NAIROBI CITY COUNTY

AIR QUALITY ACTION PLAN (2019-2023)

Supported by

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ECI ENVIRONMENTAL COMPLIANCE INSTITUTE

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1.0 INTRODUCTION

1.1 Project background

This Air Quality Action Plan has been developed by Nairobi City County Government (NCCG, Department of Environment and Natural Resources) and is an output of a pilot project implemented by UN Environment in partnership with the Environmental Compliance Institute (ECI) to support Nairobi City County to develop better air quality management strategies.

The overall objective of the project was to build the capacity of relevant national and city officials to develop, implement and enforce improved policy and regulatory frameworks for air quality management and support the development of strategies for air quality management in Nairobi City. The project was implemented in collaboration with Nairobi City County Government, working together with a multi-stakeholder Technical Committee that was tasked to develop this Action Plan.

The process of developing this Air Quality Action Plan involved an inception workshop in September 2018 to introduce the project to all relevant stakeholders and to agree on the outline of the Action Plan; Technical Committee working sessions to develop the contents of the Action Plan; and a validation workshop in December 2018 to present the draft Action Plan to stakeholders, obtain their views and input on the same and rank the proposed actions based on Nairobi's priorities.

1.2 Nairobi City County background information

1.2.1 Location, size and administrative structure

Nairobi is Kenya's largest city and is located at 1°9'S, 1°28'S and 36°4'E, 37°10'E. The city lies about 200 km south of the Equator and covers an area of about 696 km^2, with an elevation of about 1700 meters above sea level[1]. Nairobi is Kenya's capital city and also one of Kenya's 47 counties established as devolved units of governance under the country's Constitution. Nairobi City County is composed of 17 administrative sub-counties namely: Dagoretti North, Dagoretti South, Embakasi Central, Embakasi East, Embakasi North,

[1] *NCCG, 2014*

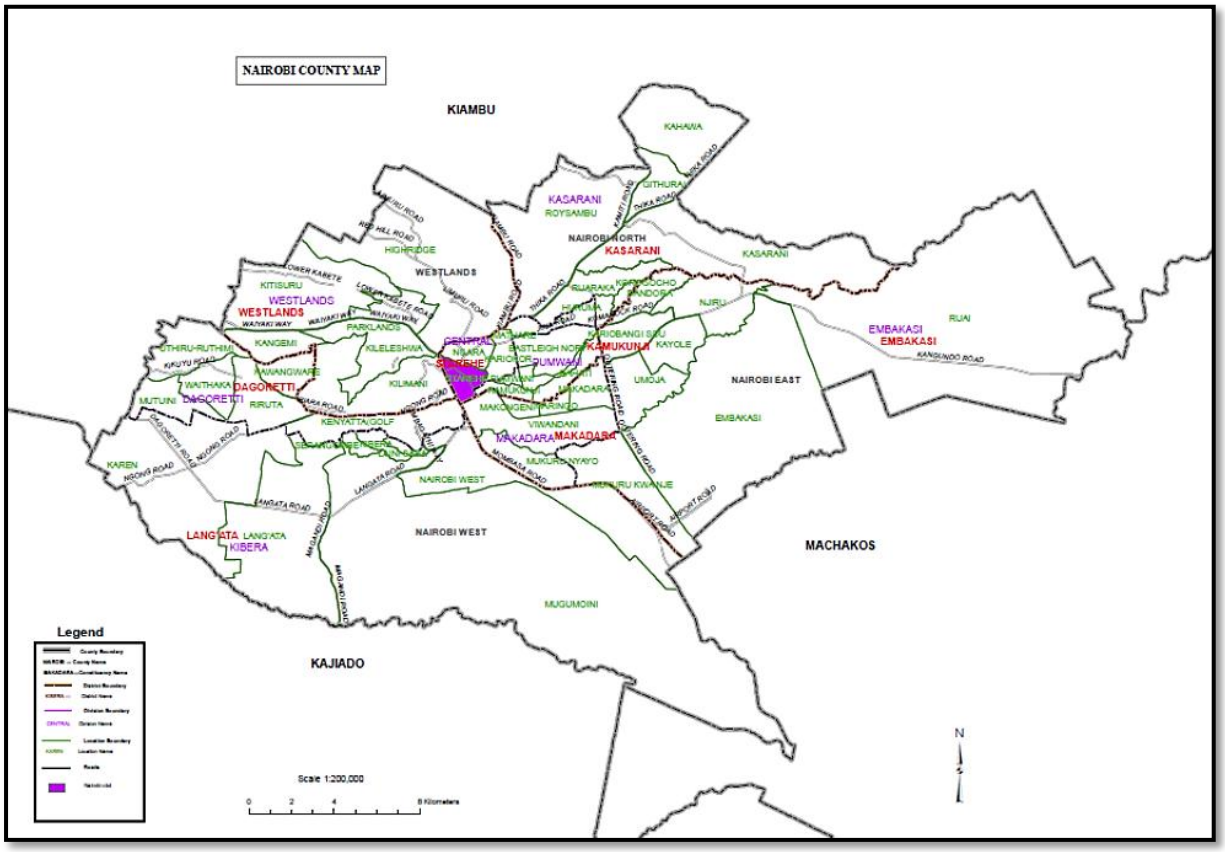
Embakasi South, Embakasi West, Kamukunji, Kasarani, Kibra, Langata Makadara, Mathare Roysambu, Ruaraka, Starehe and Westlands.

