# ASSESSMENT OF AIR POLLUTION IN TERMS PARTICULATE MATTER (PM) IN URBAN AREAS IN PRISHTINA

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**ABSTRACT**
Air pollution is one the most significant problems in the present days. Exposure to particulate matter (PM) has been associated with a wide range of effects on health, but effects on mortality are arguably the most important, and are also most amenable to global assessment. Degradation of the atmospheric environment is intensified during the last years in the major cities of Kosovo. The main current air pollution sources in Kosovo are: KEC that includes thermal power plants (Kosova A and Kosova B) and lignite mines in Obiliq, Industrial complex in Mitrovicë, Ferronikeli in Gllogovc, Cement factory - SharrCem in Hani i Elezit, etc.
The purpose of our work was the study of air pollution over Prishtina (Kosovo) region, to present the environment pollution from particulate matter and air pollution sources. Particulate matter ($PM_{10}$ $PM_{2.5}$) is a type of air pollution that is generated by a variety of human activities, can travel long distances in the atmosphere and causes a wide range of diseases and a significant reduction of life expectancy in most of the population of Europe. These particles originate from a variety of sources, such as power plants, industrial processes, diesel trucks, and they are formed in the atmosphere by transformation of gaseous emissions. Measurement campaigns were carried out in several area, at two different points, and four different periods in urban centre of Prishtina, during the year 2010-2011.

**Keywords**: air pollution, Prishtina, particulate matter, $PM_{2.5}$ PM10, air quality.

## INTRODUCTION

Air pollution has become one of the serious environmental concerns in urban areas, especially in view of the adverse health effects that have been associated with ambient fine particles. The rates of increase in pollutant concentrations in the cities of developing countries are higher than those of developed countries (BEGUM, 2008).
The potential for serious consequences of exposure to high levels of ambient air pollution was made clear in the mid-20th century, when cities in Europe and the United States experienced episodes of air pollution, such as the infamous London Fog of 1952 and Donora Smog of 1948, which resulted in large numbers of excess deaths and hospital admissions.

Subsequent clean air legislation and other regulatory actions led to the reduction of ambient air pollution in many regions of the world, and particularly in the wealthy developed countries of North America and Europe.
The 6 pollutants that account for the large majority of air pollution worldwide and for which standards are usually specified include carbon monoxide (CO), ozone ($O_3$), oxides of nitrogen ($NO_x$), sulfur dioxide ($SO_2$), lead (Pb) and suspended particulate matter (SPM). For SPM, 2 classifications are generally employed, i.e. total suspended particulate matter (TSP) and particulate matter less than 10 μm in diameter (PM10).
Current scientific evidence, derived largely from studies in North America and Western Europe, indicates that urban air pollution causes a spectrum of effects on health, ranging from eye irritation to death (WHO, 1999). Combustion of fossil fuels for transportation,

power generation, and other human activities produces a complex mixture of pollutants comprising literally thousands of chemical constituents (HEINRICH, 1997).
Exposure to such mixtures is a ubiquitous feature of urban life. The precise characteristics of the mixture in a given locale depend on the relative contributions of the different sources of pollution, such as vehicular traffic and power generation, and on the effects of the local geoclimatic factors.
Air quality in Kosovo is still unsatisfactory, although the monitoring of all indicators, as defined by the Law on Air is incomplete and consequently the data are incomplete. The inventory of air emissions and the air pollutants cadastre are not yet completed.
These deficiencies make it impossible to assess the level of emissions in Kosovo, which affect the air quality, and climate change.
As air pollution sources, except KEC, Trepca, Ferronikel, public heating facilities and other industries,traffic is considered a significant air pollution sector. Also, it should not be underestimated the air pollution caused by radioactive waste materials used in industry, medicine, and radioactive lightning arresters installed in buildings, and industrial facilities.
Kosovo is not a signatory to any of the conventions, protocols or international agreements, related to air protection. Despite this, great efforts are made to incorporate and implement the international norms, primarily those of the EU, as in legal framework, as well as on implementation.

## MATERIAL AND METHOD

Measurement campaigns were carried out in several area, at two different points, and four different periods in urban centre of Prishtina. In this paper we have detailed of air pollution over Prishtina region in Republic of Kosovo. We have measured ($PM_{10}$ and $PM_{2.5}$) on number and mass concentration, as the indicators of exposure to urban air pollution in urban areas in Prishtina.
The city of Prishtina, one of the largest cities in the Kosovo, with a huge concentration of people and resources, has suffered from many social and environmental problems. The area of Prishtina (572 $km^2$, about 600.000 inhabitants) represents one of the largest Kosovo metropolitan areas.
The first automatic station for air quality monitoring, is placed at KHMI location. This station is equipped with automatic analysers of sulphur dioxide ($SO_2$), nitrogen oxides ($NO_x$), carbon monoxide (CO), ozone ($O_3$), particulate matters PM10/PM2.5 as well as with sensors of meteorological parameters.
The second KHMI station is placed at the yard of new Government's building, ex-Rilindja, This station is equipped with a three-channel optic analyser (Grim Model 180), which is configured to measure particulate matters.


