

Table A-2.A. Skimming

Technology	Active LNAPL skimming	Uses a single pump or hydrophobic belt (e.g., bladder pump, pneumatic pump, or belt skimmer) to extract LNAPL from a well at air/LNAPL interface under natural gradients. The available drawdown is limited based on the LNAPL thickness, the density difference between LNAPL and water, and the heterogeneity of the adjacent soil. LNAPL skimming typically induces a limited ROI of <25 feet in unconfined conditions. LNAPL skimming is effective for confined, unconfined, and perched LNAPL.	
Remediation process	Physical mass recovery	Yes	Removes mobile LNAPL at the groundwater surface; does not affect residual LNAPL mass.
	Phase change	No	LNAPL remains in liquid phase.
	In situ destruction	No	N/A
	Stabilization/binding	No	N/A
Objective applicability	LNAPL saturation	Yes	Active skimming drives LNAPL saturation towards residual saturation, decreasing LNAPL transmissivity and mobile LNAPL extent.
		Example performance metrics	Direct analysis of soil to indicate changes in formation LNAPL saturations; LNAPL transmissivity reduction/ LNAPL conductivity reduction, LNAPL/water ratio, asymptotic recovery of LNAPL from a well.
	LNAPL composition	No	N/A—Skimming recovers LNAPL as a fluid and does not exploit volatilization or dissolution, so it does not lead to a compositional change.
		Example performance metrics	N/A
Applicable LNAPL type	All LNAPL types; however, lower-viscosity LNAPL (0.5–1.5 cP) is much more recoverable than high- viscosity LNAPL (>6 cP).		
Geologic factors	Unsaturated zone	Permeability	Technology not applicable to LNAPL in the unsaturated zone.
		Grain size	
		Heterogeneity	
		Consolidation	
	Saturated zone	Permeability	Soil permeability is proportional to recovery rate—higher LNAPL recovery and saturation reduction in higher permeabilities. Permeability has significant effect on ROI of a skimming well. LNAPL permeability greater at lower water table levels when saturations are higher (smear zone opened).
		Grain size	Skimming can be effective in all grain size distributions; can achieve lower residual saturation in coarser materials where capillary pressures are less.
		Heterogeneity	Moderately sensitive to heterogeneity, affecting ROI; well screen location and pump depth can help overcome heterogeneities.
		Consolidation	Not typically a factor.
Cost	Per well, the capital costs of skimming wells are low compared to other technologies; however, to achieve a remedial time frame similar to that of total liquids extraction or MPE, a denser well spacing is required due to the small ROI and lower per-well rate of LNAPL removal. Skimming wells typically need to be operated longer because they can have lower recovery rates compared to other mass recovery technologies.		