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# Transport of Iodine Species in the Terrestrial Environment

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The fate and transport of iodine in the environment is of interest because of the large production and release of $^{129}I$ from anthropogenic sources. $^{129}I$ has a long half-life ($1.57 \times 10^7$ years) and exhibits complex geochemical behavior. The main source of $^{129}I$ in the environment is from nuclear fuel reprocessing facilities; about 2,600 kg from facilities in England and France. During 1944-1972, the Hanford Site in Washington state released about 260 kg $^{129}I$. Iodine has a unique and complex chemistry in the environment, and its fate and transport in aqueous environments is dictated by its chemical speciation. In reducing environments, aqueous iodine usually occurs as the highly mobile iodide anion ($I^-$). Under more oxidizing conditions, iodine may be present as the more reactive iodate anion ($IO_3^-$), which could lead to retarded transport through interaction with clays and organic matter. Co-existing iodine species ($I^-$, $IO_3^-$, $I_2$, and organoiodine compounds), in different proportions, has been reported in various terrestrial environments. However, there are conflicting reports regarding the environmental behavior of the different types of inorganic iodine and few publications on organic iodine compounds.

This work examines the sorption and transport behavior of both inorganic and organic iodine species in geological samples from several complexes of the U.S. Department of Energy, where transport of radionuclides, including $^{129}I$, may occur. Experiments on soils and sediments from the Savannah River Site in South Carolina, Oak Ridge Site in Tennessee, Hanford Site in Washington, Livermore Site 300 in California, and a surface soil from Santa Fe in New Mexico near Los Alamos were carried out. Samples from Savannah River Site and Livermore Site 300 are available from different depths. In addition, a surface soil of Wisconsin with a high amount of organic matter is utilized. This wide variety of sample types provides opportunities to examine the influence of organic matter, clay mineralogy, soil pH, and texture on the environmental behavior of iodine. The effects of initial concentration and competitive sorption on iodine transport are also investigated.

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