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Article

The Monitoring of Carbon Dioxide and Nitrogen Dioxide in the Air in Durres, Albania

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Abstract: The major sources of indoor carbon dioxide are people, kerosene and gas space heaters, tobacco smoke, and outside air. Nitrogen dioxide (NO_2) is a ubiquitous atmospheric pollutant due to the widespread prevalence of both natural and anthropogenic sources, and it can be a respiratory irritant when inhaled at elevated concentrations. Carbon dioxide (CO_2) and NO_2 may pose direct risks to human health. The study shows that in Durres the values of CO_2 in the air are between 350 to 1000 ppm. So we can say that the level of CO_2 in Durres is high, but it is normal for cities with high circulation. So it is not considered a big problem for air pollution. On the contrary, the study shows that the NO_2 values in Durres are at an average value higher than both Albanian and EU standards.

Keywords: CO_2 values; NO_2 values; CO_2 health effects; NO_2 health effects; air pollution; EU standards; Albanian standards.

1. Introduction

Carbon dioxide (CO_2) is a gas released during respiration of the living organisms. It is constantly being emitted into the indoor environment by building occupants. The CO_2 may come from combustion sources as well [1].

Growing evidence suggests that environmentally relevant elevations in CO_2 may pose direct risks to human health. Increasing atmospheric CO_2 concentrations could make adverse exposures more frequent and prolonged through increases in indoor air concentrations and increased time spent indoors [2].

The CO_2 can significantly diminish performance on tasks requiring psychomotor coordination, visual perception, attention, and rapid response. Infants and children breathe more air than adults relative to their body size and thus they tend to be more susceptible to respiratory exposure. The vasodilator effects and enhanced ventilation could contribute to the rapid loss of body heat [3].

Nitrogen dioxide (NO_2) is mainly emitted (as NOx) from combustion in vehicles and power plants [3]. The NO_2 is a ubiquitous atmospheric pollutant due to the widespread prevalence of both natural and anthropogenic sources, and it can be a respiratory irritant when inhaled at elevated concentrations [4]. The NO_2 is harmful to human health. It can cause damage including respiratory function, hospital admission, and premature death [5].

2. Materials and Methods

The monitoring of CO_2 and NO_2 has been done from February 2019 - October 2020. The monitoring has been done in 12 areas of Durres, which include important areas such as the Town Hall, the main promenade, the area near the Train Station, the area near the Martyrs Museum, the area near the City Post, etc. The areas selected are the ones with the heaviest traffic, among the most frequented and central areas of Durres City. The monitoring points in an area are selected in such a

way as to complement the land use pattern, for example, residential area, industrial/economic area, public institutions (education, health), and green space. In each area, these two particles were measured at 10-14 different points. The monitoring stations are located away from the direct source which generates or emits air pollution and obstacles to sampling are avoided. The monitoring was made during dry climate conditions, with wind speeds less than 5 m/s. The monitoring was made at least 75% of the set time during the day (06.00 to 22.00) and night (22.00 to 06.00). Monitoring is performed from 5 to 7 hours, at a certain time of day and night.

A sensor-based device Aeroqual (Gas Sensing, Inwood, Iowa) was used to measure CO_2 and NO_2 levels in the air. It was held carefully, at a height of 1.5 m above the ground level. The equipment is properly calibrated, both before and after measuring the level of CO_2 and NO_2 in the air, according to national standards.

3. Results and Discussion

The obtained results from the analysis of CO_2 and NO_2 in the main areas of Durres were compared with both Albanian and EU standards. In Figure 1 are presented the minimum and maximum CO_2 values of each area and the average of CO_2 in each area.

