

ICARUS

Integrated Climate forcing and Air pollution Reduction in Urban Systems

AIR QUALITY AND HEALTH RISK ASSESSMENT (HRA) AROUND THE VALDEMINGÓMEZ ENVIRONMENTAL COMPLEX (VEC) LOCATED IN MADRID.

Nuñez-Corcuera, B¹, Galán-Madruga D¹, García Dos Santos-Alves S¹, Alonso Herreros J¹, Garrastazu C², Jover J², Castaño Calvo A¹ and Morillo-Gómez P¹.

1. Area of Atmospheric Pollution. Center for Environmental Health. ISCIII

2. Madrid Salud. Madrid City Council

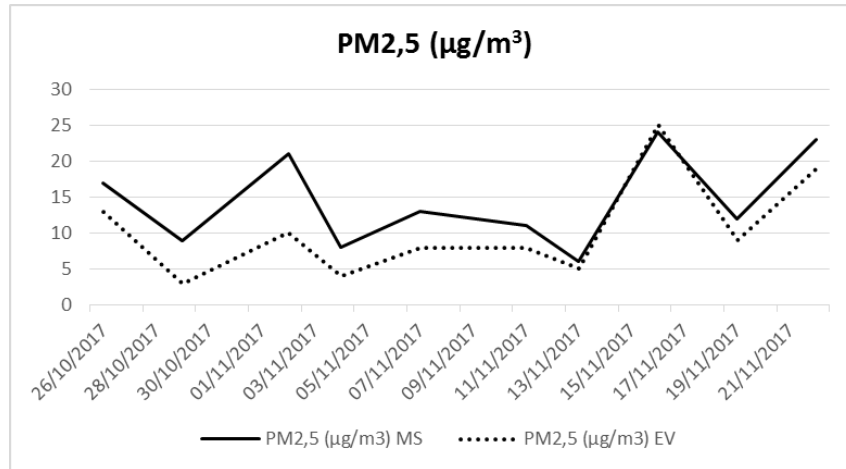
Presenting author : Beatriz Nuñez-Corcuera

- Waste Management complex that serves Madrid urban area (604,30 km², 3,165.863 inhabitants)
- Average distance to city centre 18-20 km.
- Equivalent number of waste producers (Tourist, commuters and waste producers 1.18 times register citizens, 3.745.028 inhabitants).
- Capacity to manage up to 900.000 tons waste per year (organic material 37%, packaging 44%, others 20%) .
- Efficient waste management model -Selective collection, sorting and treatment (SORTING-BioESTABILITATION-ANAEROBIC DIGESTION-WASTE ENERGY- DISPOSAL)
- A 27% of final solid waste end up into the INCINERATION process

Investigate the environmental health risk pose by VEC emissions.

- Sampling campaign to collect and characterize urban aerosols at two sites:
 - Ensanche Vallecas (EV site), 5.5 km to the VEC, urban background station
 - Madrid Salud (MS site), 18.8 km to the VEC, urban AQ facility
- Sampling period : 26th October -26th November 2017
- PM2.5 collection at both sites , total number of 10 samples (1 each 3 days)
- Chemical determination at the National Reference Laboratory (CNSA) :
 - Gravimetric measurements (EN 14907:2005 Standard)
 - Determination of Total Carbon (OC/EC) by TOT (Internal Procedure)
 - Heavy metals quantification by ICP-MS (EN 14902:2005 Standard)
 - PAHs determination by GC-MS (EN 15549:2008 Standard)
 - Dioxin and Furans (PCDD and PCDF) by HRGC-MS (Internal Procedure)
- The long term exposure to these pollutants can cause adverse health outcomes , respiratory , cardiovascular and neurodegenerative diseases, endocrine disruption and cancer.

Particulate Matter , PM2.5



MS average value : $14,40 \mu\text{g}/\text{m}^3 \pm 6,47 \mu\text{g}/\text{m}^3$
 EV average value : $10,40 \mu\text{g}/\text{m}^3 \pm 8,57 \mu\text{g}/\text{m}^3$
 Daily Limit value : $25 \mu\text{g}/\text{m}^3$

Total Carbon (Organic and Elemental)

	MS (ng/m³)		EV (ng/m3)		Mean Comparison	
	MEAN	SD	MEAN	SD	t-Test	p
OC	5,60	1,82	4,02	1,93	1.883	0.076
EC	2,81	1,31	3,46	2,07	0.839	0.412
TC	8,41	3,02	7,48	3,93	0.523	0.560
OC/EC	2,18	0,57	1,34	0,43	3.720	0.002*

