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**Characterization, Modeling, Monitoring and Remediation
of Radionuclides in the Subsurface**

Thomas Nicholson, Office on Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, 11545 Rockville Pike, Rockville, MD 20852, Thomas.Nicholson@nrc.gov, 301-251-7498; Mark Fuhrmann, USNRC, Mark.Fuhrmann@nrc.gov and Ralph Cady, USNRC, Ralph.Cady@nrc.gov;

NRC is sponsoring research to identify and assess characterization, modeling, monitoring and remediation methods used to quantify and evaluate radionuclide release and migration in the subsurface. A dose assessment to determine compliance with regulatory criteria is used to evaluate the need for and selection of remediation methods. If remediation is warranted, the choice of remediation method(s) is based upon site- and source-characterization data. This data should be integrated in a conceptual site model (CSM). The assumptions and parameterization of the significant features, events and processes (FEPs) affecting radionuclide release and transport as described by the CSM should be tested using a program of field tests and confirmatory monitoring. Insights from ongoing reviews by RES staff of field investigations involving radionuclide transport in the subsurface illustrate the need to test and confirm the CSM. In particular, the FEPs in the unsaturated zone where many leaks and spills originate need greater characterization and confirmatory monitoring than is normally performed. The choice of the remediation method, if warranted, is based upon the confirmed CSM and monitoring baseline. Remediation strategies run the gamut from highly-intense hydraulic methods such as in situ bioremediation; through pump, treat, monitor and release; to more passive methods such as reactive permeable barriers, and monitored natural attenuation (MNA). All successful remediation strategies involve monitoring programs to determine their efficacy. This monitoring should be as close to the contaminant source as feasible. The monitoring is coupled to performance assessment models using performance indicators (PIs). These PIs provide a measurable indication of remediation performance, and are derived from analysis of the CSM and the hydrologic, chemical and microbial function(s) of the chosen remediation method. Furthermore, these PIs should be the output of both the performance assessment model and the confirmatory monitoring program to evaluate the efficacy of the remediation program and compliance with dose criteria.

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