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A REVIEW OF THE BURDEN OF AIRBORNE PARTICLE POLLUTION IN SOME MEGA CITIES AROUND THE GLOBE

Robert, J. J[1]., Shedrach, T.[2]

[1, 2]Department of Physics, Ignatius Ajuru University of Education, Rumuolumeni, Port-Harcourt, Nigeria.

Corresponding e-mail Address: robert.james@iaue.edu.ng

Abstract

Air pollution has become a global problem since the advent of industrial revolution, couple with increasing human activities due to astronomical increase in the world's population. Ambient air pollution has been identified as responsible for "the Global excess mortality and estimated at 8.8(7.11- 10.41) million/year". A number of reports have indicated that globally, deaths from ambient air pollution are more than any other form of pollution. Airborne particle pollution is one of the major contributory factors to the health care burden due to the increasing number of hospital admissions, especially in highly polluted cities with high population density. Reducing airborne particle pollution in all these polluted cities, will be of immense benefits to the world, especially cities with high levels of airborne particle pollution in a number of ways, namely increase in life expectancy, reduction in hospital admissions, effects of climate change and other environmental problems associated with airborne particle pollution.

Keywords: Review. Burden, Airborne Particle Pollution, Mega Cities

1.1 INTRODUCTION

Air pollution has become a global problem since the advent of industrial revolution, and increasing human activities due to astronomical increase in the world's population. There is no region of the world that is shielded from air pollution and airborne particle pollution in particular. This is because, air pollution could be local or regional, depending on the source, concentration and the prevailing atmospheric conditions of the place. Air pollution poses serious health concerns, and particulate matter in particular. Fine particles of diameter less than 10μm pose the greatest problems, because of their ability to get deep into the lungs, as well as bloodstream (USEPA, 2021). In 2013, the world's economy incurred about $5.11 trillion in welfare losses due to exposure to outdoor and indoor air pollution (World Bank Group, 2016).

According to Lohmann and Feicher (2005), "anthropogenic aerosol particle have greatly increased the global mean burden of aerosol particles from pre-industrial times to the present day". The effects of atmospheric aerosol particles on the Eath's radiative energy balance are of great climatic and environmental importance (Wang et al., 2021). Similarly, Fei et al (2018) stated that aerosol particles of

marine origin (sea-salt) pose "great impact on geo-chemical and geophysical processes, and on the Earth's climate".

According to Vohra et al (2021), "the greatest mortality impact is estimated over regions with substantial fossil fuel related $PM_{2.5}$, notably China (3.9 million), India (2.5 million) and parts of eastern US, Europe and Southeast Asia". Amann et al (2017) opined that "reducing air pollution will result in corresponding decreased mortality rate, improvement in health, and reducing damage to crops, forests, ecology and building and other materials".

1.2 ESTIMATES OF AIRBORNE PARTICLE POLLUTION IN SOME MAJOR CITIES IN NIGERIA AND SOME OTHER REGIONS OF THE WORLD

Vanguard reports of March 13th, 2015 stated that in Lagos Metropolis, Imota had the highest maximum concentration of particulate matter of 651μg/m^3, while the smallest value of 63.4μg/m^3 was recorded at Unilag, and in February 2008, a peak value of $PM_{2.5}$ was recorded (Uwaegbulam, et al, 2015). Result from a research study conducted in Port-Harcourt Metropolis indicated annual mean ambient particulate air pollution to be 118μg/m^3 (Efe, 2008). More so, Nigeria and 10 other countries are said to be among those countries that have the deadliest air quality in the world due to a combination of environmental hazards and emissions from transportation, generators, and agricultural practice *(http://pharmatimes.com.ng/air-pollution-nigeria-ranks-4th-deadliest-globally/).* Available information from Rivers state ministry of environment based on 2016 sampling of particulate matter in Port Harcourt city revealed a high value of $PM_{2.5}$ concentration of 270μg/m^3 (Cunningham, 2018). Evaluation of air quality index of dusty football fields showed levels of PM for; $PM_{1.0}$ (13.73 – 20.18 μg/m^3), $PM_{2.5}$ (19.11 – 28.83 μg/m^3), $PM_{4.0}$ (24.73 – 44.63 μg/m^3), $PM_{7.0}$ (41.07 – 67.04 μg/m^3), and PM_{10} ranging from 65.48 – 90.82 μg/m, which were predominantly rated as unhealthy (Seiyaboh et al, 2019). Osimobi and Nwankwo (2018) assessment of airborne particle pollution in University of Port Harcourt campus, revealed variations in total suspended particulate (TSP) matter from 25.25μg/m^3 to 154.0 μg/m^3; particulate matter (PM_{10}) from 27.63 μg/m^3 to 142.75 μg/m^3 and $PM_{2.5}$ from 13.63 μg/m^3 to 67.25 μg/m^3 respectively. A review of particulate matter studies in Nigeria, from 1985 – 2015 by Offor et al (2016) revealed that "about 50% of the particulate matter loads in Nigeria exceeded both the WHO (25 μg/m^3, 50 μg/m^3) and NAAQS (35 μg/m^3, 150 μg/m^3) guideline limits for $PM_{2.5}$ and PM_{10} respectively". Similarly, ambient air pollution monitoring study of Lagos mainland by Obanya et al (2018) showed that the measured $PM_{2.5}$ and PM_{10} ranges from 43.345.2 – 127.2159.7 μg/m^3, and these were much higher than the WHO set limits. James and Ndiokwere (2006) findings showed the concentration value of total suspended particulates (TSP) in Warri ranged from 922-2333 μg/m^3, and this exceeded both FEPA and WHO standards. This TSP sample was found to contain the following elemental components; As, Se, V, Na Ca, Cd, Pb, Na and Al. Akinfolarin et al (2017) study of atmospheric particle pollution at three emerging industrial sites revealed higher concentrations of particle pollution of $PM_{2.5}$ and PM_{10} with the dry season showing concentrations higher than 150μg/m^3 and

