For years, air pollution and its impact on health have become a growing problem all over the world, which has become a concern not only of environmentalists, but also of doctors of various specialties. The main components of air pollutants are particulate matter (PM), which consists of organic and elemental carbon and other chemicals such as nitrates, sulphates, metals, and organic compounds such as polycyclic aromatic hydrocarbons (PAHs). PAHs are common environmental pollutants resulting from incomplete combustion of organic materials. PAHs have been the subject of increased attention in air pollution studies for many years, as some of these compounds have been found to be carcinogenic or mutagenic. Most of the high molecular weight PAHs only degrade slowly and therefore pose a long-term potential risk to health and the environment. Therefore, it is important to assess the exposure of PAHs, especially in urban areas.

Wastewater-based epidemiology idea
The highest concentrations of PAHs in the atmosphere can be found in urban environments due to transport and low dispersion of atmospheric pollutants. Exposure to PAHs causes a number of negative health effects, including: reproductive defects, DNA mutations, leukemia and cancer of the lung, bladder, bone, brain and scrotum.
Biomonitoring by measuring PAHs and/or their metabolites as biomarkers can provide an integrated picture. Conventional methods of human biomonitoring are often time-consuming, labor-intensive, expensive and provide information for individual exposure.

Wastewater-based epidemiology (WBE) as an innovative approach based on the chemical analysis of specific products of human metabolism (biomarkers) in wastewater can be a solution. The WBE provides objective and up-to-date information on xenobiotics directly or indirectly consumed by the population.

This study will develop and apply the WBE approach for the first time to assess human exposure to PAHs in urban areas across Europe. Many biomonitoring studies have shown a precise correlation between the exposure to PAHs and the presence of their hydroxyl metabolites. The measurement of metabolites of PAHs in human urine is a method to determine occupational and/or environmental exposure of a person to PAH, especially when multiple exposure routes have to be considered.

The authors of project hypothesize that epidemiological information from wastewater can be used to assess human exposure to PAHs by analyzing specific PAH metabolites (biomarkers). This can be described as a collective urine test, as the sewage from the city collects anonymous urine samples from thousands of people. Specific metabolites of PAHs, their hydroxyl derivatives, were selected as biomarkers based on human biomonitoring studies available in the literature and official reports of the US Environmental Protection Agency.

The project will be divided into two stages. The aim of the first stage will be to develop and validate the analytical methods of biomarkers in wastewater and sewage sludge, to identify the profile of metabolites in the wastewater treatment plant and to assess the stability of selected biomarkers, taking into account sorption on solid particles or transformation of metabolite conjugates. The second stage of the project concerns the estimation of the exposure of the population to PAHs on the basis of biomarker concentrations determined in the raw sewage. Additionally, the developed test of public exposure to PAHs will be checked for wastewater samples obtained from selected European cities. The obtained test results will also allow to determine the load of hydroxyl derivatives of PAHs to surface waters and preliminary assessment of the environmental risk related to their transport to the environment.