, through a formal letter or the terms of ESIA permits, to report their emission data periodically. Additionally, NEMA supports other lead agencies, as well as local and city authorities, in establishing their own air quality monitoring systems.

c) Data collection and analysis

NEMA collects real-time air quality data from a network of monitoring stations. These stations include those owned by NEMA, City authorities such as KCCA, Makerere University's research units, US embassy, and private operators like AirQo. This data is transmitted to a central database for analysis and assessment against established air quality standards. Additionally, NEMA requires industries and factories to submit their emission data electronically, either in real-time or periodically (monthly, quarterly, or annually), as outlined in their environmental impact assessment certificates.

To further enhance data collection, MoWT monitors air quality on its construction projects such as roads, both at the inception and throughout the implementation phase and reports to NEMA. The ministry also assesses vehicular emissions through periodic inspections (annual or biennial) of the in-use motor vehicles and shares quarterly reports with NEMA.

d) Public Awareness and capacity building of staff and key stakeholders

NEMA conducts quarterly campaigns to educate citizens and industries on air quality issues and compliance measures. Training programmes for environmental officers ensure proficiency in monitoring, analysis, and enforcement techniques, thereby building local capacity for sustainable air quality management.

NEMA collaborates with city authorities, and key stakeholders to conduct quarterly public awareness campaigns. These campaigns sensitise citizens, businesses, and industries about the importance of air quality, the health risks of pollution, and practical steps to reduce emissions. They also share information on local air quality conditions, ongoing interventions, and the implementation status of air quality management plans.

To build local capacity for sustainable air quality management, NEMA provides training programmes for regulatory officials, environmental inspectors, and monitoring station operators. This training enhances their proficiency in data collection, analysis, reporting and enforcement. Additionally, responsible officers are required to maintain records of public complaints and the actions taken to address them. All these are done with the aim of improving air quality and protecting public health.

NEMA also publicises information contained in its National State of Environment Report through the media and its website, providing regular updates on air quality data, trends, and compliance levels to keep the public and stakeholders informed.

e) Monitoring compliance

The National Environment Act, Cap. 181 requires NEMA to develop and implement a comprehensive air quality monitoring programme, designed to ensure compliance with permitted emission levels. The programme, based on environmental risk assessments, should outline the frequency of data collection, parameters to be monitored, and the necessary equipment. Monitoring activities are integrated into NEMA's annual work plans and budgets.

NEMA's monitoring teams, in collaboration with environmental officers from city authorities and lead agencies, conduct tests on key pollutants and collect data, at least annually, using stationary or hand-held monitors. This data is analysed and compared against air quality standards. City authorities and lead agencies are required to submit to NEMA, quarterly and annual environment reports, with a section on status and performance on air quality management initiatives.

Industries and factories are responsible for self-monitoring and submitting quarterly reports to both city authorities and NEMA. Environmental officers then conduct inspections and tests to verify this information. Road construction projects must assess air quality at the project's start and throughout its implementation, with MoWT submitting reports to NEMA. In addition, the Traffic and Road Safety Act (as amended) mandates MoWT to conduct periodic motor vehicle inspections to among other things assess vehicle emissions of in-use motor vehicles for compliance with set standards.

Imported used vehicles present a pre-export inspection certificate, confirming compliance with environmental requirements for clearance into the country. This information is consolidated into the National State of Environment report produced every two years.

f) Enforcement

NEMA's enforcement protection force officers in collaboration with environment officers in city authorities implement a system of periodic inspections³⁸ and annual

³⁸ Number/ frequency not specified

audits to ensure compliance with air quality standards. This system identifies non-compliant businesses, industries, and waste management facilities. In cases of non-compliance, corrective measures, tailored to the severity, range from awareness campaigns, training to notices, penalties, legal action, and even facility closures.

g) Coordination

NEA Cap. 181 mandates NEMA as a primary agency responsible for coordinating all environmental activities in the country. NEMA coordinates and collaborates with various lead agencies and city authorities in undertaking planning, resource mobilisation, environmental monitoring, inspections, enforcement, and compliance audits. These collaborative actions help streamline responsibilities and enhance the effectiveness of air quality monitoring and enforcement. In addition, NEMA engages and cooperates with non-state agencies that are involved in air quality monitoring for purposes of sharing information and experiences.

CHAPTER FOUR

4.0 FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

This chapter examines the state of air quality in the selected cities in Uganda, analysing the trends, and effects of air pollution. It assesses the initiatives by NEMA and the respective lead agencies in monitoring and enforcing air quality standards for a cleaner and healthy environment. The chapter also offers conclusions and recommendations to improve air quality and achieve safe ambient air quality tolerance limits.

4.1 THE STATE OF AIR QUALITY IN THE SELECTED CITIES IN UGANDA

Article 39 of the Constitution of the Republic of Uganda 1995 (as amended), enshrines the right to a clean and healthy environment. This right is reinforced by the country's commitment to Agenda 2030, which calls for reduction of air pollution-related deaths and illnesses (SDG 3.9.1) and improvement of urban air quality (SDG 11.6.2). In line with these commitments, WHO has set interim air quality targets, aiming to reduce the annual average PM_{2.5} concentration limits to 35 µg/m³ in 2022, and ultimately to the recommended safe limit of 5 µg/m³ (see Table below). Uganda has set an annual average tolerance limit of 25 µg/m³ and a 24-hour average limit of 35 µg/m³ for the next five years, starting in 2024³⁹.

Table 4: WHO Criteria for Ambient Air Quality Standards (µg/m³)

Pollutant	Averaging time	Interim target				AQG level
		2022 (1)	2023 (2)	2024 (3)	2025 (4)	
PM _{2.5} (µg/m ³)	Annual	35	25	15	10	5
	24 -hours	75	50	37.5	25	15

Source: WHO global air quality guidelines, 2021

Relatedly, the United States Environment Protection Agency (EPA) provides Air Quality Index (AQI) categories for interpretation of air quality results as detailed in the table below:

Table 5: Air quality categorisation based on PM_{2.5}, readings (µg/m³)

AQI Category	PM _{2.5} (µg/m ³)	Description
Good	0-12.0	Air quality is considered satisfactory, and air pollution poses little or no risk for everyone.
Moderate	12.1-35.4	Moderate health concern for people sensitive to air pollution. These should limit prolonged intense outdoor activities.
Unhealthy for Sensitive Groups	35.5-55.4	Members of sensitive groups (people with respiratory or heart disease, the elderly and children) may experience health effects and should limit intense outdoor activities.
Unhealthy	55.5-150.4	Everyone may begin to experience health effects and should thus limit intense outdoor activities. Members of sensitive groups may experience more serious health effects and should avoid outdoor activities.
Very Unhealthy	150.5-250.4	Health alert: Everyone may experience more serious health effects.

³⁹ The National Environment (Air Quality Standards) Regulations 2024.

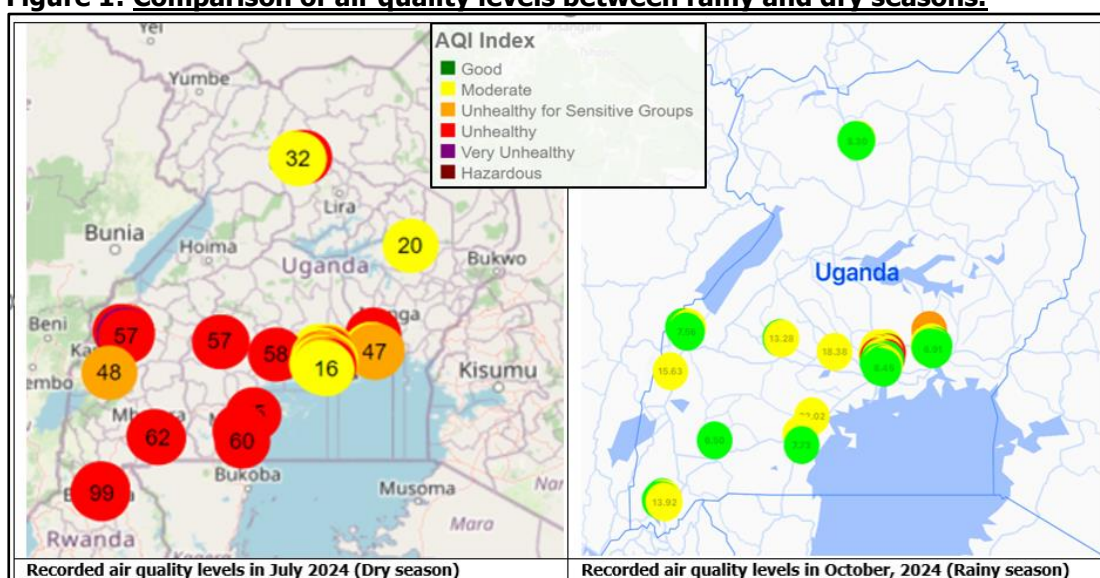
AQI Category	PM _{2.5} (µg/m ³)	Description
Hazardous	>250.5	Health warnings of emergency conditions. Entire population likely to be affected.

Source: Environmental protection agency – United States

The audit analysed air quality monitoring data from AirQo, the US Embassy, and KCCA monitors to assess trends and the overall state of air quality in the selected cities. Eight (8)⁴⁰ of the nine (9) selected cities had air quality monitoring data for the period under review, while Hoima did not.

The analysis revealed an initial improvement in air quality (PM_{2.5} concentrations) from an annual average of 36.9 µg/m³ in 2022 to 32.7 µg/m³ in 2023. However, in 2024, concentrations worsened to 36.8 µg/m³. These annual averages are consistently higher than the WHO interim annualised set limits (**see table 5 above**) for the corresponding years. Further analysis indicates seasonal variations, with better air quality during the rainy months (March, April, May, October, November, and December) and poorer quality during the drier months (January and July). The figure below illustrates the variation in air quality levels between rainy and dry seasons:

Figure 1: Comparison of air quality levels between rainy and dry seasons.

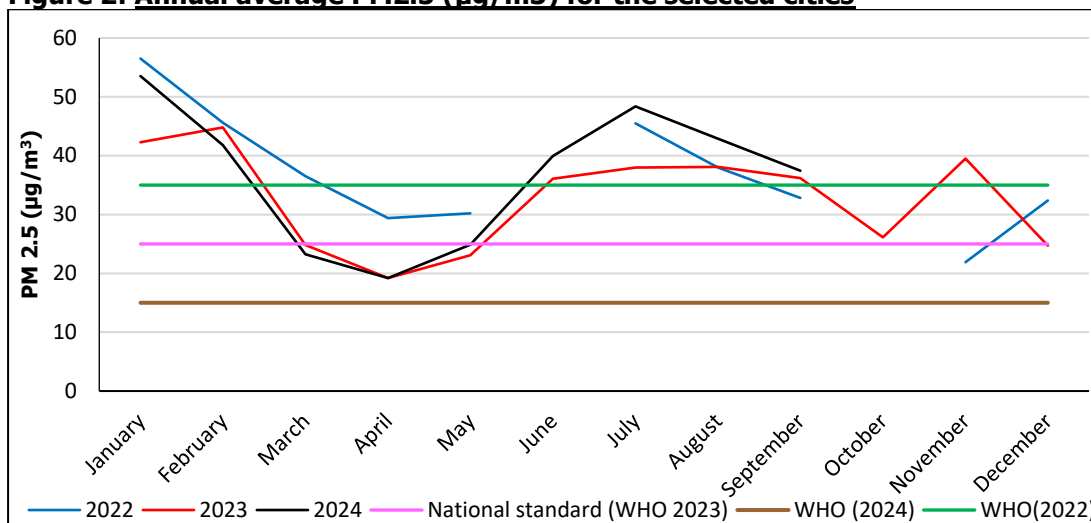


Source: OAG extracts from AirQo website

The heightened dust levels during drier months contribute to increased particulate matter in the atmosphere compared to the wetter months. The figure below illustrates monthly average air quality levels for the period under review.

