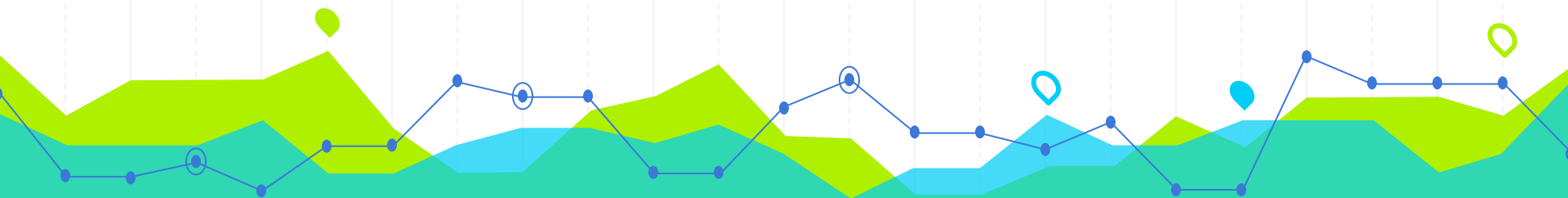


PM_{2.5} chemical speciation and source apportionment by PMF, in the capital on Tajikistan, Dushanbe



S. Papagiannis^{1,2,3}, V. Vasilatou¹, M. Gini¹, K. Eleftheriadis¹, E. Diapouli¹

¹ *Institute of Nuclear & Radiological Sciences & Technology, Energy & Safety, 15310, Athens, Greece*

² *Institute of Nuclear & Particle Physics, NCSR Demokritos, 15310, Athens, Greece*

³ *Department of Materials Science & Engineering, University of Ioannina, 45110, Ioannina*

s.papagiannis@ipta.demokritos.gr

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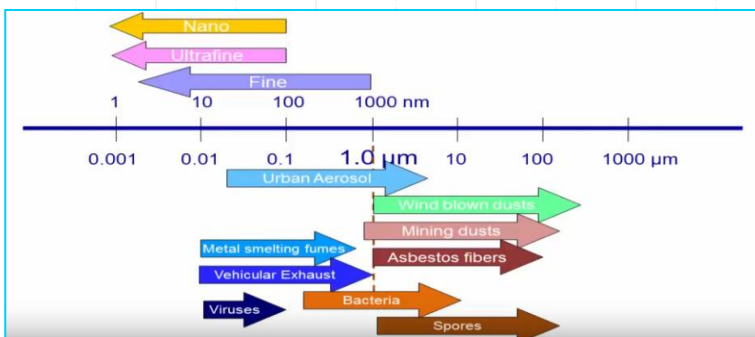
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Introduction - Scope

What are aerosols?

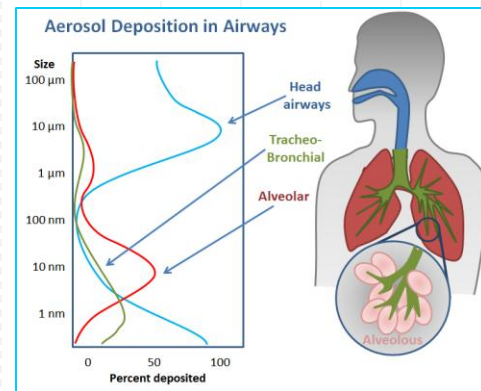
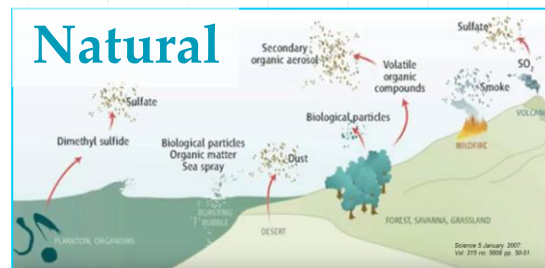
Solution of liquids or solid particles in a gas.

Particle Sizes?



Effects in health?

Yes! Depends on the particle size, and frequent exposure.



Scope

Chemical speciation and source apportionment of atmospheric suspended particulate matter (PM) in the capital of Tajikistan, Dushanbe.