Figure 1 below shows the location map of Nairobi City County while Figure 2 shows the city's administrative and political boundaries.

Figure 1: Location map of Nairobi City County

Source: KNBS, 2013

Figure 2: Administrative map of Nairobi City County



Source: KNBS, 2010

The Nairobi City County executes of responsibilities and functions as defined by the Constitution of Kenya and the County Governments Act. The Nairobi City County Government (NCCG) has two arms, namely:

(i) *Nairobi City County Assembly*: This is the legislative arm of the county government and is headed by the Speaker who presides over the plenary sittings of the County Assembly. The County Assembly is responsible for legislation, oversight and representation. The Assembly comprises of elected and nominated Members of the County Assembly who perform their functions through the organs of the Assembly, namely the plenary and the various committees of the Assembly.

(ii) *Nairobi City County Executive Committee:* This is the Executive arm of the county government and is led by the Governor, the Deputy Governor and Members of the County Executive Committee. The County Executive Committee consists of the

County Public Service Board and the County Executive Committee Members. The County Executive Committee is the highest policy making organ of the county and is responsible for operations of the respective sectors within the County.

1.2.2 Population

According to the 2009 Kenya Population and Housing Census, Nairobi had a population of 3.1 million inhabitants[2]. The city's population is projected to be about 4.9 million inhabitants in 2018[3]. With a population growth rate of 4 per cent per annum, Nairobi's population is projected to reach about 5.8 million inhabitants by 2025[4]. Nairobi's population density is 4,514 people per square kilometers. Males comprise 51.1% of the population while females comprise the remaining 48.9%. The city has a high youth population where 15-34 year olds constitute 49% of the total population[5].

1.2.3 Climate and Topography

Nairobi has a moderate warm and temperate climate with a bimodal distribution of rainfall[6]. The city experiences the long rainy season around April and the short rains around November. The annual average rainfall received is about 875mm with variation range of 500mm-1500mm. The average temperature variation ranges between 10˚Celsius to 28˚Celsius[7]. The topography of the Nairobi city is generally a rugged with an altitude range between 1,483 -1, 994 m above sea level. The western part of the city has the highest elevation and the eastern side is generally flat. The southwest part of the city is boarded by the Ngong hills. The northern part of the city spreads into the indigenous Karura Forest[8].

[2] *KNBS, Kenya Population and Housing Census, 2009*
[3] *KNBS, County Statistical Abstract – Nairobi County, 2015*
[4] *KNBS & SID, Exploring Kenya's Inequality, 2014*
[5] *KNBS & SID, Exploring Kenya's Inequality, 2014*
[6] *NCCG, Integrated Urban Development Master Plan for the City of Nairobi, 2014*
[7] *Kimayu, et al., Temporal and Spatial Variability of Tropospheric Ozone in Nairobi City, Kenya, 2017, Physical Science International Journal 13(3): 1-12, 2017; Article no.PSIJ.31452*
[8] *UNEP, Nairobi and its Environment,2014*

1.2.3 Land use distribution

Land uses in the city have been changing over the years due to urban development. Table 1below represents the different land uses in Nairobi City County.

Table 1: Land uses in Nairobi City County

Land use type	Area km^2	Percentage
Residential areas	175.6	25.22
Industrial/commercial/service centres	31.8	4.57
Infrastructure	15.9	2.28
Recreation	12	1.72
Water bodies and riverine areas	11.8	1.69
Urban agriculture	96.8	13.9
Open lands	198.8	28.55
Others (including protected areas)	153.6	22.06
Total	**696.3**	**100**

Source: NCCG, Nairobi County Integrated Development Plan, 2014

1.2.4 Socio-economic situation

Positive economic growth and development generally experienced in Kenya and Nairobi in particular has contributed to high rates of urbanisation in the city. The city's gross domestic product was estimated to be €14.1 Billion in 2015. The GDP of Nairobi contributes over 60% of Kenya's GDP . The poverty line of Nairobi City is Ksh 2,913 per person per month for urban households. The poverty line was highest in Makadara at 29.8% and lowest in Westlands at 15.3%[9]. The gross regional GDP per capita of Nairobi County is estimated to