The Total Carbon (TC) amount is higher at the MS than at the EV

The Elemental Carbon (EC) is higher at the EV site whereas the Organic Carbon (OC) increase at the MS site

The OC fraction may have a secondary origin at the MS site (OC/EC ratio)

HEAVY METALS

	MS (ng/m ³)		EV (ng/m ³)		Mean Comparison	
	MEAN	SD	MEAN	SD	t-Test	p
Lead	3,35	2,42	2,86	1,15	0.578	0.57
Cadmium	0,11	0,05	0,07	0,05	1.789	0.090
Arsenic	1,22	0,79	0,27	0,10	3.773	0.001*
Nickel	0,57	0,42	0,54	0,32	0.180	0.859
Copper	7,34	5,49	5,24	4,45	0.940	0.360
Manganese	2,45	1,8	2	1,79	0.561	0.582

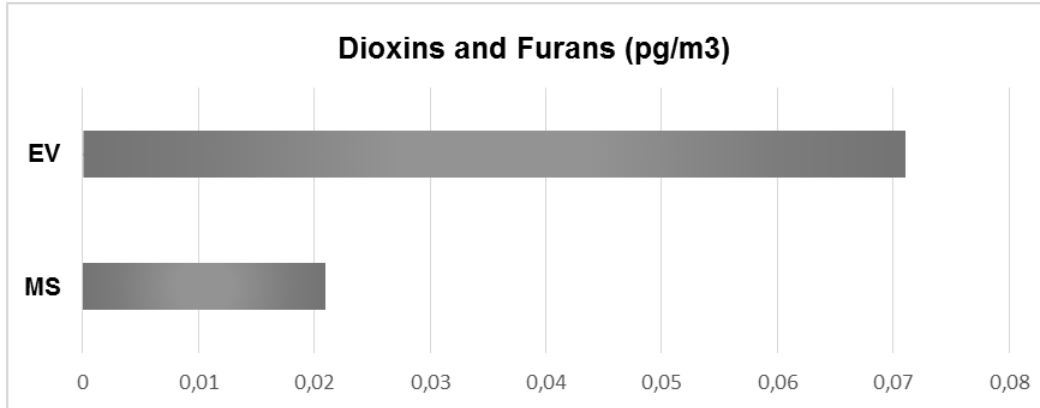
Limit Value: Lead 0,5 µg/m³ ; Target Values ; Cd 5 ng/m³ , As 6 ng/ m³ , Ni 20 ng/ m³

Polycyclic Aromatic Hydrocarbons (PAHs)

17 compounds analyzed, no significant differences among sites
The only regulated HAPs is the B(a)P , target value for human health 1 µg/m³

	MS (ng/m ³)		EV (ng/m ³)		Mean Comparison	
	MEAN	SD	MEAN	SD	t-Test	p
B(a)P	0,41	0,24	0,21	0,13	2.317	0.032*

DIOXINS AND FURANS



EV site 0,071 pg/m³

MS site 0,021 pg/m³

WHO 0,3 pg/m³

3.35 Fold increase at EV site

Probabilistic Dioxin HRA following US-EPA recommendations

- ❖ D/F are carcinogenic for humans (IARC) ; Exposure Route : inhalation
- ❖ Risk = [D/F ambient air] x URF ; URF; dioxin inhalation unit risk factor = $3,3 \times 10^{-5}$ pg/m³

Risk at EV site : $2,34 \times 10^{-6}$ Risk at MS site : $3,96 \times 10^{-8}$

- ❖ Acceptable health Range : 10^{-4} - 10^{-6}

- The VEC emissions do not have a significant contribution to the overall AQ parameters; PM2.5, Total Carbon (OC and EC) and Heavy Metals in the urban areas investigated.
- Additional AQ assessment should be carried out to address the influence of VEC emissions in furthest urban areas and bordering towns.
- The B(a)P amount is higher at Madrid city centre, so additional studies should be carried out to investigate the source.
- The long term exposure to Dioxins and Furans can cause adverse health outcomes and the concentration of these pollutants slightly increase at the proximity of the VEC.
- The Dioxin/Furans inhalation risk at both sites is within the acceptable safety health range, however the risk is lower at Madrid city centre.
- Epidemiological studies are required to assess the burden of disease (BoD) at the nearest populated area to the VEC.