Sustainability in Site Cleanup and Redevelopment: The Big Picture

USEPA-ILEPA
Internet Seminar
December 3, 2008

Sara Rasmussen
USEPA, Office of Solid Waste

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What is "Sustainable?"

EXECUTIVE ORDER 13423, JANUARY 26, 2007-

"§9(k)-"sustainable" means to create and maintain conditions, under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic, and other requirements of present and future generations…"

EPA Website -
Sustainability: means meeting the needs of the present without compromising the ability of future generations to meet their needs

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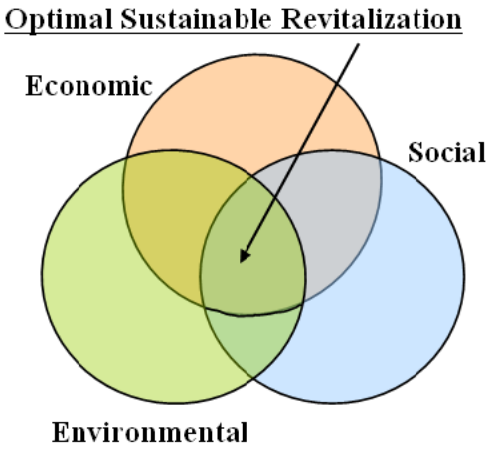
What is Sustainable Revitalization?

***Sustainable Revitalization** is a holistic approach to the cleanup and revitalization of a property.*

It considers a broad array of environmental factors and community impacts during all phases (demolition, waste remediation, design and construction, reuse), in order to maximize the environmental, social, and economic benefits associated with a project.



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EPA Strategic Objectives Support Sustainable Approaches

EPA STRATEGIC PLAN 2006-11

"EPA's Cleanup Programs have set a National Goal of returning Formerly Contaminated sites to long-erm, sustainable and productive use."

EPA ADMINISTRATOR'S ACTION PLAN

- …[F]oster technological innovations to support the clean development of domestic energy resources (oil, gas, nuclear, coal, wind, and solar)
- Restore contaminated properties, including brownfields, to environmental and economic vitality
- Promote stewardship through increased resource conservation, including waste minimization and recycling
- Expand the use of biofuels and promote diesel emissions reductions through retrofit and other technologies

OFFICE OF SOLID WASTE AND EMERGENCY RESPONSE (OSWER) ACTION PLAN

- Promote the reduction, reuse, and recycling of both municipal and industrial wastes
- Encourage the appropriate reuse and revitalization of brownfields, USTfields, Superfund sites, RCRA facilities, BRAC sites, and other federal properties

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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**

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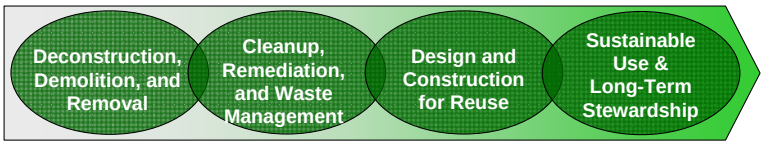
Making Land Revitalization Projects Greener



Look for green opportunities throughout all phases of a revitalization project!

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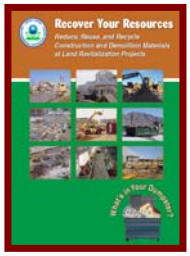
Some Examples

- **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**



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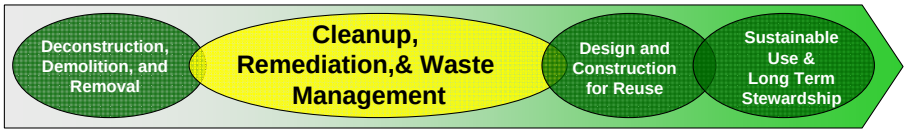

Some Examples

- **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**

"Green Remediation: The practice of considering all environmental effects of remedy implementation and incorporating options to maximize net environmental benefit of cleanup actions."

- Green Remediation Technology Primer

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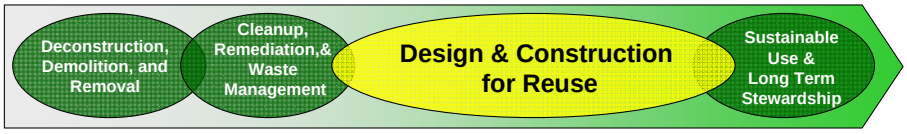
www.clu-in.org/greenremediation



Some Examples

- **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**
- **Power machinery and equipment using clean fuels**
- **Use renewable energy sources, such as solar, wind, and methane to power remediation activities**

GreenScapes

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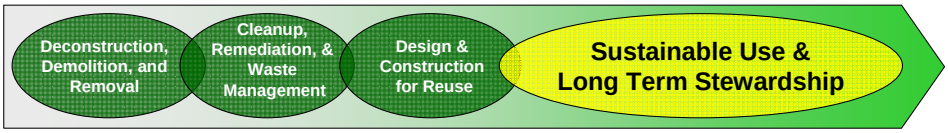

Some Examples

- **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 incorporat-ing 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**

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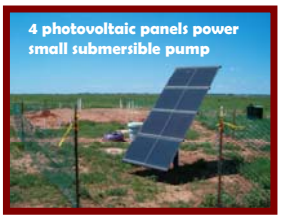
Green Approaches in Action

Altus Air Force Base



GM – Duke, Baltimore MD

Kenosha Harbor Park, WI

Romic Palo Alto, CA

Ford Rouge Dearborn, Mi

Bethlehem Steel site,Lackawanna, NY

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For More Information…

EPA's Sustainability program: www.epa.gov/sustainability/

EPA's Office of Brownfields and Land Revitalization: www.epa.gov/brownfields/

EPA's RCRA Reuse and Brownfields Prevention Initiative:
www.epa.gov/rcrabrownfields

EPA's Resource Conservation Challenge (RCC) program:
www.epa.gov/rcc/

EPA's Superfund Redevelopment program:
www.epa.gov/superfund/programs/recycle/index.htm

EPA's Environmentally Responsible Redevelopment and Reuse (ER3) program:
www.epa.gov/compliance/cleanup/redevelop/er3/

Clu-in Green Remediation webpage http://clu-in.org/greenremediation/
Clu-in Ecological Restoration webpage http://clu-in.org/ecotools/

The Brownfields and Land Revitalization Technology Support Center: www.brownfieldstsc.org/

EPA's Industrial Materials Recycling website: www.epa.gov/epaoswer/non-hw/imr/index.htm

EPA's Smart Growth Program http://www.epa.gov/dced/

Sustainable Land Revitalization




Deconstruction, Demolition, and Removal

- 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

Cleanup, Remediation, and Waste Management

- 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

Design and Construction for Reuse

- 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

Sustainable Use and Long Term Stewardship

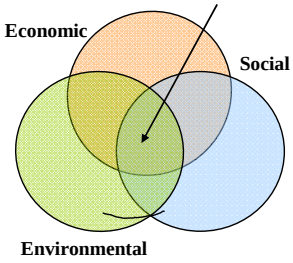
- Reduce use of toxic materials in manufacturing, maintenance, and use of buildings and land
- Minimize waste generation, manage waste properly, and recycle materials used/generated
- Maintain engineering and institutional controls on site where waste is left in place
- Reduce water use by incorporat-ing 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

SOME BENEFITS ACHIEVED BY ADOPTING GREEN APPROACHES IN THE LAND REVITALIZATION PROCESS

Economic Benefits

- Achieve lifecycle **cost savings** associated with **green remediation** and **buildings**.
- **Reduce energy footprint** and **save resources** by using energy efficient equipment/processes and renewable energy.
- **Qualify** for **tax benefits** associated with brownfield redevelopment and LEED certification.
- **Reduce construction costs**, **reduce disposal fees**, and **gain** a **new source of revenue** by recycling materials onsite.
- **Increase property value** by incorporating **Green Design** and **Smart Growth** principles, which can bring more business, people, and revenues into the community.
- **Improve employee satisfaction** and **productivity** through green building design.

