TABLE 3.3
Assembled Alternative Screening — Lower Vadose Soil and Exposition Groundwater Remediation Zone (35 to 110 Feet Below Ground Surface)

Assembled Alternative	Alternative Description	Effectiveness[1]	Implementability[2]	Cost[3]	Comments
None	Does not involve any proactive treatment, removal, or monitoring of contaminated media.	Good	Poor	None	Not protective of human health due to presence of elevated COPCs. Retained for comparison, per the NCP.
Monitored Natural Attenuation (MNA)[4]	Collect and analyze groundwater samples to document and/or model the persistence of contaminant concentrations or their natural attenuation.	Good	Poor	$2,680,000 - $3,720,000	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.
Permeable Reactive Barrier[4]	Install zero-valent PRB into subsurface; monitor groundwater to assess abiotic dechlorination; does not address soil.	Good	Good	$4,030,000 - $5,600,000	Effective primarily for the dechlorination of chlorinated ethenes; process would be slow to maintain objectives.
Pump and Treat/ UV Oxidation[4]	Extract groundwater via pumping wells; treat extracted groundwater *ex-situ* via UV oxidation.	Good	Good	$7,950,000 - $11,000,000	Contamination may migrate to deeper aquifers used for potable water; process would be slow to maintain objectives; drains and horizontal wells poor performance due to depth.
In-Situ Chemical Oxidation/ *In-Situ* Chemical Reduction/ Groundwater Extraction/ UV Oxidation/MNA	Inject oxidizing/reducing agents into the subsurface within 1,000 ppb-contour and monitor degradation process; extract groundwater within 10 ppb-contour for *ex-situ* treatment via UV oxidation; MNA outside 10 ppb-contour; does not address contaminated soil.	Good	Potential/ Good	$4,870,000 - $6,770,000	Retained. Treatability study required to determine effectiveness of oxidant delivery process
Enhanced *In-Situ* Bioremediation/ Groundwater Extraction/ UV Oxidation/MNA	Inject organic substrate into the subsurface within 1,000 ppb-contour and monitor bioremediation process (reductive dechlorination); extract groundwater within 10 ppb-contour for *ex-situ* treatment via UV oxidation; MNA outside 10 ppb-contour; does not address contaminated soil.	Good	Moderate to Good	$4,390,000 - $6,090,000	Retained. Effective primarily for the productive dechlorination of chlorinated ethenes; would need to be use in conjunction with aerobic processes to degrade vinyl chloride end product.
Vacuum Extraction/ Groundwater Extraction/ MNA/UV Oxidation/FTO and GAC	Extract contaminated soil vapor via vapor extraction wells within 1,000 ppb-contour for *ex-situ* treatment via FTO for 1st year followed by GAC until cleanup criteria met; extract groundwater via pumping wells within 100 ppb-contour for *ex-situ* treatment via UV oxidation; MNA outside 100 ppb-contour.	Good	Demonstrated/ Good	$5,520,000 - $7,660,000	Retained. Potentially feasible technology. Would require pilot tests. Would need to be used in conjunction with submersible GW extraction pumps.

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Assembled Alternative Screening — Lower Vadose Soil and Exposition Groundwater Remediation Zone (35 to 110 Feet Below Ground Surface)

Assembled Alternative	Alternative Description	Effectiveness[1]	Implementability[2]	Cost[3]	Comments
Vacuum Extraction/ Groundwater Extraction/ MNA/UV Oxidation/GAC	Extract contaminated soil vapor via vapor extraction wells within 1,000 ppb-contour for *ex-situ* treatment via GAC until cleanup criteria met; extract groundwater via pumping wells within 100 ppb-contour for *ex-situ* treatment via UV oxidation; MNA outside 100 ppb-contour.	Good	Demonstrated/ Good	$4,820,000 - $6,700,000	Retained. Potentially feasible technology. Would require pilot tests. Would need to be used in conjunction with submersible GW extraction pumps.
Electrical Resistance Heating/ Vacuum Extraction/ Groundwater Extraction/MNA/ UV Oxidation/ FTO and GAC	Electrodes are inserted into the subsurface to heat soil and groundwater to approximately 100ºC within 10,000 ppb-contour; volatized contaminants are collected through vapor extraction wells for *ex-situ* treatment; vacuum extraction within 1,000 ppb-contour for *ex-situ* treatment; FTO for 1st year followed by GAC for all *ex-situ* vapor treatment; groundwater extraction via pumping wells within 10 ppb-contour; MNA outside 10 ppb-contour.	Good	Good	$11,000,000 - $15,300,000	Retained. Short duration for "hot spot" treatment; high cost/energy requirement; must be used in conjunction with SVE or other collection system.
Electrical Resistance Heating/ Vacuum Extraction/ Groundwater Extraction/MNA UV Oxidation/GAC	Electrodes are inserted into the subsurface to heat soil and groundwater to approximately 100ºC within 10,000 ppb-contour; volatized contaminants are collected through vapor extraction wells for *ex-situ* treatment; vacuum extraction within 1,000 ppb-contour for *ex-situ* treatment; GAC for all *ex-situ* vapor treatment; groundwater extraction via pumping wells within 10 ppb-contour; MNA outside 10 ppb-contour.	Good	Good	$9,970,000 - $13,800,000	Retained. Short duration for "hot spot" treatment; high cost/energy requirement; must be used in conjunction with SVE or other collection system.

[1] 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.
[2] Implementability is the likelihood that the alternative could be implemented under the regulatory, technical, and schedule constraints. Technical Implementability encompasses the applicability/feasibility of performing the alternative's technologies. Administrative Implementability encompasses permitability, regulatory acceptance, and community acceptance.
[3] Cost is the estimated total present worth (direct capital costs and present worth operation and maintenance costs) for each assembled alterative. Cost estimates are considered order-of-magnitude and are provided for comparative purposes only, relative to the other alternatives.
[4] Alternative descriptions, detailed evaluations, and comparative analyses for these assembled remedial alternatives may be referenced in Appendix E.

COPCs	Chemicals of Potential Concern	NCP	National Contingency Plan
FTO	Flameless Thermal Oxidation	VOCs	Volatile Organic Contaminants
GAC	Granular Activated Carbon	UV	Ultraviolet