⁴⁰ Fort Portal, Gulu, Jinja, Kampala, Masaka, Mbale, Mbarara, and Soroti

Figure 2: Annual average PM_{2.5} (µg/m³) for the selected cities



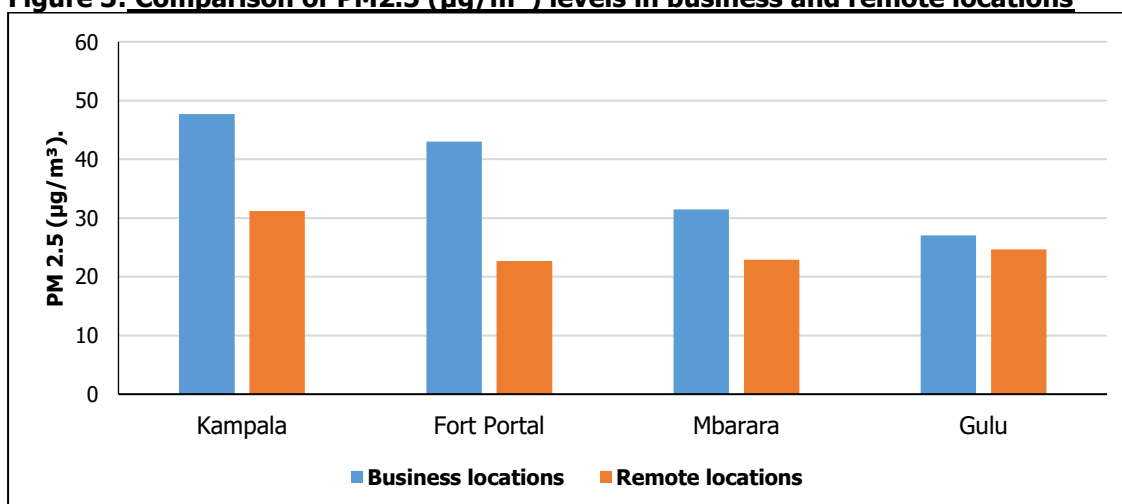
Source: OAG analysis of air quality data from AirQo.

**** The air quality data for the year 2024 was available up to September 2024 (time of the audit), and the breaks in 2022 are due to absence of data for June and October.**

The figure reveals that only March, April, and May, 2024 met the national annual average tolerance limit of 25 µg/m³. Regarding WHO limits, five months⁴¹ in 2022 met the 35 µg/m³ recommendation, while four months⁴² in 2023 met the stricter 25 µg/m³ recommendation. No month in 2024 has met the more stringent WHO limit of 15 µg/m³.

Additionally, the analysis shows that air quality was consistently poorer in business locations⁴³ compared to remote locations⁴⁴ within the selected cities. From the data available, only four cities (Kampala, Mbarara, Gulu and Fort portal) had monitoring stations in both their business and remote locations. The average air quality (PM_{2.5} concentration) recorded by monitoring stations for the years 2022-2024 review period in remote stations was better in all the four cities as shown in the figure below.

Figure 3: Comparison of PM_{2.5} (µg/m³) levels in business and remote locations



Source: Analysis of AirQo data for the selected cities with urban and background locations

⁴¹ April, May, September, November, and December

⁴² March, April, May and December.

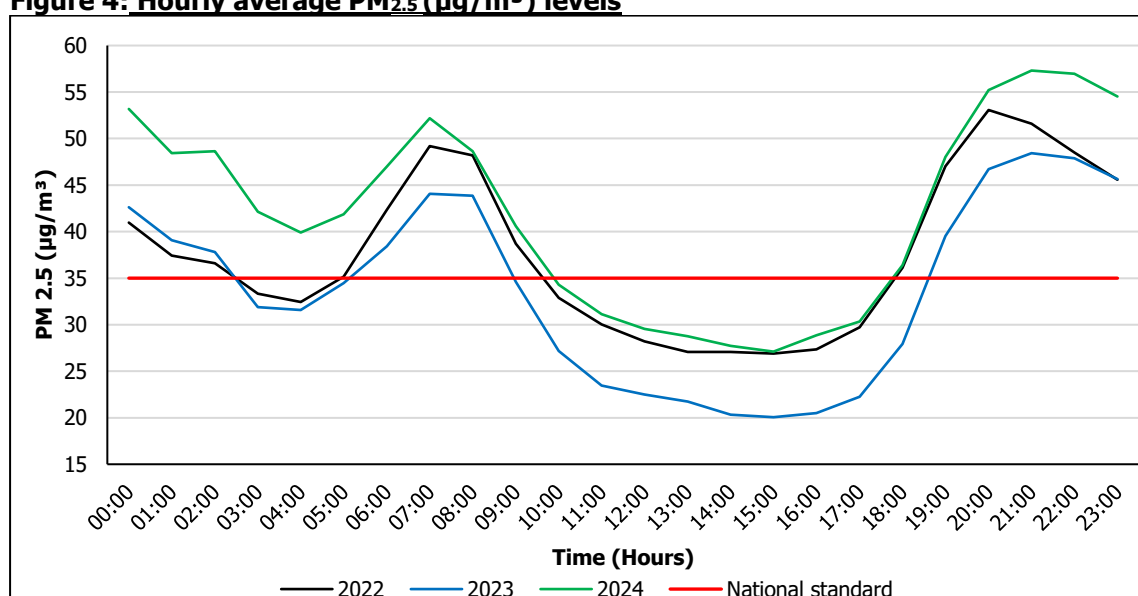
⁴³ Characterised by higher traffic (human and vehicle) levels and industrial activities

⁴⁴ Characterised by lower traffic levels and largely settlement areas.

The figure reveals that Kampala, being the busiest city, had higher PM_{2.5} concentration levels, with even Kampala's remote locations registering poorer air quality than Gulu's business locations. Interviews with AirQo's data analysts revealed that higher levels of human activity, vehicle emissions, waste burning, and industrial emissions in business locations contribute to the observed poorer air quality compared to remote locations.

Furthermore, hourly air quality analysis indicates that pollution levels often exceed the prescribed national daily tolerance limit of 35 µg/m³ especially during peak hours. These spikes occur between 6:00 AM and 9:00 AM and again between 6:00 PM and 11:00 PM. The morning and evening pollution peaks coincide with rush hour traffic, when most people are travelling to and from work, indicating increased vehicle emissions. The hourly average air quality levels for the years under review are illustrated in the figure below:

Figure 4: Hourly average PM_{2.5} (µg/m³) levels



Source: OAG analysis of AirQo data

The figure illustrates a deterioration in hourly average air quality levels in 2024. Only the hours between 10 AM - 6 PM had air quality levels (PM_{2.5}) within the nationally set daily tolerance limit of 35 µg/m³.

4.1.1 Sources of air pollution

Review of reports from NEMA and the Lead Agencies responsible for environmental protection, as well as interviews with their officers, indicated that the observed air quality levels in the selected cities were mainly from the following sources:

- Transportation, including vehicle exhaust emissions, tyre and brake abrasion, and road dust, is a significant contributor to air pollution. Studies on air pollution source apportionment in Kampala⁴⁵ and Mbarara⁴⁶ attributed 37% and 43% of PM_{2.5} compositions, respectively, to transportation. Our analysis further supports this,

⁴⁵ AirQo, Integrated Air Quality Information for Kampala: Analysis of PM_{2.5}, Modelled Contributions, and Institutional Framework. Environmental Science.

⁴⁶ Ambient PM_{2.5} temporal variation and source apportionment in Mbarara, Uganda: <https://pmc.ncbi.nlm.nih.gov/articles/PMC11212479/>

with peak hourly pollution levels aligning with morning and evening rush hours (see figure 4 above). The prevalence of unpaved roads (72.6% of Uganda's road network⁴⁷) worsens road dust pollution. The figure below illustrates transportation sources of air pollution observed during the audit:

Figure 5: Some of the observed transportation pollution sources



- Industrial and heavy fuel (generator) emissions are another main source of air pollution. During field inspections, the audit observed emissions from a multitude of industries, ranging from large-scale manufacturing to small-scale processing and milling operations. Source apportionment studies⁴⁸ indicated that this source contributed 12% and 23% of PM_{2.5} compositions in Kampala and Mbarara, respectively. Environmental officers also highlighted rapid increase in industrial activity across all cities visited. The figure below shows cases of emissions from industries;

Figure 6: Cases of emissions from industries



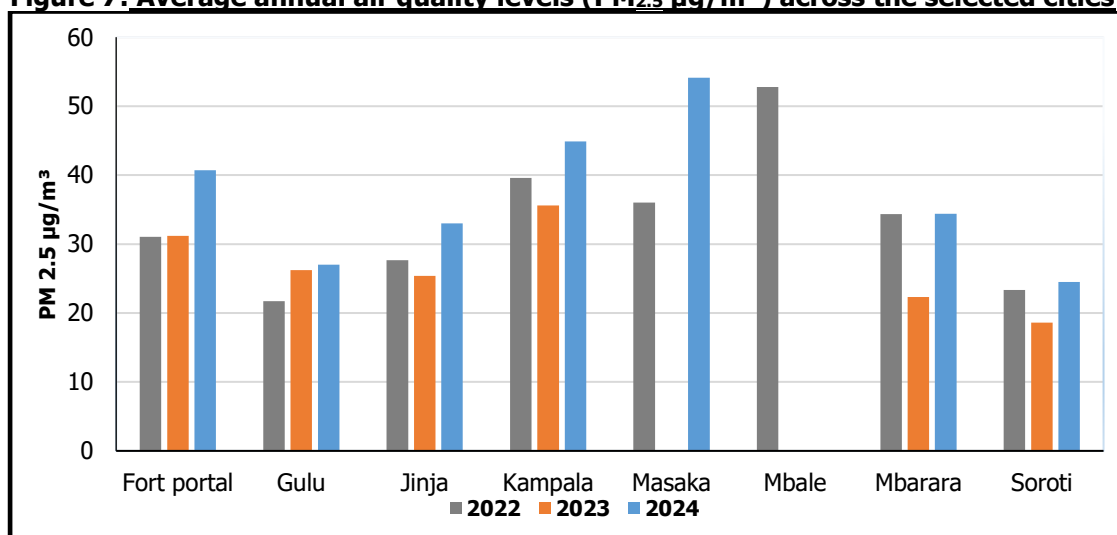
⁴⁷ UBOS statistical abstract 2023

⁴⁸ Ibid.

Air quality monitors located in industrially dense areas like Mukwano Road and Kawempe registered higher annual PM_{2.5} averages (63 and 68 µg/m³, respectively) compared to areas with fewer industries/factories, such as Butabika and Lumumba Avenue, both recording 28 µg/m³.

Furthermore, our analysis revealed that cities such as Kampala, Masaka, and Mbale, with a higher concentration of industries/factories and more vehicles recorded higher pollution levels compared to those with lower numbers like Soroti and Gulu. The figure below refers;

Figure 7: Average annual air quality levels (PM_{2.5} µg/m³) across the selected cities



Source: OAG analysis of AirQo data

The air pollution levels in these cities vary between peak and off-peak hours. For instance, in Kampala, the pollution was most visible in the sky during peak hours, when most of the city's vehicles are on the road and factories are in production. The figure below illustrates the visual variations;

Figure 8: Air pollution variation observed in Kampala



- Waste and biomass combustion also contribute significantly to air pollution. During the audit, the audit team observed widespread unregulated waste burning and the use of biomass fuels by street-side vendors, particularly in preparing snacks for low-income earners in the selected cities. The audit team also observed cases of activities such as brick burning that rely on biomass fuels. Source apportionment studies in Kampala and Mbarara highlight the substantial impact of this source,

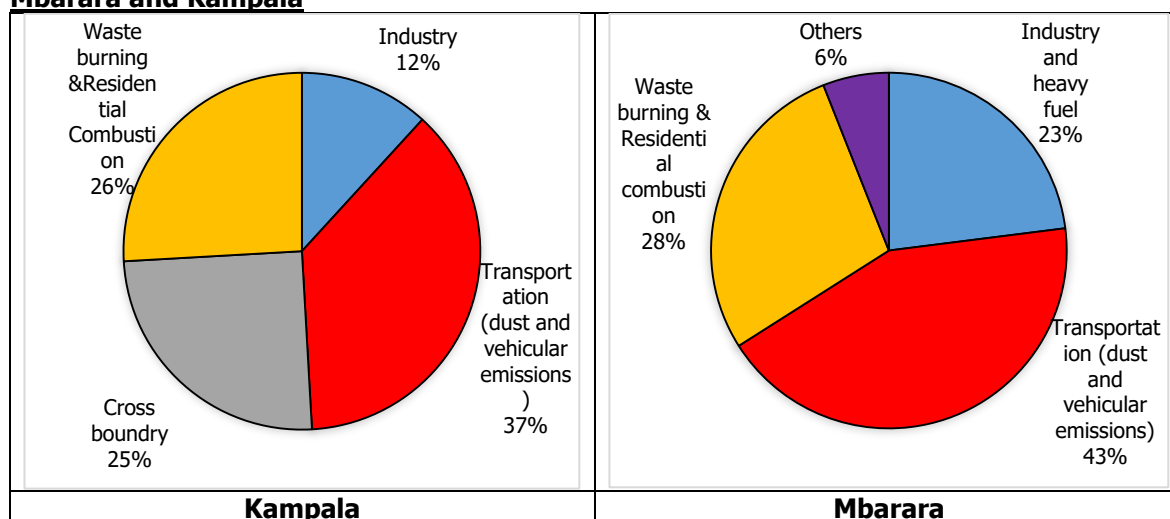
accounting for 26% and 28% of PM_{2.5} compositions, respectively. The figure below shows some cases of waste burning and use of biomass fuels by the street-side vendors;

Figure 9: Samples of biomass and waste burning activities observed during audit



The figure below illustrates the relative contributions of various sources to air pollution in Kampala and Mbarara, as established by the source apportionment studies.