Optimal Sustainable Revitalization



Social Benefits

- Improve **public health** of work force and community.
- **Create** more **walkable, accessible**, and **livable neighborhoods** by incorporating Smart Growth principles and ecological enhancements.
- Improve **aesthetics** and **public safety** by cleaning up and reusing blighted areas.
- Create **jobs** for the community and higher **tax revenues** for local government by creating new construction, commercial, and industrial opportunities and increasing property values.
- **Reduce construction traffic, noise, dust,** and **safety concerns** by reusing existing buildings and by employing deconstruction and material recovery practices.

Environmental Benefits

- **Reduce greenhouse gas (GHG) emissions** by incorporating energy efficient processes, using renewable energy sources, recycling materials, and implementing activities that sequester carbon.
- **Improve air quality** by employing Smart Growth principles, making ecological enhancements, and incorporating Green Design features.
- **Preserve greenspace and slow suburban sprawl** by cleaning up and reusing contaminated properties and facilitating their reuse.
- **Conserve resources, reduce landfill disposal, and limit the environmental impact of waste hauling** by recycling and reusing industrial materials.
- **Increase biodiversity and restore watersheds** by incorporating ecological enhancements and preserving green infrastructure.
- **Reduce long-term impact of structures** on the environment and resource use by incorporating green approaches in building and landscaping construction, including stormwater management.

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Renewable Energy Development on Contaminated Lands and Mining Sites

December 3, 2008

Penelope McDaniel
OSWER Center for Program Analysis

Background

- *RE-Powering America's Land: Siting Renewable Energy on Contaminated Lands and Mining Sites* launched the at the 2008 Brownfields Conference in May
- Renewable energy (RE) expert panel
  - industry, state and federal government, finance, renewable energy developers, and land owners
- EPA Administrator announced at the Environmental Council of States conference Sept. 2008

Why Develop Renewable Energy Facilities on EPA Tracked Sites?

- Many EPA tracked lands offer thousands of acres of land
- Situated in areas less likely to be met with aesthetic (NIMBY) opposition
- Siting amenities include: existing electric transmission lines, capacity, roads, and are adequately zoned
- Avoided new infrastructure capital and zoning costs are potentially significant

Why Develop Renewable Energy Facilities on EPA Tracked Sites?

- May have lower overall transaction costs compared to greenfields
- Reduce the stress on greenfields land for construction of new energy facilities
- Provide clean, emission-free energy for use on-site, locally, and utility grid

Why Develop Renewable Energy Facilities on EPA Tracked Sites?

- Over 16 million acres of potentially contaminated properties (approx. 480,000 sites) across the United States are tracked by EPA
  - ~80% (13.6 million acres) are non-urban
  - ~20% (3.2 million acres) are abandoned mine land
- Cleanup goals have been achieved and controls put in place to ensure long-term protection at more than 850,000 acres
- Reintroduce local job opportunities for development, operation and maintenance of, and equipment manufacture for renewable energy facilities

How Much Energy Can EPA Tracked Lands Support?

<u>Solar Energy Total Technical Potential</u>

- Solar Energy Generation Capacity on EPA Tracked Lands
  - 2,670,227 MW
- By 2010, EIA projects U.S. solar PV and thermal capacity at 6,100 MW

<u>Wind Energy Total Technical Potential</u>

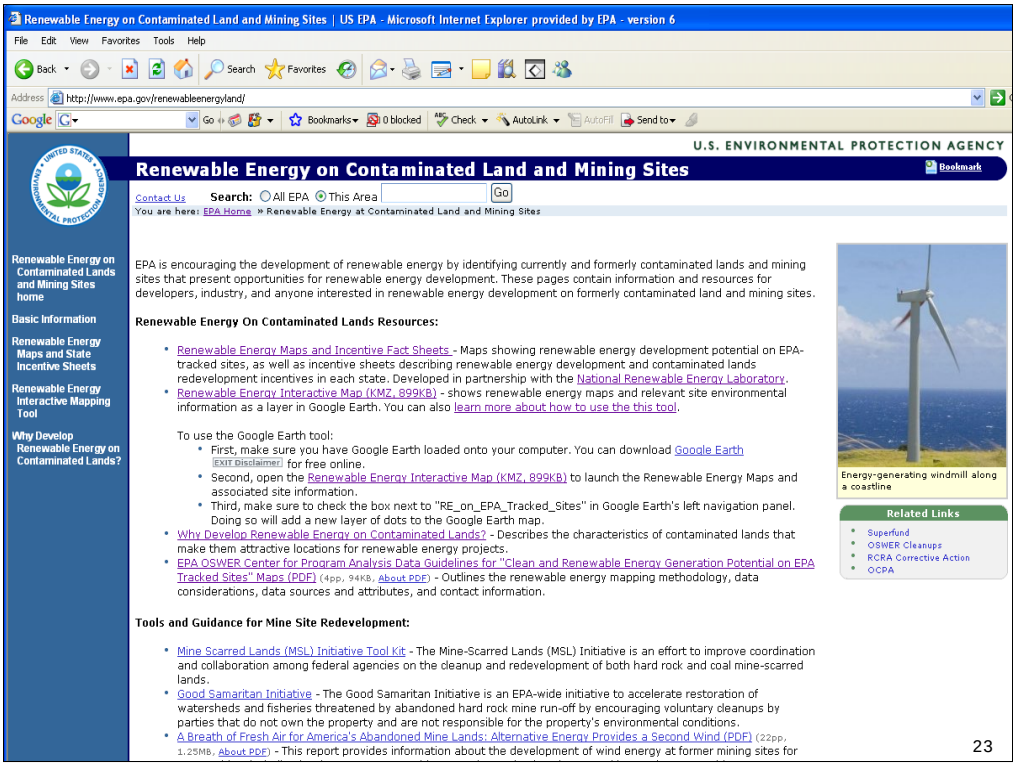
- Wind Energy Generation Potential on EPA Tracked Lands
  - 120,379 MW
- By 2010, EIA projects U.S. wind capacity at 25,610 MW

Google Earth Mapping Tool

- Successful EPA-NREL joint venture produced an interactive Google Earth mapping application www.epa.gov/renewableenergyland
- Opportunities to site renewable energy on contaminated lands and mining sites in each state
- Produced over 170 state-specific maps showing renewable energy development potential on EPA tracked sites
- Produced financial incentive sheets describing renewable energy development and contaminated lands redevelopment incentives in each state

Google Earth Mapping Tool

- Audience:
  - Developers
  - Environmental managers (state, federal, private)
  - Consultants
  - Renewable energy industries
  - Communities
  - Local, state, and federal energy and environment officials
  - Anyone interested in renewable energy projects on contaminated lands and mining sites