[9] *NCCG, Integrated Urban Development Master Plan for the City of Nairobi, 2014*

be three times of Kenya's GDP. Unemployment levels in Nairobi average at 14.70 per cent[10]

1.2.5 Transport

Walking and public transport are the main means of transport in Nairobi City. Railway transport is limited to use during peak hours. Apart from the limited urban railways, public transport in Nairobi is mainly by Matatu operated by private investors. A major challenge facing public transport is traffic congestion during peak hours. Nairobi is estimated to accommodate 30% of Kenya's total national vehicle population[11]. As of August 2018, Kenya had 3,135,573[12] registered vehicles, rising from 2,011,967 in 2013[13]. This translates to a national vehicle population growth rate of about 11 per cent per annum in the last 5 years. Based on the estimates, Nairobi City alone was home to approximately 940,672 motor vehicle units as of August 2018. Public transport accounts for more than 50 per cent of all the trips in Nairobi, private cars 15 per cent while the remaining percentage is mainly by walking and/or bicycles and motorcycles.

1.2.6 Energy situation

63.2 per cent Nairobi City County residents use paraffin as the preferred cooking fuel, 20.2 per cent use liquefied petroleum gas (LPG), 10.5 per cent use charcoal while 1.8 per cent use firewood. For lighting, 68.2 per cent of households use electricity, 28.8 per cent use paraffin, 2.9 per cent use grass and 1.7 per cent use dry cells[14].

1.2.7 Waste management and sanitation

Waste management: Increasing urbanization, rural-urban migration, rising standards of living and rapid development associated with population growth have resulted in increased solid waste generation by industrial, domestic, and other activities. This

[10] *NCCG, Nairobi County Integrated Development Plan, 2014*
[11] *Omwenga, M., Integrated Transport System for liveable Cities: A Case Study of Nairobi Kenya, paper presented at the 47th ISOCARP Congress, Wuhan*.
[12] KNBS, Kenya key economic indicators, 2015,2016,2017 and 2018
[13] *KNBS, Kenya Facts and Figures, 2014*
[14] *NCCG, Nairobi County Integrated Development Plan, 2014*

increase has been accompanied by inequivalent growth in capacity to address the problem[15]. About 2475 tons waste is produced daily in the city, domestic, industrial, road, hospital, market and other sources produce 68%, 14%, 8%, 2% and 7% respectively. Uncollected solid waste is one of Nairobi's visible environmental problems. In most middle and low income areas there is no proper waste collection system put in place[16]. The Dandora dumpsite which is the largest open dumpsite in Nairobi has also undergone some changes to help manage the waste efficiently, by introducing the weigh bridge at the dumpsite to know disposal vis-à-vis collection and generation[17].

Sanitation: 88% of residents in Nairobi County use improved sanitation, while the rest use unimproved sanitation. Male headed household are less likely to rely on improved sanitation at 88% as compared with female headed households at 89%[18].

1.3 Leading Causes of Morbidity and Mortality in Nairobi

According to Ministry of Health data, the three leading causes of ill health among children in Nairobi were respiratory diseases, diarrheal diseases and skin diseases with respiratory diseases including pneumonia, accounting for over 60% of hospital visits in 2012[19]. Recent data from Kenya National Bureau of Statistics show that diseases of respiratory system were the leading cause of morbidity in Nairobi in 2014 with 442,113 reported cases. Respiratory diseases being also rank in the top three among the Top Ten Causes of Death in Nairobi. 1,325 deaths were linked to respiratory diseases in Nairobi in 2014[20].

Table 2 below gives a summary of top ten causes of morbidity among children in Nairobi, while Table 3 gives a summary of the top ten causes of Mortality in Nairobi among the overall population.

[15] *NCCG, Integrated Urban Development Master Plan for the City of Nairobi, 2014*
[16] *APHRC, Solid waste management and risks to health in urban Africa, a case study of Nairobi and Mombasa cities in Kenya, 2017*
[17] *Ibid*
[18] *Ibid*
[19] *NCCG, Nairobi City County Health Sector Strategic and Investment Plan 2013/2014 – 2018/2019, Revised 2017*
[20] *KNBS, County Statistical Abstract – Nairobi County, 2015*