Figure 10: Showing the various contributors to air pollution levels (PM_{2.5}) in Mbarara and Kampala



Source: OAG analysis of air pollution source apportionment studies⁴⁹

The observed pollution levels that were consistently above the recommended WHO and National tolerance limits have been linked to various health concerns. Through a review of research publications on Uganda, the audit team noted that Kampala alone

⁴⁹ ibid.

had lost over 7,000 people in four years due to exposure to polluted air⁵⁰. This represented approximately 17-19% of all non-accident-related deaths in Kampala. Persistent exposure to unsafe ambient air triggers and/or worsens illnesses such as asthma, bronchitis, lung cancer, and heart disorders. There is also a positive association between monthly PM_{2.5} and healthcare facility visits due to asthma and admissions due to pneumonia⁵¹.

A study⁵² examining the link between ambient air pollution and respiratory health in Kampala found that higher pollution levels led to increased hospital visits and admissions for respiratory conditions like asthma, pneumonia, and Chronic Obstructive Pulmonary Disease (COPD). This tallies with data from the Makerere University Lung Institute, which reveals a correlation between patient clinical visits and air pollution trends. For example, Kampala experienced higher pollution levels in 2022, coinciding with a high number of clinical visits (1,849) for respiratory issues. When air quality improved in 2023, a lower number (1,163) of patient visits was observed in the same year. However, a subsequent deterioration of air quality in 2024 resulted in a near tripling of patient visits, reaching 3,363 cases within the same period.

We also noted that children living in urban areas, were exposed to higher pollution levels and demonstrated considerably lower lung function and higher rates of not achieving at least 80% of their expected lung capacity compared to children in cleaner, rural areas⁵³. Similar studies in California revealed significant improvements in lung function when air quality improved⁵⁴.

In addition, interviews with medical workers in the selected cities revealed a correlation between rising air pollution levels and increased respiratory and cardiac complications amongst patients. However, due to inadequate testing equipment, data gaps⁵⁵, and poor healthcare seeking behaviour by the population, the true extent of air pollution's health impact could not be quantified. Chronic exposure to air pollution results in reduced productivity as those affected miss work for treatment, and also affects economic activities such as tourism as people will shy away from visiting polluted cities.

Management Response

Management notes the observation. The status of air quality could be worse, considering that a number of areas are not monitored. Air pollution as a thematic environment management area of focus is relatively recent with the first UN Resolution on the subject being 1st March, 2024. Uganda has come up with Air Quality Regulations and Standards 2024 to fully address this important thematic area of environment. As such, there has been little investment in the air quality monitoring and regulation in absence of National Standards. WHO established Standards for air quality in relation to human health and no country in the World has so far met these standards. All countries including Uganda are now establishing standards and mechanisms for improving air quality through effective monitoring and undertaking interventions to

⁵⁰ Journal of Exposure Science & Environmental Epidemiology by MUK school of public health 2024

⁵¹ Association between ambient air pollution and respiratory health in Kampala, Uganda: Implications for policy and practice, 2023

⁵² Association between ambient air pollution and respiratory health in Kampala, Uganda: Implications for policy and practice

⁵³ Lung Function of Children at Three Sites of Varying Ambient Air Pollution Levels in Uganda: A Cross Sectional Comparative Study

⁵⁴ Lung Function of Children at Three Sites of Varying Ambient Air Pollution Levels in Uganda: A Cross Sectional Comparative Study

⁵⁵ District health information system data collection tool does not provide for recording of patient background information that could explain the causes to the identified illnesses, such as recording work environment, exposure to air pollution, etc.

reduce the air pollutants at source.

NEMA is currently engaging all responsible government institutions to take on their various roles and implement the various sections/provisions of the Air Quality Standards and Regulations. Engagements with Ministry of Works and Transport have already been conducted and plans to reactivate the vehicle inspection points are in progress. All Institutions of Government with mandates to improve air quality including transport, energy, roads, industries, open burning of waste among others all lack adequate capacity in terms of technology and skills. Going forward, there is need for Government to commit financing for a robust air quality management programme.

Conclusion

The audit observed a concerning trend of air quality patterns in the selected cities. The air quality consistently falls below both WHO and national standards, with annual average PM_{2.5} concentrations exceeding the recommended safe limits. Seasonally, air quality pollution worsened during the drier months, while hourly trends indicate significant contributions from human activities, with pollution peaking during rush hours. The main sources of pollution are transportation, industrial emissions, and waste/biomass burning. Cities with higher industrial activity and vehicle density, like Kampala, experienced worse air quality than those with fewer polluting activities. Exposure to this polluted air has been linked to various health issues, including respiratory and cardiac illnesses, and reduced lung function in children.

The prevailing air quality levels are largely a function of rapid urbanisation coupled with the gaps in monitoring and enforcement of air quality standards by NEMA in collaboration with the lead agencies as discussed in sections 4.2, 4.3 and 4.4 below.

4.2 MONITORING AND INSPECTION OF AIR QUALITY IN SELECTED CITIES

In accordance with Section 9 of the National Environment Act, Cap. 181, NEMA is mandated to oversee environmental activities through monitoring, inspection, and compliance audits. To enhance air quality monitoring capabilities, the NDP III Programme Implementation Action Plan (PIAP) allocated UGX.10Bn for the procurement and installation of 50 air quality monitors across 25 cities/municipalities between FY 2020/21 and FY 2024/25. NEMA, in collaboration with lead agencies, is also required to develop a 5-year National Air Quality Monitoring Programme to standardise monitoring and reporting of air quality, and establish a centralised, updatable air quality database. This information would enable NEMA identify key air pollution sources, trends, and impacts, and serve as the basis for a National Air Quality Management Plan and other evidence-based, coordinated interventions.⁵⁶

4.2.1 Availability of air quality monitoring equipment

The audit team, through review of monitoring data and interviews with NEMA and lead Agency officials responsible for air quality management in the selected cities, observed that 121 stationary air quality monitors were operational in 2024. These monitors were a result of collaborative initiatives involving NEMA, lead agencies like KCCA, and private partners such as the US Embassy and AirQo. A detailed breakdown of these monitors is presented in the table below.

⁵⁶ National Environment (Air Quality Standards) Regulations, 2024, Regulations 22 and 23.

Table 6: Number of functional stationary air quality monitors (2024) in the nine selected cities

Selected Cities	Owned by the City	NEMA	AirQo	US Embassy	Total
Kampala	48	2	40	1	91
Jinja	0	0	11	0	11
Mbale	0	0	0	0	0
Soroti	0	0	1	0	1
Gulu	0	0	8	0	8
Masaka	0	0	1	0	1
Mbarara	0	0	2	0	2
Hoima	0	0	0	0	0
Fort Portal	0	0	7	0	7
Total	48	2	70	1	121

Source: OAG analysis of AirQo, NEMA and KCCA air quality monitoring data.

The table indicates that Mbale and Hoima cities had no single operational stationary air quality monitor in 2024, despite the fact that Mbale is home to a big Industrial Park, while Hoima ("The Oil City") has experienced increased activity related to oil exploration and development in recent years. Furthermore, 91 (75%) of the operational air quality monitors in 2024 were concentrated in Kampala. The remaining 25% (30 monitors) were distributed across the other eight cities. Notably, 59% (71 monitors) were owned and operated by non-state entities such as the US Embassy and AirQo.

None of the selected cities had conducted an assessment to determine the optimal number of air quality monitors needed for effective monitoring within their jurisdictions. Given the limited coverage of these monitors, typically extending to a maximum 500-meter radius, it is evident that the current deployment is insufficient to provide comprehensive and reliable air quality data for all the selected cities. For instance, our computations indicate that Kampala city with land area of 195 km²,⁵⁷ would require approximately 250 monitors for comprehensive air quality monitoring⁵⁸.

NEMA also informed the audit team that they possessed eleven (11) handheld monitors for conducting spot inspections in industrial facilities. Of these, ten were operational at the time of the audit. Eight of these operational handheld monitors were located at the headquarters in Kampala, while one was stationed in Mbale and another in Hoima. In addition, five⁵⁹ of the nine cities had gas meters to monitor air quality, provided by the Uganda Support to Municipal Infrastructure Development (USMID) program. However, in two⁶⁰ cities, the officers were not trained to use these meters, while in Jinja and Soroti, the meters were not in use due to calibration and maintenance issues. Furthermore, analysis of the air quality monitoring data for 2024 revealed that only 20⁶¹ out of the 146⁶² districts/cities across the country had installed air quality monitors. The figure below shows the country wide coverage:

⁵⁷ Uganda state of urban sector report 2021-2022, Ministry of Lands Housing and Urban Development

⁵⁸ Number of monitors needed = Total area of Kampala / Area covered by one monitor [i.e. 195 km² / (π * (500 m)²)]

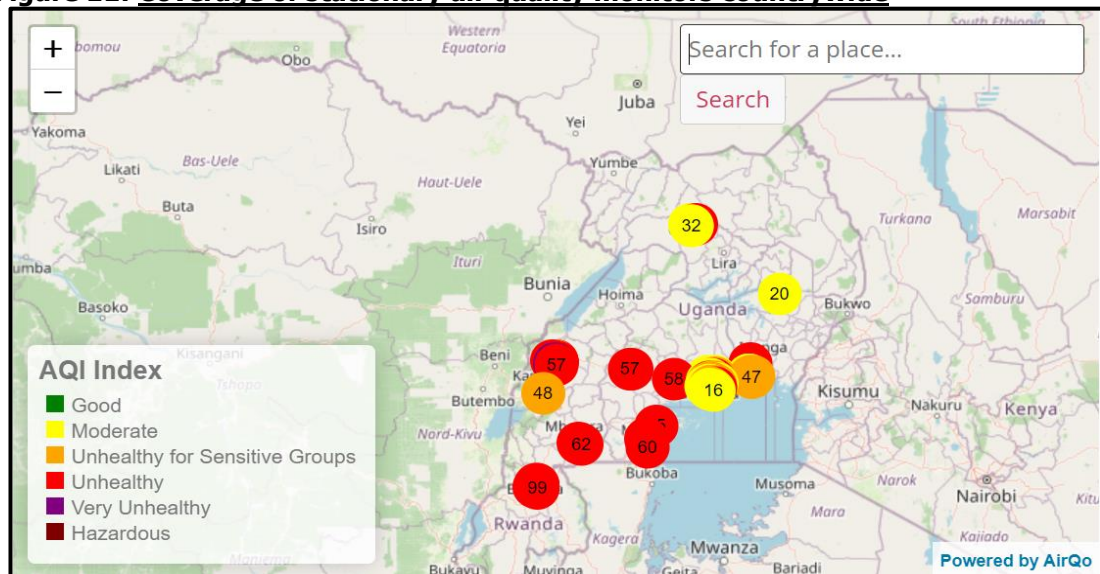
⁵⁹ Hoima, Masaka, Kabale, Soroti, and Jinja cities

⁶⁰ Hoima and Masaka

⁶¹ Bugiri, Bundibugyo, Busia, Gulu, Iganga, Jinja, Kabale, Kabarole, Kampala, Kasese, Kisoro, Masaka, Mbarara, Mityana, Mubende, Mukono, Rubirizi, Soroti, Tororo, and Wakiso

