



Project Description for ARASIA TC Programme

TC Cycle 2018-2019

Project Number: RAS0078

Project Title: Studying Characterization, Source Apportionment and Long Range Transport of Air Pollution within the Regional Network (ARASIA).

Overall Objective: To contribute to an enhanced knowledge and understanding of pollution of the atmospheric environment and its impact on human health in the ARASIA region.

Project Duration: (2019 – 2021)

Project Description: Air pollution is a worldwide problem that can affect the environment and human health. In the ARASIA region, there is a lack of data and regional studies dealing with this issue. It is obvious from the few studies conducted in the Eastern Mediterranean region that airborne particulate matter (APM) levels are much higher than in other regions, even when compared to the Western Mediterranean. In addition, ARASIA countries are exposed to long range and frequent dust storms in any one year which are badly affecting air quality in the region. The identification of local or regional pollution sources is essential for enforcing measures to improve air quality in the region. Some of these air pollution sources will have natural or anthropogenic origin, and include particles from soil, desert and sea salt, as well as arising from emissions from industrial and power plants, motor vehicles exhaust, biomass and fossil fuel burning, among others. This project builds on the expertise and data obtained in the previous project RAS0076 that established a capacity for sampling and performing elemental analysis of urban background air pollutants, using harmonized sampling protocols in the participating Member States, and setting procedures for elemental analysis based on nuclear analytical spectrometry techniques. The new project will expand the analytical results by follow up sampling campaigns, using additional samplers, in order to better cover urban areas; whereas source apportionment studies will be also carried out using positive matrix factorization models (PMFs). Additionally, the project will include the study of atmospheric dust particulates, for understanding their dynamics, dust source tracking and transport using radioisotope techniques, as well as wind speed and back trajectory techniques (HYSPLIT), which would provide new and additional insights for the interpretation of results linked to source apportionment.

Problem to be addressed: High PM levels in the ARASIA region cities could be attributed to several factors like high population density, frequent dust outbreaks, low precipitation rates, poor vegetate coverage and, in some cases, lack of regulations concerning PM levels. In addition, some ARASIA countries are suffering from the impact of dust storms, which heavily affect the air quality. The project is unique as it



addresses a gap in the available data and information about regional atmospheric pollutants. Furthermore, it is expected to build human capacities and expertise in ARASIA Member States in the field of environmental air pollution monitoring. Moreover, there is an increase dust occurrence events in the region and its temporal changes may reflect the influence of global climate change. These events are of public and governmental concerns as they affect the public health and have a negative impact on the economy. The windblown dust may contain wide ranges of contaminants, including chemicals, viruses and bacteria that can be transported by the dust and cause different health effects. The study of APM during long range transport episodes and dust events should be of special interest as it can give valuable information on air pollutants and its transport. The identification of local or regional pollution sources in PM 2.5 and PM10 is very essential for enforcing measures to improve the air quality in the region.

This project is proposed as a regional activity for the following reason(s): The first results undertaken in the RAS0072 and RAS0076 sometimes Show similarity of air pollutants and their time variability. In fact, atmospheric aerosols of PM10 and PM2.5 are trans-boundary and can effectively contribute to air pollution in a certain localized areas. In fact, pollutants travel in the atmosphere for hundreds of kilometers and can still be suspended in the air from several hours to several days. Pollutants originating from one state can affect other countries in the region. Thus, it is more correct to consider this problem in a regional scale. Similar projects have been executed, for many years, in the Pacific East-Asia region and in Europe. The new project aims at establishing a comprehensive regional data base on PM10 and PM2.5 composition, distribution among the region and related source apportionment. It is expected that the obtained results will initiate coherent actions in all the Member States of the region to improve relevant regulations concerning emissions and acceptable levels thus improving the air quality in the region.

Stakeholders: Governments of the regions, and in particular environmental, regulatory or health agencies will benefit from the project results, which will provide information on the nature and sources of air pollution. An addition, educational and research institutions will benefit from the developed know how in the field and will incorporate new subjects in their educational programmes.

Partnerships: Partnerships will be established with environmental, regulatory or health agencies in addition to science and technology ministries and educational and research institutions, the United Nations Environmental Programme (UNEP), and the World Health Organization (WHO).

Role of nuclear technology: The nuclear techniques to be used include X ray fluorescence (XRF), ion beam analysis (IBA) techniques, such as particle induced X ray emission (PIXE), particle induced gamma-ray emission (PIGE), Rutherford Backscattering spectrometry (RBS) and proton elastic scattering analysis (PESA).



These techniques have the advantages of being non-destructive, multi-elemental, fast and of adequate sensitivity and detection limits, and can be performed in some cases simultaneously. In addition, synchrotron radiation techniques, such as SR-XRF and XANES could also be applied to selected samples collected in this project. Besides the characterization of air pollution by using the above techniques, gamma/beta/alpha spectroscopy will provide additional information allowing understanding the air/dust dynamics associated with long range pollution transport. The IAEA should organize, manage and coordinate activities, such as fellowships, workshops, scientific visits, expert missions, training courses, procurement and technical assistance.