Table A-13.A. Air sparging/soil vapor extraction

Technology	Air sparging/ soil vapor extraction	AS injects ambient air or other gases (e.g., oxygen) down well bores or trenches below the groundwater table, aerating groundwater and volatilizing LNAPL. SVE induces a vacuum that volatilizes LNAPL if present above the water table and removes LNAPL vapors from the subsurface. AS and SVE may be used individually if conditions allow.	
Remediation process	Physical mass recovery	Yes	AS volatilizes LNAPL from saturated zone and capillary fringe; SVE extracts LNAPL vapors from unsaturated zone.
	Phase change	Yes	AS and SVE induce volatilization of the LNAPL.
	In situ destruction	Yes	Ambient air or oxygen sparging below the water table and vacuum induced circulation of atmospheric air into the unsaturated zone enhance in situ aerobic biodegradation.
	Stabilization/binding	No	N/A
Objective applicability	LNAPL saturation	Yes	Can potentially reduce LNAPL to below residual saturation.
		Example performance metrics	Mass removal to an asymptotic recovery of a well-operated and-maintained system (usually quantified in pounds of LNAPL constituent per day).
	LNAPL composition	Yes	Abate accumulation of unacceptable constituent concentrations in soil vapor and/or groundwater from an LNAPL source.
		Example performance metrics	LNAPL composition change, soil and groundwater VOC concentrations to below regulatory standard, soil vapor plume concentrations to below regulatory standard.
Applicable LNAPL type	All LNAPL types although better-suited to more volatile LNAPLs (e.g., gasoline, kerosene). SVE-induced vacuum extracts volatile LNAPL from the pores and increases oxygen content of unsaturated zone which, enhances aerobic respiration of heavier-phase LNAPLs. AS helps volatilize LNAPL from the capillary fringe and saturated zone as well as enhancing aerobic degradation of heavier-phase LNAPLs. As volatile LNAPL constituents are stripped, LNAPL can become more viscous, and more recalcitrant constituents can become more concentrated.		
Geologic factors	Unsaturated zone	Permeability	SVE is more effective in higher permeability materials and where treatment zone capped with a confining layer or impermeable surface to increase the ROI.
		Grain size	Small to very small proportion of fine-grained soil.
		Heterogeneity	AS/SVE is more efficient in homogeneous soils; in heterogeneous soils, air flow will follow preferential pathways, possibly short-circuiting remediation coverage, but LNAPL may also be distributed along preferential pathways.
		Consolidation	Not typically a factor.
	Saturated zone	Permeability	AS may be most effective in moderate-permeability materials (silts to sands), which are less prone to severe air channeling but do not severely restrict air flow.
		Grain size	As above, medium grain size balances AS air flow rate with distribution (ROI); small grain size may require entry pressures that exceed confining pressure and result in soil heaving for shallow treatment zones.
		Heterogeneity	Fractured bedrock and more permeable zones will induce preferential flow.
		Consolidation	Not typically a factor.