



Green Remediation: Maximizing the Benefit of Site Cleanups

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Green Approaches in Cleanup & Redevelopment



**Deconstruction,
Demolition, and
Removal**

**Cleanup,
Remediation, and
Waste Management**

**Design and
Construction for
Reuse**

**Sustainable Use
and Long Term
Stewardship**

- Reuse/recycle deconstruction and demolition materials
- Reuse materials on site whenever possible
- Consider future site use and reuse existing infrastructure
- Preserve/Reuse Historic Buildings
- Use clean diesel and low sulfur fuels in equipment and noise controls for power generation
- Retain native vegetation and soils, wherever possible
- Protect water resources from runoff and contamination

- Power machinery and equipment using clean fuels
- Use renewable energy sources, such as solar, wind, and methane to power remediation activities
- Improve energy efficiency of chosen remediation strategies
- Select remediation approaches, such as phytoremediation, that reduce resource use and impact on air, water, adjacent lands, and public health
- Employ remediation practices that can restore soil health and ecosystems and, in some cases, sequester carbon through soil amendments and vegetation

- Use Energy Star, LEED, and GreenScapes principles in both new and existing buildings
- Reduce environmental impact by reusing existing structures and recycling industrial materials
- Incorporate natural systems to manage stormwater, like green roofs, landscaped swales, and wetlands
- Incorporate Smart Growth principles that promote more balanced land uses, walkable neighborhoods, and open space
- Create ecological enhancements to promote biodiversity and provide wildlife habitat and recreation

- Reduce use of toxic materials in manufacturing, maintenance, and use of buildings and land
- Minimize waste generation, manage waste properly, and recycle materials used/generated
- Maintain engineering and institutional controls on site where waste is left in place
- Reduce water use by incorporating water efficient systems and use native vegetation to limit irrigation
- Maximize energy efficiency and increase use of renewable energy
- Take appropriate steps to prevent (re)contamination



What is Green Remediation?

The practice of considering all environmental effects of a cleanup during each phase of the process, and incorporating strategies to maximize net environmental benefit of the cleanup.

Focus is on remedy implementation vs. remedy selection



Opportunities to Increase Sustainability in Site Cleanups

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



The Mandate

- **Executive Order 13423, January 26, 2007-Strengthening Federal Environmental, Energy, and Transportation Management**
 - Section 1. Policy. It is the policy of the United States that Federal agencies conduct their environmental, transportation, and energy-related activities under the law in support of their respective missions in an environmentally, economically and fiscally sound, integrated, continuously improving, efficient, and sustainable manner.
- **EPA Strategic Plan Goal 1: Clean Air and Global Climate Change**
 - Protect and improve the air so it is healthy to breathe and risks to human health and the environment are reduced. Reduce greenhouse gas intensity by enhancing partnerships with businesses and other sectors.
- **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.



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 and idle time
- Minimized dust export of contaminants



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 (regrading, vegetative caps, etc)
- Prevention of surface water quality impacts such as nutrient-loading



Core Elements: Land and Ecosystems

- Plan for minimizing soil and habitat disturbance, and recycle topsoil where possible
- Identify and clear site of sensitive/endangered species
- Pursue revegetation with native species and integration with local habitats: “ecorestoration”
- Reduce noise and lighting disturbance



Core Elements: Material Consumption and Waste Generation

- Technologies designed and operated 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 CO₂, methane, and other greenhouse gases
- Integrate remedial decisions with reuse decisions
- Renewable energy systems for long-term cleanup and future economic benefit
- Leverage of remedy infrastructure for reuse



Core Elements: Energy Requirements

- 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
- Managed demand to leverage low peak capacity and rates



Carbon & Energy Footprints of Superfund Cleanup Technologies

Technology	Estimated Energy <i>Annual Average</i> (kWh*10 ³)	Total Estimated Energy Use <i>in 2008-2030</i> (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
<i>Technology Total</i>	<i>618,095</i>	<i>14,216,209</i>
	Annual Carbon Footprint (MT CO₂)	
Sum of 5 Technologies	404,411	



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 gas reduced over 90% in five years of operation



Green Remediation Profile: Operating Industries Landfill, Monterey Park CA

- Meets about 70% of plant needs (thermal oxidizer, refrigeration, and air blower)
- Six 70-kW microturbines for landfill gas collection (5,500 scfm) at Superfund site
- Savings reaching up to \$400,000 each year through avoided grid electricity



Green Remediation Profile: St. Croix Alumina, St. Croix VI

- PV panels generating electricity for fluid-gathering system during oil recovery
- Wind-driven turbine compressors and electric generators powering pumps to recover free-product oil
- Reclaimed oil from RCRA site used for refinery feedstock



The Green Remediation Toolkit

Existing

- Green remediation primer
- Profiles of projects and case studies on EPA green remediation site
- Upcoming internet seminars, and archived discussions (clu.in.org)
- Green remediation tech support for Federal and State project managers
- Contracts toolkit for RACs

