

According to World Health Organization (WHO), seven million people worldwide prematurely die every year because of air pollution, both outdoor and household. Although people still recognize a major risk in breathing outdoors, neglecting the fact, that indoor air may be similarly or even more polluted than atmospheric one. Also they are often completely not aware of the fact that they spend most (approximately 90%) of their time indoors. Moreover, it is very likely that during ongoing pandemic the residence time indoors has been significantly extended. These all factors lead to the conclusion that indoor air pollution is at least similarly or even more crucial factor influencing human health and well-being than atmospheric one. Among known air pollutants, particulates are of special concern. Particles (in other words particulate matter) may be released directly into the air by several processes such as mining operations or fossil fuels combustions or may be formed in the air from gases via chemical and physical processes (secondary particles). A defined fraction of particles present in the air is called respirable, because the small diameter (less than 2.5  $\mu\text{m}$ ) enables them to cross the barriers of human respiratory system and enter the bloodstream. In such case they cause the most serious health effects, such as lung cancer and cardiovascular diseases. Moreover, a positive correlation has been observed between the spread of the Sars-Cov-2 virus and air pollution, specifically particulate matter. It is suspected that particulates create a suitable environment for transporting the virus and, because of inducing lung cell inflammation, increase the susceptibility to COVID-19 and severity of illness course.

There are two subgroups of population which are particularly susceptible to adverse health effects related to poor air quality. These are children, because of not fully developed respiratory, nervous or immune systems, and elderly, because of high possibility of malfunctioning of these systems. The exceptional epidemiological situation with COVID-19 spread in 2020 led to long-term residence of these groups indoors, for example in such specific indoor environments as child and aged care facilities.

The major aim of this project is a comprehensive characterization of children and elderly exposure to particles present in indoor air, especially those invisible to the naked eye, but therefore mostly dangerous to human health. Child and aged care facilities planned to investigate will be selected from different regions of Poland, so that they will represent sites of different level of urbanization, afforestation and environmental pollution. It is planned to characterize particles of diameters from 10 nm to 10  $\mu\text{m}$  with regard to their size, number, mass, structure and types of chemicals (e.g. polycyclic aromatic hydrocarbons or pesticides) and pathogens present on their surface. It is planned to conduct two types of analysis: (i) real-time, directly in investigated facilities by dedicated to such purpose portable instruments and (ii) in laboratory, of samples collected in investigated facilities. Real-time measurements will allow to observe dynamic changes in particle size distributions and identify factors initiating these changes whereas analysis in laboratory will be a source of information on the structure of particles and what types of chemicals and pathogens they transfer.

The studies will be supplemented by the screening analysis of volatile organic compounds present in investigated indoor air with particular emphasis on compounds classified as those contributing to global warming (so called "tropospheric ozone precursors"). Obtained results will be evaluated with regard to both accurate assessment of children and elderly exposure to inherent health risks related to the presence of particulates in indoor air and for identification of main factors influencing indoor air quality in investigated sites. Despite the undeniable importance of indoor air quality, there is still a limited awareness of the society regarding household air pollution.

The results obtained within this project will undoubtedly contribute to paying society's attention to this issue, particularly in terms of indoor environments which should provide the best possible residence conditions, such as child and aged care facilities. Conducted studies will be also a valuable source of information on chemical processes that occur indoors as well as will contribute to better understanding of interactions between indoor surfaces, surrounding gases and aerosol particles. Results of the project will be shared to the wider audience via website to popularize the knowledge gained within the studies.