



## FRTR Screening Matrix and Reference Guide



# FRTR Remediation Technologies Screening Matrix and Reference Guide

Winter FRTR Meeting  
Arlington, VA  
7 December 2005



# SM and RG Background

- **Screening Matrix (SM) and Reference Guide (RG) developed as a user-friendly tool for screening potentially applicable remediation technologies**
- **59 *in situ* and *ex situ* technologies for soil or groundwater remediation**
- **Located on FRTR website: [www.frtr.gov](http://www.frtr.gov)**



## Technology Screening Matrix

Table 3-2: Treatment Technologies Screening Matrix																	
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										
<b>Soil, Sediment, Bedrock, and Sludge</b>																	
<b>3.1 In Situ Biological Treatment</b>																	
	●	●	●	●	●	●	○	●	●	◇	●	○	●	○	◇	○	
	●	●	○	○	○	○	○	●	●	●	◇	●	○	◇	◇	●	
	●	●	●	●	○	○	○	○	○	○	◇	○	○	○	○	○	
<b>3.2 In Situ Physical/Chemical Treatment</b>																	
	●	●	○	○	○	○	○	○	○	○	○	○	○	◇	○	○	
	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
<b>3.3 In Situ Thermal Treatment</b>																	
	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
<b>3.4 Ex Situ Biological Treatment (assuming excavation)</b>																	
	●	●	●	●	●	●	○	●	●	○	◇	●	○	◇	○	○	
	●	●	●	●	●	●	○	●	○	○	◇	●	○	○	○	●	
	●	●	●	●	●	●	○	●	○	○	◇	○	○	○	○	◇	
	●	○	○	○	○	○	○	○	○	○	◇	○	○	○	○	○	
<b>3.5 Ex Situ Physical/Chemical Treatment (assuming excavation)</b>																	
	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	



# Member Agency Support

- **USAEC manages SM and RG updates in coordination with SM Committee**
- **SM Committee includes members from FRTR member agencies and the Interstate Technology and Regulatory Council (ITRC)**





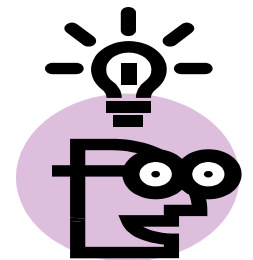
# Member Agency Support

- **SM Committee provides direction and final approval for updates**
- **Current revisions to SM and RG initiated by SM Committee in early FY04**



# Current Efforts

- **Create a user-friendly SM format that compares/contrasts multiple remediation technologies**
- **Update cost estimates for selected soil and groundwater technologies in RG**





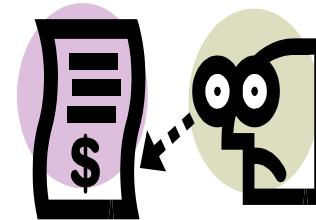
# Screening Matrix Poster

- Establish consistent and uniform rating scale
- Display only three main ranking symbols similar to the *Consumer Report* format:
  - = Above Average
  - ◐ = Average
  - = Below Average
- Eliminate and/or consolidate some categories to simplify use of legend and definitions



# Cost Updates

- **Cost data in RG outdated, oversimplified and in some cases nonexistent**



- **SM Committee directives:**

- **Estimate costs for several technologies and update technology profile cost sections in RG**
- **Utilize a standardized cost estimating tool (RACER) to provide a systematic, reproducible process to develop ranges of cost estimates for technologies at sites of varying complexity**
- **Present cost results in three tiers to aid all levels of SM users**





# Cost Updates

In FY05 completed 14 RACER-based cost updates for 8 soil and 6 groundwater technologies.

## Soil

Bioventing  
Phytoremediation  
Soil Vapor Extraction  
Chemical Extraction  
Soil Washing  
Incineration  
Thermal Desorption  
Solidification / Stabilization

## Groundwater

Phytoremediation  
Air Sparging  
Chemical Oxidation  
Air Stripping (Packed Towers)  
Air Stripping (Low Profile Towers)  
Passive / Reactive Treatment Walls



# RACER Approach

- **RACER was utilized to develop updated ranges of cost estimates, including the primary aspects of the cost drivers**
- **The site conditions were defined as follows:**
  - **Multiple scenarios (usually 4) for technology application utilized in RACER to develop the range of costs**
  - **Scenarios developed with varying complexity and scale of application**
  - **A standard “mini-matrix” was established that defines technology application varying between small/large sites with either simple/complex conditions**