230µg/m^3, which is above WHO acceptable limits for $PM_{2.5}$ and PM_{10}. Oguntoke et al (2012) findings showed that the average particulate matter concentrations within and around the Ewekero cement production plant for $PM_{2.5}$ and PM_{10} were (28–116 µg/m^3) and (74–338 µg/m^3) respectively. These mean concentrations were significantly higher than WHO permissible limits. Figure 1.1 shows that the annual average particulate levels of selected African cities are well above the WHO guideline.

PM_{10} levels in the Dakar, Accra, and Lagos are 7.5, 6, and 5 times respectively, higher than WHO standards, and more than 3 times higher in Johannesburg and Tunis (Centre for Science and Environment (CSE, 201).

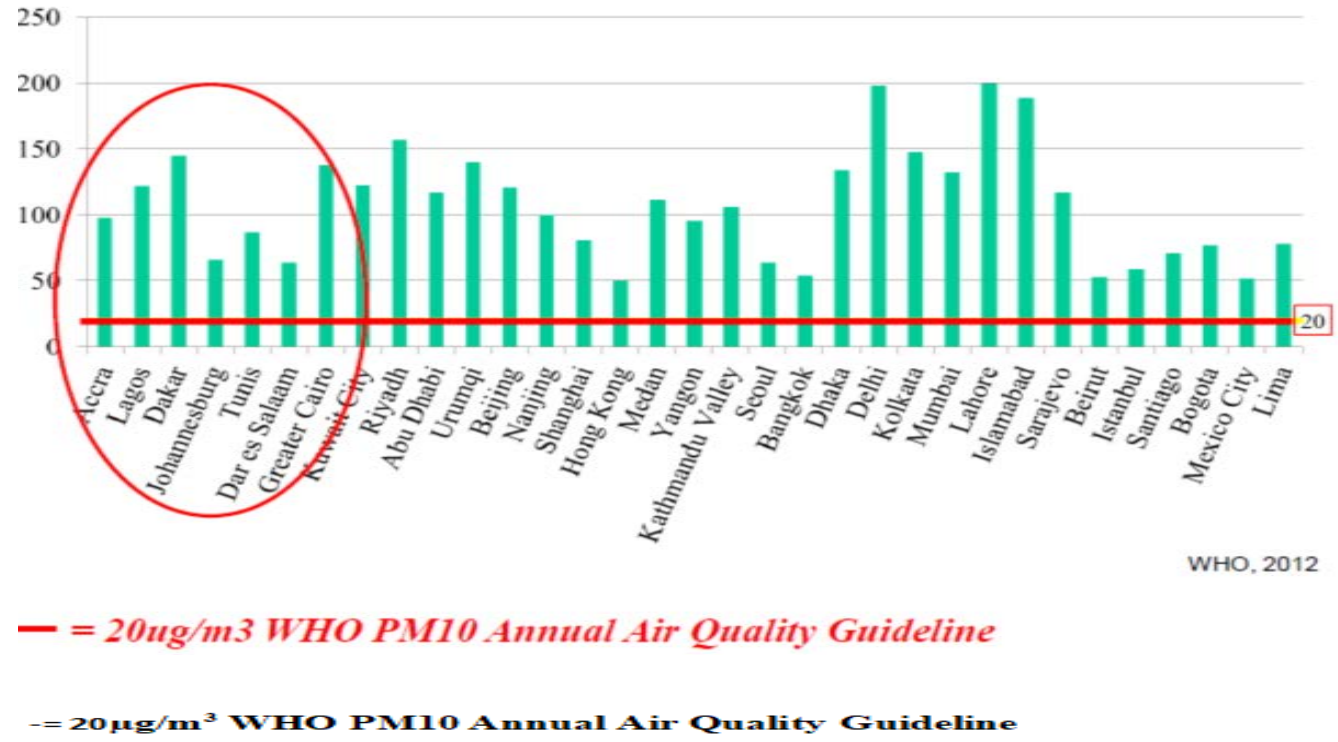

Figure 1.1: PM10 Annual Average for Selected African Cities, 2012

Many cities around the world have higher than acceptable levels of air pollution. Amongst these cities, Onitsha-Nigeria topped the list followed by Peshawar city-Pakistan and Zabol-Iran with PM_{10} annual concentration values of 594µg/m^3, 540µg/m^3 and 527µg/m^3 respectively when comparing with other cities in different regions of the world. These cities and their regions are shown in figures 1.2, 1.3, 1.4, 1.5, 1.6 while figure 1.7 shows some selected cities around the globe with higher PM_{10} annual mean concentrations