Renewable Energy on Contaminated Land and Mining Sites | US EPA - Microsoft Internet Explorer provided by EPA - version 6
File Edit View Favorites Tools Help
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Address http://www.epa.gov/renewableenergyland/
Google Go Bookmarks 0 blocked Check AutoLink AutoFill Send to
U.S. ENVIRONMENTAL PROTECTION AGENCY
Renewable Energy on Contaminated Land and Mining Sites
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Renewable Energy on Contaminated Lands and Mining Sites home
Basic Information
Renewable Energy Maps and State Incentive Sheets
Renewable Energy Interactive Mapping Tool
Why Develop Renewable Energy on Contaminated Lands?
EPA is encouraging the development of renewable energy by identifying currently and formerly contaminated lands and mining sites that present opportunities for renewable energy development. These pages contain information and resources for developers, industry, and anyone interested in renewable energy development on formerly contaminated land and mining sites.
Renewable Energy On Contaminated Lands Resources:
Renewable Energy Maps and Incentive Fact Sheets - Maps showing renewable energy development potential on EPA-tracked sites, as well as incentive sheets describing renewable energy development and contaminated lands redevelopment incentives in each state. Developed in partnership with the National Renewable Energy Laboratory.
Renewable Energy Interactive Map (KMZ, 899KB) - shows renewable energy maps and relevant site environmental information as a layer in Google Earth. You can also learn more about how to use the this tool.
To use the Google Earth tool:
First, make sure you have Google Earth loaded onto your computer. You can download Google Earth EXIT Disclaimer for free online.
Second, open the Renewable Energy Interactive Map (KMZ, 899KB) to launch the Renewable Energy Maps and associated site information.
Third, make sure to check the box next to "RE_on_EPA_Tracked_Sites" in Google Earth's left navigation panel. Doing so will add a new layer of dots to the Google Earth map.
Why Develop Renewable Energy on Contaminated Lands? - Describes the characteristics of contaminated lands that make them attractive locations for renewable energy projects.
EPA OSWER Center for Program Analysis Data Guidelines for "Clean and Renewable Energy Generation Potential on EPA Tracked Sites" Maps (PDF) (4pp, 94KB, About PDF) - Outlines the renewable energy mapping methodology, data considerations, data sources and attributes, and contact information.
Tools and Guidance for Mine Site Redevelopment:
Mine Scarred Lands (MSL) Initiative Tool Kit - The Mine-Scarred Lands (MSL) Initiative is an effort to improve coordination and collaboration among federal agencies on the cleanup and redevelopment of both hard rock and coal mine-scarred lands.
Good Samaritan Initiative - The Good Samaritan Initiative is an EPA-wide initiative to accelerate restoration of watersheds and fisheries threatened by abandoned hard rock mine run-off by encouraging voluntary cleanups by parties that do not own the property and are not responsible for the property's environmental conditions.
A Breath of Fresh Air for America's Abandoned Mine Lands: Alternative Energy Provides a Second Wind (PDF) (22pp, 1.25MB, About PDF) - This report provides information about the development of wind energy at former mining sites for
Energy-generating windmill along a coastline
Related Links
Superfund
OSWER Cleanups
RCRA Corrective Action
OCPA
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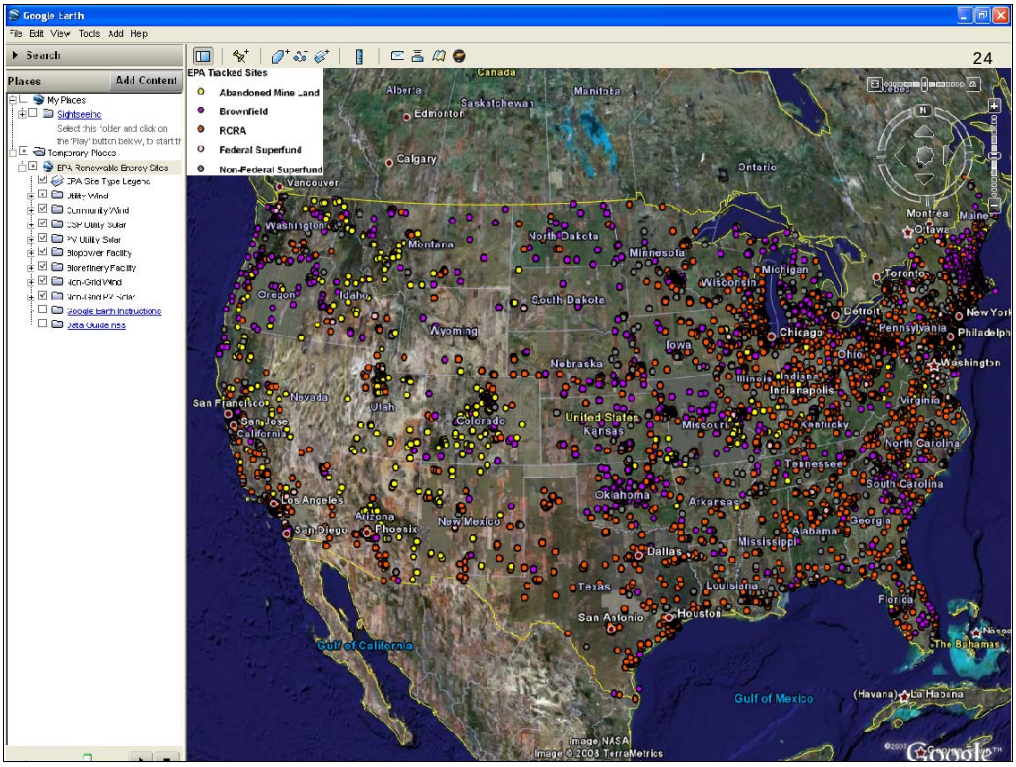
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Temporary Places
EPA Renewable Energy Sites
EPA Site Type Legend
Utility Wind
Community Wind
CSP Utility Solar
PV Utility Solar
Biopower Facility
Biorefinery Facility
Non-Grid Wind
Non-Grid PV Solar
Google Earth Instructions
Data Disclaimers
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Abandoned Mine Land
Brownfield
RCRA
Federal Superfund
Non-Federal Superfund
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Canada
Alberta
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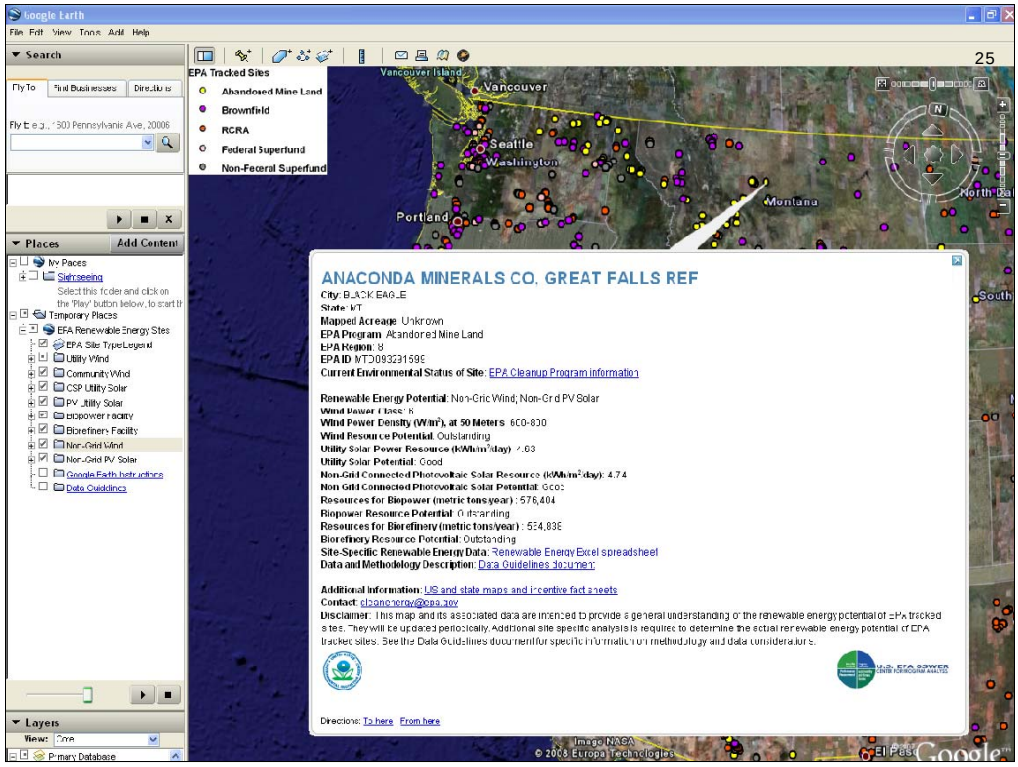
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Temporary Places
EPA Renewable Energy Sites
EPA Site Type Legend
Utility Wind
Community Wind
CSP Utility Solar
PV Utility Solar
Biopower Facility
Biorefinery Facility
Non-Grid Wind
Non-Grid PV Solar
Google Earth Instructions
Data Guidelines
Layers
View: Cities
Primary Database
EPA Tracked Sites
Abandoned Mine Land
Brownfield
RCRA
Federal Superfund
Non-Federal Superfund
Vancouver Island
Vancouver
Seattle
Washington
Portland
Montana
North Dakota
South
ANACONDA MINERALS CO. GREAT FALLS REF
City: BLACK EAGLE
State: MT
Mapped Acreage: Unknown
EPA Program: Abandoned Mine Land
EPA Region: 8
EPA ID: MTD093231595
Current Environmental Status of Site: EPA Cleanup Program Information
Renewable Energy Potential: Non-Grid Wind; Non-Grid PV Solar
Wind Power Class: 6
Wind Power Density (W/m2), at 50 Meters: 600-800
Wind Resource Potential: Outstanding
Utility Solar Power Resource (kWh/m2/day): 7.03
Utility Solar Potential: Good
Non-Grid Connected Photovoltaic Solar Resource (kWh/m2/day): 4.74
Non-Grid Connected Photovoltaic Solar Potential: Good
Resources for Biopower (metric tons/year): 576,404
Biopower Resource Potential: Outstanding
Resources for Biorefinery (metric tons/year): 524,838
Biorefinery Resource Potential: Outstanding
Site-Specific Renewable Energy Data: Renewable Energy Excel spreadsheet
Data and Methodology Description: Data Guidelines document
Additional Information: US and state maps and incentive fact sheets
Contact: cleanenergy@epa.gov
Disclaimer: This map and its associated data are intended to provide a general understanding of the renewable energy potential of EPA tracked sites. They will be updated periodically. Additional site specific analysis is required to determine the actual renewable energy potential of EPA tracked sites. See the Data Guidelines document for specific information, methodology, and data considerations.
Directions: To here From here
Image NASA
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El Paso
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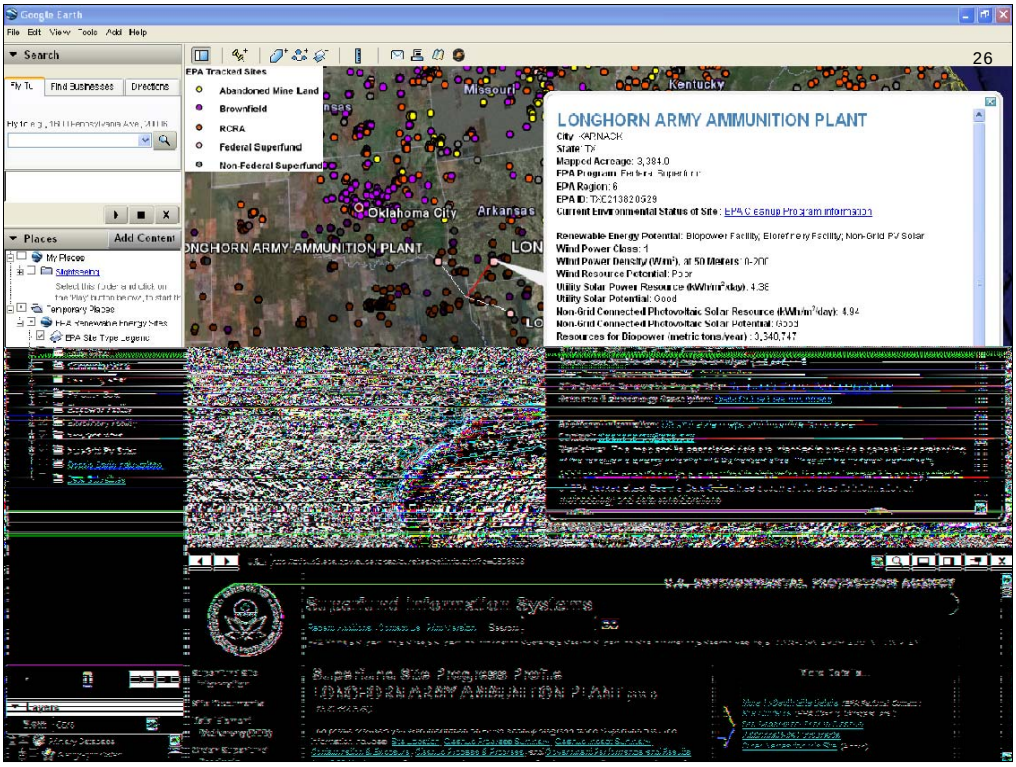
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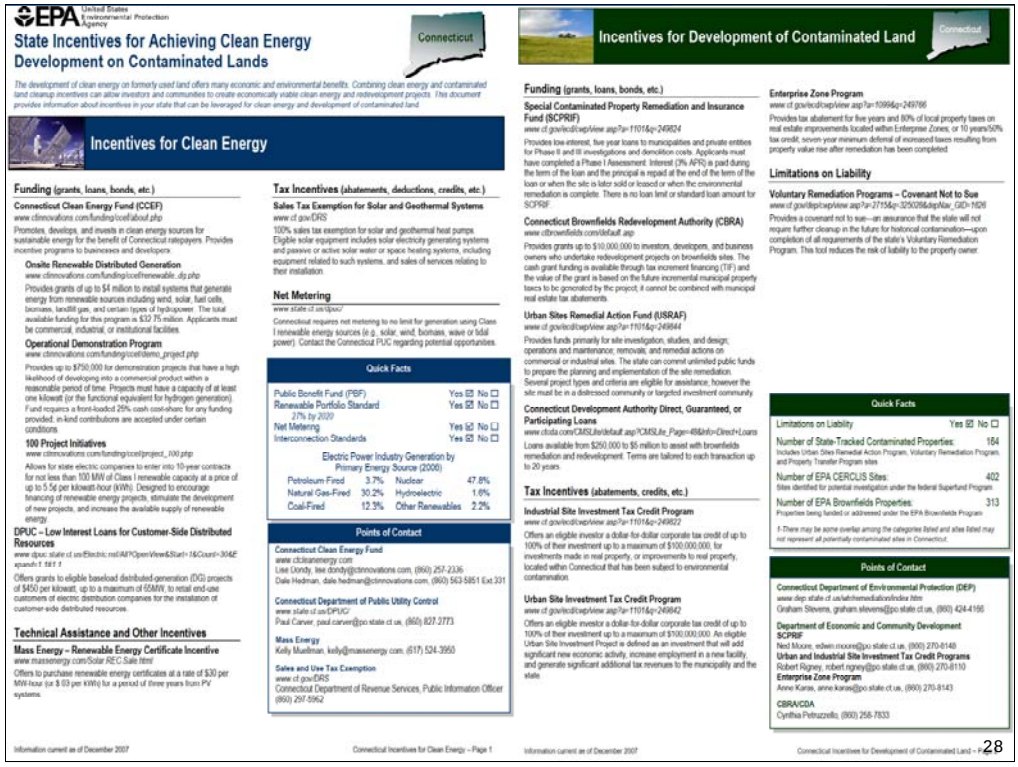
EPA Tracked Sites
Abandoned Mine Land
Brownfield
RCRA
Federal Superfund
Non-Federal Superfund
Missouri
Kentucky
Oklahoma City
Arkansas
LONGHORN ARMY AMMUNITION PLANT
City: KARNACK
State: TX
Mapped Acreage: 3,384.0
EPA Region: 6
Current Environmental Status of Site:
Renewable Energy Potential: Biopower Facility, Biorefinery Facility, Non-Grid PV Solar
Wind Power Class: 1
Wind Resource Potential: Poor
Utility Solar Potential: Good
Non-Grid Connected Photovoltaic Solar Potential: 6000
Resources for Biopower (metric tons/year): 3,340,747

