



7.0 Vadose Zone Monitoring and Characterization

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The vadose zone is defined as the area between the ground surface and the water table. This subsurface zone also is referred to as the unsaturated zone or the zone of aeration. The vadose zone functions as a transport pathway or storage area for water and other materials located between the soil surface and the groundwater aquifers. Historically, the vadose zone at industrialized and waste disposal areas at the Hanford Site has been contaminated with large amounts of radioactive and non-radioactive materials through the intentional and unintentional discharge of liquid waste to the soil column, the burial of contaminated solid waste, and the airborne contaminants deposited on the ground. Depending on such factors as the makeup of the soil, the geology of the area, the nature of the waste, and the amount of water or other fluids available to mobilize the contaminant, contaminants can move downward and laterally through the soil column, can be chemically bound to soil particles (and immobilized), or can be contained by geologic formations.

Radioactive and hazardous waste in the soil column from past intentional liquid waste disposal, unplanned leaks, solid waste burial grounds, and underground tanks at the Hanford Site are potential sources of continuing and future vadose zone and groundwater contamination. Subsurface source characterization, vadose zone moni-

toring, soil-vapor monitoring, and vadose zone remediation were conducted in fiscal year 2001 to better understand the distribution and mechanisms that control the movement of subsurface contamination. This chapter summarizes major findings from those efforts, focused primarily on vadose zone soil contamination associated with reactor operations, past single-shell tank leaks, and liquid disposal to ground as a result of spent fuel processing. This chapter also summarizes several technical studies whose results could lead to new understanding of contaminant interactions with the soil column and new and improved methods to characterize and monitor the vadose zone.

An overview of the major soil column sources of groundwater contamination is provided in PNNL-13080. This chapter discusses vadose zone contamination that could affect groundwater in the future. An overall evaluation depends, to a large degree, on integration of vadose zone and groundwater monitoring and characterization data to present a comprehensive picture of contaminant fate and transport. Significant fiscal year 2001 vadose zone results are summarized here. However, the bulk of the data interpretation on the effect to groundwater is presented and discussed in Section 6.1.