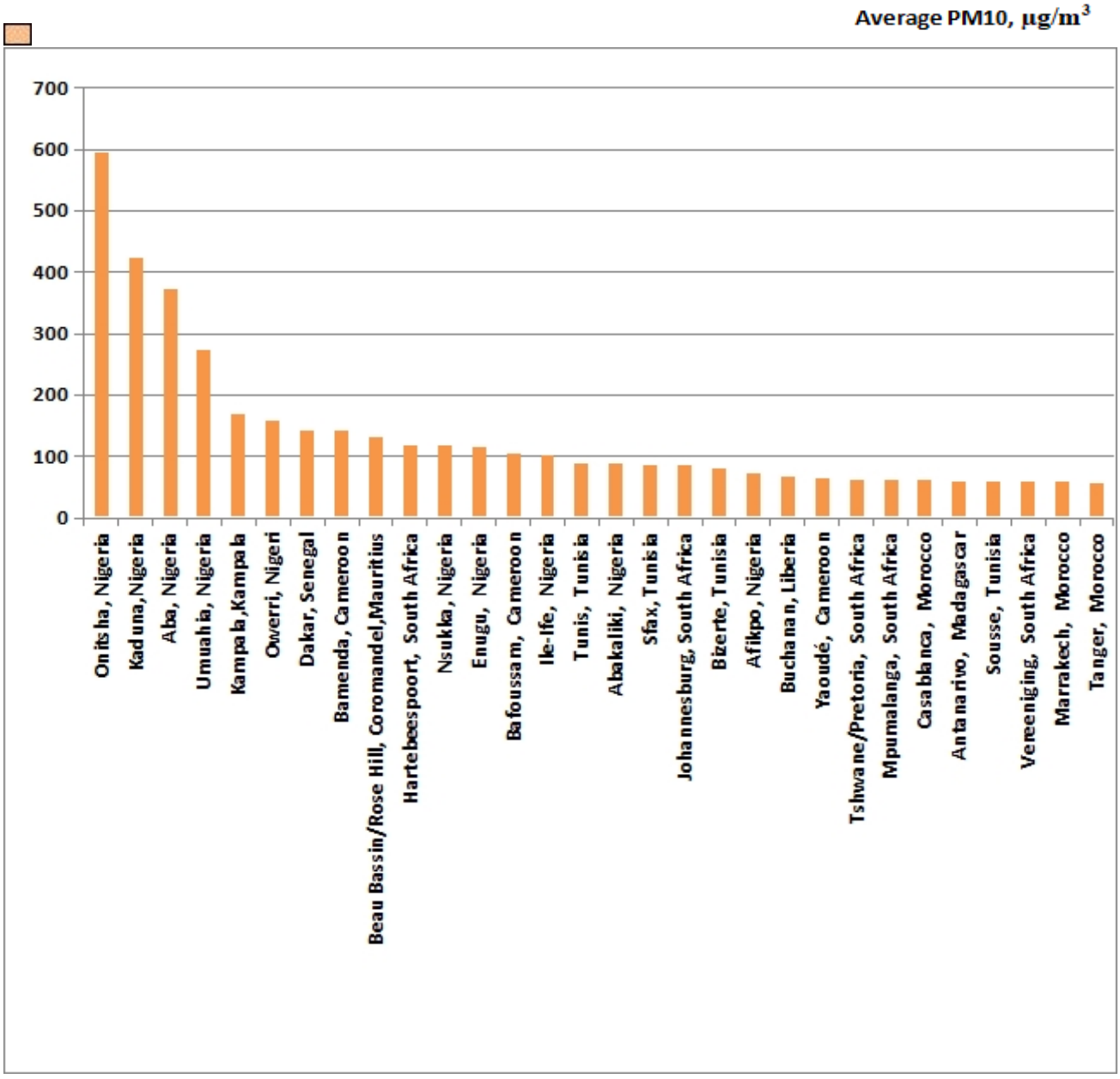

Fig. 1.2: Cities With The Worst Air Quality in Africa

Source: Migiro, G. (2018, June 28). Cities with the Worst Air Quality in Africa. (*https://www.worldatlas.com/articles/cities-with-the-worst-air-quality-in-africa.html).*

