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Monitoring of Air Quality in Passenger Cabins of the Athens Metro

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The air pollution induced by various transportation means combines the emission of pollutants with the simultaneous presence of people. In this respect, the scientific community has focused its efforts in studying both the air quality within busy streets and inside cars, buses and the underground railway network in order to identify the pollutants' sources and levels as well as the human exposure. The impact of the air pollution on commuters of the underground may be more severe because it is a confined space, extended mostly under heavily trafficked urban streets, relies on mechanical ventilation for air renewal and gathers big numbers of passengers.

The purpose of the present work is to monitor the air quality of the city of Athens Metro Network cabins and platforms during the unusually hot summer of 2012. For that cause particulate matter (PM_{10}, $PM_{2.5}$, PM_1), carbon dioxide (CO_2), the number of commuters along with temperature (T) and humidity (RH) were recorded inside the Athens Metro Blue Line trains (covering a route from the centre of Athens (Aigaleo) to the Athens International Airport) and on the platforms of a central (Syntagma) and a suburban-traffic (Doukissis Plakentias) station between June and August.

The data collection included six different experiments that took place for 2 consecutive working days each, for a time period of 6 weeks from 6:30 am too 7:00 pm in order to account for different outdoor climatic conditions and for morning and evening rush hours respectively. Measurements were taken in the middle car of the moving trains and the platform end of the selected stations.

The results show PM concentrations to be higher (approximately 2 to 5 times) inside the cabins and o the platforms of the underground network as compared to the outdoor levels monitored routinely by the Ministry of Environment. Moreover, PM_1, $PM_{2.5}$ and PM_{10} average concentrations recorded at the Syntagma Station Platform were almost constantly higher reaching 11 μg m^{-3} 47 μg m^{-3} and 246 μg m^{-3} respectively on July ^{11th}, as opposed to the ones at Doukissis Plakentias (4 μg m^{-3}, 15 μg m^{-3}and 97 μg m^{-3} respectively). Interestingly enough, inside the trains PM_1, $PM_{2.5}$ and PM_{10} average concentrations were significantly lower compared to the Syntagma Station Platform, reaching 8 μg m^{-3}, 27 μg m^{-3} and 90 μg m^{-3} . It was also observed that particulate levels were higher over the extent of the central part of the train route.

Finally, as expected CO_2 levels where found to be higher inside the trains compared to the platforms and in some cases surpassed the 1,000 ppm limit during the hottest days of the experimental campaign. Temperature and humidity remained relatively stable on the platforms whereas measurements inside the cabin fluctuated depending on the trains track locations reaching 34.8˚C at the central sector of the route.

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