Table A-12.C. Technical implementation considerations for in situ

Data requirements	Site-specific data for technology evaluation	Site size and soil characteristics	Soil permeability / grain size distribution. Lithology and location of water table (as related to vapor emissions capture). Footprint of impacts and degree of layering of impacted zones.
		Groundwater characteristics	Aquifer permeability
		LNAPL characteristics	Volatility, chemical composition
		LNAPL depth	Shallow contaminants may need to implement surface cover/cap. No maximum depth limitations.
		LNAPL location	Open area or under building, near utilities.
		Off-gas treatment	Constituents of emissions that may affect vapor technology selection.
	Bench-scale testing	Site-specific combustion testing recommended to evaluate the smoldering combustion characteristics of site soils and contaminants: 1) self-sustainability; 2) post-treatment concentration reductions; 3) peak temperatures; 4) propagation rate; 5) constituents in the emissions.	
		Soil characteristics	Grain size distribution used to assess ability to deliver air.
	Pilot-scale testing	Define boundary of treatment zone	Evaluate combustion front propagation rate and radius of influence (ROI) which govern full-scale cost drivers: 1) operational timeframe (propagation rate); and 2) ignition point spacing (ROI).
		Off-gas treatment	Selection of vapor treatment depends on concentration, contaminants, regulations, etc.
		Safety concerns	Electrical equipment and cable on cable trays on the ground. High temperature in-well heaters used to initiate the process. Carbon monoxide emitted from the process.
	Full-scale design	Footprint of impacts and timescales for remediation, along with site-specific performance metrics like propagation rate and ROI, govern the number of co-operating ignition points and system sizing (compressor / blower capacity, vapor treatment, etc.).	
		Power application/ consumption	Based on number/type of blowers, compressors, heater, and air treatment requirements.
		Off-gas treatment	Depends on air emissions requirements.
		Safety concerns	Electrical equipment and cable on cable trays on the ground. High temperature in-well heaters used to initiate the process. Carbon monoxide emitted from the process.
	Performance metrics	Temperature in treatment zone	Confirmation of ignition and propagation of the combustion reaction via thermocouples.
		Temperature outside of treatment zone	Protection of utilities and monitoring of combustion front location / propagation rate. Elevated temperature restricted to combustion / heating front which is typically on the order of a couple feet.
		Mass removal rates	Mass destruction rate can be estimated from combustion gas (CO and CO_2) mass loading rates.
		Off-gas concentrations	Monitoring of vapor treatment system performance and permit compliance.
Modeling tools/applicable models		Some proprietary models available.	

Further information	Grant, G.P., D. Major, G. C. Scholes, J. Horst, S. Hill, M. R. Klemmer, J. N. Couch. Smoldering Combustion (STAR) for the Treatment of Contaminated Soils: Examining Limitations and Defining Success, Remediation Journal 26 (3), pp. 27 – 51. http://onlineli
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