Table 2: Top Ten Causes of Morbidity

Causes of diseases		
Rank	Under 5 years	Over 5 years
1	Diseases of the respiratory system	Diseases of the respiratory system
1	Diarrheal diseases	Skin
2	Skin	Diarrhoea
3	Pneumonia	Urinary Tract infection
4	Clinical malaria	Typhoid fever
5	Confirmed malaria	Clinical Malaria
6	Ear infection	Dental disorders
7	Ear infection	Pneumonia
8	Typhoid fever	Ear infection
9	Accidents	Accidents

Source: Nairobi City County Health Sector Strategic and Investment Plan, Revised 2017

Table 3: Top ten Causes of Mortality in Nairobi in 2014*

Cause	Per cent	Total
Pneumonia	7.5	1,753
Cancer	6.9	1,596
Respiratory disease	5.7	1,325
Tuberculosis	5.5	1,286
Heart disease	4.2	976
AIDS	4.1	947
Diabetes	3.9	916
Hypertension	3.7	869
Malaria	3.7	869
Road traffic accident	3.5	821
Other causes	51.2	11,893
	100	23,251

Source: KNBS, County Statistical Abstract – Nairobi County, 2015

**Provisional*

1.4 Why air pollution is a major concern

Air pollution is currently considered as the greatest environmental health risk globally with many parts of the world recording dangerously high levels of air pollution. World Health Organization (WHO) estimations show that 90 per cent of people worldwide breathe air containing high levels of pollutants. Air pollution causes 1 in every 9 deaths globally. The WHO estimations reveal an alarming death toll of 7 million people every year caused by exposure to fine particles in polluted air that penetrate deep into the lungs and cardiovascular system, causing diseases including stroke, heart disease, lung cancer, chronic obstructive pulmonary diseases and respiratory infections, including pneumonia. Of the total annual air pollution related deaths, 4.2 million result from exposure to ambient (outdoor) air pollution and 3.8 million from exposure to household air pollution in smoke from dirty cookstoves and fuels[21].

Table 4 below outlines a summary of the air pollutants of great impact on health and environment

[21] *WHO, Ambient (Outdoor) Air Quality and Health Fact Sheet, 2018*

Table 4: Air pollutants of great impact on health and environment

Emission	Description	Sources	Harmful Effects
Carbon monoxide (CO)	CO is a colourless, odourless toxic gas produced by incomplete or inefficient combustion of carbon-based fuels and by biological and industrial processes.	Anthropogenic Sources Fossil fuel combustion for power generation or transport, agricultural burning, wood burning for heat and cooking fuel Natural sources Forest fires, emissions from plants and oceans and oxidation of methane and non-methane hydrocarbons	Health impacts Can cause dizziness, confusion, unconsciousness and death
Nitrogen oxides (NO_x)	Nitrogen Oxides (NO_X) is a collective term for nitric oxide (NO) and nitrogen dioxide (NO_2). NO is a colourless and tasteless gas while NO_2 is a yellowish-orange to reddish-brown gas with a pungent, irritating odour and is a strong oxidant.	Anthropogenic Sources combustion of fossil fuels in vehicles (predominantly road traffic) and power generation units Natural Sources wildfires, lightning, and microbial activity in soils	Health Impacts • Eye and lung irritation • May contribute to the susceptibility/ aggravation of respiratory diseases Environmental impacts • Accelerates eutrophication • Makes soils and freshwater ecosystems more acidic • Affects visibility due to formation of haze in the air
Ozone (O_3)	Major urban air pollutant caused by NOx and VOCs combined In sunlight and is usually at Earth's surface (Tropospheric Ozone)	Secondary pollutant of VOCs and NOx	Health Impacts Respiratory and cardiovascular problems Environmental problems Affects sensitive vegetation and ecosystems such as

			forests, parks, wildlife refuges and wilderness areas
Sulphur dioxide (SO_2)	SO_2 is a colourless, non-flammable gas, with an unpleasant, pungent odour.	Anthropogenic Sources Fossil fuel combustion for power generation, industry, shipping and road transport Natural Sources Volcanoes	Health effects Affects the respiratory system and irritation of the eyes, nose, throat and airways Environmental impacts • Reduces growth in plants • Accelerates loss of foliage, aging and premature death of vegetation • Causes stain and damage stone and other materials, including culturally important objects such as statues and monuments. • Can reduce visibility due to formation of haze in the air
Particulate matter (PM_{10}, $PM_{2.5}$)	Particulate matter (PM) refers to a mixture of solid particles and liquid droplets found in the air such as dust, dirt, soot, or smoke that are large or dark enough to be seen with the naked eye and can be primary or secondary. PM_{10} refers to particles with diameter less than 10µm and cannot be inhaled $PM_{2.5}$ refers to fine inhalable particles with diameter less than 2.5µm	Anthropogenic Sources Combustion from vehicle engines, power plants, domestic heating and cooking, mining, quarrying and fugitive dust emissions from construction activities Natural Sources Erosion of natural materials, wind suspension of soils and constituents of sea spray	Health impacts Respiratory and cardiovascular problems (mainly associated with $PM_{2.5}$) Environmental impacts • Nitrogen and sulphur containing particles can lead to acidification of soils and water course • High levels of dust deposition onto vegetation can affect plant health and reduce growth • $PM_{2.5}$ particles can reduce visibility in cities