⁶² 135 districts and 11 cities

Figure 11: Coverage of stationary air quality monitors countrywide



Source: AirQo website, 29th July 2024

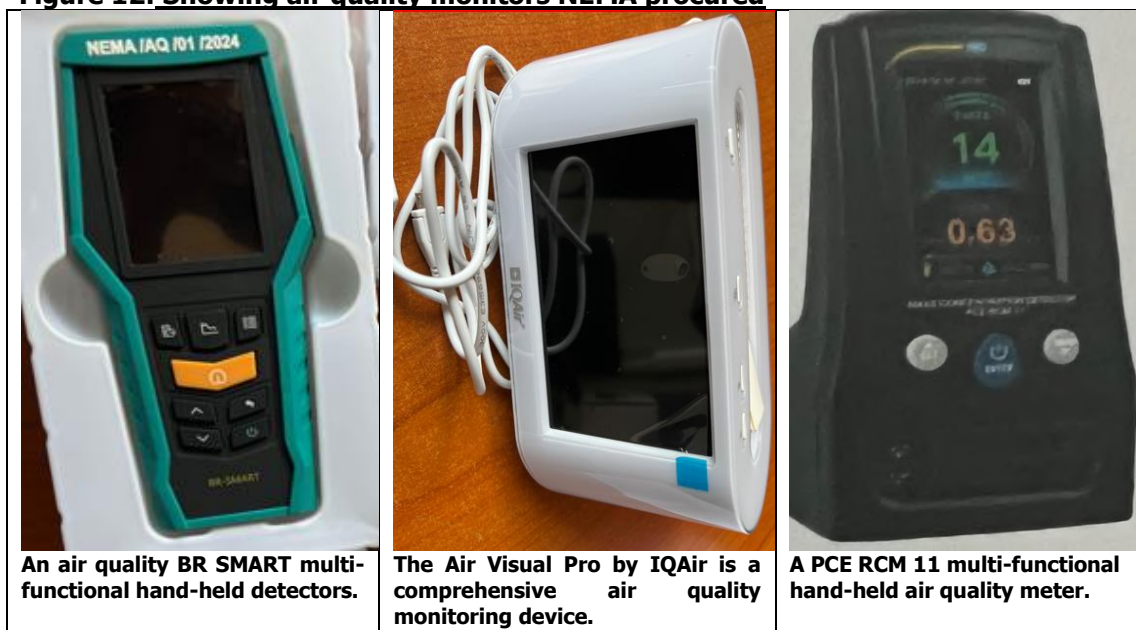
In addition, interviews with environmental monitoring officers in the selected cities revealed general lack of awareness regarding air quality monitoring equipment within their respective jurisdictions. Although eight (8) of the nine (9) selected cities had established air quality monitors, only officers from three (3)⁶³ of the nine cities were aware of their locations. Furthermore, only officers from Kampala were accessing their air quality monitoring data.

The audit team identified inadequate prioritisation of air quality monitoring by NEMA and lead agencies as a primary cause of the limited deployment of air quality monitors across the selected cities and the country as a whole. Despite a UGX.6Bn shillings allocation in the NDP III Programme Implementation Action Plan (PIAP) for procuring and installation of 50 air quality monitors across 25 cities/municipalities between 2021/22 and 2023/24, NEMA allocated only UGX.200Mn for the purchase of real-time and portable environmental monitoring equipment, including air quality, over the three-year review period.

An analysis of payment files for the three-year period indicates that NEMA acquired only six handheld monitors at a total cost of UGX.31.3Mn. These devices comprised four Air Quality BR smart multifunctional handheld detectors, one Air Visual Pro by IQAir, and one PCE RCM 11 quality meter, as illustrated below:

⁶³ Kampala, Gulu, and Mbarara

Figure 12: Showing air quality monitors NEMA procured



Source: OAG Photos taken on 15.11.2024 at NEMA HQs

Furthermore, only KCCA, in line with the Kampala Capital City Clean Air Action Plan, had established partnerships with agencies including United Nations Environment Programme, European Union and Vital Strategies to procure and install air quality monitoring equipment. None of the other cities developed clean air action plans, or included provisions for acquiring such equipment in their annual work plans.

The low number of air quality monitors across the selected cities, coupled with the inability of most of the environmental monitoring officers to access their air quality data, hinders their capacity to track trends of air pollution levels within their jurisdictions. This, in turn, compromises their ability to identify pollution sources and make evidence-based interventions for environmental protection and enforcement of air quality standards. This deficiency partly explains and contributes to the persistent poor air quality conditions and the associated effects observed in Section 4.1.

Management Response

Management notes the observation. The Authority, cities and local governments who should procure and install air quality sensors within their areas of jurisdiction as provided for under the National Environment Act Cap 181, lack adequate capacity and resourcing to do this. There is need to lobby for resources to establish an effective air quality monitoring framework for the country starting with urban areas. Following the establishment of Air Quality Standards in 2024, NEMA will work with various lead agencies to develop a National Air Quality Monitoring Plan for Uganda that will guide investments into this thematic area of environment.

4.2.2 Effectiveness of existing air quality monitoring points

Through a review of air quality monitoring data availed for the audit, the audit team observed that whereas there were a total of 162 installed air quality monitors in the selected cities, only 121 were operational in 2024. Details are provided in the table below:

Table 7: Functional and Non-functional air quality monitors

Entity	Functional	Non functional	Total
AirQo	70	14	84
NEMA	2	1	3
KCCA	48	24	72
US embassy	1	0	1
Total	121	39	160

Source: OAG data analysis of AirQo, NEMA and KCCA air quality monitoring data.

While the table shows that 121 air quality monitors were operational in 2024, only 73 transmitted data to the automated database hosted by AirQo under their collaboration with NEMA for centralised management. Notably, none of the 48 KCCA-operated monitors were integrated into this system by the time of field inspections (October, 2024). The KCCA and AirQo teams indicated ongoing efforts to connect these monitors, to facilitate streamlined data analysis and reporting. Only two NEMA operated stationary monitors were functional at the time of audit.

In addition, an analysis of the 73 monitors connected to the centralized database revealed significant uptime variability. While 47 monitors across the selected cities provided data throughout all nine months of 2024, 26 monitors exhibited data gaps. Gulu, in particular, was impacted, with three of its eight monitors missing data for eight months. Notably, Masaka's only monitor was offline for four months. A detailed breakdown is presented in **Appendix IV**. The table below provides an overview of monitor functionality in 2024;

Table 8: Overview of monitor functionality in 2024

Months off	0	1	2	3	4	5	6	7	8	Total
No. of monitors	47	4	7	3	1	3	1	4	3	73

Source: OAG analysis of AirQo data

Relatedly, Mbale city did not have monitoring data for the entire 2023 and 2024 year periods, and Masaka in 2023 (see figure 7 above). In addition, air quality monitoring data was unavailable for the entire months of June and October, 2022, across all the selected cities. AirQo indicated that some of these monitors were withdrawn or non-functional due to operational constraints. Similarly, Kampala Capital City Authority (KCCA) had 24 installed monitors whose data they could not access as a result of their inability to renew operating licences with the provider, due to budgetary constraints. NEMA had not provided resources to maintain their non-functional monitors for all the three years reviewed.

These observed data gaps compromise the accuracy of air quality assessments, hindering NEMA and city authorities' ability to promptly identify deteriorating trends, pollution hotspots, and emission sources. This, in turn, hampers the development and implementation of timely corrective measures and enforcement actions. Consequently, this contributes to the observed poor air quality levels and associated health impacts, as detailed in section 4.1.

Management Response

Management notes the observations. Uganda does not have a National Air Monitoring Programme that is fully developed as stated earlier. The few air quality monitors we have are mainly in Kampala, majorly owned by KCCA and AirQo. The monitors in the other cities are owned and operated by AirQo, a Makerere University air quality

monitoring programme. The KCCA monitors, have as of December 2024, been resolved and integrated onto the AirQo system for real-time access and reporting. Government needs to invest in a centralised air quality data management programme, regulated by the Authority.

NEMA is working with Petroleum Authority Uganda to install air quality monitors within the oil region. There is need for deliberate financing efforts by government to procure, install and maintain a network of monitors across all urban areas and other ecologically sensitive areas. Air quality management has been prioritised in NDP IV.

Following the establishment of National Air Quality Standards in 2024, NEMA will work with various lead agencies to develop a National Air Quality Monitoring Plan for Uganda that will guide investments into this thematic area of environment.

4.2.3 Inspection of motor vehicles

Section 5(2)(h) of NEA, Cap. 181 mandates NEMA to establish adequate environmental protection standards and implement effective monitoring mechanisms. The Agency is further obligated to oversee lead agencies responsible for motor vehicle inspections, ensuring periodic environmental compliance tests. In line with Section 131(h) of the Traffic and Road Safety Act, Cap. 347 all vehicles are to undergo annual inspections for public service vehicles and biennial inspections for other motor vehicles.

Furthermore, in July, 2022, the East African Community (EAC), Uganda inclusive, adopted and gazetted the East African Air quality (Euro 4 Equivalent) Vehicle Emission Standards. These standards outline permissible limits for common pollutants, including carbon monoxide (CO), particulate matter (PM), oxides of nitrogen (NO_x), and hydrocarbons, applicable to new, imported used, and in-use motor vehicles of all types. Member states were required to implement these standards within six months of gazettment, as per East African Community statutes.⁶⁴

A review of correspondences and interviews with officials from NEMA, Ministry of Works and Transport (MoWT), and Uganda National Bureau of Standards (UNBS) revealed that, although UNBS approved the East African Air Quality vehicle emission standards in December 2022 for pre-export vehicle inspections, gazettment was delayed until November 2023. While UNBS conducted pre-export inspections of used motor vehicles in accordance with Section 5(1) of the Uganda National Bureau of Standards (Inspection and Clearance of Imports) Regulations, 2022, the East African Air Quality Vehicle Emissions standards had not been implemented at the time of the audit (November 2024). The Bureau continued to rely on outdated standards in its pre-export verification checklist for vehicles destined for Uganda, which only covers carbon monoxide and hydrocarbon inspections, neglecting particulate matter and oxides of nitrogen limits mandated under the East African Air Quality Vehicle Emission Standards.

Given Uganda's unique position as the only EAC country permitting the importation of used vehicles up to 15 years old, pre-export conformity assessment of compliance to the East African Air Quality Vehicle emissions standards is crucial. During the review period, Uganda imported a total of 592,052⁶⁵ motor vehicles. Of these, 399,676 were imported after January 2023, the deadline for implementing the East African Air Quality

⁶⁴ <https://www.unep.org/events/workshop/east-africa-sub-region-becomes-second-sub-region-africa-adopt-euro-4iv-equivalent>

⁶⁵ MoWT motor vehicle registration records.

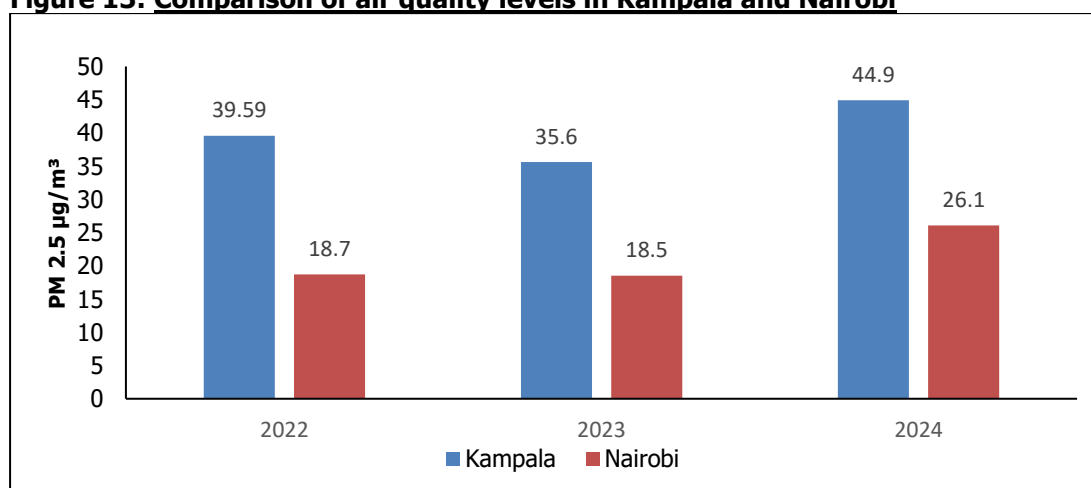
Vehicle emission standards. However, these vehicles were not subjected to tests for compliance to this requirement.