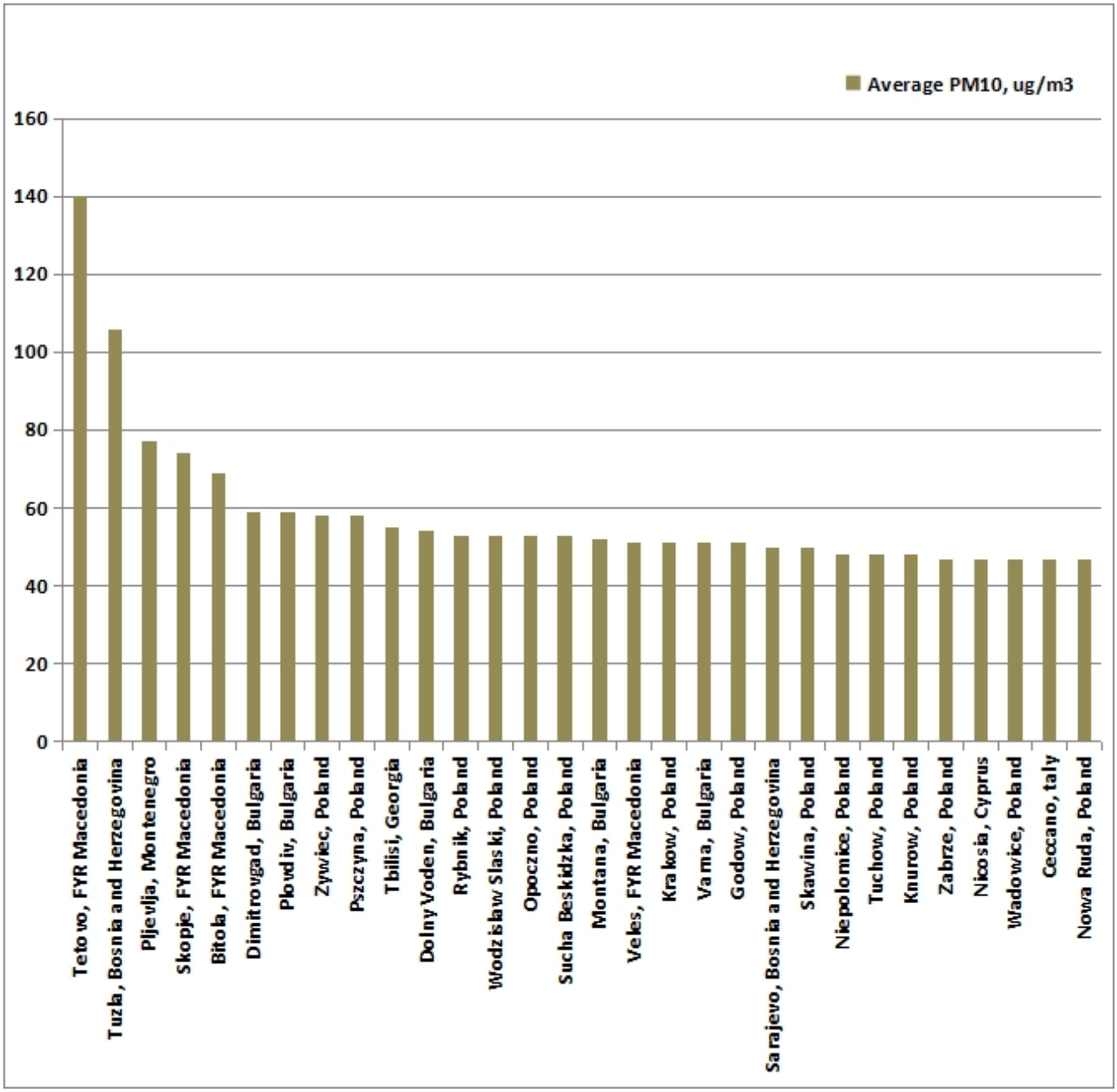

Fig. 1.3: Cities with the Worst Air Quality In Europe

Source: Migiro, G. (2018, June 28). Cities with the Worst Air Quality in Africa. *(https://www.worldatlas.com/articles/cities-with-the-worst-air-quality-in-africa.html)*