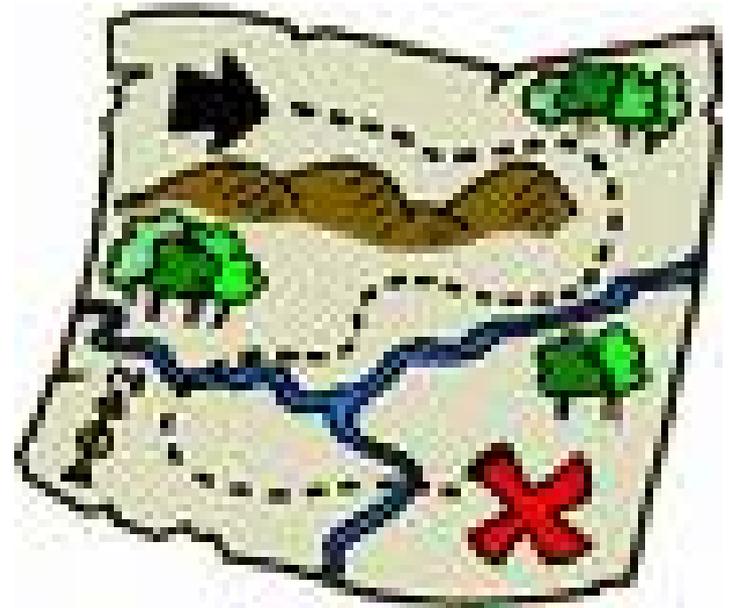
In the pipeline

- MOU with NERL
- MOU with the USACE recognizing and fostering GR BMPs at Superfund cleanups
- Contracts toolkit for ERRS
- Green remediation certification program
- Remedy specific green remediation “cheat sheets”
- Site cleanup energy audit tool
- Who’s who in green remediation (EPA Intranet)
- ER3 for Green remediation



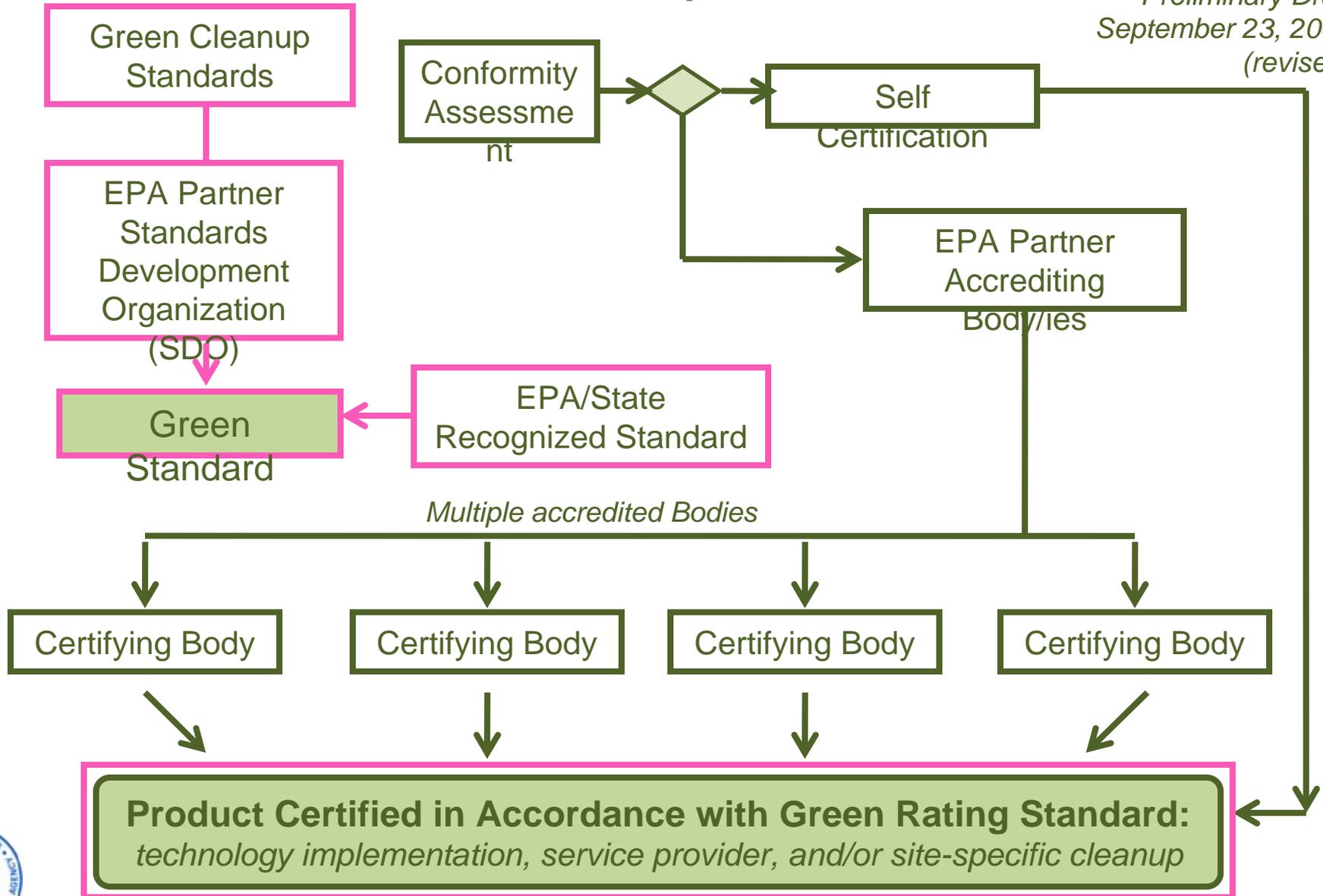
Green Cleanups Certification: Conceptual Paper