Furthermore, interviews with MoWT officials indicated that the Ministry had not conducted periodic vehicle inspections throughout the review period, contravening the provisions of the Traffic and Road Safety Act, Cap. 347, and the Traffic and Road Safety (Motor Vehicle Inspection) Regulations, 2016. The last such inspections were conducted in 2017 by *Société Générale de Surveillance* (SGS) under an outsourced arrangement, which was subsequently terminated due to procurement irregularities. During their tenure, 29,971 vehicles were inspected, with 42% failing the emission tests. This statistic is particularly concerning as it represents vehicles whose owners believed they were roadworthy enough to undergo voluntary inspection.

The audit observes that NEMA has not executed its mandatory obligation of ensuring that lead agencies, such as MoWT and UNBS fulfil their statutory obligations regarding motor vehicle inspections in accordance with the existing statutory requirements. While MoWT officials cited the lack of appropriate equipment as the reason for their failure, the team notes that this activity has not been prioritised by Government. For instance, the environment levy was instituted on importation of all used motor vehicles, to support corrective and regulatory measures for protection of the environment. While UGX.773Bn was collected under this levy during the review period, only UGX.7.7Bn was allocated, with only UGX.3.9Bn released to NEMA for implementation of monitoring and enforcement activities for environmental protection.

These observed gaps in both pre-export and periodic vehicle inspections contribute significantly to the elevated levels of vehicular emissions within the measured PM_{2.5} concentrations, as reported in section 4.1. A comparison with neighbouring countries like Kenya, which imposes stricter regulations on used vehicle imports (eight-year age limit) and conducts comprehensive pre-export inspections, reveals lower vehicle emissions and improved air quality. Notably, Nairobi City, despite its larger vehicle fleet compared to Kampala, consistently reported better air quality (moderate) throughout the review period, as illustrated in the figure below.

Figure 13: Comparison of air quality levels in Kampala and Nairobi



Source: OAG analysis of AirQo data

The data provided by MoWT underscores the significant contribution of older, imported vehicles to air pollution in Uganda. With over 2.1 million motor vehicles, of which more than 95% are used imports, and over 70% operating in and around Kampala, the city's

air quality, which is considered unhealthy for sensitive groups, is heavily impacted by these aging vehicles.

Motor vehicle emissions significantly contribute to the observed elevated levels of air pollution, and have been linked to persistent lung and heart ailments, as detailed in section 4.1.

Management Response

Management notes the observations. It is true that transport remains the biggest source of air pollution in Uganda with vehicles, motorcycles and dusty roads being the biggest contributors. To address this challenge, there is need for phasing out of all engines below Euro 4 standard, scale up uptake of electric automobiles, adopt bulk transport service (bus system and tram service) for passengers to reduce motorcycles and the number of automobiles on the road, adopt railway and water transport to reduce road use and associated emissions. There is need to dedicate a portion of funds generated from import of used vehicles to air quality monitoring and management.

Government introduced the Pre-Export Verification of Conformity programme to ensure that vehicles are inspected before being exported to Uganda. One of the parameters inspected is the quality of exhaust emissions. However, government is yet to implement the adopted East African Standards on vehicular exhaust emission limits. For vehicles that already in Uganda, government through MoWT used to run a vehicle inspection program, which faced challenges and was stopped. There is an on-going process to revive this programme.

The implementation of the adopted East African Community Standards (Euro 4 equivalent) has been delayed by absence of emission testing equipment and the need to conduct adequate sensitisation of the population. NEMA in collaboration with MoWT and UNBS are undertaking the preliminary processes necessary for implementation of these standards.

In addition, government through the Ministry of Science, Technology and Innovation, has also established an e-mobility programme where emission free vehicles, motorcycles, boats among others are being innovated. These will reduce the emissions on our roads.

4.2.4 Inspection of Factories and Facilities

The National Environment Act, Cap. 181 mandates developers to establish air quality monitoring and reporting mechanisms for all projects requiring Environmental and Social Impact Assessments (ESIAs). This requirement, outlined in Sections 176 and 177, requires developers to record and report on their emissions, annually. Additionally, Section 9(k) empowers NEMA to undertake and coordinate environmental monitoring, inspections, and compliance audits for all businesses and projects.

Interviews with NEMA officials revealed that effective 2022, and in line with the Act, all Environmental and Social Impact Assessment (ESIA) certificates issued required developers to establish mechanisms, to assess and report their daily air quality levels to the Authority. The Authority further reinforced this requirement through media notices to factories for compliance in 2023. However, the audit noted significant

compliance gaps. A review of the certificates issued confirmed incorporation of this requirement.

Out of the 2,523 factories registered with NEMA, only nine⁶⁶ had installed emission monitors at the time of audit (November, 2024), and none were submitting regular reports, indicating their emission levels to the Authority for assessment. In addition, URA data indicated that there were 6,528 registered industries/factories, implying existence of an additional 4,005 industries/factories unregistered with NEMA, potentially operating outside the Authority's oversight.

Furthermore, NEMA had not conducted a risk assessment of registered factories and vulnerability of the surrounding communities or utilised existing monitoring data to prioritize inspections of high-risk polluters. This lack of a systematic approach has led to arbitrary inspections. For instance, whereas the annual air quality averages (PM_{2.5}) in some sensitive communities with vulnerable populations were concerning, no air quality inspection or monitoring was done in these areas, to identify and manage pollution sources for the period under review. In 2024, Kawempe area within Kampala city, home to Kawempe National Referral Hospital responsible for maternal and infant care, recorded an annual PM_{2.5} average of 66 µg/m³, a level considered unhealthy for all groups. Similarly, Mulago area (also within Kampala), home to Mulago National Referral Hospital which handles the most critical patients referred from across the country, registered an annual average of 36 µg/m³, unhealthy for sensitive groups. This lack of proactive inspection in areas with vulnerable populations presents a public health concern.

In addition, our analysis, based on industry classifications provided by NEMA, identified approximately 697 high-risk industries (see table below). Given their potential for significant air pollution and the absence of emission monitoring and reporting, these industries require more frequent inspections.

Table 9: Showing auditors categorisation of industries on NEMA's register

Category	High risk ⁶⁷	Medium risk ⁶⁸	Low risk ⁶⁹	Total
Number of Factories.	697	1224	602	2,523

Source: OAG analysis of the NEMA's industry database as of 2024

A review of inspection reports availed for the audit reveals that out of the 44 factories inspected in 2023/24, only nine (9) had their air quality assessed. Out of the nine, six recorded air quality levels exceeding the national daily tolerance limits. However, there was no record of any corrective action taken or follow up inspection to assess and enforce compliance with environmental standards. In addition, inspection checklists provided by NEMA and Jinja City were found to be inadequate in assessing air quality monitoring compliance. The checklists merely asked a binary yes-or-no question about air quality monitoring, without delving into the specific methods and standards used for monitoring. This hinders reporting on air quality levels.

⁶⁶ Hima-Kasese, Hima-Tororo, Kakira Sugar, Mayuge Sugar, Modern Distillers, Mukwano Industries, National cement, SCOUL, and Terenga Project Hoima.

⁶⁷ Pharmaceuticals, Wood processing, Chemical industries, Cement, Sugar, Steel, Textile, Leather turning, Oil and gas, Pole treatment, Battery manufacturing, Oil recycling, Form production, Distillery, Transformer manufacturing and repair, Quarrying (e.g., stone and gravel), Mineral Processing (e.g., gold, copper, and limestone), Oil and Gas Extraction.

⁶⁸ Agro processing mills, food and beverages, concrete products, Paper production, Tea factories, Milk processing, Soap production, Fish processing, Plywood, Coffee factories among others.

⁶⁹ Water processing, cosmetics, detergent processing, warehouses, Alcohol blending, confectionaries, electrical assembling plant, Maize millers, wheat milling, rice milling and soya bean milling.

The number of factories inspected in 2023/24 represents a very small proportion of the 697 industries identified as high risk, or the entire 2,523 industries on the Authority's register. This is a consequence of the limited number of staff and non-prioritisation of air quality monitoring and inspection activities by NEMA. For instance, in 2023/24, out of the UGX.1.4Bn spent on monitoring and inspection activities, only UGX.27.9Mn (2%) was spent on inspections related to air quality.

There were only 12 staff responsible for monitoring and inspection of 2,523 factories, for air quality compliance countrywide, and at least annually. The situation was similar in the selected cities, where the officials indicated that their numbers were few, compared to the environmental protection responsibilities within their jurisdictions. This understaffing was compounded by the broad range of responsibilities assigned to these officers, including: conducting environmental awareness; participating in Environment Social Impact Assessment (ESIA) reviews; environmental inspections, audits and monitoring for compliance; development of environmental action plans; and participating in preparation of state of the environment reporting. This workload in view of the limited numbers hinders effective monitoring and inspections for air quality compliance. Officials indicated that they often prioritise wetland protection activities, since these usually have a budget allocation, unlike air quality monitoring. The table below shows the staffing levels in the selected cities.

Table 10: Staffing levels for environmental officers within the selected cities.

City	No. of environment officers
Masaka City	03
Kampala City	05
Mbarara City	03
Jinja City	02
Mbale City	02
Soroti City	02
Gulu City	01
Hoima City	02
Fort Portal City	02

Source: OAG analysis of cities staffing levels

Furthermore, none of the cities had a functional environmental management committee in contravention of Section 27 of NEA, Cap. 181. These committees would, if present, support development and implementation of environmental action plans, integration environmental considerations into local plans and projects, preparation of environmental reports, formulation and enforcement of environmental regulations, monitoring environmental impacts, promotion of environmental awareness, and coordination with NEMA. This would improve implementation of environmental management activities, including air quality monitoring and enforcement.

Management response

Management notes the observations. In the absence of National Standards and Regulations for air quality in the past, there was no possibility to hold accountable factories that release emissions above standards since the country did not have the standards. NEMA has now developed and Government has adopted National Air Quality Standards and Regulations, 2024 and hence there is now a basis for enforcing standards against air pollution.

While NEMA has included the need for installation of air quality monitors in the conditions of approval of ESIA requirements for industries, the implementation has been slow due to the limited staff for following up this requirement. Previously NEMA had only three inspectors to manage the whole country but these have since been now increased to six. These inspectors not only monitor air quality but also noise and vibrations. This number is absolutely low to effectively monitor the industries in Uganda. There is need for more staffing in this area and also training and equipping district environment officers in order for them to support inspections and monitoring of environment including air quality at district level.

In addition, NEMA is currently establishing a system to automate submission of reports and remind industries to submit their reports, including air quality monitoring data.

4.2.5 Unregulated sources of Air Pollution

During inspections, the audit observed a number of unregulated activities that contributed to air pollution levels in the selected cities. Neither NEMA nor the respective city authorities had in place any controls for these activities at the time of audit. These included; emissions from poorly maintained vehicles, dust from unpaved roads, road side cooking, brick burning, emissions from unlicensed factories, tyre burning, dust from construction, and open burning of waste (see figure 9 above). Interviews with officials from NEMA and selected cities confirmed a lack of enforcement against these polluting activities, primarily due to the absence of city bylaws addressing air pollution.

In addition, officials from the selected cities indicated that only road construction projects funded by World Bank, USMID, and Uganda Intergovernmental Fiscal Transfers (UgIFT) considered air quality monitoring in their contract terms, as a funders' requirement. This was a result of low levels of awareness by the contracting teams on the need to monitor air quality during road construction projects for their associated health risks.

Management Response

Management notes the observations. There is need for strengthening institutional capacity at NEMA and Local Governments to address existing inadequacies. The district environment committees are already established by the law and composition defined. But activities of these committees are minimal as they are not prioritized by local governments to sit largely due to lack of resources. NEMA will continue to follow up activities of these committees and continue engaging local governments to prioritize funding operations of these Committees.

NEMA has now introduced conditions in ESIA requiring all roads and rail lines to have trees planted in the road reserves and rail way reserves. This will reduce emissions through mitigation.

