Yousef Nazzal et al., Int J Earth Sci Geol. 2019
http://dx.doi.org/10.18689/2642-1569.a2.004

madridge CONFERENCES
3rd International Conference on
Geology & Earth Science
April 10-11, 2019 Valencia, Spain

# Long-Term Trends in Ambient Fine Particulate Matter from 1980-2016 in United Arab Emirates

**Yousef Nazzal[1]*, Fares M Howari[1], Ahmed A Al-Taani[2]** and **Ahmad Yousef[3]**
[1]Zayed University, United Arab Emirates
[2]Yarmouk University, Jordan
[3]Ministry of Energy, United Arab Emirates

This paper presents the most comprehensive datasets of ambient fine particulate matter ($PM_{2.5}$) for the UAE from 1980-2016. The long-term distributions of $PM_{2.5}$ showed that the annual average $PM_{2.5}$ concentrations constantly exceeded the EPA and WHO guidelines. They varied from 77-49 μg/m$^3$ with an overall average of 61.25 μg/m$^3$. While the inter-annual variability in $PM_{2.5}$ concentrations showed relatively a cyclic pattern, with successive ups and downs, it broadly exhibited an increasing trend, particularly, over the last fourteen years. $PM_{2.5}$ concentrations displayed a strong seasonal trend, with greatest values during warm summer season, a period of high demand of electricity and dust events. The lowest values found in autumn are attributable to reduced demand of energy. Also this period coincided with decreased atmospheric temperatures and high relative humidity that are likely to reduce the secondary formation of $PM_{2.5}$. The spatial changes of annual average of $PM_{2.5}$ concentrations exhibited gradual downward trends to the north and northeast direction. Airborne $PM_{2.5}$ is prevalent in the southern and western regions, where the majority of oil and gas fields are located. $PM_{2.5}/PM_{10}$ ratio varied from 0.52 to 0.80 with a mean value of 0.72, indicating that ambient aerosols are principally associated with anthropogenic sources. Peaks in $PM_{2.5}$/CO ratio were frequently observed during June, July, August, although few were concurrent with March. This indicates that secondary formation plays an important role in $PM_{2.5}$ concentrations in these months, especially as the photochemical activities are relatively strong in these periods. The lowest $PM_{2.5}$/CO ratios were found during September, October and November (autumn) suggesting a considerable contribution of primary combustion emissions, especially vehicular emissions, to $PM_{2.5}$ concentration. $PM_{2.5}$ concentrations are positively correlated with $SO_4$ levels, suggesting that $SO_4$ aerosols constitute an important portion of $PM_{2.5}$. In addition to sea spray, the enhancement of $SO_4$ concentration in the coastal region is due to fossil fuel burning from power plants, oil and gas fields and oil industries where they may contribute to $SO_4$ levels through photochemical transformation of $SO_2$. The population-weighted average of $PM_{2.5}$ in UAE was 63.9 μg/m$^3$, which is more than three times greater than the global population-weighted mean of 20 μg/m$^3$.

**Keywords:** $PM_{2.5}$, aerosol, emissions, UAE.