**Figure 1. Air quality monitoring network in Kosovo**

## RESULTS AND DISCUSSION

### Assessment of pollution from particulate matter (PM)

The particulate matters generated by natural and anthropogenic processes, which in diffusive form are dispersed in the air and soil, fall under the influence of gravity, or together with atmospheric precipitation.
The environmental impact of particulate matters depends on their size. Particles smaller than 10 micrometers, usually are of round shape, and under the wind influence, can be transferred in long distances.
Particulate matters are categorized based on the size of the particles, such as particulate matter PM10, PM2,5 and PM1, with certain aerodynamic diameter <10μm, <2.5 μm and <1μm, and total suspended particulates (TSP).

### $PM_{10}$ - Particulate matter with aerodynamic diameter <10μm

In the figure below are presented the annual average values for the two monitoring stations during 2010 and 2011.
The figure shows that in the two monitoring stations, the annual limit value (40μg/m3) is exceeded during the monitoring period 2010 and 2011. Representative station for traffic pollution in Prishtina reaches the highest annual average value, for up to 75.74 μg/m3, which means that there is an excess of 1.9 times, more than the annual limit value (40μg/m3) according to European directives.
When comparing the data obtained between representative stations for pollution in urban, the highest concentration of PM10 pollution is evidenced in urban areas.

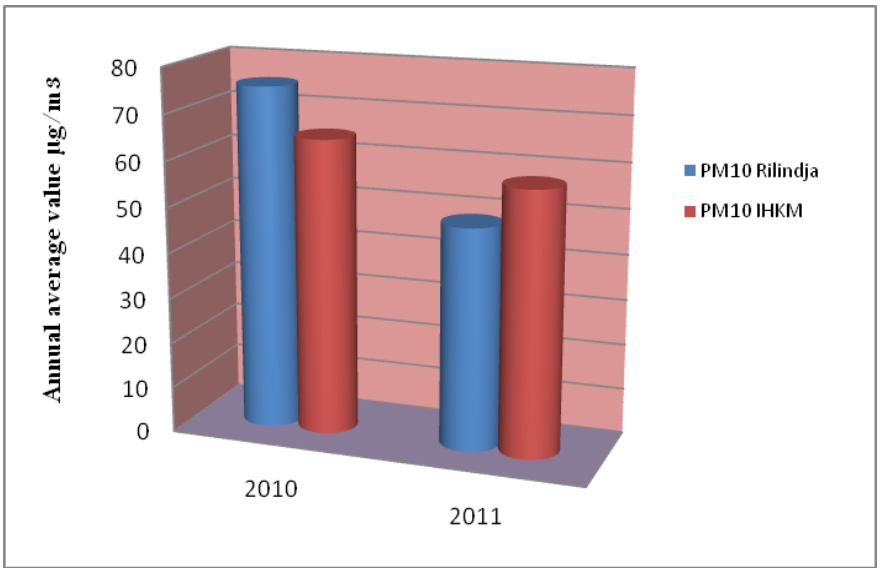


**Figure 2.Annual average values of PM10 in two monitoring stations**

In the figure below are presented the monthly average values of PM10, measured at monitoring stations KHMI and Rilindja in Prishtina, in 2010.