Conclusion

The audit revealed significant weaknesses in air quality monitoring and inspection in selected cities, hindering efforts to combat air pollution. Monitoring was inadequate, with most air quality monitors concentrated in Kampala, leaving critical gaps in other cities, such as Mbale and Hoima. This imbalance and fragmented approach stemmed from the absence of a comprehensive National Air Quality Monitoring Programme, as

well as NEMA's reliance on independent actors, whose monitor placements reflected their own priorities and capabilities. Monitor downtime led to data gaps, while limited staff capacity and insufficient prioritisation by NEMA and city authorities further hindered effective air quality assessments and enforcement. Additionally, weak institutional mechanisms, including non-functional environmental management committees worsened these challenges.

Recommendations:

The Accounting Officer of NEMA, in collaboration with the lead agencies, should:

- i. Develop a National Air quality monitoring programme and centralised database to streamline countrywide air quality monitoring, reporting, forecasting and impact-assessment;
- ii. Fast track the implementation of the adopted East African Community vehicle exhaust emissions Standards (Euro 4 equivalent), for pre-export and periodic inspection of motor vehicles.

4.3 ENFORCEMENT OF AIR QUALITY STANDARDS

Section 135 (7) of NEA, Cap. 181 requires that NEMA, an authorized officer or an environmental inspector be responsible for the enforcement of an environmental improvement notice or environmental compliance notice. This is in line with the key functions of the Authority, to enforce all the provisions of the National Environment Act⁷⁰.

NEMA through the ESIA certificates issued after 2022 required industries to put in place air pollution control systems and equipment to monitor and maintain air quality, particularly, particulate matter in accordance with the set standards. This was in line with Section 176 and 177 of the National Environment Act, Cap. 181, which requires developers to record and report on their emissions annually. While only 9 of the 2,523 factories on NEMA's register had complied with the requirement to install monitoring systems, no enforcement action has been taken by NEMA on the non-complying factories and facilities. This despite a provision in the NEA, Cap. 181 for penalties of up to UGX.10Mn and/or imprisonment of up to 15 years, for persons who fail to comply with conditions stipulated in the ESIA certificates of approval. Similarly, while the inspection records show that six of the nine inspected factories/facilities failed emission tests, there was no record of any enforcement measure or penalty instituted by the Authority.

In addition, a review of the 47 environmental audit reports provided by NEMA for the period between 2022 and 2023, revealed that only 21⁷¹ of these audit reports included details on their emission levels. While eight of these reported poor air levels, there was no record of any enforcement action taken by NEMA in response to this reported status. Furthermore, in 19 of the 21 instances, the measurements were confined to the facilities' premises and did not assess emissions released into the environment, neither during the environmental audit nor upon reviewing the self-monitoring records maintained by the developers. Similarly, no action was taken on the industries that did not include emissions data in their audit reports, as required under Section 126 of the

⁷⁰Section 9(2) of the National Environment Act 2019

⁷¹ Steel and Tube Namanve & Steel and Tube Nakawa.

NEA, Cap. 181. There was also no record of corrective/ enforcement measures taken against industries identified through inspections as not complying with air quality standards.

This was a result of limited investment in air quality enforcement by NEMA. During the financial year 2022/23, NEMA spent a total of UGX.133Mn on enforcement activities, with only UGX.13Mn on air quality related enforcements, while in 2023/24, UGX.72Mn was spent on enforcement activities, but none related to air quality.

While NEMA received air pollution complaints through various channels, their electronic documentation system (eDOC) only captured written submissions. NEMA officials' revealed that walk-in and telephone complaints were not logged into eDOC. This hindered comprehensive complaint tracking and management. Furthermore, a walk-through on the eDOC system revealed that tracking of registered complaints stops at assigning an officer to investigate and address the complaint. The system lacks the capability to track specific actions taken in response to each complaint and/or to confirm whether those complaints have been resolved. Out of the six complaints reported to NEMA (2023 and 2024) and recorded on the eDOC, available records indicate that none had been acted upon by the time of audit. The table below refers:

Table 11: Status of air quality complaints raised to NEMA

S/N	Date of complaint	Nature of complaint	Complainant	Location	Action taken
1	28.10.2024	Land and air pollution of sewage	Sino East Africa Trade Company limited.	Bugolobi, Kampala	None
2	19.01.2024	Noise and air pollution by Yaket international LTD	Kavuma Joseph	Gayaza, Wakiso	None
3	2.10.2024	Air pollution	Moses Emodu	Kireka, Bweyogerere Wakiso	None
4	08.09.2024	Car tyre burning during stone quarrying in Bukerere	Beatbox Global	Bukerere road, Mukono	None
5	02.05.2023	Air pollution from poultry farm open trench by Ssenyonga Joseph	Johnson Kajungu	Kira municipality, Wakiso	None
6	14.08.2023	Blocking of the road, noise and air pollution by SR Classic Coach Ltd and Horizon coaches.	AMCO East Africa LTD	Berkeley Road, Kampala	None

Source: OAG analysis of written complaints to NEMA

A review of the above complaints revealed that two⁷² of these were correspondences highlighting NEMA's inaction on earlier reported issues, prompting the individuals to resubmit a follow up complaint.

Furthermore, despite acknowledging receiving numerous verbal (walk-ins or phone calls) air quality complaints from the public, the city authorities lacked formal mechanisms for receiving and documenting such concerns. This hindered effective complaint management, as valuable information relayed to officials, such as natural

⁷² Car tyre burning during stone quarrying in Bukerere and complaint regarding blocking of the road, noise and air pollution.

resource and environment officers, remained unrecorded and potentially unaddressed. The city authorities indicated that their enforcement capability was limited by absence of air quality monitoring equipment and ordinances to guide environmental protection initiatives.

In addition, a review of the cities' approved plans and budgets indicated that cities did not have a specified budget for air quality management initiatives, but rather included it under the generalised environmental management activities. However, a review of reports on environment indicated that the city environment officers predominantly focused on wetlands restoration and protection activities, omitting air quality surveillance.

The gaps in staffing contributed to weaknesses in enforcement. While NEMA has an approved structure of 150 positions for environmental enforcement, only 44 (29%) were filled. Majority of these (23) were stationed at the head office, leaving just 21 personnel responsible for environmental enforcement activities across the other parts of the country. The audit team considers this staffing level as insufficient, given that they are tasked with overseeing 2,523 industries, and considering their additional responsibilities, such as wetland protection, water pollution control, waste management and other environment related incidents in the country.

These gaps in enforcement result in many pollution sources going unchecked, and ultimately the persistent poor air quality levels, as reported under section 4.1. The poor air quality levels trigger or exacerbate ill health.

Management Response

Management notes the observations. Cases of air pollution have not been effectively followed up in the past, largely due to the absence of national air quality standards. However, with the recent establishment of these standards, NEMA is now better positioned to take decisive actions against non-compliance. There is need for more capacity building in terms of personnel and air quality monitoring equipment acquisition at NEMA and at local governments' level.

To address the identified gaps in enforcement, NEMA has taken steps to modernize its operations by introducing an automated system for the submission of environmental audit reports. This system, launched on 1st December, 2024, aims to streamline the submission process, reduce manual workload, and enhance the efficiency of report generation and analysis.

Regarding complaint management, as earlier mentioned, NEMA has limited capacity to handle all complaints from all over Uganda. Currently there are 6 specialised air quality inspectors to manage the air pollution, noise and vibrations within the country and these were recently recruited. NEMA is in the process of expanding its structure to include two positions for officers responsible for complaints handling. Besides the eDOC system, NEMA is in the process of establishing a comprehensive complaints handling system, for receiving, recording, tracking actions, and providing feedback on all complaints up-to closure.

We shall continue to leverage on environment officer in cities, through designating them as gazetted inspectors and training them so that they can effectively manage air pollution in their jurisdiction with our support.

Conclusion

NEMA has established legal frameworks for air quality standards, but significant gaps remain in enforcement. Inadequate monitoring and follow-up on complaints, insufficient staffing, and weak collaboration with local city authorities have hindered enforcement efforts. This has limited NEMA's ability to effectively ensure compliance, resulting in continued poor air quality and ongoing risks to public health and the environment.

Recommendations

The Accounting Officer of NEMA should:

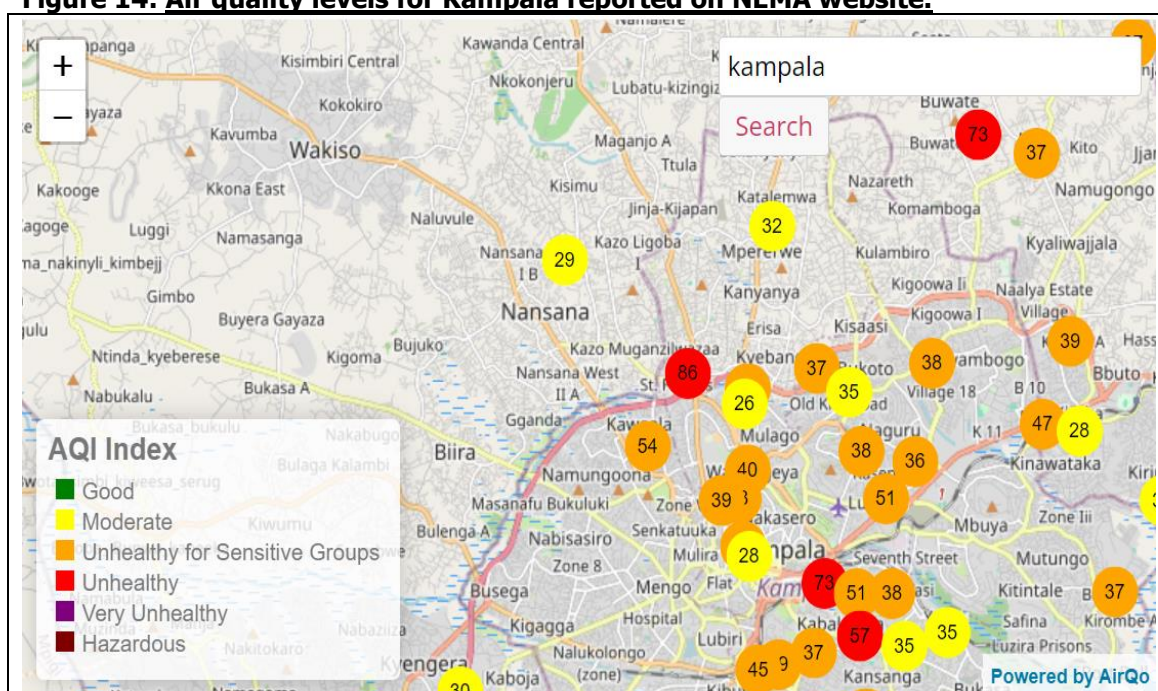
- i. Utilise the penalties provided in the National Environment Act, Cap. 181 and National Environment (Air Quality Standards) Regulations, 2024, to enforce compliance with air quality standards;
- ii. Conduct a risk assessment of registered industries to prioritise routine inspections of high-risk polluters;
- iii. Support cities in building their capacity to enforce air quality standards;
- iv. Automate air quality management systems to facilitate swift identification, follow-up and actions on non-compliance.

4.4 SENSITISATION AND AWARENESS FOR AIR QUALITY MANAGEMENT

Section 147(b) of the NEA, Cap. 181 requires NEMA to carry out quarterly public education and awareness on environment issues. Additionally, section 30 of the National Environment (Air Quality Standards) Regulations states that the Authority shall, in collaboration with the relevant lead agency and other stakeholders undertake air quality awareness programmes for the public.

Through interviews with officials at NEMA and a review of their website, the audit noted that NEMA provides a link to air quality monitoring data, powered by AirQo, through their collaboration. The link provides real time air quality levels and their interpretations for the locations monitored. The figure below refers;

Figure 14: Air quality levels for Kampala reported on NEMA website.



Source: NEMA website, 29th July 2024, 11:00 am. https://www.nema.go.ug/new_site/airquality/

However, the audit opines that this is not very effective considering that about 91% of Ugandans have no access to internet⁷³. In addition, interviews with officials in the cities visited revealed that only KCCA was aware of existence of this air quality information online. The other cities had not made efforts to access and utilise this information, despite it being available online, including on the Regulator's (NEMA) website.

NEMA also developed a popular version for the National Environment Act, Cap. 181, and translated it into three local languages, i.e. Luganda, Ateso, and Runyoro. This was to support the common person in understanding issues of the environment including air quality monitoring. NEMA has initiated media engagements to raise awareness about the existence of these popular versions, though their copies are not yet available online. To further enhance the NEA, Cap. 181, NEMA developed the air quality standards (May 2024) to provide criteria and procedures for measuring air quality, prescribe air quality standards, prescribe emission standards from various sources, and issue guidelines for air pollution control.