Source: USEPA website, accessed October, 2018

2.0 STATE OF AIR QUALITY IN NAIROBI CITY

Many African cities are faced with growing air quality problems that pose serious environmental and public health risks.[22] Deteriorating air quality in most of these cities can be attributed to several factors such as: increasing urban population, unregulated traffic activities, poorly maintained vehicles, continued use of biomass fuel as the main household energy source, inadequate regulations and air pollution control policies among others[23]. According to the World Health Organization (WHO), about 90 per cent of the world's population (97 per cent of which are in low- and middle income countries) currently reside in cities with poor air quality that exceed WHO recommended limits[24].

Nairobi City, with its rapid urbanization, fast rising population and increasing motorization, is in many ways typical of most cities in developing countries and faces similar air pollution problems. However, due to the absence of continuous air quality monitoring, Nairobi does not have any air quality inventory in place. Some ad hoc air quality monitoring has been performed in the city over the years – especially in the past decade – by different researchers and research institutions. Most of these studies have been short term with focus on limited pollutants. With this data gap, it is not possible to conclusively determine the current state of air quality in Nairobi City.

Table 5 below gives a summary of the air quality studies that have been carried out in Nairobi City in the past 15 years.

[22] *Priyanka et al., A Nairobi experiment in using low cost air quality monitors, Clean Air Journal, 2017*
[23] *Gaita et al., Source apportionment and seasonal variation of PM2.5 in Nairobi, 2014*
[24] *WHO, Ambient Air Pollution: A Global Assessment of Exposure and Burden of Diseases Report, 2016, released in May, 2018*

Table 5: Summary of recent air quality monitoring studies in Nairobi

Study	Pollutant monitored	Location	Duration of monitoring	Results & Conclusions
Pope et al., 2018	*PM1. PM2.5 and PM10*	*American Wing - University of Nairobi, Nairobi (urban background site), Tom Mboya Street, fire station, Nairobi (urban roadside) and Nanyuki town (rural background*	*February–March 2017*	• *The mean daily PM1 mass concentration at the urban roadside, urban background and rural background sites were 23.9, 16.1 and 8.8 µg m−3 , respectively* • *The mean daily PM2.5 mass concentration at the urban roadside, urban background and rural background sites were 36.6, 24.8 and 13.0 µg m−3, respectively.* • *The mean daily PM10 mass concentration at the urban roadside, urban background and rural background sites were 93.7, 53.0 and 19.5 µg m−3 , respectively* • *Peak PM mass concentration was observed during the morning and evening Nairobi rush hours* • *Vehicular traffic is a dominant source of PM in the city, accounting for approximately 48.1 %, 47.5 % and 57.2 % of the total PM10, PM2.5 and PM1concentrations respectively* • *The study shows that roadside and urban background locations in Nairobi often exceed the WHO guidelines for daily averaged PM mass concentration for both the PM2.5 and PM10* • *The study shows that air quality has become worse in the last 10 years*
Priyanka, et al., 2017	*$PM_{10,}$ $PM_{2.5,}$ NO_X, SO_2,*	*St Scholastica School – Thika Road, Kibera, Viwandani, UNEP, Alliance Girls School, All Saints Cathedral*	*May 1 2016 – Jan 11 2017*	• *Concentrations of the monitored pollutants did not exceed WHO limits in many sites save for PM_{10} and $PM_{2.5,}$ with peak concentrations observed mainly in mornings and evenings.* • *The main sources of emissions were traffic, biomass burning, and industrial activities.*
Mukaria et al. 2017	*PM2.5*	*Kamukunji, University Way, Uhuru Highway*	*1st – 9th January, 2016*	• *Kamukunji and Railways roundabouts had the highest concentrations of PM2.5 averaging 124.3 µg/M3; with Uhuru*

