



EPA Cross-Program Considerations



Green Remediation
Energy-Environment- Economics
International Conference

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Introduction

- What is Green Remediation?
- GR Core Elements Primer
- OSWER's Goals and Strategies
- OSWER's GR Principles
- Superfund GR Strategy
- Online Resources

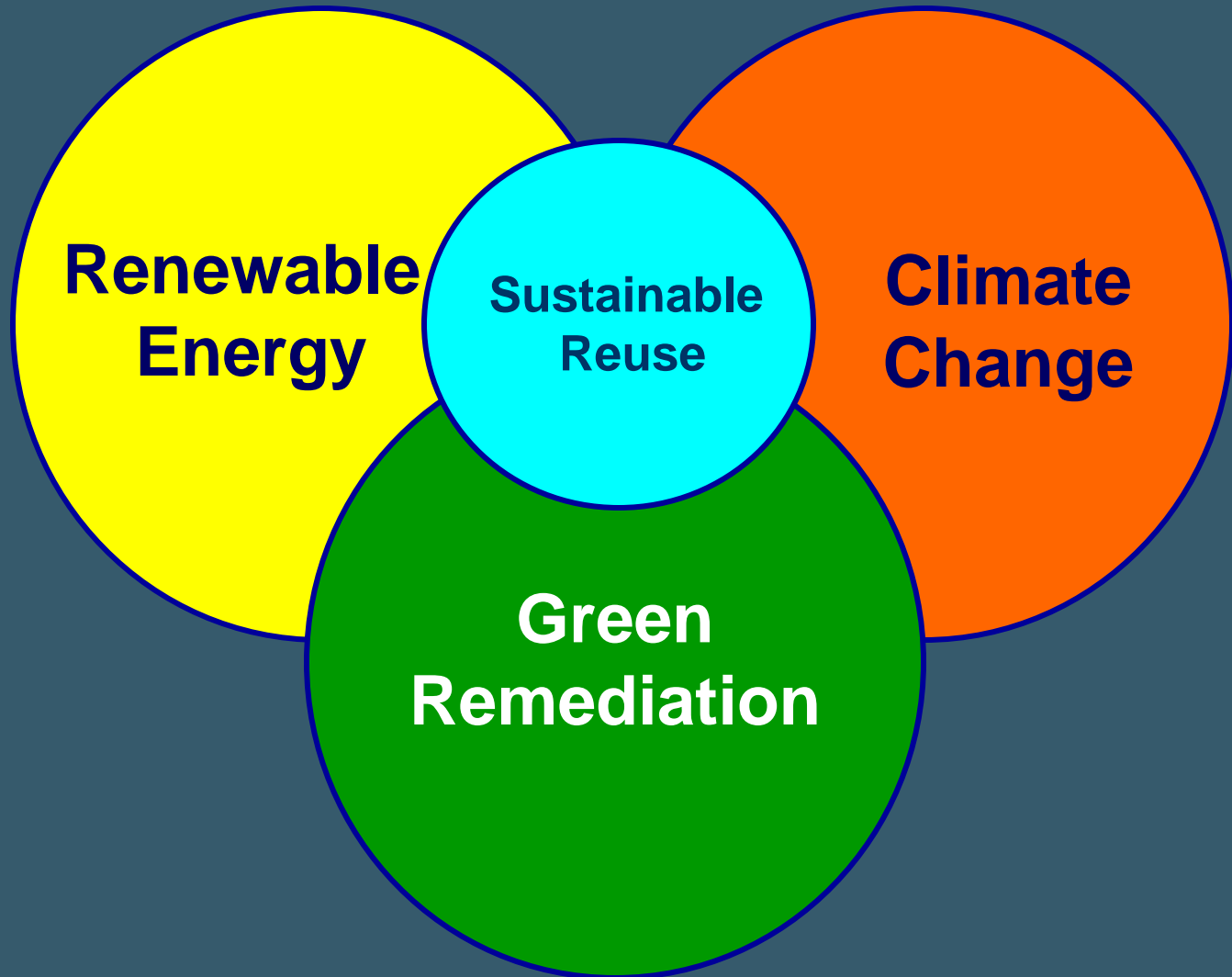


What is “Green Remediation”?

The practice of considering all environmental effects of remedy implementation and incorporating options to minimize the environmental footprints of cleanup actions.



