
Evaluation of Isotopic Diagnostics for Subsurface Characterization and Monitoring: Field Experiments at the TAN and RWMC (SDA) Sites, INEEL

Project ID: 55351

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Research Objectives

The research will explore and refine the use of isotopic ratio measurements on aquifer groundwaters and vadose zone gas for improving remediation strategies and increasing the efficiency of ongoing remediation activities at the TAN and RWMC (SDA) sites at Idaho National Engineering and Environmental Laboratory. The measurements to be made are ^{13}C , ^{14}C , ^{18}O , ^2D , $^{87}\text{Sr}/^{86}\text{Sr}$, and $^{37}\text{Cl}/^{35}\text{Cl}$ isotopic ratios, and the abundances and isotopic compositions of the noble gases He, Ne, Ar and Xe.

The isotopic ratios are used in conjunction with water and gas chemistry to determine: (1) the extent and nature of chemical reactions in the TAN plume and their role in retardation of radioactive isotopes ^{90}Sr and ^{137}Cs and the attenuation of dissolved chlorinated hydrocarbons; (2) predict the chemical effects of proposed remediation techniques (bioremediation, oxidation, and grout barrier installation) on transport in the plume; (3) the extent of natural degradation of chlorinated hydrocarbons in the TAN plume, and the transport of gases through the vadose zone from the plume; (4) the extent of natural remediation and in situ transformations of volatile organic compounds at the SDA site; (5) the extent of recirculation of surface air during VVE activities, and how this changes with season and barometric conditions. The data collected will provide a unique characterization of transport processes in the aquifer and the vadose zone, and an evaluation of the benefits of isotopic approaches in support of remediation activities at two representative sites.

The proposed studies are to be carried out in cooperation with the LITCO-supervised characterization and remediation activities at the TAN and RWMC (SDA) sites at INEEL. Most of the sampling necessary for the study is covered by normal sampling schedules; additional sampling can be done in existing wells or with soil gas sampling equipment.