# RACER Approach

## TIER 1: Simple range of costs at sites of varying complexity

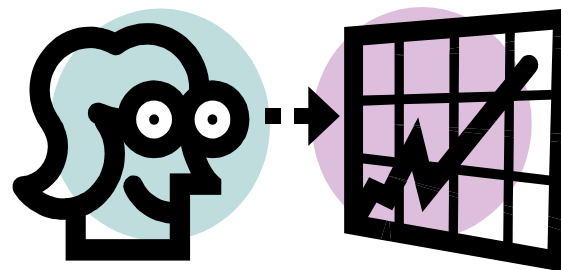
SOIL TECHNOLOGY:		Bioventing			
RACER PARAMETERS	Scenario A	Scenario B	Scenario C	Scenario D	
	Small Site		Large Site		
	Easy	Difficult	Easy	Difficult	
	COST PER CUBIC FOOT	\$5.18	\$6.03	\$0.84	\$1.80
COST PER CUBIC METER	\$182.9	\$212.8	\$29.8	\$63.4	
COST PER CUBIC YARD	\$139.8	\$162.7	\$22.8	\$48.5	



# RACER Approach

**TIER 2: Key parameters that impact total costs**

**TIER 3: All elements that contribute to the final estimated costs**



# FRTR Screening Matrix and Reference Guide



<b>SOIL TECHNOLOGY: Bioventing</b>				
<b>RACER PARAMETERS</b>	Scenario A	Scenario B	Scenario C	Scenario D
	Small Site		Large Site	
	Easy	Difficult	Easy	Difficult
Type of Installation	Vertical Well	Vertical Well	Vertical Well	Vertical Well
Soil Type	Silt/Silty-Clay mixture	Silt/Silty-Clay mixture	Silt/Silty-Clay mixture	Silt/Silty-Clay mixture
Safety Level	D	D	D	D
Surface Area of Contamination (SF)	450	2,700	9,000	54,000
Depth to Base of Contamination (ft)	30	5	30	5
Contaminated Volume (Cubic Feet)	13,500	13,500	270,000	270,000
Contaminated Volume (Cubic Yards)	500	500	10,000	10,000
<b>Drilling</b>				
Avg. Well Depth (ft)	30	5	30	5
Formation type	Unconsolidated	Unconsolidated	Unconsolidated	Unconsolidated
Safety Level	D	D	D	D
Well Diameter (in)	2	2	2	2
Drilling Method	Hollow Stem	Hollow Stem	Hollow Stem	Hollow Stem
Well Construction Material	PVC Schedule 40	PVC Schedule 40	PVC Schedule 40	PVC Schedule 40
Avg. # of soil samples per well	1	1	1	1
Contaminant of interest	SVOCs	SVOCs	SVOCs	SVOCs
Extraction Well Spacing (ft)	22	22	22	22
# of Vapor Extraction Wells	2	8	24	143
Avg. Vapor Flow Rate per well (CFM)	1.5	1.5	1.5	1.5
Total Vapor Flow Rate (CFM)	3.0	12.0	36.0	214.5
Bioventing Marked-up Costs	\$23,930	\$35,378	\$125,772	\$360,956
<b>Additional Costs:</b>				
O&M	\$35,978	\$35,978	\$88,076	\$88,076
Years of O&M	2.0	2.0	5.0	5.0
Remedial Design (\$10K or 10%)	\$10,000	\$10,000	\$13,835	\$36,096
<b>TOTAL MARKED-UP COSTS</b>	<b>\$69,908</b>	<b>\$81,356</b>	<b>\$227,683</b>	<b>\$485,128</b>
<b>COST PER CUBIC FOOT</b>	<b>\$5.18</b>	<b>\$6.03</b>	<b>\$0.84</b>	<b>\$1.80</b>
<b>COST PER CUBIC METER</b>	<b>\$182.9</b>	<b>\$212.8</b>	<b>\$29.8</b>	<b>\$63.4</b>
<b>COST PER CUBIC YARD</b>	<b>\$139.8</b>	<b>\$162.7</b>	<b>\$22.8</b>	<b>\$48.5</b>



# Future Efforts

- **Post “Revised SM” on the FRTR website**
- **Post approved cost updates on FRTR website**
- **Coordinate with SM Committee to determine the focus of the 2006 update**

# FRTR Screening Matrix and Reference Guide



## Questions?

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