First principles and methodology for a Cost Efficient Policy Tool for reduction of atmospheric Particulate Matter in Urban areas

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Abstract

$PM_{2.5}$ and PM_{10} ambient concentration levels are still a major environmental problem in several urban areas in the E.U., while new evidence of its long term impacts on human health continues to emerge. The Commission of E.C. is moving towards the implementation of the thematic strategy on air Pollution and requirements of lower limit values for PM in air will come in effect. National Authorities will have to re-evaluate the present environmental policies and measures and develop new ones.

The Development of a Cost Efficient Policy Tool for reduction of Particulate Matter in Air (ACEPT-AIR) is an effort materializing through a dedicated LIFE+ project in order to enable Authorities (both at central regional and local level) to assess the reduction of key environmental pollutants, as well as their interdependencies, thus responding in a competent way to environmental issues, specific to particulate matter atmospheric concentrations.

The work is targeting, firstly, to unravel the relative contribution of the multiple anthropogenic and other sources to the observed PM air concentrations, Secondly it will document the relative contribution of secondary aerosol particles to those from primary emissions, by taking into account the atmospheric processes which contribute secondary and primary PM at any given receptor site. State of the art data and models will be incorporated in a versatile tool which will combine comparative analysis of source contributions calculated from air concentrations and emission inventories. The tool will create a historical record of control measures, changes in emissions, targeted or economy driven, and provide results in measured concentration reductions apportioned to changes in every accounted source. This can allow the policy makers to evaluate the effects of control measures applied on specific emission sources as well as plan new ones.

Three urban areas have been selected for study: Athens Metropolitan Area, Thessaloniki Metropolitan Area and Greater Volos Area. Historical data from previous studies including results on PM_{10} and $PM_{2.5}$ concentration levels at these three urban centres, covering a period of approximately two decades, as well as source apportionment results (identification of main PM sources and quantification of their relative contribution to the observed concentration levels will be reviewed. New data sets will be constructed by carrying out aerosol campaigns at the same sites that the previous samples were collected. Special attention will be given at three regions Athens Metropolitan Area (AMA), Thessaloniki Metropolitan Area (TMA) and Greater Volos Area (GVA). Aerosol samples PM_{10} and $PM_{2.5}$ at a daily basis will be collected at these 3 sites covering the warm and the cold period of the year. These sites (receptor sites for the source apportionment) will be selected as representatives of traffic-impacted and urban background areas, respectively. In

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addition, data collected at the "Demokritos" urban background station, which is already in operation, will be utilized.
Source apportionment techniques such as PMF (Karanasiou et al., 2009) and CMB modelling (Samara et al., 2003) will be employed for the sources contribution strength to be determined. The design of the policy tool requires at least two reference periods for performing calculations, trend analysis and construction of scenarios of the emission strength for the different sources. The historical and new databases will be used as the two reference periods. A comprehensive emission inventory will be constructed for the three areas of interest (AMA, TMA and the Greater Area of Volos). The operational platform will allow evaluation of both emission and source strength data. Historical trends and forecasted projections will be produced in order to associate emission sources and the respective air quality data and provide the optimum emission reductions and measures assisting with effective air pollution abatement and sustainability.
Keywords: environmental policy; emission inventories; Source apportionment; PM.

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