Urban air pollution is becoming a source of a growing concern for scientists, urban planners and policy makers. Despite the reduction in pollutants emissions in Europe in the past years, a significant proportion of European residents still live in places where the recommended limits for air pollutants concentrations are exceeded. According to a recent extensive study, the average life expectancy in Europe is reduced by about 2.2 years due to air pollution, which is substantially higher than previously assumed. In Poland air quality management is also highly inefficient, which can be concluded based on the alarming reports. As indicated in the World Health Organisation database on urban ambient air quality, in 2016 and 2017 more than a half of 50 most polluted cities in the European Union were located in Poland.

As shown by previous studies, urban configuration and particular design solutions can contribute to the improvement of urban ventilation conditions and thus to the mitigation of the effects of urban atmospheric pollution. However, the results of these studies are not implemented in urban planning and design strategies to a sufficient extent. Moreover, the low effectiveness of urban air quality monitoring systems also remains an unresolved issue in many urban areas. They often fail to estimate the human exposure to air pollution due to the limited number of stations and their inadequate location.Therefore, the mutual relation of the urban structure and air quality requires further interdisciplinary analyses in which the fields of environmental engineering, chemistry, climatology and urban planning are integrated.

The above-mentioned circumstances provide the motivation to address the issue of urban ventilation and air quality monitoring with respect to urban planning and spatial management. The process of city planning in which air quality management and monitoring is taken into account requires a holistic approach as well as a set of novel research tools. To this end, a new integrated assessment method is developed which is aimed at determining Urban Ventilation Zones (UVZ) within the city area, based on the parameters of urban structure, and evaluating the representativeness of the existing air quality monitoring systems, especially in terms of the potential impact of the buildings and street configuration on the measurements conducted by particular reference stations. Firstly, a geographic information system (GIS) study will be performed at the city scale in order to delimit the UVZ and to provide background for a local scale study by defining main problem areas. Then the representativeness of the air quality monitoring stations will be evaluated based on a tentative computational fluid dynamics (CFD) study. In this study, 3D parametric models of the areas adjacent to the stations will be used, which will be developed by means of GIS-based tools. In order to validate the developed research method, three case studies will be performed: in Gdańsk, Poznań and Warsaw.

The proposed integrated assessment method will add to the development of the current body of knowledge in the field of urban planning, spatial management and environmental engineering with respect to air quality in urban areas. The results obtained using this method will contribute to the current understanding of the process of urban ventilation management. It will also allow to evaluate the effectiveness of the existing air quality monitoring systems in the study areas. In the future the use of the method for developing predictions and planning guidelines might be considered, e.g. by evaluating the impact of trends and scale of changes proposed in local planning documents on the management of urban ventilation. However, at this point the proposed basic research is aimed at establishing the existing phenomena and processes connected with the urban ventilation conditions as well as with the operation of air quality monitoring systems.