Methodology - Sampling

Location



Filter Sampler



Aerosol deposition On Teflon filters

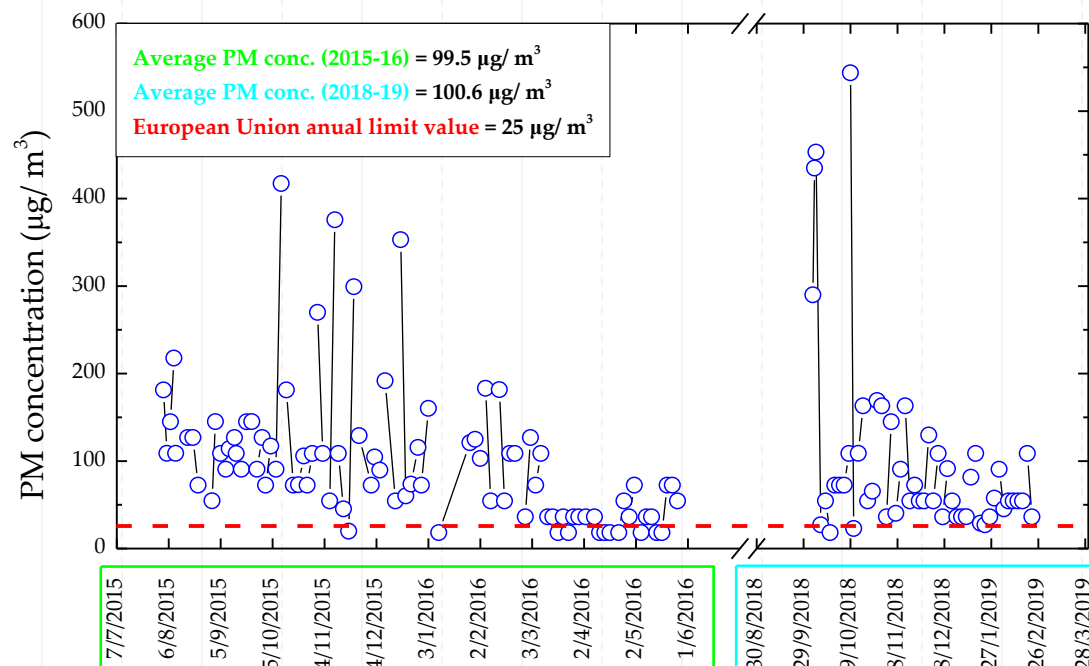


138 PM2.5 filters were collected

88 PM2.5 filters : 2015-2016

50 PM2.5 filters : 2018-2019

Time Series - PM concentrations



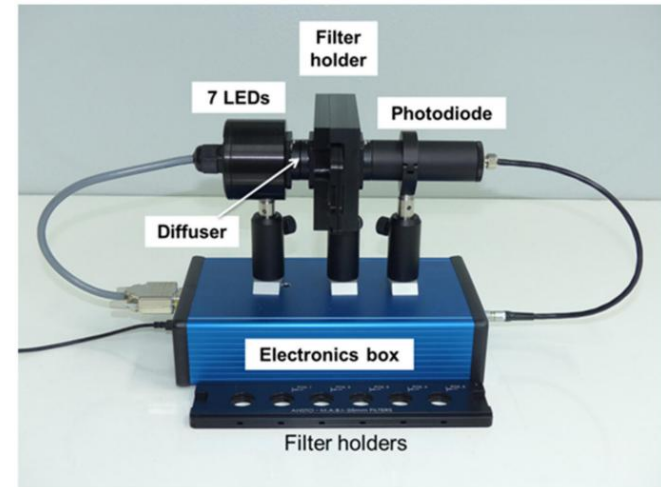
Methodology - Analysis

Elemental Analysis



- **XRF spectrometer** with secondary targets.
- Analysis up to 35 elements, from Na to Pb.
- Non-destructive technique.
- Automatic measurements (1 sample/1.5 h).
- Provides qualitative analysis for each element.

Black Carbon Analysis



- **Multi wavelength Absorption Instrument (MABI)**
- Light absorption technique for the determination of BC.
- Non destructive.

$$BC \left(\frac{ng}{m^3} \right) = \frac{10^5 \times A(cm^2)}{E \left(\frac{m^2}{g} \right) \times V(m^3)} \times \ln \left(\frac{I_0}{I} \right)$$