Related But Not Synonymous





Green Remediation: Common Themes in Site Cleanup Programs

- Fits within existing frameworks
- Opportunities exist throughout site investigation, design, construction, operation, and monitoring
- Addresses core elements
- Relevant across clean-up programs





Core Elements of Green Remediation





Superfund Energy & Carbon Footprint

Technology	Estimated energy use Annual Avg. (kWh*10 ³)	Total estimated energy use 2008-2030 (kWh*10 ³)	Estimated CO2 emissions Annual Avg. ² (metric tons)	Total estimated CO2 emissions 2008– 2030 (metric tons)
Pump & Treat	489,607	11,260,969	323,456	7,439,480
Thermal Desorption	92,919	2,137,126	57,756	1,328,389
Multi-Phase Extraction	18,679	429,625	12,000	276,004
Air Sparging	10,156	233,599	6,499	149,476
Soil Vapor Extraction	6,734	154,890	4,700	108,094
Total	618,095	14,216,209	404,411	9,301,443



Estimating the Baselines

Diesel Consumption in an Illustrative Excavation and Soil Amendment Project	Diesel Consumption (gallons)	PM Emission (pounds)^(a)	NOx Emission (pounds)^(a)	CO₂ Emission (tons)^(a)
Removing contaminated soil through use of an earth mover with a 1990 200-hp engine operating for 100 days	6,400	100	1,100	70
Hauling 35,000 yard ³ of excavated soil to an offsite waste disposal facility 300 miles away, by way of 60-yard ³ , 425-hp tractor trailers ^(b)	77,000	770	10,970	850
Importing wood milling and agricultural waste from sources 50 miles away, by way of a 60-yard ³ , 300-hp truck ^(b)	2,400	100	1400	30
Applying 2,000 tons of soil amendments over 20 acres, using a 1990 290-hp, 60-yard ³ dump truck and 1990 170-hp grader	260	8	1	3
Using two medium-duty pickup trucks for site preparation and remedy construction over six months ^(b)	380	7	170	4
Total diesel consumption and air emissions	86,440 gallons	985 pounds	13,641 pounds	957 tons

^(a) Diesel Emissions Quantifier;
<http://cfpub.epa.gov/quantifier/view/welcome.cfm>
^(b) including use of ULSD, as required for on-road applications

Adding retrofitting devices such as a NOx catalyst and a diesel particulate filter could reduce these emissions by as much as 25% for NOx and 90% for PM.



Green Remediation Starts with Effective Characterization

- Green remediation is a “life cycle” concept (assessment to close-out/reuse)
- Characterization occurs throughout life cycle of project, at all sites
- High resolution or optimized assessment and investigation processes can support green remediation can minimize footprints by:
 - Reducing energy use, material consumption, waste generated, carbon during field sampling events (moderate impact, may be greater impact)
 - Reduce need for repeated events (moderate to significant impact)



Green Remediation Starts with Effective Characterization

- High resolution or optimized assessment and investigation processes can support green remediation, can minimize footprints by: (*cont.*)
 - Impacting efficiency of clean-ups
 - Reducing amount of material excavated, footprint and energy use of excavation
 - Improve source treatment – more effective targeting (e.g., oxidants, surfactants, heat, etc.)
 - Improved (optimized) operation of treatment and monitoring systems
 - Remediation timelines
 - ***BIG IMPACT***



OSWER's Goals and Strategies

There's Still Much Work to Do



A Priority at Many Levels

OSWER Policy: Principles for Greener Cleanups

*As a matter of policy, OSWER's goal is to evaluate cleanup actions comprehensively to ensure protection of human health and the environment and to reduce the environmental footprint of cleanup activities, to the maximum extent possible.
(OSWER A.A. Mathy Stanislaus)*

EPA Strategic Plan: Goal 5 Compliance and Environmental Stewardship

*Stewards of the environment recycle wastes to the greatest extent possible, minimize or eliminate pollution at its source, conserve natural resources, and use energy efficiently to prevent harm to the environment or human health. By 2011, enhance public health and environmental protection and increase conservation of natural resources by promoting pollution prevention and the adoption of other stewardship practices by companies, communities, governmental organizations, and individuals.
(EPA Administrator Steve Johnson)*

