Radiation & Environmental Contamination: Ecosystem & Human Health Concern

1608001

Artificial radionuclides in bottom sediment of the Yenisei River (Russia)

Alexander Bolsunovsky, Dmitry Dementyev, Sergey Kosinenko

Radioecology Laboratory, Institute of Biophysics SB, Russian Academy of Sciences, Krasnoyarsk, Russia
Email: radecol@ibp.ru; radecology@gmail.com

The Yenisei is one of the world's largest rivers, over 3000 km long, flowing into the Kara Sea. There are large industrial facilities, including nuclear-fuel ones, on the banks of the river. Radioactive contamination of the Yenisei River floodplain is mainly accounted for by the operation of the Mining-and-Chemical Combine (MCC), producing weapons-grade plutonium. Studies revealed that the Yenisei River bottom sediment is contaminated by artificial radionuclides within 2000 km downstream of the plutonium complex. The sediment contains such radionuclides as cesium and europium isotopes, ^{60}Co, ^{90}Sr, and transuranium elements. Concentrations of artificial radionuclides in sediment layers remain relatively high as far as 200 km downstream of the MCC. In layers of sediment cores collected at a position upstream of the MCC, γ-spectrometric measurements registered only ^{137}Cs, with the maximal activity about 8.0 Bq/kg. The vertical distribution of radionuclides in sediment is very complex and there are some concentration minimums and maximums due to different velocities of radionuclides released by the Combine and variations in global fallouts. Different radioisotope methods have been used to calculate sedimentation rates in several regions of the Yenisei River. The history of contamination of sediments by ^{137}Cs was examined using the obtained sedimentation rates. Results of sequential extraction of the Yenisei River sediment samples showed differences in radionuclide concentrations in extracted forms: ^{90}Sr, ^{152}Eu, and ^{241}Am concentrations were the highest and ^{137}Cs concentration was the lowest. These data suggest different potential environmental availability of a large number of radionuclides (including transuranic ones) in sediments of the Yenisei River.

Keywords: river bottom sediments, artificial radionuclides, sedimentation rates, sequential extraction, the Yenisei River

1609023

Comparative assessment of hexabromocyclododecane and its alternatives based on material flow analysis

Shigeki Masunaga [1], Satoshi Managaki [1], Jung-Keun Oh [1], Kensuke Kotani [1], Atsumi Miyake [1], Takeshi Kobayashi [1], and Hiroki Hondo [1]

[1] Faculty of Environment and Information Sciences
[2] Graduate School of Environment and Information Sciences
Yokohama National University
79-7 Tokiwadai, Hodogaya-ku, Yokohama, 240-8501 Japan
E-mail: masunaga-shigeki-dh@ynu.ac.jp

In order to select the environmentally best chemical among alternatives, grasping various risks all through the life stages is important. In this study, we developed a material flow based comparative assessment method in a case study on a brominated flame retardant, hexabromocyclododecane (HBCD). First, we constructed a material flow of HBCD in Japan through its life cycle. By adopting emission factors, environmental emissions of HBCD were estimated for every life stage. Then potential alternative flame retardants (FRs), in this case, five chemical alternatives, were identified for the major use categories of HBCD, namely expanded polystyrene (EPS) and extruded polystyrene (XPS) insulation foams, curtains and car fabrics. Environmental emissions, human exposures, and exposure health risks were estimated for those alternatives and compared with those for HBCD. Our result showed that considerable amount of HBCD would be stocked as consumer products (26,000 ton in 2020) due to the long life in spite of the introduction of alternatives and indicated that the products containing HBCD would be potential emission sources for a long time. It also indicated that replacement of HBCD would significantly reduce FR emission from polystyrene foams, while it would slightly increase FR emission from curtains. As a next step, we compared products containing HBCD with those products that had similar function but did not contain HBCD. Glass wool and urethane foam as thermal insulating material and flame retardant yarn as a material of textile were selected. Comparisons in FR emission, CO_2 emission, landfill space demand for disposal, and cost among those indicated that some alternative products have better prospects of reducing environmental impact than chemical alternatives. Although our estimates still have significant uncertainties, they would provide useful information for selecting a better option among possible alternatives.

Keywords: Hexabromocyclododecane (HBCD), Alternative chemical, Life cycle risk, Comparative risk assessment, Material flow analysis.

1609050

Determining diffusion coefficient of Cs in compacted bentonite

Hanh D. Bui[1], Lanh Nguyen[2], Thanh D. Cao[1], Long Q. Nguyen[1], Tien B. Nguyen[1]

[1]Vietnam Atomic Energy Institute
[2]Ministry of Natural Resources and Environment
Email: bdhanhnt@gmail.com

Bentonite is a candidate buffer material for storage of high-level radioactive waste. The diffusion behavior of radionuclides in the compacted bentonite is an important concern to be elucidated for the safety assessment of the geological disposal. In this study, one-dimensional diffusion experiments using Cs-134 were conducted for Vietnamese compacted bentonite saturated with water solution. Based on determination of apparent diffusion coefficient of Cs-134 in compacted bentonite, immigration behavior of Cs-134 is discussed in this study.

Keywords: Vietnamese compacted bentonite, Diffusion coefficient, Cs-134, Immigration behavior

1609061

Using human health risk assessment in setting national regulatory standards for dioxin in soil

Le Thi Hai Le[1*], Nguyen Xuan Net[2], Kirsten Forsyth[3]