



The *Wind Days* Protocol: the Impact of Mitigation Policies on PM and BaP Concentrations in the Industrial City of Taranto

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Abstract

Apulia is a 19,362 km² region in the south-east of Italy, surrounded by the Adriatic Sea in the northeast and by the Ionian Sea in the south. Two relevant industrial areas (Brindisi and Taranto) and several cities of medium-large dimension characterize the territory. In particular, Taranto hosts a heavy industrial district unfavourably positioned towards nearby residential areas, including the largest steel factory in Europe (ILVA), an oil refinery (ENI) and a kiln factory (CEMENTIR).

Due to numerous PM₁₀ and Benzo(a)pyrene limit value exceedances in sites close to industrial area of Taranto in last years, a Regional Air Quality Recovery Plan was enacted in 2012. The results of this action showed relevant effects on pollutant concentrations with decrease of BaP level and number of PM₁₀ exceedances.

Introduction

Apulian air quality monitoring network consists of 88 sampling sites. Continuous monitoring stations are equipped with data analyzers connected to a data acquisition system. Data validation is carried out in order to provide accurate and reliable data.

Taranto air quality monitoring represents different sites of municipality; in particular in industrial areas there are two stations named Machiavelli and Archimede.

During the last years, several PM₁₀ and Benzo(a)pyrene limit value exceedances were recorded in Tamburi, a densely populated neighbourhood close to the industrial area. A study of these critical pollution events showed a close correlation with wind conditions, encouraging the pollutants transport from the industrial site to the adjacent urban area.

Based on the historical statistical analysis of meteorological measurements in a monitoring site placed near the coastline (San Vito), a criterion for the daily identification of these events named “wind days” was defined: these critical days are characterized by at least 3 consecutive hours of wind coming from 270-360±2deg with an associated speed higher than 6 m s⁻¹. During 2011, at monitoring sites closes to industrial area at least the 65% of PM₁₀ exceedances was related to “wind day” conditions.

The Regional Air Quality Recovery Plan enacted in 2012 [1] constrains industrial plants to reduce by 10% BaP and PM₁₀ emissions by diffuse and point source respect to mean daily values, during such episodes.

The aim of this paper is to evaluate wind days effects on particulate and BaP concentrations in Taranto city after the Regional Air Quality Recovery Plan enactment. In particular PM₁₀ concentration are investigated in relation to wind speed and direction; also other pollutants trends during wind days will be shown at the aim of evaluating any difference respect to PM₁₀.

The false positive and negative will be evaluated to understand the incidence of failure of the model on particulate concentrations.

Materials & Methods

For the study PM₁₀, PM_{2.5} and BaP data from 2009 to 2014 of air quality monitoring stations of Taranto were considered. PM₁₀ daily concentration was monitored by two different kind of instruments, both based on β attenuation method: SWAM 5a monitors (FAI Instruments s.r.l. Rome, Italy) and MP101M (Environnement S. A., Poissy Cedex, France). B(a)P determination was carried out on PM₁₀ filters collected in three Taranto sites, according to UNI EN 15549:2008. PAHs were

separated by HRGC on a DB-5 MS capillary column (30m× 0.25mm, 0.25µm film thickness, J&WScientific, California). Isotope-dilution high-resolution mass-spectrometry (HRMS) determinations were carried out on a DFS High Resolution system (Thermo Fisher, Bremen, Germany) at a resolution of 10,000 operating with electron ionization (EI) at 45 eV in the selected ion monitoring (SIM) mode.

Results

Fig. 1 shows *PM10 Polar Annulus Plot* elaborated by *Open Air Package* [2, 3] regarding data of *Archimede* air quality station from January 2009 to September 2014. The station is located to the south-east of the industrial area. Up to September 2012 data show high *PM10* concentrations from W-NW directions, when the station is downwind of the industrial area. After then, a concentrations decrease is observed and it's more difficult to identify a prevalent *PM10* source.

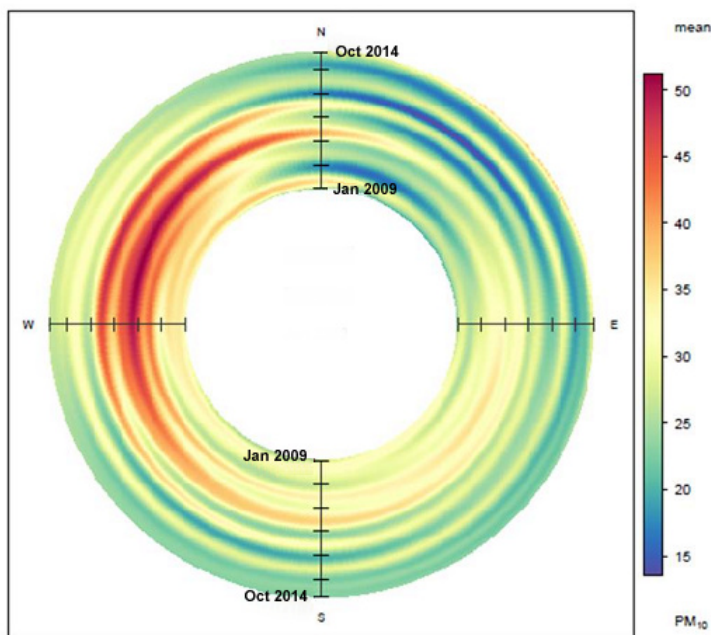


Fig.1: Archimede Station: *PM10 Polar Annulus Plot*

Significant differences are recorded for benzo(a)pyrene levels, too. As for *PM10*, a well-rendered decrease is observed for this pollutant from 2010 and, for the first time since the monitoring start, in 2012 B(a)P annual mean was lower than the 1 ng/m³ objective value. The reason of decrease could be found in Air Quality Recovery Plan for Taranto Area enacted by Apulian Government in 2012 [1]

About daily mean, it's observed that in 2013 there is a decrease in difference among wind days and the remaining days of the year, confirming that mitigation policies are efficient.

Conclusions

The study has highlighted the efficiency of Regional Air Quality Recovery Plan regard to *PM10*, *PM2.5* and BaP concentrations.

PM10 concentration differences have been investigated in relation to wind speed and direction, showing a reduction in difference between wind days and the remaining days since the Plan enactment. Other pollutants have not showed a correlation with wind days. False positive and negative have been evaluated showing a not significative influence on PM concentration or about the number of exceedances.

References

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