Source Apportionment by Positive Matrix Factorization (PMF)

$$X = GF + E$$

$(m \times n)$ $(m \times p)$ $(p \times n)$

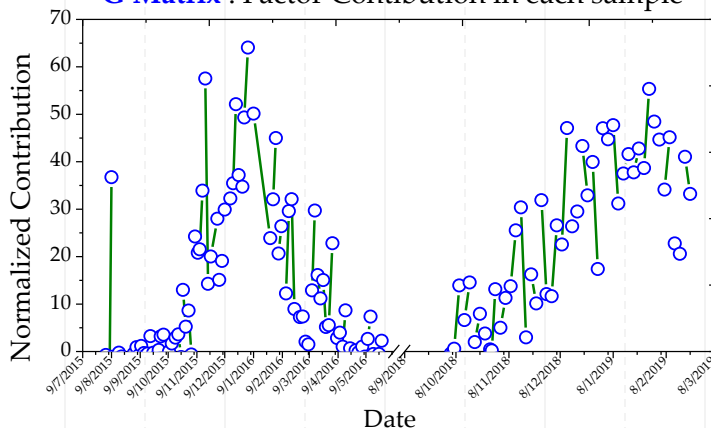
m = number of samples (daily sampling)
 n = number of species (B.C. + elements)
 p = number of factors (sources)

- X = Concentrations of each species (n) in each sample (m)
- G = Matrix of contribution of each factor (p) in each sample (m) generated by model
- F = Matrix of chemical profile of each factor (p) generated by model.
- E = Residuals

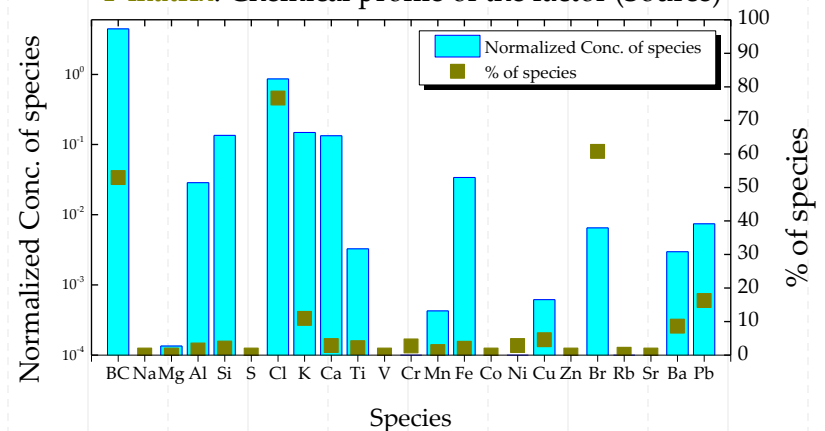


$$Q = \sum_{m=1}^v \sum_{n=1}^{\mu} \left[\frac{X_{mn} - \sum_{p=1}^N g_{mp} f_{pn}}{u_{mn}} \right]^2$$

