The aim of this project is to investigate the role of selected organic and inorganic stabilizers in the immobilization of bioavailable heavy metals fractions in soil in a laboratory scale and outdoor experiment. Furthermore, the impact of introduced materials on the functional and structural diversity of soil microorganisms will be investigated.

Ecotoxicological state of soil has become one of the most serious environmental problem in the world, especially in urban-industrial areas. According to a report of European Environment Agency in 2010 in Europe were about 3 million of places, which are the potential sources of emission of pollutants, especially heavy metals and mineral oil. Poland, one of the EU member, develops the strategy of balanced use of land and its protection against degradation and pollution.

Due to the large number of protected areas, which use is limited, the purification, revitalization and adaptation to different social and economic objectives is needed. Therefore, the use of innovative environmental technologies and reconversion the biodiversity in anthropogenic areas are implemented. Soil protection is included in the International Convention on the Protection of other elements of the environment in Agenda 21 document of the United Nations (1992) and in the project of European Commission "Towards a Strategy for Soil Protection" (COM 2002 179 final, Brussels, 16.4.2002 - Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee - Strategy for Soil Protection) the Council of the European Union and the European Parliament.

Soil contamination with heavy metals possess a serious problem of many industrialized countries in the world, including Poland. Although metal contamination of soil occurs locally in Poland, especially in industrial areas, many regions contaminated in the past and nowadays and the sources of emissions, the exceeded limit values set for pollution present in soils and land was found. The high toxicity of heavy metals causes the need to remove them from the contaminated soil using minimally invasive remediation solutions called “gentle” remediation options (GRO).

Early practice in the remediation of areas contaminated with heavy metals involved the storage of contaminated soils in places adapted for this purpose. Currently, the decontamination of polluted soil can be conducted *in situ* (in the original place of pollution) or *ex situ* (beyond the deposition place of pollutants) in a disposal plant. These processes include: leaching, washing and extraction of metals, electrokinetic and electrochemical removal, chemical oxidation, or evaporation of volatile contaminants (thermal desorption). Physicochemical methods in the treatment of soil contaminated with heavy metals still cause many reservations, because of their relatively high cost, they can lead to increased toxic effects of metals on organisms and cause radical changes in the structure and soil properties.

Global studies look forward to using environmentally friendly methods, especially phytoremediation as common solution in the remediation of soil contaminated with heavy metals. This technology is cheaper, environmentally friendly and less invasive than traditional physicochemical methods. Phytostabilization and aided phytostabilization seem to be the most promising strategies in the treatment of soil highly contaminated with heavy metals. Phytostabilization involves the use of plants capable of forming the dense vegetation cover on the soil surface and influence on the sorption of bioavailable heavy metals fractions. Additionally, the plants play a crucial role in the protection of organisms with a contaminated surface, anti-erosive and modify soil water management, reducing the risk of leaching of metals. While to enhance the effect of aided phytostabilization, the implementation of various mineral and organic materials with high sorption capacity into contaminated soil is used, able to bind mobile fractions of heavy metals and reduce their bioavailability and toxicity.

Due to the fact, that traditional physicochemical remediation techniques of soils highly contaminated with heavy metals are not efficient, most expensive and cause environmental disturbance, aided phytostabilization will be used. The experiment will be carried out *ex situ* using heavy metal-contaminated soil collected from the area of the “Orzeł Biały” former mine and zinc-lead smelter, situated between the cities Piekary Śląskie and Bytom, the Upper Silesian Industrial Region (GOP) in Poland. In the years 1927-1989 this area was associated with dolomite, coal, calamine, sphalerite and galena seam exploitation, as well as Zn, Pb and Cd ore processing. The consequence of these activities is high pollution of soil with Zn (4506±66 mg $kg^{-1}$ $dw^{-1}$), Pb (1291±66 mg $kg^{-1}$ $dw^{-1}$) and Cd (85±2.5 mg $kg^{-1}$ $dw^{-1}$) of the surface area of about 60 hectares. The three selected by-products: sodium bentonite, green waste compost, and pulp from the processing of grain as heavy metals stabilizers will be introduced into contaminated soil at a dose of 10% each. On the other hand, grass *Festuca arundinacea* (Asterix) will be used as a phytostabilizer. The combination of physicochemical and biological analyses is necessary to ensure the established goal of the application of treatment strategy in the remediation of areas contaminated with heavy metals. Due to the nature of the experiment, the following physicochemical analyses of the soil will also be carried out: the total and bioavailable heavy metals fractions, moisture content, carbon content and pH. The biomass of grass after crop will be analyzed for heavy metals content in the roots as well as in the upper plant parts and dry mass. In the experiment, the following microbial analyses will be performed: bacterial and fungal biomass and the activity of selected soil enzymes (dehydrogenases, acid and alkaline phosphatase and urease). Additionally, the functional biodiversity of microorganisms as community level physiological profiles (CLPPs) in the soil will be tested by microplate system BIOLOG® and EcoPlate™. The diversity of total soil bacteria will be determined by an amplification of bacterial 16S rDNA and fungal ITS (internal transcribed spacer) region and separation of PCR products by DGGE (denaturing gradient gel electrophoresis).

The obtained results allow to assess the effectiveness of aided phytostabilization and usability of selected stabilizers in the remediation of soil highly contaminated with heavy metals. Furthermore, this work will be helpful to complete and expand the knowledge about the functioning and diversity of soil microorganisms in the presence of heavy metals. This approach will also provide knowledge about the influence of the type of metals/metalloids stabilizers on the autochthonous soil microbial populations, the ecology of microorganisms and a better understanding of the role of grass in the accumulation of heavy metals in plant parts.Understanding these relationships seems to be very important, because of the potential application of selected stabilizers in the remediation of contaminated soil.