		and Railways roundabouts		*Highway and University way roundabouts registering the lowest concentrations of between 45.0 - 46 µg/M3* • *High concentrations of PM2.5 in Nairobi major roundabouts is attributed to vehicular traffic congestion and worsened with poorly maintained and old vehicles*
Shilenje, et al., 2016	*$PM_{10,}$ $PM_{2.5}$, NO_X, SO_2, CO, BC, O_3*	*Nakumatt Junction, Landhies Road, Pangani and Industrial Area*	*Around Christmas and End year holidays 2015*	• *Extremely high levels of BC were observed during the day on Landhies Road, which went beyond the upper limit of the instruments (50,000 ηg/m^3); and in the evening at Nakumatt Junction (14,446.5 ηg/m^3)* • *None of the four sites exceeded the WHO limit for both PM_{10} and $PM_{2.5}$ and the Kenyan ambient air quality tolerance limit of 100 µg/Nm^3 and 150 µg/Nm^3 in industrial area.* • *The diurnal mean of SO_2 over the four sites was generally below the WHO limit with the highest amount recorded at Pangani Roundabout* • *The mean 24-hr amount of CO in all the sites was above the background concentration of between 0.05-0.12 ppm with Pangani Roundabout recording the highest amount at 1.73 ppm.* • *The 8-hr mean for O_3 in all the sites were below the WHO limit of 51 ppb with the highest amount of 20.2 ppb recorded in Industrial Area* • *The high concentration of pollutants were attributed to vehicular emissions in rush hours*
Muindi, et al., 2016	*$PM_{2.5}$*	*Korogocho and Viwandani Slums*	May - October 2014	• *Household (indoor) levels of $PM_{2.5}$ ranged from 1 to 12,369µg/m^3 (SD=287.11) and varied by the type of fuels, with the highest emissions found in households using kerosene for cooking and lighting.* • *Household levels of $PM_{2.5}$ were likely to exceed WHO guidelines*

				• *High concentrations of PM2.5 were observed in the evenings and during periods of cooking using charcoal/wood.*
Engondi et al. 2016	*$PM_{2.5}$*	*Korogocho and Viwandani*	*February – October 2013*	• *The average concentration of PM2.5 were 166 µg/M3 and 67 µg/M3 in Korogocho and Viwandani slums respectively* • *Residents of the two slums are continuously exposed to high levels of PM2.5 exceeding WHO recommended limits*
Ngo, et al., 2015	*$PM_{2.5}$, BC, ultra violet active-particulate matter (UV-PM), and trace elements*	*Mathare, CBD*	*August 2nd – 18th 2011*	• *Compared to other occupational groups, bus drivers have the greatest levels of exposure to BC and PM2.5 of 63.9±18.6 and 103.8±28.363 µg/M3 respectively* • *Women in Mathare had high levels of Cl and UV-PM –This was attributed to biomass emissions and the high utility of kerosene stove* • *BC and re-suspended dust were important contributors to $PM_{2.5}$ levels, with BC contributing at least one-third to PM2.5 levels. This suggested that traffic emissions are an important pollution source for occupational groups working by roadways and inside informal settlements, with bus drivers experiencing the greatest levels of exposure to BC and $PM_{2.5}$* • *Biomass emissions and trash burning are important sources of emissions in the Nairobi's low-income areas and open-air garages.*
Kinney et al. 2017	*Black Carbon*	*Nairobi CBD and main highways feeding into Nairobi*	*Summer 2009 and late 2011*	• *BC concentrations in the CBD ranged between 20–42 $\mu g\, m^{-3}$ CBD while those at the main highways feeding into Nairobi recorded BC levels ranging between 17–79 $\mu g\, m^{-3}$* • *Measured BC near the curb side of roadways was estimated to be in the range of 34–56% of $PM_{2.5}$* • *BC concentrations reduced with distance away from traffic showing that vehicular emission is a significant contributor to black carbon in the city*

Gaita et al., 2014	*$PM_{2.5}$, BC and 13 trace elements*	*University of Nairobi Main Campus, UNEP*	*22 May 2008 - 30 March 2010*	• *The average $PM_{2.5}$ concentration at the urban background site was 21±9.5μgm−3 and 13±7.3μgm−3 at suburban site.* • *The daily $PM_{2.5}$ concentrations exceeded the WHO 24-hrguideline on 29 per cent of the days at the urban background site and 7 per cent of the days at the suburban site.* • *Traffic-related emissions (both exhaust and non-exhaust) and mineral dust (both natural and anthropogenic) are significant contributors to $PM_{2.5}$ in Nairobi.*
Kinney, et al., 2011	*$PM_{2.5}$*	*Ronald Ngala Street, Tom Mboya Street, River Road, Thika Road, Kenyatta University*	*2 Weeks, July 2009*	• *Daytime concentrations of $PM_{2.5}$ were very high at sites located adjacent to roadways ranging from 50.7 to 128.7 μg/m^3 across the three CBD sites, the commuter route, and the near-roadway locations at the horizontal and vertical dispersion sites but could not be compared to WHO 24-hr guideline since it represented averages for 3-9 days only.* • *Many Nairobi residents are exposed on a regular basis to elevated concentrations of fine particle air pollution, with potentially serious long-term implications for health given the Commuting patterns in the city.*
Gaita et al. 2016	*Particulate matter of size ranging from 0.06 to 16 μm aerodynamic diameter*	*Engineering building, University of Nairobi (urban background site)*	*August - September 2007*	• *Majority of the elements were found to be PM 2.5 μm particles* • *Deposition fractions of both coarse and fine PM accounted for 87% and 84% of the total deposited mass in the head airways region respectively* • *Deposition fractions in the tracheobronchial and pulmonary regions were approximately 15% of the total deposited fraction for both coarse and fine PM* • *The deposited PM concentration was found to be highest in the head airways region compared to the tracheobronchial and pulmonary regions.*
Kinney et al,	*$PM_{2.5}$, BC*	*YMCA, Commercial Area, Industrial Area*	*February 4–11,*	• *Urban background PM2.5 concentrations in Nairobi ranged between 15 and 28 μg m−3, with a mean of 20 μg m−3*

