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Distribution of Long-Life Radioisotopes (14C, 3H) in Water of Baltic Sea Basin

Marianna Kulkova*, Alena Davidochkina

Herzen State Pedagogical University of Russia, St.Petersburg, Russia, 191186

Abstract

The expanding construction of nuclear industrial plants and nuclear power stations on the shores of the Baltic Sea is creating a real possibility for the introduction of radioactive wastes into the sea water and the waters of Baltic Sea basin (Ladoga Lake, St.Petersburg rivers). A low-level liquid scintillation system Quantulus 1220 (Wallac, Turku, Finland) was used for measurements of water samples from this region. Significant difference was observed on the distribution of tritium and radiocarbon concentrations in different types of water and snow of Baltic Sea basin.

Keywords: *Radioactive pollution, Baltic Sea basin, Radiocarbon, Tritium, Quantulus1220, Scintillation Counter*

1. Introduction

At present the environment quality assessment is the one of priority problems. The growth of technical potential results in man-caused environmental crisis. Especially it concerns of the big industrial centers and plants located in the coastal zone of big water reservoirs. The ecosystem of Finnish Bay as part of Baltic Sea basin is the zone in which the large industrial complexes of different European countries are concentrated. The exploiting of nuclear power plants increases the risk of nuclear waste of this region. At 1981-1984 years the first great international project concerning the radioecological researches of Baltic Sea was realized. It was the coordinating scientific program "The study of radioactive material in Baltic Sea". The scientists from different countries, located in the Baltic Sea basin, have participated in this project. Monitoring of distribution of long-life radioisotopes was carried out by Helsinki commission of preservation of the marine environment of Baltic Sea (HELCOM). Data of radioactive isotope concentrations (^{137}Cs, ^{40}K, ^{90}Sr, ^{99}Tc, ^{226}Ra, ^{232}Th, ^{237}Np, ^{238}Pu, ^{239},^{240}Pu, ^{241}Am) was published in the report about study of Baltic Sea sediments for 2000-2005 years. The important role was devoted to the inspection and behavior of these radioisotopes in different conditions. While the data about geochemistry of 14C, 3H in Baltic Sea basin until now is absent. Probably the causes of this could be the labour-intensive preparation methods and measurement techniques for these radioisotopes. Today the new high-precision techniques for radioisotopic measurement are developing and it is becoming possible.

2. Background

The Baltic Sea is shallow and has isolation from Atlantic Ocean. It is the reason of low capability for purification and the time of whole water exchanging come to 27 years [2]. The industrial waste from nine countries which has on their coasts the nuclear-power reactors falls into Baltic Sea. The first disaster of the radioactive waste on the background of global radioactive pollution has appeared after damage of Baltic nuclear-power reactors. In this period the radioactive nuclides from Nuclear Power plants of Western Europe (Sellafield, La Hague) came in Baltic Sea through Danish Strait. On the data of HELCOM [7,12] there are twelve Swedish, four Finnish and nineteen Germany power(-generating) units in force in the Baltic Sea zone. In Finnish Bay the Leningradskaya (Sosnovii Bor) Nuclear Power Plant is situated. At the area of Nuclear Power plants the depositories of radioactive waste is located. The atomic submarines and ships are repairing on the coastal parts. Today the potentially dangerous sources of man-caused radioactive nuclides in the environment of Baltic Sea amass at Leningradskaya Nuclear Power Plant, at Kola Nuclear Power Plant, at Ignalinskaya Nuclear Power Plant (Lithuania). The numerous radiation-dangerous objects are concentrated within the St.Petersburg city and around one. This is the objects of medicine, shipbuilding, scientific investigations and others. The Chernobil accident had impact on the ecology of Baltic Sea basin too. The investigations of heavy radioactive nuclides in the environment of Baltic Sea region have a regular character with the exception of tritium and radiocarbon. Monitoring of radiocarbon in the environment of regions located near Nuclear Power plant, for example, near British Nuclear Power plant (Sellafield) or Chernovodsky Nuclear Power plant (Romania) is

* Corresponding author. Tel.: +79219052303
Fax: +78123144784; E-mail: kulkova@mail.ru

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