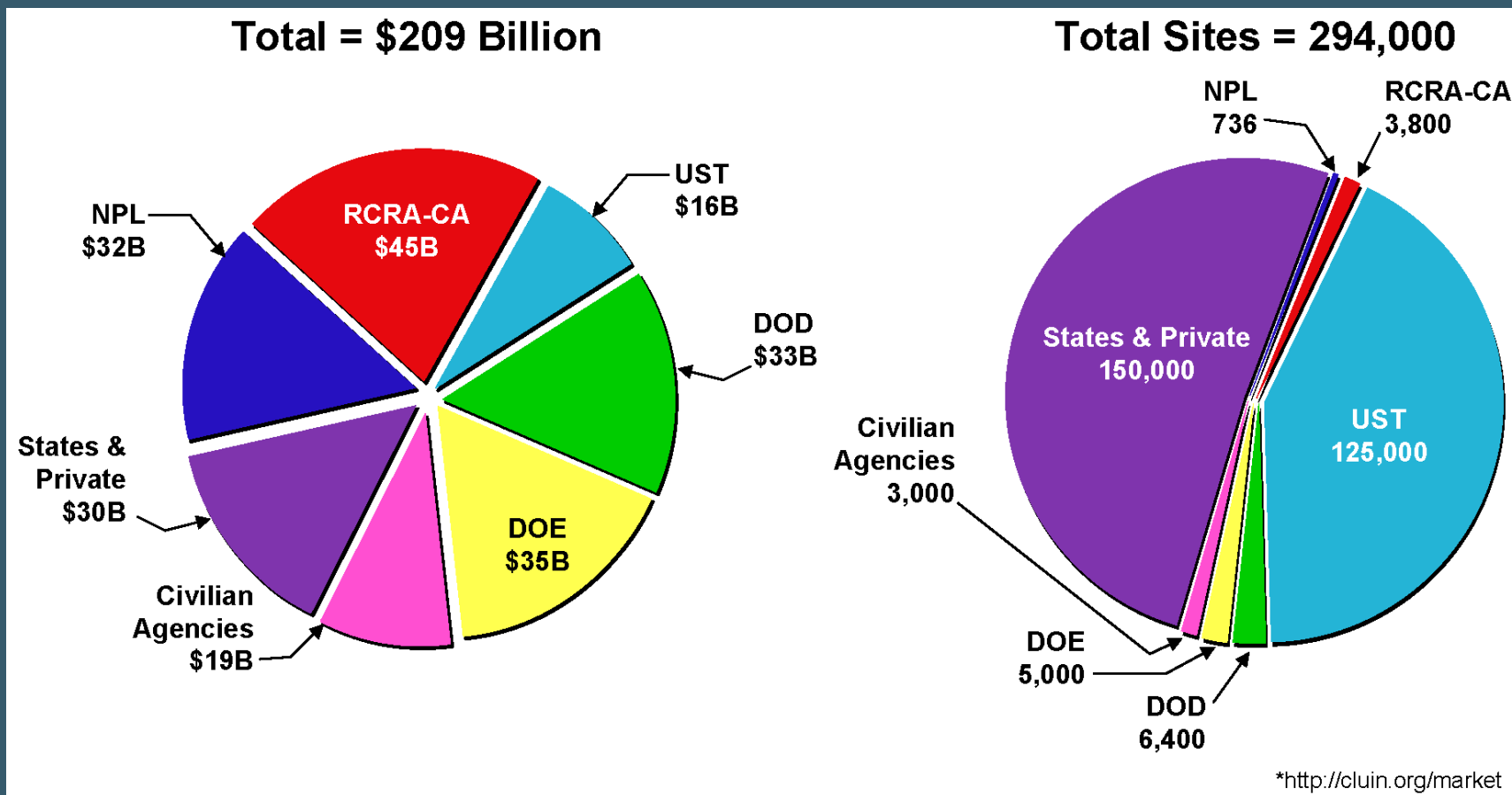
EO 13514: Federal Leadership in Environmental, Energy, and Economic Performance

*It is the policy of the United States that Federal agencies shall increase energy efficiency; measure, report, and reduce their greenhouse gas emissions from direct and indirect activities; conserve and protect water resources through efficiency, reuse, and stormwater management; eliminate waste, recycle, and prevent pollution
(President Obama)*



Long Term Goals

Estimated Number of Sites and Cleanup Cost 2004-2033*



Source: www.clu-in.org/market



Challenge – Multiple Waste Programs

- Different statutes
- Different funding
- Regulatory oversight varies
- Objectives vary
- Requires different strategies – concepts still the same
- Requires different support



Adjusting to Program Priorities (*a few examples*)

- Emergency response – urgency
- Tanks – size, timelines
- Brownfields – reuse objectives
- Voluntary clean-ups – well, voluntary
- RCRA – operating facilities
- Superfund – enforcement, maturity
- Federal facilities, DoD/DOE – scale, mission
- Other feds (e.g., mining) – size, location



