

**Report on the Short Term Scientific Mission (STSM) carried out  
in the frame of the COST Action CM 1404**

***Investigation of air pollution in terms of gaseous and particulate matter***

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**Host institution:** *Chemical Process and Energy Resources Institute (CPERI) of CERTH*

**Home institution:** *College of Energy and Electronics (CEE), Technical University of Sofia (TU Sofia)*

The current Short Term Scientific Mission (STSM) was carried out in the *Aerosol & Particle Technology Laboratory (APTL)* of the *Chemical Process and Energy Resources Institute (CPERI) of CERTH*.

The APTL has a large experience in the fields of development, assessment and implementation of conventional and renewable (e.g. solar, waste/biomass) energy solutions, the modelling and simulation of energy systems, air pollution monitoring utilizing a mobile laboratory (MOBILAB) and the health assessment of environmental pollution, also offering technological services to industrial partners in Europe and the US.

The research and education programmes of the *Department of Energy and Mechanical Engineering (EME)* at the *College of Energy and Electronics (CEE), Technical University of Sofia (TU Sofia)* are mainly focused on energy, combustion techniques and technologies, systems and utilities for emission control and environment preservation, renewable energy, air pollution control and the development and modelling of end-of-pipe processes.

## Motivation

Despite the implemented policy mechanisms, the undertaken measures, and the recently observed emission reduction all-over the European Union current reported data of the European Environmental Agency (EEA) presented in [1 and 2] show continuous non-compliance for several hazardous air pollutants according to EU Directive 2008/50/EC on ambient air quality and cleaner air for Europe [3]. The inconsistency with the Directive 2008/50/EC and the estimated regional background levels for some pollutants (e.g. PM<sub>10</sub>, PM<sub>2.5</sub> and NO<sub>x</sub>) in the Balkan Region are higher in comparison to the West and Central Europe.

The National Report on the Status and the Protection of the Environment (NRSPE) of 2015 [4], presents the distribution of the emissions of air pollutants according to [3] for 2013 by groups of sources. Thus, the main source of PM<sub>10</sub> in 2013 was the *household heating*. The sector emits about 59 % of the total PM<sub>10</sub> quantity emitted in the atmosphere, 21 % of PM<sub>10</sub> are due to *incombustible production processes*; 11 % - to *Thermal Power Plants*; 6 % - *road transport* and about 3 % - *the remaining sources*.

According to the same report [4], the NO<sub>x</sub> are emitted mainly by the *Thermal Power Plants* (about 31 %) and the *road transport* (about 31 %). It is established that in 2013 the share of the emissions from the Thermal Power Plants decreased as compared to 2012. The *incombustible production processes* and the *remaining kinds of transport* emit, respectively, about 20 % and 6 % of the total emissions of NO<sub>x</sub>.

In 2013, there is a high percentage of population living in elevated levels of PM<sub>10</sub> – 92 %, while only 0.5 % of the total population of Bulgaria is affected by the consequences related with the increased levels of NO<sub>x</sub>, presented as NO<sub>2</sub> in [4]. According to the same source of data in 2013, from 48 points measuring PM<sub>10</sub>, there were no exceedances of the Average Daily Norm (ADN) in only in 11 of them and the Average Annual Norm was not exceeded in 24 points.

In addition, in 2013 in three AAQAMAs (Agglomeration - Sofia, South-West and South) the standards for NO<sub>2</sub> have been achieved and according to [5] no exceedances of NO<sub>x</sub> were reported in 2014.

*The specific objective* of priority axis (PA) 5 of Operational Programme “Environment 2014-2020” (OPE) [6] is: *Reducing ambient air pollution by lowering the quantities of PM<sub>10</sub> and NO<sub>x</sub>*, which *Specific objective (SO)* is: *Improvement of the ambient air quality*. The attainment of the

specific objective is measured through the change made in the value of the relevant result indicator into the desired direction [7-10].

Recently, a set of analytical tools was developed at the EME, CEE, TU-Sofia for studying the PM<sub>10</sub> exceedance and the Air Quality (AQ) Plans/Programmes in terms of the AQ regulations prescribed by Directive 2008/50/EC [3]. The work has been conducted on behalf of the *Ministry of Environment and Waters of Bulgaria (MoEW)*, the *General Directorate of the OPE*.

**Thus the necessity for accurate source apportionment and the identification of urgent and effective AQ policy and measures for PM<sub>10</sub> regulation were observed for several municipalities in Bulgaria.**

### **The purpose of the present STSM**

The main objectives of the present STSM were:

- The establishment of collaboration initiative between CEE, TU-Sofia and APTL, CERTH Thessaloniki with the main focus on air pollution emission monitoring and emission reduction policy and measures, relevant to the particular features, characterizing the air quality of the Balkan-Mediterranean Region and
- The investigation of the methodologies for gaseous pollutants and particulate matter measurement and emission control in Thessaloniki using the mobile laboratory equipment (MOBILAB), available at the APTL, CERTH, Thessaloniki.

### **Implementation**

Based on the above described objective and the preliminary observations a project consortium was established, involving EME, CEE at TU-Sofia and APTL, CERTH as well as public authorities and partner organisations from Bulgaria, Greece, Former Yugoslavian Republic of Macedonia (FYROM) and Albania.

During the STSM implementation period a project proposal was elaborated, focused on the air pollution in the Balkan-Mediterranean Region, which needs to be tackled through co-operation at regional level.

The proposal aims at assisting the local and regional legal authorities in the process of development and implementation of air quality policies and measures for the highly polluted agglomerations/zones in the entire region. The achieved results are expected to significantly

facilitate the process of reaching the compliance with Directive 2008/50/EC in the air quality zones/agglomerations of Bulgaria and Greece showing persistent exceedance of specific air pollutants.

On the other hand it is expected to lay down a solid base for the reliable implementation of the Directive 2008/50/EC in the non-EU States of the region that are still behind the EU standards and the target values (FYROM and Albania).

The project proposal was submitted to the **1<sup>st</sup> call for proposals** (26<sup>th</sup> of April 2016) within the **INTERREG – Balkan-Mediterranean Programme 2014-2020**.

During the STSM implementation period, a detailed introduction to the measurement equipment and the established measurement procedures of air pollutants (gaseous and particulate matter) monitoring and emission control with the use of the high-quality mobile laboratory available at the CERTH, Thessaloniki (MOBILAB) was conducted by the Assoc. Researcher Apostolos Tsakis for the Assoc. Prof. Dr. Iliyana Naydenova.

### **Future prospective**

Current prospective for further collaboration in the field are envisaged in the frame of the submitted project proposal upon its approval.

In addition to this, the possible design, implementation, modeling and testing of emission control and air pollution monitoring systems for particular mobile and stationary applications at TU-Sofia were discussed. The procedures for their further implementation were also envisaged upon available financial resources.

## References

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