Assessment of Aerosol Emission Sources in a Traffic Site Combining On-line and Off line Measurements

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Abstract

In urban areas evidences from epidemiological and experimental studies show that traffic-related air pollution has adverse effects on respiratory and cardiovascular systems. Urban air pollution accounts for 3% of mortality from cardiopulmonary disease and 1% of mortality from acute respiratory infections in children under 5 years, worldwide. Therefore, disease and mortality associated with vehicle emissions represent a substantial challenge in public health.

Source apportionment, using receptor models, is an essential tool to support the implementation of the European and Member States legislation on air quality and principally to reduce the impact of exposure to Air Particulate Matter (PM) on human health.

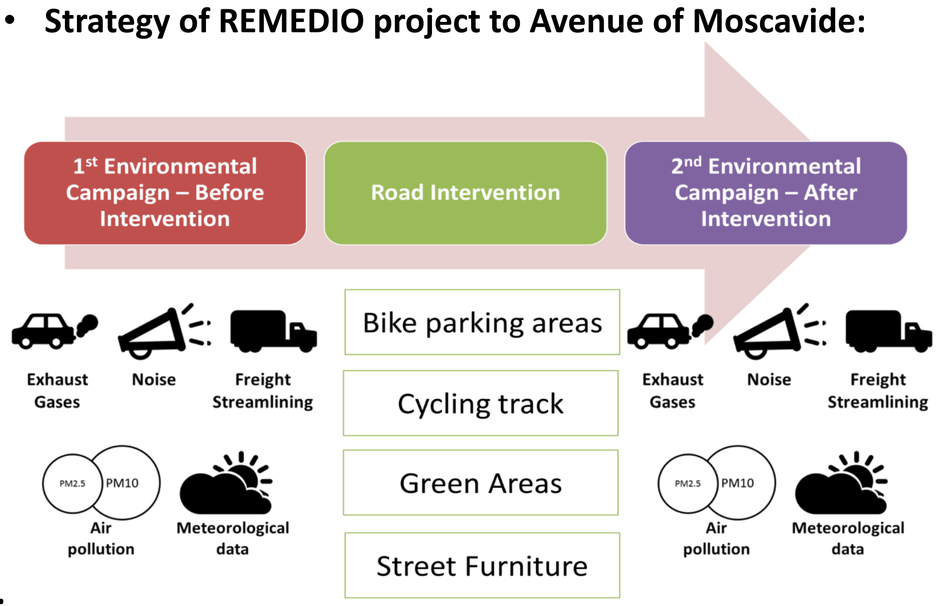
This work was developed in the framework of the Interreg Med project REMEDIO and aims to assess the aerosol emission sources in an urban traffic site, located in the outskirts of Lisbon.

Methodology

- **Study site:**

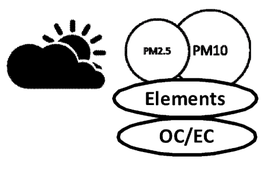
Av. Moscavide (Loures, PT) → urban-traffic background

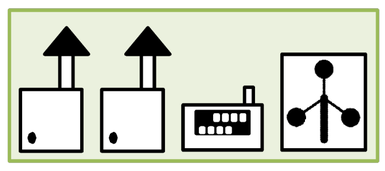
- **Strategy of REMEDIO project to Avenue of Moscavide:**



- **Experimental set-up for the 1st Environmental Campaign:**

Sampling period: 1 month (october – november 2016)





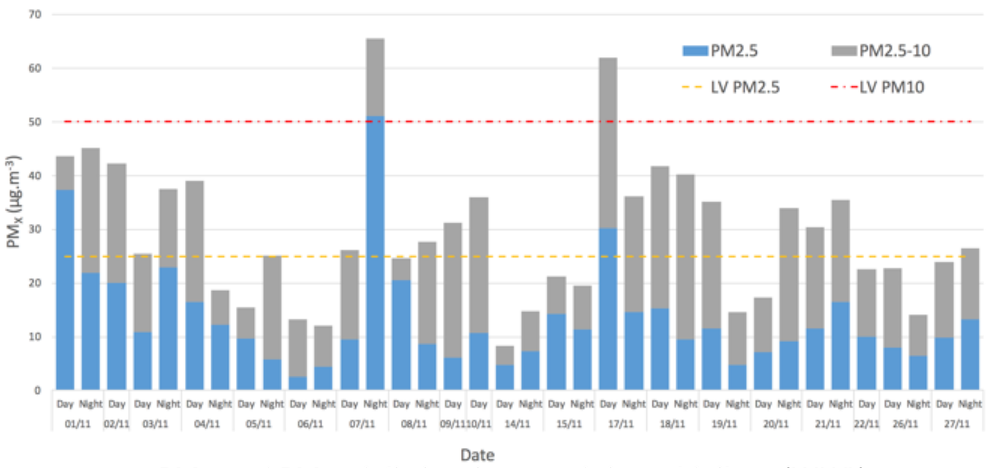
TECORA
Sampling time: 12h
Matrix: Quartz filter
Pollutants:
- PM_{10} mass - OC/EC

→ **Thermal optical technique**
- Analysis of OC and EC
- Equipment Carbon Aerosol Analyser (Sunset Laboratory)
- NIOSH Method 5040
- Detection limit: 0.2 µgC.cm^{-2}

GENT
Sampling time: 12h
Matrix: Polycarbonate filters
Pollutants:
- PM_{10} and $PM_{2.5}$ mass
  - Na, Al, Si, S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Ni, Cu, Zn, Sr, Pb → **XRF**

