

Presence of ionizing radiation in environment is caused by natural sources and also by human activities. From 1945 to 1998 nuclear weapons tests were carried out to determine the effectiveness and explosive capability of nuclear weapons which caused radioactive pollutions (mostly radioisotopes of americium, cesium, strontium, plutonium) as a side effect. Despite the vast majority of those explosions took place on northern hemisphere from 1957 to 1963, it is possible to detect radioactive contamination on territories around the South Pole. Moreover in 1964 an American satellite energized by an on-board plutonium system SNAP-9A failed to achieve orbit and fell from the sky, disintegrating as it dropped above Madagascar. This accident caused additional plutonium contamination. Nowadays there are numerous research stations on the Antarctic, where various environmental studies are carried out (Henryk Arctowski Polish Antarctic Station is situated on King George Island of the South Shetland Islands). Even though different scientists continue to research on Antarctic ecosystem, accumulation of natural and artificial radionuclides has not been explored enough so far. This proposal is going to fulfill the lack of these information throughout numerous radioecological analysis. Proposed research project includes Earth system science in particular changes and protection of natural environment.

Tasks performed within this PRELUDIUM 9 project shall be determining natural ( $^{40}\text{K}$ ,  $^{210}\text{Pb}$ ,  $^{230,232}\text{Th}$ ,  $^{234,238}\text{U}$ ) and artificial ( $^{241}\text{Am}$ ,  $^{137}\text{C}$ ,  $^{238,239,240,241}\text{Pu}$ ,  $^{90}\text{Sr}$ ) radionuclides concentration in selected Antarctic ecosystem elements: mosses, lichens, soil, birds, seals, fishes, algae etc. Additionally changes radioisotopes' accumulation in 27 years period will be analyzed (research materials were collected between 1988-2015) and radionuclides' transfer within the Antarctic environment. Relative abundance of plutonium isotopes ( $^{239}\text{Pu}$  &  $^{240}\text{Pu}$ ) will be measured by mass spectrometer in order to indicate sources of contamination. Mass ratio  $^{240}\text{Pu}/^{239}\text{Pu}$  for southern hemisphere (global fallout) is equal to 0,21. Results of activity calculations will be dosimetrically interpreted as absorbed annual doses for biota around the South Pole approximation and time dependent doses variability in period of research material collecting. Outcomes will be a groundwork for searching out bioindicators which might be significant for radioecological analysis. Radionuclides concentrations will be determined with atomic spectrometry and radiochemical procedures will be used for samples preparation. Doses calculations will be based on absorbed energy estimation taking into consideration type (alpha, beta, gamma) and magnitude of energy and ways of exposition to ionizing radiation (internal or/and external). Results of radionuclides concentration and doses calculations will be graphically demonstrate as maps of distribution covering area of research.

Antarctic region is regarded as most clear and untouched by mankind. Knowledge about accumulation of natural and artificial radionuclides is crucial for radiological protection of southern polar environment. This kind of data is significant when radiation accidents with radioactive substances releases are taking place and level of danger must be estimated. Recent Fukushima Daiichi nuclear disaster shows that in spite of implementation of new technologies and high safety standards those situations unfortunately may occur. Studies carried out within PRELUDIUM 9 project shall expand and improve information about levels of ionizing radiation on Antarctic region and will help to understand transport and accumulation of radionuclide in ecosystem of polar circle regions. Doses approximation will be an additional way of radioactive contamination evaluation. Analysis will be made on environmental material – both terrestrial and marine. Examination of diverse samples will allow to find species that can be used to monitor the health of an Antarctic ecosystem, provides quantitative information on the quality of the polar environment especially on radioactive contamination. Results of this proposal could develop and enrich knowledge of protection of natural environment what is part of Earth system science.