SAŽETAK

U ovom doktorskom radu istraživan je radiološki utjecaj odlagališta ugljenog pepela i šljake na kopnene i morske organizme u blizini toga odlagališta. Istraživanjem su bili obuhvaćeni prirodni radionuklidi ^{238}U, ^{235}U, ^{226}Ra, ^{232}Th te ^{40}K.

Ciljevi su bili odrediti koncentracije aktivnosti prirodnih radionuklida u pepelu i šljaci te okolišu, odrediti prijenos radionuklida iz odloženog pepela i šljake u okoliš te procijeniti radiološki rizik za odabrane referentne organizme zbog radionuklida prisutnih u pepelu i šljaci.

Za određivanje koncentracija aktivnosti radionuklida u uzorcima je korištena visokorezolucijska gamaspektrometrijska metoda. Prijenos radionuklida iz pepela i šljake u biljke određivao se koncentracijskim omjerima (CR vrijednostima) te uspoređivao s podacima za kontrolno područje. Procjena radiološkog rizika za kopnene i morske organizme napravljena je uz pomoć ERICA Tool programa.

Rezultati ovog rada pokazali su da su koncentracije aktivnosti radionuklida ^{226}Ra, ^{235}U te ^{238}U u istraživanom pepelu i šljaci statistički značajno veće od vrijednosti uobičajenih za tlo geološkog područja na kojem se nalazi odlagalište. No, prijenos radionuklida iz pepela i šljake u biljke manji je od onog u prirodnom okruženju. Nisu pronađeni dokazi o migraciji radionuklida s odlagališta u morski ekosustav, a povećane koncentracije aktivnosti ^{226}Ra te ^{238}U u morskom sedimentu dovedene su u vezu samo s pepelom i šljakom koji su u prošlosti bili izravno odlagani u more. Procjena rizika je označila značajnima samo koncentracije aktivnosti ^{266}Ra u pepelu i šljaci za kopnene organizme te ^{226}Ra i ^{238}U za morske organizme. Rizik od pojave značajnijih bioloških efekata za populaciju morskih organizama je malen, dok postoji rizik za kopnene organizme koji su u bliskom kontaktu sa odloženim materijalom u vidu utjecaja na njihov broj i veličinu jedinki.

Ključne riječi: pepeo i šljaka, okoliš, ERICA Tool, prirodni radionuklidi, procjena rizika.

ABSTRACT

This doctoral thesis investigated the radiological impact of a coal ash and slag disposal site on the terrestrial and marine organisms in its vicinity. This included natural radionuclides ^{238}U, ^{235}U, ^{226}Ra, ^{232}Th and^{40}K.

The aims of this study were to measure the activity concentrations of radionuclides in coal ash and slag and the nearby environment, investigate whether radionuclides migrate from coal ash and slag into the environment, and assess the radiological risk for reference organisms caused by the measured activity concentrations of radionuclides.

High resolution gammaspectrometry was used to measure activity concentrations of radionuclides in the samples. Migration of radionuclides from coal ash and slag into the plants was determined by concentration ratios (CR) and compared to control samples. Radiological risk was assessed by the ERICA Tool terrestrial and marine organisms.

The results of this thesis show that the migration of radionuclides ^{226}Ra, ^{235}U, and ^{238}U from ash and slag to plants was less frequent than the one in a natural environment. Nevertheless, the transfer of radionuclides from ash and slag to plants was lesser than in a natural environment (soil-to-plant). Also, there was no evidence for the migration of radionuclides from the disposal site to the marine ecosystem. The enhanced activity concentrations of ^{226}Ra and ^{238}U in sea sediment stemmed only from the coal ash and slag previously deposited directly into the sea water. The risk assessment marked activity concentrations of ^{226}Ra as significant for terrestrial organisms and ^{226}Ra and ^{238}U for marine organisms. The risk of causing significant biological effects on the population was small for marine organisms, but significant for terrestrial organisms in direct contact with coal ash and slag (impact on the number of soil invertebrates and the size of individual organisms).

Keywords: coal ash and slag, environment, ERICA Tool, natural radionuclides, risk assessment.