

AIR QUALITY ASSESSMENT IN SELECTED SITES IN KENYA

BY

PROF SHEMA O. WANDIGA
DEPARTMENT OF CHEMISTRY,
UNIVERSITY OF NAIROBI

February 27, 2015, First India-Africa Dialogue and Media
Briefing on Air Quality and Mobility, Nairobi, Kenya.

INTRODUCTION

- ▣ Air pollution is one of the major and most prevalent forms of environmental pollution worldwide including in Kenya.
- ▣ Industrial activities and emissions, vehicles, construction and agricultural activities, incineration and wind blown dust are some of the main contributors of hazardous air pollutants.

INTRODUCTION

- ▣ A significant number of roads and industries in this country are in close proximities to heavily populated human settlements and residential areas.
- ▣ A substantial percentage of the local population is therefore continuously exposed to polluted air, as a result of industrial activities and vehicular emissions.

INTRODUCTION

- ▣ Continuous exposures to hazardous air pollutants often result in various forms of ailments including respiratory diseases.
- ▣ Ailments usually result in loss of productivity and sometimes loss of life.
- ▣ Air pollutants can further be transported over long distances and frequently end up in terrestrial and aquatic ecosystems, through wet and dry deposition.

POLLUTANTS OF CONCERN THAT ARE CURRENTLY BEING MONITORED

- ▣ Sulphur dioxide, nitrogen dioxide and particulate matter are some of the prevalent air pollutants in Kenya, especially in urban areas and industrial sites.
- ▣ They have been widely associated with adverse effects on human health and the environment.

SOME OF THE ADVERSE EFFECTS : SULPHUR DIOXIDE

- ▣ **Aggravation of asthma and chronic bronchitis.**
- ▣ **Respiratory ailments , eye and throat irritation.**
- ▣ **Acidification of aquatic ecosystems through acid rain and reduction of soil fertility.**
- ▣ **Acceleration of corrosion and destruction of some components of buildings.**

NITROGEN DIOXIDE

- ▣ Inflammation of lung tissues.
- ▣ Pulmonary fibrosis.
- ▣ Respiratory irritation.
- ▣ Impairment of lung defenses.

PARTICULATE MATTER

- ▣ Respiratory diseases and eye irritation.
- ▣ Toxicity from metallic dusts and lung cancer.
- ▣ Reduce visibility and retard photosynthesis in plants by blocking stomata in the leaves.
- ▣ Nutrient containing particulate matter also contributes to eutrophication of water bodies.

STUDY AREAS

- ▣ Selected sites in Nairobi City, Kikuyu , Athi River Town, Kisumu City, Turkana County and Vipingo Area in Kilifi County.

AIR SAMPLING AND CHEMICAL ANALYSIS

- ▣ Air samples were collected using the Active Sampling Methodology, where a suction pump was used to trap the air pollutants in appropriate trapping solutions and trapping media.
- ▣ Chemical analysis was carried out in the laboratory using standard methods in wet chemistry.

LEVELS OF SULPHUR DIOXIDE IN AMBIENT AIR

SAMPLING SITE	PERIOD	AVERAGE CONCENTRATIONS ($\mu\text{g}/\text{m}^3$)
WESTLANDS, NAIROBI	SEPT-OCT 2008	77
UTHIRU, NAIROBI	SEPT-OCT 2008	167
KIKUYU	SEPT-OCT 2008	218
MUTUINI, KIKUYU	SEPT-OCT 2008	167
NGONG FOREST	SEPT-OCT 2008	90
WILSON AIRPORT, NAIROBI	SEPT-OCT 2008	167
OPPOSITE ST JAMES HOSPITAL ALONG MOMBASA ROAD, NAIROBI	SEPT-OCT 2008	244
UNIVERSITY OF NAIROBI MAIN CAMPUS, NAIROBI	SEPT-OCT 2008	257
INDUSTRIAL AREA , NAIROBI	SEPT-OCT 2008	260
INDUSTRIAL AREA, NAIROBI	SEPT 2009	282
INDUSTRIAL AREA, NAIROBI	MARCH 2009	213
ATHI RIVER TOWN	MAY 2011	201
KIBOS AREA, KISUMU	SEPT 2011	68
LOKICHA, TURKANA COUNTY	JUNE 2012	28
LODWAR TOWN	JUNE 2012	29
VIPINGO, KILIFI COUNTY	FEB 2013	NOT DETECTED