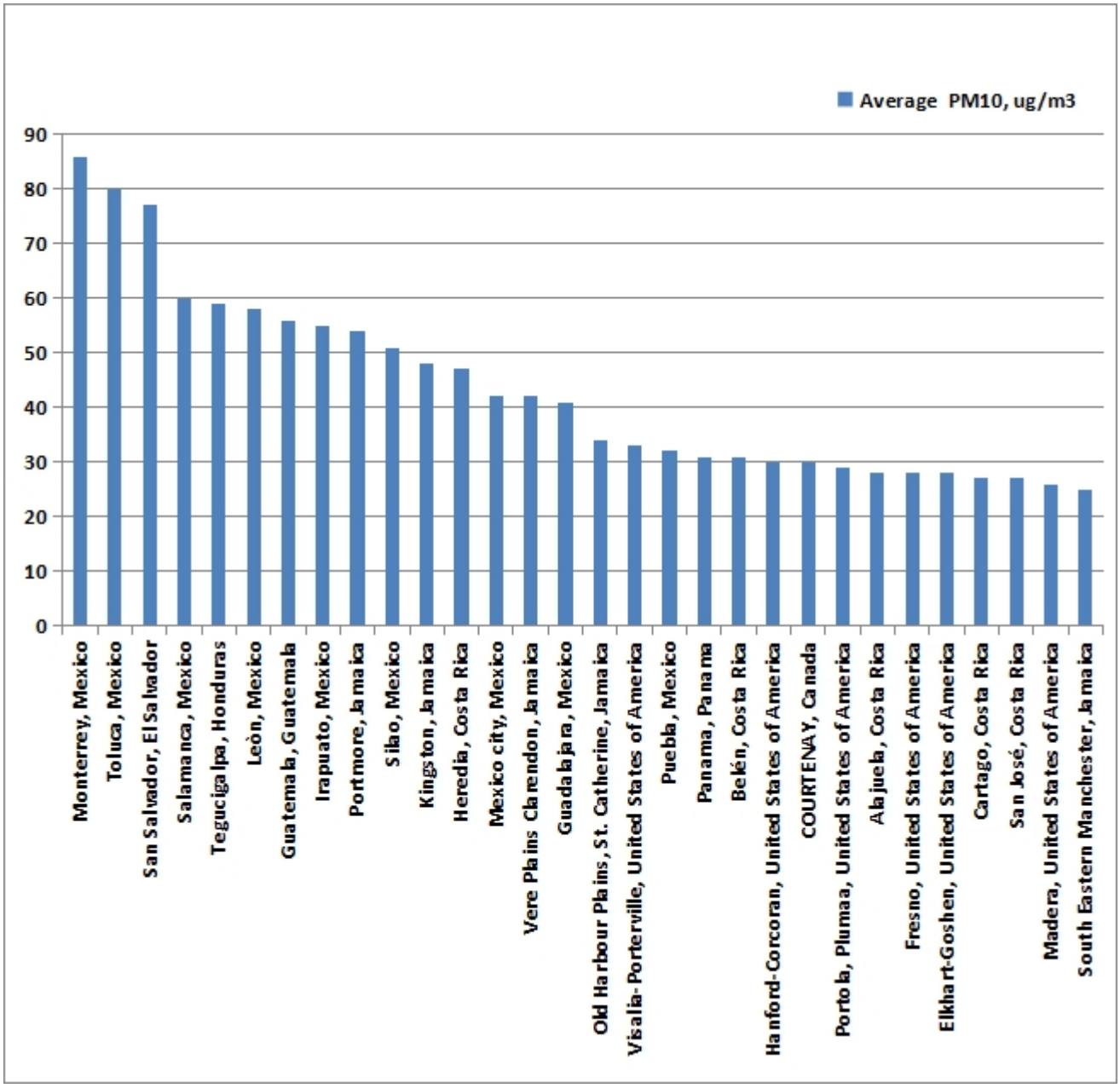

Fig. 1.4: With The Worst Air Quality In North America

Source: John, M.(2018, August 6). Cities with the Worst Air Quality in North America. (*https://www.worldatlas.com/articles/cities-with-the-worst-air-quality-in-north-america.htm).*

