

DESCRIPTION FOR THE GENERAL PUBLIC

One of the sources of the environmental pollution by metals is their emission into the atmosphere from fuel combustion processes and industry. As a result of atmospheric deposition, metals migrate to water and soil, where they can be taken up by plants, animals and further transferred through the food chain directly into humans. Once released into the environment metals are continuously undergoing physical and chemical transformations that affect the forms of their occurrence and determine their toxicity. Currently observed changes in the structure of particulate matter emission into the air involving a significant reduction in coarse particles, emitted mainly from industrial sources as well as increased emissions of ultrafine particles (combustion by car engines) allow to conclude, that the actual environmental pollution by metals is primarily caused by the smallest particles. For this reason, many scientists point at the urgent need to study the future effects of the risks posed by these particles in different temporal and spatial scales. Priority area for these studies should be a particularly large and heavily polluted industrial conurbation. Intensification of processes of below-cloud scavenging due to rainfall acidification and intense anthropogenic activity contribute to an increase in metals wash-out from the airborne PM (Particulate Matter), observed especially in conditions of atmospheric stagnation and temperature inversions stimulating PM accumulation close to the ground. Therefore, the quantitative determination of the effectiveness of metals migration from atmospheric air into soil environment is now one of the main problems associated with the transformation of the Earth's surface. For more information on the actual impacts of metals associated with the slightest fraction PM, it is necessary to quantify the contribution of each of their chemical and physical forms on route: source of origin - receptor. The mechanisms of metals transport, especially those bound to the finest PM fractions and the prediction of their likely deposition in an soil environment is very difficult to be measured. It is mostly due to the fact that fine PM in contrast to coarse particles for a long time maintained in a suspended state, and together with air masses migrates over a very long distances. While in the case of coarse particles the factor determining their availability for the other environmental components is mainly deposition, in case of fine PM, this could be their chemical form. This Project involves the realization of two major research objectives. The first one includes an indication of the processes and factors regulating the speed and efficiency of metals and metalloids migration from the air into the other components of the environment. The second one - an assessment of the effectiveness of their migration together with an indication of current and future risks associated with this transfer. The proposed scope of this submission and the usefulness of the obtained results will help create the only internationally as a comprehensive and analytically advanced Project concerning the problem of PM-bound metals mobility in the environment. The implementation of the Project's objectives will require an interdisciplinary collaboration of specialists from different disciplines: chemistry, atmospheric physics, environmental engineering, instrumental chemistry, mineralogy, soil science and statistics. The proposed Project's framework and suggested methodology will allow to develop new analytical and computing procedures, which can obtain the status of "gold standards" in atmospheric aerosol science. The proposed Project will use a modern scientific workshop including an integration of set of methods like i.e. exploratory data analysis, field monitoring by means of highly specialized equipment for deposition collection and PM aspiration, ground-based precipitation measurement and mathematical modeling for the assessment of PM origin. The implementation of a wide variety of chemical analyses will also allow to improve some methods popularly used for chemical fractionation of the PM-bound elements.