Additionally, NEMA alongside other stakeholders such as AirQo, KCCA and the US embassy have organised the air quality awareness week, in Kampala for the last three years (2022-2024). During the week, they raise awareness about the pressing issue of rising air pollution levels in the city centre through various channels, including banners, radio shows, newspaper articles, and television broadcasts. The figure below refers:

⁷³ National population and housing census 2024: https://www.newvision.co.ug/category/news/what-more-ugandans-are-looking-for-on-the-int-NV_197170

Figure 15: Display of air quality information to the general public



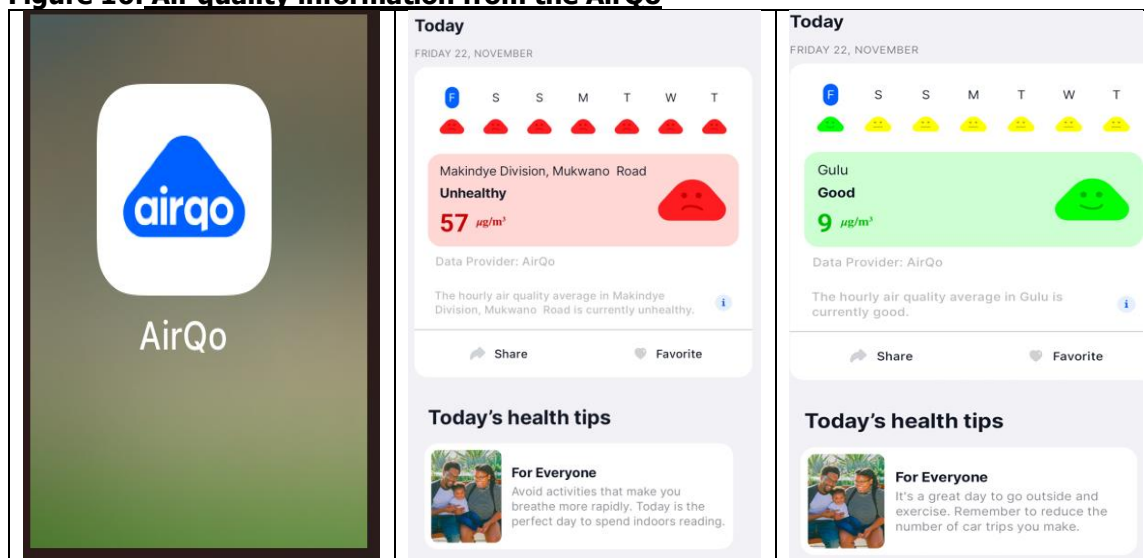
A publication of consequences of air pollution in the local media. OAG extract

A publication for a radio talk show on air pollution. OAG photo

While these awareness campaigns were commendable, they were isolated events rather than part of a continuous effort. Through review of the environment awareness workshop reports, training manuals, training reports and interviews with NEMA officials, the audit team noted that, out of the nine (9) trainings on environmental related topics for the period under review, only two (2) trainings included a component of air quality. The other trainings and training manuals focused mainly on wetland restoration and waste management.

Additionally, the audit team noted that NEMA collaborates with an independent operator, AirQo, under the Makerere University, that collects data on air quality and avails the information to the general public through their website, and through a mobile application that is accessible via the google play store and app store as shown in the figure below:

Figure 16: Air quality information from the AirQo



Source: OAG photos taken from AirQo app.

Through this application, individuals can obtain information about the status of air quality, a seven-day projection, and health tip for their location and any other locations of interest provided the locations have monitors stationed and the individuals have a smart phone/laptop and good internet connectivity.

Through interviews with the officials in the selected cities, the audit team noted that awareness on air quality issues have only been carried out in 2 out of the 9 cities. These two cities, Kampala and Jinja, organised "Car Free Days", which included street closures to promote walking and cycling. Kampala has held this event annually since 2022, and Jinja, once in 2024. These interventions are aimed at creating awareness of the effects of air pollution especially from vehicular emissions and to make the public aware of the main air pollutants that damage human and environmental health. The remaining seven⁷⁴ cities indicated that they had not carried out air quality sensitisation in the three financial years under review.

Additionally, through review of the KCCA training reports and interviews, the audit team noted that they have carried out trainings in line with their Clean Air Action Plan, to further create awareness on air quality for communities in Makindye, Kawempe and Nakawa divisions in 2024. However, the team observed that these activities were not included in the approved annual plans, but were rather ad hoc, and dependent on financing from development partners, such as the US embassy.

These gaps in sensitisation have resulted in limited public awareness on air quality, exposing individuals to health risks and hindering informed decision-making. For instance, during the audit period, the team observed numerous instances of people jogging in areas or during hours with unhealthy air quality levels, when it would be recommended to avoid or reduce intense outdoor activities. On the other hand, healthcare workers in the selected cities indicated that some patients with respiratory complications, after being made aware of the contribution of air pollution to their conditions, took steps to reduce their exposure and subsequently experienced health improvements.

⁷⁴ Mbale, Fort Portal, Hoima, Mbarara, Masaka, Gulu, Soroti

State of the environment report

The NEA, Cap. 181 mandates NEMA, in collaboration with lead agencies such as city authorities, to prepare and disseminate the State of the Environment Report every two years. The information contained in these reports should then be used to develop the National Environment Action Plan every five years, and reviewed every two and half years, taking into account emerging issues, challenges, and opportunities. The city councils are required to develop their environment action plans covering 5 years, reviewed every 2.5 years, and in conformity/alignment with the national environment action plan. The plans are to guide environmental planning and decision-making at all levels of government.⁷⁵

A review of documents and interviews with NEMA and city officials revealed that the national state of environment report⁷⁶ for the period under review was prepared. However, the selected cities had not fulfilled their obligation of preparing their state of environment report for the entire period under review, and NEMA had not taken any action to ensure compliance. It was also observed that city authorities were not involved in the preparation of the national state of environment report, hindering inclusion of their unique emerging issues, challenges and opportunities. Additionally, while these reports are meant to be disseminated through environment offices in the cities and districts, and the NEMA website, interviews with natural resource officers in selected districts revealed that they had not received the reports. The most recent State of Environment Report available on the NEMA website dates back to 2016/17.

In addition, although NEMA, in collaboration with lead agencies, produced the national State of the Environment Reports, the accompanying National Environment Action Plan was not developed. This hindered NEMA's ability to compel cities to formulate their own localized environmental action plans, resulting in a lack of such plans across the selected cities. Notably, however, Kampala Capital City Authority (KCCA) proactively developed a Clean Air Action Plan for the period 2022-2025, specifically targeting air pollution and its associated challenges.

Management Response

Management notes the observations. To address these issues, NEMA recognizes the need to intensify public awareness campaigns and educational initiatives. These efforts aim to inform citizens about the harmful effects of practices like waste burning, emphasizing the importance of collective responsibility in environmental protection.

NEMA is making all efforts to raise awareness through all available media platforms such as NEMA X handle, raising awareness in schools, conducting community outreaches, organising and participating in car free days, organising air quality week, training of local governments among others. NEMA has also supported ministry of education to ensure that that environmental issues are main streamed in the school curriculum at all levels. However, there is need for more investment to upscale these interventions.

⁷⁵ Sections 44 and 46,

⁷⁶ National State of Environment Report, 2022

NEMA in collaboration with the lead agencies are in the process of developing the National Environment Action Plan, and will help cities develop their environment action plans.

Conclusion

While NEMA and some lead agencies have made some efforts to raise public awareness about air quality management through collaborations and initiatives, the impact has been limited. The focus on Kampala and Jinja only and reliance on digital platforms have hindered wider outreach. Moreover, the lack of a structured, sustained approach to awareness-raising and training, coupled with overdependence on external support, has compromised the long-term effectiveness of these interventions.

Recommendation

The Accounting Officer NEMA should:

- i. Include and also support cities to include specified interventions for air quality awareness in the approved work plans and budgets;
- ii. Incorporate air quality issues in all environment training/ sensitisation programmes conducted by the Authority;
- iii. Prioritise development of the National Environment Action Plan, including air quality management measures, and support adoption or adaptation of the same by cities and other local governments, with clear strategies for resource mobilisation for establishment and operation of adequate systems for air quality monitoring, reporting, enforcement and public sensitisation;
- iv. Enhance public access to up-to-date air quality information through varied methods including displays on the NEMA website.

OVERALL AUDIT CONCLUSION

NEMA, in collaboration with lead agencies, has established a legal framework for air quality monitoring and enforcement, developed monitoring networks through partnerships, and initiated public awareness campaigns. However, compliance with air quality standards remains inadequate due to limited monitoring infrastructure, concentrated mainly in Kampala, leaving cities like Hoima and Mbale unserved. Reliance on independent operators, resource and staffing shortages, and non-functional environmental committees have further weakened enforcement efforts. Public awareness initiatives have been limited in coverage, heavily reliant on digital platforms, and dependent on development partners, limiting their impact. As a result, major pollution sources, including transportation, industrial emissions, and waste burning, operate with minimal regulation. Consequently, the annual and daily average PM_{2.5} concentrations consistently exceeded WHO and national set safe limits for the period under review, posing serious risks to public health and the environment.