G Matrix : Factor Contribution in each sample

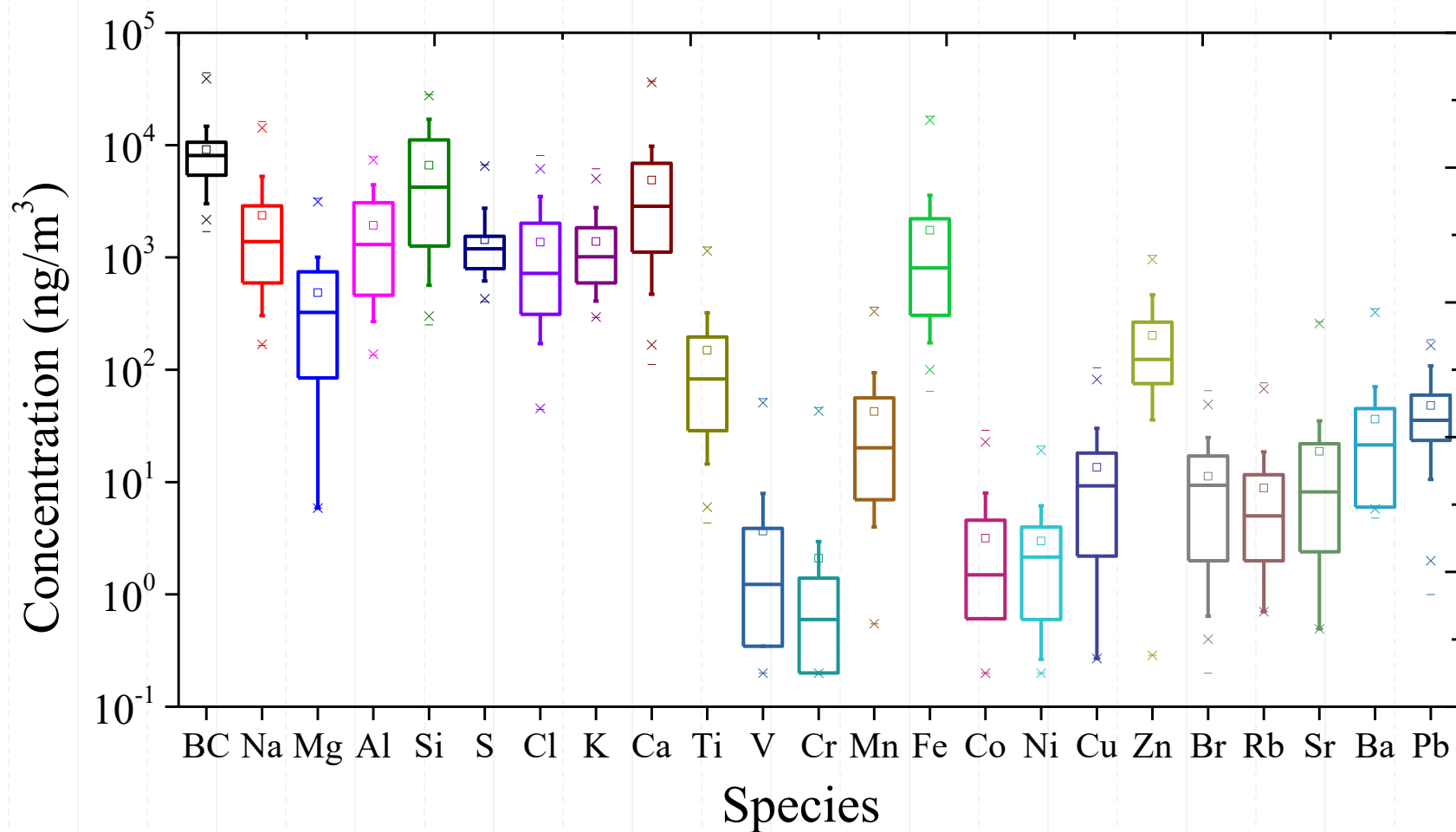


F matrix: Chemical profile of the factor (Source)