Incentives

- State Incentives
  - Grants and Loans
  - Tax abatements, deductions, credits
  - Net metering
  - Other incentives: equipment loan programs for wind production
- Federal incentives
  - Extended Production Tax Credit (PTC) for renewable energy for sales of electricity for the first 10 years of operation

Resource Type	In Service Deadline	Credit Amount
Wind	December 31, 2009	2.0¢/kWh
Closed-loop Biomass	December 31, 2010	2.0¢/kWh
Open-loop Biomass	December 31, 2010	1.0¢/kWh
Geothermal Energy	December 31, 2010	2.0¢/kWh
Landfill Gas	December 31, 2010	1.0¢/kWh
Municipal Solid Waste	December 31, 2010	1.0¢/kWh
Qualified Hydroelectric	December 31, 2010	1.0¢/kWh
Marine and Hydrokinetic (150 kW or larger)*	December 31, 2011	1.0¢/kWh

  - Solar - Businesses and individuals who buy solar energy systems are eligible to receive the 30% investment tax credit (ITC) for solar energy. Tax credit has been extended until Dec. 31, 2016.
  - Federal grants and loans
- Up to date Database of State Incentives for REs and EE
  - www.dsireusa.org



EPA United States Environmental Protection Agency

State Incentives for Achieving Clean Energy Development on Contaminated Lands

Connecticut

The development of clean energy on formerly used land offers many economic and environmental benefits. Combining clean energy and contaminated land cleanup incentives can allow investors and communities to create economically viable clean energy and redevelopment projects. This document provides information about incentives in your state that can be leveraged for clean energy and development of contaminated land.

