Coal waste dumps have become part of the Silesian landscape, where mining has been carried out for over a century. After its placing in a dump, the organic and mineral matter of the coal waste is subjected to many secondary processes (e.g. leaching by rainwater, biodegradation and oxidation), causes the release of harmful gases and odors during self-heating and self-ignition of the stored material and leaching of water-soluble components. Research of organic matter fate in coal waste dumps is very important for many mining regions around the world, where coal has been exploited in the past or is currently being mined. In such areas, coal waste dumps are located nearby or even within human settlements. Assessment of environmental and health impacts of these dumps requires carrying out experiments under controlled laboratory conditions to simulate processes occurring spontaneously and chaotically inside the dump, and then analyzing the products formed. The presented project, due to taking into account the variable conditions of these processes (access of oxygen and water, type of rock) will allow to obtain a full picture regarding the type and amount of organic substances released into the air and waters.

The main purpose of this project is to recognize how different conditions of self-heating of coal waste, i.e. temperature, water and oxygen availability and nature of the rock itself (organic carbon content, organic matter maturity and mineralogy of co-occurring rocks), affect the amount and composition of gas liquid and solid pollutants, released at various stages of the process on the example of the Upper Silesian Coal Basin (USCB). Self-heating will be simulated by water pyrolysis (HP), anhydrous pyrolysis (dry distillation, DD) and oxidation (HTO) at temperatures of 250, 360 and 400^{o}C. Conducting experiments in various conditions (with and without water and oxygen) will allow to determine the amount and composition of pollutants emitted to the environment at various stages and under various conditions of the self-heating. The gaseous, liquid, water-soluble (organic and inorganic) and solid products obtained during HP, DD and HTO experiments will be correlated with the pollutants collected from the coal waste dumps. Interpreting the composition of stable carbon isotopes in methane and CO_2 taken from dumps will allow to determine their origin. With reference to data obtained from gases generated during pyrolysis and oxidation experiments, it will be possible to determine the processes in which these gases originated. Moreover, the interpretation of composition of organic and inorganic compounds dissolved coal waste leachates in correlation with reference data obtained for brines from pyrolysis and oxidation experiments will allow to estimate the amount and composition of pollutants released into groundwater during coal waste self-heating. Comparison of the experimental results to the content and composition of organic and inorganic compounds in coal wastes collected from the dumps with the experimental results for solid residues after pyrolysis and oxidation experiments will enable the monitoring of changes in the composition of organic matter and minerals and determination of the share of individual macerals and minerals in self-heating.

The research planned in the project is pioneering in the world, because according to the best knowledge of authors, no so comprehensive approach to the self-heating problem has been undertaken so far, i.e. starting from laboratory simulation in variable conditions and taking into account rock (waste) as a whole to comparison with the process occurring in natural conditions and all of the products being created. These studies will contribute to better recognition and understanding of self-heating of coal waste and related pollutants emissions into the environment, a problem that is important for all modern and old coal mining regions, and thus will help in the selection of appropriate methods to reduce emissions. The solution of the above problems is of fundamental importance for the development of science about the mechanisms of processes taking place in coal waste dumps. It can also be used to estimate the amount of gaseous and water-soluble pollutants generated during the self-heating of organic matter occurring in coal waste dumps and development of programs preventing pollutants emissions.