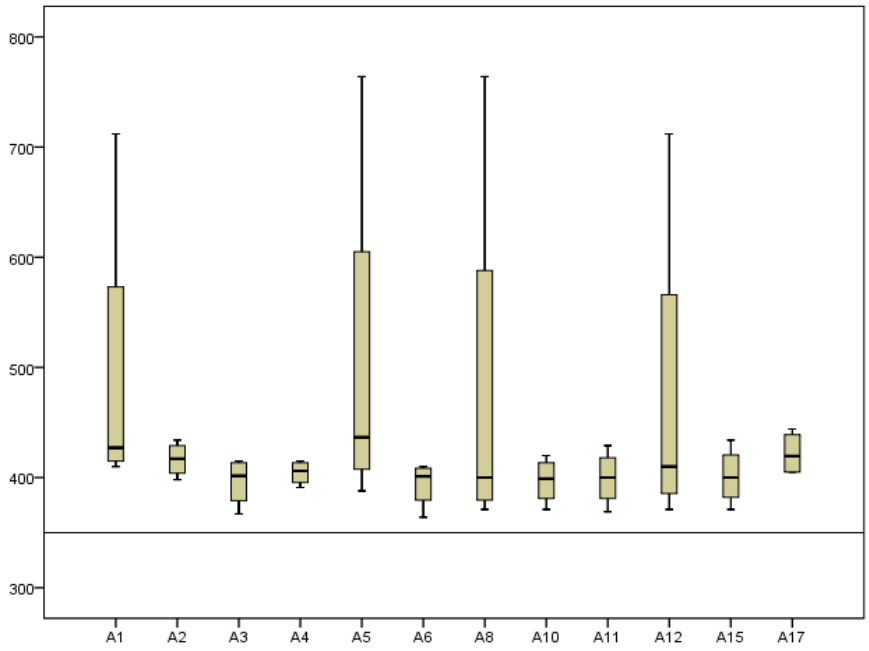

Figure 1. CO_2 values in each area (ppm); Vertical axis - CO_2 values; Horizontal axis - Monitoring areas.

The standard of CO_2 is 0-350 ppm. If the value of CO_2 is 350-1000 ppm the city is considered with high traffic, but it is not considered a big problem. If the CO_2 value is more than 1000 ppm it is considered a problem for air pollution. The chart shows that all of the 12 areas we have studied had CO_2 values between 350 to 1000 ppm. So, we can say that the level of CO_2 in Durres is high, but it is normal for cities with high circulation. So, it is not considered a big problem for air pollution.

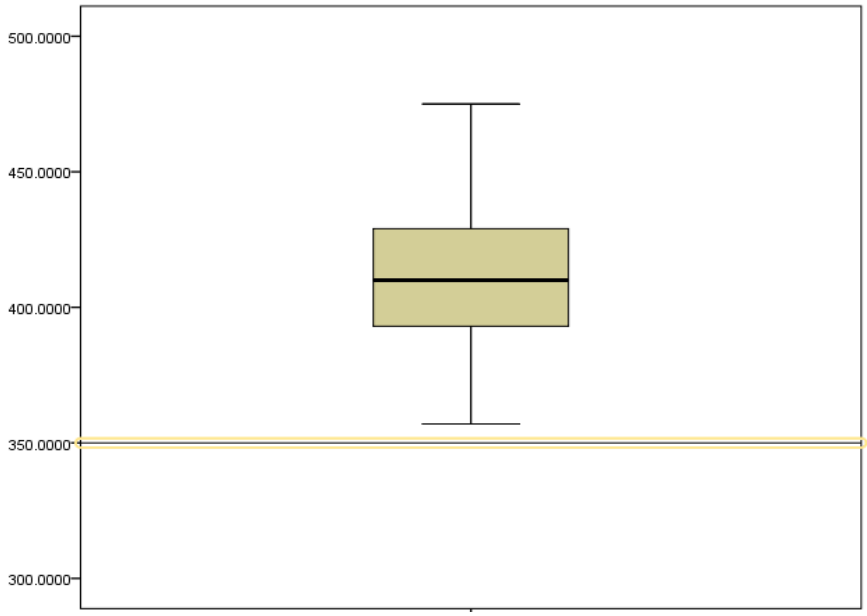

Figure 2. The presentation of all the group areas for CO_2 (ppm); Vertical axis - CO_2 values; Horizontal axis - Monitoring areas.

In Figure 2 are presented the minimum and maximum CO_2 values in Durres and the average of CO_2 in Durres. The study shows that in Durres the values of CO_2 in the air are between 350 to 1000 ppm. So, we can say that the level of CO_2 in Durres is high, but it is normal for cities with high circulation. So, it is not considered a big problem for air pollution.

In Figure 3 are presented the minimum and maximum NO_2 values of each area and the average of NO_2 in each area. The EU standard of NO_2 is 0.04 mg/m^3, while in Albania it is 0.06 mg/m^3. The chart shows that all the 12 areas we have studied have points where NO_2 values are higher than the Albanian standards. If we refer to the average values of NO_2 measured in each area, it resulted that in only 3 areas taken in the study the average NO_2 values taken were within the Albanian standards.