- What are we certifying?
 - Projects
 - Individuals
- What does the structure look like?
 - Leed (rating system)
 - ISO 14000 (management system)
 - Other
- Who is the certifier?
 - Self certification (audits)
 - 3rd party
- What are the incentives?
 - Monetary
 - Emotional
 - Branding
- What is our approach for a consensus developing process
 - Standards Developing Organization
 - Non-profit



Conceptual Structure of Recognition Program for Green Site Cleanups

Preliminary Draft
September 23, 2008
(revised)



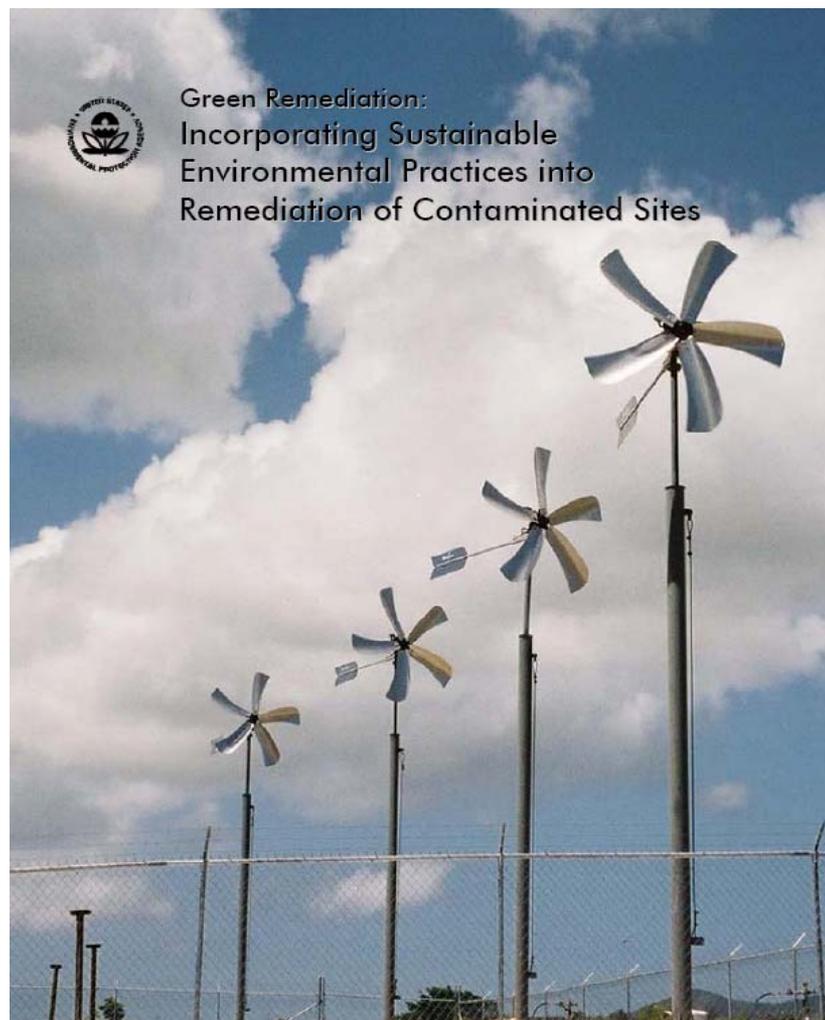
Green Remediation: A Workers' Perspective

- Worker health and safety remain the top priority, along with remedy protectiveness
- Were not seeing “GR” technologies, we’re seeing GR best practices
- Best practices often id’d on ground, at the site level – importance of worker training and empowerment
- Companies with strong sustainability principles often have robust EMS systems and SHE policies



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://clu.in.org/greenremediation>



Green Remediation on the Web

www.clu-in.org/greenremediation

CLU-IN.ORG | Green Remediation | Overview - Microsoft Internet Explorer

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Green Remediation

Join the Earth Day Green Remediation Panel Session

EPA Releases Green Remediation Technical Primer

Overview

Technical Information

Profiles of Green Strategies

Sustainability

EPA is committed to developing and promoting innovative cleanup strategies that restore contaminated sites to productive use, reduce costs, and promote environmental stewardship, while ensuring that cleanups are protective of human health and the environment. In accordance with EPA's strategic plan for compliance and environmental stewardship, the Agency strives for cleanup programs that use natural resources and energy efficiently, reduce negative impacts on the environment, minimize pollution at its