Optimizing Existing Remedies

- Large target of opportunity, particularly in Superfund
 - Large number of sites
 - Remedies operating for extended periods
 - Needs of systems change over time
- Other programs have “legacy” sites
- Optimization principles can be applied earlier in the process
 - Investigation process
 - Design review
 - Value engineering



OSWER Green Remediation “Strategy”

- Principles for Greener Cleanups: Common policy position for all U.S. EPA cleanup programs
- Superfund Green Remediation Strategy: “Operationalizing” the Principles in the Superfund Cleanup Program
- Voluntary Green Cleanup Standards & Certification System: Robust tool for fostering greener cleanups in various cleanup programs
- RE-Powering America’s Land: Renewable energy on contaminated lands
- Regional Initiatives
 - Climate change strategies
 - Policy and guidance development, etc .

Key Action	Description
Policy and Guidance Development	
Key Action #1	Clarify the role of green remediation in remedy selection and implementation
Resource Development and Program Implementation	
Key Action #2	Develop a compendium of protocols and tools to help project and Program managers integrate green remediation practices
Key Action #3	Identify options that enable use of green remediation practices
Key Action #4	Address air pollutants and diesel emissions
Key Action #5	Develop pilot projects to evaluate and demonstrate green remediation applications
Key Action #6	Establish opportunities in contracts and assistance agreements to identify green remediation practices in selected remedies
Key Action #7	Communicate and share success stories and lessons learned among “implementers” across the Program and the public
Program Evaluation	
Key Action #8	Evaluate green remediation application at the site level
Key Action #9	Develop Program evaluation measures
Key Action #10	Evaluate the Superfund Green Remediation Strategy





OSWER

Green Remediation Principles

Goal - Evaluate cleanup actions comprehensively to ensure protection of human health and the environment and to reduce the environmental footprint of cleanup activities, to the maximum extent possible.

• <http://www.epa.gov/oswer/greencleanups/principles.html>



OSWER

Green Remediation Principles

- Consistent with existing laws and regulations, it is OSWER policy that all cleanups:
 - Protect human health and the environment
 - Comply with all applicable laws and regulations
 - Consult with communities regarding response action impacts consistent with existing requirements
 - Consider recommended five core elements
- *The Principles are not intended to trade cleanup program objectives for other environmental objectives.*



Green Remediation Support Systems In Place

- Green remediation primer, website, and profiles of projects, Internet seminars, and archived discussions
- Tech support for Federal and State project managers
- Renewable energy fact sheets, website, and IA with NREL
- 8-hour and 4-hour in NARPM and OSC Readiness training in 2009 and 2010
- Regional leadership
- Contracts & Administrative toolkit
- Green Remediation pilots



Superfund Green Remediation Strategy

Overview and
10 Key Action Items



Superfund GR Strategy: Overview

- Sets out the Superfund Program's plans to promote green remediation practices during site cleanups without compromising cleanup goals
- Covers three areas:
 - Policy and Guidance
 - Resource Development and Program Implementation
 - Evaluation
- Includes 10 "Key Actions"; each action includes several implementation activities (46 total)



Superfund GR Strategy: Overview

- No “tenth” criteria
- Can include “green” considerations, actions into existing process
 - Overall protection of human health and environment
 - Compliance with ARARs
 - Long-term effectiveness and permanence
 - Short-term effectiveness
 - Implementability
 - Costs
 - State, community acceptance
- Key: Documentation in ROD, Administrative Record



Superfund GR Strategy Status of Public Comment

- Approximately 40 individual comments were received.
- Over 100 pages of feedback and comments, in the majority positive and constructive.
- Recurring themes include;
 - Request for guidance on environmental footprint evaluation
 - Request for guidance on remedy selection
 - Technology developer proposals for green solutions
 - Suggestions on scope
- Comments are being addressed in a “Triage” mode (direct edits, minor additions/modifications, and major changes requiring discussion).



Concerns/Obstacles/ Answers

- Common concerns
 - “Green” as a guise to “do nothing”
 - “Green” to stretch out timelines of clean ups
 - “Green” as an added burden on regulated community
 - “Green” increases costs and requirements on clean-up programs (Federal and State)
 - “Green” means different things to different people – no standard definition
 - Green vs. sustainable
 - Worker safety
 - Land as a resource
 - Communities



Concerns/Obstacles/ Answers

- Obstacles or hurdles
 - Competing definitions
 - “Silver bullet” mentality
 - Administrative
 - Contracting
 - Budgets
 - Regulations
 - Performance measures
 - Proliferation of decision tools
 - Lack of “applied” information, tracking and measurement tools, training
 - Singular focus on energy, carbon
 - Enforcement issues