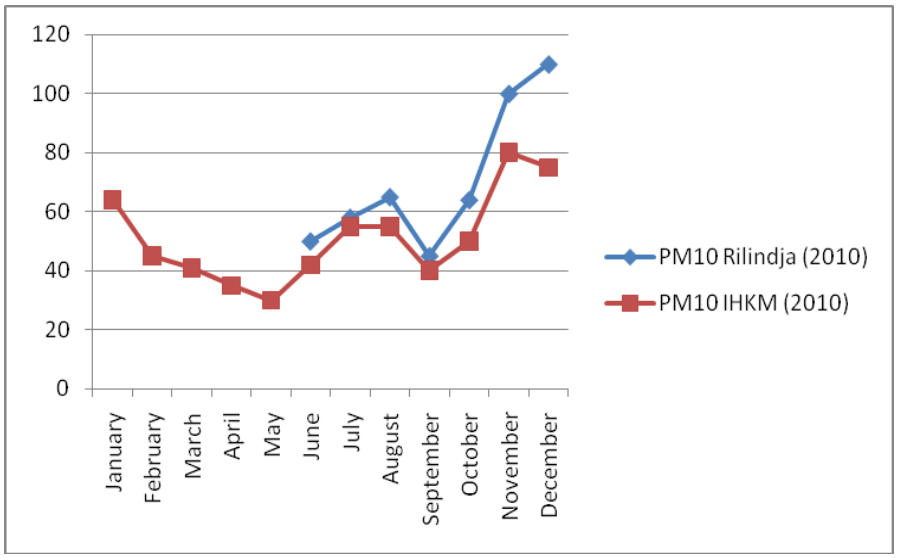


**Figure 3. Monthly average values of PM10 at monitoring stations (RILINDJA AND KHMI, 2010)**

Measurements presented for the station located near Rilindja are valid for the period from June to December only. It is indicated that the highest concentration of PM10 has been recorded during the winter season (80-116 µg/m3).
In the figure below are presented monthly average values of PM10 measured at monitoring stations in IHMK, Rilindja in 2011. Measurements presented, for the station located near Rilindja are valid for the period from June to December only. It is indicated that the highest concentration of PM10 has been recorded during the winter season (75-112 µg/m3) during the 2011 year.

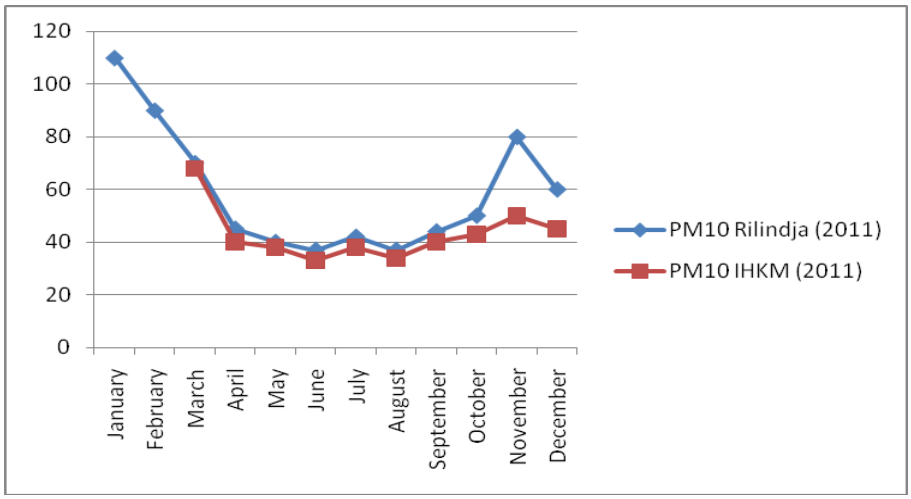


**Figure 4. Monthly average values of PM10 (µg/m3) at monitoring stations during 2011**

**Particulate matter with aerodynamic diameter <2.5µm**

The below table represents the annual average values of PM2.5 measured at Prishtina-Rilindja station during 2010 and 2011.

**Table 1. Annual average of PM2.5 at monitoring station Rilindja-Prishtina**

| PM2.5- Annual average | 2010 | 2011 |
|---|---|---|
| Annual Limit Value | 25 µg/m3 | |
| Prishtine, Rilindja | 38.71 | 42.12 |

This table shows that there is a slight increase of PM2.5 concentration, from 38.71µg/m3 as it was in 2010, to 42.12 µg/m3 during 2011, which means that the annual limit value (25µg/m3) according to European directives.

## CONCLUSIONS

Air quality is a major problem in many urban areas in the Republic of Kosovo and therefore has an impact on human health. The main serious air pollutants are: Nitrogen Oxide ($NO_x$), Sulfur Oxide ($SO_x$), Carbon Monoxide CO, Carbon Dioxide ($CO_2$), and different dusts ($PM_{10}$ and $PM_{2.5}$).
Particulate matter ($PM_{10}$ $PM_{2.5}$) is a type of air pollution that is generated by a variety of human activities, can travel long distances in the atmosphere and causes a wide range of diseases and a significant reduction of life. Representative station for traffic pollution in Prishtina reaches the highest annual average value, for up to 75.74 µg/m3, which means that there is an excess of 1.9 times, more than the annual limit value (40µg/m3). $PM_{2.5}$

concentration, from 38.71μg/m3 as it was in 2010, to 42.12 μg/m3 during 2011, which means that the annual limit value (25μg/m3) according to European directives.

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