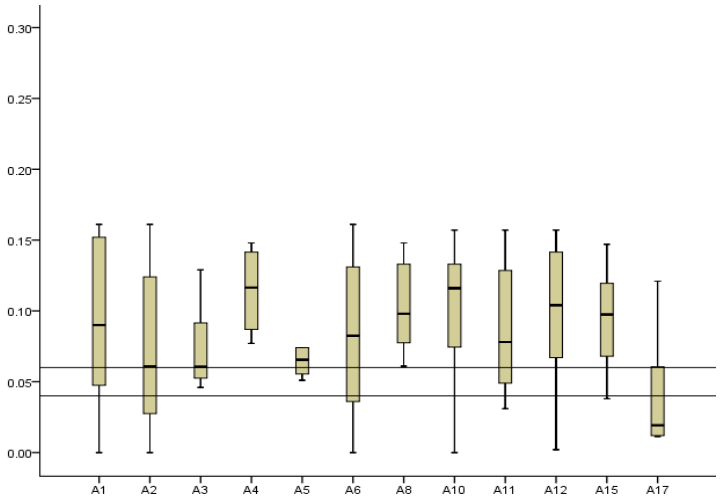

Figure 3. NO_2 values in each area (mg/m^3); Vertical axis - NO_2 values; Horizontal axis - Monitoring areas.

If we refer to EU standards we see that all the 12 areas we have studied have points where NO_2 values are higher than the EU standards and only one area has the NO_2 average value which is within the EU standard.

In Figure 4 are presented the minimum and maximum NO_2 values in Durres and the average of NO_2 in Durres. The study shows that in Durres the values of NO_2in the air are at an average value higher than both Albanian and EU standards.

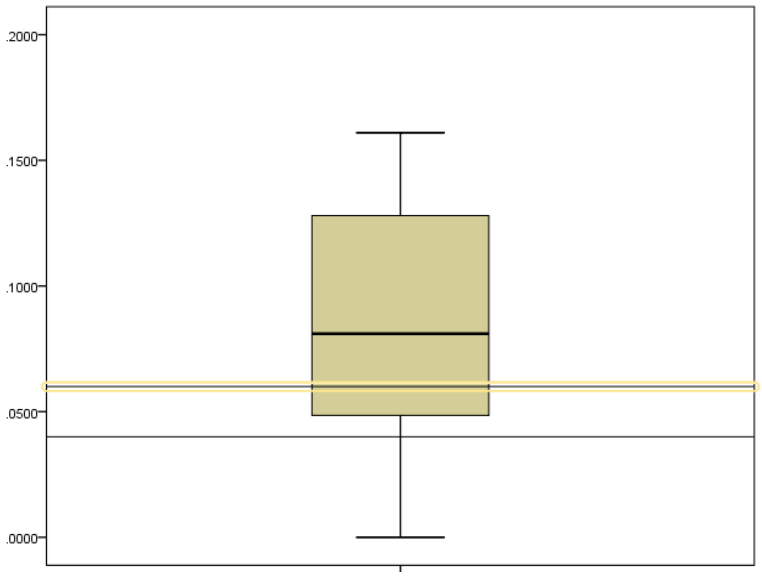

Figure 4. The presentation of all the group areas for NO_2 (mg/m^3); Vertical axis - NO_2 values; Horizontal axis - Monitoring areas.

The measurement of air components in the city of Durrës within the framework of the "Green Lungs - Green lungs for our cities" project, has shown that the state of air quality in Durrës is not among the most optimal. The area with the most polluted air in the city of Durres is the Port area. Also, the air quality deteriorates during the construction process.

The priority remains the fulfillment of the legal requirements of the EU, including the standard values of the determining components of air quality; monitoring air pollution from various sources such as stationary sources (industrial plants), vehicles, etc., and taking measures to eliminate the causes of exceeding the permitted rates for various agents of pollution, for the protection of human health and the environment. The values measured during years show that in 2002 and 2009 the air in Durres was more polluted by dust particles than in other years. The 2017 and 2019 are the years when the air is cleaner from dust particles [6,7]. DCM no. 352/2015 "On the assessment of the quality of the environment and the requirements for some pollutants in relation to it", was approved on 29.04.2015 [8].

4. Conclusions

The Air purification from the dust particles may have come as a result of several legal initiatives taken during 2014-2015. They relate to ambient air quality and the tax system for combustibles. DCM no. 594, dated 10.09.2014, approved the National Strategy for Environmental Quality and Law no. 162/2014, dated 04.12.2014 "On the protection of the quality of the environment". This law constitutes the framework for the protection of quality and is based on Directive 2008/50 EC and 2004/107 EC. The law was effective in December 2017.

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Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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