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Remediation of Soils Contaminated with Hydrocarbons

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I. INTRODUCTION

Contamination of subsurface soil and groundwater can occur as a result of release of contaminants from leaky underground storage tanks, ruptured pipe lines, chemical waste disposal, and oil spills. If left untreated, the contaminated soil and groundwater can pose a significant environmental risk. Aside from contamination of groundwater and the subsurface soil, the release of petroleum products in the subsurface environment can lead to explosion hazards due to accumulation of hydrocarbon vapors in building basements, and the degradation of utility lines which come in contact with leaked hydrocarbons.

After a liquid contaminant is released into the subsurface environment, it percolates downward as well as spreading laterally because of capillary and gravity forces. When the amount of contaminant released is small, the contaminant may be held in the interstices of the soil particles as a discontinuous phase and may not reach the water table. However, if the leak is large, the contaminant may continue to move downward until it reaches a low permeability soil layer or groundwater. Figure 1a shows a typical scenario for an underground leakage source. The variation of contaminant saturation in the soil is depicted qualitatively in Figure 1b. Depending upon the saturation of contaminant in the soil, several zones such as unsaturated zone, capillary zone, and free hydrocarbon layer can be identified. In the unsaturated zone, the contaminant is held in the interstices by capillary and adhesion forces, and exists as a discontinuous phase. The contaminant

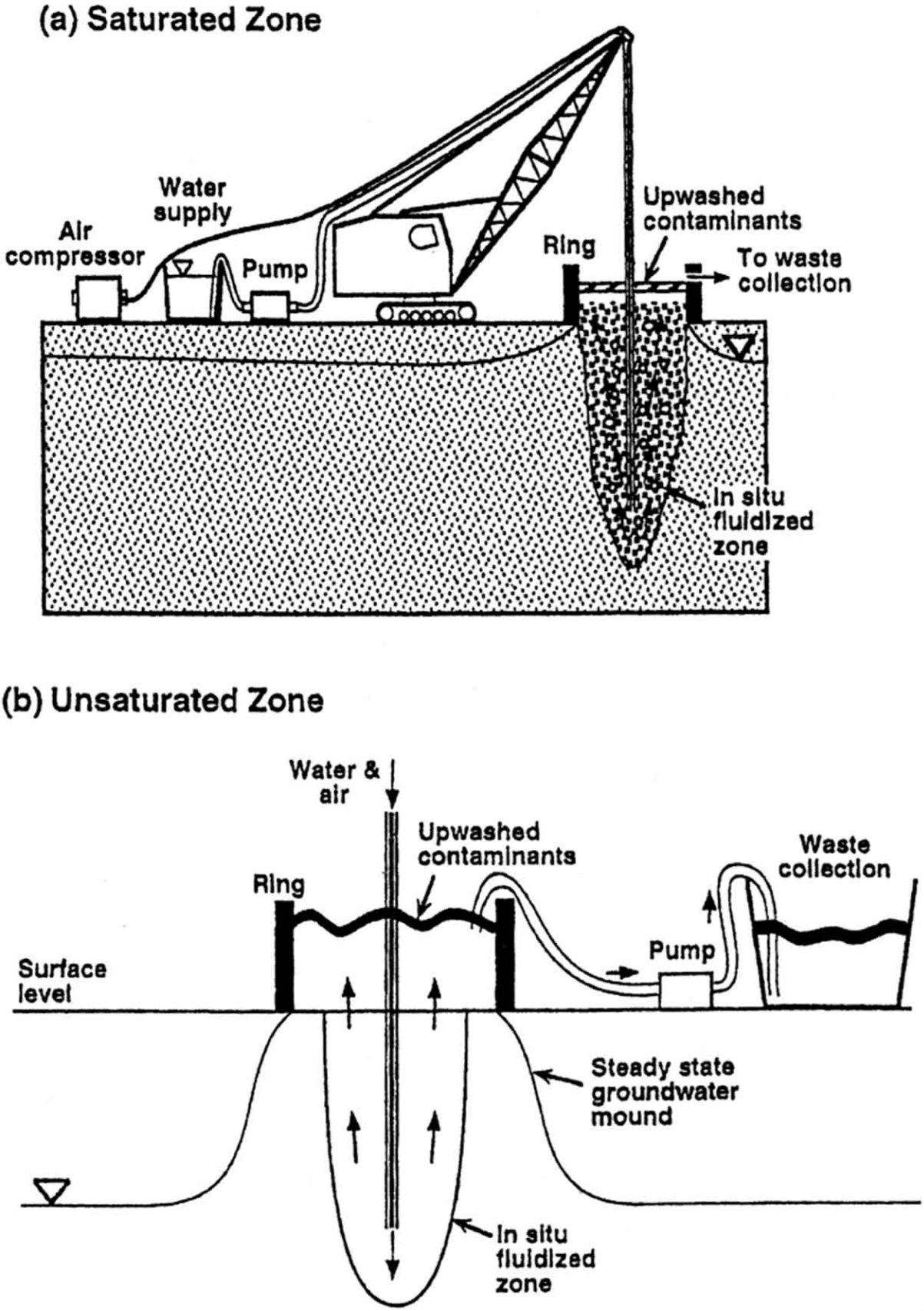

Figure 2. A schematic diagram of the field implementation of in-situ multiphase fluidization: (a) saturated zone; (b) unsaturated zone (as proposed by Niven and Khalili 1998).