Incentives for Clean Energy

Funding (grants, loans, bonds, etc.)

Connecticut Clean Energy Fund (CCEF)
www.ctinnovations.com/funding/ccef/about.php

Promotes, develops, and invests in clean energy sources for sustainable energy for the benefit of Connecticut ratepayers. Provides incentive programs to businesses and developers.

Onsite Renewable Distributed Generation
www.ctinnovations.com/funding/ccef/renewable_dg.php

Provides grants of up to $4 million to install systems that generate energy from renewable sources including wind, solar, fuel cells, biomass, landfill gas, and certain types of hydropower. The total available funding for this program is $32.75 million. Applicants must be commercial, industrial, or institutional facilities.

Operational Demonstration Program
www.ctinnovations.com/funding/ccef/demo_project.php

Provides up to $750,000 for demonstration projects that have a high likelihood of developing into a commercial product within a reasonable period of time. Projects must have a capacity of at least one kilowatt (or the functional equivalent for hydrogen generation). Fund requires a front-loaded 25% cash cost-share for any funding provided; in-kind contributions are accepted under certain conditions.

100 Project Initiatives
www.ctinnovations.com/funding/ccef/project_100.php

Allows for state electric companies to enter into 10-year contracts for not less than 100 MW of Class I renewable capacity at a price of up to 5.5¢ per kilowatt-hour (kWh). Designed to encourage financing of renewable energy projects, stimulate the development of new projects, and increase the available supply of renewable energy.

DPUC – Low Interest Loans for Customer-Side Distributed Resources
www.dpuc.state.ct.us/Electric.nsf/All?OpenView&Start=1&Count=30&Expand=1.1#1.1

Offers grants to eligible baseload distributed-generation (DG) projects of $450 per kilowatt, up to a maximum of 65MW, to retail end-use customers of electric distribution companies for the installation of customer-side distributed resources.

Technical Assistance and Other Incentives

Mass Energy – Renewable Energy Certificate Incentive
www.massenergy.com/Solar REC Sale.html

Offers to purchase renewable energy certificates at a rate of $30 per MW-hour (or $.03 per kWh) for a period of three years from PV systems.

Tax Incentives (abatements, deductions, credits, etc.)

Sales Tax Exemption for Solar and Geothermal Systems
www.ct.gov/DRS

100% sales tax exemption for solar and geothermal heat pumps. Eligible solar equipment includes solar electricity generating systems and passive or active solar water or space heating systems, including equipment related to such systems, and sales of services relating to their installation.

Net Metering
www.state.ct.us/dpuc/

Connecticut requires net metering to no limit for generation using Class I renewable energy sources (e.g., solar, wind, biomass, wave or tidal power). Contact the Connecticut PUC regarding potential opportunities.

Quick Facts

Public Benefit Fund (PBF)	Yes ☑ No ☐
Renewable Portfolio Standard *27% by 2020*	Yes ☑ No ☐
Net Metering	Yes ☑ No ☐
Interconnection Standards	Yes ☑ No ☐

Electric Power Industry Generation by Primary Energy Source (2000)

Petroleum Fired	3.7%	Nuclear	47.8%
Natural Gas-Fired	30.2%	Hydroelectric	1.6%
Coal-Fired	12.3%	Other Renewables	2.2%

Points of Contact

Connecticut Clean Energy Fund
www.ctcleanenergy.com
Lise Liondy, lise.liondy@ctinnovations.com, (860) 257-2336
Dale Hedman, dale.hedman@ctinnovations.com, (860) 563-5851 Ext.331

Connecticut Department of Public Utility Control
www.state.ct.us/DPUC/
Paul Carver, paul.carver@po.state.ct.us, (860) 827-2773

Mass Energy
Kelly Muellman, kelly@massenergy.com, (617) 524-3950

Sales and Use Tax Exemption
www.ct.gov/DRS
Connecticut Department of Revenue Services, Public Information Officer
(860) 297-5962

Information current as of December 2007

Connecticut Incentives for Clean Energy – Page 1

Incentives for Development of Contaminated Land

Connecticut

Funding (grants, loans, bonds, etc.)

Special Contaminated Property Remediation and Insurance Fund (SCPRIF)
www.ct.gov/ecd/cwp/view.asp?a=1101&q=249824

Provides low-interest, five year loans to municipalities and private entities for Phase II and III investigations and demolition costs. Applicants must have completed a Phase I Assessment. Interest (3% APR) is paid during the term of the loan and the principal is repaid at the end of the term of the loan or when the site is later sold or leased or when the environmental remediation is complete. There is no loan limit or standard loan amount for SCPRIF.

Connecticut Brownfields Redevelopment Authority (CBRA)
www.ctbrownfields.com/default.asp

Provides grants up to $10,000,000 to investors, developers, and business owners who undertake redevelopment projects on brownfields sites. The cash grant funding is available through tax increment financing (TIF) and the value of the grant is based on the future incremental municipal property taxes to be generated by the project; it cannot be combined with municipal real estate tax abatements.

Urban Sites Remedial Action Fund (USRAF)
www.ct.gov/ecd/cwp/view.asp?a=1101&q=249844

Provides funds primarily for site investigation, studies, and design; operations and maintenance; removals; and remedial actions on commercial or industrial sites. The state can commit unlimited public funds to prepare the planning and implementation of the site remediation. Several project types and criteria are eligible for assistance; however the site must be in a distressed community or targeted investment community.

Connecticut Development Authority Direct, Guaranteed, or Participating Loans
www.cbsta.com/CMSLite/default.asp?CMSLite_Page=48&Info=Direct+Loans

Loans available from $250,000 to $5 million to assist with brownfields remediation and redevelopment. Terms are tailored to each transaction up to 20 years.

Tax Incentives (abatements, credits, etc.)

Industrial Site Investment Tax Credit Program
www.ct.gov/ecd/cwp/view.asp?a=1101&q=249822

Offers an eligible investor a dollar-for-dollar corporate tax credit of up to 100% of their investment up to a maximum of $100,000,000, for investments made in real property, or improvements to real property, located within Connecticut that has been subject to environmental contamination.

Urban Site Investment Tax Credit Program
www.ct.gov/ecd/cwp/view.asp?a=1101&q=249842

Offers an eligible investor a dollar-for-dollar corporate tax credit of up to 100% of their investment up to a maximum of $100,000,000. An eligible Urban Site Investment Project is defined as an investment that will add significant new economic activity, increase employment in a new facility, and generate significant additional tax revenues to the municipality and the state.

Enterprise Zone Program
www.ct.gov/ecd/cwp/view.asp?a=1099&q=249766

Provides tax abatement for five years and 80% of local property taxes on real estate improvements located within Enterprise Zones, or 10 years/50% tax credit, seven year minimum deferral of increased taxes resulting from property value rise after remediation has been completed.