LEVELS OF PARTICULATE MATTER IN AMBIENT AIR

SAMPLING SITE	PERIOD	AVERAGE CONCENTRATIONS (mg/m ³)
WESTLANDS, NAIROBI	SEPT-OCT 2008	2.17
UTHIRU, NAIROBI	SEPT-OCT 2008	2.17
KIKUYU	SEPT-OCT 2008	8.7
MUTUINI, KIKUYU	SEPT-OCT 2008	1.08
NGONG FOREST	SEPT-OCT 2008	1.3
WILSON AIRPORT, NAIROBI	SEPT-OCT 2008	17.4
OPPOSITE ST JAMES HOSPITAL ALONG MOMBASA ROAD, NAIROBI	SEPT-OCT 2008	13
UNIVERSITY OF NAIROBI MAIN CAMPUS, NAIROBI	SEPT-OCT 2008	4.3
INDUSTRIAL AREA , NAIROBI	SEPT-OCT 2008	2.52
INDUSTRIAL AREA, NAIROBI	SEPT 2009	2.62
INDUSTRIAL AREA, NAIROBI	MARCH 2009	2.74
ATHI RIVER TOWN	MAY 2011	0.332
KIBOS AREA, KISUMU	SEPT 2011	0.579
LOKICHAR, TURKANA COUNTY	JUNE 2012	0.133
LODWAR TOWN	JUNE 2012	4.12
VIPINGO, KILIFI COUNTY	FEB 2013	0.054

LEVELS OF NITROGEN DIOXIDE IN AMBIENT AIR

SAMPLING SITE	PERIOD	AVERAGE CONCENTRATIONS ($\mu\text{g}/\text{m}^3$)
WESTLANDS, NAIROBI	SEPT-OCT 2008	9
UTHIRU, NAIROBI	SEPT-OCT 2008	15
KIKUYU	SEPT-OCT 2008	15
MUTUINI, KIKUYU	SEPT-OCT 2008	15
NGONG FOREST	SEPT-OCT 2008	21
WILSON AIRPORT, NAIROBI	SEPT-OCT 2008	30
OPPOSITE ST JAMES HOSPITAL ALONG MOMBASA ROAD, NAIROBI	SEPT-OCT 2008	21
UNIVERSITY OF NAIROBI MAIN CAMPUS, NAIROBI	SEPT-OCT 2008	15
INDUSTRIAL AREA , NAIROBI	SEPT-OCT 2008	104
INDUSTRIAL AREA, NAIROBI	SEPT 2009	142
INDUSTRIAL AREA, NAIROBI	MARCH 2009	33
ATHI RIVER TOWN	MAY 2011	40
KIBOS AREA, KISUMU	SEPT 2011	18
LOKICHAR, TURKANA COUNTY	JUNE 2012	6
LODWAR TOWN	JUNE 2012	7
VIPINGO, KILIFI COUNTY	FEB 2013	31

OBSERVATIONS

- ▣ The concentrations of sulphur dioxide at all sites except in Westlands, Nairobi, Ngong Forest in the environs of Nairobi, Kibos Area in Kisumu, Lokichar, Lodwar Town and Vipingo in Kilifi County exceeded the 24 hour WHO guidelines of 125 to 150 $\mu\text{g}/\text{m}^3$.
- ▣ The levels sulphur dioxide at all sites, except in Vipingo, exceeded the 1 year guideline of 60 $\mu\text{g}/\text{m}^3$.

OBSERVATIONS

- ▣ The concentrations of nitrogen dioxide at all sites except in Industrial Area did not exceed the WHO guidelines (1 year guideline of $40 \mu\text{g}/\text{m}^3$ and the 8 year guideline of $120 \mu\text{g}/\text{m}^3$).
- ▣ The levels of nitrogen dioxide in Industrial Area exceeded the 8 hour WHO guideline of $120 \mu\text{g}/\text{m}^3$ in 2009.

OBSERVATIONS

- ▣ The concentrations of particulate matter at all sites, except in Vipingo, were significantly high and exceeded the WHO guidelines (1 year guideline of 60-90 $\mu\text{g}/\text{m}^3$ and the 24 hour guideline of 150-230 $\mu\text{g}/\text{m}^3$).
- ▣ Industrial sites and sites near the roads recorded comparatively higher pollution levels.

CONCLUSIONS

- ▣ The concentrations of sulphur dioxide and particulate matter in the above mentioned sites exceeded the WHO guidelines for ambient air.
- ▣ Industrial and vehicular emissions were found to have been among the major contributors of these air pollutants.
- ▣ The above mentioned pollutants were likely to have chronic adverse human health effects.