Introductory Presentation

Overview of Remediation Technologies for Radionuclides in Soil and Ground Water

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Remediation of radionuclides seeks to prevent exposure and/or reduce the risk and associated concentration of radionuclides to meet overall objectives of protecting human health and the environment. The characteristics of a radionuclide affects what type of remediation will be effective. Radionuclide half-life, mobility, and biogeochemical reactivity need to be considered in assessing candidate remedies. Contaminated site properties, radionuclide distribution, site-specific attenuation processes, exposure pathways, and the required end state of the site are also important in defining the target problem for remediation. Remediation technologies operate at the intersection of the radionuclide characteristics, the target problem, and remedy functionality. Thus, the state of remediation technologies for radionuclides is related to 1) the state of understanding for radionuclide behavior in the subsurface and how this can be measured for a specific site and 2) the types of remedy functionality that are available and how the remedy is implemented. Categories of radionuclide characteristics, definition of target problems, and types of remediation technology functionality are described to provide an overview of the state of radionuclide remediation, focusing on groundwater protection and groundwater remediation.

Main Presentation

Remedy Selection and Implementation for Radionuclides in Soil and Ground Water

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Understanding and quantifying the processes that affect contaminant mobility are needed to support remediation decisions for contaminants in the vadose zone and groundwater at the Hanford Site. Mobile contaminants of concern include chromate, I-129, Tc-99, uranium, and nitrate. Characterization efforts have been conducted to quantify the mobility of these contaminants for subsurface conditions important to waste site and plume remedy decisions. Information on attenuation and transport characteristics of contaminants feeds a systems-based approach to estimate mass-flux and to assess the coupled vadose-zone/groundwater system in predicting future contaminant behavior and evaluating remedy options. Pump-and-treat is a baseline groundwater remedy already implemented at Hanford to address a number of the existing plumes, for which improved information on continuing or new sources is needed to manage this remedy and planned transition to Monitored Natural Attenuation. Hanford has also been investigating potential vadose-zone remedies through treatability testing. Source characterization quantifies how much passive or active source reduction is needed to be protective of groundwater and, in conjunction with passive or active groundwater remediation, reach ultimate groundwater remediation objectives.

Characterization efforts have shown the mobility of chromate, I-129, and uranium to be related to waste discharge and carbonate chemistry. I-129 mobility was shown to be impacted by the iodine species present in the subsurface, which include iodide, iodate, and organic iodine. For all of the contaminants, leachability testing and partitioning tests provided quantitative measures of mobility for use in fate and transport analyses. Additionally, application of electrical resistivity tomography has been demonstrated to improve interpretation of contaminant distribution in the vadose zone. Collectively, this information is providing support to ongoing remedial investigation, feasibility studies, and remedy implementation.