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PM-induced oxidative potential: Two years measurements and source apportionment, on a seasonal basis, in Athens, Greece

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PM-induced oxidative stress has been proposed as a primary mechanism in cardiovascular and respiratory diseases, as well as premature death. Consequently, a variety of in vitro and in vivo assays have been developed in order to estimate the oxidative potential of ambient PM (Particulate matter), including the acellular assay of DTT (dithiothreitol), which is used in the present study. Athens, Greece is representative of air masses arriving over Eastern Mediterranean, highlighting the effect of long-range aerosol transportation and intense local emissions, such as wood burning for domestic heating purposes during the coldest period of the year.

Most studies of aerosol oxidative potential (OP) cover a short period of time, while in this study the OP was measured during two years (2016-2018), in parallel with other PM chemical components, in order to identify the sources of aerosol OP. Fine aerosol fraction ($PM_{2.5}$, diameter < 2.5 μm) was collected, using quartz fibre filters and low-volume samplers, in the centre of Athens city.

An innovative semi-automated system was used for the determination of PM water soluble oxidative potential, following the approach of Fang et al. (2015). Concurrent estimation of inorganic and organic aerosol components' concentrations was accomplished through Ion chromatography, Aerosol Chemical Speciation Monitor, Aethalometer and OC/EC analyser. Additionally, the samples were further analyzed by Inductively coupled plasma mass spectrometry for major and trace water-soluble metal concentrations. Principal component analysis and Positive Matrix Factorization are applied to identify the sources of fine aerosol at the studied site in Athens, and determine the contribution of each source to aerosol OP, on a seasonal basis

As expected, OP presented higher values during wintertime, when wood burning appeared to be the dominant source of aerosol. These results agree with previous studies, indicating that the combustion is the major source of water-soluble OP, both as primary and secondary emission (Paraskevopulou et al. 2019). Whereas during summer, the current study reveals, for the first time, the significant impact of water-soluble metals in aerosol toxicity during the warmest period of the year, over the studied area. The aforementioned combination of various PM chemical parameters leads to a scarce identification of various aerosol OP sources on a temporal basis, in the area of

Eastern Mediterranean.