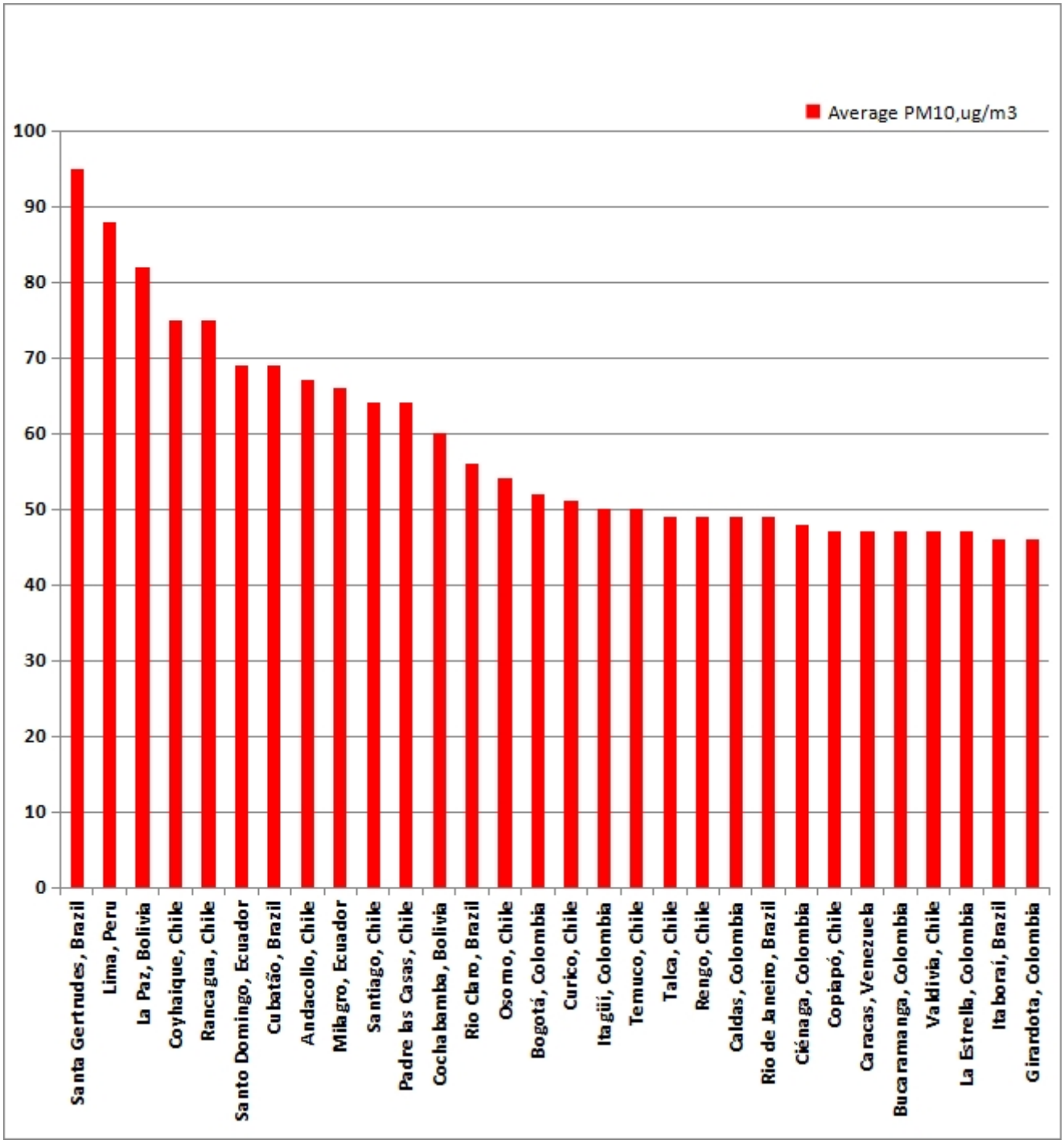

Fig.1.5: Cities With The Worst Air Quality In South America

Source: Sawe, B. E. (2018, June 26). Cities with the Worst Air Quality in South America. (*https://www.worldatlas.com/articles/cities-with-the-worst-air-quality-in-south-america.html).*