Concerns/Obstacles/ Answers

- (Some) answers
 - Clear and active focus on need to support protectiveness of remedy, other requirements
 - Focus on implementation vs. focus on selection
 - Advance understanding that green remediation is not a new technology, its improving the tools we are already using
 - Addressing contracting issues
 - Improving understanding of costs, pros/cons (“certification”); common measurements/metrics
 - Providing a growing collection of information resources, training, tools
 - Interagency collaboration



Reuse / Revitalization

Restoring contaminated and
potentially contaminated
sites to productive use



Reuse / Revitalization Challenge: Part of the Sustainability Equation

- True “site” life cycle
- U.S Census estimates population growth of 60 million within next decade (= California x 2)
- Cultural value of open space is high
- Quantity of livable open space is limited
- Leverage existing infrastructure: focus on urban corridor redevelopment
- Cleanup of contaminated sites is critical to maximizing full site reuse potential



Green “Opportunities”

- New focus on green jobs and green economy
- Job training programs
- Opportunities for small businesses
 - Sustainable
 - How do we build capacity of small, minority-owned and disadvantaged businesses

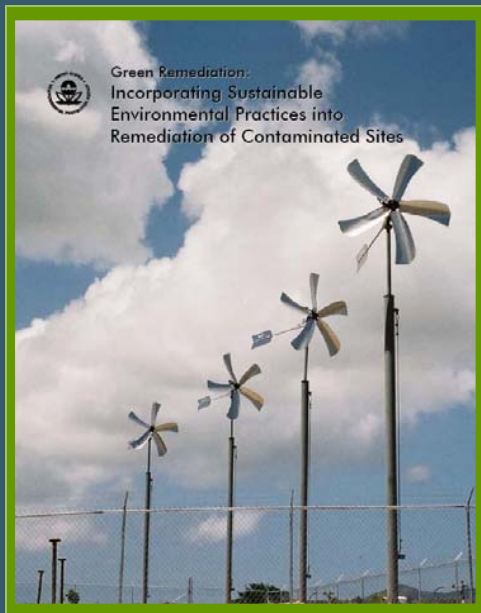


More Information from U.S. EPA

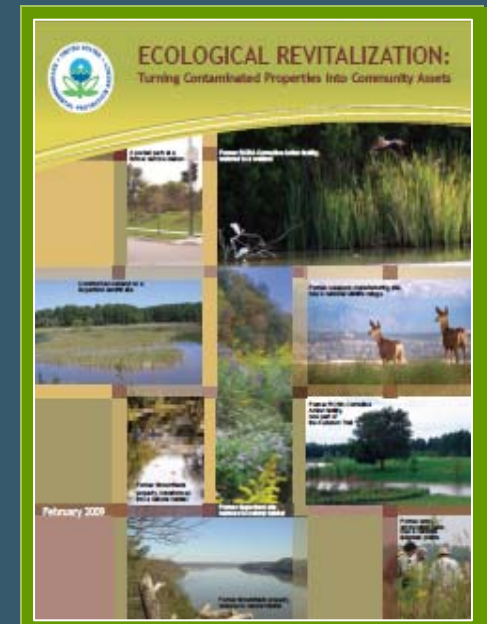


www.clu-in.org/greenremediation

- Guidance Documents
- Special Issues Primers
- Technical Bulletins
- Fact Sheets / Case Studies
- Technology Descriptions
- Internet Resources



Aerojet-General Corporation	CA	☀️	♻️			
Altus Air Force Base	OK	☀️	♻️	💧		♻️
Apache Powder	AZ	☀️	♻️	💧		
Barksdale AF Base	LA			💧	🌲	♻️
BP Casper	WY				🌲	♻️
BP Paulsboro	NJ	☀️	♻️			
California Gulch	CO		♻️			♻️
Crozet Orchard	VA	☀️	♻️	💧		
De Sale Restoration Area	PA	☀️	♻️	💧	🌲	♻️
Delfasco Forge	TX	☀️	♻️			♻️
Former Carswell Air Force Base	TX	☀️	♻️			♻️
Former Ferdula Landfill	NY	☀️				
Former Nebraska Ordnance Plant	NE	☀️				
Former St. Croix Alumina Plant	VI	☀️	♻️			♻️
Fort Carson	CO	☀️	♻️	💧		♻️
Frontier Fertilizer Superfund Site	CA	☀️	♻️			



www.epa.gov/superfund/greenremediation



Thank You!

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