FRTR Meeting

May 2017

Web Subgroup Update

FRTR Web Subgroup Update

- Primary focus is still the Technology Matrix Update
- We have agreed on a final Technology Profile Template
- We are finalizing the first two rounds of Profiles
- We have finalized the changes to the Matrix ("Poster")
- We are drafting a revised schedule
- The goal is to mass-produce and review the profiles, eventually only looking at profiles with "significant" comments in detail as a subgroup

Matrix Template

Rating Codes ● Above Average ◑ Average ○ Below Average N/A - "Not Applicable" I/D - "Insufficient Data" ◈ - Level of Effectiveness highly dependent upon specific contaminant and its application	Development Status	Treatment Train	Relative Overall Cost & Performance					Availability	Nonhalogenated VOC's	Halogenated VOC's	Nonhalogenated SVOC's	Halogenated SVOC's	Fuels	Inorganics	Radionuclides	Explosives
			O&M	Capital	System Reliability & Maintainability	Relative Costs	Time									

Development Status and Availability	Cost and Performance				Contaminant Class Applicability Rating (Rating code: ● Demonstrated Effectiveness, ◖ Limited Effectiveness, ○ No Demonstrated Effectiveness, ◊ Level of Effectiveness dependent upon specific contaminant and its application/design, I/D Insufficient Data)								
	Upfront Costs	O&M Costs	Implementability Considerations	Duration	Nonhalogenated VOC	Halogenated VOC	Nonhalogenated SVOC	Halogenated SVOC	Fuels	Inorganics	Radionuclides	Munitions	Emerging Contaminants
Link	*Link*	*Link*	*Link*	*Link*	*Rating*	*Rating*	*Rating*	*Rating*	*Rating*	*Rating*	*Rating*	*Rating*	*Rating*

Profile Template

- Schematic
- Abstract / Other Technology Names
- Description
- Development Status and Availability
- Applicability
- Costs / Duration
- Implementabilty Considerations
- Resources

Profile Section Examples

Development Status and Availability

The following checklist provides a summary of the development and implementation status of phytoremediation:

- ☐ At the laboratory/bench scale and shows promise
- ☐ In pilot studies
- ☒ At full scale
- ☒ To remediate an entire site (source and plume)
- ☐ To remediate a source only
- ☒ As part of a technology train
- ☐ As the final remedy at multiple sites
- ☐ To successfully attain cleanup goals in multiple sites

Phytoremediation is available through the following vendors:

- ☒ Commercially available nationwide
- ☐ Commercially available through limited vendors because of licensing or specialized equipment
- ☐ Research organizations and academia

Section Example

Applicability

Contaminant Class Applicability Rating for Phytoremediation (Rating codes: ● Demonstrated Effectiveness, ◖ Limited Effectiveness, ○ No Demonstrated Effectiveness, ◊ Level of Effectiveness dependent upon specific contaminant and its application/design, I/D Insufficient Data)								
Nonhalogenated VOC	Halogenated VOC	Nonhalogenated SVOC	Halogenated SVOC	Fuels	Inorganics	Radionuclides	Munitions	Emerging Contaminants
◖	●	◖	●	●	◖	◖	●	I/D

Phytoremediation can be used to treat a wide range of inorganic and organic contaminants in shallow groundwater and soil, and is applicable to sites where water uptake is desirable for hydraulic/migration control or treatment. Contaminant classes for which phytoremediation has been applied include nonhalogenated and halogenated VOCs, fuels, inorganics, radionuclides, munitions, polychlorinated biphenyls (PCBs), and pesticides (ITRC, 2009). Full-scale implementation has been documented for phytoremediation for all of these contaminant classes (ITRC, 2009).

Phytoremediation is typically selected when a longer treatment time can be tolerated, and when starting concentrations are relatively low or as part of a treatment train as a polishing step. For groundwater,

Section Examples

Cost

In situ phytoremediation is a passive technology that typically requires little equipment installation (except in some cases where elaborate irrigation systems are required), and the implementation cost is typically low compared to other more aggressive technologies. Phytoremediation is typically selected when a longer treatment time can be tolerated, and when starting concentrations are relatively low or as part of a treatment train as a polishing step. Grid planting of a large number of tree stands is a typical approach for using phytoremediation to provide groundwater hydraulic/migration control. As with all in situ technologies, application costs vary according to site conditions and contaminants. The labor and equipment associated with site preparation and planting represent the primary capital costs for phytoremediation. The cost of the plants themselves can also be a cost driver, although not in all cases. For instance, when planting 9-inch hardwood cuttings of hybrid poplars, the cost of the cuttings themselves is typically just a few hundred dollars. Major cost drivers include:

Upfront Costs

- Degree to which existing infrastructure (e.g., buildings, pavement, and utilities) must be removed in order to plant
- Need for pilot studies or bench-scale tests to demonstrate effectiveness at a particular site
- Need for, and complexity of, irrigation and monitoring systems
- Site climate
- Selected species of plant and growth stage (e.g., hardwood cuttings versus whips)
- Size of treatment area, topography, soil type, and drainage requirements
- Degree of growing media amendments and support materials required

Operation and Maintenance Costs

- Level of plant maintenance, including irrigation, fertilization, pest control, pruning and thinning
- Need for harvesting and disposal (for phytoaccumulation)
- Need to replace plants lost to disease or damage
- Treatment timeframe, which may require plant/tree replacement, which is mostly applicable to hydraulic/migration control applications.

The list above highlights those cost dependencies specific to phytoremediation and does not consider the dependencies that are general to most in situ remediation technologies. Click here for a general discussion on costing which includes definitions and repetitive costs for remediation technologies. A project-specific cost estimate can be obtained using an integrated cost-estimating application such as RACER® or consulting with a subject matter expert.

Section Examples

Implementability Considerations

The following are key considerations associated with implementing phytoremediation:

- Employing specific plant species to target particular contaminants at a site can be difficult because of species adaptability problems.
- Climatic or seasonal conditions may interfere with or inhibit plant growth, slow remediation efforts, or increase the length of the treatment period.
- In addition to climate, site soil type, lithology, and hydrogeology characteristics may not be conducive to needed plant/tree species (e.g., insufficient groundwater yield or transmissivity for tree root systems).
- The transpiration mechanisms of phytoremediation function almost entirely during the active growing season, and during daylight hours when solar radiation drives transpiration. Choosing a mix of species can somewhat accommodate the variation in treatment efficiency resulting from