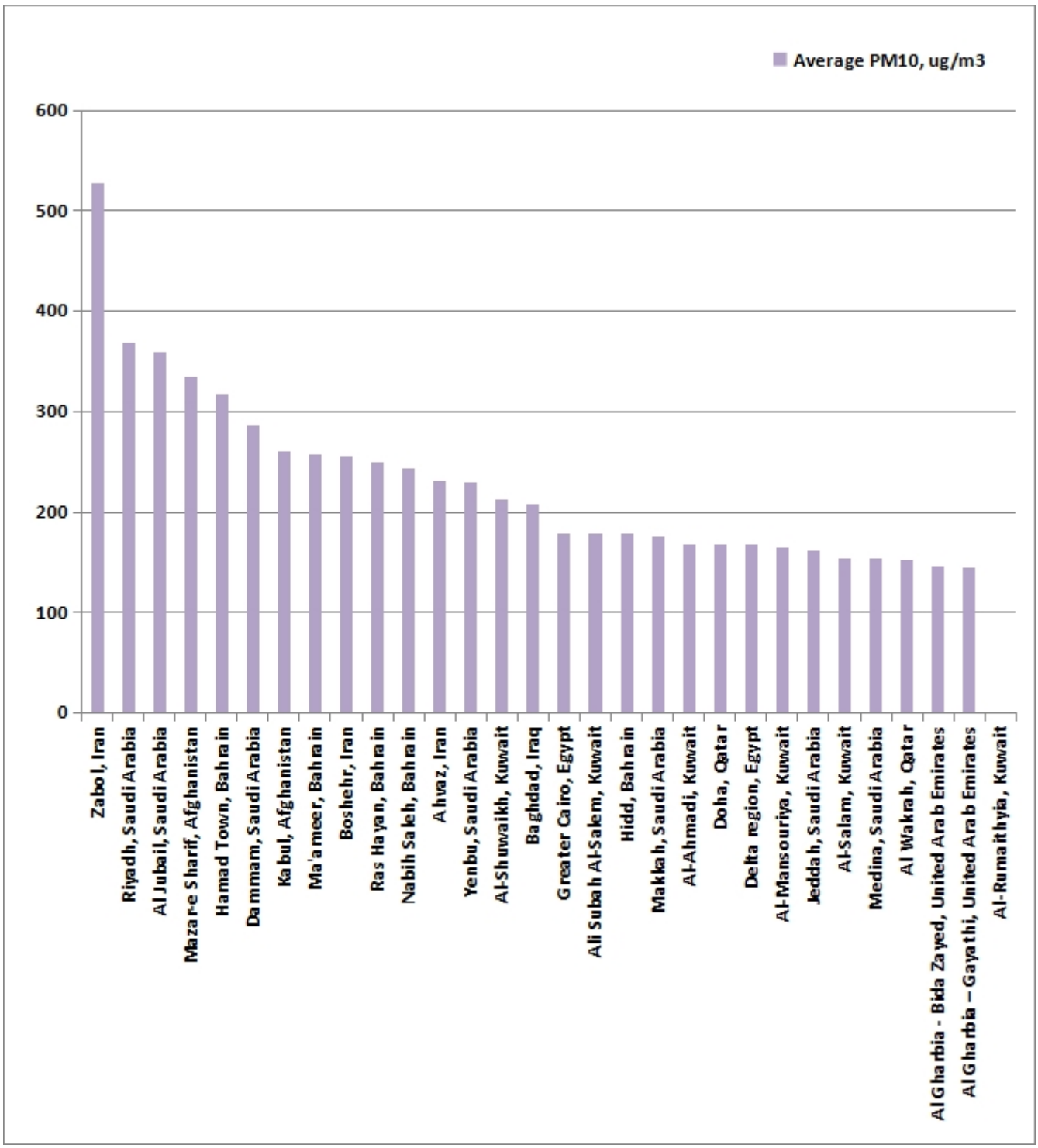

Fig.1.6: Cities With The Worst Air Quality In The Middle East

Source: Migiro, G. (2018, July 4). Cities with the Worst Air Quality in the Middle East. (*https://www.worldatlas.com/articles/cities-with-the-worst-air-quality-in-the-middle-east.htm)*