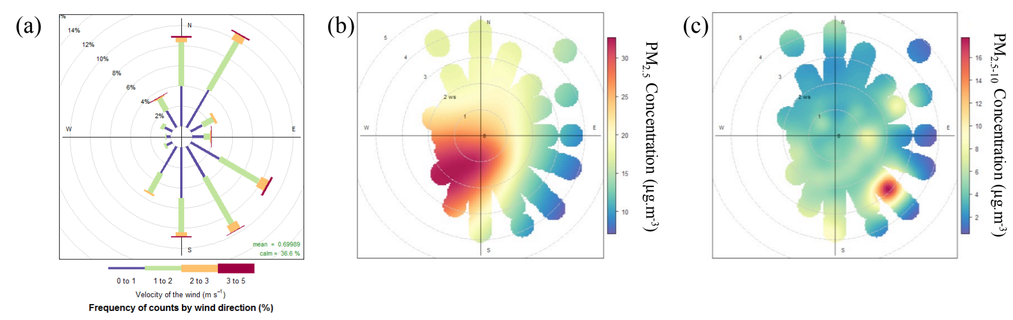
TSI DustTrak™ DRX Aerosol Monitor 8533
Measuring time: continuous 24h (monitoring frequency time – 1 min)
PM_{10}, $PM_{2.5}$

Results and Discussion



PM_{10} and $PM_{2.5}$ **daily levels exceed the guidelines** (WHO)

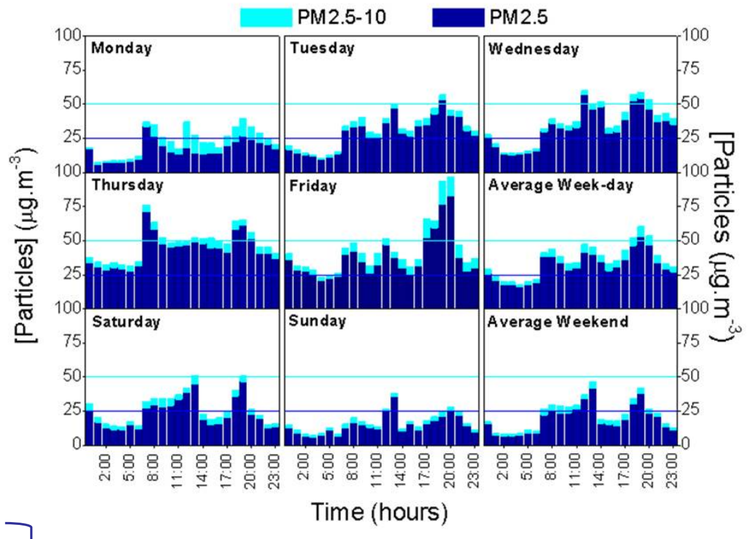
mitigation measures should be implemented in the studied area in order to protect the population health (*check **P3-135** for the results of the 2nd environmental campaign!)*



(a) frequency of wind direction and velocity, (b) pollution dispersion maps of $PM_{2.5}$, and (c) pollution dispersion map of $PM_{2.5-10}$ during the monitoring campaign at the studied street canyon.

✓ $PM_{2.5}$ and $PM_{2.5-10}$ hourly variation (time of the day in hours) and average mass concentration in weekdays and weekend;

✓ PM concentrations were higher on weekdays than on weekends, which can be explained by higher road traffic levels on weekdays.



Concentrations (ng.m^{-3})	$PM_{2.5}$				$PM_{2.5-10}$			
	DAY		NIGHT		DAY		NIGHT	
	Mean	STD	Mean	STD	Mean	STD	Mean	STD
Na	755	382	a)	a)	587	201	624	260
Al	73.4	74.3	217	203	145	109	350	467
Si	209	178	193	166	478	263	345	194
S	339	330	315	320	167	87.4	123	67.2
Cl	551	622	296	341	a)	a)	992	949
K	159	116	113	72.2	a)	a)	75.1	30.2
Ca	326	305	187	163	1146	743	691	499
Ti	11.7	9.78	8.13	3.61	29.9	19.4	23.1	9.5
V	7.43	7.15	9.62	5.90	a)	a)	a)	a)
Cr	1.53	1.56	1.01	0.17	2.86	1.38	3.05	1.88
Mn	5.15	0.84	4.10	1.61	15.8	8.22	17.9	5.36
Fe	195	170	123	74.9	412	232	281	148
Ni	2.08	1.27	3.63	1.90	1.84	0.89	1.70	1.03
Cu	9.24	4.69	8.04	3.12	32.9	19.6	34.5	21.0
Zn	12.7	9.10	10.6	5.19	36.4	17.5	31.2	14.9
Sr	2.84	0.79	a)	a)	2.64	1.85	3.47	1.49
Pb	14.6	9.81	11.0	5.46	30.1	15.1	37.6	16.3

Concentrations of chemical elements

predominance of elements from **marine aerosols** origin (Na and Cl); followed by those from the **Earth's crust** (Ca, Fe, Si, Al); and, finally, by chemical elements associated to with anthropogenic sources, mainly **traffic influence** (S, Ti, V, Cr, Mn, Ni, Cu, Zn, Sr, Pb).

Results from this study clearly showed that exposure to air pollutants in a street canyon is a problem that should be tackled. The low dispersion of pollutants observed can be explained by the street layout and the intense traffic in some periods of the day.

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