TABLE 2.7
Technology/Process Option Evaluation—Perched Groundwater

General Response Action	Remedial Technologies	Process Options	Technical Implementability	Effectiveness	Cost	Comments
No Action	None	None	Good	Poor	None	Not protective of human health due to presence of elevated COPCs. Retained for comparison, per the NCP.
Institutional Actions	Access Restrictions	Deed Restrictions on Future Use of GW	Fair	Poor	Low	Does not meet RAOs, does not prevent migration to deeper groundwater zones. GW in perched zone not producible or potable water source.
	Monitored Natural Attenuation (MNA)	Monitoring	Good	Poor	Low	Retained. Potentially applicable in conjunction with other technologies. Not time feasible for "hot spots." MNA or monitoring in general is critical to the implementation of any alternative.
Containment	Vertical Engineered Barrier	Deep Soil Mixing	Fair	Poor	High	Does not meet RAOs; potential for leaching to deeper zones.
		Permeable Reactive Barrier	Good	Poor	High	Retained. Viable technology. Potential still exists for leaching to deeper zones.
		Grout Curtain	Fair	Poor	High	Does not meet RAOs; potential for leaching to deeper zones.
		Sealable Joint Sheet Piling	Fair	Poor	High	Does not meet RAOs; potential for leaching to deeper zones.
		Slurry Walls	Fair	Poor	High	Does not meet RAOs; potential for leaching to deeper zones.
	Horizontal Subsurface Barriers	Block Displacement	Not feasible due to heterogeneous stratigraphy at the site.			
		Grout Injection	Not feasible due to heterogeneous stratigraphy at the site.			
	Hydraulic Controls	Pumping Wells	Good	Fair to Good	Moderate	Retained. Difficult to implement due to multidirectional GW flow and low permeability of perched zone; process would be slow to maintain objectives.
In-Situ Treatment	Physical	Air Sparging	Good	Fair to Good	Moderate	Difficult due to low volume of water in perched zone and low permeability; required to be used in conjunction with SVE.

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General Response Action	Remedial Technologies	Process Options	Technical Implementability	Effectiveness	Cost	Comments
		Dual-Phase Extraction	Good	Demonstrated	Moderate	Retained. Potentially feasible technology. Would require pilot tests.
		Free Product Recovery	Good	Poor	Moderate	Low permeability and irregular stratigraphy limit effectiveness.
		In-Well Air Stripping	Good	Fair	High	Small radius of influence would require multitude of wells in order to be effective.
		Soil Flushing	Fair	Fair to Good	Moderate	Difficult to implement due to multidirectional GW flow and low permeability of perched zone.
		Vapor Extraction	Good	Fair to Good	Moderate	Retained. Would need to be used in conjunction with another process option to remove product in GW (e.g. dual-phase extraction or free product recovery).
		Vertical Recirculation Wells	Good	Poor to Fair	Moderate	Potentially feasible in conjunction with ex-situ treatment; not effective for reducing certain chlorinated COPCs by itself.
	Chemical	Oxidation/ Reduction	Good	Potential	Moderate	Retained. Treatability study required to determine effectiveness of oxidant delivery process
		Permeable Treatment Beds	Fair	Fair	High	Difficult to implement due to multi-directional groundwater flow.
	Thermal	Electrical Resistance Heating	Good	Good	High	Retained. Short duration for “hot spot” treatment; high cost/energy requirement; must be used in conjunction with vapor extraction.
		Hot Water/Steam Flushing and Stripping	Good	Good	High	High cost; high-energy requirement; must be used in conjunction with SVE or other collection system.
		Radio Frequency Heating	Good	Good	High	High cost; high-energy requirement; must be used in conjunction with SVE or other collection system.
	Bioremediation	Aerobic	Good	Moderate to Good	Low to Moderate	Retained. Most effective for petroleum, aromatic hydrocarbons, and vinyl chloride; must evaluate feasibility of combining aerobic/anaerobic processes in different plume areas.

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Technology/Process Option Evaluation—Perched Groundwater

General Response Action	Remedial Technologies	Process Options	Technical Implementability	Effectiveness	Cost	Comments
		Anaerobic	Good	Moderate to Good	Low to Moderate	Retained. Effective primarily for the productive dechlorination of chlorinated ethenes; would need to evaluate feasibility of combining aerobic and anaerobic processes in different plume areas.
		Bioslurping	Good	Demonstrated	Moderate	Aerobic biological processes are consequence of high vacuum extraction.
		Biosparging	Good	Moderate to Good	Low to Moderate	Would enhance aerobic processes in different plume areas.
		Co-metabolic treatment	Good	Fair	Moderate	Only certain COPCs are amenable to co-metabolic treatment; regulatory concerns exist over most substrates.
		Oxidation Enhancement w/ Air Sparging	Good	Fair	Moderate	Difficult to implement in complex stratigraphy and lithology of 'perching clay'.
		Oxidation Enhancement w/ Hydrogen Peroxide	Good	Good	Moderate	Enhance aerobic biodegradation in areas with aromatic hydrocarbons; could also provide chemical oxidation of chlorinated ethenes; treatability study required.
Collection	Extraction and/or Drainage	Recovery Trench	Good	Fair	Moderate	Difficult due to various GW flow directions.
		Pumping Wells	Good	Fair	Moderate to High	Retained. Low volume of water and low yield requires multitude of wells.

Effectiveness is the ability to perform as part of a comprehensive alternative that can meet RAOs under conditions and limitations that exist at the site. Technical Implementability encompasses the applicability/feasibility of performing the process option under the regulatory, technical, and schedule constraints of the project. Cost is for comparative purposes only, relative to other processes/technologies that perform similar functions.

COPCs	Chemicals of Potential Concern	RAOs	Remedial Action Objectives
GW	Groundwater	SVE	Soil Vapor Extraction
NA	Not applicable	VOCs	Volatile Organic Contaminants
NCP	National Contingency Plan		