^{239,240}Pu balanso vertinimas Kuršių mariose

Estimation of ^{239,240}Pu balance in the Curonian Lagoon

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The Curonian Lagoon (Fig. 1) has a surface area of 1584 square kilometers (~6.2 km^3) [1]. The average annual water discharge is about 500 m^{3}s^{-1} for the Nemunas River, 124 m^{3}s^{-1} of the Matrosovka branch, 40 m^{3}s^{-1} for the Minija tributary, and 30 m^{3}s^{-1} for the Deima River [2]. Water outflow gate is the Klaipeda Strait.
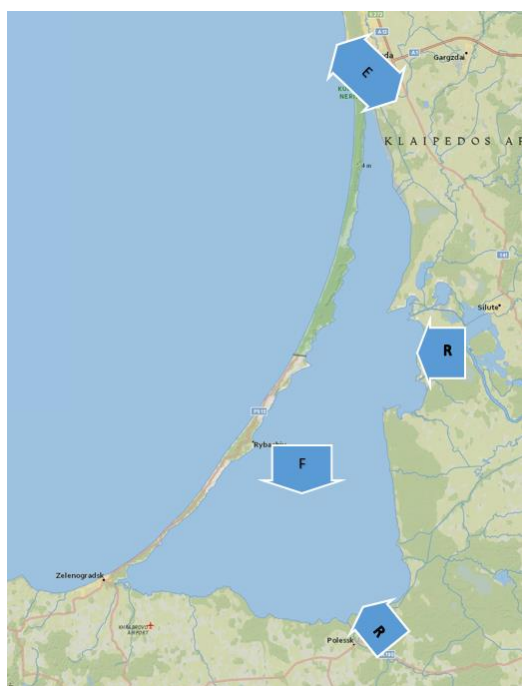

Fig. 1. Map showing the study area

The overall water balance shows that the Lagoon receives water from rivers and precipitation 4 times higher than its volume. The lowest water residence time values were found in front of the Nemunas Delta and in the Klaipeda Strait, while the central and southern parts of the lagoon are characterized by residence times higher than 100 days [2].
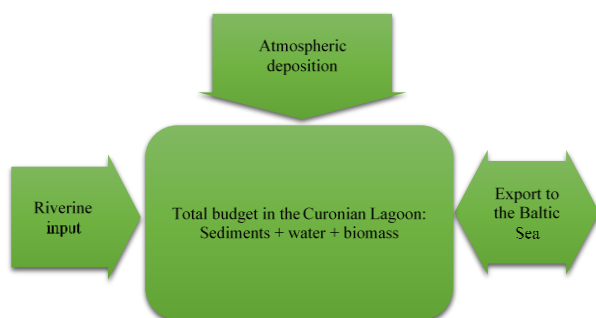

Fig. 2. The mass balance model of the Curonian Lagoon

Using mass balance model [3], we aimed to estimate the ^{239,240}Pu balance in the Curonian Lagoon. The mass balance model (Fig. 2) reflects the total sources and losses of the ^{239,240}Pu in the Curonian Lagoon:

$$I = R + F - E \qquad (1)$$

where I - inventory of ^{239,240}Pu in the sediments and suspended particles and water, R – riverine input, F – fallout, E – exchange with the Baltic Sea.

The main inputs of ^{239,240}Pu to the Curonian Lagoon are the river inflow and global fallout after the Nuclear weapon tests aa well as Chernobyl accident. The part of ^{239,240}Pu outflow through the Klaipeda Strait with suspended particles.
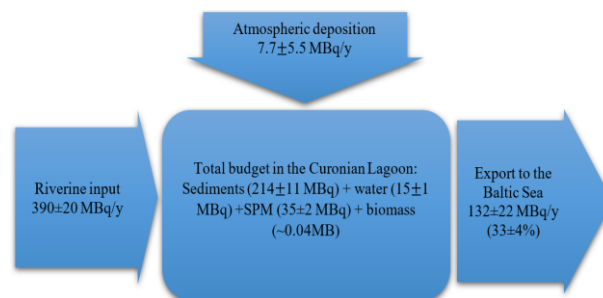

Fig. 3. Estimated ^{239,240}Pu mass balance in the Curonian Lagoon

Based on the mass balance model, the atmospheric and riverine contribution to the Curonian Lagoon was estimated at 397.7 MBq per year. Most part of this plutonium is stored in the bottom sediments, water, and suspended particles (Fig. 3). About 33% of the received plutonium outflows the lagoon with a rate of 132 MBq per year.

Keywords: ^{239,240}Pu balance, box model, Curonian Lagoon

Literature

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