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**A Summary of *Vadose Zone Science and Technology Solutions*
Case Studies from the “DOE Book”**

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Vadose zone processes play a pivotal role in the behavior of subsurface contaminants and often determine the options and opportunities for environmental cleanup. Unfortunately, the significance and control exerted by this subsurface interval – the soil, sediment and rock between the ground surface and the water table – is often overlooked. The influence of the vadose zone is not routinely incorporated into conceptual models of contaminant behavior at waste sites and industrial facilities. Throughout the 20th century, the vadose zone was often assumed to simply “hold up contaminants and protect the groundwater.” This official policy was assumed to be “true” until conclusively disproven - typically without direct vadose zone monitoring. Monitoring at such sites consists of upgradient and downgradient wells that indicate environmental impacts only after groundwater is already contaminated. In 1998 and 1999, the U. S. Department of Energy (DOE) sponsored an international effort to identify technical and scientific challenges associated with the vadose zone. The effort resulted in the publication of a comprehensive book – *Vadose Zone Science and Technology Solutions*. A sampling of case studies provides a clear understanding of the importance and pervasiveness of the influence of vadose zone processes on environmental characterization and clean-up. “Simple” case studies such as tritium migration at the Brookhaven National Laboratory, “complex” case studies such as Hanford waste tanks, “arid” site case studies such as Yucca Mountain, and “humid” site case studies such as Savannah River Site, all document that a new emphasis and awareness of vadose zone science is needed. Based on the input of all of the participants and contributors, a listing of science and technology needs was developed for the book. As expected, the identified needs centered on issues such as heterogeneity, upscaling, complex transport processes, setting remediation goals, and the like. The book, including its case studies and recommendations, has been a primary resource in DOE’s current effort to develop a roadmap for future subsurface science research.