

Projects Description for ARASIA TC Programme TC Cycle 2014-2015



Project Number: RAS/0/072

Project Title: Evaluating and Mapping Air Pollutants Using Nuclear Analytical Techniques

Overall objective: To foster cooperation between ARASIA Member States to study air pollution utilizing nuclear analytical and complementary techniques.

Project duration: 2 years

PROJECT DESCRIPTION

Regional gap / Problem / Need analysis: Serious environmental degradation is perceived worldwide, where increasing related diseases have been noticed and have been attributed to environmental pollution. Some of these pollutants have also negative impact on the ecological system and cultural heritage monuments as well. The Mediterranean basin is considered one of the most controversial regions for aerosol transportation due to its location at the intersection of air masses circulating among the three continents. It is obvious from the few studies conducted in the Eastern Mediterranean region that Particulate Matter (PM) levels in air are much higher than in other regions, even when compared to the Western Mediterranean. High PM background levels in most Eastern Mediterranean cities could be attributed to several factors like high population density, frequent dust outbreaks, low precipitation rates, poor vegetal coverage and, in some cases, lack of rules and regulations concerning PM levels. Based on the on-going RAS0061 project and achievements, ARASIA Member States have made the strategic decision to embark on the establishment of a collaborative network for study of problems related to atmospheric aerosols, and to emphasize their contribution to environmental research and monitoring in the region. In recent years considerable progress has been made in development and application of nuclear instrumentation and associated analytical methodologies for environmental sampling analysis. It is obvious that there is insufficient human capacity in the region available for the activities associated with environmental sampling and analysis using Nuclear Instrumentation. The project is envisaged and oriented to tackle issues that are of high regional interest. The activities include coordinated research needed for development project capabilities based on competencies, and for providing solutions to problems associated with the atmospheric aerosol and air pollution, which do not recognize boundaries, by using nuclear and complementary methodologies. It would also be involved in capacity building through human resources development and would grow into a major regional information and database center. The growing demand for environmental analysis, in particular for air sampling where just few studies were undertaken and by individual groups, should be answered by a collective effort from ARASIA MS within a regional approach. The global level and its reflection on the region compels the intellectual powerhouse of ARASIA MS to carry out their responsibilities and assume a leadership role in addressing the sustainable environment and efficient operation challenges facing the region. Emphasis was, however, made on the choice of air samplers, sampling sites (urban, rural, industrial, location in the regional map), methodologies of meaningful sampling of air particulate matter followed by analytical measurements and nevertheless the data interpretation, including statistical processing of collected data, taking into account the meteorology and the geology of the sampling sites. Beside the sampling issue, nuclear analytical techniques should play a major role in the achievement of this project. Ion beam analysis (PIXE, PIGE and RBS) and instrumental XRF will be the analytical techniques used for the identification and evaluation of chemical pollutants. Concerning Synchrotron radiation XRF, it is advisable for the time being, for

researchers of the region to become familiar with the technique and take the advantages of this powerful technique by using it whenever and wherever available if needed. Other relevant techniques could be of help to complement the information about pollutants, such as XRD, SEM, FTIR, ICPMS, Raman and TOF-SIMS. On the other hand, other environmental samples (soil, rocks, plants or trees) relevant to the study, could be occasionally considered for the analysis. Beside elemental content and chemical speciation, the determination of volume fractions of various sizes of air particulates is essential. It is important to evaluate the volume fraction of coarse particles PM₁₀ (particulate matter having size diameter of less than 10 micrometer), and fine particles PM_{2.5} (particulate matter having size diameter of less than 2.5 micrometer). This latest represents more hazards to human health as it goes deeper to the lungs. Unifying efforts on establishing protocol and campaigns for air quality and environment, making exploitation of all available resources in ARASIA MS and intensifying scientific research in this topic would undoubtedly enhance the successful achievement of this project and to be as a scientific reference for future environmental studies in the region.

This project is proposed as a regional activity for the following reason(s): Atmospheric aerosols and environmental issues have largely been recognized not to have geographic boundaries and therefore, collective regional and perhaps international efforts must be integrated as part of regional responsibility to study air pollution and assess the adverse effects on human health, the environment and corrosion effects on cultural heritage monuments and objects. The complementarities of equipment and expertise needed to undertake research activities related to environmental pollution in ARASIA MS are an asset. Creating and maintaining a monitoring network based on effectiveness and efficiency, and quality of routine sampling will help to recognize air pollution and identify possible sources. The open access and availability within the region of the existing IBA facilities (Lebanon, Jordan and Syria) and other complementary techniques such as XRF and μ -XRF, XRD, SEM/EDS, FTIR and μ -RAMAN (UAE and other MSs), will launch collaborations between ARASIA MS within the framework of exchange of information and to take advantages of the use of nuclear analytical techniques.¹⁴ Stakeholder analysis and partnership: Jordan: University of Jordan Iraq: Ministry of Science & Technology and Ministry of Higher Education & Scientific Research. Lebanon: Lebanese Atomic Energy Commission. Syria: Atomic Energy commission of Syria UAE: Sharjah University Qatar: Ministry of environment Yemen: National Atomic Energy Commission

Role of nuclear technology: Nuclear analytical techniques (IBA, XRF) and related nuclear technology are the main tools to be used to achieve the project