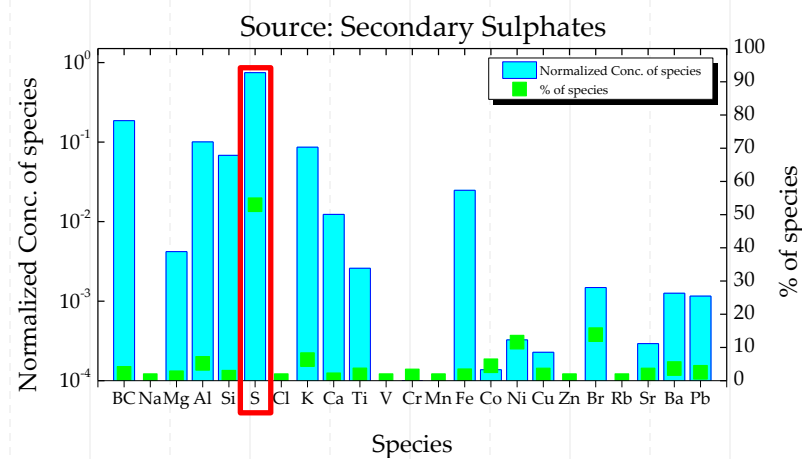
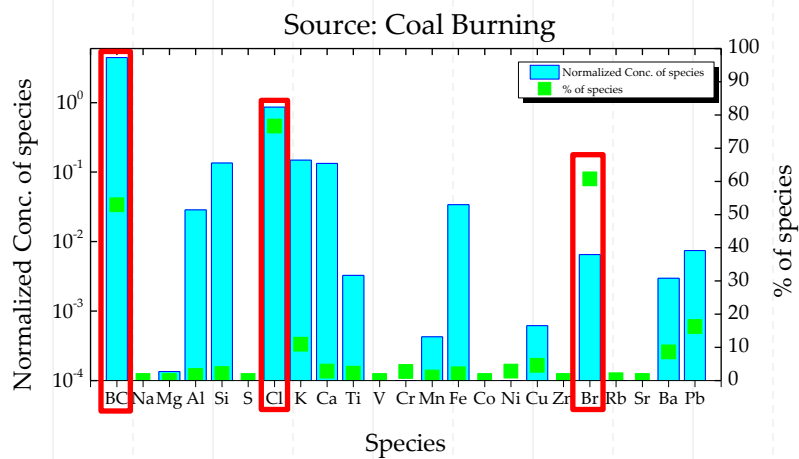
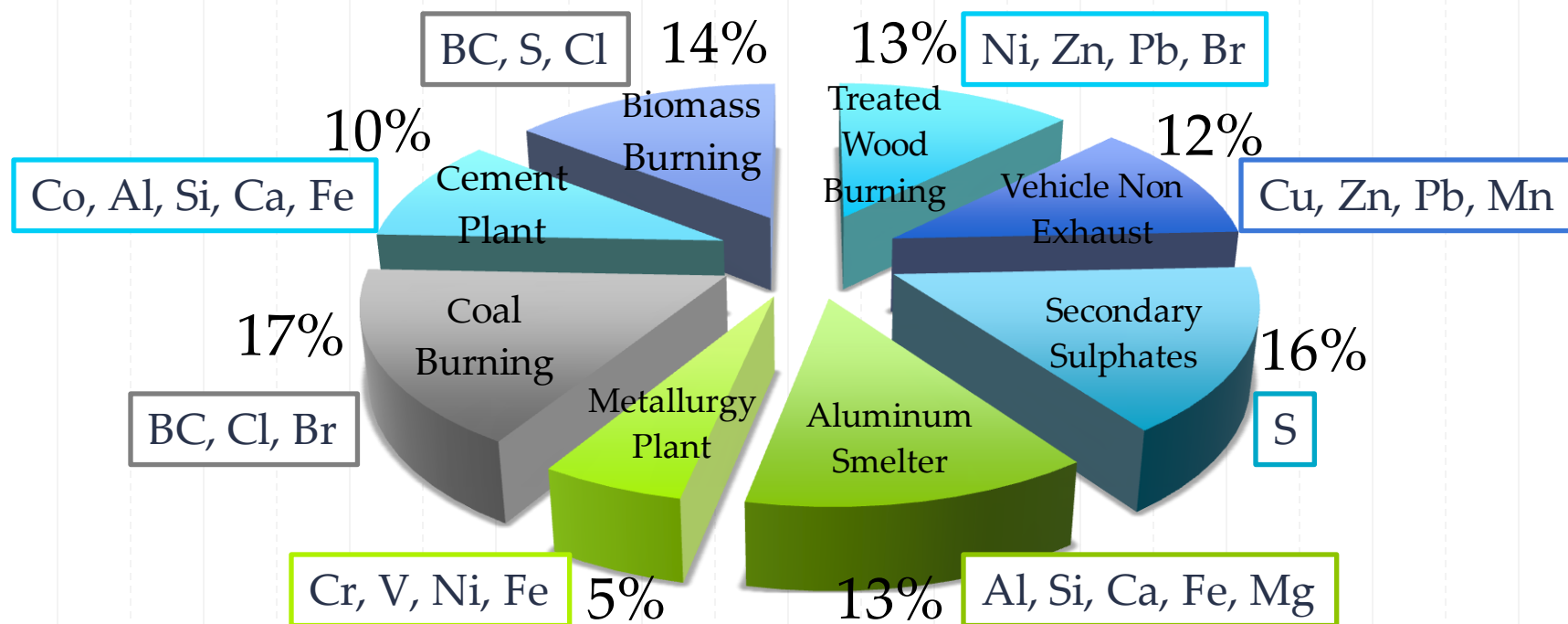
Results

Average aerosol chemical composition (ng/m³)



Results

PM2.5 Source Contributions in Dushanbe, Tajikistan



Conclusions

- PMF was used to identify the sources of air pollution in Tajikistan, Dushanbe. → High air pollution levels were measured.
- **Coal Burning (17%)** → Power Plant
- **Biomass Burning (14%), Treated Wood Burning (13%)** → Tracers from toxic heavy metals.
- Identification of heavy industrial activity → **Cement Plant (10%), Aluminum Smelter (13%), Metallurgy Plant (5%).**
- **Vehicle traffic** was recognized only with respect to the **non-exhaust (12%)** part.
- Significant contribution from **Sec. Sulphates formation (16%).**