2007		*and Roadway sampling along Thika Road (Nairobi - Ruiru)*	*2006*	• *Roadway PM2.5 concentrations between Nairobi and Ruiru, ranged from 397 to 431 μg m−3, with a mean concentration of 414 μg m−3* • *BC levels at the background site averaged 5.7 × 105 m−1 whereas BC concentrations on the roadway averaged 60 × 105 m−1* • *Concentrations of PM2.5 are highly elevated on roadways in Nairobi as compared to urban background areas within Nairobi but away from roadways.*
Odhiambo et al, 2010	*NO_X, O_3, PM10, and trace elements*	*Roundabout connecting University Way and Uhuru Highway*	*February to April 2003*	• *Mean PM10 level was 239±126 μg/m3 with a range of 66.7-444.4 μg/m3l; with coarse particulate accounting for more than 70%* • *The concentrations of NO2 (0.011-0.976 ppm), NO (0.001-0.2628 ppm) and O3 (LLD-0.1258 ppm) were within the WHO recommended limits* • *Traffic is a common source for both fine particulates and NOx*

3.0 THE ACTION PLAN

This is the first Air Quality Action Plan for Nairobi City County. It outlines the actions that the Nairobi City County Government (NCCG) will undertake in the period 2019 – 2023 in order to reduce harmful air pollution in the city.

Legal Context:

In preparing this Air Quality Action Plan, NCCG draws legal mandate from the following Constitutional and Statutory provisions:

1) ***Constitution of Kenya, 2010:***

- ***Artcle186*** – The functions and powers of the national government and the county governments, respectively, are as set out in the ***Fourth Schedule***, except as otherwise provided by the Constitution.
- ***Fourth Schedule of the Constitution of Kenya, 2010: Part 2, Section 3*** – The functions and powers of the county are – control of air pollution, noise pollution, other public nuisances and outdoor advertising.

2) ***County Governments Act, No.17 of 2012 as amended by Act No. 7 of 2016:***

- ***Section 5 (1)*** – A county government shall be responsible for any function assigned to it under the Constitution or by an Act of Parliament.
- ***Section 5 (2)*** – Without prejudice to the generality of subsection (1), a county government shall be responsible for, inter alia, functions provided for in Article 186 and assigned in the Fourth Schedule of the Constitution.

This Air Quality Action Plan is built on a set of actions under the following four broad topics:

(i) Building scientific evidence for policy, legislative and regulatory interventions for air quality management;
(ii) Raising public awareness on the health and environmental impacts of air pollution;
(iii) Developing effective approaches for air quality management; and
(iv) Building an effective implementation and enforcement programme for air quality legislation.

3.1 OBJECTIVES, STRATEGIES AND ACTIONS

Objective 1: Build scientific evidence for policy, legislative and regulatory interventions for air quality management in Nairobi City									
Strategy: Undertake an inventory of the air pollutants and emission sources that most contribute to poor air quality in Nairobi City									
Action Code	**Description of Action**	**Lead Institution**	**Time Frame for Implementation (2019 – 2023)**					**Resources needed**	**Resource options/sources**	**Opportunity for linkage with other county development plans**
			Y1	Y2	Y3	Y4	Y5			
1.1	Build capacity of NCCG officials to monitor and report air quality data.	NCCG (Environment Department)						- Training modules - Trainers - Funds	Government (national/NCCG); bilateral partners; universities	CIDP, Master Plan, Strategic Plan, NAMSIP
1.2	Establish Nairobi City's air quality baseline through rapid assessment cutting across seasons.	NCCG (Environment Department)						- Equipment (air monitoring and data storage) - Staff (monitoring and analytical expertise) - Funds	NCCG; bilateral partners; universities	CIDP, Master Plan, Strategic Plan, NAMSIP
1.3	Install a network of air quality monitors in Nairobi City and in selected background locations to	NCCG (Environment Department)						- Network equipment (including calibration	Government (national/NCCG); bilateral partners; universities	CIDP, Master Plan, Strategic Plan, NAMSIP