Limitations on Liability

Voluntary Remediation Programs – Covenant Not to Sue
www.ct.gov/dep/cwp/view.asp?a=2715&q=325026&depNav_GID=1626

Provides a covenant not to sue—an assurance that the state will not require further cleanup in the future for historical contamination—upon completion of all requirements of the state's Voluntary Remediation Program. This tool reduces the risk of liability to the property owner.

Quick Facts

Limitations on Liability	Yes ☑ No ☐
Number of State-Tracked Contaminated Properties: Includes Urban Sites Remedial Action Program, Voluntary Remediation Program, and Property Transfer Program sites	164
Number of EPA CERCLIS Sites: Sites identified for potential investigation under the federal Superfund Program	402
Number of EPA Brownfields Properties: Properties being funded or addressed under the EPA Brownfields Program	313

1-There may be some overlap among the categories listed and sites listed may not represent all potentially contaminated sites in Connecticut.

Points of Contact

Connecticut Department of Environmental Protection (DEP)
www.dep.state.ct.us/wtr/remediation/index.htm
Graham Stevens, graham.stevens@po.state.ct.us, (860) 424-4166

Department of Economic and Community Development
SCPRIF
Ned Moore, edwin.moore@po.state.ct.us, (860) 270-8149
Urban and Industrial Site Investment Tax Credit Programs
Robert Rigney, robert.rigney@po.state.ct.us, (860) 270-8110
Enterprise Zone Program
Anne Karas, anne.karas@po.state.ct.us, (860) 270-8143

CBRA/CDA
Cynthia Petruzzello, (860) 258-7833

Information current as of December 2007

Connecticut Incentives for Development of Contaminated Land – Page 2

Successes

Bethlehem Steel Superfund Site Lackawanna, NY

- 8 wind turbines
- 20 MW generation capacity – 7,000 homes
- By 2010 expansion to 18 wind turbines – 45 MW
- Domestically manufactured wind turbines (Cedar Rapids, Iowa)
- Local job creation

Successes

Fort Carson, Colorado

- 2 MW solar array on 12-acre landfill
- Produces 3,200 MW-hrs of electricity each year
- Fort Carson purchases electricity produced from the array at a fixed rate of 5.5 cents per kW-hr for the duration of a 17-year contract
- Expected savings of $500,000 in electricity costs during the contract life

Successes

Summitville Mine Site, Colorado

- Mico-hydroelectric plant
- Will provide enough power to operate the new on-site treatment plant,
- The treatment of acid-mine drainage will be a zero-net energy operation

Successes

Holmes Road Landfill Solar Field, Houston TX

- Revitalization of a 300-acre former landfill site located near downtown Houston
- EPA awarded a $50k grant to assess solar energy production
  - Evaluating various environmental, engineering, and regulatory issues involved in the project
  - Conducting a solar energy production and financial feasibility study

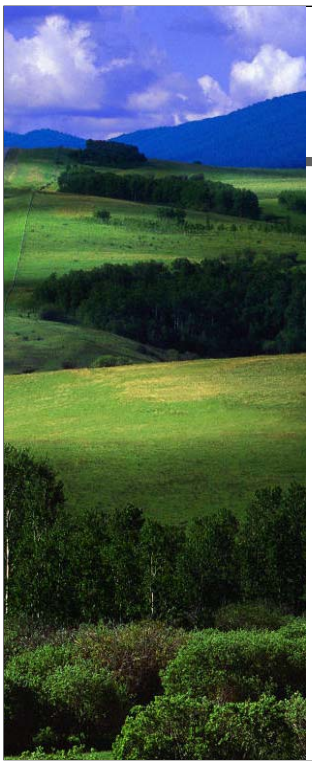
More Information

- Renewable Energy on Contaminated Lands and Mining Sites:
  http://www.epa.gov/renewableenergyland

- Further information:
  cleanenergy@epa.gov

Questions?

Penelope McDaniel
OSWER Center for Program Analysis
202-566-1932
mcdaniel.penelope@epa.gov



Green Remediation: Evolving Best Management Practices

USEPA-ILEPA

Internet Seminar

December 3, 2008

Carlos Pachon
U.S. EPA Superfund Program
pachon.carlos@epa.gov

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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

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p. 1-2

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 and 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

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 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

- Adaptive management approach integrated into long-term actions and redevelopment
- Renewable energy systems for long-term cleanup and future economic benefit
- Plan low impact long term remedy operations and remedy exit strategy
- Maximize natural carbon sequestration potential

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 gas reduced over 90% in five years of operation

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"OSWER" Green Remediation Strategy

For the purpose of advancing green remediation best practices across cleanup programs OSWER seeks to:

- » Benchmark and document GR best management practices
- » Assemble a toolkit of enablers
- » Build networks of practitioners
- » Develop performance metrics and tracking mechanisms

Why a "Strategy"

- A common understanding for better internal communication
- A unified EPA voice and position when working with regulated parties
- Developing shared goals to better measure and communicate progress
- Leverage similar efforts with other organizations (ITRC, SERDP, ASTSWMO, FRTR, etc).

Is it Our Job?

- **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.

Green Remediation Information & Feedback Channels

Technology Innovation Program Green Remediation (GR) Effort
Superfund GR Workgroup
Technical Support Project (TSP) Green Committee
Green Remediation, Revitalization, and Reuse (GRRR) Team
Climate Change and Contaminated Lands (CCCL) Workgroup
Climate Change Coordinating Committee (C4)
ASTSWMO Greener Cleanups Task Force
ITRC Green and Sustainable Remediation (GSR) Project
Federal Remediation Technologies Roundtable (FRTR) GR Focus
EPA Partnerships with Other Federal Agencies **Department of Defense (USACE IAG & MOU))** **Department of Energy (NREL IAG & MOU)**
State Initiatives (Cal/EPA GR Team, Illinois Greener Cleanups, Wisconsin Initiative on Sustainable Cleanups (WISC)
Brownfields Sustainability Pilots: Green Redevelopment
Tribal Initiatives
EPA Regional Initiatives: **Region 3 Pilot Project on Green Cleanup Standards** **Region 9 Cleanup-Clean Air Initiative**
Sustainable Remediation Forum (SuRF)

The Green Remediation Toolkit

Existing

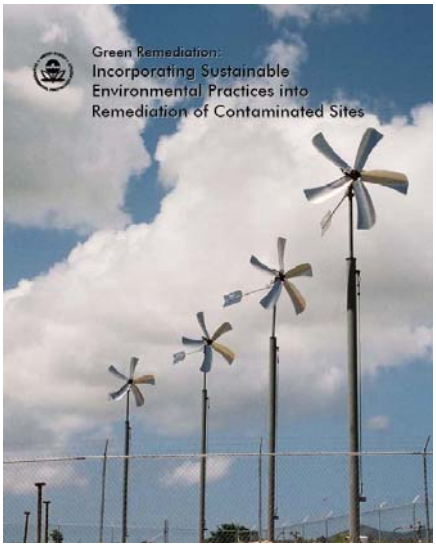
- Green remediation primer
- EPA green remediation website
- Profiles of projects and case studies
- Internet seminars, and archived discussions (cluin.org)
- Tech support for Federal and State project managers
- Contracts toolkit for RACs
- Renewable energy fact sheets and website
- NARPM 8-hour training

In the Pipeline

- MOU with NERL
- MOU with the USACE recognizing and fostering GR BMPs at Superfund cleanups
- Contracts toolkit for ERRS
- **Green cleanup voluntary standards program**
- Remedy specific green remediation "cheat sheets'
- Site cleanup energy audit tool
- Who's who in green remediation (EPA Intranet)
- ER3 for green remediation
- OSC 4-hour training
- Engineering forum "GR review and technical support" capability