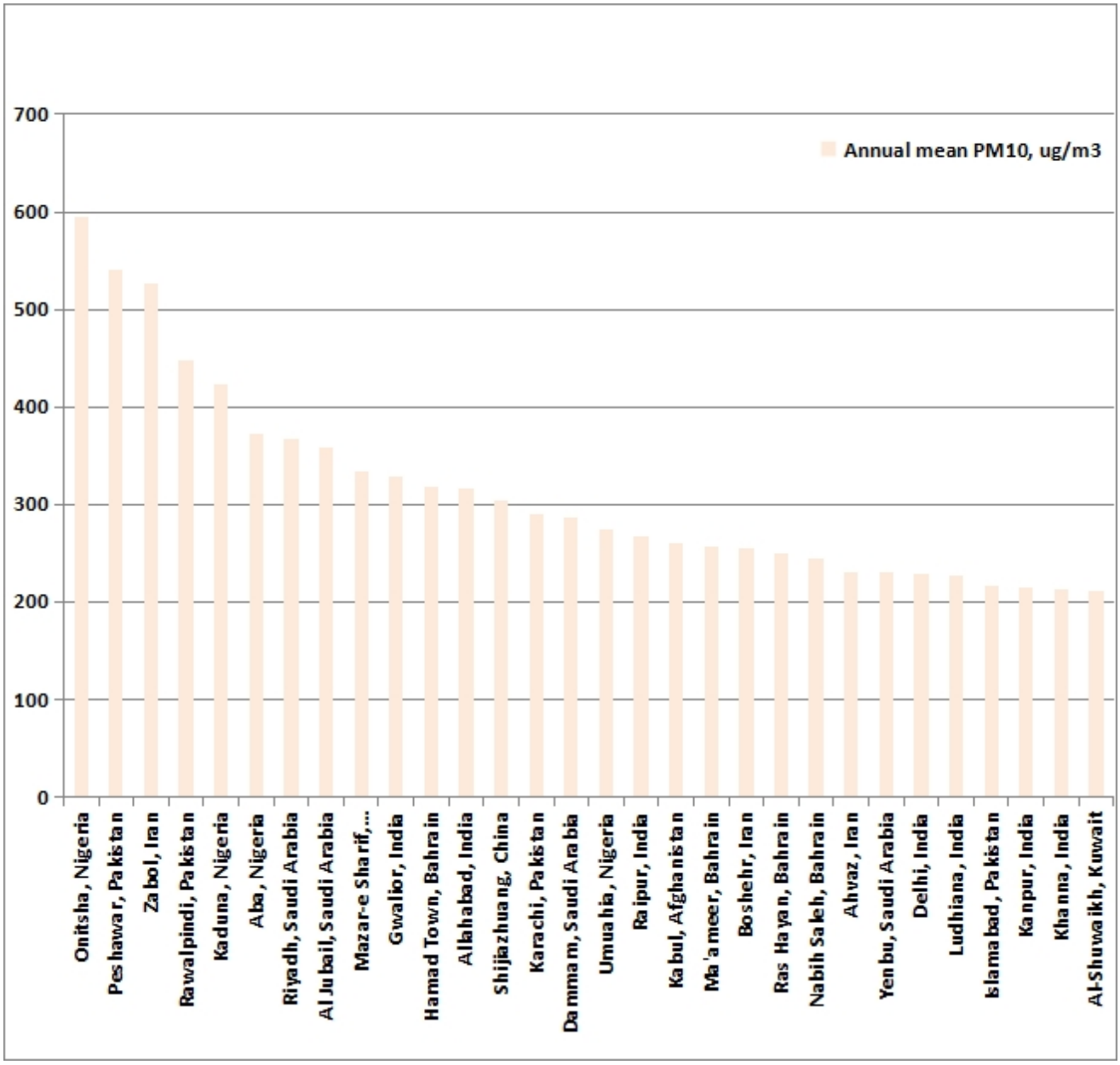

Fig. 1.7: Cities With The Worst Air Quality In The World

Source: Miaschi J.(2018, December 4).Cities with the Worst Air Quality in the World. (*https://www.worldatlas.com/articles/cities-with-the-worst-air-quality-in-the-world.html.ry6)*

Furthermore, based on 2019 data, the World Population Review listed concentrations of particle pollution of some countries such as India (83.2µg/m^3), Nepal (83.1µg/m^3), Niger (80.1µg/m^3), Qatar (76µg/m^3), Nigeria (70.4µg/m^3), Egypt(67.5µg/m^3), Mauritania (66.8µg/m^3), Cameroon (68.5µg/m^3), Bangladesh (63.4µg/m^3) and Pakistan (62.6µg/m^3) as the 10 top countries with the worst exposure to air particle pollution of the order of 2.5microns (World Population Review, 2021).

More so, from 2020 data, World Population Review listed Bangladesh, Pakistan, India, Mongolia, and Afghanistan as some of the worst air polluted nations in the world per IQ Air 2020. The cause of this high level of pollution in these countries were attributed to the use of klins in brickmaking, burn coal, growing number of

vehicles on the road, burning of garbage, steel mills, dust storms, forest fires and biomass (World Population Review, 2021)..

1.3 CONCLUSION

Conclusively, no race or social class is shielded from the terrible effects of air pollution and airborne particle pollution in particular, since they are suspended in air and carried by the wind from one end of the city to another. Reducing airborne particle pollution in all these polluted cities, will be of immense benefits to the world, especially cities with high levels of airborne particle pollution in a number of ways namely; increase in life expectancy, reduction in hospital admissions, climate change and other environmental problems associated with airborne particle pollution.

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