	monitor key air pollutants of concern.							capacity) - Staff - Funds		
1.4	Estimate the health and environmental/climate change impacts of Nairobi City's air pollution and likely future trends	NCCG (Environment Department)						- Staff for data collection, modelling; - Software	NCCG; universities	CIDP, Master Plan, Strategic Plan, NAMSIP
Objective 2: Raise public awareness on the health and environmental impacts of air pollution in Nairobi City										
Strategy: ***Deploy effective communication on the health and environmental impacts of air pollution, mitigation options and benefits***										
Action Code	**Action Description**	**Lead Institution**	**Time Frame for Implementation (2019 – 2023)**					**Budget Estimate (USD)**	**Resource options/sources**	**Opportunity for linkage with other county development plans**
			Y1	Y2	Y3	Y4	Y5			
2.1	Develop and implement a communications strategy for disseminating air quality information to decision makers and the public in Nairobi City	NCCG (Environment Department)						- Funds - Expertise	NCCG; bilateral partners	CIDP, Master Plan, Strategic Plan, NAMSIP
2.2	Develop and implement a public participation strategy for air quality management in Nairobi City	NCCG (Environment Department)						- Funds - Expertise	NCCG; bilateral partners	CIDP, Master Plan, Strategic Plan, NAMSIP

Objective 3: Develop effective approaches for air quality management in Nairobi City									
Strategy: Adopt policy, legislative and regulatory options for air management that incorporate mandatory requirements, voluntary and market based approaches									
Action Code	**Action Description**	**Lead Institution**	**Time Frame for Implementation (2019 – 2023)**					**Budget Estimate (USD)**	**Resource options/sources**	**Opportunity for linkage with other county development plans**
			Y1	Y2	Y3	Y4	Y5			
3.1	Develop the Air Quality Policy for Nairobi City (on-going)	NCCG (Environment Department)						- Funds - Expertise	NCCG budget; bilateral partners	CIDP, Master Plan, Strategic Plan, NAMSIP
3.2	Develop Air Quality Legislation for Nairobi City	NCCG (Environment Department)						- Funds - Expertise	NCCG budget; bilateral partners	CIDP, Master Plan, Strategic Plan, NAMSIP
3.3	Develop the Implementation Strategy for the Nairobi City Air Quality Legislation	NCCG (Environment Department)						- Funds - Expertise	NCCG budget; bilateral partners	CIDP, Master Plan, Strategic Plan, NAMSIP

Objective 4: Build an effective implementation and enforcement programme for Nairobi City's air quality legislation									
Strategy: Enhance the capacity of NCCG for* implementation *and enforcement programme for Nairobi City's air quality legislation									
Action Code	**Action Description**	**Lead Institution**	**Time Frame for Implementation (2019 – 2023)**					**Budget Estimate (USD)**	**Resource options/sources**	**Opportunity for linkage with other county development plans**
			Y1	Y2	Y3	Y4	Y5			
4.1	Set up an air quality unit within the NCCG	NCCG (Environment Department)						- Staff - Funds	NCCG	CIDP, Master Plan, Strategic Plan, NAMSIP
4.2	Develop a training manual/toolkit/handbook for implementation and enforcement of air quality legislation	NCCG (Environment Department)						- Content developers for toolkit - Funds	- Local experts (universities, research institutions etc) - External experts - Funds	CIDP, Master Plan, Strategic Plan, NAMSIP
4.3	Train enforcement officers	NCCG (Environment Department)						- Training modules - Trainers - Funds	NCCG budget; bilateral partners; local/overseas training institutions	CIDP, Master Plan, Strategic Plan, NAMSIP
4.4	Develop and implement an incentive based compliance promotion programme among the regulated community	NCCG (Environment Department)						- Staff - Funds	NCCG	CIDP, Master Plan, Strategic Plan, NAMSIP

4.5	Monitor compliance & enforce air quality requirements	NCCG (Environment Department)						- Staff - Funds	NCCG	CIDP, Master Plan, Strategic Plan, NAMSIP
4.6	Evaluate performance of the Action Plan, remediate and/or reinforce as necessary, building into the next Action Plan.	NCCG (Environment Department)						- Monitoring, evaluation and learning expertise - Funds	External evaluation alongside inbuilt mechanisms within county processes	CIDP, Master Plan, Strategic Plan, NAMSIP