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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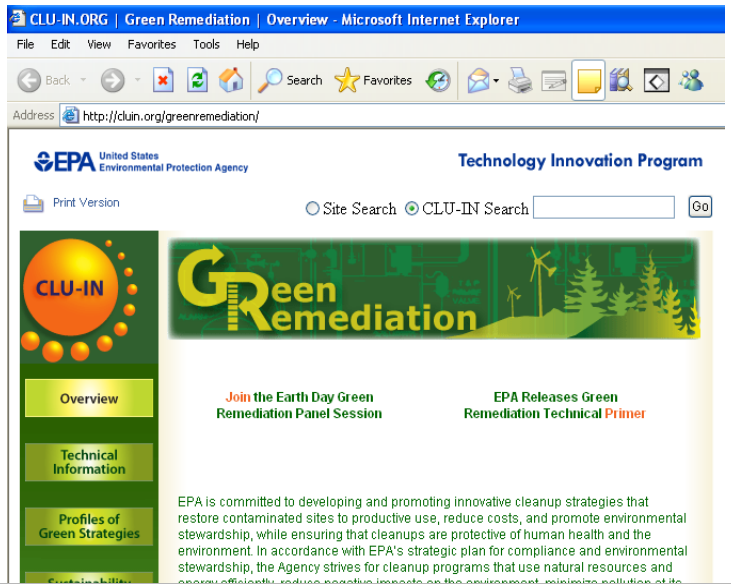
Green Remediation on the Web

www.clu-in.org/greenremediation



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Green Cleanup Standards
Building on a Concept
Deborah Goldblum, EPA Region 3
USEPA-ILEPA Green Remediation Update
December 3, 2008

RCRA Remedy Selection Criteria

Threshold Criteria

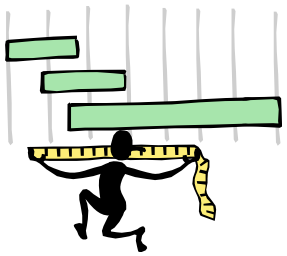
- Protect Human Health & the Environment
- Control Sources
- Meet Cleanup Objectives

Balancing Factors

- Long-term reliability
- Reduction of toxicity, mobility or volume
- Short-term effectiveness
- Ease of implementation
- Cost
- Community acceptance
- State acceptance
- Sustainability

Objectives

- Develop sustainability framework
  - Factors (common language)
  - Measures
- Process for implementation



Sustainability Framework

- land use
- water use
- air impacts
- energy
- PM-10
- human exposure hours
- NO_X
- CO_2
- local issues
- treatment vs. containment
- SO_X
- occupational risk
- recycled materials

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Sustainability Measurement Factors

- Greenhouse Gases & Energy
  - CO_2
  - Energy
- Resources Consumed/Recycled
  - Soil & Solid Material
  - Water
  - Land


DuPont Martinsville, VA
Unit H1
North
Fire Training Area
DuPont Precision Concepts (DPC) Building
Smith River
1980's-1990's
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Credit & Debit Matrix

Media or Impact	Credit (+)	Debit (-)
Greenhouse Gases & Energy		
Carbon Dioxide (CO_2 equivalents)	❑ Sequestered in-situ ❑ Sequestered by plants	❑Generated by fuel & energy for cleanup ❑Generated by manufacture of consumables ❑Generated by management of residuals ❑Sequestration loss by vegetation removal
Energy (kWh)	❑Renewable energy created and used by remedy	❑ Used for remediation ❑ Used for manufacture of consumables ❑ Used for management of residuals
Resource Conservation		
Soil/Solid Material (tons)	❑ Reused-recycled soil or soil-substitute ❑ Improved soil usability	❑Off-site soil required for remedy ❑Off-site disposal
Water (gallons)	❑ Reused-recycled	❑Public or surface water use ❑Groundwater captured for remediation – where resource is critical
Land (acres)	❑No limitation to anticipated use ❑Wetlands created or upgraded ❑Conservation easement	❑Permanent limited use

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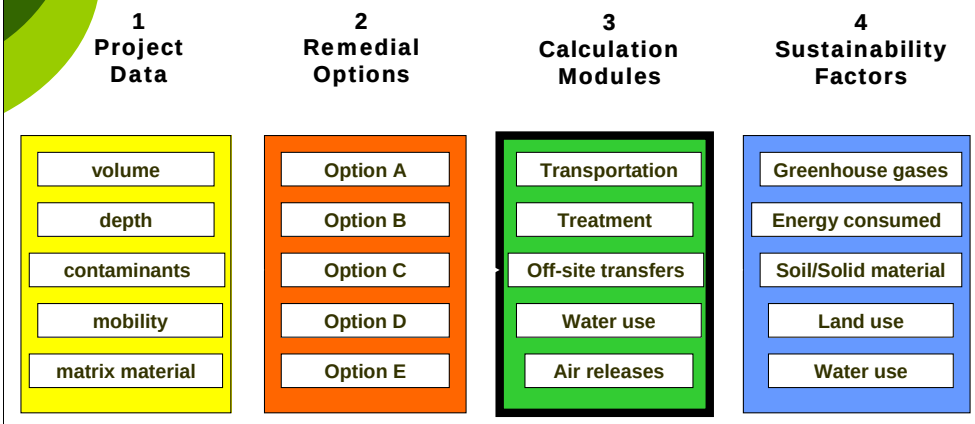
Conceptual Framework for Sustainability Analysis



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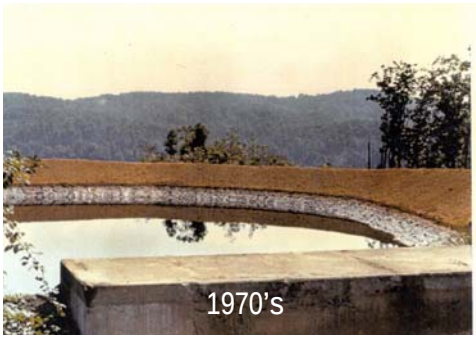
Step 1 – Project Data

Unit H1

- Former finish oil disposal pond
- Chlorinated VOCs in soil & groundwater
- PCBs, arsenic (coal ash) in soil
- About 100' diameter; impacts 3.5 to 8 feet bgs
- Groundwater about 90' bgs
- Soil volume 63,000 cf



Step 2 - Remedial Options
Unit H1

Cleanup source to achieve MCLs throughout the plume

- Excavate (source material removal) and landfill + MNA
- Excavate & ex-situ thermal treatment + MNA
- Cap + MNA
- Soil vacuum extraction (SVE) + MNA
- Zero valent iron (ZVI) in-situ treatment + MNA

PASS THRESHOLD CRITERIA

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Step 3 – Identify Components
ZVI Treatment + MNA

Task	Item	Quantities
Mobilization and Site Prep	Time Staff Equipment	10 days 11 - 1 Super, 1 Eng'r, 9 Operators & Laborers Man lift, forklifts (2), crane, mix head, others
Crane and Mix Head Assembly	Time	5 day
Shallow Soil Mixing	Time Staff Equipment Materials	17 days 11 - 1 Super, 1 Eng'r, 9 Operators & Laborers Mix head/crane, fork lifts, excavator 70 ton ZVI, 50 ton bentonite, 200 ton kiln dust 130,000 gal water
Demob, including grading	Time Staff Equipment	4 days 11 - 1 Super, 1 Eng'r, 9 Operators & Laborers Excavator, man lift, forklifts (2), crane, mix head

Step 3 - Quantify Components
ZVI Treatment + MNA

Fuel for remedy

- Mobilization/demobe
- Soil mixing
- Regrading
- Sub-base installation
- Delivery of ZVI
- Delivery of kaolinite
- Delivery of flyash
- Sampling events

Gasoline (gallons)

Diesel (gallons)

Consumables

- ZVI
- bentonite
- kiln dust

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Process Model Examples - CO_2 Emissions