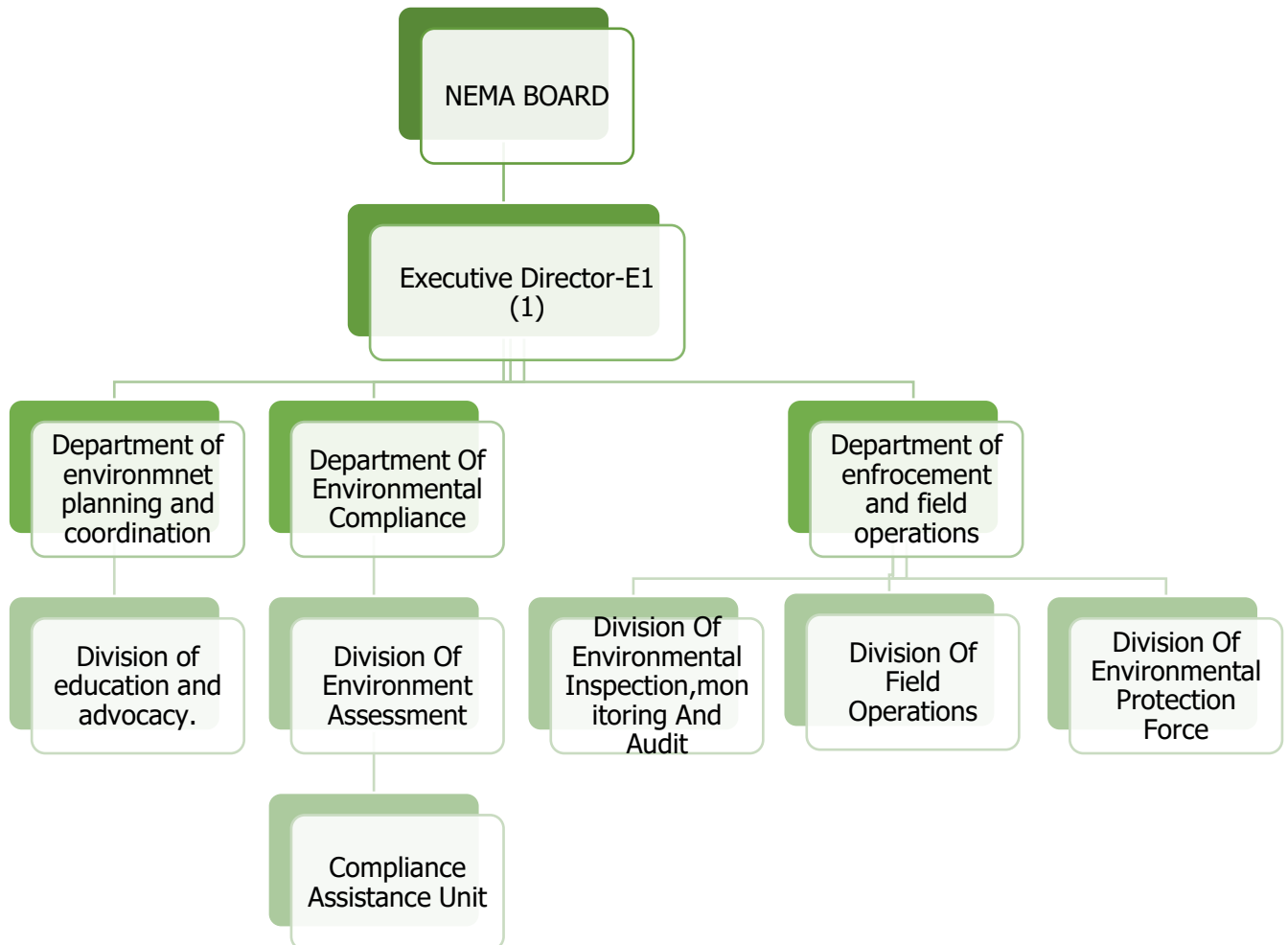
Edward Akol

AUDITOR GENERAL

27th December 2024

APPENDICES

Appendix I: Organogram



Appendix II: Documents reviewed

S/N	Document	Focus Areas
1	Government Constitution (1995)	Constitutional provisions to a clean and healthy environment
2	National Development Plan III	Goals, strategies, and targets for national development, for achieving good air quality.
3	The Agenda 2030	Targets and indicators for air quality management.
4	Vision 2040	Targets and aims for cleaner air goals
5	National Environment Authority 2019	Regulatory guidelines, requirements, obligations, responsibilities for air quality management.
6	Air quality standards 2024	Regulatory guidelines, limits, requirements, obligations, responsibilities for air quality management.
7	NEMA strategic plan, Annual programme plans, Annual budgets	Plans, budgets, activities, targets and objectives set with regard to air quality standards monitoring and enforcement.
8	Performance reports	Performance reporting on monitoring, evaluation and reporting activities for compliance with air quality standards
9	A deep dive on the economic impacts of Air Pollution of 5 th July 2023; https://www.clarity.io/blog/a-deep-dive-economic-impacts-of-air-pollution (accessed on 2 nd September 2024 at 12:19 pm)	To understand poor air quality consequences for environmental health.
10	World air quality report 2021	To obtain an understanding of the health related impact of poor air quality.
11	National environment management authority. Annual corporate management report FY 2022/2023	To obtain information regarding to the programmes undertaken in relation to awareness and enforcement.
12	NEMA's performance reports, audit reports, ESIA certificates, training reports, monitoring and inspection reports, complaint registers, financial reports, etc.	To assess the performance, effectiveness, challenges and opportunities in environment compliance and enforcement activities.
13	Studies on air pollution and associated effects	To ascertain the facts, trends, and relationship between air pollution and human health.

Appendix III: Persons Interviewed

S/N	Person Interviewed	Purpose of the interview
1	NEMA staff (Senior Environment Inspector, Head of Department, Department of Enforcement and Field Operations, NEMA regional officers for Mbale and Mbarara including Senior Environment Officer, Principal Environment Officer, NEMA Regional Manager, environment protection officer and Investigations officer).	• To gain insight into the government's policies and guidelines instituted to manage air quality standards in Uganda • To understand the interventions and activities done by NEMA in regards to monitoring and enforcement of air quality standards in major cities in Uganda.
2	Environment/Natural resource officers for the selected cities	• To understand air quality control practices, strategies and challenges in the various local governments.
3	Makerere University- AirQo project lead.	• To understand their interventions and activities done by AirQo with regard to monitoring air quality in major cities. • To obtain data on air quality monitoring. • Gain insights into air quality monitoring best practices.
4	KCCA	• Gain an understanding into the Authority's interventions, plans, partnerships, successes, challenges, and performance in air quality monitoring and enforcement.
5	UNRA	• To gain insights on the actions undertaken by UNRA for monitoring and managing air pollution during road construction.
6	Ministry of Works and Transport	• To establish the mechanism undertaken by MoWT in managing air quality during infrastructure developments. • Assess performance and interventions for motor vehicle inspections
7	Regional Referral Hospitals	• To get insight into effects of air pollution • To obtain data, if any on air pollution health effects.
8	Makerere college of public health	• Share their experiences of the work done (studies) in the field of air quality, effects and opportunities for improvement.
9	UNBS	• Understand the processes, parameters, measures in place for pre-export inspection of vehicles for compliance to air quality standards
10	Makerere University Lung institute	• Share their experiences of the work done (studies) in the field of air quality, effects and opportunities for improvement. • Obtain information on effects of air pollution

Appendix IV: Months data was collected for each monitoring point

Monitoring point	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Months with no data
Gulu City Council								117.3		8
Lapeta Health Centre 3	71.4									8
Layibi Gulu	44.5									8
Buganda Road P.S								42.8	42.1	7
Bugolobi, Nakawa	36.8	40.6								7
Kampala Metropolitan CPS								41.3	33.5	7
Nile avenue, Kampala, Uganda								38.7	34.5	7
Mukwano road. Device 2	64.8	46.1	25.4							6
Buhinga						48.6	49.6	35.5	23.6	5
Kasusu, Fort Portal						35.2	48.7	44.8	28.5	5
Lorry Park, Fort Portal						52.5	58.8	51.4	39.9	5
Nyendo, Masaka					40	54.6	61.4	52.8	47.1	4
Buwenge North, Jinja			46	49.4	61.2	69	69.4	62.1		3
Mbarara Central	49.6	49.6				27.8	47.4	40.3	27.4	3
Rubaga, Kampala			15.7	10		9.1	9.7	9.1	9.1	3
Bahai, Kawempe	28.1	11	19.4	20.2	40.3	46	49.8			2
Lower Nsooba, Kawempe	58.9	44.8	24	22.5	22.6	23	58.4			2
Makindye, Lukuli Makindye			17.3	17	25.5	49.4	63.6	52.5	49.7	2
Rwengoma, Kabarole			17.2	25.3	24.4	52.4	61.6	59.1	45	2
St.Ponsiano primary school, Makindye			23.4	17.9	20.7	41.1	40	40.8	40.9	2
Wabigalo			14.7	17.1	19.4	23.6	27.4	46.2	45.5	2
Walukuba East, Jinja City	27.2	30.7			13.5	14.9	25.7	22.3	26	2
Booma, Fort Portal		36.5	20.7	18.6	18.3	33.9	41.5	36.5	23.4	1
Makerere University Weather Station	56	41.5	21.6		20.1	33	50.3	50.6	47.4	1
Mpererwe, Kawempe	52.8	37.9	21.6	17.6	26	42.5	46.7	42.6		1
Nakawa, KCCA Head Office	46.4	34.8	19.7	15.1	21.2	40.2	40.9	32.2		1

Monitoring point	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Months with no data
Banda, Kampala	48.1	34.2	15	12.2	15.3	24.9	38.2	30.3	26.8	0
Bukoto I, Kawempe	61.6	47	25	15.8	28.8	51.1	57.8	46.5	45.4	0
Butabika, Nakawa	40	30.8	14	10.1	15.1	30.2	39.2	28.4	25.5	0
Buwate, Kira Municipality	52.2	40.8	24.5	16.7	26.9	42	50.2	43.6	37.3	0
Central, Soroti	38.8	25.5	17.5	14.1	14.2	20.6	27.6	20	20.1	0
City Council, Jinja	31	28	16.8	16.1	16.3	26.1	42.5	36.4	30.6	0
Embassy of France, Lumumba avenue	54.8	37.7	19.4	15.2	14.6	22.5	36.4	24.1	20.8	0
Ggaba, Makindye	48.4	34.8	24.7	19.7	24.6	36.5	38.4	43.7	42.3	0
Gulu Main Market	81.7	49.3	22.8	14.8	17.9	40.1	32.5	22.4	17.7	0
Gulu university	73.8	54.2	22	12.8	15.8	35.5	25.4	20.1	16.4	0
Impala Ave	46.5	31.1	15.9	12.4	16	29.9	38.1	33.6	26.6	0
Jinja Main Street, Jinja	26.3	20.5	12	9.1	11.4	13.8	27.2	19.9	21.1	0
Kabalagala town, Makindye	59.3	43.8	27	21.5	29	45.6	59.8	56.2	52.2	0
Kalerwe, Kawempe	78.7	63.4	43.1	35.7	53.3	76.6	76.6	67.7	66.7	0
Kansanga Seed Secondary School	50.6	40.1	23.4	15.3	30	24.8	49	48.3	31.7	0
Kasubi Central Gulu	69.3	49.2	23.8	15.7	16.7	40.6	32.7	23	17.4	0
Kasubi, Rubaga	81.5	70.4	46.4	42.9	63.7	80.8	88.1	77.1	75.7	0
Katende Ward, Jinja	33.1	30.3	17	12.1	16.9	27.4	35.9	13.7	13.3	0
Katwe 1, Makindye	70.8	58.2	30.5	25.7	32.8	34.3	45.6	49.5	51.7	0
Kawempe	89.2	67.8	41.7	37.1	48.5	71.5	75	71.9	61.3	0
Kibuli, Makindye	80.9	55.5	34.3	27	35.6	61.4	68.5	57.8	53.7	0
Kimaka, Jinja	50.5	46.9	27.9	21.1	25.2	35	48.5	42.8	37.2	0
Kinyamasika, Fort Portal	50.8	44.2	18.8	16.4	19	25.8	40.9	34.1	21.5	0
Kitukutwe, Kira Municipality	33.9	28.4	19.9	13.8	15.9	23.8	22.5	19.6	16.9	0
Kivubuka Budondo, Jinja	31.5	25.8	15.9	11.2	14.3	22.5	34.5	24.6	23.7	0
Kyabirwa Namizzi, Jinja	32.6	23.4	25.4	16.4	16.2	18.3	41.3	41.7	34.2	0
Kyebando, Kampala	46.6	41.1	21.4	16.6	20.2	26.9	34.5	27	25.6	0
Luwafu, Makindye	72.8	57.9	40.1	37.5	41.9	57.3	71.4	61.1	54.7	0

Monitoring point	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Months with no data
Makerere University_01, Kawempe	51.3	33.5	17.8	13.7	18.7	31.7	42.9	36	33.8	0
Makerere, Kawempe	50.9	37.6	22.5	14.4	27.1	35.7	41.8	37.8	37.6	0
Makindye KCCA division offices	29.8	23.3	16.7	14.9	23.1	34.4	55.1	48.3	42.3	0
Mary Queen of Peace P/s Gulu	71.1	42.8	17.3	13.4	12.9	22.7	26.3	23.2	95.6	0
Mbarara University, Mbarara	26.6	25.3	15.4	12.7	15.1	19.1	41.1	33.5	22.8	0
Mbuya II, Nakawa	47.8	41.4	23.5	19.3	26.4	46.9	53.3	45.4	36.5	0
Mountains of the Moon University, Fort Portal	43.9	41.5	17.5	14.3	15.6	29.1	37.1	31.9	20.5	0
Mpanga, Fort Portal	72	65.5	32.1	26.9	26.8	43.7	59.9	51.6	37.7	0
Mpumudde, Jinja	37.9	38.2	19.3	17.1	29.2	35.8	44.8	27.3	33.4	0
Mukwano Road device 5	70.3	51	32.7	26.6	41	58.3	68.9	66.2	65.5	0
Muyenga tank hill, Makindye	42.3	34.7	11.3	11.6	18.4	18.1	53.1	38.2	35.6	0
Naguru II, Nakawa	50.7	41.7	20.9	15.3	22.6	39.7	51.7	43.4	40.1	0
Nakasero II, Kampala	70.9	49.1	25.8	21.3	33.1	40.7	47.1	39.8	36.3	0
Nsasa, Kira Municipality	45	40.1	20.6	13.7	22.1	41	49.2	34.7	31.5	0
Ntinda, Nakawa	62.5	45.2	21.3	14.7	23.2	40	51.6	45.6	43.2	0
Pece Gulu	78.1	50.3	24.4	13.1	15.9	45.1	31.7	21.8	15.4	0
Rubaga Ward, Jinja City	27.5	24.9	15.8	13.6	16.3	28.9	42.2	38.3	30.8	0
U.S. Department of State Uganda - Kampala	105.1	40	13.3	10	17.7	50.7	45.9	39.6	40.4	0
YMCA, Jinja	34.6	38.5	16.6	12.5	19.3	28.4	46.6	32.3	31	0



Audit House, Plot 2C Apollo
Kaggwa Road,
P.O.Box 7083 Kampala.



041-7-336000,



info@oag.go.ug,



www.oag.go.ug



@OAG_uganda