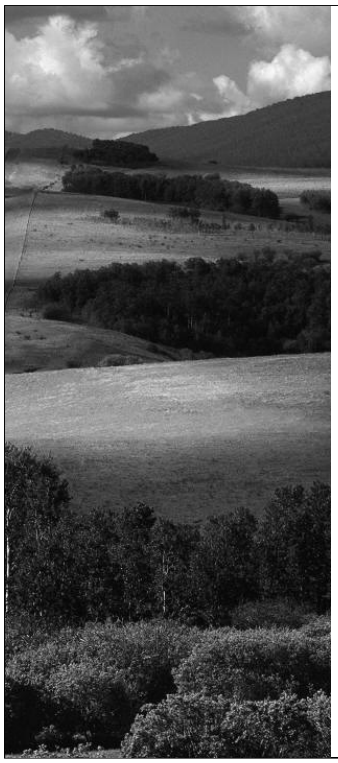

Green Remediation

ConSoil 2008 Special Session
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Carlos Pachon
US EPA
Office of Superfund Remediation & Technology Innovation
pachon.carlos@epa.gov

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What is "Green Remediation"?

Green Remediation - The practice of considering the environmental effects of a remediation strategy (i.e., the remedy selected and the implementation approach) early in the process, and incorporating options to maximize the net environmental benefit of the cleanup action.

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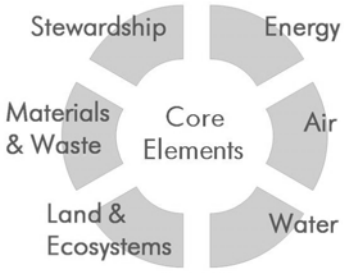
Opportunities to Increase Sustainability in Site Cleanups

- Apply to all cleanup programs
- Exist throughout site investigation, design, construction, operation, and monitoring
- Address core elements



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Core Elements:
Energy Requirements

- Optimized passive-energy technologies, with little or no demand for external utility power
- Energy-efficient equipment operating at peak performance
- Periodic evaluation and optimization of equipment with high energy demand
- Renewable energy systems to replace or offset grid electricity

Core Elements: Air Emissions

- Optimal use and proper maintenance of heavy equipment
- Use of cleaner fuel and retrofit diesel engines for heavy equipment
- Modified operations to reduce operating & idle time
- Minimized dust export of contaminants

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Soil erosion

No till

Plant growth – photosynthesis – permanent vegetative cover can store CO2 as organic carbon; land cover is greatly effected by land use/management

Soil disturbance – removes carbon from soil carbon pol --- erosion, tilling are major factors in soil degradation and loss of OM. Significant amts of CO2 are lost after tillage

Core Elements:
Water Requirements and Resources

- Minimum fresh water use and maximum reuse during treatment and site operations
- Reclaimed treated water for beneficial use or aquifer storage
- Native vegetation requiring little or no irrigation
- Prevention of water quality impacts such as nutrient-loading

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Core Elements:
Land and Ecosystems

- Minimally invasive in situ techno
- Passive energy technologies as primary remedies or “finishing steps”
- Minimal soil and habitat disturbance
- Adopt ecorestoration and reuse practices
- Reduced noise and lighting disturbance

Core Elements: Material Consumption and Waste Generation

- Technologies designed to minimize waste generation
- Reuse and recycling of materials, including C&D debris
- Minimized extraction and disposal of natural resources
- Passive sampling devices producing minimal waste

Core Elements: Long-Term Stewardship

- Reduced emission of CO_2, methane, and other greenhouse gases
- Adaptive management approach integrated into long-term actions and redevelopment
- Renewable energy systems for long-term cleanup and future economic benefit
- Leverage of remedy infrastructure for reuse

Carbon & Energy Footprints of Superfund Cleanup Technologies

Technology	Estimated Energy Annual Average ($kWh*10^3$)	Total Estimated Energy Use in 2008-2030 ($kWh*10^3$)
Pump & Treat	489,607	11,260,969
Thermal Desorption	92,919	2,137,126
Multi-Phase Extraction	18,679	429,625
Air Sparging	10,156	233,599
Soil Vapor Extraction	6,734	154,890
Technology Total	*618,095*	*14,216,209*
	Annual Carbon Footprint (MT CO2)	
Sum of 5 Technologies	404,411	

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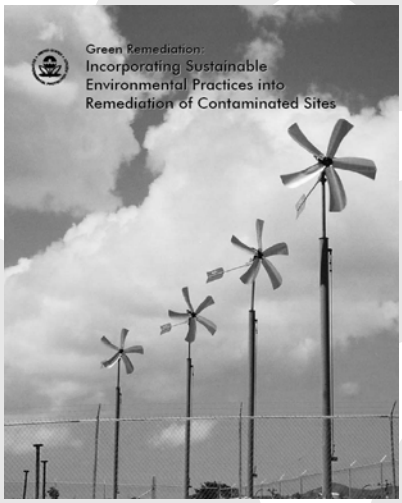
Green Remediation Profile: Ferdula Landfill, Frankfort NY

- Soil vapor extraction relying on wind power to draw vacuum from landfill vents
- Exclusively off-grid operations providing a pulsed effect for carbon removal of VOCs
- VOC concentrations in soil reduced over 90% in five years of operation

EPA Green Remediation Primer

- Provides introduction to best practices with examples of how and where they are used
- Focuses on remedy implementation across regulatory frameworks
- Released April 2008, available at; http://cluin.org/greenremediation



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