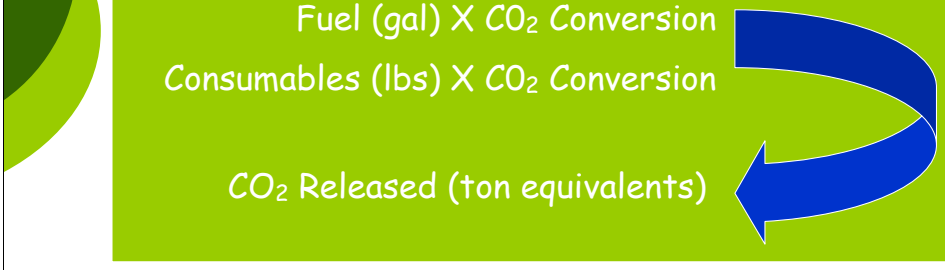
Combustion of Fuels			CO2 emissions				
Fuel	Quantity	Unit	Pre-Combustion	Combustion	Total	Data Source	Total GWP kg CO2 eq
			lb CO2	lb CO2	lb CO2		
Diesel	1000	Gal	3258	2254.3	25801	nrel.gov/lci	
Gasoline	1000	Gal	2776	1740.3	20179	nrel.gov/lci	
	Quantity	Unit	kg CO2	kg CO2	kg CO2		
Diesel	1	kg	0.46	3.18	3.64	nrel.gov/lci	
Gasoline	1	kg	0.46	2.86	3.31	nrel.gov/lci	
Propane	1	kg	0.48	3.00	3.48	ecoinvent	3.59
Consumables	Quantity	Unit	kg CO2	kg CO2	kg CO2		Total GWP kg CO2 eq
Electricity, US Average	1	kWh			0.85	nrel.gov/lci	0.861
Electricity, US Average	1	kWh			0.73	MSU data	0.77
Cement	1	kg			0.74	Ecoinvent	0.77
Concrete	1	cubic yard			195.47	Ecoinvent	202.53
HDPE Sheet	1	kg			2.41	Plastics Europe	2.47
High Alloy Steel Pipe	1	kg			4.99	Ecoinvent	5.31
Carbon Steel Pipe	1	kg			1.85	Ecoinvent	2.02
PVC pipe	1	kg			2.35	Industry data	2.58
Activated Carbon	1	kg			6.45	Kirk-Othmer,nrel.gov/lci	
Asphalt	1	USD			2.00	US Input-Output DB	2.49
Zero Valent Iron	1	kg			1.21	Ecoinvent	1.32
Kiln Dust	1	kg			0.74	Co-product of Cemer	0.77
Bentonite	1	kg			0.44	Ecoinvent	0.47
Transportation - Use the table below from NREL, then the combustion data above to get to energy and CO2							
	Quantity	Unit	lb CO2	lb CO2	lb CO2		
Xport - Tractor trailor	1000	ton-miles	34.2	236.7	270.9	nrel.gov/lci	
	10.5	Gal Diesel					
	Quantity	Unit	kg CO2	kg CO2	kg CO2		
Xport - Tractor trailor	1000	tonne-kg	0.009	0.059	0.068	nrel.gov/lci	
	18.67	Gal Diesel					
	Quantity	Unit	kg CO2	kg CO2	kg CO2		
Earthwork	1000	kg earth	0.244	1.688	1.932	Ecoinvent	
	0.53	kg Diesel					

Step 3 - Multiply X Conversion Factors
ZVI Treatment + MNA

Fuel (gal) X CO_2 Conversion

Consumables (lbs) X CO_2 Conversion

CO_2 Released (ton equivalents)



ZVI Treatment	→	**170 CO_2 ton equivalents**
MNA	→	**5 CO_2 ton equivalents**
		175 CO_2 ton equivalents

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Step 4 – Sustainability Factors
ZVI Treatment + MNA

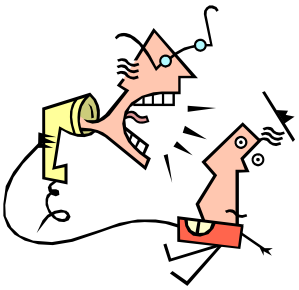
Media or Impact	Credit (+)	Debit (-)
Greenhouse Gases & Energy		
Carbon Dioxide (CO_2 equivalents)	0 CO_2 ton equivalents from contaminant destruction	175 CO_2 ton equivalents from remedy & consumables
Energy (kWh)	0 kWh of renewable energy generated	791,000 kWh of energy used by remedy & consumables
Resource Conservation		
Soil/Solid Material (tons)	0	200 tons of soil required to cap area
Land (acres)	<1 acre available for use	0 acres with permanent limited use
Water (gallons)	0 gallons reused/recycled	130,000 gallons of water used

Greenhouse Gases

	ZVI In Situ Treatment +MNA	Excavation & Off-Site Disposal +MNA	Ex-Situ Thermal Treatment + MNA	Soil Vapor Extraction + MNA	Capping + MNA
CO_2 Equivalents (tons)	175	255	595	165	29

Feedback

- Leads to more innovation
- Fosters collaborative process
- More robust evaluation



- Dangerous – too much opportunity for monkey business
- Remedy at every site will be natural attenuation
- Slow down cleanup due to review time

Potential Solution…

Develop Green Cleanup Standard

- Type of Energy Use
- CO2 Evaluation
- Water Use
- Soil/Materials Use/Reuse
- Ecosystem Enhancements

Green Cleanup Standards

- Developed 1-pager
- OSWER Innovation Proposal
  - -OSRTI (Superfund)
  - -FFRRO (Federal Facilities)
  - -OUST (Tanks)
  - -OSRE (Enforcement)
  - -ASTSWMO (States)
  - -OSW (RCRA)
  - -OBLR (Brownfields)
  - -CPA (Cross program)
  - -Regions 5 & 9
  - -NIST **(National Institute of Standards and Technology)**
- Benchmark Report
- Established a Workgroup

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Green Cleanup Standard Objectives

- Promote new thought process
- Foster practices through incentives
- Be applicable across all cleanup programs
- Work within the existing regulatory frameworks
- Show measurable results
  - # of certified green cleanups
  - CO_2 reduced through use of renewable energy
  - Pounds of material recycled during cleanup

The Timing is Right

- Growing interest in social responsibility
- Companies have internal goals to become greener
- New tools are being developed to evaluate impacts from cleanups
- Builds upon state and local government incentives currently being developed
- US Green Building Council has indicated interest in EPA developing green cleanup standard
- Initiates a constructive dialogue

Green is the new red, white, and blue

- Thomas Friedman

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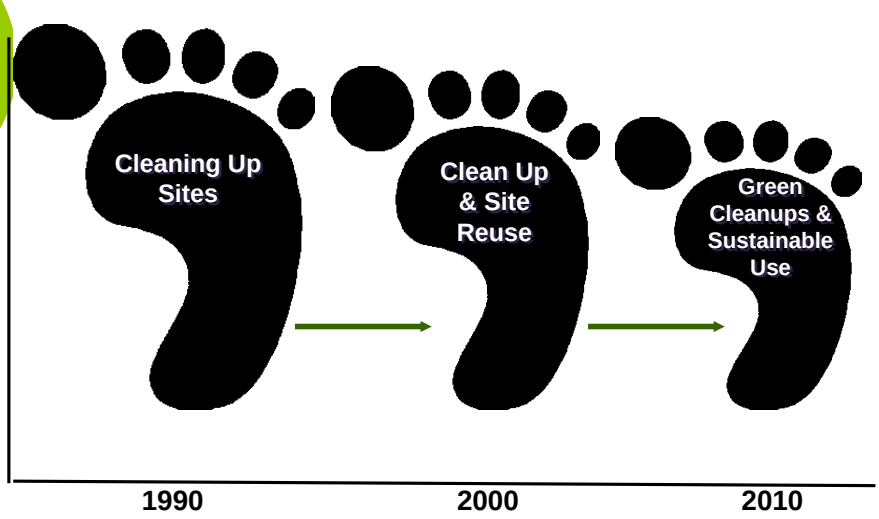
Better Outcome from Cleanups



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After viewing the links to additional resources, please complete our online feedback form.

Thank You

Links to Additional Resources

Feedback Form

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